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. Since the foregoing paper was read I have received "a sample of deposit from clear running water," as likely to be of interest in reference to cave deposits. "It was formed in eight weeks to a thickness of one inch and a half; the water flowing behind an iron casing in a pit-shaft passed through a large quantity of lime, but flowed a perfectly clear water to the pump at the bottom. The deposit was formed uniformly over the surface of a four-inch pipe, reducing its diameter in eight weeks to less than one inch; but it has crystallised and grown in lines like the section of a tree, just as if it had taken a few thousand years to do it. No doubt a very few more weeks would have exhausted the supply of lime placed in the shaft or behind the casing, and it would have taken a great many thousand years to add as much again to the deposit in question."

A section of this deposit, from Hampton Colliery, near Wednesbury, I shall have the pleasure of depositing in the library of the Institute. It illustrates in a remarkable manner the formation of the "*old floor of crystalline stalagmite*" (see page 10, *ante*).

The following paper was then read by Mr. T. K. CALLARD, F.G.S. :—

*IMPLEMENTS OF THE STONE AGE A PRIMITIVE
DEMARCATIION BETWEEN MAN AND OTHER
ANIMALS.* BY JOSEPH P. THOMPSON, D.D. LL.D.*

WHEREVER on the face of the globe there is found an implement of any sort, we say, at once, Man has been here. It may be that, as in the caves in the Dordogne, there are rude sketches of art to associate the flint and bone implements with the handiwork of man; or, as in the lake findings in Switzerland, there may be traces of human habitations to identify the stone utensils with the building of the pile-dwellings; or, as in the shell-mounds (Kjokkenmøddings) of Denmark, a ruined hearth-stone and the bones of birds and animals of

* The late.

the chase, skilfully opened for their marrow, may point to man as the maker and user of the implements found in these heaps of refuse; and it may even happen that sometimes in the same place of deposit with the primitive implements of stone is found an indubitable relic of man himself, in a small fragment of the human skeleton. Yet in all these cases the implement itself, apart from its accessories, is an argument for the presence of man. The implement certifies the man as really as the man certifies the implement. This no one would think of disputing; but I give emphasis to the unanimity of science on this point, because of its bearing upon the primitive *differentia* of man as a species. We say, If man was indeed contemporary with these wild denizens of the caves, then these are the weapons with which he slew them, the implements with which he prepared them for his food; and the finding of the implements imbedded with the animal remains is evidence that man was contemporary with such animals.

If we go back to the river-drift gravels, as, for instance, in the valley of the Somme, where we have no trace of human habitations or other works, and perhaps no authentic specimen of a human bone, but simply compare one stone with another, we say, again: Man was here at the remote period of this formation; for these flints are shapen, adapted to a use, and are no longer stones, but implements. We may raise the question whether the findings are genuine or forgeries, whether "the flint implements are of the same age as the beds in which they are found," or have come there by accident, or have sifted down from some later deposit; but if they are genuine, and of the same age with the drift, we hold them for conclusive proof that man was there in that age.

But in making this decision, do we not unconsciously impose upon ourselves with the tacit presumption that only man is capable of making and using an implement? Science cannot admit a presumption, except as a tentative hypothesis; she must rest all her conclusions on the known basis of fact. But that only man is capable of making an implement is a fact of observation and experience, and not merely a presumption *à priori* from something in the nature of man. Such a presumption is, indeed, valid as against physical nature. Wherever we perceive adaptation to an end we do immediately ascribe such adaptation, or the thing so adapted, to an intelligent purpose. Whether this reference of adaptation to intelligence is intuitive, or the result of cumulative experience, this is not the place to argue. Suffice it to say,

that wherever adaptation is found, the conviction of the human mind is immediate, universal, and absolute, that there was enough of foresight and skill to produce that adaptation. But we never ascribe such foresight and skill, such intelligent purpose, to physical nature. Nature furnishes the stone and the iron; but nature does not make the hammer, the knife, the axe, the spear. Nature abounds in materials of which man can build himself a house; but beyond the cave in the earth and the leafy covert in the wood, she provides nothing for his habitation. The crude material lies in the lap of nature; but the shaping of this material to any use or end requires a degree of intelligent purpose of which we do not find in inorganic nature any trace or suggestion. Hence as against inorganic nature, the presumption does hold *à priori*, that man, as a creature of intelligence, is alone capable of making an implement, of transforming inorganic matter into a tool for use.

But this presumption from the nature of man does not hold as against other animals. For, though intelligence must be presupposed wherever we perceive adaptation, yet whether other animals than man possess the kind or degree of intelligence requisite to fashioning an implement for a specific purpose, is a question of fact that only observation can determine; and observation has decided this in the negative. There is no instance on record of any animal making an implement for a special use or end. There are animals and birds that use the materials of physical nature with much ingenuity and skill in building their houses and nests. It is enough to instance the intelligence of the beaver in adapting stone, wood, earth, and water to his wants, and in surmounting the obstacles to his task in some less favourable site. There are tribes of *Simiæ* that use stones and sticks for cracking nuts or as weapons of defence. But all this is far removed from the making of implements for a purposed use. The beaver chooses his stones and breaks or twists his sticks; but he never shapes a stone with which to cut and shape a stick. The chimpanzee takes a stone to crack a nut; but he takes it up a stone, and lays it down again a stone; he never shapes it to a hammer, fits it with a handle, to be reserved for this special use. The baboon throws a stone to wound or frighten his enemy. He never shapes the stone to a spear-head or a battle-axe, to be kept by him for the service of war. No animal goes beyond using the crude material that nature furnishes. He may use this skilfully and well, adapting it to his own necessities; but he does not improve upon nature, does not change the form of

her crude material, making of this an instrument for higher ends; does not make an implement in the sense which we attach to that word in the hands of man. Hence the implement is a line of demarcation between man and other animals. This fact, again, is well-nigh universally accepted by differing schools of scientists; though Mr. Darwin gives it but a qualified assent,* and Sir John Lubbock suggests that tool-making was at first a matter of accident.

But though the use of implements is acknowledged to be a line of demarcation between man and all contemporary animals, it is argued that existing species of *Simiæ* have reached the limit of their development, but, there were prehistoric species which by natural selection attained higher and yet higher stages of progress, until the first type of man emerged, when the antropoidal progenitor gradually became extinct. Hence it is said to be unfair to make the use of implements a demarcation between man and pre-existent animals, or a characteristic of his standing in the scale of being.

To this objection there are two replies. First, in the present state of scientific knowledge, there is no tangible evidence of the existence of any such higher kind of apes. The links between the highest known species and man must have been many and long; but no trace of these has yet been found. True, this is a merely negative reply. But the existence of such species of apes is a pure *assumption* based upon analogy. Now the want of *data*—that is to say, negative evidence—is logically valid against an assumption. Since then, the links of connexion are wanting, this antropoidal pedigree of man must be held in suspense as only a hypothesis. Darwin presents it with his accustomed modesty.† But Hæckel goes so far as to say, “we must necessarily come to the conclusion that *the human race is a small branch of the group of Catarrhini, and has developed out of long since extinct apes, of this group in the Old World.*”‡

Now there is danger that an unproved inference put forth with such authority shall be prematurely accepted as the verdict of science. But though we would concede much licence to hypothesis, yet in the name of science as well as of logic, we must protest against putting assumptions in the

* *Descent of Man*, vol. i. p. 49.

† *Ibid.*, vol. ii. chap. xxvi.

‡ *The History of Creation*, vol. iii. chap. xxii. (The italics are his own.)

same category with facts, and drawing authoritative conclusions from hypotheses as if these were facts established before our eyes. Until, therefore, some trace is found of a tool-handling ape, we are warranted by all known facts in adhering to the use of implements as a primitive demarcation between man and other animals.

My second answer to the objection is, that it proves too much for the objector himself. The whole argument for the derivation of man from a lower form of animal is drawn from the correspondences between man and the inferior animals as we see those animals to-day. This correspondence is traced by Darwin in almost every particular,—intellectual, emotional, and even moral. Huxley says, “No absolute structural line of demarcation, wider than that between the animals which immediately succeed us in the scale, can be drawn between the animal world and ourselves; and I may add the expression of my belief that the attempt to draw a psychical distinction is equally futile, and that even the highest faculties of feeling and of intellect begin to germinate in lower forms of life.”*

It is the homology of man with the animal world *as it is*, and the manifold correspondences of known species of animals with man, as well as the general analogy of nature, that lead to the theory that man is derived from some lower animal progenitor. Well, we go back to the Stone Age, and there find man differentiated from animals in a most pronounced manner. The implements are evidence that man was there; but directly we come upon this demarcation we are told not to compare man *in this particular* with existing animals which he resembles in so many other particulars, but to presuppose extinct species of a higher grade that paved the way from the stone to the tool! To use a homely adage, “One cannot burn the same powder twice over”; and one cannot use the same facts to establish both the positive and the negative side of his argument. Mr. Wallace has set forth the lessons of the Stone Age with rare felicity. Having described the long processes of development in nature, he says, “At length there came into existence a being in whom that subtle force we term *mind* became of greater importance than his mere bodily structure. Though with a naked and unprotected body, *this* gave him clothing against the varying inclemencies of the seasons. Though unable to

* *Man's Place in Nature.*

compete with the deer in swiftness or with the wild bull in strength, *this* gave him weapons with which to capture or overcome both. Though less capable than most other animals of living on the herbs and the fruits that unaided nature supplies, this wonderful faculty taught him to govern and direct nature to his own benefit, and make her produce food for him when and where he pleased. From the moment when the first skin was used as a covering, when the first rude spear was formed to assist in the chase, the first seed sown or shoot planted, a grand revolution was effected in nature, a revolution which in all the previous ages of the earth's history had had no parallel; for a being had arisen who was no longer necessarily subject to change with the changing universe,—a being who was in some degree superior to nature, inasmuch as he knew how to regulate and control her action, and could keep himself in harmony with her, not by a change in body, but by an advance of mind.”* This we see already in the Stone Age. But whence came this capacity in man, or whence came man having this capacity?

It has been suggested that man came by accident to the use of implements; that the savage, beginning like the monkey with using a round stone for cracking nuts, accidentally discovered that he could crack other stones also, and sharpen these for cutting; and, moreover, by thus eliciting sparks he made the accidental discovery of fire.† Now all this may have been; but it is an unscientific method to take our present knowledge of implements and their uses and prescribe from this the way in which the primitive man must have invented his tools. It is, to say the least, a curious accident that no such accident as is here imagined for the savage ever happened to the monkey; that it never occurred to *him* to crack a stone and shape it into a knife, or to gather sparks for kindling a fire. And it is still more curious—indeed unaccountable upon the theory of a kindred intelligence—that no monkey, baboon, or chimpanzee has profited by the example of man in learning to make implements of the crude native materials about him. Different tribes of savages, it is believed, have separately stumbled upon these inventions; but in all the ages since the Stone

* *Anthropological Review*, May, 1864, p. clxvii.; also reprinted in *Natural Selection*, p. 325.

† Sir John Lubbock's *Pre-historic Times*, chap. xiv.

Age, no tribe of *Simiae* has either stumbled upon such inventions or copied them from man. The most savage tribes learn from civilized man to improve their weapons of warfare; sometimes copy with deadly effect the weapons and tactics of their superiors; but no tribe of *Simiae* has yet learned to make the simple weapons of stone that even the rudest savage manufactures for himself. All experience teaches us that man is the only animal capable of fashioning an implement for a specific purpose; and hence the implements of the Stone Age are a primitive demarcation between man and other animals.

This fact has no necessary bearing upon the question of man's derivation as to his bodily frame; but it does mark very distinctly a point of departure in the crude pre-historic data of our race. The Stone Age is, after all, an age of human capacity, discovery, invention, and also of prophecy, and we need not be ashamed of our connexion with it. Admitting that the first suggestion of a knife, the first hint of fire, came of the accidental striking of two flints together; in the same sense it may be said that the invention of the steam-engine was accidental, being suggested by the vapour lifting the lid of a tea-kettle; and if we may accept the legends about Newton and Galileo, the discovery of gravitation was due to the accident of a falling apple; the suggestion of the heavenly motions, to the accidental swinging of a chandelier. In every case there was something in the man for the accident to work upon; the accidental sharpening of the stone sharpened his capacity into a purpose for adapting inorganic nature to his use; the first spark struck from the flint elicited a spark from his consciousness that kindled to a flame of invention. What we see in the Stone Age is man asserting his supremacy over nature by taking into his own hands her raw materials and shaping these to his higher uses. The first attempts are crude enough, and the progress to polished and ornamental implements, and to works in metal, is toilsome and slow. But the germ of great possibilities is there; the science of architecture is there; the science of engineering is there; the science of husbandry is there; all arts, manufactures, inventions are potentially there; for in building the cathedral, the fort, the viaduct, in forging Krupp's cannon and the armour of the Thunderer, man is but carrying to higher and yet higher perfection that which he began to do when he first formed the rough materials about him into tools and weapons for his own use. He then began the mastery of nature through his adaptive intelligence and his purposing will. All that he has yet accom-

plished in subordinating and adapting nature to his ends has been through the development of the faculty that first taught him to shape an implement out of a stone. That line of demarcation separates man on the one side from physical nature by all that is possible in invention, and on the other side separates him from other animals by all that is actual in achievements over nature.

Hence the prominence given by science to the Stone Age involves no controversy with the philosophy of man. That age is not derogatory to man as philosophy would present him in his intellectual and moral attributes. The surveying, measuring, choosing, purposing, conquering intelligence is already there, discriminating him from the brute not only quantitatively, but qualitatively also. The old arguments of philosophy for the exaltation of man are indeed brought in question by modern science. Consciousness, language, reason, reflection, memory, imagination, the domestic affections, the emotions, and even the moral feelings,—all these, once assumed to be distinguishing prerogatives of the human species, are now claimed in some degree for different animals. I shall not trespass here on this debatable ground. Science has first of all to do with facts, without regard to their bearing upon theories of philosophy and ethics. But it is science that offers us the Stone Age as an incontestable witness for man. And surely, the germs of the spiritual and the ethical are given in an intelligence that first addressed itself to the mastery of rude nature for human ends. The conquest of thought over matter began in the making of implements; and the first rude scratches to record memory, feeling, or fancy foreshadowed that supreme implement of thought by which man gives permanence to knowledge by the written page, records the phenomena of nature and the discoveries of science, and transmits to other ages the history of the race.

The CHAIRMAN.—I am sure that the meeting will allow me to return thanks to Mr. Callard for the manner in which he has read this short but interesting paper, written by one of our members who has now gone to his rest.

Mr. D. HOWARD, F.C.S.—I think we must all agree that the paper is a very interesting one, inasmuch as it calls attention to what is the weak point in the doctrine of evolution, which requires the continuous natural evolution of species linked altogether but with no gaps, because in this theory a single gap is fatal. It is of no use to tell us that there

is a high road from London to Dover, and at the end of the Admiralty Pier at Dover it is continued to Rome. No doubt, the Admiralty Pier shows an intention of getting to France; but the road ceases there, and we must look for some other means of getting to the Continent. So it is with regard to what we see in nature, where we find everywhere evidence of chains, and then gaps. These things undoubtedly point to unity of purpose, but not to unity of origin. Therefore, I think that a paper like this is valuable, because it points out one of these gaps, which it certainly lies with the propounders of the evolution-theory to get over. It is not sufficient to say there is such an immense difference between the lowest savage who makes a rude flint tool and the forger of a modern cannon. This, I repeat, is not enough. You must show how to get over the gap between the animal, however intelligent, that has not made nor used a tool, and the man, however unintelligent, who has. There are plenty of things which equally mark material physiological differences. Supposing the doctrine of development to be true, there are these curious questions:—How is it conceivable that a simple circulation of the blood becomes more and more complex? How, where you have a given and simple form of heart, is it developed into the fourfold heart of the upper and superior animals? It is almost impossible to conceive how one can become two, two become three, and three become four. This illustration may serve to bring out more forcibly the question as to how a non-toolmaking animal can become a tool-making animal. There is no sign or trace of any such thing having ever happened. It may be true, as Professor Huxley has said, that “no absolute structural line of demarcation, wider than that between the animals which immediately succeed us in the scale, can be drawn between the animal world and ourselves.” This may be perfectly true, but then the word “wider” covers a somewhat wide gap. For example, there are the wide gaps that exist between the lower animals—gaps almost as great as that which we find between the ape and the man. I do not say quite so great, but certainly quite as awkward to get over. Therefore, there is a hidden depth of meaning in that one word “wider,” to which I would call the attention of those who are prepared to accept the doctrine of evolution. I am not prepared to say that evolution is not conceivable; but I do say that there is no known process of nature which can carry out the whole process from beginning to end. And even if we could conceive evolution, we should still require to know how to get over these gaps. If there has been evolution, which I am not prepared to assert or to deny, it requires a distinctively creative act to bridge over these gaps,—a creative gap as distinct as a fresh creation of new animals. It is these gaps, the existence of which are so studiously ignored by those who are popularising the doctrine of evolution, that ought always to be kept fully in mind by those who really wish to arrive at any sound and scientific conclusion upon this matter. (Hear.)

Mr. T. K. CALLARD, F.G.S.—About the middle of the paper, reference is made to the progress of the anthropoid ape until he reached that stage in

which the first type of man emerged, and the anthropoid progenitor gradually became extinct. The only man I know who has ever suggested that the anthropoid ape made implements is Professor Gaudry, a French geologist, who says that it is probable. He says the anthropoid apes must have made the implements, if they were made at all in the Miocene period, for he believes that man did not exist in that period. The idea that these anthropoid apes lived on to be the progenitors of man, and then gradually became extinct, must be a fiction; because these apes passed away in the Miocene period, and man did not appear till long afterwards. As I remarked some time ago, in this room, if the anthropoid apes reached such a stage of progress as has been asserted, they ought not to have died out, but should have lived on, on the principle of the "survival of the fittest." I think the author of the paper deals ably with this error. I agree with what he has stated, that when any implements were made, man made them, and not a monkey. The author has said:—"The chimpanzee takes a stone to crack a nut; but he takes it up a stone and lays it down again a stone; he never shapes it to a hammer, nor fits it with a handle to be reserved for this special use." I have an implement with me, and wherever such an implement is found there ought to be no question whether it is the work of man. This [producing an implement] came from the Swiss Lake Dwellings. The stone is polished and fitted to a handle. Professor Gaudry would not suppose for a moment that any ape could have made it. The author of the paper has said,—“If we go back to the river drift gravels, as, for instance, in the Valley of the Somme, where we have no trace of human habitations or other works, and perhaps no authentic specimen of a human bone, but simply compare one stone with another, we say again, man was here at the remote period of this formation; for these flints are shapen, adapted to a use, and are no longer stones, but implements.” I am not quite so sure of this. I am sure that the ape did not make them, but I do not, therefore, arrive at the conclusion that man did. If I see an implement such as has been described here to-night, I am quite prepared to believe that it was made by man, or that man made this [holding up a flint arrow-head], because here is a tang. But when I come to this [holding up another flint which had been sent by Mr. Whitley as being called a palæolithic implement], I see that there is no fitting into a handle here, and that such a thing was never intended. I have brought two specimens, one from St. Acheul, in the Somme Valley, and another from Moulin Quignon, where M. Boucher de Perthes first found flint implements. I will not say, with the writer of this paper, "man was here." I can understand that their appearance of having been worked into form may induce a person to pause before arriving at the conclusion that these things are not the work of man. Here is a photograph of one of the implements [pointing to it], and here, beside it, is the representation of another flint nearly of the same form, which was evidently not fashioned by man, for it has never yet been released from its matrix of silicious sandstone. In the second photograph another accepted implement is compared with a similar form

still in its matrix. The fact that in these cases the forms are so similar ought, I think, to lead us to doubt whether we should say unhesitatingly, when we see these specimens, that they are human work. In this, a third photograph, Professor Hughes takes No. 1 to be an unquestionable implement, No. 2 he rejects, and he is doubtful about No. 3. I think that they are too much alike for any one to be able to speak very positively as to one being an implement and the other merely a fractured flint. Then there are other little difficulties that will arise, and which we are bound to look at. The writer of this paper has said, "We may raise the question whether the findings are genuine or forgeries." I have brought a forgery, if that be the proper term for it. This [producing it] was not made by palæolithic man. It came from the Somme Valley, and I do not think it is ten years old. It was made by one of the workmen, and will not aid us at all in solving the question of the antiquity of man. The man from whom I obtained it did not try to impose on me; he said that it was made by one of his fellow-workmen. I asked, "How did he make it?" and the man replied, "He used an iron punch and a hammer." I said to him, "But, you know palæolithic man had neither iron punch nor hammer." "No," said the man; "I suppose he had not." "Then how," said I, "do you suppose palæolithic man made his implements?" "Well," replied the man, "he must have cut them out with a stone." I asked him to show me how, and he at once got a stone, with which he struck off three or four chips on this side and three or four on that, and after this had been done, it certainly did look a little more like human workmanship than it had done before. When he had done this, the stone went back into the basket among the other implements, and if any one had gone there a fortnight afterwards, he might have picked up that very flint and said, "It really does look as if there had been some human workmanship here," and he would have been right; but it was not the work of palæolithic man. We have had a great many of the forgeries of the notorious "Flint Jack"; in the Salisbury Museum there are a number of them; I do not mean to say that all that have the appearance of being artificial are forgeries: all I want to impress upon the meeting is that a considerable amount of caution is required in dealing with these specimens,—it must be borne in mind that geologists have rarely found them *in situ*. I have only taken two or three from the gravels, the rest I have received from workmen; and if a workman perceives the importance of one of these things being a little sharper than it is when he finds it, and knocks a little off the edge and puts it back again into the basket as in the case I have referred to, the person who comes afterwards must be careful he is not guided simply by the form of the flint, and its chipping. We must also bear in mind that there is no collateral evidence going with those flints, as is the case with the implements found in the Swiss Lake dwellings, where wheat has been found, with them, and many other things are brought from the lake to strengthen the supposition that these implements were the work of man. There is nothing of this kind found associated with the Somme flints. I would advise caution.

If the doctrine of the antiquity of man is to rest on these implements, I do not think the evidence is sufficient. You may observe in this natural stone that there is an approach to a tang, and if you were left to choose which of the two was the artificial stone, you might be inclined to choose the natural one. (Applause.)

Mr. L. T. DIBDIN.—I am afraid that Mr. Callard has demoralised us upon the subject of flint implements. There is one point mentioned on the last page but one of the paper which I wish had been enlarged upon, and that is where, in speaking about the difference between man and the lower animals, and showing that, whereas man makes tools animals do not, the author has drawn attention to the very important point, that not only do animals not make tools of their own accord, but there is no evidence of monkeys ever having imitated man in making even the rudest implements. I regard this point as one of importance, because we all know that monkeys are very imitative animals, and even admitting fundamental distinction between the instinct of animals and reason, we might still have expected that if they could not imitate the manufacture of tools, they could, at any rate, with man's example before them, imitate the making of those tools.

Mr. R. W. DIBDIN.—In the second page of the paper it is stated,—“Yet, in all these cases, the implement itself, apart from its accessories, is an argument for the presence of man.” If that is so, surely it shows the extreme importance of the line of study which several of our members, and more especially Mr. Callard, have taken in sifting the evidence as to whether the stones found are really implements that have been made by man, or whether they are not accidentally fractured, or forgeries, or are the product of modern times, and not of the extreme antiquity of which some of their advocates and possible inventors claim for them. I think we cannot be sufficiently grateful to those of our members who have so thoroughly searched into this subject, and prevented our being carried away by what at first may seem very plausible arguments in favour of the antiquity of certain flint implements, and necessarily also for the extreme antiquity of man.

The meeting was then adjourned.