

ARTICLE VII.

PROFESSOR PRESTWICH¹ ON SOME SUPPOSED
NEW EVIDENCE OF THE DELUGE.

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IN scientific circles the name of no geologist carries more weight than that of Joseph Prestwich, late professor of geology in the University of Oxford, and author of one of the most elaborate and comprehensive treatises on geology which have ever been published. In England Professor Prestwich's position is very much such as that of the late Professor Dana was in America. His descriptions of the geological facts which have come under his own observation are generally set down to be as nearly perfect as it is possible for a human observer to make them. It is worthy also of note, in connection with the present subject, that Professor Prestwich was the first English geologist fully to recognize the evidence of glacial man in the gravel deposits of Northern France and Southern England. For nearly forty years he has been foremost in the investigations establishing the great antiquity of paleolithic man in Western Europe.

¹ "The Raised Beaches, and 'Head' or Rubble-drift, of the South of England: their relation to the Valley Drifts and to the Glacial Period; and on a late Post-glacial Submergence." From the *Quarterly Journal of the Geological Society*, Vol. *xlvi*. pp. 263-343. London, 1892.

"The Evidences of a Submergence of Western Europe, and of the Mediterranean Coasts, at the Close of the Glacial or So-called Post-glacial Period, and immediately preceding the Neolithic or Recent Period." [From the] *Philosophical Transactions of the Royal Society of London*. Vol. 184 (1893) A, pp. 903-984. [Plate 33.] London: Kegan Paul, Trench, Trübner, and Co., 1893.

"A Possible Cause for the Origin of the Tradition of the Flood." Author's copy. Pp. 38.

The scientific papers from which the present summary is made, are the result of observations extending over a lifetime ; but the facts were of such a nature as long to resist all ordinary attempts at explanation. It was only as a last resort that the distinguished author applied to them the theory, that since the advent of man there has been in Western Europe a subsidence of the land to the extent of between one thousand and two thousand feet, from which it subsequently rose in a succession of earthquake shocks. In the opinion of Professor Prestwich this theory, and this only, adequately accounts for all the phenomena, which he details, and thus brings into the view of science an event closely corresponding to that described in Genesis, which is recorded to have been so destructive to the life both of men and animals. We will endeavor to compress into a few pages the more salient points in the evidence ; but to receive an adequate impression of the arguments one must consult the original papers with their abundant illustrations. It should be noted, also, that the facts dwelt upon all relate to regions outside of the glaciated area, and have been carefully distinguished from the many anomalous gravel deposits which have been so diligently studied in connection with the direct evidences of glacial action.

The evidence is classed under three heads, namely, The Rubble-drift of Southern England and Northern France ; The High-level Loess of France and Central Europe ; and The Ossiferous Breccias of the Continent.

1. *The Rubble-drift.*—At numerous places over the southern counties of England and on the south side of Dover Strait, in France, there are deposits of angular gravel, bearing no relation to the present drainage systems of the country, and containing paleolithic implements and the bones of extinct animals associated with prehistoric man. This drift is found as far inland as the vicinity of Oxford, and at an elevation on the Cotteswold Hills of about nine hundred feet. It differs in important respects from all ordinary gravel, such as

is found along river courses or on the beach of oceans and lakes, in—

(1) The angularity and sharpness of the harder constituent débris. Evidently the material has been moved but a short distance; since both the fragments of stone and the fractured bones retain their sharp angles.

(2) A second peculiar characteristic is that the material is all of local origin, and is derived from the higher grounds of the immediate vicinity. A significant fact, also, in connection with this, is that the drift is arranged around the base of the higher land, as if it had been swept in all directions from it, yet so far from the base that the agency of distribution could not have been running water. In some cases, as on the South Downs, at Portslade, west of Brighton, this drift extends from two to five miles over a comparatively level surface, but the material is not collected in deltas, as would be the case if it were transported by small streams, but is pretty equally distributed around the base, nor does it have any regular stratification, as would be the case if it had been transported by ordinary water action.

(3) There is a total absence in these deposits of marine and fluviatile shells. This has ordinarily been taken as conclusive evidence against the origin of these deposits during a period of submergence. In the opinion of Professor Prestwich, however, it is simply evidence of the brevity of the submergence: the time of its continuance was too short to permit the establishment of colonies of shell-fish of any description.

The only way in which Professor Prestwich finds it possible to explain this distribution of Rubble-drift is on the theory of a submergence followed by a series of paroxysmal periods of elevation. We will permit him to explain the process in his own words:—

“It is evident that the force—whatever it was—which determined the formation of the Rubble-drift acted from above downwards. This, under certain circumstances, might have been the result of the descent

from the hilltops of ice and snow, or of water. Ice might have acted in some respects in accordance with the observed phenomena, but in other respects there are the objections I have already named; and with regard to rain and surface-waters, the results are, as I have shown, irreconcilable with their agency. But there is another form under which we may consider the action of water, and this, although not free from objections, answers to all the physical conditions of the case.

"It is that of water in a body, not moving rapidly over the surface as in a wave of translation, but displaced from a state of rest, while the land is in process of elevation from beneath it. There is the objection, amongst others, to a wave of translation that it would carry the *débris* in one prevailing direction, and in each locality we should have foreign elements more or less largely introduced, and the drift assuming a 'crag-and-tail' arrangement behind the hills; whereas no such distribution prevails, but on the contrary we have in the area we have described a number of local centres from which the drift diverges in different or in quaquaversal directions and combines in the intervening valleys. This is a result which would necessarily follow on the emergence of land from beneath a body of water, and such seems to me the most probable solution of the problem we have before us.

"I am therefore led to suppose that a submergence of the land which, judging from the heights at which the Rubble-drift is found, could not have been less than one thousand feet, followed immediately upon the epoch of the low-level valley drifts and the Caves. There is little or nothing to show as a direct consequence of the submergence. The land over which the waters spread seems to have undergone but trifling alteration or denudation. The Raised Beaches exhibit in consequence thereof no apparent erosion, and the Blown Sands only slight denudation; and this may be due to the impact of the Head. It is even difficult to say whether their irregular thickness and eroded surface resulted during the submergence or emergence of the land. I can only conclude that the submergence was slow and gradual, yet sufficiently rapid to prevent wave-action from removing the whole of the Blown Sands, or from forming terraces, which it would have done had the fall been prolonged or subject to long interruptions. For the same reason no portion of the strand was washed on to the land.

"The absence of marine shells in the submerged land may seem a difficulty. Had the submergence been of long duration, a marine fauna would necessarily have established itself; and I can only account for its absence by supposing that re-elevation followed, after but a short interval, on the previous subsidence. The physical results of that elevation are sufficiently definite to justify our assumption, and are explanatory of the conditions under which it was in all probability effected.

"Mr. Hopkins has shown that if a considerable area at the bottom of the sea were suddenly elevated, a *wave of translation* accompanied by a

current, the velocity of which would depend principally upon the depth of the sea, would diverge in all directions from the central disturbance. Calculations, he says, 'prove beyond all doubt that paroxysmal elevations, beneath the sea, varying from 50 to 100 feet in height, may produce currents of which the velocities shall vary from at least 5 or 6 to 15 or 20 miles an hour, provided the depth of the sea do not exceed 800 or 1,000 feet.' In considering the magnitude of the blocks which might be moved, he found that the force exerted on the surface of given magnitude *increases as the square of the velocity*, and that it '*varies as the sixth power of the velocity of the current.*' But the movements must be repeated for large blocks to travel beyond short distances.

"It is evident that we have in this form of disturbance an engine of enormous power; and though our hypothesis does not deal with the great changes and powerful currents contemplated by Mr. Hopkins, we may infer what the results might be with even a fractional proportion of such changes. Movements of this character would, like Nasmyth's hammer, be capable at times when the uplift was rapid of exerting enormous force; while at other times, when the uplift was slow, the action might be of the most gentle character. Hopkins's calculations were made for one central area of elevation, and dealt with surrounding level surfaces. In the case before us the area of elevation consisted of a variable and uneven land-surface, so that each hill or group of hills formed a centre for the divergent currents, the velocity of which would further vary according to the varying gradients and lengths of the slopes.

"It follows from these premises that the character of the deposits formed under such circumstances will afford a relative measure of the velocity and duration of the currents under which they were accumulated. Where, for example, the sediment is fine, we may conclude that the velocity was slow, and the rise which gave origin to it small. When, on the contrary, the materials are coarse, we may suppose the rise to have been more rapid and the velocity of the current greater. Where, again, large blocks have been transported, a more energetic movement is made manifest. Some indication also of the duration of the uplift is afforded by the mass of the material moved and distance traversed.¹

As direct evidence of the rapidity of the subsidence, Professor Prestwich points to numerous raised beaches and dunes of blown sand, which underlie the Rubble-drift throughout a considerable portion of its extent near the English Channel. These buried dunes show that, after the beach was formed, the land was somewhat elevated so as to expose it to the wind and so permit the accumulation of the dunes. This

¹ Raised Beaches, etc., pp. 331-333.

elevation was, however, slight. The submergence which followed, was so rapid that there was not time for the waves to obliterate the sand dunes, as they would surely have done had the exposure lasted for more than a very brief period. Upon the re-emergence of the land, the Rubble-drift was swept down over the beach, and thereby everything was preserved from further disturbance till the present time.

2. *Ossiferous Fissures.*—The same theory is demanded to explain the “ossiferous fissures” abundant in Southern England and in France, and long ago described by Buckland in his “*Reliquiae Diluvianae*,” but not fully understood by him. These fissures abound in the limestone regions of Southern England. They are not caverns in the ordinary sense of the word, but simply fissures, open at the top and extending down perpendicularly, or at a slight inclination, sometimes a hundred and forty feet. They are filled with angular rock fragments, broken and splintered bones whose fractured edges are unworn and sharp, all cemented together in a matrix of sand, earth, and clay through which lime has filtered, making what is called a breccia. The bones represent the horse, ox, deer, wolf, hyena, tiger, hare, water rat, weasel, boar, and some other animals.

It is acknowledged by all that these fissures have been filled in from above, and it was the opinion of Dr. Buckland, that the process had been very gradual, and that the animals had accidentally fallen in from time to time. An unanswerable objection to this theory is, that, though the opportunities for observation have been very extensive, in no case has a complete skeleton of any animal been found, or even scattered bones that would make a skeleton. If animals had fallen in, as Buckland supposed, it is inconceivable that this result should have followed. In the fissure at Oreston, Mr. Cottle collected, 1,587 teeth of the animals above mentioned, 147 jaws, 250 vertebræ, and 26 skulls; but there was not a single whole skeleton, nor did any of the bones show marks

of wear, such as would appear if they had been rolled along by a running stream of water, nor did any show the marks of hyenas' teeth, which are common upon the fragments of the ordinary caves.

After considering exhaustively all possible modes of accounting for these facts, Professor Prestwich finds himself limited, as before, to the hypothesis of a brief submergence of the land, such as would drive the animals in a heterogeneous mass to the higher lands, where they would be drowned, and their remains scattered over the surface. After time enough had elapsed for their carcasses thoroughly to decay, the re-emergence of the land distributed the bones by the same process that determined the distribution of the Rubble-drift. As the material was swept along by the successive impulses of uplift beneath the water, the fissures along the slopes became filled in the heterogeneous manner described.

Among the most interesting and instructive fissures supposed to have been filled in this way is that at Santenay, a few miles south of Chalons, in Central France. This is situated upon an isolated hill connected with the range of Côte-d'Or, 1,030 feet above the valley of the Saône, which is here 600 feet above the sea. Two ordinary bone-caves occur upon the opposite sides of the hill, containing remains of the horse, wolf, fox, bear, lion, deer, ox, elephant, and rhinoceros.

The fissure under consideration is near the summit of the hill, and is filled with a breccia—

“composed of the fragments of the adjacent rocks, embedded in a yellow or brownish earth, with bones which were determined by Professor A. Gaudry to be of the cave lion, lynx, horse, wolf (very abundant), fox, badger, bear, hare, rhinoceros, hog, ox, and deer. These were all ‘in a very broken state. M. Gaudry observes that their accumulation could neither be attributed *to man nor to animals*, for the fractures in no way resemble those made by man for the purpose of extracting the marrow, and, notwithstanding the abundance of wolves, *none of the bones show traces of having been gnawed by Carnivora*. How then could this collection have been brought together? As M. Gaudry justly remarks, ‘why should so many *Wolves, Bears, Horses, and Oxen* have ascended a

hill isolated on all sides?' M. Gaudry further remarks that the deposit seems to have been formed by water precipitating the breccia and the bones into a fissure. 'But whence,' he says, 'have come the waters sufficiently abundant to bring together the bones?' The fissure is so near the top of the hill that there is little gathering ground above it, and had the bones and fragments of rock been carried in by a stream or torrential rains, they must have shown more or less wear, and have lost their sharp angles."¹

After duly considering all other suggested hypotheses, Professor Prestwich applies his theory for the solution of the problem in the following forcible paragraph:—

"The condition and position of the bones are, on the other hand, at Santenay and Pédémar, as they are at Oreston and Catsdown, such as might result from the effects of a gradual submergence of the land. For a submergence of the character I have described would naturally drive the animals in the plains to seek refuge on the higher hills. Flying in terror and cowed by the common danger, The Carnivora and Herbivora alike sought refuge on the same spot, and alike suffered the same fate wherever the hill was isolated and not of a height sufficient for them to escape the advancing flood. We may suppose the subsidence to have been so slow that there was no sudden rush of water to carry the bodies far away, so that as they decayed, the limbs fell and were scattered and dispersed irregularly on the submarine surface. When that surface was again upheaved, the bones and detached limbs, together with the detritus on that surface, were, as I have before explained, carried down by divergent currents to lower levels, or they fell into fissures of the rock over which the detrital matter passed, or else, when facing the coast, over the ledges of the old cliffs rising above the Raised Beaches. Swept down by the intermittent currents produced by the more or less rapid uplifts, and falling with the mass of detritus in a body over the old cliffs or into the open fissures, the bones, in the one case as in the other, were broken and smashed in the extraordinary manner we now find them. Added to this was the fall, caused by the earth tremors inevitable with such movements, of fragments of rock, some of large size, from the sides of the fissures, so that very few of the bones escaped whole. At the same time the action was of too short duration, and the transport was too short a distance to wear down the sharp angles either of the rock or the bone fragments. Raised again to the surface, the rain waters, percolating through the calcareous rocks traversed by the fissures, and carrying down carbonate of lime, have generally cemented the débris of the fissures, and occasionally of portions of the 'head' (Brighton), into a hard brecciated mass from which it is now difficult to extract the bones. Where, on the

¹ The Evidences of a Submergence of Western Europe, etc., pp. 936-937.

contrary, the débris remained loose on the surface and formed permeable superficial drift, the effect of water percolation has been to remove the calcareous matter together with the bones, so that where thus exposed, the rubble is more unfossiliferous than when it lies in fissures or hollows where the surface waters could not freely percolate."¹

An equally striking application of the theory is found on the rock of Gibraltar, where fissures nearly three hundred feet deep occur, filled with breccia similar to that already described. In the case of Gibraltar, strong additional support to Professor Prestwich's opinion is given by consideration of the smallness of the area at the top of Gibraltar. The animals found in the fissures on Gibraltar are nearly the same as those enumerated at Santenay. It is in the highest degree improbable that all these various wild animals could have at any time or habitually lived together on the rock.

"The crags and caves may have been the resort of Hyænas and other predaceous animals, but the Deer, and other ruminants, the remains of which were numerous, could never have lived in the neighborhood of these Carnivora. They would naturally have frequented the surrounding plains and forests, where they could have found food, shelter, and water, rather than scrags—dry and in great part barren. It is true that the predaceous animals might have carried there some portions of their prey, but had they done so, either the bones would have been devoured, or such as remained must inevitably have shown marks of the animals' teeth.

"In the second place, no animal remains left on the surface could possibly have escaped destruction in the proximity of ground frequented by Hyænas and other Carnivora; or, supposing any bones had escaped, they would have decayed under ordinary atmospheric agencies, and exhibited more or less weathering; had they also been washed down by streams and amongst rocks, they would have been rolled and worn. But there is no evidence of weathering or wear, nor is it shown that the fissures are connected with old watercourses. The bones have clear and sharp fractured edges. Only in two instances it is mentioned that the bones present the appearance of being weathered and sun-cracked, and this seems to refer to those found with human remains and works of art, and not to the older breccia.

"For these reasons I think this explanation cannot be accepted, and would again revert to the hypothesis of a submergence of the land. This affords a *vera causa* for the association of animals otherwise so little likely

¹ Evidences of a Submergence of Western Europe, etc., pp. 938-939.

to be found together. It could only have been, as in the cases I have before named, a great and common danger, such as that of the gradual encroachment of the sea on the land, that could have so paralyzed their natural instincts as to have driven those various animals to flock together in search of a common place of refuge from a catastrophe which threatened all alike. Under such circumstances the Ruminants would naturally flee from the plain to the higher hills, and when these were isolated, as in this and the other cases I have named, whenever the waters rose above those hills, they were drowned and their limbs dispersed in the manner I have before described."¹

We have room for but one more illustration upon this point. Near Palermo, upon the island of Sicily, there is an ossiferous breccia of a very remarkable and unique character, containing an enormous number of hippopotamus bones, which are so fresh that they are cut into ornaments and polished, and when burnt give out ammoniacal vapor. More than twenty tons of bones were shipped from this one place for commercial purposes in the first six months after their discovery. The bones were mostly those of hippopotami, with a few only of deer, ox, and elephant. They belong to animals of all ages down to the foetus. The bones of the various animals were mixed together without order, and were broken, scattered, and dispersed in fragments, and none of them bore marks of gnawing. The collection is at San Ciro, about two miles from Palermo, and is at the base of the remarkable amphitheater of hills surrounding the plain on all sides, except towards the sea. The hills are from two thousand to four thousand feet in height. The amphitheater is from two to four miles in diameter, and the elevation of the rock shelter is about two hundred feet above the sea.

"The circumstances, therefore, which led to these remarkable accumulations of the remains of the Hippopotami must have been *extraordinary*, and I see no hypothesis which meets the case, so well as the one that I have suggested to account for the bones of Mammalia in the Rubble-drift and in the ossiferous fissures, though the local conditions in this case are peculiar.

"On the submergence of the Sicilian area, the wild animals of the

¹ The Evidences of a Submergence of Western Europe, etc., pp. 944-945.

plains would, as in the case of Santenay, Cette, and Gibraltar, be driven to seek refuge on the nearest adjacent high ground and hills. In the instance before us, the animals must have fled to the amphitheatre of hills which encircle the plain of Palermo on all sides except the sea, and on the slopes of which the Cave of San Ciro and the others are located. As the waters rose, the area of this plain became more and more circumscribed, and retreat more and more impossible, except through a few rare passes in the range of hills, until, at last, the animals were driven together at the base of the hills, where they were stopped by mural precipices impassable to the larger and heavier animals, though some of the more active and agile Ruminants and Carnivores may have, and, judging by the rarity of their remains, probably did escape to the mountains behind. Retreat entirely cut off by projecting promontories on either side, the only paths yet open to the imprisoned herds were those that led to the caves, which were a little above the general level of the plain. Hither the animals must have thronged in vast multitudes, crushing into the caves and swarming over the ground at their entrance, where they were eventually overtaken by the waters and destroyed, and, as their bodies decayed, a confused mass of their remains were left and scattered on or near the spot where they had finally congregated.

“For reasons before given, the land could not have remained long submerged. As it rose intermittently from beneath the waters, our supposition is that the rocky débris on the sides of the hills was hurled down by the effluent waters on to the piles of bones below, breaking them into fragments, and forming, together with them, the heterogeneous mass of bones and rubble constituting the breccia. The last more rapid uplift, the effects of which are so frequently seen in many sections of the *head*, brought down the larger blocks of rock that now lie on the top of the whole. Scinà, an independent witness, inferred from the character of the rock fragments, and from the red clay in which they are imbedded—and which comes from decomposed rock surfaces on the hills above—that, in the case of the Belliemi breccia, both the detritus and the bones had been washed down from Monte Belliemi. All this must have been effected in a space of time comparatively so short, that, though the bodies of the animals decayed, the bones underwent but little change, nor, encased as they became in an almost impermeable breccia, has the change they have since undergone been great.

“Thus there is, in all the essential conditions, a close agreement between this Sicilian breccia and the Rubble-drift of the south of England, as likewise with the rubble on the slopes of Mount Genay, of the Rock of Gibraltar, and of other places mentioned in the preceding pages. In all, the débris consists strictly of local materials; the fragments are angular and sharp; the bones are mostly in fragments, and are neither gnawed nor worn; and the faunal remains are those alone of a land surface, and of species such as then were to be found in the district. This rubble, also,

forms in all these cases the last of the drift beds. The only apparent difference arises from the circumstance that, in the Sicilian area, the geographical configuration was that of a land-locked bay with many minor bays or embasures in the front of the hill-range, so that, as the waters rose, the animals of the plain were driven together, as in a seine, into those bays, where, as a last resource, they sought shelter under the mural precipices and in the more accessible caves. As these precipices were nearly vertical, they formed, as the land rose again, a partial protection from the effluent currents, which otherwise might have carried the débris a greater distance outwards. Under no other circumstance that I can conceive could the animal remains have been massed as they are at the foot of the escarpments encircling the plain of Palermo.

"It may be asked how could large herds of Hippopotami have existed in so limited a plain as that of Palermo. It needed then to have had much greater extent and larger rivers. I have shown that the present height of the Raised Beaches on the English Coast does not give the initial upheaval, but is the sum of the differences of several earth-movements—that the primary upheaval of the beaches was not less than 100 to 150 feet greater than the altitude at which they now stand, and that this led to the conversion of a considerable extent of the area of the Bristol and English Channels into dry land. What little evidence we have on the coast of Malta, and of Greece, points to similar elevations of the coasts of the Mediterranean, so that large tracts of dry land may then have existed between the Sicilian and Italian shores, and formed suitable pasture grounds for the Hippopotami. With increase of the land area, so would the rivers also have had increased size, and though they may not have been very large, yet as Sir S. Baker has shown, perennial waters are not indispensable to the Hippopotamus, for in the Settite and other rivers of the Soudan, these huge animals tide over the dry season, by resorting to the few pools left in the dried-up channels of the rivers."¹

Not to pause longer upon the numerous other facts collected by Professor Prestwich bearing upon this point, we turn finally to select one from his many illustrations drawn from the "loess deposits of Europe." It is well, however, to call the attention of the reader to the fact that the origin of the loess is one of the most difficult problems which geologists have to consider, and that here, as in the other evidence, it is the wide experience and great skill of Professor Prestwich which have enabled him clearly to see the bearing of the facts presented. For clearly the loess has been distrib-

¹ Evidences of a Submergence of Western Europe, etc., pp. 959-962.

uted by a variety of agencies. It is only in special conditions that its occurrence can have the significance which Professor Prestwich assigns to it in the instances adduced by him.

Loess is a very fine loam without any intermixture of sand or gravel, or indeed of any grit, and without any remains of marine or fluviatile shells, which in various regions occur upon the surface of the soil. Along the Missouri River from Kansas City far up into Dakota, loess forms the lining bluffs of the valley, having a depth of more than a hundred feet. Large areas in China are covered with it to even greater depths, while its occurrence along the valley of the Rhine accounts for the German name by which it is ordinarily designated.

The anomalous facts connected with its distribution have greatly puzzled geologists. The material is so fine that it is readily blown about hither and thither by the wind, so that Baron Richthofen and others maintain that the loess of China is but the accumulated dust which the westerly winds have brought over from the parched and elevated plains of Mongolia and Thibet. The definite relation, however, of the deposits to water levels in the valleys of the Mississippi and the Rhine make it certain that in many areas these are water deposits. Still, the facts are so complicated that Geikie and others think it necessary in Central Europe to bring in both wind and water to account for its distribution. In the glaciated regions both of Europe and America many anomalous local deposits of loess can be readily accounted for by the action of water held in place by ice during the retreat of the continental glacier. No doubt the greater part of the arguments for the flood drawn from the loess by Mr. Howorth and others are explained by fuller knowledge of the irregularities produced by the slowly melting ice-sheet which covered the northern parts of the continents of Europe and America. But the facts adduced by Professor Prestwich have been carefully selected with reference to this danger of error, and

strongly confirm the other evidence pointing so strongly to the occurrence of a recent catastrophe in Western Europe closely analogous to that described in the biblical account of Noah's Flood. A single one of the facts under this head must suffice.

The Channel Islands of Guernsey and Jersey are surrounded by a raised beach which is overlaid by Rubble-drift such as was described under that head. The greater part of the island, however, consists of a plateau of granitic rocks from 300 to 350 feet above sea-level, but without any commanding heights. This plateau is covered very generally by a deposit of loess or brick earth from five to ten feet thick, extending over the highest points of the surface. In character this is identical with that on the mainland.

It is not possible to account for this deposit of loess on any of the theories which are limited to river floods, glacial inundations, or rain wash as the distributing agencies; for—

“there are no rivers in either island, and the water courses are mere small brooks that could scarcely flood the lowest ground, and certainly could never, in present nor past times, have reached the plateau on which the loess occurs. Nor are there any hills, rising above the general level of the plateaux, the wash from which could have been spread over those plateaux. Nor can it be admitted that it was formed when the island was connected with the mainland, and that the loess is due to the extension of the land flood-waters, over what was then part of the continental area; for, unless the loess were older than the raised beaches, it is obvious, as those beaches extended all round the islands, that at the time of the deposition of the loess, the islands were then, as now, detached from the mainland.”¹

After giving further evidence that this loess must “have an origin independent of those to which it is ordinarily assigned,” and presenting similar evidence in a large number of other cases both among the Channel Islands and over widely spread portions of the Continent, Professor Prestwich states the probable method of accumulation as follows:—

¹Evidences of a Submergence of Western Europe, etc., pp. 913-914.

"I am well aware that several objections, more or less formidable, may be raised to the hypothesis which I have suggested to account for the origin of this drift. A few of these I may allude to here, though it would not be possible to discuss in these pages the wide and important general questions involved. Those who hold uniformitarian views will object to the want of known precedents and to the exceptional character of the agency proposed. In this difficulty I cannot share. I must repeat what I have long contended for, that it is impossible to suppose that our very limited experience—say of 2,000 years—could furnish us with standards applicable to the comparatively illimitable past. In fact, those that are relied on depend upon unstable conditions and are liable to vary with every passing century. While admitting the *permanence of the laws of Nature*, it is impossible, under the conditions through which this globe has passed, to suppose that at all former periods the effects, which have resulted from the operation of those laws, though equal in kind, were equal in degree. As in other similar questions, we must judge of the hypothesis not by an *à priori* assumption, but by the agreement of the consequences which it involves with the facts, and by the extent to which it satisfies the various conditions of the problem."

"Whatever phase of the Rubble-drift we may examine, we recognize in all of them physical and faunal conditions referable to the agency of one and the same cause. Whether we look at (1) the *débris* in one section of the Loess, (2) the Breccia on slopes, (3) the '*Head*' over the Raised Beaches, (4) the Basement gravels of many valleys, or (5) the Ossiferous fissures, we discern a complete absence of that wear which results from maintained river, sea, or ice action. Nor is there any indication of that transport of *débris* from a distance which attends river or tidal action. On the contrary, all the component materials are of *local origin*, derived from the adjacent slopes or hills, and they are *all unworn*. The evidence of the organic remains is to the same effect, in that they are those of a *land fauna alone*, with an entire absence of marine and fluvial remains. The bones found in the Rubble-drift are not only in the same unworn condition as the rock fragments, but they are *free from all marks of gnawing*. This is a proof that the animals had not, as in the caves, fallen a prey to Carnivora, but must have met their death in a way which was unusual—such as from drowning—for had their bodies remained on a land surface after death, they would have been subject to being devoured by predaceous animals, or else the bones would have shown traces of weathering and wear. At the same time the *sharply* fractured state and dispersion of the bones show that they must have been subjected to considerable violence and displacement. These conditions, as well as the mode of distribution of the rubble from many independent centres, accord in all points with the results that would ensue from the submergence and re-elevation of a land surface from beneath deep waters after a temporary submergence.

"These conclusions, startling though they may appear, have been forced upon me, not only by my own observations in the South of England, and parts of the Continent, but also by the independent evidence of other geologists, though their interpretation of the facts may be different. Looked at in all its aspects, I see no alternative that equally well answers to all the conditions of the problem. Other explanations may satisfy some of the conditions in particular cases, but none of them satisfy all, whereas I think it will be found that the submergence hypothesis not only meets the requirements of each particular case, but that it also shows them all to be concordant, and such as would pertain to one common and general cause.

"Another important conclusion hinges upon this question. I have before pointed out the bearing that the position of the Rubble-drift should have in limiting our estimate of the time elapsed since the close of the Glacial period. In a paper already referred to I had shown cause why that time was not to be measured by Dr. Croll's reckoning of eighty thousand years, as not being supported by the facts of geology. The position and character of the Rubble-drift show that the transition from the so-called Post-glacial beds to the recent Alluvial deposits is very abrupt, and that there is an absence of sedimentation or of anything indicative of lapse of time between these two series. This conclusion is confirmed by the sections of the Belgian caves. There, as we have seen, the Quaternary cave deposits are separated by only a few feet of Rubble-drift from deposits of the stone or Neolithic age. Nowhere are there any intervening sedimentary beds, or any deposits requiring length of time for their accumulation—the only subsequent work requiring time being comprised in the alluvial accumulation of our great rivers.

"Besides, on Croll's hypothesis, Man must have remained comparatively stationary during a vastly long period. But how does this accord with the facts? Take the earliest works of Man with which we are acquainted—the rude implements of the Chalk plateau—and note the difference between them and the implements of the later Valley gravels. The former consist of rude flints picked up on the surface, and given only such an amount of trimming as to bring an angle to a point, or to form a cutting edge out of a blunt natural fracture, or else the stones, just as they were found, were used as hammers and trimmers. The valley implements, on the other hand, comprise flint tools and implements carefully worked all over and trimmed to certain definite patterns, the workmanship, apart from the want of grinding, being in some cases so fine as almost to equal that of the implements of the Stone age.

"The caves of Central France and of Belgium afford still clearer evidence of the progress made by early Man in the interval between these two stages. His work in the last Quaternary stage exhibits an intelligence higher than that of many modern savages. His harpoons and bone implements were skilfully made, and that he possessed some artistic taste

is shown by the sculptured bones and horns, and by the rude, but sufficiently accurate representations, of the contemporary fauna. How can we, then, believe that Man, who had shown himself thus progressive early in the Quaternary period, could towards its close have remained for, say, seventy thousand years without further progress than that shown by Man of the early Stone period. There is certainly nothing to represent geologically that long period of time, nor have biologists been able to detect any essential structural differences between Paleolithic Man and Neolithic Man in support of such a conclusion. All the evidence tends, on the contrary, to prove that late glacial (or post-glacial) Man, together with the great extinct Mammalia, came down approximately to within some ten thousand to twelve thousand years of our own times, and that the Rubble-drift marks the stroke of the pendulum when the Glacial period came to a close, and the Neolithic age commenced."¹

¹ *Evidences of a Submergence of Western Europe, etc.*, pp. 982-984.