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condemn it, as wrong; the moral emotions attending the condemnation will be the same as though the state of the will belonged to another person. It does really belong to another person, viz. to the old man which we have put off, with the affections and lusts belonging to him. We shall always disapprove of that state, feel indignant towards it. But it is no longer ours. The understanding now sees a state of will in us which has love to God and man. The moral faculty approves of that state, and its approbation is followed by a class of emotions which fill the soul with joy and peace.

ARTICLE II.

THE RELATIONS OF GEOLOGY TO THEOLOGY.

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(*Continued from page* 388.)

III. GEOLOGY gives additional force to the arguments for the truth and inspiration of the scriptures. The arguments for the truth of the historical statements of the Bible and its authority had been clearly stated and confided in by the church before the birth of geology. Not knowing that the history of immense periods anterior to man could be acquired, divines supposed the world began with man, and that only the existing animals and plants were produced in the creation. As soon as glimpses of the truth appeared, sceptics cried out that the Bible had committed itself to scientific error, and honest inquirers were bewildered. After decades of discussion, sceptics are silenced, the church adopts new interpretations of Genesis, and allows the conclusions of science to illuminate the sacred page. This feature of the connections between science and religion has been the most commented upon, though less important than some others.

Geology confirms the biblical account of the antiquity of the earth; the order of creation, particularly the compara-

tively recent origin of man; the nature of the Noachian deluge; and the future state of the earth. The interpretation of the Bible was formerly incorrect in these particulars. Before entering immediately upon the discussion of these topics, let us examine the form and evident design of the first eight chapters of Genesis, which contain the principal statements respecting the early history and condition of the earth.

Form. The accounts of the creation and fall of man must have been directly revealed to Moses, or else he was inspired to select material from historical records, to be moulded into one connected narrative. The latter course seems to have been adopted. The style of the first chapter is different from that employed later in the Pentateuch. There seem to be separate statements, each giving the history of some particular event, and complete in itself. The earliest documents were quoted in full, and they succeed each other abruptly. Those later may have been abridged, pruned of human additions, and explained by the insertion of Mosaic connectives and sentences. So far as the truth and inspiration are concerned, it makes no difference where Moses obtained his information; he was inspired to select what was proper.[1]

The different documents are characterized by the special names applied to God. Thus Document No. 1 (chap. i., ii. 1–3) describes the creation of the universe, using only Elohim [God] for deity. This account is brief, simple, and pertinent. Document No. 2 (chap. ii. 4–25, iii.), is a different record, composed by another hand, and written without reference to the first. It describes man's original condition and fall, and is appropriately prefaced by a brief notice of the creation of plants, the earth, and heavens. These are repetitions of what has gone before, but the account of the creation of man and woman is amplified. The progressive nature of the creation is not at all alluded to. This record uses only the words "Jehovah Elohim" (LORD God) for deity, except when Eve speaks with the serpent, which may be a quotation.

Document No. 3 (chap. iv.) gives the history of Cain and

[1] See Bibliotheca Sacra, Vol. xii. p. 87. Yahveh Christ; or the Memorial Name, by A. MacWhorter, p. 56 et seq.

Abel, using the word "Jehovah" [LORD] almost exclusively for deity. Document No. 4 (chap. v.), is the book of the generations of Adam, using only the word "Elohim" for deity. The account of the deluge (chap. vi., vii., viii.) seems to have been compiled from both Elohistic and Jehovistic documents. Elohim is an older name than Jehovah, the latter first coming into general use in the time of Enos, when "men began to call upon [use] the name of Jehovah."[1]

We have thus briefly alluded to the fragmentary character of these chapters, because the knowledge of their origin enables us to interpret them more intelligently. If Moses was simply guided in selecting the materials, as Ezra compiled the books of Chronicles, he may not have been aware of their full meaning or importance, while the preservation of the original history of the creation, probably revealed to Adam or some one before the time of Enos, shows us the designs of providence in giving us, thousands of years later, the means of properly interpreting his first revelation.

This ancient document, the first chapter, is of necessity retrospectively prophetic. Divinity alone can reveal to man what happened before his birth. We may conceive these truths to have been made known in a series of visions to Adam. Each great act in the drama of the earth's history passed before his mind, and the successive impressions are recorded in the form of a pictorial history. It is not a poem, nor an epic, but a plain, simple description of each vision in the magnificent panorama; not that the subject was not sufficiently grand for versification, but we should not expect to find metrical composition in the first family, whose ideas and words were few and expressive of the most common objects and sensations.

The first scene is of the materials about to be used for the building up of the earth, unarranged, without atmosphere, ocean, life, or even light, just as they had been created. God says: "Let there be light"; and suddenly chemical action commences among the atoms, and light shines. In the second vision activity is apparent. God commands the elements

[1] Gen. iv. 26. Bibliotheca Sacra, Vol. xiv. p. 107.

to move, and the sky separates itself from the earth, clouds gather, and thus there was established, apparently, a great reservoir above, from which rain falls; and there is now a space between the waters in the clouds and those resting upon the earth.

The third scene represents the collecting together of the waters into oceans, and the elevation of continents; and presently the arid expanses are covered with verdure — a beautiful change from the previous barrenness. The fourth scene brings to view the sun and moon. The heavy primeval mists have cleared away, revealing the celestial bodies, while in the background of the picture there may be other green landscapes, but the mind is occupied with contemplations of the greater and lesser lights, so as not to mention them. In the fifth scene the attention is directed to the smaller objects — the animals sporting in the sea, on the land, and in the air. The ocean is seen to be swarming with corals, shells, and fishes; insects and birds fly in the air, and great leviathans and whales sail upon the waters. God had commanded the elements to abound with animals, and they appeared in regular order and definite succession. At the beginning of the sixth vision the command is uttered, and immediately the land is seen to be alive with living creatures, — camels, elephants, oxen, sheep, the smaller creeping animals, and wild beasts of the forest. And while the new races are enjoying their existence, the determination is expressed to create man in the likeness of the Elohim, with a moral nature, who should multiply, dominate over the senseless beasts, and use them for his purposes. With the introduction of man the visions cease, but the following day of rest was made as memorable as the periods of vision.

Even if such a series of visions appear fanciful, none can deny that the supposition will explain the obscurities and systematize all the facts better than any other. And we can perceive its uses.

The pictorial method of representing facts is used elsewhere to reveal the future. The source of all description is

eye-witness; and when events in the past or future are to be described, they must be represented precisely as they appear. Two kinds of pictorial descriptions of future events are employed in scripture; the one where the precise acts or objects are represented, the other where the things perceived are symbols of the reality. Of the first class is the vision of the secret chamber of imagery, where Ezekiel saw seventy men of the ancients of Israel offering incense to idols; the women sitting in the northern door of the gate of the temple weeping for Tammuz; and also the vision of twenty-five men between the porch and the altar worshipping the sun. We may consider the pattern of the tabernacle showed Moses in the mount as another instance. Examples of symbolic visions are numerous. The living creatures, the wheels within wheels, and the brightness seen by Ezekiel symbolized the appearance of the likeness of the glory of God. The vision of dry bones taking on flesh and life symbolized the national and spiritual restoration of Israel. The visions of the fat and lean kine, the full corn and blasted ears, symbolized the years of plenty and famine in Egypt.

But there is a special class of symbolic representation peculiarly appropriate to our discussion, the time-symbols. The seventy weeks of Daniel symbolized the time that should elapse before the destruction of Jerusalem. The forty-two months, or twelve hundred and sixty days, mentioned in two places, symbolize the duration of antichrist. Then there are the thousand two hundred and ninety days, the thousand three hundred and five and thirty days, the thousand years during which Satan is to be bound, the time, times, and a half, all symbols of periods whose duration is not known. The best interpreters are now agreed that the days mentioned in the account of the creation are symbolical of previous periods of unknown length, like the time-symbols used by the prophets. The time-symbols of the future have a double signification; so have the time-symbols of the past; and we are authorized to draw inferences from the connections of the word "day" in other parts of scripture under either signification.

Some authors think the word "day" should be interpreted figuratively, i.e. it means directly an indefinite period, and not at all a common day. It is then necessary to attach definite significations to the mornings and evenings, which is done clumsily. It is better to adopt the symbolical theory which gives all the advantages of both the figurative and literal significations. The figurative sense is occult and abstruse; the symbolical does not nullify the obvious meaning.

Thus the most important peculiarities in the form or style of the first few chapters of Genesis are these. It was written by different authors; it is retrospectively prophetic; it is a pictorial history of the creation, and the word "day" is used in a symbolic sense.

Design of the Creative Account. The account of the creation was probably designed to teach several important religious truths:

(a) The creation of all things is ascribed to God. It is repeated again and again that God commanded so and so; God created; God saw; and God approved. The word "Elohim" is used thirty-five times in thirty-four verses. As God created the animals and heavenly bodies, men are taught to worship him who made all else.

(b) It was designed to teach that the creative work was performed in a manner worthy of God. It was accomplished with infinite ease. What can be more admirable than the creation of light? The atoms were all emptiness and desolation, but God says: "Let there be light," and the universe was instantly illuminated. There is no machinery, no visible exertions; but God speaks, and it is done. No agent is anywhere employed. Even where the expression seems to imply the aid of instrumentalities, — the waters commanded to bring forth the moving creature, the air to abound with fowl, and the earth to produce quadrupeds, — the context declares immediately that God made the great whales, the fowl, and cattle. That God is the energy enabling second causes to act is the plain doctrine of Genesis. We derive the impression that the creative work was performed in

accordance with a predetermined plan. Each days' work is approved, as if the result corresponded with the purpose; and the plan is evidently progressive, with a growing fitness for the introduction of moral beings. There is no creation of organic life until the continents are finally separated from the oceans, and no animals until sustenance is prepared for them. And when the six days' work is completed, the several parts are seen to be combined into one perfect whole, "very good."

(c) It was designed to show the superiority of man over the brute animals. They were commanded to be fruitful and multiply, but man was to have dominion over them.

(d) It was designed to show what was the natural and proper food of man — the fruits, grain, and vegetables. This was his sustenance in paradise, and it was not till after the flood — when sin had grown so mighty as to overwhelm the world — that the use of animal food was allowed.

(e) It was designed especially to remind men that a portion of their time must be consecrated to the service of God. The very first families were distinctly notified that the example of their Maker must be imitated. Six days had been spent in fitting up this beautiful world for their residence, and the day succeeding the cessation of labor was sanctified, forever set apart from other days for sacred employments. The only other reference in the Bible to the divine work is the command to remember the seventh day to all generations. Here we conceive, is the origin of the use of the number "seven" to denote perfection. The work of creation was perfect, and hence it was natural for men to transfer the idea of perfection to its most conspicuous feature. We cannot, therefore, so invert the order of the symbol as to suppose the use of the number "seven" simply denotes the perfection of the creative work, while there is no truth in the special acts of each day, or that the creative document is merely a poetical fiction, designed to teach great truths, but with no foundation in facts.

God was not satisfied with ordering the observance of the seventh day; the law of the Sabbath was written in the con-

stitution of the animal kingdom. Its violation is visited with a penalty. The week is thus a natural as well as a positive institution, and from its origin is commemorative of the creative work. We have really, therefore, an argument for the truth of the creative narrative in the constitution of men, animals, and society.

(f) We believe the creative chapter was designed at the outset to confirm the truth of the sacred narrative in a remote sceptical age. A modern science, born fifty-five centuries after the art of music, illustrates the earliest inspired record, so that it is better understood than at any intermediate period. Though not given to teach scientific principles, the fact that the incidental statements of the document designed to illustrate the power, wisdom, and benevolence of God are properly understood only till the fifty-ninth century, while whole systems of false creative philosophy and pretended revelation intermediate have been overwhelmed, proclaims unmistakably the truth and inspiration of the scriptures. Gladly would irreligion convert the substantial foundations of the biblical edifice into airy myths, that the superstructure might crumble at their blasts; but the corner-stones have been planted upon a rock, and will not yield to storms and floods. The first chapters of Genesis are at the foundation of religion. If we call them myths we destroy the obligation of the Sabbath, the doctrine of human depravity, and the sanctity of the marriage relation.

With these preliminaries we now propose to state briefly how the science of geology confirms the truth of the incidental statements of the Bible concerning the antiquity of the earth, the order of creation, and the time of the introduction of man.

There is a presumption in favor of a notice of the geological history, arising from the character of the rest of Genesis. The sacred writings of the Jews describe the early history of the human race, while those of every other nation are limited to the events pertaining to themselves. Hence we should expect to find a description of the creation of all things in the creative chapter.

Days.	Order of Scripture.	Order of Geology.		Names of Formations.	
		When introduced.	Predominance.		
6	Man.	Man.	Man.	CENOZOIC	Alluvium.
	Mammals.	Large Mammals.	Mammals.		Tertiary.
5	Birds.	Small Mammals. Birds.	Reptiles and Reptilian birds.	MESOZOIC	Cretaceous. Jurassic. Triassic.
	Water animals.				
4	Sun, moon, and stars.	Reptiles. Fishes. Articulata, Mollusca, and Radiata.	Plants, Amphibians. Fishes, Plants. Mollusks and trilobites.	PALEOZOIC	Permian. Carboniferous. Devonian. Silurian.
3	Plants. Dry land and seas.	Protozoans. Plants. Dry land and ocean.		AZOIC	Huronian. Labradorian. Laurentian.
2	Clouds and waters separated. Atmosphere.	Development of Atmosphere. Gradual cooling and condensation of the earth.			Previous to the formation of Strata.
1	Day and night. Light. Creation of matter.	Day and night. Igneous fluidity. Nebular state. Light. Creation of matter.			

We present five columns in which we have endeavored to give the true order of the succession of events, both according to scripture and science. The last three are paralleled according to their geological age. The third represents the geological order of the inorganic acts, and the first appearances of the different classes of organisms. The fourth gives the classes predominating in the several periods. No events have been moved up or down for the sake of manufacturing an agreement. It will be noticed that the order of the events, both as respects the times of introduction and predominance in the two geological columns, agrees with that in the scriptural account. No attempt is made to specify from geological data the time when the heavenly bodies first gave light to the earth. It was probably not later than the dawn of the Silurian period. (See Table, p. 437.)

First Day. So far back as we can be carried by the formation of strata we have a sure guide to the general physical structure of the earth. Beyond that the hints are mostly of the probable, and will be viewed differently. We think that matter came into existence chiefly as original elements, in their various forms of solid, liquid, and gaseous, or perhaps all were expanded to the gaseous condition. These particles of matter did not long remain quiescent. Having mutual affinities, contiguous atoms immediately united to form compounds, and this union was attended with intense light and heat. At the same time the universal law of gravitation affected the mass it began to revolve, portions of it were detached to be developed into planets and satellites, while the large nucleus remained as the sun. For all the particulars consult the Nebular Hypothesis.

Our planet was a mass of rarified, intensely-heated, revolving matter. It continued to revolve and condense till reduced to igneous fluidity. Still condensing and cooling it attained its present sphericity and rotatory speed. Hence there were days of twenty-four hours established thus early, with intervals of darkness as soon as light came from the sun. Were the early days of different length, the polar diameter

of the earth would have been either greater or less in proportion to the time. According to La Place the present oblateness is precisely that belonging to a fluid globe of the weight and size of ours, revolving at its present rate. After the formation of a stiff crust its sphericity could not have changed perceptibly without inducing the utmost confusion, of which there is nowhere any intimation.

The scriptural statements may refer to these early conditions of the earth. The beginning may be the creation out of nothing (*bara*[1]) of the heavens and earth, or the whole material creation apprehended by the senses. There was nothing but bare matter, for the earth was very empty. But the Spirit of God was hovering over the "bottomless commixture of elements," probably of a fluid (*thehom*) character, dark and desolate. He spake, and light came; and the light was divided from the darkness, producing day and night. This period was evidently long, from the brooding action of the Spirit of God. The parallel events between the two accounts are these: (1) creation of matter out of nothing; (2) light; (3) succession of light and darkness, involving the axial revolution of the earth. This light may have been generated by chemical action, or have been derived from the sun, so far obscured by vapors as to be invisible himself, like his absence during a stormy day. We derive no hint of igneous fluidity from the text, further than is involved in the idea of day and night. It is not necessary to consider the question of a vast interval of time between the first and second verses.

Second Day. Until the fiery globe had cooled so that a crust had begun to form, the sky would not have been perceptible, nor could water have existed near the earth, except as steam. The next stage in the process of refrigeration, therefore, was that in which water began to collect, and part remained as vapor or clouds, and part settled down upon the earth. The same events appeared in the vision. The prophet

[1] For the use of *bara*, and a thorough and satisfactory discussion of the philological meaning of Gen. i. by Professor Barrows, see Bibliotheca Sacra, Vol. xiii. p. 749 et seq. Compare Ps. xc. 2; Heb. xi. 3.

saw the firmament or sky appear to be covered with clouds, while the heavier mists below were condensed into water. We cannot agree with those who interpret the waters by the gases of the nebulous period.

Third Day. We can now learn more of the history from geology. The gradual refrigeration of the crust of the earth caused it to shrink, so that great ridges and furrows were formed. There were changes of level in the crust, and the water collected in the depressions, leaving the ridges, so that dry land and seas began to exist. Since that time there have always been continents. Now commenced the work of denudation. Wherever on the dry land rain fell, currents and streams of water formed, and began to wear away the earth and push it towards the sea, the primitive igneous rock of the earth being broken up and deposited in the bottom of the ocean. There was an immense thickness of these deposits formed, in our country nearly twenty thousand feet, called the Laurentian series. Great disturbances agitated the crust at the close of this period, and upon the edges of the upturned Laurentian strata another series of sedimentary beds were deposited, over ten thousand feet thick, called the upper Laurentian or Labrador series of rocks. These two in turn were disturbed, and another series called the Huronian (Cambrian?) twelve thousand feet thick were piled upon them. It is in these three great series that traces of life are first seen, yet very obscure, so scant that some geologists still apply the term Azoic to the group. The evidences of the existence of plants are twofold: (1) Beds of plumbago or pure carbon, which is generally supposed to have been derived from vegetation, though no traces of the plant structure have yet been detected in them. (2) Beds of iron-ore. It is believed that nearly all beds of iron-ore are formed by the action of vegetation, just as our present bogs are abstracting iron from the soil and depositing it as ore. Water steeped with plants has the power of reducing the insoluble peroxyd of iron or rust to the state of the protoxyd. This new compound is dissolved in the water, and remains in it, flowing

away till coming in contact with the air, more oxygen is absorbed, and it returns to its original insoluble peroxyd state, and falls to the bottom. A constant repetition of this process will ultimately accumulate enough of the peroxyd to form a large bed of ore. The Laurentian iron beds were formed in this way, thus involving the presence of vegetation, and probably in considerable abundance. In the Cambrian a few distinct marine plants have been discovered.

The remains of animals lately discovered in the Laurentian group are those of Rhizopods or Foraminifera. They are the simplest of all animals, and probably constitute an independent type of life, like the Vertebrata. They are the nearest approach of the animal to the vegetable kingdom. These fossil specimens are chiefly microscopic, were discovered by Sir W. E. Logan, in Canada West, and have been described by Dr. Dawson of Montreal, under the name of Eözoon Canadense.[1]

The features of the third day as described in the vision may be recognized in this geological account. The waters were gathered together into one place, and the dry land appeared. But this was a work of time, therefore requiring long periods for its accomplishment.

Next commences a new order of things. Life is introduced. The dry land is covered with vegetation. God commands the earth to bring forth the tender grass, such as cattle feed upon (or more probably inclusive of seedless or cryptogamic plants), the herb yielding seed, such as the different species of cereals, and the fruit tree bearing fruit. These all have seed in themselves, that is, are capable of sustaining themselves without the necessity of a new creation. This classification of plants is a popular one adapted to the wants of man. That adopted by botanists is more exact. There are two great divisions, the Cryptogams, without flowers or seeds, and the Phenogams, or flowering and seed-bearing plants. The former include sea-weeds or algae, fungi, mosses, and ferns; the latter embrace the Endogens — grasses, grains,

[1] See Canadian Naturalist, 2d series. Vol. ii. p. 99.

lillies, etc., and Exogens — coniferous plants, forest trees, herbs, and fruit trees. The plants first introduced were sea-weeds. No land plants are known till the Devonian, and it is chiefly the higher Cryptogams and lower Phenogams that flourish till the later Mesozoic. It is a fact also that all the plants existing through nearly the whole geological history are now extinct. In view of these facts we would interpret the scriptural statements thus: God established upon the earth the vegetable kingdom, with its laws of propagation and general form, before the commencement of animal life. The prophet could not describe the peculiar classes of vegetation without scientific details, and therefore modelled his descriptions upon existing plants. Thus there is an essential agreement in both records concerning the events transpiring upon the third day.

Fourth Day. Following the geological record we are brought to the great Paleozoic age of life, including the formations known as the Silurian, Devonian, Carboniferous, and Permian, whose faunae and florae have a general resemblance to one another. In the Lower Silurian, representatives of three types of animal life were introduced — corals, graptolites, and starfishes of the Radiata; multitudes of trilobites of the Articulata; brachiopods, gasteropods, and gigantic chambered shells, the sharks of the early ocean, of the Mollusca. Plants were represented by sea-weeds, and vegetation must have been abundant to supply the material for the thick masses of bituminous shale and reservoirs of petroleum which occur in these rocks in Kentucky. In the Upper Silurian the assemblage of life was similar, but new species and families appeared. The whole period may be fancifully named the age of trilobites or mollusks, because these animals predominated. It is a disputed question whether the earliest rocks containing a few remains of fish in England belong to this or the following group.

The Devonian life differs from the Silurian by the presence of large numbers of sauroid fish — scarce in America, but abundant elsewhere; by the presence of land plants in the

latter part of the period, and by a diminution in the number of trilobites. Plants were sufficiently abundant to form local coal-beds, and from that time to the present nearly every formation has its beds of vegetable debris that can be used for fuel. The Devonian also furnishes the astonishing amounts of petroleum spouting out of the ground in Pensylvania. Insects and reptiles commenced to live near the close of the period. This has been styled the age of fishes.

The next has been called the age of plants, or the Carboniferous period. Most of the productive American and European coal-fields belong to this group. To the animals already mentioned must be added a few large amphibians, with numbers of insects. The trilobites have dwindled down and entirely disappeared in the following period — the Permian. The plants in both were chiefly terrestrial, trees and reeds of gigantic size and tropical luxuriance, but not so highly organized as our conifers. They were tree-ferns, tree club-mosses, and fern-conifers. Their *tout ensemble* was like that of existing tropical marshes. The Permian period witnessed the close of the great Paleozoic age, and the disappearance of most of its peculiarities.

These periods were probably synchronous with the great events of the fourth day. Upon this day the heavenly bodies were not created (*bara*), but appointed (*asa*) to the office of giving light and regulating the seasons, whence it is inferred they may have existed from the first, but were not visible upon the earth till this time. This view will harmonize both records. The sun is the central body, on which the earth depends. The oblateness of the poles and the succession of day and night were probably caused by the revolutions of the earth before the Laurentian period. By the theory that the original light was chemical or electrical purely, and the sun created on the fourth day, we know not how the days and nights were produced for many ages after the disappearance of the chemical light beneath the crust; and the electrical theory does not permit the succession of light and darkness. There must have been some foreign body to give

this succession; yet this light may have been obscure. During the Paleozoic age the atmosphere was heavily charged with carbonic acid, so that animals of delicate organizations could not have lived. The amount of gas may be conceived by reflecting that a portion of it has been condensed into the coal-beds. Such an atmosphere would increase the temperture enough to produce a tropical climate all over the globe, even if there were no increments of heat radiating from the internal fires. This is also indicated by the fossils; for the carboniferous rocks contain tropical species between twenty-five and seventy-seven degrees north latitude. The density of the air would diminish the amount of atmospheric disturbance; not that storms and winds would have been uncommon, yet the fall of rain may have been greater because of the increased amount of evaporation, and there would have been mists and clouds constantly resting upon the land. It may be that the presence of these clouds explains the apparent absence of the sun until the purification of the air permitted the light to shine through. Some have imagined the presence of the nebulous matter about the sun himself to explain all these phenomena.

We get the idea that this period was as long as the others, from the biblical notice of the fourth day. We may, therefore, suppose that the attention of the prophet during this vision was so much occupied with the contemplations of the astronomical bodies, that he overlooked the progress of events upon the earth, none of which were very different from what had been previously perceived. Adopting this notion, we may synchronize the Paleozoic age of geologists with the fourth day of Genesis. Or there may have been a slight repetition in respect to time. The events of the fourth day may have occupied the whole specified period; but in the enumeration of the animals introduced upon the fifth day, the creeping things of both the Paleozoic and Mesozoic may be included.

Too much stress has been laid upon the equal length of the periods; one may have been very much longer than another.

The suggestion that the order is that of importance, rather than of time, has much force. On account of the scarcity of words to express anything but absolute wants, the prophet, although inspired with a perfect knowledge of the disclosures of modern science, could not have expressed philosophic ideas, except by a narration of events succeeding one another. First came the most important matter. He had no word corresponding with materials, but expressed the idea by the phrase "heavens and earth." Next came the forces that act upon matter, or the inorganic laws of nature. What could have better represented the origination of forces than the creation of their representative, light, especially since it is found that the inorganic forces are mutually convertible? Next in importance would be the sky; and so on in the order of Genesis. The events must be described as successive, as that was the most convenient mode of expressing relative importance. It so happens that the order of importance is also that of time; but if for any reason they should differ, we ought not to lose faith in the record.[1]

Fifth Day. Following the geological account we come next to the Mesozoic age, divided into the Triassic, Jurassic, and Cretaceous periods. Many of the ancient types of life have disappeared, such as the cyathophyllum family of corals, graptolites, cystideans, several genera of brachiopods, and all the trilobites. In the Trias were representatives of all the great types. There were beautiful crinoids or sea-lilies, with star-fishes and corals among the Radiates; representatives of all the Molluscan classes; crustacea, worms, and true insects among the Articulates. The Vertebrates were the most conspicuous. The fishes were more modern in their structure. The reptiles were numerous and peculiar. There were frogs as large as oxen, traces of turtles, and our own New England furnished flocks of birds and reptilian birds, thirty-five species. There were also a few small marsupials. The plants were similar, in general, to those of the Carboniferous age.

The Jurassic animals and plants differed generically and

[1] Christian Examiner, Nov. 1855, p. 385.

specifically from these. There were new mollusks of the oyster tribe, and interesting cephalopods. Some of the higher insects appeared. The peculiarity of the period consisted in the immense saurians, terrestrial, aquatic, and aerial. A few of the mammals were non-marsupial. The Cretaceous period showed a great change in the vegetation. There were more than a hundred species of trees similar to those now growing in warm temperate forests, the tulip, oak, poplar, willow, etc., also conifers, and the first of the palms. The Rhizopods, or systemless animals, were abundant and characteristic; so were interesting conchifers and cephalopods, immense reptiles, the first appearance of modern osseous fishes, true crocodiles, and cetaceans or whales. There were besides a few mammals and birds. In general the whole Mesozoic period may be called the age of reptiles.

The fifth day of the Bible is marked by the introduction of creeping things, fowls, and great dragons. Jarchi says creeping things include "every living thing which is not high above the ground," such as flies, ants, worms, beetles, lizards, weasels, mice, snails, and other like creatures, and all fishes. The term "fowl" includes bats, grasshoppers, and flying insects generally, as well as birds. Great dragons may include serpents, crocodiles, and sea monsters. There would be no difficulty in referring all the animals in both the Paleozoic and Mesozoic ages to these descriptions. If however it be wished to make the work of the fourth day include the former, the Mesozoic alone is enough for the fifth.

Sixth Day. The deposits remaining belong to the Cenozoic period, including all recent accumulations. These are in two groups — the Tertiary and Alluvium. There have been four or five separate creations of life, at the beginnings of the Eocene, Miocene, Pliocene, Post-Pliocene, and Recent. None of the Eocene animals are now living. In the European Miocene fifteen to twenty per cent of the fossils are of existing species; in the Pliocene from forty to fifty per cent of the animals still flourish, and about ten per cent of the Post-Pliocene groups are extinct. No living species have been

found in the American Eocene or Miocene. Forty to sixty per cent of the Pliocene animals of South Carolina are still living, and the number of extinct American species of the latest period is about the same as in Europe.

The plants of the Tertiary were of a warm, temperate cast, including oak, maple, hickory, magnolia, palms, conifers, cinnamon, etc. There were rhizopods, corals, echini, brachiopods, conchifers, including modern oysters and clams, gasteropods, and no cephalopods except nautilus. The Articulates were represented by most of the modern crustacea and insects, even the higher group among the crabs — the Maioid. All four classes of Vertebrates abounded. Sharks were in their perfection; but the mammals were of especial interest; it was the age of mammals. There were whales equal in size to those living. West of the Mississippi were many peculiar forms, now characteristic of the Eastern continent, as the hyena, rhinoceros, camel, and horse. The tapir family was there also, which was chiefly developed in the Paris basin at this period, although the nearest living analogue is in this continent. Mastodons and elephants were introduced in this age. There are evidences of different climates, and many regions had peculiar local characters, just as there is now in marsupial Australia and edentate Brazil. Thus there was an approximation in the character of the life and the climatal features to existing nature.

At the beginning of the Alluvial period the continents had attained essentially their present altitudes. Then there came an ice period in all high northern latitudes, when many of the still existing Tertiary animals and plants must have been destroyed or moved southerly. In the tropics the organisms may not have been affected, and the deposits show no marks of ice. But in the temperate zones, the existing races were introduced after the disappearance of the ice, which vanished slowly, and still remains among high mountains. With a warmer climate the animals of the lower zone would gradually emigrate to the vacant region, often the same species that had been forced by the cold to leave. The glacial

deposits are called drift, and were chiefly laid down before the appearance of man. The last creation was after the general ice period, but a large number of the animals previously existing were permitted to live on.

The period succeeding the glacial was one in which our prairies, river-bottoms, and terraces were produced. The materials composing the sand, gravel, and clay, were chiefly derived from the universally diffused glacial ruins, and differ from them by stratification. The former are miscellaneously piled up; the latter are neatly arranged according to specific gravity, the heavier stones in gravel beds, the fine grains in strata of sand, and the completely pulverized rock in clay. Local beds of coarse drift may overlie fine sands and clay. Every country had its own peculiar alluvial physical history. A volume is needed to give all the details upon this subject; but we must be contented with presenting, in parallel columns, some of the most important features of the Alluvium in different countries.

Nomenclature.	New England.	Great Lakes.	Switzerland.	Human Periods.
POST-PLIOCENE. — Drift,	Northern drift on high mountains.	Northern glacial drift.	Northern glacial drift.	
POST-PLIOCENE. — Modified Drift,	Beach period, upper terrace and sea-bottom period.	Fresh water subsidence.	Post-Tertiary Mammals — Period of subsidence.	
POST-PLIOCENE. — Drift,	Marine drift of Atlantic coast; boulders on surface.	Boulders of copper, etc. on surface.	Ancient diluvium; large smoothed pebbles.	
RECENT. — Modified Drift,	Terrace period. Lower terraces, River bottoms, Peat and marl.	Lake terraces and ridges.	Modern glaciers, terraces, and loess.	Early stone age. Deluge. Later stone age. Bronze age. Iron age.

The question whether the early northern drift has been produced by icebergs or glaciers, implying therefore a subsidence or elevation of the land, is not yet settled. The evidence is increasing in favor of both an elevation and depression. There is a marine drift along the New England coast, overlying both the ancient glacial piles and a fossiliferous stratum; so that there may have been both a glacial and an iceberg period. These facts have been overlooked until lately by geologists.

The predominant species in the latest-born system of life is man. All geologists, whatever their religious notions, agree that man's remains are confined to the deposits laid down since the glacial period. He is supposed to have been introduced in company with most of the existing animals and plants, certainly not before them. According to Darwinian principles, man must be the latest-born animal, since he stands at the summit of the series. The ninety per cent of Post-Pliocene organisms still living, form a very small proportion of existing nature.

The biblical account of the sixth day harmonizes with the geological record. The earth, obedient to command, is covered with living souls, cattle, the mammals, and the *remes* — another class of creeping things, small land animals, having a low creeping motion, — and wild beasts. They represent the mammals, the highest type of the animal kingdom, and introduced immediately before man. Last of all God created *the man*. He came directly from the hand of God. He was an object of forethought and conference. He received, after the animal, a mental and moral nature, that rendered him superior to all who existed previously. The vegetable kingdom was ordained for his food, and with the introduction of the original pair into the garden of Eden commenced the age of man. The seventh day may symbolize the historic period, when God is resting from the work of creation, and the present system of life is working out its destiny.

Conclusions. A review of the work of creation as described

in nature and revelation, convinces us of the essential harmony of the two records:

(1) The order of events in the inorganic creation is the same. Neither record fixes the time of the beginning, and both present the same order of light, atmosphere, day and night, clouds, water, dry land, oceans, the appearance of the heavenly bodies, and most of these before plants.

(2) The order of the introduction of organisms is the same. Both describe plants before animals, the marine lower forms before reptiles, birds and reptiles before mammals, and mammals last of all before man. The agreement is perfect.

(3) Apparent discrepancy is removed. Nothing seems more natural than that plants could not exist without the full light of the sun. But there is reason to believe that the sun was not visible for ages after the creation of plants. Probably this apparent discrepancy will hereafter prove the most convincing proof of the truth of the creative account.

(4) The animals in the eye of the writer of the biblical record were chiefly those of existing races. No one can read over the simple creative account without receiving this impression. The world abounds in living forms, more numerous, varied, and perfect than those of any previous period; and it was these which received names from Adam. We suppose the extinct groups were included only by implication. We may compare the description to a photograph of natural scenery. It is the large objects in the foreground that arrest our attention. But if we use a microscope, numerous minute features in the background appear. They were not observed till they were searched for. So the creative visions may have been chiefly of existing races, while the ancient and distinct forms are distantly alluded to, and are plainly perceived by the aid of modern research.

(5) The work of creation was progressive with intervals of repose. There were five evenings when there was rest. We find similar periods of creative inactivity in the scientific record. These are the most prominent features in science. There were successive epochs of creation followed by long

intervals of repose. Changes of level, synchronous with geological catastrophes, marked the beginnings of creative activity. The number of creations has been stated differently, according to the additions to our knowledge of organic remains. It is clear that there have been no less than twenty-seven different exterminations and creations, or periods of activity and repose. Their number will be increased rather than diminished by the progress of knowledge.

(6) The time-words in Genesis were intended to be understood as literal days, like those used by the prophets, till the age came when their proper meaning is understood. Then we perceive the meaning of the symbol, and become aware of a twofold signification. And we are authorized to apply either meaning to the term, as may be convenient.

(7) Man was introduced last. Some facts recently developed prove that certain animals have become extinct since the birth of man. They were probably introduced in a previous age, and had nearly completed their cycle when man came, and he may have aided in their extermination.

The question has been raised of late whether man has not existed much longer than six thousand years. Even if a greater duration be assigned than has been common, it will not conflict with the creative record, in which no limit is fixed; and there may be improvements in the science of biblical chronology in the future. As the facts are recent, we will now present some geological notices of man's antiquity and early history.[1]

Antiquity of Man.

As soon as men became numerous their works and remains accumulated in alluvial deposits, and by examining these relics or fossils geologists infer periods corresponding more or less perfectly to the results of historical research. Geologists have arranged the history of man into three periods, called the stone, bronze (or copper), and iron ages, the names

[1] See Review of Lyell's Antiquity of Man in North American Review for Oct. 1863.

being derived from the materials of which their implements were successively composed. Since the change of implements must depend upon the ingenuity of different races, and their location near veins of tin-ore, or native copper, the length of these ages is not the same among all nations. The Papuans and some of the American Indians have not yet completed the stone age. The antediluvians in the time of Tubal-Cain understood the use of brass and iron. The Greeks and Romans entered upon the age of iron very much later, though early in their history. Hence we must study separately the archaeological monuments of every nation, whether historic or geological, in order to ascertain their progress in the arts; and it is only closely allied tribes that will be found to have progressed uniformly. We will present a few characteristic details.

The Danes find in their peat bogs and *kitchen-middings* or ancient refuse-heaps, remains of various trees at successively higher levels. The stone period showed a predominance of the Scotch fir, while the inhabitants were brachy-cephalous, with short heads and small bodies like the modern Laplanders. In the bronze period the people were larger, possibly of another race, displacing the former, and the forests were of oak. The iron period is synchronous with the commencement of historic records, and is marked by the prevalence of the beech tree. All these trees existed in each of these periods, but only one seems to have predominated at once. Caesar must have visited England in the oak or bronze period, as he mentions the scarcity of the fir and beech. And if the trees of the adjacent countries were similar, the age of beech must have commenced since the time of Christ. No fir trees now live in Denmark. Probably the time occupied for the formation of the peat bogs was about four thousand years, according to the Danes. The bones of two extinct animals have been found in Denmark, the *Bos urus*, a wild bull, mentioned by Caesar and an author in the sixteenth century, and the Auk, last seen alive in 1844. The other animal remains found are of existing edible mollusks, common mammals, birds, and fishes.

In Switzerland the remains of ancient dwellings are found in the lakes. Piles were driven in shallow water, and houses constructed upon them. The refuse-heaps were accumulated beneath the houses, and composed of material very much the same as in Denmark — remains of the stone, bronze, and iron periods. Fifty-four species of animals were found, all now living except the *Bos urus*. The earliest known notice of dwellings of this character is given by Herôdotus of the Paeonians, a Thracian tribe, who flourished about 520 B.C. A few fishing huts were constructed on this plan in Switzerland, in the last century, and at the present day the Papoos in New Guinea live in them. No reliable estimate of age can be derived from the relics.

We pass over numerous details to speak more particularly of those relics of man found in connection with the bones of animals extinct before the time of written history. These have been found in caverns and alluvial deposits.

Until recently it was commonly supposed that the intermixture of the remains of men and extinct animals in caves was produced accidentally, the dens of the animals having been selected by man for places of burial in a later age. Dr. Buckland, thirty years ago, illustrated this view in his *Reliquiae Diluvianae;* and the bone-caverns described by him are admitted to be of this description. One of the most convincing proofs of the contemporaneous intermixture is in the limestone at Brixham in Devonshire. Its exploration was conducted under the auspices of the Royal Society. All limestone rocks abound in caverns formed by underground currents of water. Originally simple crevasses, they gradually increase, partly by denudation, and partly by chemical action, till perhaps they are connected with streams at the surface. It is not uncommon in limestone regions to see a river instantly plunge underground, and as suddenly emerge somewhere else. Such streams are constantly depositing detritus in the caverns and changing their courses, so that the early accumulations are now high and dry, exposed where they can be easily examined.

The discovery of the Brixham cave was accidental, where a portion of the roof had fallen in. Five galleries have been excavated there, or the deposits removed for a length of five hundred feet. There are three different layers; at the top a stalagmite, next loam or bone earth, and lowest of all a gravel, generally destitute of fossils. From the two upper layers have been derived the bones of the mammoth, rhinoceros, cave-bear, hyena, cave-lion, reindeer, horse, ox, and some rodents, chiefly extinct species. No human bones were found, but a large number of flint knives were exhumed from the bone earth. The clearest case of the synchronism of the knives and bones was where a very perfect tool was found in close proximy to the entire left hind leg of a cave-bear. Every bone of this leg lay in its proper place, even to the patella and astragalus. It must have been introduced when the bones were still joined together by the natural ligaments. They could not have belonged to an age previous to the knife, and the tool must have been fashioned by the hand of man. This is genuine proof of the contemporaneity of man with mammals now extinct. We need present no more examples of this class, as the Brixham case is convincing. It was, however, a wild assemblage for man's companionship, a circle of acquaintance we should best appreciate at a distance. The population of England at that time was the following, after Owen:

"Gigantic elephants of nearly twice the bulk of the largest individuals that now exist in Ceylon and Africa roamed here in herds, if we may judge from the abundance of their remains. Two-horned rhinoceroses, of at least two species, forced their way through the ancient forests, or wallowed in the swamps. The lakes and rivers were tenanted by hippopotamuses, as bulky and with as formidable tusks as those of Africa. Three kinds of wild oxen, two of which were of colossal strength, and one of them maned and villous like the bonassus, found subsistence in the plains. There were also deer of gigantic dimensions, wild horses, and boars, a wild cat, lynx, leopard, a British tiger, much larger than that

of Bengal, and another carnivorous animal, called machaerodus, quite as large, which, from the great length and sharpness of its sabre-shaped canine teeth, sometimes eight inches long, was probably the most ferocious and destructive of its peculiarly carnivorous family. Besides these, troops of hyenas larger than the fierce *Hyena crocuta* of South Africa, which they most resemble, crunched the bones of the carcasses relinquished by the nobler beasts of prey, and doubtless often themselves waged a war of extermination on the feebler quadrupeds. There were also in Britain a savage bear, larger than the grisly bear of the Rocky Mountains, wolves, foxes, badgers, otters, beavers, hares, rabbits, bats, moles, rats, and mice. The bones of these species, all of which are extinct, are found in the rocks and caverns of the country. The teeth of at least seventy-five hyenas have been found in one cave, along with the bones of various animals, from elephants to hares, on which they fed; and the marks left on some of the bones exactly fit the hyena teeth which occur with them. Fragments and chips of bones cover the bottom of the cavern, and the abundant hyena excrements are just like those of the modern South Africa hyena, which is especially greedy of bones."[1]

The most noted locality of the combined human and extinct mammal remains is in the valley of the river Somme, in the north of France. The most important excavations are near Abbeville, Amiens, and St. Acheul. The river empties into the English channel, after passing through Picardy in a northwest direction. Abbeville is about twelve miles from the sea, St. Acheul, thirty-four, and Amiens, thirty-seven. The valley has been excavated out of chalk, averaging a mile in width, and from two hundred to three hundred feet deep. Beds of peat from twenty to thirty feet thick occupy the bottom of the valley, underlaid by gravel containing elephant's bones and flint tools. Works of art of the iron and stone period, including articles of Roman manufacture, have been found in the peat, but no succession of forests as in

[1] New Englander, May 1859, p. 320.

Denmark.. The gravel beds have yielded many bones of living and extinct animals, marine and fresh-water shells, and flint tools. More than a thousand of the flints have been obtained, exhibiting different degrees of skill in their manufacture. The most imperfect are chalk flints, very slightly fashioned. Then come the "knives," which are little more than chips of flint rudely shaped. Next are arrow-heads and oval spear-heads. The edges appear to have been fashioned by chipping, like those of the North American Indians. A human lower jaw has also been found in these gravel beds, associated with the knives and elephant's bones. It had a very fresh look, and by some was thought to have been too recent to have been derived from the gravel. We have not reliable data in this valley upon which to base a chronology.

In the year 1820 a human lower jaw, in company with bones of the elephant and various living animals, was obtained from near the base of the *loess* or ancient silt of the Rhine. This deposit is supposed to have been formed when the Rhine flowed at a higher level than at present, from the impalpable dust and very fine mud washed from glacial moraines. Its recent place in the Swiss deposits may be seen in a table already presented.

Besides the works of men, a few skulls and other bones have been found in the alluvium at various localities. The Darwinians, supposing that they must show close affinities with the apes, have examined them with great care. But they find in none of them more marked pithecoid characters than can be exhibited any day in the skulls buried in the cemeteries of London. Huxley, the most learned of this school, admits, after their examination, that the first traces of primordial man "need no longer be sought by those who entertain any form of the doctrine of progressive development in the newest tertiaries; but that they may be looked for in an epoch more distant from the age of the Elephas primigenius, than that is from us."

Calculations have been made of the age of the mound-builders of our Western States from the size of the trees grow-

ing upon them, and their supposed predecessors. Judicious estimates of the age of their builders are reliable, and present no unexpected figures. In Mississippi and California the remains of men have been found associated with the bones of megalonyx and mastodon, now extinct. The calculation of the age of the Indian skeleton found beneath four cypress swamps at New Orleans — fifty-seven thousand six hundred years — is notoriously monstrous; and the calculated age — ten thousand years — of the human bones described by Count Pourtalis in the Florida coral reefs rests upon data yet to be established.

We do not shrink from the conclusion forced upon us by the facts, although it would have been avoided ten years ago: Man and his living associates were partly contemporary with the extinct animals of the Post-Pliocene age. Admitting this statement, it remains to be proved incontestably that man was introduced more than six thousand years ago. It is very common to find certain species of one geological age surviving the extinction of their fellows, and witnessing the introduction of new races. The records of paleontology teem with such instances. More of the Post-Pliocene animals are living than have become extinct. If we may believe the best authorities only five or ten per cent have disappeared, and the remainder are still living. The following are some of the living mammalian contemporaries of the hyena and rhinoceros, known from the presence of their bones in the gravel: the red deer, roe, reindeer, aurochs, wild cat, bear, wild boar, wolf, fox, weasel, beaver, hare, rabbit, hedgehog, mole, dormouse, field-mouse, water-rat, shrew. On the other hand, many Post-Pliocene animals have become extinct within the time of written history. Sixteen species of birds have recently become extinct, and another, the great auk (*Alca impennis*), has not been seen alive since 1844, although its remains are exceedingly abundant in some alluvial deposits. The Dodo and Solitaire of Mauritius were alive two hundred years ago. Eleven species of Dinornis, the Notornis and Apteryx of New Zealand, and the Aepiornis of Madagascar

have also passed away recently, chiefly, perhaps, by the hand of man. The large siren Rhytina is not now found living, and the Arctic musk-ox is on the point of extinction. The Bos primigenius existed till the time of Julius Caesar. The great Irish stag probably lived much longer than many of his earlier contemporaries. The aurochs would have become extinct long ago, did not legal enactments preserve a few in a forest in Lithuania. One of the mammoths was introduced in the newer Pliocene, and lived to be contemporary with man for a time.

The question has arisen in some minds, whether the human contemporaries of the mammoth were different from the living races. No great peculiarities have been detected in their bones, but it is certain they were an uncivilized and barbarous race. Some authors think the human contemporaries of the mammoth may have belonged to a different species from that living. If it can be proved that the Post-Pliocene period terminated with the introduction of the now living species, this would be a plausible theory, removing all difficulties; and we may have scriptural hints of it in references to beings which kept not their first estate, who had evidently sojourned for a time in some terrestrial abode. Such a view would give rise to many interesting speculations.

We have in our country some glimpses of the late existence of a few of the extinct animals. One of the finest specimens of a mastodon's skeleton ever exhumed came from Newburg, New York, in 1845. The bones were remarkably fresh, and the half-chewed twigs he last devoured were perfectly preserved. The animal had become mired in a bog when in search of food. His immense weight caused him to sink so deep in the marl and peat that extrication was impossible. The bones were chiefly in a marl bed, such as are now forming. Above this was a bed of peat about three feet thick. We do not know the rate of the growth of peat in this country, but by assuming a rate rejected by Lyell as too small for the valley of the Somme, three or four thousand years would suffice for its accumulation; and even this appears exaggera-

ted. It is probable that the animal was caught while devouring the twigs which grew upon the peat. He probably flourished long after man's creation.

The Indians have their traditions of the appearance of an immense animal in the Ohio country, which President Jefferson, in his notes on Virginia, refers to the mastodon. The South American Indians have traditions of a giant naked bear, and another animal resembling Jefferson's megalonyx. Other North American legends speak of the great elk or buffalo, which, besides enormous horns [tusks], had an arm [proboscis] protruding from its shoulder, with a hand at its extremity. Lyell, in speaking of extinct quadrupeds in his "Second visit to the United States," says, "that they were exterminated by the arrows of the Indian hunter is the first idea presented to the mind of almost every naturalist."

Within a hundred years the entire carcasses of an elephant and a rhinoceros have been dug out of the frozen mud of Siberia. The former, when living, was protected from the cold by an abundance of long hair. Its flesh was eaten by dogs when discovered. The impression derived from all these examples is, that these gigantic animals have lived almost to our time. These and similar facts, when carefully studied, will afford interesting inferences.

Accuracy of calculations. One of the assumptions upon which the arguments for a very great antiquity of man are based, is the so-called "uniformitarian theory." Though possessing many elements of truth, it must not be carried out too rigidly. This theory is the especial hobby of Sir Charles Lyell, and the principal part of his writings have been composed in its defence. It assumes that the rate with which changes are now going on in the earth's crust must be taken as the measure of the duration of the ancient life-periods. It also assumes long intervals of quiet between the successive ages of action, denying suddenness of change, and maintaining that old species have gradually died out, and the new ones been as slowly introduced.

We take the ground that while upon the whole, the opera-

tions of nature have been uniformly progressive in all the later periods, the agencies acting with variable intensity have been too numerous to admit of accurate calculation. The time may come when such estimates will be reliable; at present they are very inferior to historical records, and must always defer to them. For instance, a conglomerate at Tisbury in England contains silver coins of the reign of Edward I. The deposit must be more recent than the reign of that king, even if the uniformitarian theory would carry it further back. Another example is in the Egyptian monuments. Bunsen ascribes the age of Menes, the earliest king to 3643 B.C., and Lepsius to 3893 B.C., or at the most about six hundred years earlier than the deluge, according to the Septuagint. Now these dates are so well established that they are accepted as an approximation to the truth, especially as they agree with astronomical estimates of the ages of the pyramids,[1] and they should form the basis of geological calculations. Therefore when we find gentlemen obtaining very different figures for these events from geological data, the presumption is against the calculators, even if we did not also discover that the facts were not accurately stated. It has been calculated from the time required to raise the valley of the Nile a few inches, that bricks dug from the depth of sixty and seventy-two feet were deposited there from twelve thousand to thirty thousand years ago. This is from six thousand to twenty-four thousand years earlier than the first king, according to the monuments. The error is from one to five hundred per cent in excess of the true amount. Shall we accept the mean of this — three hundred per cent — as the proper ratio of the variation in all uniformitarian calculations? It is easier to find a geological than a historical variable; therefore the former must generally yield to the latter in cases of discrepancy.

A very important variable in geological calculations is change of level. This agency keeps all *terra firma* in motion, though much more rapidly in some districts than

[1] Annual of Scientific Discovery for 1863, p. 286.

others. For instance, our Atlantic coast from the Delaware river to Nova Scotia is gradually sinking. Since the Romans were in Great Britian, a part of Scotland has been elevated twenty-seven feet. In Hoosic, N.Y., a hill has risen within the past fifty years so much as to conceal from certain farm-houses a mountain in Bennington, Vt., twenty-five hundred feet high.[1] There may be changes of hundreds of feet in the interior of a continent during any geological period, which would not be generally noticed, yet this is a highly important variable, seriously affecting all calculations. Elevation would increase the amount of rain and snow, augment rivers, and a greater thickness of deposit would be the result. Similar oscillations, as Lyell has shown, may change the climate of a continent. Now, if we wish to obtain accurate geological calculations of time we must know exactly what oscillations have been in progress for several thousand years, and what the difference has been at the extremes of altitude. The reader may judge of our knowledge of these changes, when he bears in mind that until the accidental discovery of the rising of Russell Hill in Hoosic, few geologists imagined that different parts of the same township would rise or fall unequally. Who knows how many hundreds of similar cases may exist, of which we shall never be informed? We can estimate changes of level on the shores of the oceans, but changes in the interior do not leave indelible marks behind them.

Another variable is the succession of forests. A diversity of causes, both known and unknown, may operate in the change. The character of the soil, liability to destruction from fire, the comparative speed of the growth of different species, the competition between them, the amount of moisture received according to the elevation of the land, are some of the known variables affecting the duration of each forest. Those who have observed the accumulation of alluvial deposits in valleys very well know that a stratum of sand may be ten times greater one year than another; but

[1] American Journal of Science (2d series), Vol. xxxviii. p. 248.

which shall be taken for the standard? The existence of extensive forests about the sources of streams affects the amount of water in the rivers, rendering their flow equable; but when the trees have been cut down the water rushes in floods for a short time, and is scarcely perceptible the rest of the year.

The great truth taught by geology concerning man is this, and it is perfectly harmonious with the Biblical record, even if evidence should suggest an enormous antiquity to the race: Man did not appear upon the globe until a very late epoch of the Alluvial period; and no one can instance a single example of a species introduced later. It was fitting that the monarch of the animal kingdom should be introduced last into a world whose continents had been inhabited for ages by his servants, who had purified the atmosphere and fertilized the soils for his benefit.

The Noachian Deluge.

The opinions in respect to the nature and causes of the Noachian deluge have been various and conflicting. There has been more agreement since the investigations of my father, Dr. Pye Smith, and Hugh Miller. Geological principles illustrate the mode in which the waters may have been accumulated and the people destroyed. A more exact explanation may be expected when the geology of Asia shall have been thoroughly explored. We will present the most acceptable views on this subject in a series of propositions:

1. The Noachian deluge could not have deposited all the organic remains found in the solid rocks, nor could these strata have been formed between the birth of man and the flood. These statements do not require formal proof, as they constitute the basis of all correct geological reasoning.

2. The Noachian deluge does not correspond with the Drift period of geologists. Fifty years ago this was the common doctrine. The latter was an overwhelming deluge, but long anterior to man.

3. Deluges similar to the Noachian have frequently occurred

in geological history. They have been coincident with changes of level, and partial or complete exterminations of life. The proofs are, changes in the dip of the strata, in the material of the deposits, in the life, and often there were outbursts of volcanic matter. A great fall of rain is not the necessary accompaniment of any of these phenomena except the last. Some of these oscillations may have been as rapid as the Noachian, particularly when the entire life-systems were overwhelmed. Doubtless every partial extermination witnessed more or less change of level. It was only the precautions adopted by Noah that preserved any of the antediluvian fauna. Evidences of this submergence may yet be discovered, where remains of the works and bones of men have been accumulated in favorable localities. It would not be strange if the extinct mammals of the stone age were destroyed by some catastrophe similar to the deluge.

4. The Noachian deluge was probably not co-extensive with the earth's surface. This view has been generally adopted since the beginning of the present century.

(a) A universal deluge was unnecessary: it would not be required to overwhelm more of the earth than was inhabited, and the population was probably confined to a small area.

(b) It would be contrary to analogy to suppose all the continents to be submerged at once, so that there should be a universal ocean. There is plenty of water, however, to accomplish such a result provided the land should sink and the beds of the ocean rise. Nearly three fourths of the present surface are covered with water, and the average elevation of the land is less than the mean depth of the ocean. But if the universal flood were derived from rain, one miracle must produce and another remove it; for rain by the present laws of meteorology is derived from existing water by evaporation and condensation, and ultimately returns to its source by a cyclical statute.

(c) The ark built by Noah was not large enough to contain pairs of all the land animals, besides their food. This vessel was probably four hundred and fifty feet long, seventy-five

wide, and forty-five high, and it is estimated that there are living twenty-one thousand species of Vertebrates, three hundred thousand Articulates, twenty thousand Mollusks, and ten thousand Radiates. Those that would require protection in the ark would be, say, sixteen hundred species of mammals, five thousand of birds (allowing two thousand for aquatic species that would take care of themselves), a few hundred reptiles, all the fresh-water fish, about half the Articulates and a few hundred Mollusks. Sir Walter Ralcigh estimated that room would be required only for one hundred and twenty animals of the size of an ox, besides space for a few birds, and provisions for carnivorous beasts. Buffon's estimates were double those of Raleigh, and these old calculations would have been sufficient for the whole animal kingdom, did not zoölogists constantly add to the number of species. We do not need to attempt to calculate the space required for storing the thousands of living species. Many vessels of the capacity of the ark would be required. Over fifty thousand species of plants would require preservation also, if the flood were universal, and space should be calculated for them. But a vessel of the size of the ark may have been large enough to contain all the animals requiring preservation, if the deluge were limited to one district. It is well known that every country supports animals and plants peculiar to itself, and that they will not flourish when transported to another zone, always excepting a few domesticated animals. Darwinian results may be admitted far enough to allow that the animals capable of adapting themselves to slight changes in their circumstances, may have migrated from the adjacent countries after the cataclysm, and spread themselves gradually over the vacant territory. It is not irrational to suppose that Noah was supernaturally directed in his choice of the animals requiring preservation, especially as the foreknowledge of the cataclysm was revealed to him. Hence we may be satisfied that the ark was sufficiently large to preserve from extinction all the organisms needed to repopulate the devastated area.

(d) There exist cones of volcanic craters, formed of loose scoriae and ashes which would have been washed away by a universal deluge. Such are those of Auvergne in Southern France and Etna in Sicily. Examples of the washing away of volcanic cones are Graham's, Nyoe, and Sabrina islands. Graham's island arose out of the Mediterranean in July 1831. It attained a height of two hundred feet, and a circumference of three miles; but in three months this immense mass was worn down to the sea-level, and in a few weeks more it became a shoal. Such would have been the fate of Etna and the Auvergne craters had the waters covered the whole earth. Etna's cones are estimated to be not less than twelve thousand years old, while those in France belong to the Miocene Tertiary.

(e) The interpretation of the language of scripture does not necessarily imply a universal deluge. Without entering into details it is only necessary to mention the names of divines entertaining this view. They are such as Matthew Poole, Bishop Stillingfleet, Pye Smith, and nearly all modern hermeneutists.

5. The Noachian deluge was probably limited to a portion of Western Asia, while so far as the human race was concerned it was universal. This theory will reconcile all difficulties, both exegetical and scientific.

The physical character of the country supposed to have been inhabited by the antediluvians, proves that it would have been easily overflowed by the sea, if small changes of level were induced.

(a) In Western Asia, extending even into Russia, there is a large territory, nearly as large as Europe, whose rivers empty into internal salt seas, and do not communicate with the ocean. They are the Caspian, Aral, and Dead Seas, Lake of Ooroomiah, and others; and such rivers as the Volga, Ural, Sihon, and Jordan flow into them. Some of this territory is beneath the ocean level. The Caspian is eighty-four feet below the Black Sea, and a portion of the great steppes adjacent — as the Steppe of Astracan — has an average level of

thirty feet below the Baltic, and the Dead Sea is thirteen hundred and twelve feet below the Mediterranean. Now if the low barrier between the Caspian and Baltic were depressed, a torrent of water would immediately flow in and overwhelm this immense region.

(b) There is geological evidence that the Caspian in the later Tertiary period covered a much larger area than at present, yet it did not communicate with the ocean. This is indicated by the peculiar organic remains, and by vast plains white with incrusted salt, including the desert of Khiva. Other changes are intimated in a remark of Herodotus, twenty-three hundred years ago, who says the sea of Azoff was equal in extent to the Euxine. It is not so now.

(c) A large portion of western Asia, ten degrees of latitude in breadth, including much of Asia Minor, ancient Armenia, Georgia, and part of Persia, shows evidence of abundant volcanic eruptions in the later Tertiary, and slightly in historic times, as in the Caucasian range. The Katakekaumene of the Greeks, or the burnt district of Asia Minor and Mount Ararat, has probably witnessed eruptions within the human period. Eruptions are commonly accompanied by torrents of rain, but do not necessarily attend changes of level, yet are almost certain when the oscillation is rapid.

(d) There are instances on record of a sudden change of level near the ocean. Upheavals in the interior would not be so readily perceived, on account of the absence of a fixed line of comparison. In 1819 two thousand square miles of the delta of the Indus in the Cutch were suddenly depressed beneath the sea-level, and the water immediately rushed in, covering everything except the tops of the houses and the tower of a fort which still remain projecting out of the water. That area now forms an inland sea. In 1821 there was a similar depression of the valley of the Mississippi for a distance of three hundred miles, and the depressed area was filled with water. This overflow was made use of successfully by General Pope in his campaign against Island No. 10. These changes of level were attended by earthquakes.

We have, therefore, abundant facts to justify the construction of a rational theory of the Noachian deluge. Let us suppose the antediluvians peopled this remarkable region from the Euxine to the Persian Gulf, comprising an area of over two millions of square miles. We may suppose the barriers had been gradually sinking for ages, so that they were nearly overcome, when all at once there were eruptions of lava from the volcanoes, accompanied with earthquakes or paroxysmal changes of level. If these oscillations should occur nearly simultaneously in three directions, on the Euxine, Gulfs of Finland and Persia, the "fountains of the great deep" would have been undermined, and the water would have flowed in torrents all over the low countries, drowning all the animals and men before they could possibly escape. And the air would be filled with drenching rain in consequence of its disturbance by streams of lava. Like other catastrophes this deluge would be of brief existence. Forty days and forty nights would afford time enough to cover the whole country with water, and destroy every living thing in which was the breath of life, both man and beast. The most of the water must have been derived from the ocean, while the rain must have appeared the more terrible. It is not necessary to suppose that every day's rain was new material, for the process of evaporation was constantly going on, and the same water may have fallen several times during the forty days.

It is difficult to say how deeply the earth was covered. According to our theory at least two sides of the new sea were bounded by high land. As the Ararat upon which the ark rested was probably in Armenia, and not the modern mountain of that name, we do not need to hold that the land sunk to the depth of that peak — seventeen thousand seven hundred feet. If Noah described the scenes according to appearances, he would represent the flood as universal, for he would have been out of the sight of all land over the plains of Shinar, or the steppes of Astracan, even if the water was but a few hundred feet deep.

After the culmination of the disaster, this theory supposes a change of level back again. This would cause the ark to ground on high land and the waters to run off into the ocean. Probably the change continued till the parts now below the ocean level were temporarily elevated above it, so that none of the waters were left to increase the size of the inland seas. It accords with geological observation that a great oscillation in level is commonly followed by another in the opposite direction, so that the changes of the earth's physical features during the deluge were in accordance with previous experience, and the relative levels in western Asia may now be essentially what they were in antediluvian times.

Some authors suppose there was a new creation of animals and plants at the close of the deluge, in order to repopulate the desolated district, just as after similar geological cataclysms. The principal objection to this view is the absence of reference to it in the Bible. Provision was made to secure the repopulation of the world, by the building and filling of the ark with representatives of the earlier races. Why then was it necessary to create others? At the same time it must be remembered that the Bible contains nothing opposed to such a creation, or to others at subsequent periods. Possibly there is an allusion to this creation of new species in Ps. civ. 29, 30.[1] No geologist has yet been able to point out examples of new species, and most theorizers have held to the contrary view.

Almost every nation upon the face of the earth holds a a tradition of the early destruction of the inhabitants of the world by a deluge.[2] If every human being was destroyed except those in the ark, the flood was universal so far as the race was concerned, and it is not strange that its memory has

[1] Thou hidest thy face, they are troubled; thou takest away their breath, they die, and return to their dust. Thou sendest forth thy spirit, they are created; and thou renewest the face of the earth.

[2] See Articles by E. Hitchcock, Biblical Repository for January 1835, and April 1836. Testimony of Rocks (American edition), p. 283, etc. Bibliotheca Sacra, Vol. xx. p. 395; Vol. xxii. p. 416.

been branded into the mental structure of mankind. In view of the universality and general agreement of the traditions, compared with the account in Genesis, there is no force in the objection that the individual records refer to certain local floods producing great devastation to each nation in their early history, and not to the whole human race.

The Destruction of the Cities of the Plain

Modern researches throw light upon the catastrophe that overthrew the cities of Sodom, Gomorrah, Admah, and Zeboiim, in the time of Abraham (Gen. xix.).

The surface of the Dead Sea is thirteen hundred and twelve feet below the Mediterranean. Its bottom may be considered as two submerged plains, the one averaging thirteen hundred, the other, the southern portion, averaging thirteen feet below the surface, while along the southern margin it is scarcely one foot in depth. This structure naturally suggests a more recent submergence of the shallow portion south of the promontory on the eastern shore, or where the cities were supposed to have been situated. It is conjectured that immediately after the conflagration, a paroxysmal change of level was induced by an earthquake, so that the plain was submerged. The "rain of fire and brimstone" does not sound exactly like the description of an eruption of lava and cinders; but may mean, besides a shower of sulphur, lightning combined with flames from earthquake fissures, kindling the carbonaceous gases and petroleum filling the "slime pits." Like this catastrophe was the destruction of the city of Euphemia in Calabria in 1638. An observer looked for the city after the earthquake, and saw a black cloud, and when this was gone, a dismal and putrid lake occupied the place of the houses.

The following facts support this view: (1) The language of scripture implies that the cities were submerged. Moses in speaking of the vale of Siddim before the destruction of the cities, says, "which is the salt sea,"[1] or, in other words, the sea is now where the cities were.

[1] Gen. xiv. 3.

Some have supposed the Dead Sea did not exist till after this event, and that the Jordan formerly flowed into the Red Sea by way of the Wady Arabah. The structure of the river valleys south of the Dead Sea forbids this view. Their gorges, worn down for ages previous to man, point towards the north, because the streams followed the depression of the land. Were this theory true these valleys would have converged in the other direction.

(2) There is no evidence of eruptions of lava in modern times about the Dead Sea. The region is one of extinct volcanic action, for the few specimens of igneous products discovered have not the modern facies. The rock salt of Usdum and the asphaltum are not necessarily volcanic products.

(3) A profound fault extends along the valley of the Jordan through to Akabah on the north-east arm of the Red Sea. It is along such fractures that earthquakes are felt, thermal springs abound like those near the Sea of Tiberius, and eruptions occur.[1]

(4) The vale of Siddim was full of slime pits, or wells of petroleum. These were undoubtedly like those now common on the Caspian Sea and in Burmah. The modern Orientals, probably in imitation of their ancestors in the vale of Siddim and on the plains of Shinar, dig pits in an oil region, and gather the petroleum gradually collecting upon the surface of the water, instead of boring deep artesian wells. Asphaltum or bitumen is inspissated or hardened petroleum melting readily, but not kindling rapidly, when placed in the fire. Inflammable gases always abound in oil regions. Some wells discharge only gas, others gas and petroleum alternately. Hence, in cases of neglect fearful accidents occur, as the late terrible conflagrations at Pit Hole City and Shaffer's in Pennsylvania, where, in a few moments, many lives and property worth millions of dollars have been destroyed. The pits in the vale of Siddim must have contained this inflam-

[1] See Biblical Repository, Vol. iii. second series, pp. 24, 324. Transactions of the Association of American Geologists, 1842, p. 365.

mable gas, which, once ignited, either by lightning or earthquake flames, might have occasioned fearful destruction, and by its suddenness preventing the escape of the inhabitants. On the contrary if the catastrophe resulted from an overflow of lava, or the combustion of the underlying bitumen, many of the people could have escaped, especially upon the latter alternative, for large beds of asphaltum would burn as slow as coal. Beds of coals have been known to burn in the earth for several years without seriously affecting the surface or consuming very much material, and certainly without injury to the miners.

(5) Any one familiar with oil regions will recognize in the descriptions of the regions at the south end of the Dead Sea geological indications of the fluid. The underlying limestone is fetid, impregnated with petroleum, as in Canada West. Maundrell describes stones on the shores of the lake, "which being held in the flame of a candle, soon burn and yield a smoke of an intolerable stench, losing only its weight but not bulk." This is shale or sandstone saturated with heavy oil. Dr. Madden describes native sulphur, and says that, on bathing, his body was coated with inflammable asphaltum. The solid asphaltum from which the name of the lake was derived exists only at the bottom of the shallow portion, and is forming there as in ancient times. It is probable that artesian bore-holes would develop producing wells of petroleum in this valley.

The Future Condition of the Earth.

It is very difficult to interpret prophecies. Very few of those contained in scripture have been properly understood till after their fulfilment. The hints respecting the future condition of the earth are brief, and every interpretation of them must be accompanied with abundant allowance for misconception. The chief account of the end of the world is in 2 Pet. iii. It implies that the heavens or atmosphere and the earth are "reserved unto fire against the day of judgment"; that the "heavens shall pass away with a great

noise, the elements melt with fervent heat," and that the earth with its works shall be burned up. The common interpretation of this, and a few other kindred passages, is, that the present system of life and action will be terminated by fire just as the antediluvian world was overwhelmed by water.

1. These passages do not imply the annihilation of the matter of the earth. Fire consumes, but does not annihilate; the elements change into the gaseous form and become invisible. Matter can be annihilated only by the special action of the power that created it.

2. These passages do not necessarily imply the return of the earth to the state of igneous fluidity. Considerable labor has been expended in explaining the steps of the transition from the present to the new heavens and earth through ages of fire, but such effort seems to us unnecessary. As in the Noachian flood, with which this is contrasted by Peter, the objects were accomplished by a limited deluge, so the termination of the present system may be effected by fire without reducing all things to a melted state. The object of the catastrophe seems to be to purify the world of sin, and provide new heavens and earth wherein righteousness may dwell — a renovated and beautiful abode, constructed for the redeemed from the ruins of their former habitation.

3. The earth contains within itself the agencies necessary for its desolation by fire. The crust of the earth is supposed to be several hundred miles thick, while the interior mass is in a state of fusion, like lava. The three hundred active volcanoes on the crust are the breathing-holes of the internal fire. At present counteracting agencies prevent this lava from breaking forth: But let the order be issued for its liberation, and these vents will all belch forth fire and desolation. The works of man, in which we take so much pride, may be crumbled in a moment by the concussions of the crust. Liberated gases may combine explosively with the oxygen in the air, so that the heavens should pass away with a great noise.[1] If the expression is to be understood as apply-

[1] Astronomers tell us of *new stars* which occasionally suddenly appear in the

ing to the earth, "that there shall be no more sea," we can conjecture what will become of the water. Confusion and utter ruin would result from the disruption of the crust, and every human work would be destroyed. Synchronous with these events will be others of a judicial nature, not foreshadowed in the earth's physical features.

4. The earth has already experienced igneous devastation with a change of its inhabitants. These catastrophes in different parts of the earth have been nearly or quite simultaneous, yet its entire surface was never so covered with fire as to leave universal traces of it. Any atmospheric disturbances could not be recorded. But that exterminations of life have resulted from overflows of igneous matter and their concomitants is abundantly proved.

These changes have always ushered in an improved condition of the earth. Analogy, therefore, independently of revelation, suggests that when the present system has culminated there will be a season of desolation followed by an improvement in the earth's condition. Inspiration reveals a future glorious world as the residence of believers, and the fact that

sky, but are not permanently brilliant. One of the latest of these temporary stars appeared in the constellation of the Northern Crown in May 1866. It was analyzed with the spectrum, by those careful observers, Huggins and Miller. They concluded that the spectral lines peculiar to this star, "taken in connection with the comparative suddenness of the outburst of light and its immediate very rapid decline in brightness, from the second down to the eighth magnitude in twelve days, suggested the startling speculation that the star became suddenly enwrapt in the flames of burning hydrogen. In consequence of some convulsion it may be enormous quantities of gas were set free. A large part of this gas consisted of hydrogen, which was burning about the star in combination with some other element. As the free hydrogen became exhausted the flames gradually abated, the photosphere became less vivid, and the star waned down to its former brightness." It seems, then, that there are known instances of worlds wrapped in flames. They ignite, burn fiercely, fade, and almost disappear. Suppose now, that for any reason a combustible gas should be evolved upon our planet; then it might combine explosively with the oxygen of the atmosphere, or burn like the star in the Northern Crown. Either case would meet the conditions of the prophecy. We think, therefore, that the words of Peter are amply illustrated by the latest discoveries of astronomy. We also desire to say that the spectrum analysis has confirmed the view of the nebular hypothesis given above.

the purification of the present can render it a beautiful habitation, fit for the residence of princes, renders probable the belief of many divines, that the redeemed will dwell upon this earth after the day of judgment.

IV. Geology illustrates God's plans or the doctrine of decrees. The object of philosophical inquiries is to ascertain the plan upon which every department of nature is constructed. Every generation adds information to the knowledge delivered to it, but we are still far removed from a perfect understanding of any portion of the whole. One attempts to discover the fundamental idea in the structure of the animal kingdom; another investigates the composition of matter; a third the principles that regulate the motions of bodies; a fourth studies into the structure of the human mind, its works and its words. The investigations in every department aim to develop its fundamental idea, while the foundation principles of all the sciences form parts of one grand whole, standing out as clear as crystal to the Divine Mind.

Now these wonderful arrangements are not the result of chance or fate; they are God's plan, in accordance with which he has decreed every event in nature, so that he knows beforehand what shall happen. We feel instinctively that the events of the universe are governed by law; that effects result from causes, and that the course of nature as we see it is uniform. It is impossible to conceive of any way for the accomplishment of these results, except through the establishment of the system by Omnipotence: "For every house is builded by some man; but he that built all things is God."

The early history of the earth abundantly illustrates the existence of decrees, for it reveals how they have been executed in every age. The ancient trilobite crawling upon the surface of an unfinished planet, the earth revolving in its assigned method, and the mountains arising out of the sea by law, all obey divine decrees, each in his appointed place. The bounds have been set which they cannot pass.

V. Geology illustrates God's providence, or such a control over the universe as secures the accomplishment of his decrees. The views prevalent as to the manner in which God's providence is exercised tend to two extremes, which may be called distinctively the law theory and the God-acting theory. The first ascribes the control over the universe to second causes. After the world was created its government was committed to laws or forces impressed upon matter and mind, which have the power of producing all natural phenomena. This view may include the theory of animal development, and deny the reality of miracles.

The second theory supposes every event to be due to the direct and immediate agency of God, that the laws of nature are the uniform modes of his action, and that he occasionally interferes to oppose the uniform course of nature, when moral reasons demand interference.

The most acceptable views of divine providence may be stated serially:

1. God created and preserves in existence matter and forces. Without his sustaining hand no agencies can operate.

2. God chooses to sustain the operations of nature, or all the events of his general, universal or particular, ordinary or common, direct and indirect, providence, by means of subordinate forces or agents, properties of matter, and organisms. Even the fall of a sparrow and the rustling of a leaf have been planned in his decree and executed by his providence. Infinite in power and knowledge, he fainteth not, neither is wearied by attention to the minutest particulars.

3. By means of his system of agencies God secures the occurrence of phenomena specially fitted to arrest attention by their marked adaptedness to a moral design. These are special providences, and are less common in the geological than human history.

4. When second causes cannot provide for certain exigencies God acts directly upon nature, or employs new agents, producing results inexplicable by the established course of nature. These extraordinary events are miracles, and may

be conceived of as provided for from eternity by special agencies diverse from others, just as the common providences have been decreed; but they will not thus be deprived of their moral uses. If the early history of the earth was to be repeated, these miraculous events would recur.

When a sling is used to hurl a stone, the movements of the strap through the air describes a curve more or less spiral. By varying the length of the strings, or the impelling force, these curves will be varied. One kind of spiral, after passing successively through a million revolutions, will change into another. When arranged in a certain way there is a series of eight different curves, one passing into another in a certain order, even when the first and fourth may resemble each other more than the first and second. After all the eight gyrations have been passed through, the revolutions return through the same series in the reverse order.[1] These curves afford an illustration of the occurrence of miracles. After witnessing a million revolutions of the sling, the observer would think it always described this particular curve; but the next revolution is of an entirely different character. There was an occult force providing for an altered curve upon the first revolution succeeding the millionth. Miracles appear in a similar unexpected manner, subject to the law of divine interposition. Without knowledge of all the elements producing them, the observer can never predict their occurrence.

We only need to present illustrations of the special and miraculous providences displayed by geology; the common providences are generally admitted. Some of the careful preparations made for man in the structure of the earth indicate special providence as well as prospective benevolence. The storing up of cubic miles of coal, reservoirs of petroleum, veins of metals, and other useful articles are phenomena specially fitted to arrest attention by their adapt-

[1] Imperfectly reported memorially from a communication by Prof. B. Pierce of Cambridge, to the National Academy of Sciences, on the theory of the sling, August. 1865.

edness to the wants of man, and their uselessness to the former inhabitants of the earth. For man also the rich profusion of natural scenery, mountains, rivers, trees, and flowers were prepared.

A third class of these providences appears in the special adaptations of animal and vegetable races to the varied conditions of the earth at different epochs. The course of nature was not permitted to continue as it began, although well arranged at first. Certain features in the organic structures were modified, special provision being made for altered conditions. Time forbids the mention of others.

Miraculous Providence. Exigencies demanding the action of a power above nature have occurred in the geological history of the earth when the seas were destitute of life. It requires a new creation to explain satisfactorily the restocking with organisms the depopulated continents and oceans. This exigency has been met probably from twenty-five to thirty times. There are three phases to this series of miracles: First, there was the creation of organisms out of inorganic matter; second, there was a succession of races; and third, man appeared. These creations may be regarded as the interruptions of cycles — the arches spanning the yawning gulfs between different aeons — the marks of the divine hand cutting asunder the great chain of life and organizing new systems.

Inferences from IV. *and* V. 1. If all events in the natural world have been foreordained, there is a presumption that the acts of men have been likewise predetermined. For the physical acts of man are the same in kind with those of animals; and the operations of mind are as much regulated by law as those of the body. The one class would seem no more intricate than the other.

2. It has been objected to miracles that they are contrary to nature, and therefore impossible. Geology proves the reverse; and therefore these extraordinary events may be expected in either form of God's government, natural or moral. It is easier to call the biblical miracles myths than

to disown the characters written in the book of nature. All miracles may be under the control of law, but not in any sense that will impair their religious uses.

3. If special providences have been provided for in nature, much more may they be looked for in human history, where minds exist capable of appreciating their moral designs. It is surely no more difficult for Omnipotence to decree answers to prayer, than to predetermine the force and direction of the wind. Even if every future answer to prayer is as rare as the occultations of the planets, the results happen in consequence of the supplication. By referring all these things to law, we only philosophically explain how God acts, instead of removing him entirely from the arena, as many would desire. Let the Christian then exult, because his prayers will be answered as surely as the tides shall rise or the rains descend.

VI. Geology illustrates the doctrines of scripture respecting the fall of man. A common notion has been that all nature changed when the first sin was committed; herbivores were changed into carnivores; arctic cold and tropical heat succeeded to an ever vernal climate; the serpent had previously walked erect or like an alligator; and that every species of natural evil then first began to exist.

In the place of these antiquated notions, two theories press themselves upon us: 1. Whether he be obedient or disobedient the world is adapted equally well to man.[1] 2. The world was intended to be a theatre for the exhibition of the work of redemption.[2]

We will first consider what the Bible teaches concerning the fall. The events of each creative day were pronounced "good," and the whole "very good," by Elohim. This account included the creation of carnivores, — and consequently suffering and death among the animals, — uncouth forms, fierce characters, and the death of plants. Certain

[1] See Anticipations of Man in Nature, by Professor Dana, New Englander, May 1859, p. 293.

[2] Bibliotheca Sacra, Vol. xviii. p. 253.

natural evils therefore were included in the system which met the approval of Omniscience. Man was placed in a beautiful garden, containing trees pleasant to the sight and good for food, besides the tree of life, and of knowledge of good and evil. We may suppose the fruit of the tree of life was intended to prevent or heal sickness, sorrow, and to instill immortal vigor into the system, so as to counterbalance all possible natural evils; for, lest the race should have feasted upon it and lived forever, the first pair were expelled from Eden. The eating of the forbidden fruit gave man his knowledge of the distinction between holiness and sin, and was the occasion of moral evil and suffering to the race.

The serpent tempted man to sin. The inference that previous to the curse he walked erect, is warranted neither by scripture nor science, for in the Tertiary rocks are found the bones of serpents like those now living — boa-constrictors and vipers. Probably an evil spirit entered into the serpent, just as in other parts of scripture dumb beasts have been influenced by spirits, both good and bad; as Balaam's ass, the fish that swallowed Jonah, the fish with a coin in his mouth, and the Gadarene swine. Hence the curse may apply partly to the evil spirit, and partly to the animal. The curse upon the evil spirit is persecution and final destruction by the seed of the woman; that of the serpent seems to be the estimation placed upon him by mankind. He is avoided by them, he trails upon his belly in the dust, and is a symbol of the deceitful.[1] The curse pronounced upon woman pertains to herself alone. That pronounced upon man renders his labor unproductive, and entails sickness, suffering, painful death, spiritual evils, and penalties. The ground is also cursed, yet entirely in its relations to man. In consequence of the transgression the human race receives the same curse as Adam.

It is an inference of theologians that the curse includes all physical evils, such as the sufferings and death of animals,

[1] See the "Serpent in Eden," by Dr. John Duns, Bibliotheca Sacra, Vol. xxi. p. 163.

extremes of climate, existence of carnivorous animals, absence of beauty, earthquakes, etc. It can be no longer maintained that natural evils did not exist before the fall, as we have already proved, and the creative chapter implies the presence of some of them before man's introduction. Besides, herbivores could not be changed into carnivores except by a new creation.

The first theory denies that the pre-Adamic evils are included in the curse. They would have continued to exist if man had never sinned. Carnivores cannot subsist upon plants, therefore suffering and death must have prevailed among the animals. Even the herbivores would have devoured many insects and other minute forms unintentionally. In some regions there would have been deserts and extremes of climate. There would have been ugly characters, deformities, absence of perfection and beauty, eruptions from volcanoes, and earthquakes. Man would labor, as he was to dress and keep the garden, but his toil would not be accompanied with sorrow. As the population increased they would naturally spread to all parts of the earth, and would devise means to protect themselves from climatic extremes and miasmatic influences. There would have been no sickness nor sorrow; unavoidable injuries would have been either impossible or instantly remedied from the tree of life, and the mar of sin would have been wanting. What a beautiful world this would have been even with the evils, without the blot of sin!

The second theory includes post-Adamic and pre-Adamic evils in the same category. God knew that man would sin, and therefore fitted up the world to be in harmony with man's state. It was full of natural evils, because they are particularly appropriate to a fallen condition. The pre-Adamic evils are logically a consequence of the transgression, though chronologically previous. Had obedience been foreseen, the world would have been fitted up differently, without physical evils. As many of the simplest laws involve evil, the difference in nature would have been fundamental.

Such a view exalts our conceptions of the extent and grandeur of the work of redemption, because every event, from the first axial revolution of the world to the elevation of the last foot of land above the ocean, has had reference to man's character and wants as a sinful being in a probationary state.

This theory then accounts for the existence of evil in the system. It was introduced, not because it could not have been prevented, but because man's disobedience made it necessary. Benevolence, which foresaw the evil, adapted the universe to man's fallen condition. Had man chosen obedience, the entire system would have been constructed without the presence of evil. This view explains why it was best for God to permit the existence of evil.

The first theory involves a different notion of the introduction of evil; it was necessary to the symmetry of the system. The very idea of law implies the existence of imperfection; and hence it may be that God could not prevent the presence of evil, and at the same time sustain a moral government.

These two theories are presented without comment. Either of them explains all the facts, although resting upon very different foundations. Neither of them has atheistic or heterodox tendencies.

NOTE. — Since the preparation of this Article many additional facts respecting the association of flints and human bones with the remains of extinct animals have been published, and more precise subdivisions of the stone age have been suggested. These facts are similar in kind to those described above, and all interested in the details may consult the scientific journals. The writer has also visited the valley of the Somme and other localities of interest, and has seen nothing that will conflict with the conclusions stated above. It would not be strange, however, if in the future we should find it desirable to revise our chronology.