ARTICLE VII.

# GEOLOGICAL CONFIRMATIONS OF THE NOACHIAN DELUGE.[1]

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## ITS SCIENTIFIC CREDIBILITY.

THE main evidence of the Noachian Deluge must always be historical; but it is the prerogative of science to consider the degree of its intrinsic credibility, and so to remove unwarranted prejudicial bias. With this in view, in the present article we will limit ourselves to facts bearing upon the reasonable credibility of the supposition, that, since man came into the world, there may have been changes of land level of sufficient extent and rapidity to destroy the human race, and fairly to meet the demands of the biblical narrative when properly interpreted. The adequate discussion of this point calls for a somewhat comprehensive survey of geological theories relating to the general stability of land levels, and of the causes of the extensive changes of level which all admit to have taken place. The first of these has to do with the general question of uniformity in the action of geological forces. It will be in place, therefore, at the outset, to adduce the considerations which emphasize the fact that

## GEOLOGICAL FORCES ARE FAR FROM BEING UNIFORM IN THEIR ACTIVITY.

Geologists may be roughly divided into three classes,—Catastrophists, Uniformitarians, and Evolutionists. The Catastrophists hold that nearly all the changes in the

[1] Continued from page 293.

earth's surface have taken place with great rapidity. In their view, the species which succeed each other in the geological strata were, each and all, fresh creations. At each geological epoch, according to the Catastrophists, the board was swept clean, and a new record spread upon its surface. The mountains were upheaved by a single stroke of divine power, and the foundations of the great deep were broken up with equal suddenness. A hundred years ago the Catastrophists held the field against all opponents. Indeed, their theories were scarcely questioned by anybody.

But, largely through the influence of Sir Charles Lyell, in the publication of his "Principles of Geology" in 1830, the Catastrophists were in due time almost entirely superseded by the Uniformitarians. These hold that the present is a perfect measure of the past,—that all the vast geological changes to which the earth's crust bears witness, were effected by the slow processes which are now going on. With this view, the Uniformitarians felt free, and were indeed compelled, to make unlimited drafts upon the bank of time, and allot hundreds of millions of years to a single geologic period, as though eternity alone limited the history of the earth's changes. In one of Darwin's famous calculations, three hundred and sixty-six million years is spoken of as "a mere trifle" of geologic time.

The difference between these two theories has been well set forth in the saying, that "the Catastrophists are prodigal of force, and parsimonious of time; while the Uniformitarians are parsimonious of force, and prodigal of time." The leading Uniformitarians were so parsimonious of force that they were aptly characterized as "the homœopathic school of dynamics."

The more attentive study of the facts, and the more rational attitude of mind which characterizes the opening of the twentieth century, are bringing into prominence the great truth which lies between these two extremes. In

the light of these, it is seen that the processes of nature cannot be comprehended under either of the foregoing theories. There is, in fact, no such thing as uniformity in nature. On the contrary, nature is a continuous series of changes the rate of which is far from uniform. Sometimes these changes proceed for a long period at a rate so slow that its steps seem almost infinitesimal, while at other times they go forward with leaps and bounds. The true theory is that of Evolution. There is continuity in the geological progression, but not uniformity: catastrophes are by no means unknown in nature.

The illustrations of this principle are so numerous and familiar that it seems strange that it should ever have been overlooked. In every great movement, there is a last feather which "breaks the camel's back," and produces visible results which are out of all proportion to what had before been apparent. The boiler remains intact under increasing steam pressure up to a certain point, before which the successive addition of pound after pound of pressure produces no apparent change in the phenomena. But, upon the addition of another pound's pressure, the boiler bursts into a thousand fragments, and shatters everything with which it comes in contact. Or, again, the bow gradually bends to every successive increase in the strain to which it is subjected up to a certain point, when it suddenly snaps in the archer's hands, and becomes a useless piece of wood. In either case, mathematicians might have predicted the results, if the nature of the forces involved had been fully known. But empirical philosophy which made the past and the observed narrow present a full measure of the future, would have been completely at fault in its predictions.

Turning to greater things for illustration, we may note that, previous to the first century of our era, the fires of Vesuvius had been so long quiescent that all memory of

their former activity had been erased from the consciousness of mankind. The slopes of the extinct crater were covered with vineyards and villas. The cities of Pompeii and Herculaneum were thronged with a pleasure-seeking crowd, all of whom were "Uniformitarians," believing that "from the beginning of the world all things had remained as they were," and that the present was a full measure of the future. But in the year 63, suddenly this feeling of security was shocked by an earthquake which shook down palatial residences, and prostrated defensive walls which from time immemorial had been the pride of Southern Italy. In the twinkling of an eye, the pressure of the accumulating gases beneath had passed the danger-point, and produced a catastrophe of the most tragic order.

But even this was not sufficient to disturb the false security. Roman capital and Roman artists poured into the desolated city, and in a decade rebuilt it on a scale of still more magnificent splendor. In freshly adorned palaces the philosopher retired to the quiet of these unrivaled pleasure-resorts, to ponder upon themes which were out of place amid the every-day affairs of the great capital on the Tiber; while the satirical poet built his luxurious residence close by, from which to launch his keen shafts of ridicule; and the courtesan, in a neighboring street, shamelessly flaunted the sign of her nefarious enticements. Thus, literally, a whole city full of pleasure-seekers was dancing on the edge of a volcano.

The end was such as to make an impression which few occurrences in history have done. This time the struggling vapors beneath found relief, not in an earthquake, but in dense showers of volcanic dust and in streams of lava. Herculaneum was hermetically sealed by a broad sheet of basalt. Pompeii was buried beneath showers of dust and ashes. Moistened by the copious rain which accompanied the eruption, the fine sediment flowed into the

parlors and bedrooms and workshops and prison-cells, and inclosed the inmates, making casts of them in all the life-like attitudes in which they were found. Thus, for more than a thousand years, these cities lay hid from view, while the gardens and vineyards of successive generations flourished on the rich soil above the houses of Pompeii, and chariots rumbled unceasingly on the natural pavement made by the incasing sheet of lava which covered the streets of Herculaneum. During much of this period, Vesuvius was quiescent, and, for a while, Spartacus, with his band of robbers, found a ready-made natural fortress in the crater of this historic volcano.

At the time of writing, the tragic events in Martinique are emphasizing the same great truth. To be a "Uniformitarian" in presence of such facts requires a peculiar definition of uniformity.

But to measure the small demands made on our credulity by the story of the Flood, we do well to consider attentively the fact that

ALL GEOLOGICAL MOVEMENTS ARE COMPARATIVELY SLIGHT.

It is almost impossible not to have an exaggerated idea of the relative greatness of the changes of level in the earth's surface which are brought to light by geological investigation. When we read of the actual changes of level which have taken place since the beginning of the Tertiary period, for example, they seem enormous. Nearly all the high mountains of the world are the result of that period of land elevation. The Pyrenees, the Alps, the Himalayas, the Andes, and the Rocky Mountains, all bear upon their summits deposits of sea-shells belonging to this most recent geological epoch. Since the middle of the Tertiary period, all these mountains have been raised to their present heights from the level of the sea. Here is

brought to view an elevation of land more than two miles in perpendicular extent. Nor was the elevation confined to the narrow mountain-chains. The vast plateaus of Central Asia shared in the movement; while the extensive western plains of the United States from the Mississippi River to the Pacific Ocean then received most of their elevation. There is abundant evidence, also, that Northeastern America, and Northwestern Europe, at the close of that period, stood from two thousand to three thousand feet higher than they do now. Furthermore, this elevation at the close of the Tertiary period, which was coincident with the coming-on of the glacial epoch, soon gave place to a subsidence which carried the land much below its present level. At the close of the glacial epoch, the land at Montreal was five hundred feet lower than it is now, and farther north one thousand feet lower.

But great as these changes of level in the earth's crust actually are, they are relatively very small; so that one may well wonder how the delicate equilibrium between land and sea which is essential to civilization, and indeed, to life, is secured. The earth is a sphere eight thousand miles in diameter. A mountain-chain four miles high produces only a roughness on the surface one-two-thousandth part of this; while, in the vicinity of Denver, the plateau, which there reaches the elevation of about a mile, produces a swelling of the circumference amounting to only one-eight-thousandth of the diameter. Were we to transfer these inequalities to a globe ten feet in diameter, —an object, by the way, which would leave little space in a moderate-sized sitting-room,—the roughness of the surface would be hardly appreciable: the plains of Denver would be represented by a swelling in the surface of only about one-sixty-sixth of an inch, or the thickness of a moderately thin sheet of paper; while, if these irregularities were represented to scale on a globe the size of a large

apple, they would become indiscernible, except with a microscope. The desiccation of an apple does not have to go far to produce wrinkles of that size. The irregularities on the earth's surface do not indicate any greater relative changes than this in its interior, or any relatively greater exertion of the forces stored within it.

In cheap derision of the biblical Deluge, we often hear it said, that there is not water enough in existence to cover the tops of the highest mountains. This flippant remark overlooks the fact that the biblical account, as already remarked, represents the Flood as caused not so much by the rising of the water, as by the sinking of the land. It says that all the fountains of the great deep were broken up. Now, if all the land in the world should sink below the level of the sea, it would raise the water level only about two hundred feet; that is, less than three times as much as the tide regularly rises in the Bay of Fundy. The abstraction of the water from the ocean during the glacial period to be locked up in ice over the northern hemisphere, and its subsequent return on the melting of the ice at the close of the period, produced greater changes in the ocean level than Noah's flood would have done, on the most literal interpretation of the account.

That we may not overestimate the significance of the present relative stability of the earth's crust, it is in place to consider the known extent of

RECENT GEOLOGICAL CHANGES.

Fortunately, the balance of geological forces is so delicate and perfect that most of the changes on the earth's surface take place slowly. Otherwise it would have been impossible for the higher forms of life to have maintained their existence. But there are many facts which bear indubitable witness to recent geological movements of great relative rapidity. Among these may be enumerated many

lake basins occupying depressions in the earth's surface. Of them I will for the present speak of three only which have recently come under personal observation, namely, Lake Baikal, and the Aral and Dead seas.

Lake Baikal occupies a north-and-south cleft in the broad belt of elevated table-land which extends from Central Asia into Northeastern Siberia. It is about four hundred miles long and thirty wide. Its elevation is 1,561 feet above the sea, but the mountains on either side rise to a height of from four thousand to seven thousand feet. The mountain barrier on the west, however, is narrow, and penetrated by a single transverse cleft through which the Angara River carries the surplus water of the vast drainage basin emptying into the lake. But, unlike the other rivers mentioned, this has by no means kept pace in erosion with the elevation of the barrier. It still has much to do before it obliterates the rapids which separate the lake from the more leisurely current of the river fifty miles below, at Irkutsk.

Still further, the present depth of the lake is significant. While the northern half is shallow, being only a few hundred feet deep, the southern half runs down to a depth of 4,186 feet, or nearly three thousand feet below sea-level. The significance of these facts is enhanced by those relating to its drainage basin. This covers an area of about two hundred thousand square miles, and is served by the Selenga, the Khilok, the Uda, and the Upper Angara, rivers of the first order, besides numerous smaller streams. These all come down from the surrounding high granitic table-lands with a gradient which makes their erosive power excessively large. And they are all characterized by open eroded channels from one to several miles broad, with a depth of one or two thousand feet. Evidently the amount of sediment brought down has been enormous,—enough to have filled the bed of the lake many times over. The

great depth of the lake, therefore, and indeed its existence at all, indicates that the subsidence of its bottom is an event of recent geological occurrence.

Its recentness may be appreciated by the following brief calculation: The Selenga River, emptying into Lake Baikal from the east about one hundred miles from the south end, drains, as we have said, an area of two hundred thousand square miles. The mountainous plateau in which this vast river system rises is fully three thousand feet higher than the surface of Lake Baikal, giving such a gradient to the streams that their erosive activity would be considerably above that of average rivers. Assuming, however, that it is relatively the same as that in the Mississippi basin, we shall be able to make an approximate calculation which cannot be very far from the truth.

By long and careful experiments conducted by Humphreys and Abbott for the United States Government, it is ascertained that the sediment, consisting of gravel, sand, and mud, which is carried by the Mississippi River past New Orleans is sufficient in quantity to remove one foot of material from the whole Mississippi basin, stretching from the Rocky Mountains to the Alleghenies, in five thousand years. All this material is being deposited along the margin of the delta which the river is pushing out into the Gulf of Mexico. In the more mountainous region of Northern Italy, the river Po is bringing sediment down to the head of the Adriatic Sea at a rate which would remove a foot of material from its entire drainage basin once in every seven hundred years. As a striking tangible evidence of the rapidity of this erosion, and the consequent accumulation of material about the mouth of the river, it is worthy of note that the city of Adria, which was at an early period a port of such importance and celebrity as to give name to the sea on which it stood, is now sixteen miles inland.

But taking even the lower rate of the Mississippi as the standard for that of the Selenga River, we shall arrive at results which are sufficiently instructive and even startling. All the sediment brought down by the river is deposited in the southern half of Lake Baikal. It is impossible to believe that the average depth of this basin was ever more than one-half mile. Taking the length of the southern half of the lake basin as two hundred miles and its average width to be thirty miles, which are both liberal allowances, we should have three thousand cubic miles of space to be filled. But, on the basis of the calculated erosion from the drainage area of the Selenga River of one foot in five thousand years, forty cubic miles of sediment would be deposited in the lake every five thousand years.

The whole portion of the basin, therefore, in which the deposit is made, would be filled up by the sediment in three hundred and seventy-five thousand years. But so little has the delta encroached upon the lake, that it is certainly not one-fifth full, and probably not one-tenth full. The extensive geological changes, therefore, which have produced this great basin cannot have been more than seventy-five thousand years ago, and probably were not forty thousand years ago, and may be even considerably later. Geologically, the relative period of its formation was during the latter part of the Tertiary or the beginning of the Glacial period. Altogether this is one of the most striking and convincing evidences heretofore adduced of the recency of some of the most extensive geological changes which the world has ever witnessed, while it is difficult to see any way in which the figures can be very greatly enlarged.

The great Aral-Caspian depression is another of those vast inclosed basins bearing unmistakable evidence of recent rapid geological changes in the earth's surface. In this case a region nearly as large as the whole United

States is without any outlet to the ocean, and is subject to an evaporation just equal to the rainfall. The surface is dotted with dried-up lake basins of greater or less size, most of which contain salt beds at their bottoms. Under these conditions one would naturally expect to find the water of the Aral and Caspian seas to be, like that of the Dead Sea and Great Salt Lake, salter than the ocean. On the contrary, the Caspian Sea is only one-third as salt as the ocean, and the water of the Aral Sea is so nearly fresh that animals on the islands freely drink it. The explanation is that the oceanic outlet has only recently ceased to exist. Previously the great rivers flowing into these basins had brought in so much fresh water that an oceanic outlet was a necessity, and the seas were partly freshened. The changes which have diminished the rainfall and increased the evaporation have been so recent that there has not been time for the seas to become saturated with salt like most inclosed lakes. All the rivers with their modicum of salt are continually running into these seas, yet their waters are not full of salt. The sure inference is that the time during which these agencies have been acting is narrowly limited. The desiccation of this vast region is a very recent geological event.

This conclusion is supported, also, by the geological evidences that, up to recent times, a vast inland sea as large as the Mediterranean occupied the interior basin of Central Asia known as the Desert of Gobi, around which extensive shore-line deposits of sedimentary material are reported in various places. Moreover, the early Chinese records refer to this sea, under the name of Han Hai, as still covering an extensive area within the historic period. Lob Nor is, at the present time, the sole remnant of this body of water, indicating a recent period of greater rainfall throughout Asia.

In case of the Dead Sea, we have a depression whose

surface is thirteen hundred feet, and its bottom twenty-six hundred feet, lower than the surface of the Mediterranean, forty miles away. But the isolation has been so long continued that the water of the Dead Sea is saturated with salts of every kind. Evidence of the recentness of the formation of this deep basin is, however, unmistakable. The Jordan is one of the muddiest of all rivers, while numerous wadies of large extent which are periodically gorged with water, making them eroding and transporting agencies of the most efficient kind, come down into it from the highlands on either side. Why, then, has not the present basin of the Dead Sea been filled up with sediment? Evidently because the bottom of the lake has fallen out in recent geological times.

From the size of the drainage basin, as compared with that of the Dead Sea itself, and the rate at which sediment is being carried into the sea, it will appear, upon calculation, that fifteen thousand years is a longer period than has probably elapsed since the extreme depression of the Dead Sea was formed. Evidently it is a region in which geological forces have been active with enormous intensity in comparatively recent times.

### THE LATEST GEOLOGICAL EPOCH, ONE OF GREAT CHANGES OF LEVEL.

The history of the three lake basins just described might have been introduced under this head. But it will be more in point to adduce facts of a more specific character. To this end the entire history of the glacial period is in place. The glacial period, both in Europe and America, was coincident with, if not caused by, an extensive continental elevation of the land throughout the region. Just before the glacial period, as already said, the land in a large part of the northern portion of North America stood from two thousand to three thousand feet higher than its pres-

ent level. The evidence of this is abundant on every hand. Both the eastern and the western shores of the United States and Canada are bordered by a shelf of shallow water, which, at distances varying from a few miles to a hundred miles or more, suddenly breaks off into much deeper water. The depth of the water on this shelf is less than six hundred feet, while, beyond, it suddenly becomes several thousand feet deep. Now, there is indubitable evidence that, at the close of the Tertiary period, this shelf was dry land, standing at such an elevation that the great rivers coming down from the interior cut channels through it hundreds of feet, and in some cases thousands of feet, in depth. These submerged drainage channels are brought to our knowledge by the sounding-line of the Coast Survey. The Hudson River then found its way to deep water south of New York through a cañon more than one thousand feet deep, extending to its mouth between precipitous cliffs nearly one hundred miles beyond Sandy Hook. The Delaware and Susquehanna rivers found similar outlets through cañons extending far out beyond Delaware and Chesapeake bays; while the St. Lawrence extended in its lower course several hundred miles through a deep-cut channel in dry land where now we find the Gulf of St. Lawrence and the Banks of Newfoundland. Similar channels intersect the shelf which borders the Pacific Ocean on the coast of California, Oregon, Washington, and British Columbia. At the same time, numerous borings for oil have brought to light in Central New York, Ohio, Indiana, and Illinois many eroded channels in the rocks, now filled with glacial *débris*, which immediately before that period conducted away the drainage of the interior at a depth considerably below that of the present sea-level.

To the same effect is the evidence from Northwestern Europe. On the approach of the glacial period, the North Sea between England and Scandinavia, which is now

everywhere very shallow, was all dry land, intersected only by the channel of a mighty stream which conducted away to the far north the combined floods of the Rhine, the Weser, and the Elbe, augmented by all the water which issued from the area of the Baltic and of the eastern watershed of Great Britain. The fiords of Norway then increased their grandeur by the addition of many hundred feet to the present height of their cliffs above the water. To the south, this preglacial continental elevation was sufficient to join Africa to Europe across the middle part of the Mediterranean, and to permit the elephant and the hippopotamus freely to roam over the plains of Sicily and Southern Italy. Fresh bones of these animals have been mined for export by the ton from the caves near Palermo.

### THE GLACIAL PERIOD AS A VERA CAUSA.

The significance of the glacial period can be fully realized only by those who have made a special study of the subject. Still, there are a few facts which can be briefly stated, and which bear with great force upon the question of the recent occurrence of a period of exceptional instability in the earth's crust; while the proper appreciation of these facts will tend to remove prejudices which the uniformitarian theory has raised in many minds against crediting any such story as that of the Flood. The main facts relating to the glacial period, which are both capable of abundant proof and pertinent to the question in hand, are these:—

At the close of the Tertiary period, snow accumulated over the elevated portions of the northern part of North America and the northwestern part of Europe faster than it melted. Under the pressure of its own weight, this was consolidated into ice, which, under the laws regulating glacial movement, slowly flowed outward from the center

of accumulation in the line of least resistance until it was melted by contact with the warmer atmosphere in the south. The area which was eventually covered by this glacial mass was about six million square miles, four million being in America, and two million in Europe. Its depth is known to have been one mile in New England, from the fact that it covered the top of Mount Washington, leaving foreign boulders upon its very summit. It is altogether probable that its average depth was fully as great as this. In Greenland at the present time the thickness of the ice-covering over the center of the area is probably more than this.

On this estimate, however, the mass of ice accumulated over the northern hemisphere at the climax of the glacial period would be six million cubic miles; thus adding the pressure of this immense weight over the area of accumulation to disturb the balance of forces which preserve the normal relations between the continents and the ocean. Furthermore, not only was the weight of this mass added to the northern part of the continents, but, to furnish the accumulating snow over this region, an equal amount of water was abstracted from the ocean. This would be sufficient to lower the level of the ocean two hundred and fifty feet the world over; thus relieving the ocean beds of that enormous weight.

It will help to an appreciation of the tremendous significance of this temporary transfer of weight from the ocean beds to the continents to note that a mass of ice one mile thick would produce a pressure at the bottom of one hundred and twenty-five atmospheres, equal to two thousand pounds to the square inch, or four billion tons to the square mile. The total amount of pressure thus transferred during the glacial period from the ocean beds to the northern part of America and Europe would be twenty-four thousand million million tons.

Still better to appreciate these figures, one needs to compare them with those expressing the bulk and weight of the continents. North America has an area of eight million square miles, with an average height above sea-level of six hundred feet, which would make one million cubic miles, or only one-sixth the amount of glacial ice at one time piled up on the northern hemisphere. Reckoning the specific gravity of rock to be three times that of ice, the weight of the entire continent of North America above tide-level would be only one-half that of the ice of the glacial period. The total land area of the world is thirty-eight million square miles, and measures in bulk above water-level only about the same as that of the glacial ice on the northern hemisphere during the climax of the glacial period.

In addition to this, Mr. Woodward, the mathematician for the United States Geological Survey, calculates that the attraction of the ice piled up during the glacial period about the north pole would be sufficient to raise the water in that region several hundred feet, and to lower the ocean-level over the main ocean beds about fifty feet. This, therefore, would have to be added to the direct disturbing force of the ice itself.

Now, if the earth be indeed in any degree plastic, it is easy to believe that the transfer of this enormous weight of ice from one portion of the surface to another would produce marked temporary changes in land level. The piling-up of such a mass of ice over the glaciated area is a cause tending to depress the continents, whose effects geologists are compelled to reckon with. At the same time it is to be observed that the tendency of this increase of pressure over the glaciated area to depress the continents is reënforced by the relief of pressure in other portions of the earth's surface, caused by the abstraction of water from the ocean. Interest in the problem is further increased by

the subsequent melting of this mass of ice, and the return of the water to the ocean beds; thus relieving the glaciated area of the pressure, and restoring it again to its normal condition. If any one can in thought pass lightly over these known great changes which have recently taken place in the distribution of the forces of gravity over the earth's surface, it is because he has not paused long enough upon them to comprehend their significance.

That there is a considerable degree of plasticity to the earth is proved by a wide range of geological facts. The very separation of the earth's surface into land and water, which indicates that the continental areas are elevated portions of the earth's surface, and the ocean beds depressed areas, proves it. Fossil sea-shells upon the summits of our highest mountains give clearest evidence that extensive areas which were formerly buried beneath the ocean have since been raised to great elevations. Indeed, the language which speaks of "the earth's crust" is as scientific as it is popular. As compared with the mass of the earth, the cooled-off outside crust is but a shell sensitively subject to the influence of the shifting of any load from one point to the other, such as is brought to light in the accumulation of glacial ice and its subsequent melting.

That the earth's interior forty or fifty miles below the surface is hot enough to melt all known minerals is beyond reasonable controversy. So far as man has penetrated the surface in wells and mines, the temperature is found to increase one degree for every fifty or sixty feet, or one hundred degrees for every mile, which would give a heat of five thousand degrees fifty miles below the surface; while, that there is some such reservoir of heat within a moderate distance from the surface of the earth is evident enough from the existence of volcanoes; whose activity we are learning from sad experience has been by no means confined to past ages.

To just what extent, however, the center of the earth is in a fluid condition is not determined solely by its heat. Upon approaching the center of the earth, the pressure of gravitation so increases that it is supposed to compress the hottest substances into a solid. But, as all concede, there must be, about fifty miles below the surface of the earth, a ring of material, of indefinite thickness, which is in a sufficiently semiplastic condition to allow it to respond to changes in the amount of superincumbent pressure. Upon this molten mass the crust of the earth reposes in a state of equilibrium which is constantly liable to disturbance. The extent of the disturbances to which it is liable is measured by the facts already adduced in the elevation of the continents and the depression of the ocean beds, and in the changes which have repeatedly taken place in these elevations as shown in geological history.

Indeed, it would seem that the height of the mountains is limited by the forces which maintain the equilibrium of the earth's surface. Mountains could not be maintained above a certain height without overloading "the low arch of the earth's crust"; so that it would settle down into the semiplastic mass beneath. In short, the crust of the earth is like a pontoon bridge: the more you pile on at the top, the lower it will sink down at the bottom.

This brings us to the point had in view in this part of our discussion. The equilibrium of the earth's surface is so delicately balanced that it is very easy to believe that the disturbances of the glacial period produced such an abnormal temporary instability of conditions that the story of the Flood, when reasonably interpreted, is not encompassed with any more *a priori* geological improbabilities than is any of the other great facts of geological history.

In my recent excursion across the Asiatic continent I set out with the expectation of finding evidence in Mongolia, Manchuria, Siberia, and along the base of the Thian

Shan Mountains that the glacial period was marked by accumulations of ice on the Asiatic continent commensurate with those which occurred in North America and Northwestern Europe. But in this I was disappointed. Whatever accumulations of ice have taken place in that region are very small in comparison with those which took place in America and Europe. In consequence of this, it at first seemed difficult to connect the recent depression of the Asiatic continent implied in the story of the Flood, and confirmed by the abundant evidence to be presented in the next article, with the glacial period.

But, upon reflection, it will appear that a temporary depression of the Asiatic continent would not be dependent upon the overloading of its surface by an accumulation of glacial ice. The simple fact that the ocean beds were relieved of pressure, to the extent to which we have indicated, by the abstraction of three hundred feet of water from the whole surface of the ocean, would, very likely, so disturb the equilibrium, that, in the readjustment of forces, the Asiatic continent would sink of itself, and rise again when the glacial ice was melted off, allowing the water to return to its former position.

Thus, by attention to the general conditions accompanying the glacial period, we are led to the recognition of the existence of a unique period of instability in the relations of land and water levels which passed away only a few thousand years ago. For a brief geological time the ocean beds were relieved of an immense mass of water, which was piled up in the shape of ice upon the northern continent. After a time, which was very brief as geologists reckon it, this ice melted off, relieving the glaciated area from its pressure, and restoring it again to its original place on the ocean. During this process a general subsidence of the continental masses is not only far from improbable, but actually to be expected. But the forces in opera-

tion were too vast and complicated to permit us to work out their effects in detail. Usually, however, in such cases the results culminate in a period of rapidly changing effects towards the climax of the period.

The geologist, therefore, need not be disturbed by such a consummation of events as is described in the story of the Flood, but he well may be surprised at the sobriety of the account, at the prominence given to "the breaking-up of the fountains of the great deep," and at the assurance that the earth is no more to be destroyed by a flood; for these characteristics of the biblical story are not the natural products of the human imagination, but show that the narrator was restrained, either by personal knowledge of the facts or by the guidance of divine inspiration. The glacial geologist especially may well be impressed by the announcement that the danger of so universal a deluge had passed away, since he also now discerns a reason for the present stability of the earth's crust in the passing-away of the temporary disturbing conditions connected with the glacial period.

In the following article we will present a remarkable series of facts, many of which have recently come to notice, going to show that the changes of land level which are here seen to have been probable, have actually occurred since man came into existence. This cannot, indeed, be expected to prove the truth of the biblical narrative in detail, but may be expected to show that there is no valid scientific reason for rejecting the historical account of the Flood. The occurrence of the Flood does not make extravagant demands upon our scientific credulity.