

5 1 upper palaeolithic core from Timonovka re-used as retoucher; 2 its method of use reconstructed; 3 and 4 neolithic cores re-used as retouchers from Gorodishchenskaya Mountain; 5 neolithic striker from the same site (AB, the keel of the stone used for striking; C, scratches and abrasions on convex side of stone due to glancing blows).

cores in practice is no easy thing to do. Eloquent of this, at least, is that so far no archaeologist has been able to produce flint blades the practical way.

For this reason the theoretical side of the technique of pressure flaking lacks practical demonstration. Even now it is not fully understood how from an isotropic material with conchoidal fracture one could obtain prismatic blades of relatively regular shape, that is with comparatively slight curvature. Of course, such a flake has a roughly regular geometric form only in transverse section. Its long axis very often has a slight bend, giving it a bow-shape, particularly if it came off a large core, but it has a negligible bulb of percussion, while undulations are trifling or even absent. Sometimes the cores are almost regular, multi-scaled prisms.

The problem of the different methods of mechanical action in working stone has great interest at a theoretical level. We know from the law about the distribution of waves in isotropic bodies (taking fluids as an example) that the frequency of oscillation depends on the nature of the external impulse. A thrown stone falling into water produces numerous concentric waves and even turbulence on the surface, but a stone slowly immersed produces a smooth circular oscillation.

The example in a sense illustrates the contrast between percussion and pressure retouch. Both methods can be produced on glass. A blow on the edge of glass produces a deeply conchoidal scar and the thick flake breaking off will often have a sharp bulb. By pressing with a pressure tool on the edge the resulting scar is much less concave, and flatter, while the detached flake has a thin section. The experiment shows that in pressure the fracture line is comparatively straighter in an isotropic mass. The opposite is the case in a dynamic relationship. However, pressure requires incomparably greater force than percussion, because the power of the blow is magnified by the momentary conversion of potential into kinetic energy.

The technique of blade-making relies on the use of a brief push or impulse. It is quite obvious that blades could not have been obtained by direct blows with a striker-stone, as some students believe.¹ The striking platform on the end of such blades shows this; it is very small, sometimes barely discernible. Traces of blows can never be detected on the core's platform in optical examination of the surface, but careful preparation of this area before the detachment of each blade is at once recognizable. The preparation consisted mainly in removing the projections from its edge, the so-called 'platform fringe', left by the detachment of the previous blade. Preparation of the platform was a necessary

preliminary on the core to provide a resting point for the presser on its edge. The pressure point had to be as close as possible to the very edge and, when a platform for one reason or another did not offer serviceable support for the presser on its edge, it was improved by detaching a horizontal flake, that is partially removed. This was done mainly by pressure but also by percussion. Much depended on the core's condition. If its side was stepped by the fracture of unsuccessful (incomplete) blades, a large flake, thick in section, was struck off. Obviously this reduced the size of a core and the length of the blades. The pressure method of trimming the platform was designed to furnish the necessary angle on which to rest the presser.

The technique of preparing a core from a nodule or pebble, as well as the different methods of trimming it, have been more or less worked out by archaeologists. A fair amount of work has been done on blade-making, beginning with J. Evans and L. Capitan and going on up to recent times (F. Bordes, L. Coutier, A. Barnes and others).

It is, however, the ethnographic evidence that provides the most important and interesting material. Although it is true that the older ethnographers were little interested in problems of stone-working among backward tribes, yet whatever kind of evidence there is has been collected and extensively used by archaeologists.

Amongst the earliest information of this kind that we can use is the short description of making obsidian blades by pressure amongst the Mexican Indians left us by the Spanish Franciscan friar, Juan de Torquemada, in 1615.² This description was first translated from Spanish by Taylor, and, as later cited by Evans, has become very familiar to ethnographers and archaeologists.

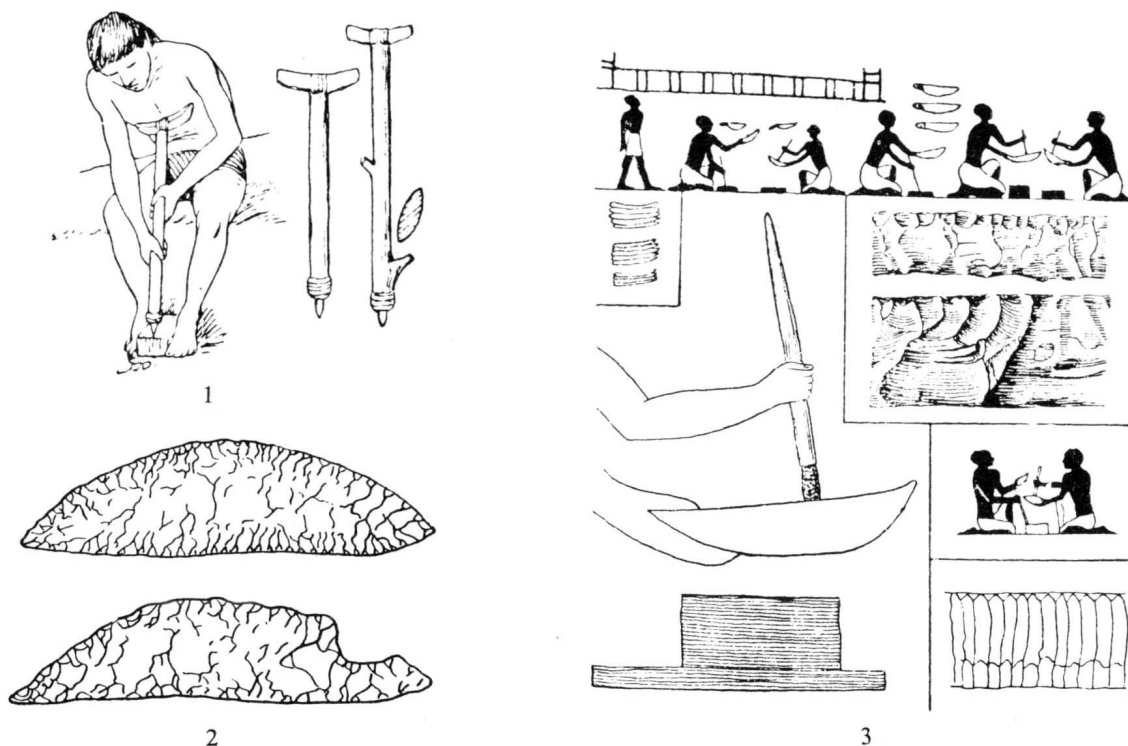
According to Torquemada the Indians worked in a sitting position. The core was held between the feet, and a short pole with cross-piece at the top and pointed end at the bottom was rested on the edge of the core. By a quick push on the instrument with the chest and both hands the Indian detached a blade of the full height of the core. Torquemada wrote: 'As a result flakes fly off like two-edged knives and as regular in shape as if they had been cut off a turnip with a sharp knife or forged in cast-iron. . . . By this method the operator in a short space of time can make more than a score of knives'³ (fig. 6.1).

Such a fleeting description left many important details unexplained which were not elucidated by a further description of similar work by Hernandez in 1651. He

¹ P. P. Efimenko in his *Prehistoric Society* (Kiev, 1935, p. 298) wrote that blades were detached 'by means of a hard blow with a hammerstone'.

² J. de Torquemada, *Monarquía Indiana* (Seville, 1615).

³ J. Evans, *The Ancient Stone Implements of Gt. Britain*, 2nd Edition (London, 1897) pp. 23-24. The last line is not quoted in Evans. T.



6 1 Method of pressing-off blades used among the American Indians (after Holmes); 2 ancient Egyptian knives; 3 retouching of flint knives as illustrated in the tomb of Pharaoh Amen of the twelfth dynasty (after Barnes).

made a valuable addition, which was that the Indians worked on the obsidian core with a hard semi-precious stone before they went to work with a wooden presser.¹ He himself thought that they used the hard stone to take the sharp angles off the platform and edge before exerting pressure. Coutier and Barnes considered that in addition the Indians scratched the platform with the stone to make its surface rough, so that the tip of the pressing implement should not slip and break away from the pressure point.²

This type of record and other facts have given rise to the view that it was necessary to give the core preparatory abrasion. Coutier carried out tests on blade-making from obsidian cores by percussion, using a short wooden intermediary and a wooden mallet made of hard wood. Barnes and other workers have made blades from glass using an intermediary and a wooden mallet,³ but detailed accounts of this have not been published. There

are no documented accounts about tests on flint, which is appreciably harder to work than obsidian or glass.

A rough surface on the striking, or rather pressure platform, of a core was obtained in some places by retaining the cortex of the obsidian nodule, which is of granular texture. Such cores have been found not only in Mexico but in mesolithic and neolithic sites in the islands of Melos and Crete and elsewhere in the Mediterranean. Flint cores with cortex pressure areas also occur in this period in northern Europe, India and south Asia. Nevertheless cores with roughening by abrasion or 'crusty patches' of cortex are uncommon. The most widespread method of preventing the presser from slipping was to flake the platform, which made the edge slightly concave, due to the conchoidal fracture of flint, obsidian and similar rocks.

Rather fuller ethnographic information comes from the second half of the nineteenth century in a description

¹ A. Cabrol and L. Coutier, *Bulletin de la Société Préhistorique Française* (1932).

² A. Barnes, *Proceedings of the Prehistoric Society*, 13 (1947), 101.

³ *ibid.*, p. 104.

by G. Sellers, based on the observations of G. Catlin, the artist who lived several years with the North American Indians.¹

He wrote: 'The instrument used for this is a kind of tube or rod 2-3 in in diameter and of varying length from 30 in to 4 ft depending on need. The stick was fitted with a bone or antler tip in its working end, lashed on with sinew or raw skin to prevent the stick from splitting.'

The core of obsidian or chert, according to Sellers, was set on hard ground and gripped between the operator's feet. If the work was done sitting the presser was short, if standing longer.

Sometimes the core was gripped between two strips of wood as in a vice. The ends of the wooden blocks were bound strongly together by rope or rawhide. The craftsman stood with both feet on the blocks, and pressed with his tool on the unyielding core in short powerful movements with the full weight of his body, the top of the tool held against his chest. The bone or antler point of the presser rested on the core's platform, which had previously been trimmed to a right angle so as to prevent the tool slipping. Usually at the pressure point the core's edge was slightly raised by percussion or pressure trimming of its platform, as has been described. As a point for the tool walrus tusk from the extreme north was especially valued.

Among the tribes whose life was described by Catlin there was a division of work in the manufacture of prismatic blades. One group of people specialized in obtaining the raw material, nodules of obsidian or chert; others prepared the cores by removing the cortex and making the pressure platforms; while some were engaged in flaking the blades. In ancient Mexico the preparation of different kinds of blade tools by retouch was sometimes done by different craftsmen. Sellers, again basing his information on Catlin, described another type of presser made from the stem of a young sapling. A tree with two low branches was selected, one near the root, the other higher up on the opposite side. The branches were chopped off to leave short stumps. To the upper one a heavy stone was attached to increase the force of the pressure. As for the second stump, the lower one, it was struck with a heavy club. The blow would be given by the craftsman's assistant, who stood opposite, if his own efforts had not successfully detached a blade, and the blow was accompanied by a short hard push on the presser. In this way by the action of two men blades 10-12 in long could be detached.

According to Marehead some Californian Indians

made blades by blows of a mallet on a short presser, or, more strictly, an intermediary.²

Catlin described a similar method among the Apache Indians using the tooth of a sperm-whale and a mallet, the tooth acting as an intermediary. The whole operation was done in the hands without resting the core on a hard body; the operator held the core and intermediary in the left hand and the mallet in the right. Sometimes the work was done by two craftsmen; one held the core in his left hand and the intermediary in his right, while the second delivered the blows with the mallet. The work was carried out to the accompaniment of chanting.

We must leave the ethnographic evidence. The facts described form the basis of present views on the sort of practices employed in blade-making.

Sometimes in the western literature stone pressers have been recorded. For example Müller identified several late flint tools with traces of use as pressers or retouchers.³ G. de Mortillet, referring to pressers, put them in the category of schist pebbles, which in reality can only be retouchers. Other examples could be given, but the facts adduced by the authors are casual ones without clear classification; commonly retouchers or strikers are confused with pressers.

Before turning to the results of our laboratory experiments we are bound to confess that the archaeological material does not wholly square with the impressions derived from ethnographic sources. Amongst innumerable bone objects of different types from the palaeolithic and neolithic periods we have not been able to identify any that could have served as pressers. Bone retouchers are found already in Mousterian levels, but pressers are virtually unknown to us.

On late neolithic sites archaeologists have found either the components of retouchers or complete ones. A bone tool from Brittany can be referred to this class of retouchers, found in the eneolithic site of Er-Yoh on the island of Houat, close to the megalithic area of Morbihan.⁴ Its handle was made of a long bone of a large animal with the epiphysis cut away, and set into it was a thick bone plate (fig. 11.3). The overall length of the tool was about 28-30 cm. The authors record that the plate was damaged from pressure on hard objects with a sharp edge. The handle was polished from friction against soft matter, evidently the skin of the hand. Vayson de Pradenne and Breuil identified it as a retoucher for working stone arrowheads, comparing it with Eskimo retouchers.

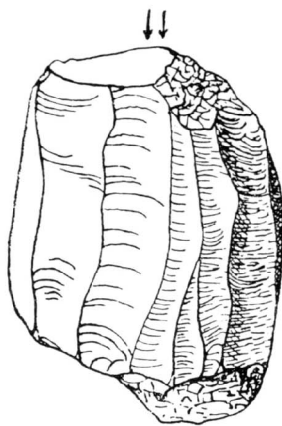
Tools of deer antler found in later neolithic graves in

¹ G. E. Sellers, *Annual Report of the Smithsonian Institute*, 1 (1885), pp. 871-91.

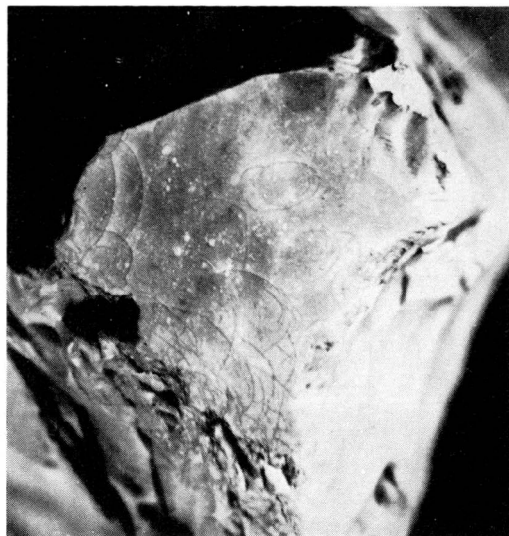
² W. Marehead, *The Stone Age in North America* (London, 1911), I, p. 74.

³ S. Müller, *Nouveaux types d'Objets de l'Age de Pierre* (Copenhagen, 1889), p. 158, fig. 70.

⁴ M. and S. Péquart, *L'Anthropologie*, 45 (1935), pp. 362-73.



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7 1 and 2 Mesolithic core from Shan-Koba (1 general view; 2 pressure platform with cracks from exertions of the presser enlarged 3 ×); 3–5 upper palaeolithic core from Kostenki IV (3 general view); 4 and 5 enlargements of the edge crack and a hole and scratches on the platform.

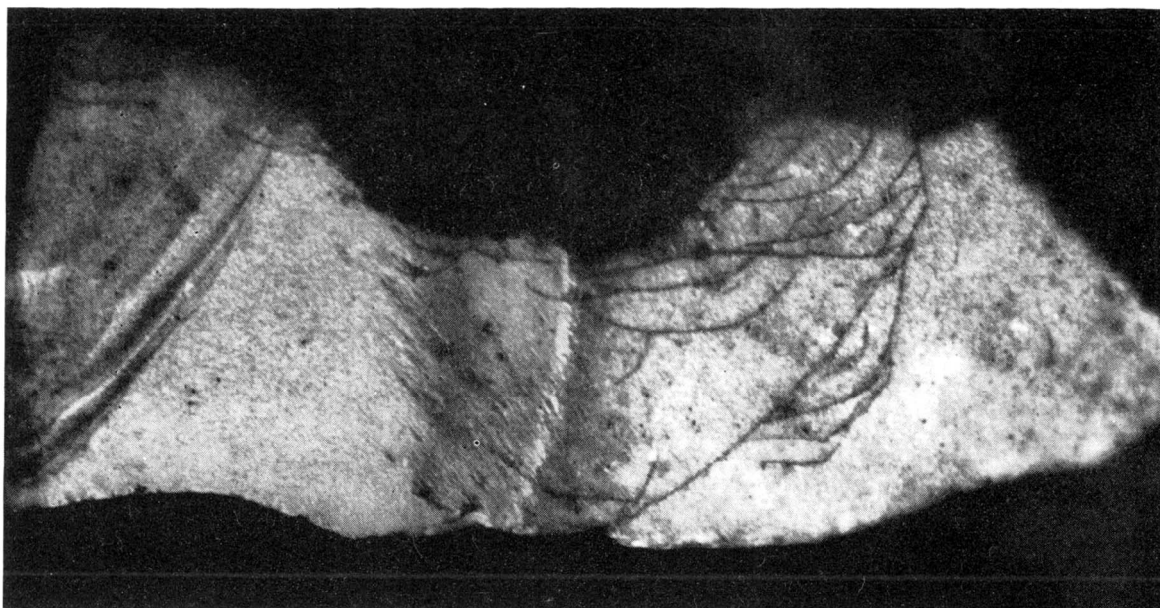
the Angar, Lena and Selenga areas, shaped like rods 9–12.5 cm long, should also be considered as retouchers for pressure retouch, but not as pressers for blade-making.¹

Cores have been submitted to microscopic examination, mainly from Kostenki I and IV, Timonovka and Shan-Koba, which have shown interesting traces on their platforms. These consisted of holes, that is very small depressions or hollows, as well as cracks and

scratches, always grouped around the edge of the platform and only in rare cases extending into the centre. It must be noted that holes were always combined in one area with cracks or scratches; single cracks and scratches without holes did not occur.

This indicated that the holes were traces of pressure on the platform left by the working end of the presser. The cracks were arc-shaped, semi-circular and sometimes closed up (irregular circles), if the point of pressure

¹ A. P. Okladnikov, *Materials and Researches on the Archaeology of the U.S.S.R.*, 43 (1955), pp. 16–17.



8 Micro-photograph of the pressure area on an upper palaeolithic blade platform (cracks, holes and scratches) from Kostenki I.

had been further back from the platform's edge. These cracks were produced if pressure was insufficient to consummate the act of flaking or if the pressure point had been badly chosen.

As for the scratches, sometimes single but usually in a group or whole batch, these were caused by the presser when its working tip tore off the pressure area and slipped off the platform. Not one but usually several scratches led away from a hole. This may be explained by the end of the flint presser crumbling when it was damaged by the sharp angles of the platform (fig. 7.5).

The platforms of several cores from Shan-Koba were exceptionally revealing in their combinations of holes and cracks. There was no trace of the action of fire over the whole area covered by cracks, which is recognizable by its net pattern. In this case all the cracks were disposed around the edge and were arc-shaped, open towards the edge. The lip was smothered by innumerable projecting splinters caused by repeated unsuccessful attempts with the presser. Splintering is a normal occurrence on almost all cores, but what is noteworthy is the persistence of the craftsman, who after one unsuccessful attempt to detach the flake, repeated it numerous times, still without result. When the edge was splintered and broken he moved the end of the presser back and exerted it several times in the centre, before he finally threw the core away. The pressure traces in the centre of the platform are not arc-shaped but irregular rings (fig. 7.1, 2).

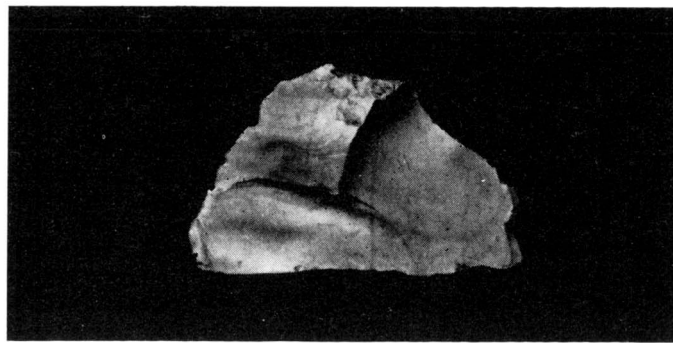
During preliminary observations doubts arose as to

whether these traces might be accidental, due to fire or some other factor, and even that all the holes, scratches and cracks were the result of roughening of the surface, as was sometimes done in Mexico. It was obvious that these marks owed their origin to human action carried out not with a bone, still less a wooden, presser, but with an instrument that could not have been less hard than the material itself, i.e. flint.

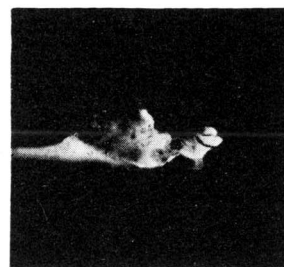
The 10-degree hardness scale of Mohs used in science is based on the principle of scratching, a harder mineral scratching a softer one. In practice, naturally, minerals of equal hardness will produce marks by scratching on each other, but this requires a good deal of force when hard bodies are involved. We have very often made a mark with flint on flint which was visible under a magnifying glass.

After establishing that the traces on the cores had been produced by a very hard presser we turned our attention to the study of the platforms on the blades themselves. For this a series of blades was selected from Kostenki I retaining their platforms just as they were after leaving the core. They had neither traces of retouch nor use on them, so the evidence of detachment was unaltered. With a binocular microscope observations were made at a magnification of 65 \times , the pressure platforms being treated with a violet colorizer to bring out the traces and intensify contrasts in the marks observed.

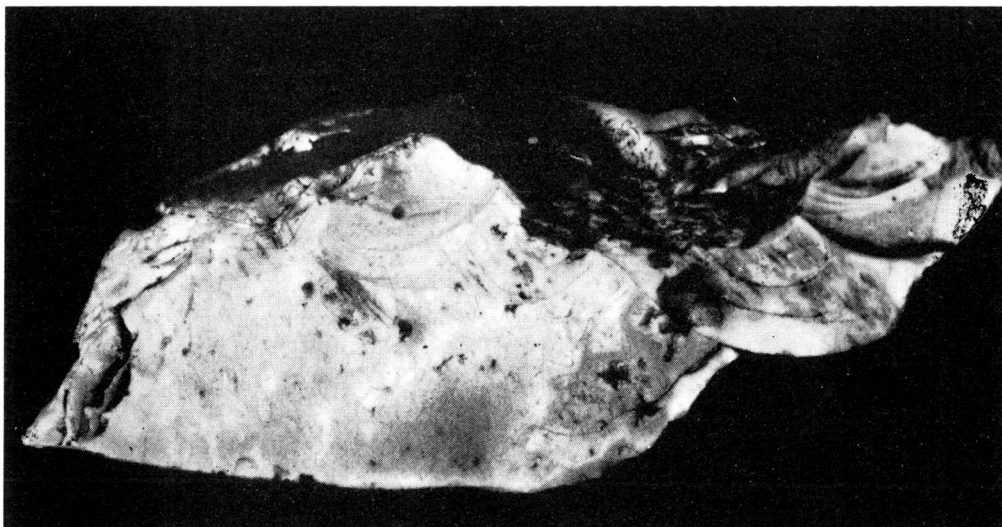
Examination of the pressure platforms revealed four



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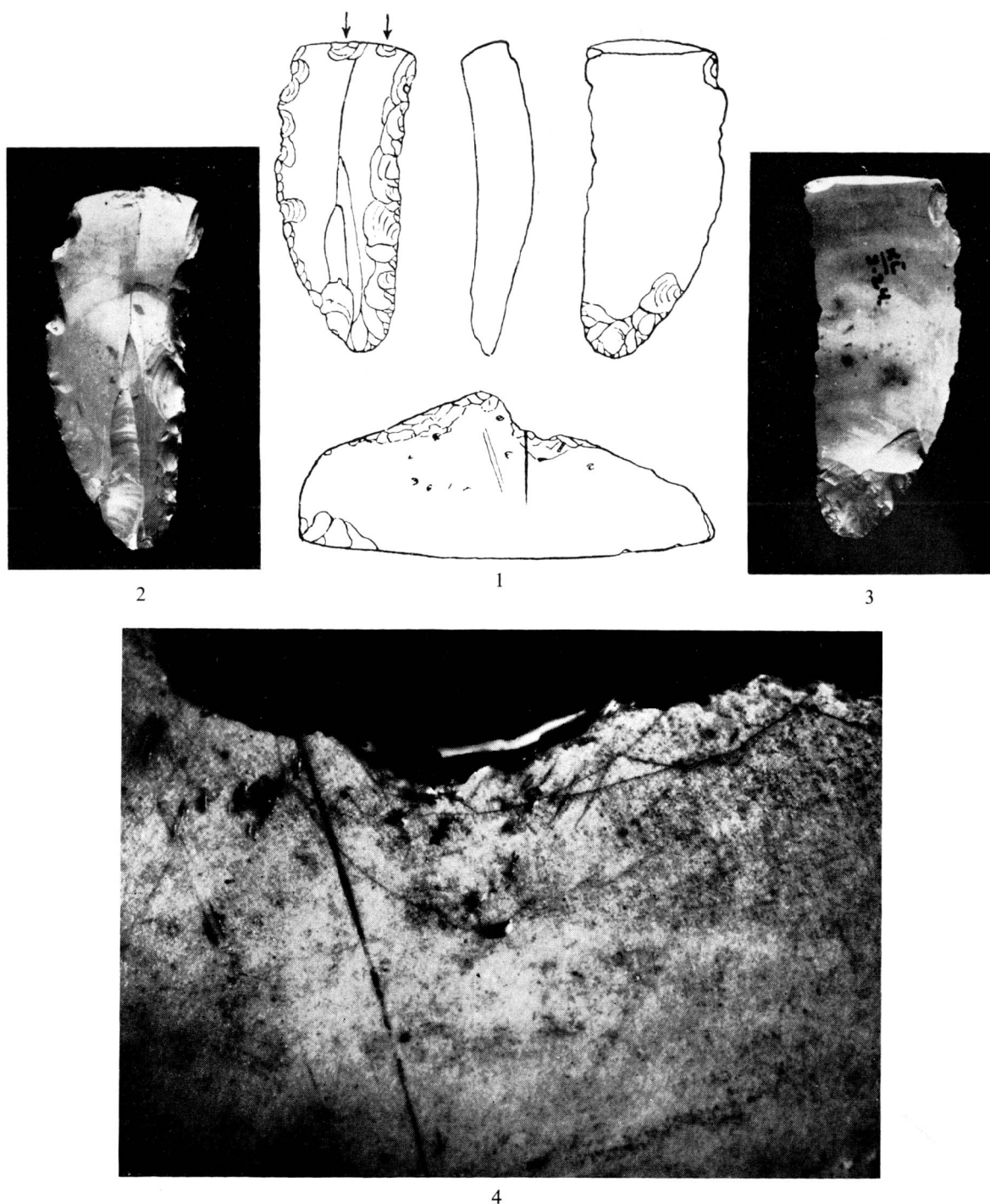


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9 1 Upper palaeolithic blade fragment from Kostenki I; 2 stereo-photographs of it; 3 micro-photograph of pressure platform (holes, scratches and cracks).



10 1 Stump of broken shouldered point from Kostenki I showing attempts to use it as core; 2 and 3 both faces; 4 micro-photograph of part of the pressure platform with traces left by the presser (scratches, holes and cracks).

kinds of trace: scratches, holes, cracks and crushing on the rim. The scratches crossed the narrow platform diagonally (from right to left), the blade held upright as it was in the moment of flaking, i.e. with dorsal side away from the operator. These scratches start wide and become narrow, indicating like an arrow the direction of the presser's movement in the hands of the operator. Their depth is evidence not only of the use of flint as a presser, but also of the great force applied; while their diagonal direction (right to left) shows that the man worked with one hand, the right one.

The holes and cracks around them indicated the number of exertions with the presser on the platform. In some cases the number of holes and cracks was large, up to several dozen, showing that the operator had had to expend no little effort before successfully detaching the blade. The crushing (splintering) on the outer edge of the platform (dorsal) confirmed this. There were no marks of retouch or use whatever on the blade, which was fresh flaked with sharp razor-like edges without a single scar, and yet the pressure platform was crumpled on one side, and covered with minute cracks and ridges. The presence of holes, scratches, cracks and crushing testifies to the fact that the operator using the core repeatedly exerted pressure before producing a successful detachment, in order to find a favourable spot to apply his strength. Only in rare instances did he detach a blade at the first exertion.

The four categories of traces enumerated occurred in various combinations. Sometimes scratches and cracks preponderated, sometimes holes and cracks; rarely was there only one type. Much depended on the shape of the platform and its angle of declension. Scratches were more numerous on platforms whose angle of declension did not allow use of the full force of the presser, because it broke away and slipped off. The platform of a blade from Kostenki I can serve as an example. Holes preponderated where the edge rises, so preventing the presser from breaking away or slipping. We can see such an example on a broad blade from Kostenki I (fig. 9.2, 3), recalling a Mousterian flake, but produced by pressure instead of percussion. Here there are deep holes with little cracks, or without them, but very slight trace of the presser breaking away.

One can illustrate the combination of the two types of platform on one blade (fig. 8). Here on one half we see scratches with slight, almost unnoticeable holes, and on the other more marked holes enclosed by cracks. On this large irregular blade, in the flaking of which a lot of time had been spent, we have, in fact, two platforms at different angles to each other. Blades are found on whose pressure areas there are neither scratches, holes nor even cracks, or albeit very few. Such blades were detached from the core by almost first or second exertion of the presser.

Cases may be noted where attempts were made to convert fragments of tools into cores. For example on a fragment of shouldered point from Kostenki I attempts had been made to detach blades, but the dried-out flint would not allow it (fig. 10.1–3). Traces of pressure from a flint presser (holes, scratches and cracks) are visible on the tang, as well as facets on the dorsal side.

How do we reconcile the results of microscopic analysis with the general view of pressure flaking as having been done with bone tools? Perhaps there were two basic operations in the production of blades: first work with a stone presser on the platform, and then the final detachment with a bone tool. But such a conclusion does not tally with the sum of the evidence.

At Kostenki I the primary working of the flint had not been carried out on the site. The flint was obtained outside in a deposit where the blade-making was done, and the blades were taken as rough-outs to the settlements. There the blades underwent secondary treatment according to need, that is they were shaped into tools by retouch. The absence from the site of cores (apart from certain uncharacteristic examples), strikers and flint retouchers shows this. For the latter were substituted slate and bone retouchers.

The rare examples of flint retouchers found on this site bore all the signs of use in working flint tools: large patches of starred surface and polished areas (from friction against the skin of the hand), numerous cracks and scratches, and traces of splintering from strong pressure. These retouchers were probably used to some extent as pressers. Thanks to their rough surface they would not have slipped in pressure on the core, but would have held firm on its edge. Their circular or oval shape lent itself to free pressure with the hand for the strong physical effort demanded in touching up platforms (fig. 11.1).

In blade flaking the core did not rest on a stone support, for the lower, and usually conical part, of cores does not show traces of crushing and splintering, nor signs of pressing on a very hard object. Support for the core was evidently supplied by wood or bone which would leave no trace.

An essential feature in blade flaking was the shape of the core's base. The direction of the force of the presser from above could not coincide with the resistance from the rest below. If the base was flat, like the platform, the flaking line (fracture line) would not follow the desired direction, and as a result the core could shatter or shed a short flake. When a core was originally cylindrical the craftsman deliberately made its base oblique, that is conical or chisel-shaped. The blade came off with its lower end slightly curved underneath, and in a good core the blade's central arris and its side edge met in one point at the base.

This description of the external aspect of the operation

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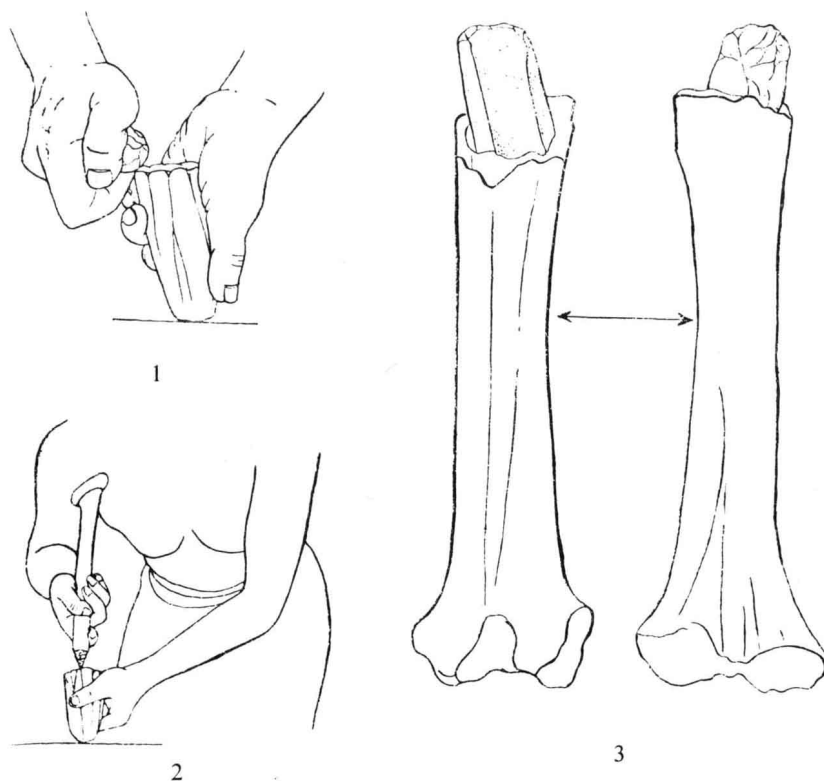
cannot re-create the work as a whole. In blade flaking critical dynamic and kinematic factors arise, which could only be worked out by prolonged experiments, for they leave no evidence in the traces.

The shapes and dimensions of the pressers undoubtedly depended on the core size. Neolithic cores from Siberia, commonly of chalcedony or agate pebbles the size of a walnut, would require small pressers. There are grounds for supposing that pressers in blade flaking were composite tools consisting of a bone handle and stone point.

Microscopic study of pressure areas on cores and blades has introduced serious corrections into our picture of the technique of blade-making. However, the problems cannot be regarded as conclusively settled until prismatic flint blades have been actually made in tests in the laboratory.

Upper palaeolithic flint blades were only rough-outs from which end-scrapers, burins, whittling and meat

knives, needles, drills, awls, lanceheads and other tools were made by pressure retouch. In mesolithic times they were divided into triangular or trapeze-shaped segments for insertion into composite knives, spears, harpoons and arrowheads, as we know from examples in southern Europe. Mesolithic hunters of the Swiderian culture of eastern Europe made small leaf-shaped arrowheads out of blades, but they also used them for other everyday purposes. Blades were rarely used in the Stone Age without retouch, but composite neolithic knives, daggers and spearheads are known whose edges were made from micro-blades struck from small cores and mounted unretouched. Characteristic examples of such are the insertions in the tools of the Lake Baikal area, and a dagger from Olen island (Lake Onega). The use of almost whole blades for insertion can be explained by the peculiarities of flaking micro-blades from miniature cores. On micro-blades the conchoidal fracture is barely detectable, as the blades came off as almost straight



11 1 Method of trimming the edge of the pressure platform on a core reconstructed; 2 method of flaking off prismatic blades from a core with a flint-tipped presser reconstructed; 3 retoucher with bone point from neolithic site at Er-Yoh (Brittany).

geometrically regular prisms with thin razor-like edges which could be mounted in a groove in bone almost without trimming or retouch. In upper palaeolithic times such composite objects are rare, but we know of them from a find at Talitsky on the River Chusov and in Amvrosievka.

An intermediate position between percussion and pressure flaking in working flint is the method known as the burin blow. This name is applied to the method of making burins. It consists in flaking part off a blade edge vertically, commonly by a blow, as shown in medial burins and the steep scar on many angle-burins which are splinter-like, although many angle-burins were also made by means of pressure flaking.

However, a burin blow was not used only in making the tools whose name it bears, for it was very often employed instead of steep blunting retouch on blades of upper palaeolithic knives to provide a place to hold. In the same period this method of pressure flaking was used also as a means of obtaining micro-blades. The peculiarity of this method of work is that, instead of using a nodule or pebble as a core, a broad but short prismatic blade or a fragment of a large blade was split lengthways into two or three pieces. We can see this use of burin spalling to get micro-blades in the large series of cores, rough-outs and objects in the upper palaeolithic site of Kostenki IV,¹ where the micro-blades have a high back and are thick in section.

In Kostenki IV small sharp needles (awls) and tiny knives (lancets) were made from these micro-blades by fine pressure retouch to remove the sharp edge on one side, probably to provide a rest for the index finger. On some of the edges there were small notches. Other details of the secondary working of micro-blades were of interest.

In addition to the ordinary run of tools, the manufacture in Kostenki IV of these minute flint implements, which are counted by hundreds, indicates some tendency towards specialization whose character is still not understood.

d. Broad pressure retouch and the problem of the so-called Solutrean technique

The technique of pressure retouch, as is well known, arose in a rudimentary form in Mousterian times, shown by finely worked points, scrapers and other tools, as well as by bone retouchers with traces of pressure on their edges. Even among the flint tools from St Acheul of the Acheulian period some of the simplest specimens made on flakes show evidence of slight pressure retouch on their edge.²

In widening the scope of its application man did not confine the use of pressure to merely trimming and strengthening the fine delicate flint blades into the tools, which came into general use in upper palaeolithic times with the adoption of narrow blades for rough-outs. He went further and tried to use this technique for changing the form of flints to give the object an altered shape. In this way arose the so-called Solutrean retouch. The peculiarity of this is that it was a method of pressure on the edge of the flint rough-out, used by upper palaeolithic man, not just to remove tiny flakes and alter the angle of the point and shape of the blade, but also to take off large and relatively thin flakes from the surface of the rough-out. In other words it increased the plastic possibilities of stone working. By this means the irregular rough-out could be given a desired thickness at any point, made flatter, the end sharpened; the curve taken out of the top, edge or base; this or that kind of notch made; a handle, tang or shoulders formed, and so on. This was particularly important in making spear- or dart-heads, as well as double-edged knives. With all their advantages blades had one obvious snag; as a rule they were curved along their long section and so were more or less bow-shaped in profile (fig. 12.1-3). In order to get a straight tool the blade had to be basically transformed by removing a good part of it with flat pressure retouch.

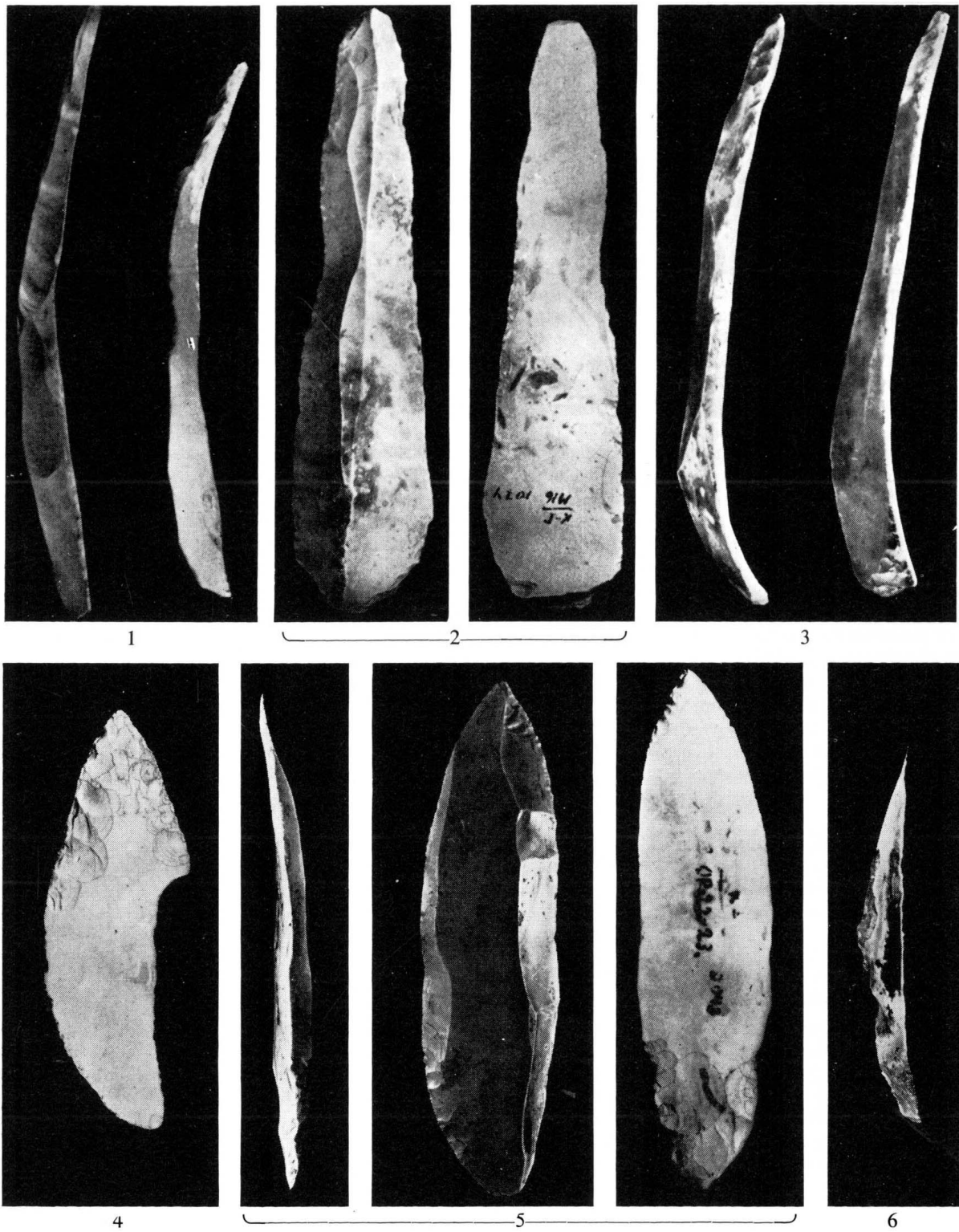
To make a spearhead the blade had to be whittled down either at one or both ends from the ventral face, as this was the inner side of the chord made by the blade (fig. 12.4-6). On the top surface retouch was applied just to sharpen up the end.

Consequently from large and medium blades one could get straight tools only by shortening and retouch. Small blades detached from small cores and used in palaeolithic times for insertions in composite tools were an exception and very often had a straight axis. The object of bifacial work therefore was mainly to produce straight tools. Naturally this quality was particularly needed in projectile heads and certain types of knife. So we can understand why the extensive use of arrowheads and flint knives in neolithic times required the perfection of bifacial pressure retouch.

It was not just when projectile heads and knives had to be made from curved blades that bifacial pressure retouch was needed. Both in palaeolithic and neolithic times the character of the raw material might require its use. If tabular flint was employed, which prevented the use of a large core (because veins of flint are often very thin, uneven and twisted, with cretaceous or lime crust on both sides), no other course was possible except the use of bifacial retouch. The material from the lower

¹ A. N. Rogachev, *Materials and Researches on the Archaeology of the U.S.S.R.*, 43 (1955), p. 46.

² F. Bordes and P. Fitte, *L'Anthropologie*, 57 (1954), pp. 1-44, pl. v-xiii.



12 Examples from Kostenki I that illustrate how the bow-shaped profile of prismatic blades gave rise to Solutrean retouch: 1-3 views of blades in profile and from front and back; 4-6 blades worked by Solutrean retouch either leaf-shaped (5) or shouldered (4 and 6) seen facially and in profile.

layer of Kostenki I may serve as an example of the unavoidable use of this on nearly all the tools; the coloured tabular flint used at this time on the site was of local origin and had very cramping characteristics. Preparation of a knife from such flint could not be done without bifacial working, as the cortex had first to be removed from both faces of the block, which was done by pressure retouch. Due to the adoption of this technique and the quality of the material the best specimens of tools from the lower layer of Kostenki I rival neolithic ones, while at the same time the less successful examples are pretty rough, recalling archaic types of middle palaeolithic times made by bifacial percussion work.

In making the rare examples of Solutrean points of large size tabular flint was also used. One of these was the broken point found at Kostenki IV in 1937 by A. N. Rogachev, which was 20 cm long, 4–7 cm broad and 1.4 cm thick, carefully retouched so that no remains of cortex were detectable on it. Yet its straight profile and great width indicate that it was made not from a blade but from a piece of tabular flint, as was evidently the case with almost all the large laurel-leaf points of Solutrean type, as well as large neolithic points. Cortex can be seen on the surface of laurel-leaf points found by Okladnikov in the graves of the Serovsk cemetery (neolithic period in the L. Baikal area).

Once started in upper palaeolithic times the technique of broad, flat pressure retouch was not confined to making points and knives. Spearheads of Solutrean type, shouldered points (or knives) of the type of Kostenki I and Avdeev, and leaf-shaped points of the Telmansk type are rare, but traces of pressure retouch in a less conspicuous form can be seen on flint tools from nearly all the sites. Different kinds of flat retouch trimming (inaccurately called 'snipping') may be seen very often on the back and front of blades, on core platforms and on the surface of blade rough-outs. It will be understood that by the term 'pressure retouch' we mean not only the flat retouch typified by that on Solutrean points, but retouch by pressure found on a variety of objects.

Pressing relatively large, but thin and fine, flakes off a flint surface is a technique that may depend as much on the physico-chemical properties of the material as on the method of work. Flint taken straight out of a chalk deposit contains 1.5 per cent moisture, and this is the most favourable condition for flaking and retouch. A boulder or river pebble that has been exposed to the sun does not respond so well in working. Such material yields short blades and flakes or shatters, and develops

cracks that alter the direction in flaking and retouching. The scars on artefacts of dried-out flint have an angular splintery look. The lost plastic properties of dried-out flint can evidently never be fully recovered, but there is some ethnographic evidence that flint, chalcedony and agate pebbles and boulders of other rocks, after prolonged soaking in water or burying in damp earth, become more suitable for flaking and retouch, in contrast to similar pebbles and boulders that have not undergone this preparatory treatment.

Broad pressure retouch has been as little studied as the technique of blade-making. In the ethnographic literature the problem of pressure retouch is hardly mentioned, while researches by archaeologists in this field have been modest and controversial.

From what one learns about pressure retouch in the literature on the Eskimos one may conclude that retouching of stone tools was done with bone retouchers.¹ The latter sometimes had a wooden handle whose broad butt allowed the palm of the hand to exert considerable physical force. The working end of the retoucher was pointed, and sometimes a bear's canine was used as the tip, the point being lashed with thongs or sinews to a wooden handle. The retouching was done by pressing the end of the instrument on the edge of the object. In certain cases, when a much greater force was required than the hands could give, the Eskimo pressed on the butt with his shoulder. As a rule the object being worked stood on a wooden rest, or was held against it.

Of great interest is the wall painting on the tomb of the Pharaoh Amen of the Twelfth Dynasty at Beni Hasan, where the final stages of making flint knives are depicted.² In this picture (fig. 6.2, 3) a group of slaves is shown working under an overseer, each holding two objects in his hands and kneeling with the right knee drawn up to his waist, the left on the ground. In one hand he holds a crescentic object and in the other a stick about 50 cm long with a point, and in front of each slave is a kind of anvil. For a long time the picture on the tomb of the Pharaoh Amen was a puzzle, but it is now regarded as a representation of a workshop for flint knives.

The attitudes of the workers and the position of the objects is variable, but they show that the stick with its point on the edge of the worked object was held erect. In the opinion of Barnes the retouching was done not by pressure of the retoucher but by a slight blow or knock of the lower edge of the knife against the wooden anvil, while the bone or antler point of the retoucher was held against its top.³

¹ J. Murdoch, *Annual Reports of the Bureau of American Ethnology* (Washington, 1892), pp. 287–88.

² F. Griffith, *Beni Hasan* (London, 1896), pt. III, pp. 33–35, pl. vii–viii.

³ A. Barnes, *op. cit.*, pp. 111–12.