

ARTICLE V.

THE GLACIAL PERIOD AND NOAH'S DELUGE.

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References to a possible connection between the Noachian deluge and the glacial period have not been infrequent of late. If we mistake not, President Warren, in his "Paradise Found," would attribute the flood, as well as the dispersion of nations, to that comprehensive cause; and in a thoughtful volume, published a few years ago by Rev. Edson L. Clark, entitled "Fundamental Questions," the theory was distinctly propounded that the "Flood was the last throe of the glacial period. . . . Toward the close of the glacial period the weight of the enormous accumulations of ice and snow had become so great over vast regions in the higher latitudes of the northern hemisphere that the crust of the earth at last gave way, and great depressions of the surface occurred over widely extended areas. These depressions at the north caused, of necessity, an equally extensive upheaval of the land in other regions farther south. . . . This elevation seems to have taken place along a broad belt of the earth's surface in the lower half of the north temperate zone."

This certainly is quite possible; for upon the melting away of the ice at the north, at the close of the glacial period, the way was, very likely, prepared in the eastern hemisphere for the sudden subsidence of a vast tract, including northern Africa, southern Europe, and western Asia. With this subsidence Mr. Clark would connect the Noachian flood, supposing that at first the earth in that



region was depressed below the normal amount, and soon regained the natural elevation which it still maintains. More recently, Sir William Dawson has dwelt upon the possible connection between these oscillations of level at the close of the glacial period and the deluge of Noah; Professor Claypole, also, in a paper read before the Edin-

burgh Geological Society in 1887, has made similar suggestions.

I have myself been slow to accept any hypothesis of this nature. But I must confess that the prolonged study which I have devoted to the subject in connection with the publication of my recent volume upon "The Ice Age in North America, in its Bearings upon the Antiquity of Man,"¹ has forced upon me the conviction that the theories above mentioned cannot be wholly set aside, but are deserving of careful attention.

In the accompanying map of North America during the ice period, taken from Professor Newberry for my volume, the glaciated portion of North America is shaded. During the glacial period all that portion was covered with ice to a very great depth, averaging probably not much less than a mile. The total area thus covered with ice was not far from four millions of square miles in North America, while two millions of square miles in Europe and Asia were under a similar covering. Supposing the depth of this ice to have been thirty-six hundred feet, which is the estimate made by the most conservative authorities, one can readily see what an enormous power of pressure is brought into operation over the glaciated region; and it must, at the same time, be borne in mind that not only is this immense weight added to the glaciated region, but an equal amount is subtracted from the ocean beds from which the water originally ascended in vapor. The formation of the amount of ice supposed to have existed over the glaciated area would abstract water enough from the ocean to lower its entire level fully one hundred and fifty feet. Here we have, therefore, in this transference of force to the northern part of the northern hemisphere during the glacial period a cause of almost incalculable power tending to the production of some such series of catastrophes as Mr. Clark has delineated.

It is impossible as yet to determine just the extent to

¹ D. Appleton & Co., 1889, pp. 640.

which changes of level took place in North America during the glacial period. But there was certainly a subsidence in the Mississippi valley near the climax of the period amounting to four hundred and fifty feet, and an equal amount in the valley of the St. Lawrence in the vicinity of Montreal. Of this we have definite evidence. A much greater subsidence for a shorter period of time may easily have occurred without leaving any distinct marks. One thing rendered certain by recent investigations is that the whole Quaternary period in which the glacial epoch occurred was characterized by remarkable oscillations in the earth's crust. Since the great ice age there has been an elevation in portions of Greenland of as much as sixteen hundred feet, and a similar amount has taken place in the West India Islands since the beginning of the period. The coast of Peru has also been elevated within that time to a height of at least twenty-nine hundred feet. Le Conte believes that the Sierra Nevada Mountains have risen several thousand feet since the beginning of the Quaternary period. The same is true also of the Himalayas, which, according to Medlicott and Blanford, have, in great part, indeed almost wholly, been uplifted since the Tertiary period.

Thus it is certain that the Quaternary period has been one of unusual instability in the movements of the earth's crust, and is one of the three great mountain-building eras of the earth's history ; so that the occurrence of floods was by no means uncommon in this most recent of the geological eras. If the Noachian deluge is to be connected with any of these Quaternary floods it can only be done, however, upon the theory that that flood was local in its character so far as the earth is concerned. The main objection to considering it local has arisen from the impression that the population of the earth at that time was very large and very wide-spread. Hugh Miller, in his "Testimony of the Rocks," directed his best efforts to prove that at the time of the Flood the population of the world was neither large nor wide-spread, but was very likely con-

fined to the early centres of civilization. In his argument, however, he had nothing to rely upon but general considerations drawn from the representation in *Genesis* of the great wickedness of mankind. This, he contended, must have interfered with their natural increase, and perhaps have limited it to a very small amount.

Recent discoveries have, however, brought to light indisputable facts indicating that the human race had spread over all the northern hemisphere before the close of the glacial period. Palaeolithic man is, perhaps, to be identified with the antediluvians, and abundant marks of his presence are found in the glacial deposits both of Europe and North America. In no less than four localities (hereafter to be mentioned), have these implements recently been found in glacial deposits in North America. But at the same time with the discovery of this evidence of the wide extension of the antediluvians, causes appear which in all probability brought about a wide-spread destruction of the race. The operation of these causes can best be appreciated by glancing at the map already presented, upon which it will be observed that nearly two-thirds of the area of North America was subjected to glacial conditions. A little reflection will impress one with the wide-spread disturbance which this must have produced not only in the area actually glaciated, but throughout the whole continent. Before the glacial period the plants and animals which now flourish in Europe and in the central portions of the Atlantic States of North America flourished well up towards the north pole in Greenland and in the northern part of British America, and in Iceland and Spitzbergen. All these became fugitives before the advancing rigors of the glacial climate, migrating slowly southward to keep pace with the movement of their natural climatic conditions. It is easy to see, however, that the problem of their survival was not merely one of keeping pace with their climatic conditions, but was largely one of success in the sharp competitive struggle forced upon the individuals of these species by the contracting are

the continent. What species should survive this struggle would depend upon a very complicated set of causes. A number of species we know succumbed to the adverse influences and became extinct in North America. Before the glacial period there were two species of lion, four species of canis, six species of horse, two of bison, one of camel, two of elephant, two of mastodon, living in America, which had become extinct before its discovery by the whites; and in the Tertiary period the continent fairly swarmed with species of horse, rhinoceros, camel, and various other animals, which became extinct before the close of the glacial period. And as we have seen, with this struggling mass of animal life, we must now reckon antediluvian man. It would be natural, also, that he should have found it impossible to cope successfully with the difficulties of the situation and survive the changes of that destructive period. Whether he really did so we have no certain evidence, but such as we have points, I think, to his extinction upon this continent.

Before pausing to dwell upon the direct evidence bearing upon this point, it will be profitable to say something further upon the variety of adverse forces which were crowding in to constrict the habitable area of North America during the progress and culmination of the great ice age. Not only did the ice wall slowly close in upon them from the north to limit the area, but the depression to which we have referred upon the Atlantic coast and in the Mississippi Valley still further constricted the habitable area, devastating the fairest portions of the land. At the same time there occurred upon the Pacific slope and upon the plains of the great West a series of some of the most enormous volcanic eruptions which ever occurred in the history of the world. The gold-bearing gravels of California are doubtless of glacial origin, and belong to the glacial period. These over immense tracts are covered by vast lava-deposits, in some places many hundreds of feet in thickness and extending over tens of thousands of

square miles. These lava outflows occurred not from volcanic cones, as in typical craters of the present day, but from immense fissures where the earth seemed to crack open for long distances to permit the escape of the molten flood. Such Quaternary lava masses form the walls of the Columbia River for scores of miles, and constitute an important portion of the Yellowstone Park, while the Black Hills were probably a contemporaneous centre of volcanic activity. Over considerable portions of north-eastern Nebraska, interstratified with deposits of glacial origin, is an extensive stratum of volcanic ash which must have been belched out from craters hundreds of miles away, and transported by the wind.

With considerable plausibility Professor Alexander Winchel connects these vast Quaternary outflows of lava with the direct effect of the pressure upon the earth's crust exerted by the ice which was piled up over the glaciated area. This pressure upon one part of the crust caused the fluid portion of the interior to exude through cracks in the weaker portions just as pressure upon one part of an orange will cause the juice to exude through other portions of the rind. It is easy to see, also, that these great lava flows among the Sierra Nevada and Rocky Mountains must, by melting the snow and ice upon their summits and the glaciers in their valleys, have produced local floods of great dimensions. Thus we have man and his companions in the animal world huddled together in the gradually contracting area of the southern part of the United States—beset with a wall of ice upon the north, with advancing waves of the Atlantic upon the east, and with their territory divided by the extension of the Gulf of Mexico far up the Mississippi Valley, and with the great plains of the West and the mountain slopes of the Pacific coast made uninhabitable both by fire and by flood. It would be strange indeed if amid it all man as well as the horse, the camel, the elephant and the mastodon should not become extinct upon this continent.

As already intimated, what little direct evidence we have points to such an extinction. The implements found in the gravels deposited by glacial floods at Trenton, N. J., Madisonville, O., Medora, Ind., and Little Falls, Minn., are all of what is called the palæolithic type, closely resembling those found in similar conditions in Northern France and Southern England. The implements connected with the existing races of Indians are of a different type and are found only on the surface. Furthermore, everything points to a rather modern connection between the Indian tribes in America and certain Asiatic races. All investigation shows that the Indians of America belong to one race. Their physical features, their language, and their method of reckoning relationships, indicate a common descent from some center since the glacial period. Mr. Lewis Morgan, with great plausibility, connects them, by means of their method of reckoning family relationships, with certain tribes in India, and it seems altogether probable that these races reached America through the Aleutian Islands, and penetrated the continent through the avenues opened by the Columbia River and its tributaries. Evidently these tribes are connected with a rather recent dispersion of mankind. The only tribe which can with any plausibility be put forward as descendants of the Palæolithic, or as they might be called, the Antediluvian, inhabitants of America, are the Eskimo of the north, and the evidence of this is by no means convincing.

Thus it would seem to us that the great destruction of species naturally connected with the glacial period renders it easy to believe that at the time of Noah the only remains of the human race left were in Western Asia, where the scene of the Noachian deluge is laid, and where we may well enough believe a supernatural intervention was necessary for the preservation of the race.

We do not, however, put forth these theories with any great assurance, nor is it necessary that we should do so

in order to defend the biblical narrative. An attitude of agnosticism is eminently appropriate under the circumstances. But the slight degree of probability supporting these theories increases by no small amount the credibility of the Scripture narrative if we take it as of a deluge which overwhelmed all the surviving members of the human race in the time of Noah. Of this, however, we are certain from scientific data, that there was a great destruction of life during the Quaternary period, and vast floods characterized its closing stages, that man himself most probably run great risk of being exterminated by them, and, finally, that the Noachian Deluge, considered as limited to the portions of the earth inhabited by man at that time, is by no means so improbable an affair as some would represent it to be.