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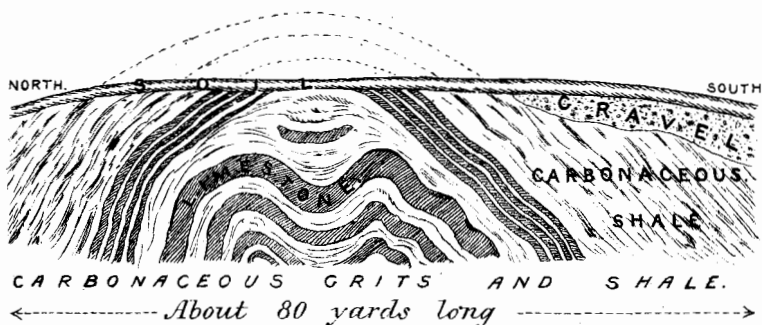
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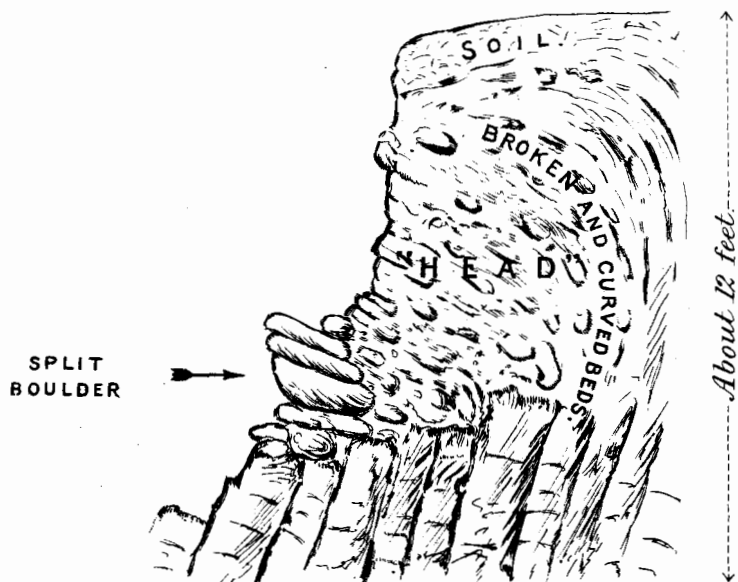
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SECTION OF THE CLIFF AT WESTWARD-HO! N. DEVON; SHOWING A BOULDER OF BLUE CARBONACEOUS GRIT, *Split and Faulted* BY THE DOWN HILL PRESSURE OF THE Ice Sheet.

ORDINARY MEETING, APRIL 11, 1881.

H. CADMAN JONES, ESQ., IN THE CHAIR.

The minutes of the last meeting were read and confirmed, and the following elections were announced :—

MEMBER :—H. B. Guppy, Esq., M.B. Edin., R.N., Falmouth.

LIFE ASSOCIATE :—Rev. C. Hebert, D.D., Ambleside.

Also the presentation of the following works for the library :—

“Proceedings of the United States Geological and Geographical Survey.”

From the same.

“The Writings of Swedenborg.” Rev. A. Clissold. *Rev. T. M. Gorman, M.A.*

The following paper was then read in the author's unavoidable absence by his son, Mr. H. Michell Whitley, C.E. :—

THE SUPPOSED PALÆOLITHIC IMPLEMENTS OF
THE VALLEY OF THE AXE. By NICHOLAS WHITLEY,
C.E.

ONE of the most recent finds of the so-called stone implements of “Palæolithic man”—that at Broom, in the valley of the Axe, about three miles N.E. from Axminster, is the most important, as showing their geological, and not their artificial, origin. As a large number of specimens have been found at this place similar to the so-called “Axes” from the drift of the valley of the Somme, and as a long and high section of the gravel-bed there is now in full working, the origin of this gravel may be read with a greater amount of certainty than that of former discoveries.

The discovery at Broom came about in this manner. Waiting

at the Queen-street railway station at Exeter on the 12th of October, 1876, for the train, I observed that the railway was ballasted with chert gravel of a peculiar form, and a search of a few minutes produced two rough "tools" of the Somme type, and at most of the stations eastward as far as Basingstoke, among similar gravel, similar forms caught my eye. On arriving in London I wrote a letter to the *Standard*, in which I drew the conclusion, that if the asserted tools from Brixham Cavern and from the drift-beds were implements, then the South-Western Railway was ballasted with flint implements from Exeter to Basingstoke, a distance of at least 110 miles. This letter was replied to by Mr. S. G. Perceval, of Beer, and by Mr. P. O. Hutchinson, of Sidmouth, both asserting that no palæolithic implements had been found at Broom, or in that neighbourhood; and Mr. Hutchinson intimated that I had been blinded by seeing with my own eyes, and deceived by judging by my preconceived prejudices. The result, however, proved that both my eyes and my head were faithful to the trust which I reposed in them.

Mr. D'Urban, the intelligent Curator of the Albert Memorial Museum at Exeter, seeing the published letters, instituted a search of the ballast of the railway and the gravel-pit at Broom; and with the aid of the workmen obtained about fifty "implements" of the drift type, which are now in the Exeter Museum. Several of these flints from the ballast of the railway are stained with the oil dropping from the locomotive engines in passing over the line.

At the meeting of the Anthropological Institute, on the 9th of December, 1879, "Mr. Worthington G. Smith, F.L.S., exhibited a series of sixty 'palæolithic implements,' principally from the Valley of the Axe." The President, Mr. E. B. Tylor, remarking that,—“For the rude and heavy palæolithic type of instruments [*sic*], the specimens now exhibited showed the local chert to be a tolerable material, though quite unsuited to the finer flakes and arrow-heads of the Neolithic age.” I have obtained several of these "implements," which I now exhibit; it will be seen that they vary much in size and in form; that there is no "secondary chipping" on their edges, but indications that the edges have been bruised by being rolled in the gravel.

I have inspected this gravel-pit at Broom on two occasions,—the slopes of the hills on each side of the valley, and also the gravel on the hill-tops. The pit is an open excavation into a mass of chert-gravel, which forms the lower slope of a spur of a hill on the eastern side of the valley; it has been excavated to the level of the rails, and exposes a perfect section of the

gravel from 20 to 30 feet in height, over a distance of from 200 to 300 yards. The gravel is mainly composed of fractured angular pieces of salmon-coloured chert (the flint of the greensand) confusedly mixed with sand, and covered with the same loam and soil which coats the slopes of the hill-sides above. The "implements" are mainly obtained from near the base of the bed; as is also the case in the gravel-beds of the valley of the Somme.

On the west side of the valley on Coaxton-common I found long rough pieces of fractured chert, in colour and form similar to the so-called implements found on the surface of the greensand at Grand Pressigny, in Central France; showing that the same form of "implement" is found in the same geological bed, and indicating a natural rather than an artificial origin.

On the surface of the arable land, about a mile east of Axminster, I found many perfect chert "cores" (from which flakes are supposed to have been struck by man), but few perfect flakes; this peculiarity, however, arises not from human design, but from the nature of the fracture of the stone itself, as "chert differs from pure flint in breaking with a square splintery fracture, instead of a conchoidal fracture,"* again indicating a natural rather than an artificial origin for these "cores." Thus, in both cases, there is no evidence of the skill of man overcoming the intractable nature of the material.

I have called these broken pieces of chert from the ballast-pits *implements*, for the convenience of indicating that they are similar in form to those which, from other sites, have been dogmatically asserted to be implements made by palæolithic man, and on which the whole of the direct evidence in support of that mythic creature at present rests; but a consideration of the geological evidence in this case strongly leads to a contrary opinion, as the origin and geological history of the chert gravel is so stamped on the surface of the country, that it can be read with an amount of certainty not attainable in former cases of this kind.

As the pure flint is found in the upper chalk, so the less pure chert is mainly found in the upper greensand; and the greensand beds cover an area of at least 500 square miles in the West of England. The flat-topped hills of this formation rise to a height of 900 feet above the sea at its northern extension, and southward on the coast line to about 500 feet.

* Bristow's *Glossary of Mineralogy*,—CHERT.

Viewed at a distance from the west, this land has the appearance of a sloping plain of marine denudation, falling 400 feet to the south; all the principal valleys flow southward to the English Channel, and show conclusive evidence of having been excavated by a great denudation to a depth of from 300 to 500 feet, destroying in some parts the continuity of the strata, and leaving isolated patches of greensand at a considerable distance from the general mass. The finer materials of sand and clay were by denudation readily transported to the sea, while the solid and heavy blocks of chert remained on the surface of the denuded land. Then followed the glacial age, with its thick masses of land ice, planing and rasping the rugged face of the ground, and crushing and flaking the nodules of flint and chert by its weight and downward progress, and forming those gentle curves on the outline of the landscape, which constitute its chief beauty. Then came the pluvial period of excessive rainfall, mingled with land-floods from melting ice, which re-arranged the gravel beds, leaving large masses on the flat hill-tops,—sweeping other portions from the steep hill-sides to lower levels, and forming the thick gravel beds which now border the more recent alluvium of the valleys. Afterwards the whole country appears to have sunk beneath the ocean, and when it re-appeared, after its baptism, and the turbulent waters slowly retreated from off the surface of the ground, the beat of the waves, and the prolonged tide-washing in shallow water, left a blessing behind them, by depositing first the clayey subsoil, and then the less heavy but more fertile soil, thus rendering the land a fit abode for the last and best of all God's works.

In order that this outline of the latest geological changes of the surface of the country may not be considered as a picture drawn from the imagination, I will lean for support on the high authority of the late Sir Henry De la Beche, Director-General of the Ordnance Geological Survey, who, describing the greensand of the West of England, says :—“The whole country is more or less traversed by faults. Gravel covers all the hills, and is most frequently composed of unrolled flints and fragments of chert, which do not appear to have been transported any great distance, but to have resulted from a dissolution of the chalk and greensand in place, leaving the upper surface of the chalk or greensand, as the case may be, corroded and uneven.”*

* *Sections and Views illustrative of Geological Phenomena*, by H. T. De la Beche, p. 5.

I cannot refrain from quoting further the remarkable concluding paragraph of Robert Chambers, who, in his paper on "Ice and Water," says:—"On the whole subject of the Superficial Formation, I am disposed to make one concluding remark. I desire to refer to the broad fact, that, in the regions of the earth where soil can least be dispensed with, there should have been a peculiar agency at work, which secured the very general diffusion of soft matters over the hard surface. The warm parts of the world have large growth from little soil; but if the parts north and south of the fortieth parallels had been left to only such influences as the air and water, they might have been so meagerly furnished with the needful matrix for vegetation, that little population could have there existed. As it is, we have clays, and sands, and gravels, and mixtures of all three, spread in deep beds, very generally over the temperate regions, so as to insure ample material for the agriculturalist to work upon. In the present state of the subject of final causes, I suppose it would be held as rash to say that all this was a matter of design; but I feel at least inclined to say that, if it was not from a premeditated plan of the Almighty Creator of the worlds, it looks marvellously like one, just as the existence of coal and other minerals does, and I do not see that we can be far and fatally wrong if we feel thankful for it accordingly."*

Thus, the origin and history of the gravel beds appear to lead irresistibly to the conclusion that the "implements" (if a constituent part of gravel) had a geological, and not an antiquarian, origin. And this conclusion is supported by an inspection of the exposed section of the gravel bed, which shows that the "implements" and gravel are similar in the nature of the stone,—are embedded in the same matrix,—show the same kind of fracture, and have been subject to the same forces, both in kind and degree, as the angular chert gravel in which they are found. Thus, we must infer that the implements do constitute a true part of the gravel itself, and that the natural agents which split and fractured the mass of the gravel, also split and fractured the selected pieces of chert, which have been dignified by the name of implements. If, on the other hand, we come to the conclusion that these fractured pieces of chert are implements made by human hands, then we cannot escape from the inference, that men existed in great numbers before the formation of the present cultivated soil, and before the final close of glacial catastrophe.

* *Ice and Water: a Review of the Superficial Formation*, p. 41.

In former papers, read before this Society, I have pointed out that the true flint implements of the Neolithic age show the same kind of evidence of wear, by use, as that of a well-worn chisel or a wasted ploughshare; and that, though I have inspected at least a thousand "drift implements" of the Palæolithic age, in England and France, I have not seen one bearing the same authentic evidence of use as is impressed on the true stone tools of the Neolithic age; and later discoveries, as well as this at Broom, confirm the opinion that such evidence does not exist.

But further, the skill of all savage tribes hitherto discovered is wonderfully exhibited in the design and carving of their implements of war and the chase. This is well exemplified in the various tools and relics of man obtained from the lake dwellings of Switzerland, and our museums are crowded with overwhelming evidence on this point. But these fractured pieces of chert from Broom show no indication of any manipulative skill, or bear the impress of any intellectual thought.

The chert gravel beds, at the foot of these greensand hills, extend, throughout all their windings, over a distance of at least two hundred miles; the gravel is of the same nature and fracture everywhere in the district; the geological causes which operated on it must have been everywhere the same, and we may therefore expect to find similar results in the fractured forms of the gravel; especially as during the erection of the telegraph-posts between Chard and Axminster similar "drift implements" have been discovered, four of which are now in the Blackmore Museum. The "drift tools" at Broom have been found after the rate of 2,000 to a mile, which for a distance of 200 miles gives an estimated quantity of 400,000 tools for the gravel beds at the foot of the hills only.

From the gravel beds of the valley of the Somme thousands of these drift "tools" have been exhumed. The valleys of Norfolk and Suffolk are loaded with gravel beds, in which these drift "implements" are so abundant that hundreds have been dug out of a single pit. And over a period of at least twenty years, numerous antiquaries have collected untold numbers of these splintered flints; and at the present time, notwithstanding all the abundance of the discoveries, and the labours of extended research, not a single bone of man's frame has been found in the drift gravel, or any other authentic relic indicative of his presence, to confirm the bald supposition that these flints are human implements.

Further: much of the evidence which had been prominently

put forward in support of the high antiquity of man has, during the past few years, been completely abandoned. Thus:—

The Abbeville human jaw from the gravel of the Somme is acknowledged to be “a plant.”

The palæolithic “beads” of St. Acheul are found to be organisms of the chalk.*

The human bone from the Victoria cavern, which Professor Boyd Dawkins once described as “establishing the fact that man lived in Yorkshire before the glacial period,” and who added, that “the man to whom it belonged was probably devoured by hyænas,”† has now been pronounced to be the bone of a bear; ‡ and a “cut” bone, said to have been found in an undisturbed layer in association with the extinct mammals in the same cave, belongs to a domestic sheep or goat, both of which were unknown in Europe before the Neolithic age.§

Some of the artistic drawings upon the fossil bones found in the Thayingen Cave in Switzerland, are now pronounced to be spurious, and the result of intentional deception. The same drawings are contained in a work published six years before the discovery of the cave.||

The reputed discovery of relics of man 800 feet deep in a Miocene deposit at the Dardanelles, by Mr. Frank Calvert, is now utterly rejected.¶

The supposed dressed flints from Miocene beds at Theney,** the “worked” flints from the Pliocene beds of St. Prest, and the supposed basket-work from lignite, in Switzerland, have all broken down under a searching examination.

And I claim, on the evidence adduced in former papers read before this Society, to have stamped out the evidence of Palæolithic man from the “famous” cavern of Brixham. But above all we are indebted to the Woodwardian Professor of Geology at Cambridge for the important statement,—that the evidence for the antiquity of man “has completely broken down in all cases where it has been attempted to assign him to a period more remote than the post-glacial river gravels.”††

* *The Geologist*, vol. v., p. 234.

† *Cave Hunting*, p. 411.

‡ *Journal of Anthropological Institute*, vol. vii., pp. 159, 183.

§ *Early Man in Britain*, p. 187.

|| *Nature*, November 30, 1876.

¶ *The Epoch of the Mammoth*, p. 32.

** *Journal of Victoria Institute*, vol. xiii., p. 319.

†† *Ibid.*, vol. xiii., p. 327.

Thus, rejecting secondary and inferential evidence as inconclusive, the only direct evidence in support of the high antiquity of man, is limited to one single inquiry,—*Are these rough-splintered flints from the drift gravel implements made by man?*

This question is more fully answered by the discoveries made in the valley of Axe than by any heretofore, the main object and point of this paper being to show that these supposed implements had a geological and not an antiquarian origin; that they have been fractured in the same manner as the angular gravel in which they are found, and by the same natural cause; and that there is in addition a preponderating weight of evidence against the assumption that they are implements made by human hands.

The two Geological Sections illustrate the effects of what appears to be glacial action in North Devon.

No. 1 is a section of the side of a lime quarry across the strike of the beds at Bickington, near Barnstaple. It shows that the former surface of the land has been denuded and rasped down by glacial action from the north, and drift gravel deposited on the south slope of the hill. (From my Sketch Book, 1852.)

No. 2 is a section of the cliff near Westward Ho! Bideford Bay. It shows the effects of the pressure of land ice in its progress down the slope of the hill, bending and crushing the upper ends of the perpendicular carboniferous beds; and in particular splitting and faulting along the lines of lamination, a large boulder of blue carbonaceous grit. The broken and bent edges of the up-turned strata throughout Devon and Cornwall show similar evidence of ice-action. (The section is from my Sketch Book, 1868.)

The CHAIRMAN.—I have to return the thanks of the meeting to the author of this interesting paper, and to his son, who has so ably read it.

Mr. J. RENDALL.—There are one or two questions which I should like to ask. With regard to the first paragraph on page 2, I would say it strikes me that, when engaged in investigating the authenticity of these flints as being implements, it is rather a dangerous plan to apply to the workmen engaged in the places where such things are found, to furnish them,

because there is little doubt that, if they can make the flints look a little more valuable by any process, there is a direct temptation to them to do so. I do not quite make out whether the next paragraph means to state that the flints now on the table were among the implements to which Mr. Smith referred as being palæolithic, or whether it is only meant that they are similar; because the author of the paper says that Mr. Smith "exhibited a series of sixty 'palæolithic implements,'" and then, having quoted a remark of the President of the Anthropological Institute, he goes on to say,—“I have obtained several of these 'implements,' which I now exhibit.” Does he mean that Mr. Smith and Mr. Tylor have spoken of those flints on the table as being “palæolithic implements”? Then, with regard to what is said on page 40, I have never had the opportunity of seeing any of those results of human industry which have come from the Lake dwellings in Switzerland, except the few that are in the British Museum and in the Christy Museum. It has not struck me, in looking at those specimens, that they do exhibit any great indications of manipulative skill or intellectual thought. They seem to me the rudest things, on which no great amount of skill has been exerted. I do not mean to say they do not indicate the labour of human hands; on the contrary, I think they do; but I have not been struck with their displaying any great amount of thought or of manipulative dexterity. In another paragraph on the same page, there seems to me to be very much like an over-statement of the case in asking any such Society as this to suppose that persons in positions of reputation, and who are supposed to be possessed of some ability, could possibly take for “palæolithic implements” things that have been found over a large area at the rate of 2,000 to the mile. You may easily get out of a great number of specimens one or two as to which you may entertain doubt; but to take flints discovered at the rate of 2,000 to the mile, and to treat it as doubtful whether all are to be regarded as “palæolithic tools,” seems to me to be reducing those who think that *some* are palæolithic and *some* are doubtful implements, to a position of absurdity, which can only be regarded as an over-statement of the case. Fancy 400,000 palæolithic tools in a distance of 200 miles! Does any one in the world suppose that all flints so found could possibly have been palæolithic implements? I cannot believe it. I should like Mr. Whitley, who has read this paper to us, to say what he or his father thinks about the antiquity of the specimens we have all seen at the British Museum and in the Christy Museum,—what he thinks of those carvings done on bone, and the other specimens. Does he think they are all fraudulent? And, if not, does he doubt their being human work? It has always seemed to me, in looking at those specimens, that there is one thing about which there is great doubt. You there see a large number of chisels or axes. Those things have been picked up, as the labels tell us, by some one, here or there. How do they know this? Of course you may give credit to the curators of museums for not being inclined to take part in a fraud; but what is the evidence? Take those drawings on bone that are found in the Christy Museum. Where is the evidence as to their having been found as stated? They have been accepted by a number

of persons as genuine, and then up comes some person who knows more about the subject and says the things are a fraud. It seems to me that all these things ought to be taken with great caution, and that there ought to be a history and pedigree along with each, so that they should not be generally accepted for a great many years, and then characterised by some one as not genuine. It strikes me that there is much want of the missing link between the instruments as they are brought before the eye of the public, and the historical verification of the antecedents of those things which are produced to prove a human antiquity of many scores of thousands of years.

Dr. T. COLAN, R.N. (Deputy Inspector-General of Hospitals and Fleets).—In reference to the point as to the antiquity of the Stone age, I should like to say that I have known of men in the present century who practise the art of making stone implements. It was my lot to be Fleet Surgeon in the last Arctic Expedition, which, it will be remembered, got within 400 miles of the North Pole. While on that expedition, I inquired into the habits of the Esquimaux, and I found that in the coffins of their dead they placed stone implements, such as arrow-heads. It is well known that the persons with some of whom these things were buried existed within the present century; that some of the persons thus intombed were the immediate forefathers of the existing generation; and that the reason they used these stone implements was that they had neither bronze nor iron. In the part of the world they inhabit, there are no means of inventing bronze and no chance of finding iron; so that the Esquimaux, from time out of memory, have been forced to use stone implements. In fact, in many places they have no wood, and in the Northumberland Straits, where they have to go very far to find wood, it is a great kindness to give them the oar of a boat, or any other piece of timber, out of which they can make arrow-stems. They are so hard up for wood, and so little drift wood is found in some parts of Smith's Sound, that the Esquimaux there, when they have shot a reindeer, or any other animal, with one of their wooden arrows, will pick out any broken pieces of the arrow and splice them to the other part of the shaft. I have merely mentioned this to show that at the present day when we in England, after nearly six thousand years of man's existence, are making use of mixtures of all kinds of metals, there is existing in another part of the globe a race of human beings who have actually within the last few years been using nothing but stone, and they, too, a people not at all devoid of intelligence. The Esquimaux are men of the highest type of barbarous intelligence,—if I may use such a phrase,—men who, if they had had the opportunities of inventing bronze, would have done it, and who, had there been iron to be found in their country, would have made use of it. The only iron they have found in the country is a sort of iron-stone, which they use to strike fire with. They travel long distances to get at the mines where the iron-stone is found, and, when they have got it, strike two pieces together so as to obtain a light, which they apply to the Greenland moss forming wicks, which they float in the oil of the seal, &c. I think these facts are sufficient to show that we need not go so very far back to prove that there has been a Stone age,—that the Stone age is not so

remote as some people imagine; but that it is actually within the knowledge of the Arctic Expedition of only a few years back in the present century.

Mr. S. R. PATTISON, F.G.S.—My old friend, Mr. Whitley, appears to perform the same functions in regard to this branch of science and knowledge that Lord Eldon did in regard to the law. I have some knowledge of what Mr. Whitley has done in other fields and, about two months ago, I went to the place mentioned in this paper—Broom, in the valley of the Axe,—with the object of endeavouring to discover some of those implements, or tools, supposed to have been fashioned by the hand of man. I was, however, wholly unsuccessful. I spent a long afternoon, and think I thoroughly investigated the deposit, which is accurately described in this paper as a tumultuous assemblage of chert, split into small junks and angular fragments, and admirably adapted for that kind of nature's cutlery which people use when they are driven to the necessity by not having metals ready to hand. Just such a place and deposit would be selected by any of us if we wanted a sharp implement, for digging or other purposes, supposing we had no other material. There is a tall cliff, forming the end of a plateau above the valley, projecting just where one of the side valleys comes into that of the Axe. It is extremely difficult to understand how the accumulation could have been formed by present causes, unless we included an almost inconceivable amount of time, of which there is no evidence. I was quite of Mr. Whitley's opinion that there were no flint implements visible. A remark has been made in reference to the workmen, and I remember saying to those I saw, "I am very desirous of getting one of these things." They said, "We cannot furnish you with one, because there have been none found for nearly twelve months." I said, "could you not make them?" The answer was, "Oh, no!" I asked, "Don't you think some of them were made?" and the reply was, "I dare say it would be very easy to make them; but those we found were not made. We had no time to make them, but we did find a good many of them; they have not, however, been found lately." The flints referred to were found in the lower stratum, and they showed me where. Now, this is some slight proof as taken from the men who handled these things, that there is a difference between the things to which human origin was assigned and the mere flakes and pieces naturally fractured. I can therefore accept all that Mr. Whitley states, without accepting his conclusions. It is just as if he were playing a game at skittles, in which he undertook to knock down every pin, but in which, according to the laws of the game, unless he succeeded in knocking down every pin, he really accomplished nothing. If one of the stones brought from the Valley of the Axe exhibited undoubted proof of design, and therefore of the mental application by man, his whole argument at once becomes utterly worthless, and, so far as it tries to prove a negative, is fallacious. I did not go on to Exeter, where I before saw rough flints said to have come from the Valley of the Axe, and attested by Mr. Evans, who is the prime expert in these matters, and by others who have made observations

upon them, to be not the same as implements admitted to be of human origin. They are exhibited there to show, not so much that they are human implements, as that they form a portion of a deposit from which human implements might be struck, and in that view they are interesting. I cannot conceive any one putting forth the hypothesis that these things are of human origin; they are merely fractured stones, like other fractured stones; but this does not upset the conclusions drawn from one or two that have had a different origin, and, unless we are prepared to give up all evidence or reasoning on these matters, we are bound to accept as genuine the implements of the palæolithic age which are claimed by the experts to be of human origin. The first speaker has asked where is the proof that these things are genuine, and has spoken of the necessity of pedigrees. The pedigree of the things in the late Mr. Christy's museum is well assured; Mr. Christy, besides being conscientious, was a very good observer, and so was his friend, M. Lartet. Both had been taken in by frauds and impostures, and had become very cautious, and the result was that they received only as genuine things which were taken out under their own eyes, and then they saw the labels pasted on them with the names and dates. The same plan was followed by Mr. Evans, in the Blackmore Museum, and by Mr. Prestwich, at Abbeville; so that all these things can be traced by an exact pedigree to the locality and the source whence they came. Just as there is capability of proof for everything that came from Mycenæ, Troy, and Pompeii. With regard to the story these things tell in reference to chronology, I do not feel prepared to go into that matter fully at this hour. I have said the accumulation of the Axe Valley was one going entirely beyond the reach of present causes; but they are accumulations which may have taken place since man has come upon the earth. As a similar instance I may mention that I was the other day at the Bluffs of the Missouri, and high up those Bluffs, towards the interesting regions of the Dakota territory, far above the height to which man can now reach, in a position to which it would be very difficult, if not impossible to climb, inscriptions are written in a picture-language unknown to any of the existing tribes of North American Indians. This is of a piece with the evidence we get all over western Europe to the effect that, since the advent of man there has been at least one great physical change, which, whether slowly or rapidly produced, has amounted to something like a cataclysm. There have been very great changes of this kind; and, feeling that this has been the case, I have no difficulty with regard to the age of those implements, which were made and deposited antecedent to the occurrence of that cataclysm. The time antecedent to the latter must have been that during which men dwelt on the earth, as these things prove. It is impossible to show that some four or five thousand years would have been insufficient to have effected all this. We have no historical testimony against such an opinion, nor have we any geological facts against the supposition. Some five thousand years ago, man may have come on our shores, then outskirts of the known world, and lived just as man does now in some parts of North America, Africa, and elsewhere, and used the kind of flint implements

which are or were quite recently in use among the Esquimaux and other tribes. There may have been similar things going on in Syria and Egypt, and elsewhere, preceded by civilisation in some other locality, followed by physical changes and alterations produced by floods, ice, and so forth, producing the facts we now find. We have evidence of the facts of the occupation, of the disturbance, and of the subsequent settling down at the present level. We know the present causes to be very inconsiderable, and such as do not interfere with the regular occupations of mankind, and we infer without fear of contradiction that the former causes were more intense for the time. For my part, I do not see any reason for stretching one's belief, or being eager about the establishment of the fact that the flints in these gravels are not human implements, and, when I see things that are as evident tokens of workmanship as are the decorations of this room, I have no more hesitation in accepting the one than I have in believing the other.

Mr. T. K. CALLARD, F.G.S. — I think it rather difficult for any one to know when he has got a flint implement. I have brought from the Somme Valley certain forms of flint, and shown them to experts, who have said, "Some of them are implements and some are not." Those which are received as implements are not much more like implements than the others. That they have something of the form which would give one an idea or first impression that they had been made by design I have never disputed; but when I have looked at the evidence all round I have found much that points in an opposite direction. Of the flints now on the table I should at once reject all but about three, and I should hesitate even about the three. There is a remark on the second page of the paper about which I should like to ask a question. The author says, "It will be seen that they vary much in size and in form; that there is no '*secondary chipping*' on their edges; but indications that the edges have been bruised by being rolled in the gravel." Now, I should like to know whether that remark applies only to the flints now before us, or to all the sixty flints which are said to be implements, and which were exhibited by Mr. Smith? This is a very important question, because, on a former occasion, in this room, I produced two specimens of spear-heads. Professor McKenny Hughes, who is an expert in flint implements, at once recognised one, that which I have in my hand, as of human workmanship. Now, some of those before me look quite as much like human workmanship as it does. I then showed him another, which I now produce, and Professor Hughes said, "I recognise this piece (the first) as the work of man, from the combination of blows that have produced a form generally associated with man's handiwork. With regard to this other, I do not know how it has been produced, but it is certain that nature alone has been at work here. In the implement which I say is the work of man, I find that blows have been delivered all round the edge, with the evident and definite design of producing the form." Now, if I look at the two forms, this, the rejected one, certainly seems to me as much like a spear-head as the other. I want to know what it is that determines which is a true implement and which is really the work

of nature? Professor Hughes, says, "In the implement which I say is the work of man I find that blows have been delivered all round the edge, with the evident and definite design of producing this form"; that is, the chipping to which reference is made early in this paper as "secondary chipping." Professor Hughes, leads us to this conclusion, that if there be no secondary chipping we have no evidence of an implement; but that if there be secondary chipping, we have an implement. The specimens before us are without secondary chipping. Dr. Evans says of the Broom Pit implements, "In form they closely resemble the ordinary types from the valley of the Somme." But if the types from the Somme Valley are not more like implements than these, they will not carry conviction to my mind. Their being fractured does not prove the presence of man. I have two fractured flints, which I brought from the Somme Valley. Of these Professor Hughes says, "With regard to the shattered flints, all flints of this kind are shattered by surface action,—the action of changes of temperature due to frost and sun." If frost and sun shattered these, may not frost and sun have shattered some of those on the table before us? Then, if you are to take the outward form, I have a flint, accepted as an implement by Mr. John Evans, and also one of precisely the same form, not yet removed from its matrix, and which cannot, therefore, be of human workmanship. If, then, the form does not determine it, and the fractures do not determine it (for we are told that ice, frost, and sun will account for these), we must be careful how we arrive at the conclusion that this, that, or the other is really a human implement. I should like to ask Dr. Colan whether the workmanship of the implements of the Esquimaux was not much more like human workmanship than that in those we see before us,—whether the flint arrow-heads of the Esquimaux had not a tang or some mode of attachment to the shaft, by which one could recognise them as of human workmanship more readily than one can those on the table?

Dr. COLAN.—I would mention that the implements I have in my possession are very small. They are merely the heads of arrows, such as toxophilites use, and are of the ordinary arrow shape; they could be fastened on to a shaft. Another stone implement, about the size of two or three bodkins put together, appears to be a needle or bodkin which carried "dried gut" as thread, in the stitching of seal skins, and other articles. The arrow-heads are very small in comparison with any of those flints now on the table, and very much more like the work of man.

Mr. CALLARD.—It is my conviction that any implement which is an unquestionable implement, such as that used by the Esquimaux, can be recognised at once, and there can be no doubt about it; but, when I look at the flints on the table, there is a considerable amount of doubt in my mind as to accepting them as human implements without any collateral evidence whatever, but simply on account of their forms. If we ask why we should accept certain forms as of human origin, we are told they are like the stone implements used by other and barbarous nations, some of whom continue to use them at

the present time. But, when I see these implements of other nations, I find that they are not like the flints before us, and consequently, to my mind, the evidence fails there. Of the accepted drift implements, Professor Hughes says:—"We refer them to a certain date by their known association." I presume he meant by that their association with certain extinct mammals. I have brought a portion of a bone of one of these extinct mammals, which I took out of the gravel along with certain of these so-called implements. It would appear that in the Broom pit, from which these specimens were taken up to two years ago no bones whatever were found. Therefore, if the association with similar remains is one point of the argument, that point does not hold here. I should say of the fractured flints before me,—none of them evidence the work of human hands.

Mr. W. GRIFFITH.—Notwithstanding the pleadings of the lecturer, I feel inclined to follow the example of Lord Eldon, and to doubt. The paper before us has been prepared with great care, and I think the arguments used are arguments of great plausibility. It is not many weeks since, in this very room, the opposite opinion was advocated, and, therefore, when we hear doctors disagreeing, we may well feel a little difficulty ourselves as to the conclusions we ought to adopt. But it appears to me that the question involved may be regarded in this way: the stones before us may or may not display human handiwork, but that is altogether apart from or preliminary to the theory sought to be established, as to the connexion of the stone implements with the earliest history of mankind. A most interesting conclusion was drawn from these implements a few weeks since, namely, that man was not of the same species as the ordinary brute creation, because these implements showed him to have been possessed of reason and social qualities which distinguished him altogether from the lower animals. I think, therefore, that, if we could satisfy our minds that these implements were of the early date which some assign to them, we should be establishing a very interesting fact in connexion with the human race,—one tending to show that the doctrine of development is not so surely founded in fact as some people imagine. This being so, it seems to come to this: what is the evidence for the two sides of the question? I do not altogether agree with the writer of the present paper in the view he has put forth with regard to the glacial period. He speaks of it as a period long since passed away; as a pre-historic period, before the appearance of man. But what does the present time give us? A glacial period still exists in the northern regions, which are constantly under the action of frost and covered with snow and ice; and glaciers are still working out the same process they are supposed to have worked centuries ago in the earlier periods of the earth's history. I think that, when we talk of the glacial period as something that has passed away, we are going somewhat beyond the fact, because it exists at the present moment to a certain extent. The remarks made by Dr. Colan, who has travelled so far in those northern regions, certainly seem very pertinent to the question before us. He has told us that in that part of the earth where the glacial period still exists, the Esquimaux are forced by

the wants of nature to make implements of stone; that, being unable to obtain bronze, or iron, or wood, they, therefore, fashion the flints into such forms as are useful for the purposes of their daily life. It is a reasonable analogy that in the glacial periods of former times, if men were then in existence, the same process would take place. The answer given is this: many stones that have been found in the Valley of the Axe are not really stone implements, but have been formed by nature in such a way that some persons choose to call them stone implements; therefore, we are to reject all the evidence produced by geologists and scientific men, and to say that stone implements were not used in times past. It seems to me that the evidence for this is too weak. The British Museum authorities have made an extensive collection of these implements, and the authorities at the Exeter Museum have also an extensive collection. There is likewise a collection in the Blackmore Museum, and at Rouen I was struck with the collection I saw in the Museum there; so that we have not only those of our own nation, but the scientific men of France also,—men of practical experience,—besides naval officers who have travelled in the northern regions, testifying to the fact that stone implements have been in use from time immemorial, and are still in use in the glacial regions. Well, then, it is said that the other evidence as to man's existence in pre-historic times,—at so remote a period,—is almost conclusive in an opposite direction; that that evidence adduced in favour of a very great antiquity fails. Whether this be so or not, I do not think much affects the question. We have scientific men saying that stones have been used as implements in times past, and that they are still so used by men who have to make the implements themselves. It is possible that a stone may be naturally split into particular forms; but it is very difficult to conceive that a number of angles of a given shape will be caused in a stone so split. If we take a piece of flint we find that it will split angularly; and, if we find a great number of angles shaped into a specified form and not rounded off as in other flints by the constant friction of rolling over and over among other stones, it is probable that the angles made on that flint are of human origin. If we look at the evidence presented to us, it is, I think, in favour of the supposition that stone implements have been in use from time immemorial; and this, certainly, is an interesting fact, because it shows that the earliest man did possess intelligence.

Sir JOSEPH FAYRER, K.C.S.I., M.D., F.R.S., &c.—I have no intention of discussing this subject, as I do not understand it sufficiently well to do so, but rise merely to ask a question. It is said that some of the pieces of chert now on the table are in their present form the productions of nature. Would the reader of the paper be kind enough to say whether there is any recent instance on record of pieces of chert or flint being chipped and formed into the axe-like shape assumed by many of the stones lying on the table? The last speaker has alluded to the impossibility of nature producing a number of angles and points in a given form. I do not know whether this is so or not, but I believe that many of these stones are wont to divide with conchoidal fracture or cleavage, and I can understand that many

of the flakes we see might be thus produced ; but it is, I confess, difficult to understand how the pieces of stone now on the table were thus formed into a shape which is so exactly like that which some of the recognised and authenticated implements of man have assumed. If the author will give us some notion of what forces of nature produce this peculiar form in the stones before us—whether it has been the frost and the sun in alternations of heat and cold ; surface action ; or whether vertical or lateral pressure ; he will remove a difficulty I have never yet been able quite to overcome. With reference to the Stone age continuing to the present time, I may say that the fact which has been stated is not peculiar to the Esquimaux, and that, if you were to look into the condition of some of the tribes of Australia, you would find almost the same thing at the present day. Whether they use stone or split flint I do not know, but some of them are so savage and barbarous as not even to know the uses of iron or bronze, and not even to have invented the use of the bow and arrow. I shall be glad if the reader of the paper will give some information in reply to the question I have asked.

Capt. F. PETRIE.—Sir Joseph Fayrer has alluded to the fact that the natives of Australia, not knowing the uses of iron or bronze, adopt stone implements. I can state it as a fact that until recently the natives of the neighbouring Pacific Islands did so. When at Sydney, twenty years ago, I remember that the men-of-war coming from the Pacific used to bring many of these stone implements, which had been obtained from the natives at some of the islands ; now, however, with the spread of European civilisation we cannot get any more implements from them : their “iron age” has set in !

Mr. H. MICHELL WHITLEY.—With reference to the human bone from the Victoria Cavern, referred to near the end of the paper, a letter has been published by Professor Boyd Dawkins in *Nature* of the 24th of March, 1880, and in it the Professor says :—

“I must adhere to my decision not to play the part of *Secutor* any further to a glacial *Retiarius* in the arena of *Nature*. If his net be strong enough to carry the upper Pleiocene and the Pleistocene mammalia of Europe, as well Palæolithic man and the Neolithic skull of Olmo, I wish him joy of them. If, further, he will kindly give me the proof that the mammalia of Auvergne, considered upper Pleiocene by Falconer, Gaudry, Gervais, and other leading palæontologists, are, as he terms them, ‘a hash-up,’ they shall be properly served and *iced*, if necessary, in my second edition.

“I feel, however, that it is only right for me to notice the new gladiator who springs to the aid of his friend. The antiquity of man in the Victoria Cave is solely due, as it appears to me, to the *perfidium ingenium* (I speak in all respect) of Mr. Tiddeman. It was first based on a fragment of fibula which ultimately turned out to belong to a bear. Then it was shifted to the cuts on two small bones, which were exhibited and discussed at the British Association, at the Anthropological Institute, and at the Geological Society of London. The bones are recent, and belong to sheep or goat, two domestic animals introduced into Britain in the Neolithic age. The cuts have been probably made by a metallic edge. Numerous bones of the same animals, in the same condition, and hacked in the same way, occurred in the Romano-British refuse-heap on the top of the clay, and frequently slipped down over the working

face to the bottom of the cutting before I resigned the charge of the exploration to Mr. Tiddeman after nearly four years' work. There were frequent slips afterwards. Under these circumstances the reader can decide whether it is more probable that the mutton-bones in question did slip down from a higher level, to be picked out at the bottom, or that there is evidence of 'interglacial' (J. Geikie), or 'preglacial' (Tiddeman) man possessed of domestic animals, and probably using edged tools of metal. The mutton-bones seem to me to prove so much on the latter hypothesis, that they may be thrown aside without further thought.

"The reindeer (bones of feet) was found in 1872, along with fox, rhinoceros, elephant, hyæna, and bison, in the cave, at the lower horizon, which afterwards was proved to contain the hippopotamus. It was omitted in Mr. Tiddeman's lists up to 1876, when I called his attention to the fact. Then he wrote that the fact that it was so found was 'noteworthy,' and that 'these remarks [his generalisations] were made solely on the evidence which passed through your present reporter's hands since he undertook to conduct the exploration of the cavern' (Brit. Ass. Rep. 1876, p. 118). Surely it is too late, in his letter to *Nature* (March 10, 1881), to recall this on the grounds that these remains were discovered in a shaft, that my exploration was not carried on so accurately as his own, and further, that because he did not find the reindeer in the lower strata I did not. It is not for me to compare my own experience in cave-hunting with his, or to point out the value of negative evidence. The exploration while under my charge was *not* carried on by shafts only. When the hyæna-layer was reached, it was followed in the deep cutting visited by the British Association in 1873. The presence of reindeer in the hyæna-layer renders Mr. Tiddeman's views untenable which are based on its assumed absence. Most of these points have been so fully argued out before the above-mentioned societies that I am sorry to be obliged to repeat them in this letter.

W. BOYD DAWKINS.

"*Owens College, March 11.*"

Sir JOSEPH FAYRER.—As to the supposed human bone from the Victoria Cavern, I think it was only provisionally said, but not positively asserted, to have been human. It was a portion of a fibula, which turned out to be part of the fibula of a bear. No doubt it bore great resemblance to the human fibula. The anatomist who gave an opinion upon it, though not an absolute one, was Professor Busk.* No more trustworthy and scientific anatomist lives than Professor Busk, and I am not aware that he ever gave it as his certain and positive opinion that the bone was human. Professor Busk afterwards said that on further examination he believed the bone to be part of the fibula of a bear.

Mr. T. K. CALLARD, F.G.S.—I have seen the bone, and can well conceive that any anatomist might have made a mistake about it. It is only 6 inches

* I have a letter from Professor Busk, saying:—"After long dubitation wasted upon what at the time I regarded as tolerably good evidence, I concluded that the doubtful bone might be human, though of abnormal conformation." The bone has since been referred to by several geological writers, and it is somewhat curious, now that it has been finally pronounced by Professors Busk and Boyd Dawkins to be part of the fibula of a bear, to read the comments and theories that the first opinion gave rise to.—Ed.

in length—a piece of the middle without the articulation. Professor Busk afterwards withdrew the opinion he had ventured. Professor Boyd Dawkins in his book on “Cave Hunting” refers to it,* and suggests the animal that killed the man; while Professor Rupert Jones, also an authority, has told us the race of men to whom the bone belonged, and said it was sharp-shinned,—“platycenic.”†

The CHAIRMAN.—As Mr. Whitley, the author of the paper, is not present, he will send his reply in writing; but Mr. H. M. Whitley, who has read the paper, wishes to notice one or two points in the discussion.

Mr. H. MICHELL WHITLEY.—I was asked one or two questions as to the manner in which these flints were formed. I can only speak as an engineer and a mathematician. I should be very much surprised indeed if I did not find some of the so-called implements perfectly oval. If I took an oval pebble of symmetrical form, and delivered a large number of blows of more or less intensity at equal points of delivery all round, the oval pebble would tend to form an oval implement. When these pebbles are knocked about in the glacial drift, they are somewhat in the same position.

Sir JOSEPH FAYRER.—How do the sharp ragged edges survive?

Mr. H. MICHELL WHITLEY.—They would retain them if only knocked about,—not rubbed about. Another point is the extreme caution that ought to be exercised in deducing the extreme antiquity of man from the data before us. I have lately been conducting some investigations in Cornwall as to the time that river silt has taken to accumulate. There are in that part of the country some very interesting deposits of silt, one about 80 feet in depth, and situated over a submarine forest, which is 80 feet below high-water mark. The trees in that forest were evidently cut down by the hand of man. Of course, 80 feet is an immense accumulation of silt, and I found, on investigation, that the accumulation of silt from alluvial deposit was going on very slowly at that spot—in Restunquit Creek, in Falmouth Harbour. It so happened, however, that I came across an old chart from which I found that, 200 years ago, that same creek had, at the spot I speak of, only 38 feet, instead of 80 feet of silt, so that, in 200 years, the accumulation had amounted to 42 feet. Several questions have been asked me which I may divide into two classes:—the first, as to facts; the second, as to my father’s opinions. With regard to the facts, I may say at once that I have not visited Broom, and

* He accepted it as a human bone on Professor Busk’s statement, but afterwards withdrew that acceptance.—Ed.

† “The Hyænas had used the old cave as a den, and had dragged in their prey, among the remains of which is the human *fibula* above referred to. This is platycenic in character, that is, belonged to some sharp-shinned race. * * For the age of this venerable relic we must apply to some such calculation as that used for the determination of the great uprise of Snowdon.” (The period is given as about 224,000 years.)—Lecture on the “Antiquity of Man,” by Professor T. R. JONES, F.R.S., 1877, p. 39.

therefore it would be much better and fairer to my father if he were to be allowed to reply in writing to the observations that have been made by several speakers to-night. The same observation applies, of course, to his opinions.

The meeting was then adjourned.

MR. WHITLEY'S REPLY.

The remarks embodied in the discussion of my paper cover so wide a range of thought that it will be necessary for me to confine my reply to the one subject only to which it refers, viz. :—Are the so-called stone implements from the drift gravel at Broom, in the valley of the Axe, tools manufactured by man ?

Mr. RENDALL appears to doubt both the authenticity and the vast number of these "tools." I can only reply that I have personally inspected the whole range of these Greensand hills, from their high escarpment which overlooks the Vale of Taunton Dean on the north, to the English Channel on the south, and that I find the angular chert gravel over the whole of the district ; but more largely developed on the flat hill-tops, and on the spurs of the lower slopes of the hills bounding the valleys, everywhere presenting similar angular forms to those of the gravel at Broom. And that in many pits over this wide range of country the supposed implements have been found and recognised as human tools, by Dr. John Evans, Mr. E. B. Tylor, Mr. Worthington Smith, Mr. D'Urban, Mr. F. Brent, and other archaeologists.

Mr. PATTISON confirms my description of the section of the gravel at Broom, and tells us that he has also inspected the supposed tools exhibited in the museum at Exeter, obtained from this gravel, of which he says :—" I cannot conceive any one putting forth the hypothesis that these things are of human origin ; they are merely fractured stones, like other fractured stones. But this does not upset the conclusions drawn from one or two that have had a different origin, and unless we are prepared to give up all evidence or reasoning on these matters, we are bound to accept as genuine the implements of the Palæolithic age which are claimed by the experts to be of human origin." I accept the concession that some of them are merely fractured stones, and not of human origin ; but I cannot consent to give up the results of the labours of over twenty years' examination of this subject in the field, at the bidding of a few archaeological experts. And if I am not a believer in Palæolithic man, the stubbornness of the facts with which I have had to deal must bear the blame.

My friend says it is of no use my knocking down eight skittles if one is left standing. Well, I admit if one piece of fractured chert should be

certainly found *in situ* deep in the undisturbed drift gravel at Broom, bearing authentic marks of human workmanship, or conclusive evidence of having been used by man, his pre-glacial existence is as fully proved as if a complete human skeleton had been found there. I have often demanded the production of such a single witness ; but it has never yet been brought into court, and if it ever should be, certainly I will not receive the evidence without a strict cross-examination. My friend may, perhaps, on the testimony of an "expert," produce one or two of his nine pins, but hitherto they have proved to be only wooden, speechless bogies. I stand firmly on my adopted, but borrowed, motto, "Time and I against any other two."

With the deductions drawn by Mr. CALLARD from his argumentative and able speech, I most entirely agree ; and in reply to his inquiry, I am enabled to say, that I have seen no *secondary chipping* indicative of human workmanship on any of the supposed implements which were shown when my paper was read, or on those in the Museum at Exeter, which I have carefully examined.

SIR JOSEPH FAYRER said,—“It is, I confess, difficult to understand how the pieces of stone now on the table were thus formed into a shape which is so exactly like that which some of the recognised and authenticated implements of man have assumed.” This supposed similarity of form in stone implements of different ages was just before denied by my friend Mr. Callard ; and I agree with him that it does not exist ; and this point of difference is again and again pointed out by Sir John Lubbock, who says of “Palæolithic Implements,”—“These are all of types which differ considerably from those which came subsequently into use.”* “When M. Boucher de Perthes’ work was published, the weapons therein described were totally unlike any familiar to archæologists.”† “They ought to correspond with other stone implements of the Stone period. But this is not the case.”‡

In several parts of this discussion it seems to be assumed that I am contending against the authenticity of ALL Stone implements; this is a mistake, and it has often been used to throw discredit on my researches and opinions. I pray, therefore, that it may be clearly understood that my contention is only against the authenticity of the supposed drift tools of the imaginary “Palæolithic” age. And that I have ever firmly held that the Stone implements of the Neolithic age are as truly the work of man as any Sheffield penknife.

* Intro. to Nilsson’s *Stone Age*, p. 20.

† *Pre-historic*, 1st ed., p. 278.

‡ *Ibid.*, p. 279.