On Some Palaeolithic Knapping Tools and Modes of Using Them

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Source: *The Journal of the Anthropological Institute of Great Britain and Ireland*, Vol. 13 (1884), pp. 109-114+117-118

Published by: [Royal Anthropological Institute of Great Britain and Ireland](#)

Stable URL: <http://www.jstor.org/stable/2842002>

Accessed: 14/06/2014 22:52

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tion whatever of the methods of stone cutting; he described some of the most evident results, without any technical criticism or research; and from his allusions to the choice of soft metal for *chisels*, to be used with *emery powder*, it is difficult to see what definite ideas he had of the capabilities or use of tools. Hard powder used with a chisel would be merely crushed up, without doing any work. Of his most valuable drawing of dressing the stone by means of a line and offset pieces, explained in this paper, he does not give even one word of description. Hence, saying here that his remarks on these subjects are only such as any intelligent traveller might make, is certainly not an over-strong statement. That setting the stones inside very small tube drills would be impossible, may be freely allowed; but no tapered cores under 2 inches diameter are known in hard stones; the small cores are all in alabaster, which could be readily drilled merely by sand. The setting of stones in the insides of the tubes would not be very difficult, either through larger holes in the opposite side, or else by cutting holes right through the metal. The great pressures alluded to were only for cutting in block; doubtless the delicate bowls were thinned off by grinding and polishing; and probably they would be filled solid with pitch during the final finishing. The disappearance of the tools is not to be wondered at. The specimens of work yet found are but a small fraction of what a single tool would cut out; and of the far commoner tools, as chisels, hammers, &c., there are but very few specimens known. The jewelled tools would be royal property, and would never be buried with the workman; and the bronze would be melted up, and jewels reset, again and again, as they wore out.

The following Paper was read by the author:—

On some PALÆOLITHIC KNAPPING TOOLS and MODES of USING THEM. By F. C. J. SPURRELL, Esq., F.G.S.

(WITH PLATE III.)

ALTHOUGH in many situations where implements of flint have been found in river-deposits, flakes or wasters and minor implements have been found also, yet there has been little success in getting the waste flakes and imperfect implements, together with the tools or knapping stones with which the much-desired *hâche* was formed.

It is obvious that where these remains are found in coarse gravel, there will be small chance of obtaining such particulars; and if so found there would be no proof that any particular knapper produced any particular flake, or was employed for any particular purpose. But on sandbanks, in out-of-the-way parts of a river-bed, and in retired situations, such remains

have been found; in fact, they are common and easy to find, and their relative age and positions at once suggest a close connection between them.¹

Of the mode of producing flakes it is obvious that much may be inferred from the mere inspection of a flake; but when we consider the uniformity of the material we are surprised at the variety in the shape of implements and the difference in the style and method of chipping as practised by the old men.

When three years ago I found at Crayford a locality on the beach of a river, covered with a layer of chipped flints, I was able to show that the chipping had been done on the spot, and that no movement whatever of the remains had taken place since they were dropped by man.

All the stones had been obtained from the base of the chalk cliff, and it thus happened that the irregular staining of their surfaces by the iron from the gravel, helped materially in replacing the chips in their original form. The relics consisted of large and small flint flakes and minute chips, together with cores and spoilt hâches. With them I found hammers.

From the appearance of the flakes it was at once seen that several methods of workmanship had been practised, and this was more clearly brought out on their restoration into the original blocks.

In some cases the whole stone was split up into long, parallel, regular flakes (such an one I gave to Sir John Lubbock). In other stones the object was clearly to break the stone, but apparently without ulterior purpose as to the pieces detached, so coarse and clumsy were the results.

Other stones were broken evidently to obtain knife-like plates (which were afterwards carefully elaborated), and this was accomplished by means of a continual rectification of the superior (and necessary) plane of percussion from which the large flakes were struck.

In order to obtain a better stroke a continual lowering of that plane was practised by the freeing of minor flakes from it, parallel with its surface; each act of flaking, both horizontally and vertically, being frequently alternate. The restoration of flakes presents, consequently, a stair-like arrangement under this treatment.

¹ In searching the refuse of bone-caves, where flakes, knappers, and tools for working bone, &c., certainly lay with the general rubbish, it would seem that little care has hitherto been taken to collect and re-arrange them; it can only have been haste or carelessness, on the excavators' part, that lost so good an opportunity of obtaining those details which help to trace the turns of thought and ingenuity in overcoming those difficulties which enable us to distinguish the minor points marking the progress of man's mind. Though so much has been lost much may still be done, and it is to be hoped that in future greater care will be taken.

The hammers with which flaking was done were apparently ordinary flints. Such flints are much bruised at the *ends*, or the *edges* of the *end* of a long stone, broken across; and I think that this must have been their most common form, as it certainly produced the simplest kind of palæolithic chipping.

There can be little doubt that some large flints, which show a peculiar jarred appearance chiefly on flat or hollow parts, were anvils on which to rest the block.

Another method of working was to break off large or small pieces from the outside or crust of a nodule, with the ultimate purpose of getting at its interior. The flakes yielded by this method, from Crayford, as restored by me, show great irregularity of form and order of removal; they are usually broad and inelegant.

With these flakes were found two stones, which from their appearance I at once concluded to be hammers of a special shape. One of them is a green-coated flint of great toughness; it was chosen to suit the grasp of the hand, and was trimmed at either end to a suitable length. The thick layer of tough white crust on one side of it was peculiarly suitable, as resisting its own too rapid wear. It was not until this crust was worn down to the black flint that the hammer was thrown aside.

Another small chalk flint was evidently tried, but being of the ordinary kind was speedily thrown aside as unsuitable or worn out.

It became necessary to discover how this hammer was used, which I am able now to say I have done. By making experiments on this form of hammer (fig. 1, Plate III), and procuring a similar piece of stone, I succeeded in producing similar work. There was no anvil needed in this work.

The block of stone to be operated on being held in the left hand was struck by a long swinging sweep of the right hand holding the hammer, in the way a violin bow is held (in the direction of the arrow in fig. 2, Plate III). It is evident that in general the lower surface of a long hammer passing lengthways over the edge of the block would merely strike the thin edge, at (*a*), and that unless an irregularity in the hammer happened to hit further back, a flake, properly speaking, would not be detached. In order, therefore, that the hammer should strike the right spot (*b*) at once, the projecting edge (*a*) was chipped or trimmed slightly, so as to remove the projection in the line of stroke back to (*b*), at the same time roughing the surface and enabling the hammer to get a "grip": this being done the flank was successfully detached.

That this method was actually employed may be distinctly shown by the fact that many of the flakes, when placed together,

show the trimming above described passing continuously across the base of both of them: thus they were chipped in a preparatory way more or less, or not at all, as occasion required.

One of the flakes, from which a smaller splinter has separated after it had reached the ground (the result of continued action of the blow which severed the flake from the block, and which, therefore, could never have been used), is much roughened by this chipping.

In arranging the flakes for the restoration, most of which had fallen to the ground at once, some could not be found, and this is explained by the fact that when imitating the use of the hammer above described, occasionally a flake flew to a great distance: one flew with a fearful whirr a distance of over 60 feet; doubtless this incident occurred to the old men. Notwithstanding that these flakes, on their first exhibition, were at once identified by a very high authority as having been "used," it is evident that the chipping at their bases is not the result of wear, but is merely a detail of manufacture.

I was enabled, by a careful examination of the surface, to see from the disposition of a heap of flakes, which lay divided by two slight lines and other signs, that the operator *sat* on the sand with his legs but slightly apart.

Sometimes stones nearly of the size and shape of the implement required to be formed were selected, and the crust removed wholly or in part from the surface. It does not appear that any of the crust was retained for a purpose, as in almost every case where the chipper was sufficiently skilled the whole was removed. I have seen many spoilt tools broken, in the apparent endeavour to remove some such blemish, which were otherwise perfect.

Since the Crayford find I have met with several floors where men wrought, and in one, which I succeeded in keeping somewhat to myself for a time, I observed some fresh details.

This was at Northfleet; it, like the last, was a river beach, perhaps dry in summer and subject to floods;—though, subsequently to the deposition of the refuse, some of the ground has been pushed about by ice, yet the immense quantity of flakes (cartloads), and other signs of man's occupation, furnish abundant evidence that he lived near, and worked on the spot.

These flakes are of all sizes, from over 3 lbs. in weight to a grain or two. Some are of great age, and have travelled far or lain long kicking about on the shingle, while others are as sharp as if made to-day; of the latter, some are clumsy, and some long, thin, and very straight.

Besides the ordinary method of chipping, that is, of hitting one stone with another in a manner not requiring much technical

ability, at this spot a hammer was employed (fig. 6) which I have not noticed elsewhere. Many stones (flint) were found whose characteristic may be summed up by saying that they were pointed (and *the* point much used). In their best form they resembled kites, though they frequently were but long flints (a not unusual form), chosen for their weight and the possession of a good point, which, if not existing, was trimmed up; in weight they ran up to 10 lbs. Some of them were, however, not strictly pointed, but broken obliquely to the length, the part used being the projecting edge.

At this place, in the ordinary way of making a *hâche*, a stone was shaped and finished at the butt; in finishing the tip, however, by means of striking longitudinal flakes from a small surface left at that end, a heavy, sharp-pointed hammer was needed for the exact delivery of the blow, such as those before described. When the blow was true, and the tilt of the surface right, all went well; but it was not always so, and by means of spoilt implements I am able to show that the tilt was not always rectified, or the blow delivered with exactitude. Thus the striking off of too thick and large a flake, and the consequent spoiling of the implement, sometimes happened. This may have occasionally resulted from the hammer being worn out.

Another mode of manufacture largely depended on these sharp-pointed hammers. A flint stone being selected, and trimmed coarsely round the sides, was worked on its upper surface into the form of a flat dome; then from one end the whole of this prepared surface was detached by a single blow (fig. 5), producing, when the operation had been well conducted, a "turtle-backed" flake, with a flat surface on the other side (figs. 7 and 8).

In this and the before-mentioned uses of this kind of hammer, it is remarkable how much preparation and labour depended for its ultimate success on adroitness in the delivery of a single stroke! Many flakes were worthless, and were cast aside, but of those which were retained as suitable, two uses were reserved. Some were trimmed round the edges, mostly at one end and the sides, the other end or some part being left untrimmed, as if left for handling without inconvenience. This trimming was not needed so much at first when exquisitely sharp, as afterwards when the edge was lost by use. The trimming is invariably on one side alone (the raised one). I have called these "turtle-backed scrapers" (see figs. 7 and 8).

I think that though trimmed to keep the edge sharp, they would be less efficient than when new. These stones, which might equally be skinning implements, or sleeks (slicks) for dressing skins, were admirably adapted for the first purpose.

An ordinary flake, used to skin an animal, would as frequently cut upwards through the skin, as down on the bones or subjacent tissues, and would be less governable and more dangerous to the integrity of the skin in proportion to its sharpness; but these turtle-backed flakes, held with their rounded (or bevelled) sides towards the skin, could only cut *downwards*, and if they slipped could not perforate or injure it, a matter of extreme importance in those times. For the second use, that of currying and scraping, it being a less delicate operation, they would be well fitted.

A large number of the flakes at Northfleet showed signs of having been "worked." Some were what are called round or thumb scrapers, others present a straight edge, and some resemble the so-called hollow scrapers, and doubtless many might have been used for scraping bone and wood into shape. On examination, however, it is perceived that most of these implements show all the chipping to be on one side only, that it is sharp and unpolished, the hollow is very wide, and placed much to one end: these points do not agree with the shapes or uses of scrapers. They are not scrapers, but *knappers* (fig. 3). In consequence of this surmise, whilst trying to make a flat flake into a round scraper with another simple flake, I found that by resting one horizontally on a point of stone or wood, and striking it with the edge of another in a direction downwards, and slightly away from me, I could easily imitate to perfection many found at Northfleet, while on a repetition of the operation with the same knapper, I found its action improved, until at last it was difficult to tell the original from my own by the form alone.

So necessary was the deep hollow to success in their use that flakes were chosen which had a slight accidental hollowing. Some were left-handed in use. Their weight runs from about an ounce up to 8 lbs., and apparently the large ones must have been used in making hâches, some stones presenting signs of such treatment. It appears likely that the turtle-backed flakes were trimmed by this means occasionally.

I have never found any stones, other than flint, that have been used for the purpose of knapping or striking off flint flakes on river-banks, though tough pebbles of quartz, sandstone, &c., are common enough, and when these have presented signs of wear it was of that kind resulting from pounding some comparatively soft substance on another stone. I obtained the tools exhibited from the beds with my own hands; in truth, had I not done so, I should not have considered them worthy of the attention of this Institute; and I felt the necessity, on this occasion, of being able to say this, even if it entailed the omission of a few better examples than those present.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 6.

Fig. 5.

Fig. 7.

Fig. 8.

Fig. 9.

FLINT HAMMERS, WITH ILLUSTRATIONS OF THEIR USE.

The restriction which I thus placed upon myself has prevented some further observations being made, of an inductive and experimental nature, on palæolithic as well as later stone-working.

Description of Plate III.

Fig. 1. Stone hammer from Crayford; 3·8 inches long, 6·7 inches in circumference.

„ 2. Diagram explanatory of the use of the hammer (fig. 1). S represents the hammer, and F the block of flint.

„ 3. Flat flake of flint chipped by use into a hollow on one edge; there are no signs of chipping on the other side. This is a good example of the common form, the larger ones are less elegant.

„ 4. Diagram representing the manner of using the flake (fig. 3). It is held (the worked part upward) by the right hand at *x* in the position *a*. Another flake to be trimmed is held by the left hand at *b*, resting on a piece of wood; *b* being struck at *d* by the downward motion of *a*, the chips fly from the unopposed surfaces of each flake.

„ 5. A block of flint trimmed at the sides and at the top, where the form is indicated by dotted lines. This upper part is struck at one blow, at the spot marked $\times$ by fig. 6.

„ 6. A hammer, which was used at the pointed end, to ensure accuracy; the blunter end may also have been used. This is the most usual form.

Figs. 7 and 8. A tool made from a flake resembling the upper part of fig. 5. The flat side is left unworked; the other is trimmed to a regular form, and served as a slick or skinning implement.

Fig. 9. Also made from a flake like the upper part of fig. 5. It is, however, worked on both sides into a *hâche*; this tool is in admirable preservation.

N.B.—The above outlines (figs. 2 to 9) are drawn from actual specimens, on a scale of one-fourth natural size (linear).

DISCUSSION.

Mr. W. G. SMITH drew attention to the fact of quartzite pebbles, with abraded ends, being found in neolithic positions, such pebbles being generally accepted as hammer-stones, for flaking and pounding. Quartzite, he said, was specially useful for this purpose, being hard and tough, whereas flint is brittle. Mr. Smith exhibited quartzite pebbles, with the ends abraded off, from palæolithic positions, and he said if they were accepted as hammers when found with neolithic objects they had an equal claim to be considered hammers,

when found with palæolithic implements. Mr. Smith exhibited some finely chipped palæolithic implements, and said it seemed impossible that such minute flakes had ever been detached from the tools by hammering at all. He believed all the small flakes were pushed off, as some savages now push off small flakes in making stone tools. In support of this he referred to the neolithic tools, termed "fabricators" by Dr. John Evans, and said that tools of a very similar character were found in palæolithic gravels: some of these he produced, and said, if the former small tools were used for tapping and pushing off small flakes, it seemed reasonable to consider that the palæolithic examples were used for a similar purpose. He agreed with Mr. Spurrell that hammer-stones of flint were often used in palæolithic times, and anvil-stones, as described by Mr. Spurrell, exhibiting distinct marks of percussion from hammer-stones, he had many times seen on the palæolithic floor discovered by himself at Stoke Newington Common.

Professor FLOWER, Professor BOYD DAWKINS, and Mr. PARK HARRISON took part in the discussion, and the author briefly replied.