FLINT KNAPPING

The Nature and Subsequent Uses of Flint

IKARUS BOOKS

John W. Lord

Foreword

Although the instruction contained within this booklet has been presented relatively simply, there is still much to be gained by seeing a 'live' flint knapping demonstration. Keep a watch on Museum publicity, there are still several of us practicing the craft, and one of us may well appear in your locality.

It would be useful here to explain to readers new to this subject, that the word lithic is from the Greek, and means; 'of or appertaining to stone': and the word knapping is from the Dutch, meaning to flake, snap or break.

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Chapter 1

INTRODUCITON

Included in the pdf are links to web sites, particularly for the movies and animations which are embedded in the iBook version.

click here for introduction movie

Man and his ancestors have been in existence now for approximately 2 million years, and only during the past 2500 years in Britain, has mankind not been dependent on flint and silicious materials for tool manufacture. In that relatively short time, we have lost the ability to manipulate these materials, though the interest in stone tools is inherent to human nature.

Today's knappers who are engaged on relearning lithic techniques, are constantly being asked to publish their methods. In response to this, I have produced what I hope will be, the first of a series of booklets dealing with aspects of flint technology both ancient and relatively modern.

The interest in this subject is by no means confined to the academic world, and so I have designed the contents to be of general appeal. It is hoped that this booklet will inspire many to try their hand at knapping, but here I must point out, there is an etiquette to this practice.

DO NOT WORK FLINT ON OR NEAR ARCHAEOLOGICAL SITES

Discarded roughouts and debitage will eventually find it's way back to museums, where it is bound to cause frustration. Collect the raw material and take it home. Make a rockery from the debitage, or bury it in the garden along with a sealed note saying who you were and what you were up to.

It is hoped that readers will enjoy working with flint, or at least learning more about the material, but please not not proceed before reading the HEALTH WARNING!

Health warning

Section 1

THE GEOLOGY

Flint has formed in parts of the world where Chalk deposits are to be found. Chalk is a calcareous rock, i.e. it has formed entirely from the remains of microscopic marine creatures which were in abundance in the shallow tropical seas. A large proportion of these remains were rich in Silica and at a point in geological history, between 100 million and 70 million year ago, the once ooze like sea bed became a dry porous land surface. In some areas, the Chalk formation is known to be up to 300 metres in thickness and geologists have divided the bed into three main strata; the Lower, the Middle and the Upper Chalk. Each of these major divisions are also found to be stratified, which is thought to be due to a cessation or change in bed formation, probably the result of ecological differentiation. Within certain strata, concentrations of larger fossils are present and it was similar strata to these that became a nucleus for flint formation. The rain water which was now able to percolate down through the Chalk strata, was partly charged with carbonic acid, which had the capability to dissolve silica from the remains of the minute creatures that formed the very Chalk itself. On its journey down through the strata, the silica rich rain water came into contact with concentrations of the larger fossilized marine creatures such as Echinoids and Bivalves etc. It was here, probably due to the non porous nature of the fossils, that the rain water parted company with the molecules of silica that it had been transporting. This continuous process, interrupted only by periods when the land found itself below sea level again, accounts for the 70 million year build up of almost pure silica, which we now commonly know as 'Flint'.

Since formation, the Chalk has experienced many changes both geologically and climatologically. It has withstood changes in sea levels, the movement of land masses via plate tectonics and possibly the most damaging of all, some Northern areas have endured several periods of glaciation. The glaciers have been responsible for re-contouring the Chalk formation and in some areas have completely removed the Chalk right down to the underlying strata. As a result of this action, not only the Chalk but also the stratified layers of flint were 'bulldozed' southward and were deposited elsewhere as gravels and outwashes amounting to hundreds of millions of tonnes.

The amount of flint contained within the Chalk, in either past or present times, remains an unknown quantity. Today's lime quarries and coastal cliff faces are the only features which allow flint to be seen in section, and while certain areas boast an abundance of flint, others yield little or nothing.

The shape and quality of flint is subject to great variation. While flint is formed largely from, refined silica, most formations are contaminated to some degree with elements such as aluminium, potassium, sodium, magnesium, calcium and iron. Variations in the proportions of these elements within the stone can affect the colour and quality of the material. The shape of whole flints are divided into five main categories; they may be small irregular nodules, large irregular nodules, cylindrical, lenticular boulders or a tabular sheet. As a rule, the larger formations are to be found in horizontal bands mainly in the Upper Chalk strata.

Complete flints in the Chalk, present an outer surface which is referred to as the 'Cortex'. The thickness of this cortex varies from area to area and even from layer to layer. For example, small irregular nodules in the Upper Chalk may possess no more than a thin lustreless skin, while larger nodules at lower levels may have cortex up to two inches in thickness. Cortex is off white in colour and although it is much harder than the surrounding Chalk, it is softer than the flint contained within. Geologists are uncertain at present, whether cortex represents an intermediate stage in flint formation, or whether it represents a stage in the decomposition of the nodule. One thing is certain though, cortex fractures in a similar fashion to flint.

Flint still situated in the Chalk strata is considered to be of the finest quality. The Chalk has offered complete protection from weathering for millions of years and in addition has allowed the flint to retain its natural water content. The more familiar weathered flints are a common sight on arable land, on beaches, on the beds of rivers and streams, they are also abundant in aggregate quarries in the south of England. Unlike flint situated in the Chalk, weathered or derived flints have had far from an easy time. They have been removed from the Chalk by the onslaught of glaciation, during which time they were subjected to extremely low temperatures. They have been under tremendous pressure, rolled, washed out from retreating ice in the raging torrents that ensued the melting glacier and during milder periods, surface flints were baked by the sun until they had lost their moisture content.

It has been mentioned that flint began forming on and around fossils or on inclusions in the Chalk strata. In order to clarify this process, imagine that an amount of silica has been deposited on a sea urchin. The water now relieved of its burden, finds a clay around the urchin before continuing its downward progress. In so doing, it displaces a small amount of Chalk, thus providing a minute cavity. It is in this small void that a fresh dispatch of silica may conveniently settle. If this situation be correct, then this process may explain the way in which flint now displays such peculiar and random shapes.

All complete flints contain either fossilised material or some other form of inclusion. The inclusion may not necessarily be contained centrally within the nodule and flint frequently forms away to one side of the obstruction, therefore, it is not unusual to find part of a sea urchin perhaps, peeping through the cortex of a flint.

Each molecule of flint possesses a cavity capable of containing moisture and the molecules are arranged in such a way that the cavities interlink. This formation permits flint to become either completely saturated, or totally dehydrated. Changes in saturation however, can occur only extremely slowly. The ability to contain moisture is perhaps the main weakness of flint. Saturated nodules that became frozen beneath the glaciers, risked being flawed or split apart by a sudden thaw and many derived flints have been subjected to this process repeatedly.

It is evident from the description offered, that should mankind wish to come to terms with the manipulation of flint, then he would be presented with a variety of sizes and qualities from which to choose. Man did indeed become master of the material and there has seldom been a lull in the exploitation of silicious rocks since the appearance of early stone tools, approximately two million years ago, leading right through to the present day.

Section 2

THE EXPLOITATION

The early exploitation of stone by our prehistoric ancestors represents a complete chapter in history. No subsequent use of the material has ever required the degree of skill and artistry seen to emerge from those times. There is little doubt, that the very earliest utilisation of stone, required only the selection and use of the sharp edges produced by the material's natural fracture. Development was slow and this practice sufficed for many thousands of years.

In the absence of suitable natural material, appeared man's first attempts at creating sharpness by crude flake removal. This simple technology, once again lasted with our ancestors for many more thousands of years. Man and his requirements from the world were evolving. His attempts to complete certain tasks with crudely fashioned stone proved to be a difficulty. At this point in time came the realisation, that with limited degrees of thought and skill, the shape of crude implements could be improved.

Controlled flaking had begun.

With the passing of time came cultural diversity, and fresh tasks led to the refinement of tool typology. The progression of technology varied somewhat for the different cultures, while some were content for long periods of time to settle with the crudest of tools, others had developed tool manufacture to degrees where practicability took second place to artistry and craftsmanship. The steady progress of technical ability never back-tracked, not even with the advent of bronze.

The Bronze Age succeeded in promoting flint knapping skills to their height. Cultures who were without the metal but had nevertheless witnessed its application, succeeded with copying the bronze castings in flint, by adjusting their techniques to a degree, which to this day, defies belief.

While undiscovered continents continued with their respective stone ages, in Britain, Europe and the Middle East, the end of the Bronze age heralded a lull in the utilisation of flint.

It was not until the Roman conquest that flint emerged again as a useful commodity. In particular, the beach rolled pebbles made a fine footing for the new roads that began to span the country.

Subsequently, the adoption of the Christian faith led to the erection of countless churches, and the foundations and part walling of many of these monuments were supported by flint boulders.

Times of unrest meant regular threats of invasion coupled with civil turmoil. Castles and fortifications began to appear, and flint, where material sources were abundant, was seen once again to upholster construction.

The overall shape of the large flints used on those early buildings were often problematic. Masons and crafts men who were by then in possession of sturdy iron hammers, soon put them to use and learned how to reduce ungainly shapes into stones of more manageable proportions. Having noticed the beauty created by those fresh percussive fractures, buildings soon began to appear with the flints arranged in such a way that the freshly cut surfaces were presented as a feature.

Man was again becoming the master of flint.

Skills in flint knapping techniques increased at a pace and particular attention was paid to the application of dressed flint to prestigious buildings. Time posed as no deterrent to some of the fine work that ensued.

Plate 1. Replication of a Solutrean point

Plate 2. Ufford Church porch. Repair to medieval flintwork.

Plate 3. Victorian flintwork on Cromer church.

At a time when man was unaware that there had in fact been a stone age, the advancement of science led to an amazing coincidence.

The advent of gun powder coupled with the knowledge that ignition could be achieved with the aid of flint and steel, created a new industry. Surface flints were crudely struck in order to produce small, wedge shaped flakes which were capable of producing sparks when struck against steel. The waste produced from this process bore an uncanny resemblance to some of the crude tools which had been manufactured during the early Palaeolithic period.

Man's ingenuity knew no bounds! It was soon rediscovered that flint taken directly from the chalk strata was of a superior quality. This, coupled with a change in flaking techniques, gave rise to a flourishing industry. The fresh flaking method turned out to be nothing new. Man had again taken paces back to prehistoric examples by choosing to produce long, parallel sided blades from prepared cores.

Odd, is it not? That generations so widely separated, should have chosen to exploit what is surely the finest quality flint in the world, from sources not 4 miles apart. Not only did they settle on the same strata, but their methods of extraction were remarkably similar.

Technological advances have subsequently led to the demise of, not only the gun flint industry, but also to the use of flint as a building material. Conservation conscious planners are hoping for a revival.

"we can relearn the techniques".

Plate 4. A trainee at work.

Section 3

TERMINOLOGY

The following terms will be frequently referred to throughout this publication.

ABRASION

A process during which a coarse grit or sandstone pebble is used in the fashion of a file, for consolidating and isolating striking platforms.

BIFACE

A sharp edged implement, with both surfaces flaked.

BI-POlAR CORE

The term usually applied to a blade core that possesses two opposing striking platforms.

BLADE

A detached piece of material with parallel sides, the length of which totals more than twice it's width.

BULB OF PERCUSSION

The remainder of part of the cone of percussion, seen on the ventral surface of struck flakes, just below the point of impact.

BULBAR SCAR

A mark on the bulb of percussion, from where a thin sliver has been torn during detachment. This is a common feature where impact has been maximised.

CONE OF PERCUSSION

A feature that develops within the material, as a result of a sharp blow having been directed at the material's surface.

CORE

A carefully prepared piece of material, from which some of the removals are termed as the tools.

CORE TOOLS

Bifacial tools.

CRESTED BLADE

The first removal from a blade core which has been crested by the use of alternate flaking.

CRESTING

The engineering of a facet by alternate flaking, which will ensure a predictable removal, usually applied to blade core technology.

DIRECT PERCUSSION

Blows aimed directly at the material, using either soft or hard hammers.

DISTAL END

The flake end opposing that which carries the striking platform.

DORSAL SURFACE

The side of a flake which bears the scars of previous flake removals.

FISSURES

Stress marks that radiate away from the point of percussion longitudinally.

FLAKE

Any piece of material detached by striking.

FACETS

The marks left on the core or tool, after a flake or blade has been removed. Facets reflect the dimensions of the removal.

INDIRECT PERCUSSION

Pressure exerted on a striking platform with the aid of an intermediate punch, used in the fashion of a hammer and chisel.

PROXIMAL END

The end of the removal that carries the striking platform and/or bulb of percussion.

PLATFORM PREPARATION

Any adjustment that is made to the striking platform. This usually takes the form of angular adjustment or consolidation.

REJUVENATION

Term applied to the redressing and correcting measures aimed at controlled blade cores and cores.

SHOCK RIPPLES

Rings that radiate away from the point of percussion latitudinally.

SILICIOUS ROCKS

Rocks other than flint which fracture conchoidally. Some of the rocks used by our early African ancestors are as follows- Quartzites, lavas, chert, chalcedony and silcrete.

STRIKING PLATFORM

The area destined to receive percussion.

VENTRAL SURFACE

The side of the flake which carries the bulb of percussion.

Terms which apply to the diagrams are as follows;

PLAN. = The broadest view of the implement.

PROFILE. = View of implement length, taken from the implement's edge.

SECTION. = Cross section through the width of the implement.

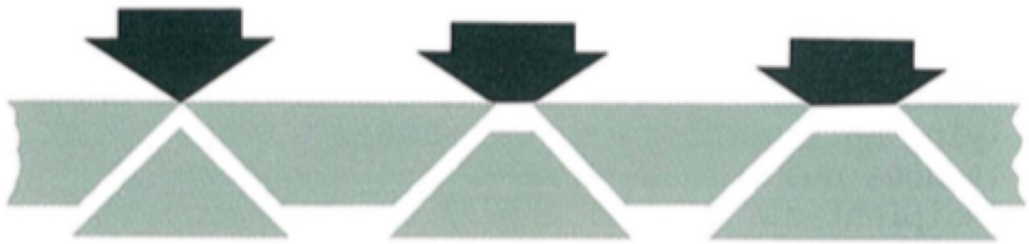
Plate 5. Flakes showing ventral surfaces.

SECTION 4

CONCHOIDAL FRACTURE

Flint, like many other silicious rocks and homogeneous materials, can be fractured conchoidally. The word conchoidal is taken from the Greek, and means shell or shell like. An untrained eye could easily mistake certain man made flakes, for parts of fossilised bivalves. Away from the point of percussion there forms a conical fracture. The extent of the cone's development is determined by the amount of pressure produced by the impact. Hammers that present small areas of contact with the material produce pointed cones, whereas broader or worn hammers give rise to cones that have flattened apexes. See Fig 1.

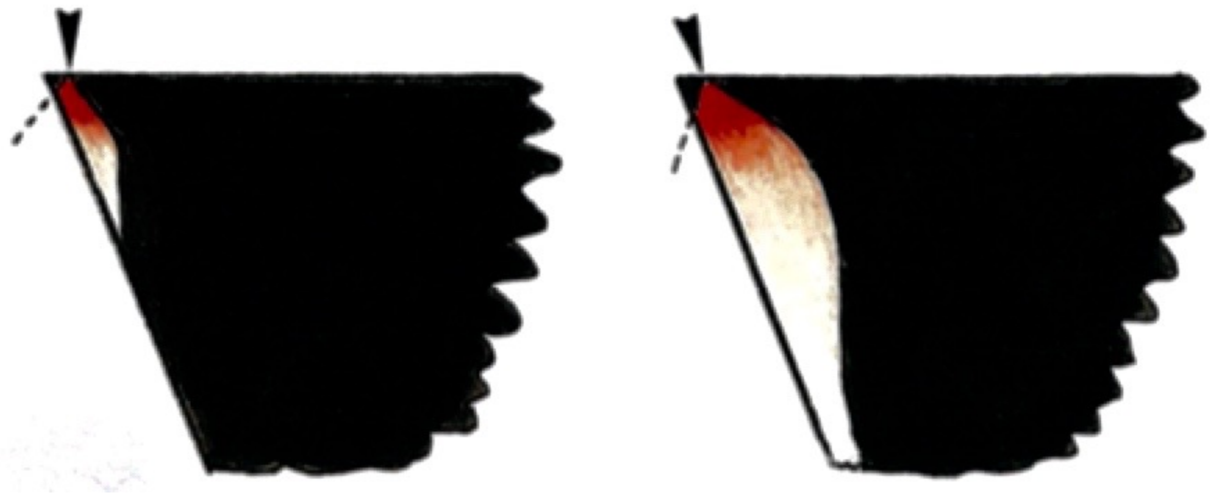
Figure 1



This variation of precision is also noticeable when observing the bulbs of percussion on struck flakes. The broader hammers produce bulbs which are more diffused.

The base of the cone of percussion forms a plane which is at right angles to the direction of the pressure. The cone develops geometrically until the force of the blow has significantly dissipated. Pressure applied close to the edge of a piece of material would allow only partial development of a cone. Upon the dissipation of the applied force, the fracture will continue by smoothly altering it's course until it is travelling in the direction of the impact. This feature is known as the development of the bulb of percussion. See Fig 1a.

Figure 1a



Very little damage is evident when observing the surface of a centrally struck flint, the result is referred to as incipient imperfection. The cone would remain hidden until the removal of a flake lying horizontal to the initial point of impact. It does not just take man's action to produce incipient damage. Derived flints frequently knocked against one another in transit and as a result, their surfaces are often found to be riddled with incipient damage. In order to work a flint damaged in this way, the cones have to be undercut by flaking systematically from all directions and the flawed material discarded. Rolled beach pebbles are severely affected by incipient damage, but nevertheless, perfectly good implements can be produced by using the flint that Lies beneath the damaged surfaces. Material that has suffered impact damage and subsequent frosting, often displays pitted surfaces, and this pitting has occasionally been mistaken for the work of man. Given the knowledge that conchoidal fracture will develop under given pressure, it follows that much study and practice will be required before a knapper can expect to gain complete control over this phenomenon and thus apply it to flint and other silicious materials.

Click to see movie

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Section 5

FLINT SELECTION

The selection and collection of material is an endless task for an active knapper. Good quality flint is comparatively uncommon in some areas, though some lime quarries may prove to be an exception. Flint taken from freshly quarried chalk is generally of good quality, though the shape of nodules coming from the strata at anyone time, may impose restrictions on what may be accomplished.

The alternative is to hunt over the reject piles at sand and gravel pits. Here the knapper will need to develop a trained eye and ear. The appearance presented by the patinated flint is often contrasted by the colour and quality of what lies within. Samples need to be partly fractured at the quarry, to enable the knapper to become familiar with what is certain to be, a vast range of material from which to choose.

Flint, when loosely held aloft and tapped gently with a quartzite pebble, will ring like a bell if it be free from thermal or incipient damage. Should the material be suffering from internal imperfection, then it will emit a duller note or a distinctive "clack". As a general rule, the finest quality flint in Britain is black in colour. The quality is determined by the ease with which the material can be persuaded to fracture. Grey flint and flint contaminated by quartz inclusions, are found to be more resistant to flaking. There are exceptions to this rule of thumb however, some samples of pure, pale grey flint are known to respond equally as well as some of the finest black. Only experience will enable a knapper to know what is best avoided.

Just as there are no two finger prints alike, so it follows that there are no two identical flints. Material selected by the knapper will fall into one or all of the following categories.

A section of tabular flint.

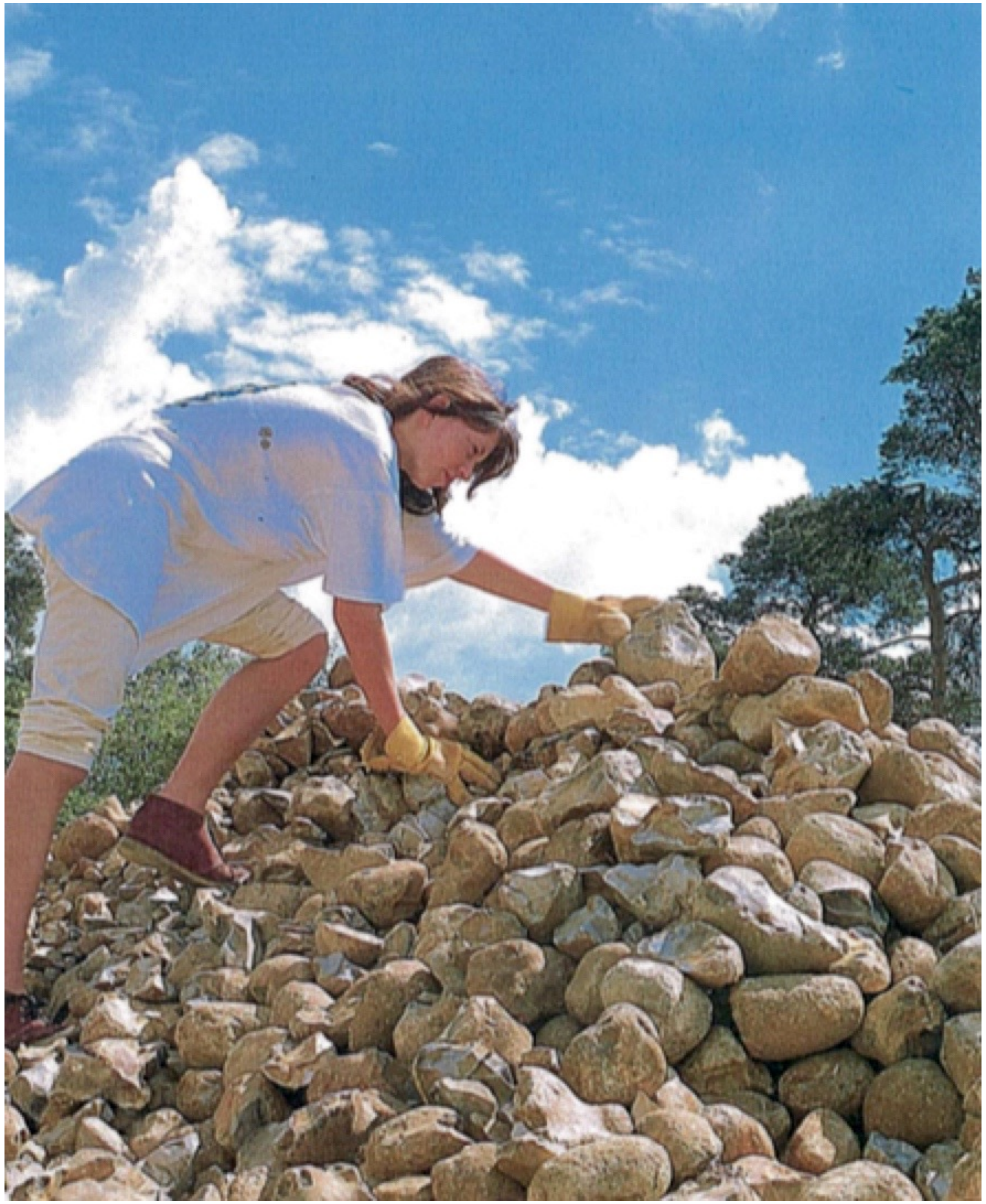
Whole or part lenticular boulder.

Whole or part cylindrical nodule.

Whole or part large/small irregular nodule.

Having returned to base, hopefully with a good selection of all the above mentioned categories, the knapper has then to decide how best to utilise these samples. An experienced knapper can usually produce what is required from the most ungainly shapes, even at the expense of being wasteful, but for the sake of simplicity and material economy, the subsequent explanations will be concerned only with material suitability.

Plate 6 Student selecting flint at the quarry.



Section 6
TOOLS OF THE TRADE

The finest way to gain a complete understanding of the nature of flint fracture, is to begin in the way of early Palaeolithic man and work up to the tools and techniques of the present day.

The tools of the Palaeolithic are listed as follows:

Hard hammerstone = flint or quartzite

Medium hammerstone = sandstone or granite

Soft hammerstone = solidified clay or mudstone

Wood, bone and antler 'soft hammers' .

Working with hammerstones should be the initial concern of the beginner. They are sufficiently hard and heavy and will enable the knapper to gain some early positive results. In the interest of safety, though not Palaeolithic, beginners are strongly urged to wear some form of eye protection in addition to protection for the hands and knees, for flint hammers have the habit of breaking on impact and the resulting debitage is quite often released toward the knappers face.

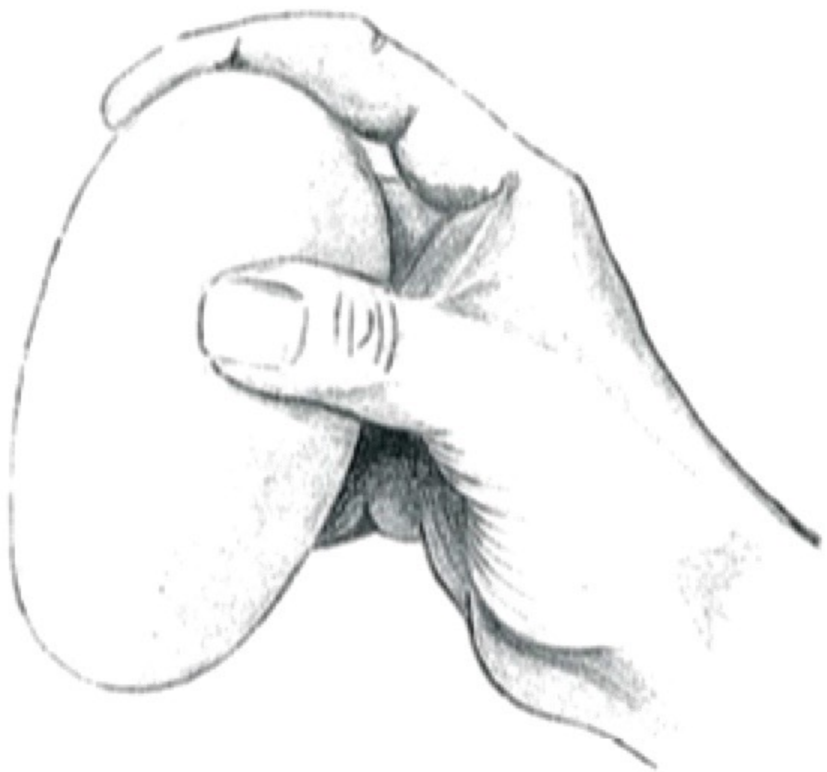
Plate 7 Antler soft hammers, antler punches, antler pressure flaker, abrading stones and hide palm pad

SELECTING HARD HAMMERS

Many aggregate quarries, as well as being sources for flint, also hold a percentage of quartzite and sandstone pebbles that may be useful as hammerstones. Knappers should take the time to collect a range of sizes, from egg size, up to the largest pebbles that can be comfortably held. Regular elliptically shaped pebbles, plus some flattened elliptical shapes, usually prove to be the more efficient. Hammerstone collection may be made easier by making trips to certain beaches, where the material is in abundance and has been rolled into regular, convenient shapes by tidal activity.

Though knappers develop their own personal ways of holding hammerstones, the suggestion shown in Fig 2, keeping the hammer away from the palm of the hand, should prove to be the least painful technique.

Figure 2



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DEALING WITH THE RAW MATERIAL

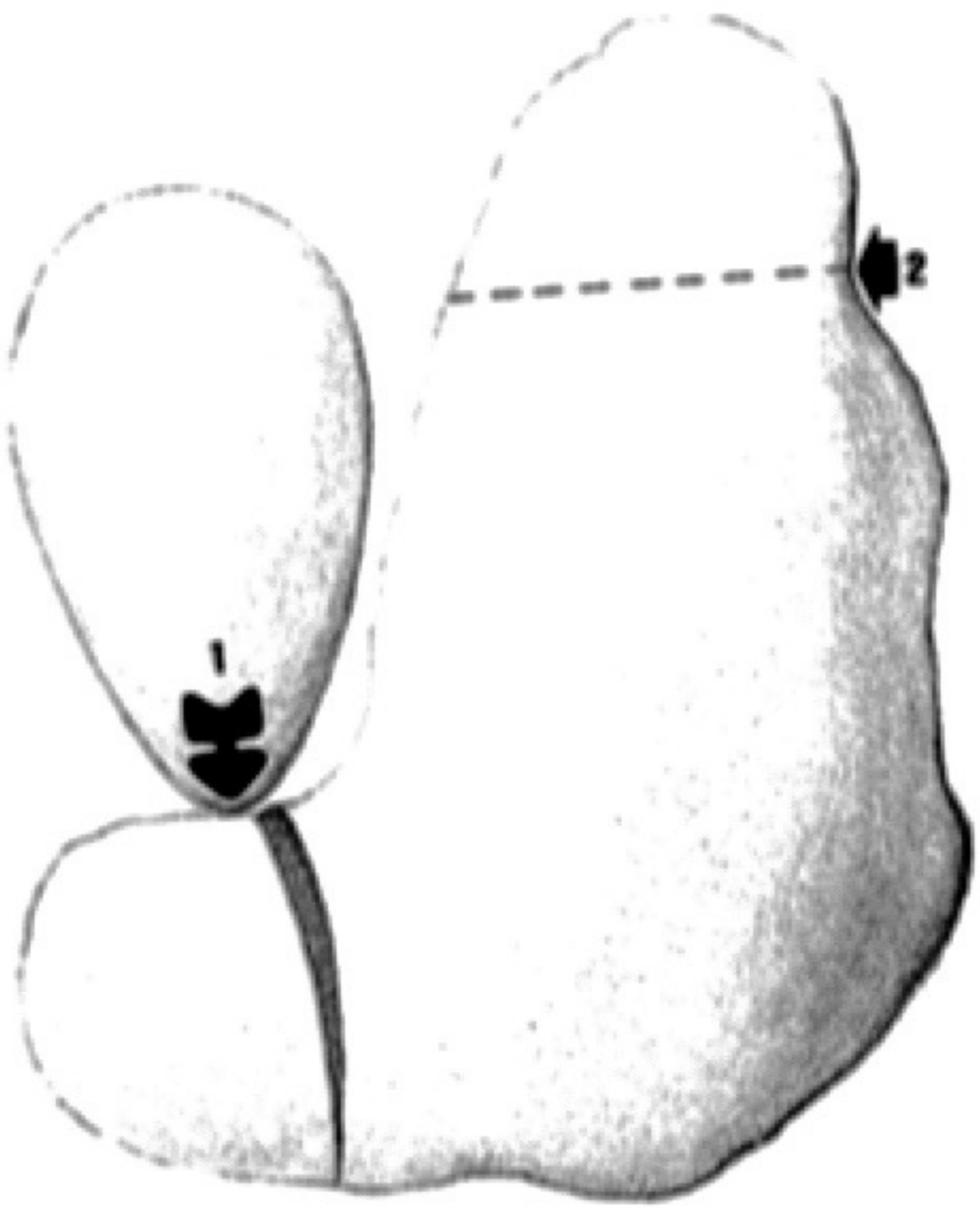
Exceptionally large flints, i.e. those that are too large to manipulate, may need to be 'quartered'. Quartering, as well as being a 'misnomer', was a term used by the gun flint knappers, which meant, to reduce to useful and manageable sizes. The process of quartering a boulder can result in the production of any number of useful pieces and not just four, as the term quartering implies.

The medium and smaller sized flints selected, do not need to be quartered. The knapper should decide what each piece is most suited for and then strive to achieve this by methodical reduction.

QUARTERING

Fig 3. Illustrates a large lenticular nodule that possesses two ideal cortical platforms. The detached portion and the indicated detachment to follow, will both leave flint platforms which will be Hell suited for further reduction.

Figure 3



The aforesaid fact that no two flints are alike, draws attention to the certainty of there being many similarities. It is the recognition of these similarities that will assist the knapper in gaining control of the material.

The surfaces of the majority of flints, present concavities in their structures. Those that are totally convex are best avoided, unless the knapper enjoys using brute force and is prepared to sacrifice a favourite hammerstone. On a suitable flint, the ideal area at which to aim the initial blow, is at a point where a convexity meets a concavity. See Fig 3.

In order to assist the beginner to achieve early consistent results. Consider that a knapper should deliver the heavier blows by using forearm movement only. Like the hand on a dial, the forearm should move anti-clockwise through an arc, from twelve o'clock to nine o'clock. This movement, if viewed by a left handed knapper would be clockwise. This action will help maintain the angle and accurate delivery of blows. The flint should be positioned in such a way that the arm movement remains comfortable. If seated, then the knapper's knees become the ideal anvil, and even the quartering of large boulders is best dealt with in this manner, though a knapper's lack of strength may dictate the need for an alternative technique.

When the quartering process has been dealt with, the knapper will sort the material and decide on suitable applications for each piece. Some pieces will undoubtedly lend themselves to core tool production, while others may best be used as cores for the manufacture of blades or flakes. It is true to say that blades and flakes may be produced from almost any form of raw material, though the dimensions of the products would naturally be dictated by boundaries of the core.

Click to see movie

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SECTION 9

BIFACIAL TECHNOLOGY

It will be favourable to deal firstly with bifacial technology, as this will create a foundation of understanding for most of the techniques that are to follow.

BIFACIAL TECHNOLOGY

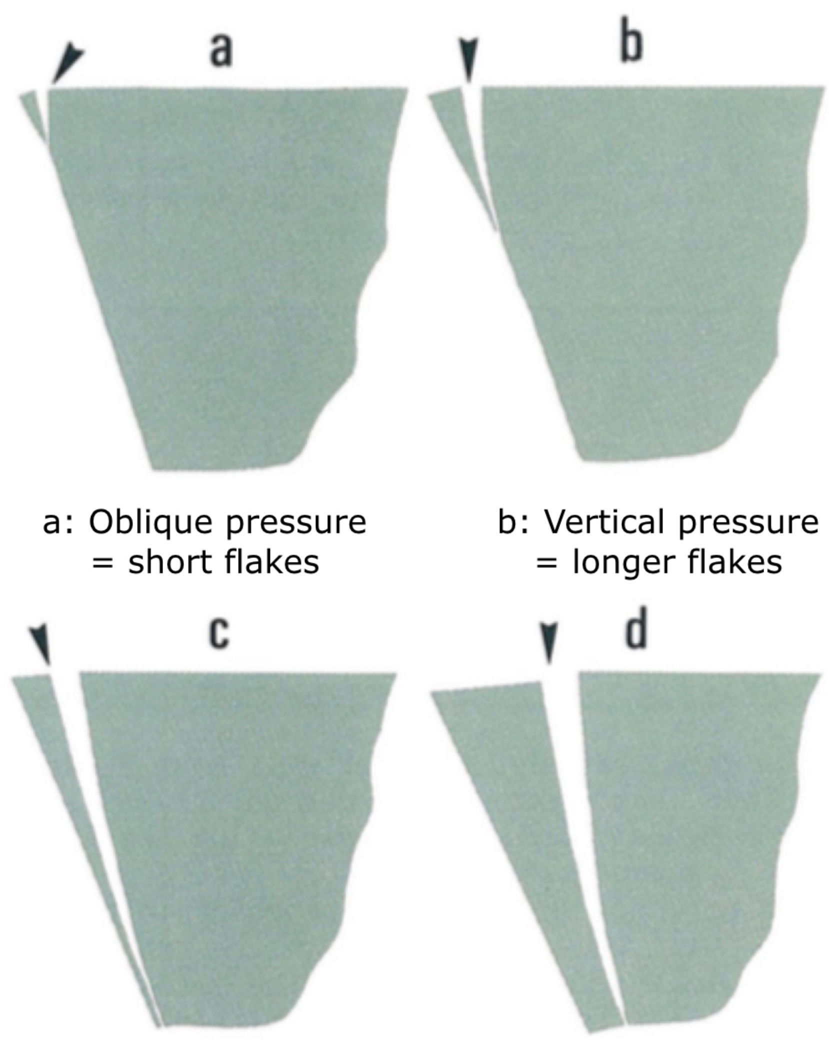
By definition, a biface is a sharp edged implement which has been shaped as a result of flakes having been removed from both surfaces. Hand-axes, axes, projectile points and a host more implements fall into this category.

Butted hand-axes and large Acheulian hand-axes, were made from whole or bulky pieces from which all the unwanted material had to be systematically removed, and they are subsequently referred to as 'core implements'. Many of the smaller and medium sized bifaces were produced from large flakes, but unless the associated debitage has been recovered, it is difficult to distinguish between 'core' and 'flake' implements.

The first recognisable man made tools to emerge from the Palaeolithic period were the 'chopper cores'. These efficient tools were made by crudely flaking chunky pieces of material. Many of the flakes removed from the chopper cores may also have been put to use as cutting tools.

In order to replicate the chopper core, select a medium sized nodule and detach a chunky flake from one end. See Fig 4.

Figure 4: Flaking Angles

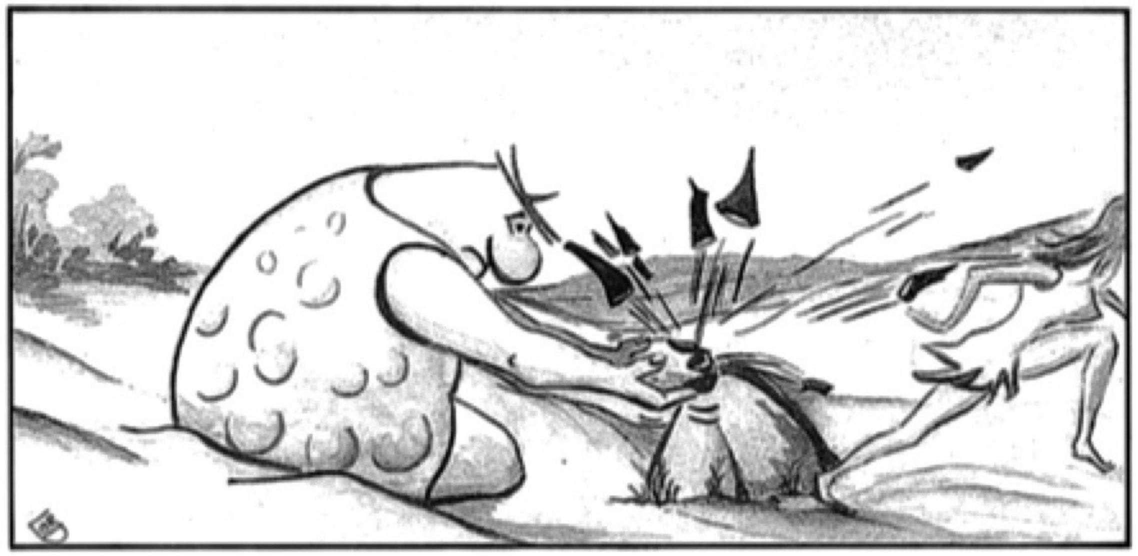


c: Intrusive pressure
= long flakes

d: Pressure well into platform
= long flakes

Next, determine which cortical area of the flake edge is the most comfortable to hold and detach a flake from the opposing end, using the flake surface as the striking platform. The striking platform', is knapping terminology which simply means, the area that is about to be struck. Later, when more advanced methods of flaking are to be dealt with, much attention will be payed to striking platforms, but with regard to the chopper core, the basic description will suffice. The removal of flakes from chopper core blanks can be dealt with in either of the following ways. Removals by a hand held, hard hammerstone, or removals via the 'anvil technique'. The first mentioned method is relatively safe, "if flint knapping be safe at

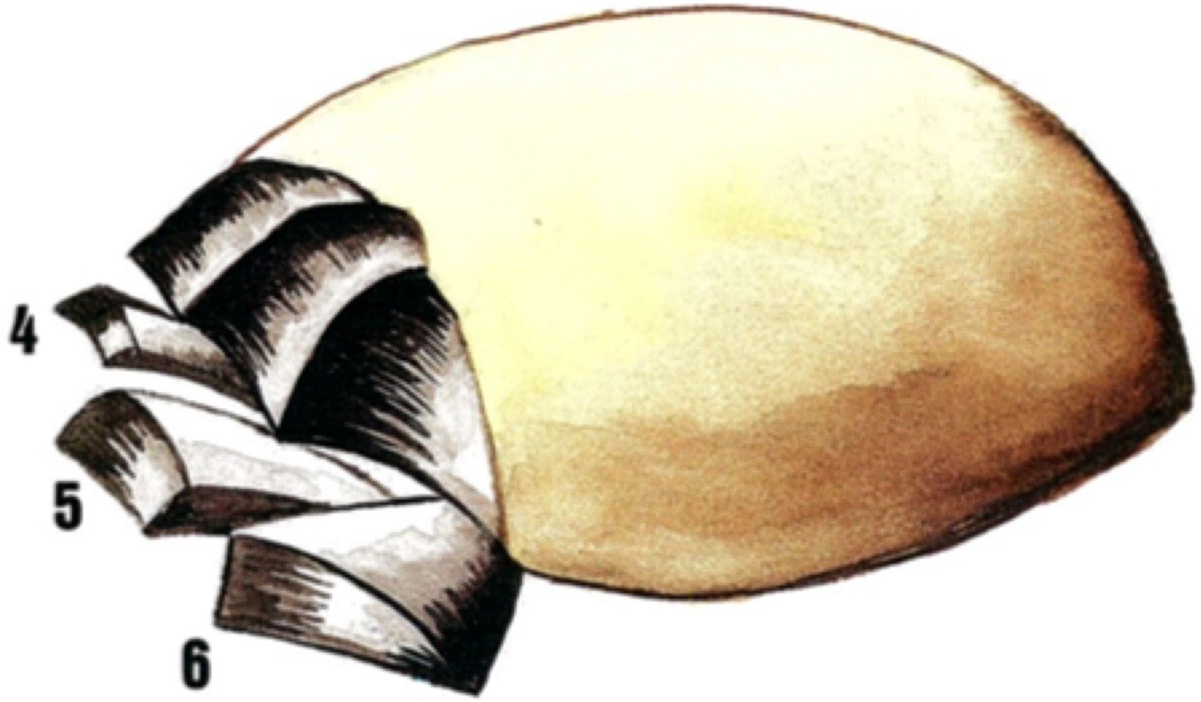
Anvil technique



all"? Whereas the second method can be highly unpredictable and could quite easily damage the knapper and observers or both.

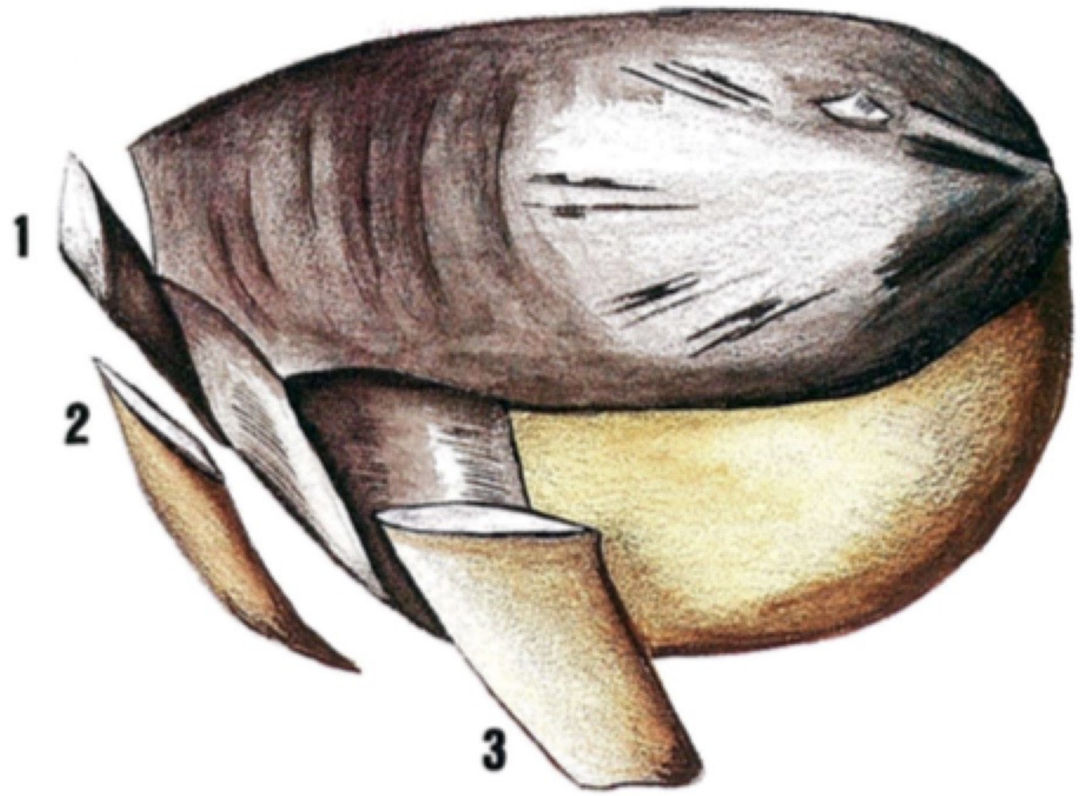
In the hope that the beginner will have chosen the hand held, hard hammerstone method, flakes 2 and 3 can now be detached, once again using the flake surface as the striking platform. See Fig 5.

Figure 5



Providing that all has gone according to plan, the knapper will have succeeded with the production of a unifacially knapped blank by the method known as 'parallel flaking'. Parallel flaking means simply, the removal of a series of adjacent flakes when struck from a single striking platform. To continue, the knapper must now work on the opposite side of the blank. The chopper core can be completed with the removal of three more flakes, by using the scars of the previous removals as the striking platforms. See Fig 6.

Figure 6



Chopper core production, has seen the knapper through what are in fact, the early roughing out stages of the 'butted hand-axe'.

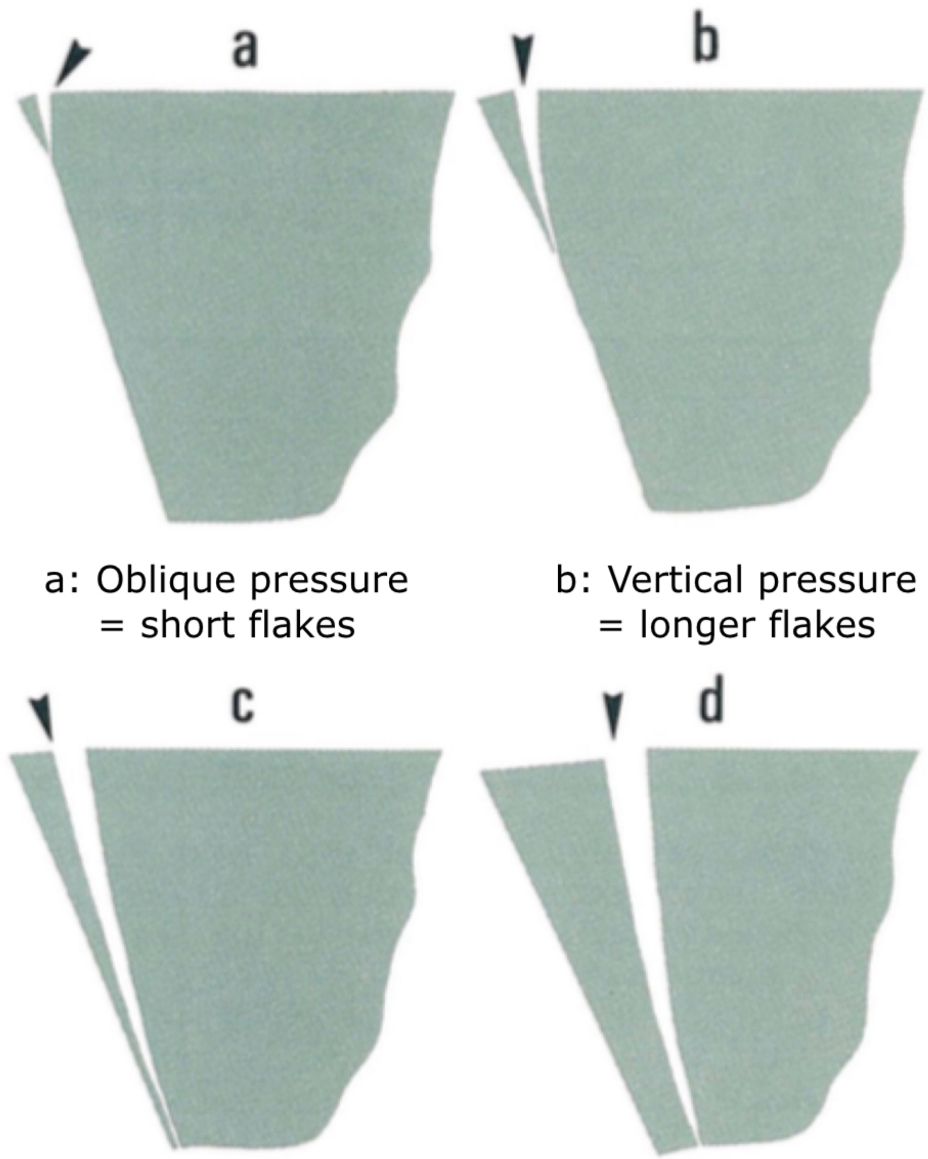
CONTROLLED FLAKING OF BIFACIAL CORE TOOLS

Large bifacial core tools are best produced from lenticular boulders. No matter what tool the knapper decides to replicate, the initial procedures will vary but little. The knapper needs to visualise where the tool lies within the boulder and should at all times be mindful of where the the tool's edge, in relation to it's axis, will lay.

Detach the initial flakes by utilising any cortical platforms that present themselves as being ideal, regardless of which side of the biface this process will reduce.

The removal of the initial flake/flakes, will have left one or more platforms from which to proceed with alternate and/or parallel flaking. The knapper should, even at this early stage, be conscious of the angles at which the blows are to be delivered. Any unwanted bulk is best removed as soon as possible, and this may involve the detachment of some short flakes via oblique pressure in order to create strong platforms from which to detach more intrusive flakes. Refer again to Fig 4.

Figure 4:Flaking Angles



a: Oblique pressure = short flakes

b: Vertical pressure = longer flakes

c: Intrusive pressure = long flakes

d: Pressure well into platform = long flakes

Having completed the flaking around the lateral circumference of the lenticular boulder, the knapper should reconsider what has happened to the proposed edge in relation to the axis, of what can now be referred to as a bifacial roughout.

The roughout at this stage will possess a zig-zag edge when regarded in profile. Areas that dip below or rise above the visualised edge, will now serve as striking platforms for bifacial flaking. Flaking this time around, will be aimed at straightening the implement's edge. Particular attention should be payed throughout, to the length and thickness of flakes being removed, and many platforms may need to be dressed or strengthened in order to achieve the desired result.

As the knapper's skill and control improves with practice, so the amount of flakes that will need to be detached from a roughout will decrease. This of course will enable the knapper to produce larger and more impressive implements in a shorter space of time.

It will be toward the later stages of thinning techniques, that the shape of the implement in plan need be considered. The opportunity to create shape may present itself when preparing platforms for thinning flakes, and the finishing touches can be achieved by a series of more delicate oblique strokes.

During the course of thinning a biface, even an experienced knapper may create or uncover inherent problems within the material. Step fractures created by misjudgment, and any incipient or thermal damage that may possibly be removed, should be dealt with as soon as the problem becomes evident. Failure to do so is almost certain to end with dissatisfaction.

SECTION 11

FAULTS AND ERRORS

Inclusions in the material that are resistant to conchoidal fracture, and hidden thermal damage, often dictate that the replication be abandoned, or accepted, even though it may contain imperfections. There are many prehistoric examples of these problems and they should only serve to offer encouragement to today's knappers.

CRUSHED STRIKING PLATFORMS

This fault occurs when the knapper delivers a blow to a sharp, acute platform. The platform being fragile, disintegrates instead of yielding the desired flake. Avoid this problem by abrading the platform obliquely, thus giving the platform added strength. Crushing is a problem more common toward the end of the thinning process and the way to correct the error once perpetrated, is to dress the edge back by the use of oblique strokes until the platform has regained strength. As a result of this, the implement is likely to end up smaller than envisaged.

FLAKE SCARS TOO DEEP

A problem common to any knapper whose concentration or interest lapses. The blow has been delivered at too acute an angle. Beginners having produced a rogue deep flake scar, should try not to forget just how it was achieved, for there may be times when this angle of flaking will need to be maintained. If a deep flake scar is unacceptable to the knapper, correction means that the whole piece will have be to re-flaked until all the remaining flake scars reach a similar depth.

STEP & HINGE FRACTURES

Here the knapper is guilty of having been inaccurate with the angle of percussion in relation to the amount of pressure used. Or it could simply be a case of where the knapper has been overcautious. When a biface reaches the stage where it's proportions are delicate, it is understandable that fearing breakage, the knapper may be inclined to pull punches. It is this insecurity which leads to the step fracture. Having created a step fracture, it will be futile to attempt to undercut the problem by using the same platform. In order to undercut a step, a fresh platform must be prepared on the opposing edge, and a flake needs to be driven from it at 180 degrees toward the offending removal. Determination is needed at this juncture, for should the knapper fail, the problem may have to remain on the implement for all to see. See Fig 9.

END SHOCK

"A shock indeed!". You have two pieces, your platform was inadequate, there are no corrective measures.

When regarding cross sections through the widths of bifaces; axes and hand-axes possess similarities in their sections. See Fig 7. Flakes that are removed from the side platforms of either face of an implement, providing that platform preparation has been no more than an attempt at consolidation, will terminate at approximately the centre of the tool when it is regarded in plan. Continual flaking in this manner, will reduce the overall size of the implement, but without noticeably altering the proportional aspects of the tool in section; i.e. Central thickness will be maintained. See Fig 7.

Figure 7

Click to see animation

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In order to maxlmise the thinning of a biface for the production of daggers and Solutrean points for example; the knapper, having developed a basic roughout, will need to alter the platform angles via the removal of obliquely struck short flakes: See Fig 8. It will help to strengthen platforms if they are abraded with the aid of a coarse sandstone pebble.

Turn the book to see the inverted no.s correctly

Figure 8

Click to see animation

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Thinning a biface is work for the 'soft hammer. The ideal soft hammer materials are, deer antlers, hard wood or bone, trimmed to the shape of batons to be used in the fashion of modern hammers.

To remove thinning flakes with a soft hammer, see Fig 8. The knapper needs to aim intrusive blows, delivered with power, accuracy and determination. No other aspect of flint knapping is quite so therapeutic as is thinning a biface successfully.

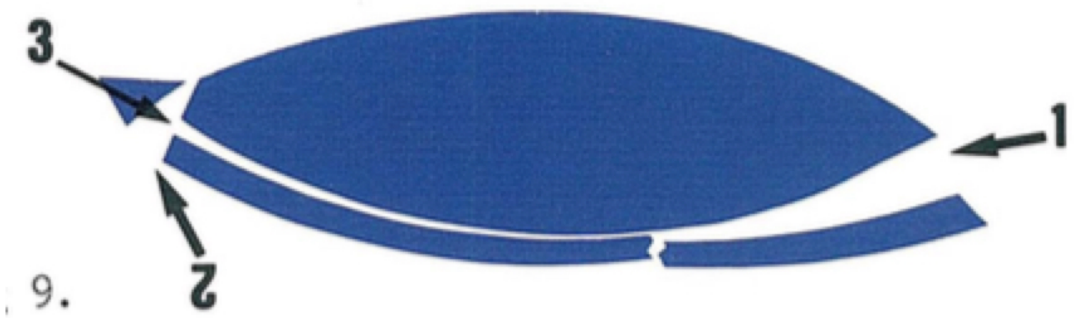
The late stages of the thinning process are sure to require some tedious platform preparation. Platforms may be in need of pressure flaking to ensure their perfection. They may also need to be isolated in order that the clumsy soft hammer contacts no more than the required amount of the platform. Narrow platforms, may demand that especially shaped hammers be prepared, or alternatively, the knapper may resort to an antler punch and the use of indirect percussion for the removal of difficult flakes.

To avoid end shock, do not attempt to flute large delicate bifaces. Always flake across from the side platforms and finish the points off by pressure flaking. Even the slightest tap on a badly prepared platform toward the point of a large thin implement, can cause the ears to ring and the opposing end to leap from the cherished replication.

It is extremely difficult to relate to angles that cannot be accurately measured. The beginner will be sure to notice that oblique, perpendicular and intrusive blows, produce markedly differing results. The reading here is no shortcut to success, experience and practice are indispensable. Beginners will make the same mistakes repeatedly before learning that perhaps to have tilted the material an extra 3°, would have saved many many tears.

STEP FRACTURE CORRECTION

Figure 9



1 = The creation of a problematic step fracture.

2 = Opposing platform preparation.

3 = Correcting removal.

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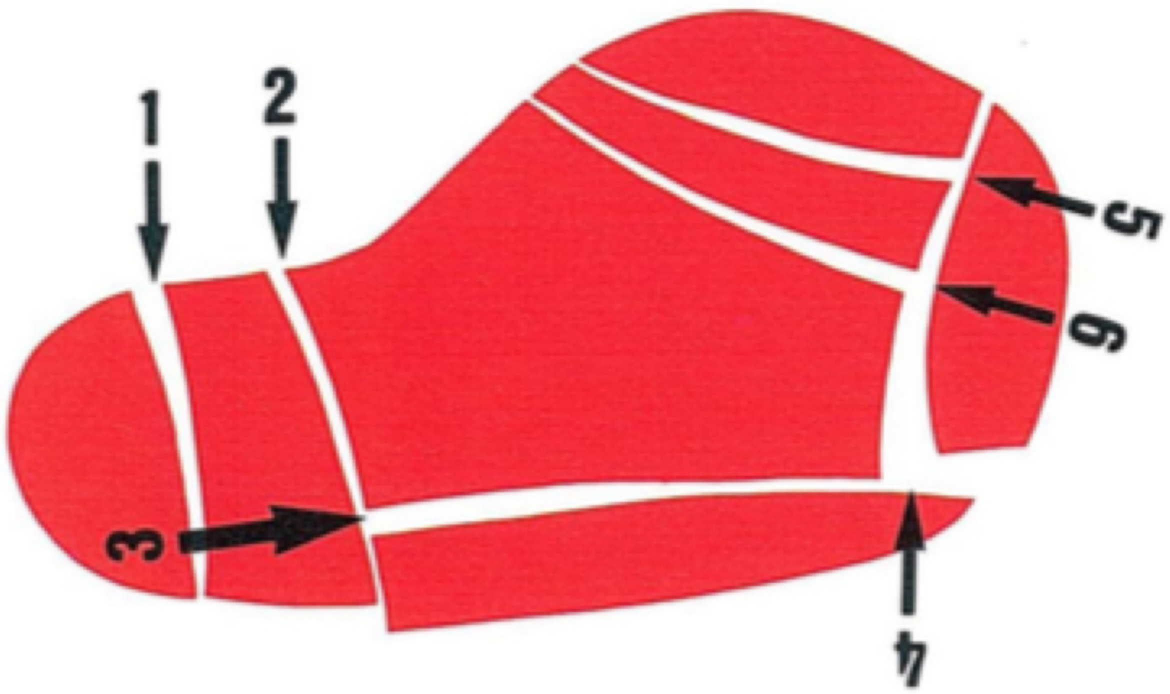
PRODUCITON OF BIFACES FROM FLAKES

See Fig 10. for suggestion on how to produce flakes from a large nodule. Use a large weighty hammerstone and aim hefty determined blows well into the platforms.

Figure 10



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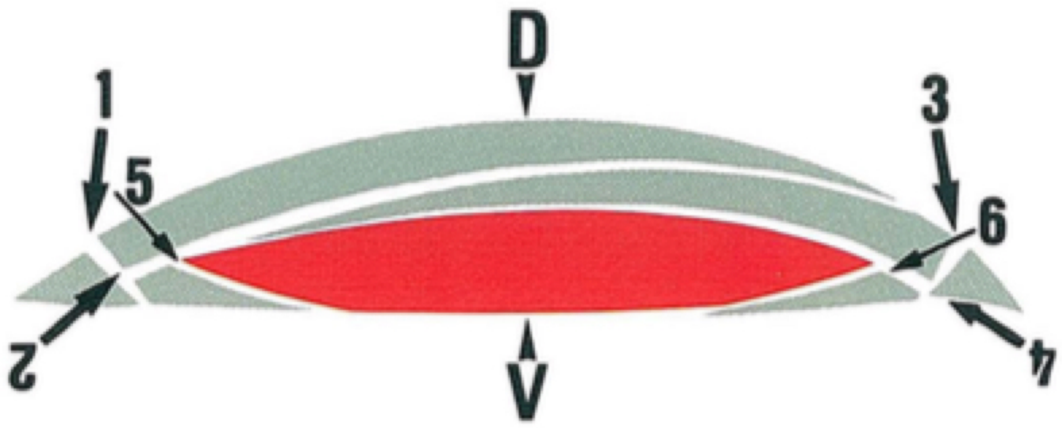
The knapper should have made a selection of flakes, some of which will have cortical dorsal surfaces, the dorsal sides of the remainder may bear one or more flake scars relating to previous flake removals. All flakes produced should have smooth, flattish ventral surfaces. The production of bifaces from flakes equals material economy, for sections through flakes bear similarities with the sections through well thinned core tool roughouts.

Symmetry of section should be the knapper's first consideration when dealing with flakes, and a beginner will frequently maintain the lens section of a flake throughout the operation, due to having made too late an attempt at reducing the bulk of the dorsal surface. For the acquisition of early symmetry; see Figs 11 &12.

Figure 11: Lens shaped flake, usually cortical on the dorsal surface.



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A more complex approach to reduction will be required when dealing with flakes that bear the scars of previous removals. Common problems, i.e. concave facets and scars on the dorsal surfaces of flakes, will soon become a familiar sight to the beginner. Many such flakes will need to be heavily reduced as indicated in Fig 12, and the knapper will need to visualise whether as a result of this process, sufficient material will remain toward the manufacture of the desired replication.

Flakes are perfectly willing to travel up facets provided that the facets are straight or convex, and the knapper should make good use of this facility, for every flake removed provides two more facets from which to elect for further flake removal. Concave facets and scars do not lend themselves to flake removal and any attempt at such is likely to terminate with step fractures. The way to deal with concavities is to dress obliquely from the reverse side, thus reducing the concavity's area. In addition to this measure, prepare platforms and detach flakes from the dorsal surface, the terminal ends of which are designed to undercut and further reduce the area of concavity. See Fig 12.

Figure 12: Reducing a concavity on the dorsal surface of a flake.

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Breakage during the final few removals from an ultra thin biface, is undoubtedly the most distressing feature that the knapper will need to come to terms with. The most common causes for late breakage are as follows;

a. Inadequately prepared platform.

b. Inaccurate delivery of percussion.

c. Platform too narrow for hammer.

d. Velocity of percussion too great.

a: Final platforms, often require pressure flaking in order to ensure their perfection. Platform abrasion, using a small sandstone pebble will greatly improve platform strength at this stage. See Fig 13.

Figure 13

Figure 13. Section through length and thickness of biface.

The line represents the edge axis. Note how preparation takes the platform below the axis. The subsequent removal should return the edge to its correct position.

b. & c: Accuracy will only come with practice and no short cuts to that can be offered here. If the flake to be removed is a regular finishing flake, the knapper should make sure that the soft hammer, or an area on the hammer, will fit the platform and not foul those on either side. If the hammer does not fit, then either the hammer should be reshaped, or another of similar weight and one that will fit, needs to be selected before continuing. Should the flake to be removed be problematic, i.e. if the knapper is attempting to correct a step fracture or perhaps trying to undercut the final remaining thickness, then it may be advisable to isolate the platform. This action may result in the loss of a small amount of tool width. A small price to pay if the final removal is successful. See Fig 14.

c.

Figure 14

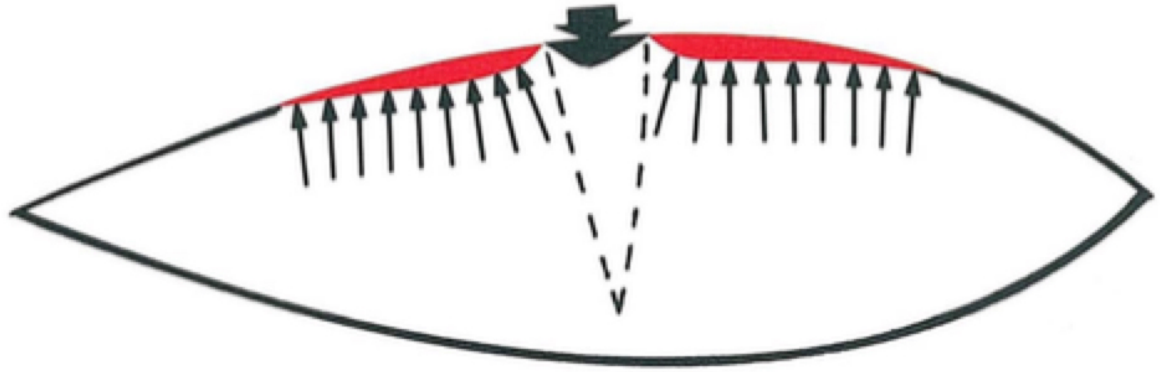


Fig 14. Represents the biface in plan. Red areas either side of the platform indicate width loss due to platform isolation. The adjustments made on either side of the platform which will establish isolation may be made by oblique abrasion, pressure flaking or careful oblique percussion.

d. The knapper should resist the temptation of using a smaller and lighter hammer for the removal of the final thinning flakes. To maintain the flaking pattern with a hammer of less mass, the velocity of the blows would need to be increased. It is often this excessive velocity that is the cause of late breakages. The small soft hammer does have approval however, for the final edge dressing of the biface.

Plate 8

A fossilised Belemnite emerging from the cortex,looks set to hinder bifacial technology.

SECTION 1

PRESSURE FLAKING BIFACES

When viewing debitage from the process of abrasion under the microscope, what may reasonably be classed as dust and minute fragmentation will, when magnified, reveal itself to be true flake material. The homogeneous structure of flint is such that no matter how small an implement the knapper is intent on producing, the bifacial technology will remain constant and only the force required to produce flakes and the dimensions of the knapping tools need be reduced.

For pressure flaking, a few fresh tools will need to be added to the knapper's existing collection. A thick leather pad for palm protection. A couple of deer antler tines; pointed and fairly straight; one of which will need point maintenance, while the other may be allowed to blunt. A section of antler cut from a straight antler beam which should be shaped to resemble a large needle. If the knapper should wish to replicate Bronze age barbed and tanged arrow heads, then flaking tools made from copper or bronze are permissible and necessary. Some knappers may prefer to reduce the size of their abrading pebbles, though this is not essential.

In previous paragraphs, reference has been made to the use of pressure flaking for platform preparation. Whereas it may not be difficult to visualise the effectiveness of forcing off short flakes via oblique pressure, the beginner will be sure to question the statement that flakes can be forced to travel 35 mm along a facet without resorting to direct percussion. But by strictly adhering to the advice offered in the bifacial technology section, long removals by pressure flaking alone should be possible after a considerable amount of practice.

The beginner will be tempted to hunt through the bifacial debitage pile in order to select ultra thin flakes, with the aim of producing arrow heads. In the prehistoric past there is little doubt that for the production of quick, efficient but perhaps rather unsightly results, this very technique was useful. However, to produce an arrow head that will display complete bifacial flaking, the starting flake will need to be substantial enough to withstand all the necessary bifacial procedures and thus allow the knapper to gain complete control during mid production.

Pressure flaking, as the knapper may have noted while preparing platforms by this method, is a precise procedure. It is difficult to miss a striking platform when there is an opportunity to place the flaker exactly where it is required. As a result of this, breakages may be fewer, though satisfaction may not come quite so readily.

Pressure flaking is time consuming, on occasions mildly stressful, and as always, there are no short cuts to satisfactory results.

Effective pressure flaking techniques among flint knappers will be diverse. The strength and physique of a knapper will lead to the personal adjustment of any suggested method. However, to avoid offering no description at all, the knapper may care to attempt the following proven technique.

The seated knapper needs to rest the back of the hand which grips the replication and protective pad against the inner thigh. Which thigh of course, depends on the handed bias of the individual. With the remaining hand, the knapper will grip the pressure flaker, (approximately 200 mm in length), and will place the point of the flaker on the striking platform while resting the butt of the flaker against the stomach or navel. Still supporting the flaker, the knapper leans the body forward, thus applying intrusive pressure to the platform. In addition to the intrusive pressure, the hand which supports the flaker is free to exert pressure sideways. How much side pressure is exerted and the angle at which the replication is being supported will have an effect on the dimensions of the removal. The knapper must experiment with this, for without the aid of complex measuring equipment it becomes difficult to analyse exactly what happens here.

Plate 9. Pressure flaking tools.

Plate 10. A pressure flaked platform.

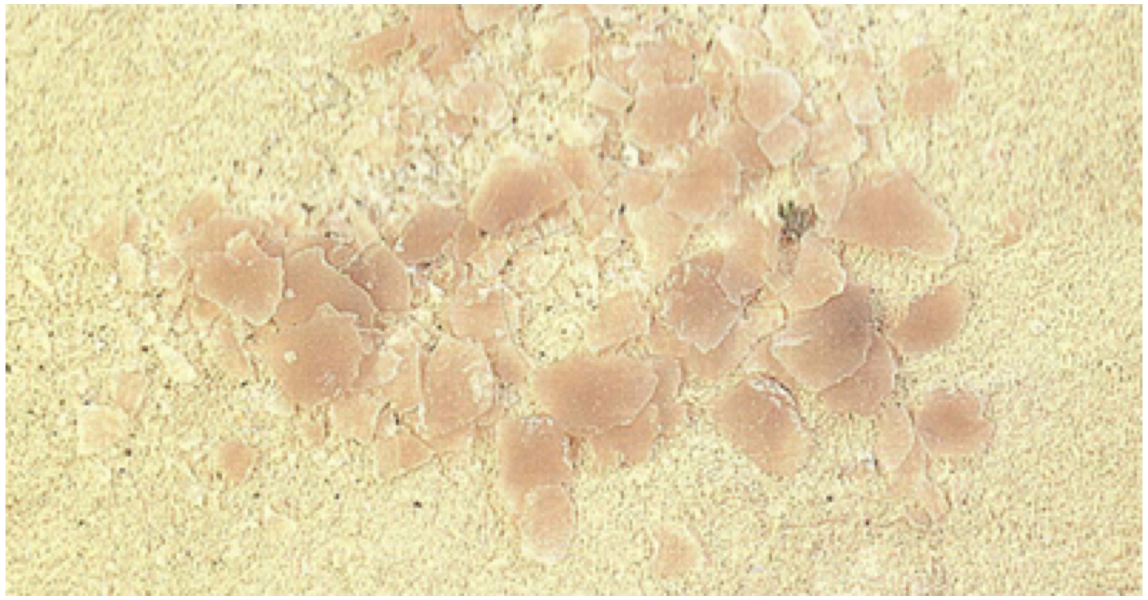
Plate 11a Oblique pressure platform preparation.

Plate 11b Intrusive pressure.

It may be helpful to the knapper to realise that the finer the point of the flaker, the finer will be the removal. Therefore, should the knapper wish to remove bulk, then the broad blunted point would be the one to use.

"Beware"! For unless the knapper has arms similar to those of 'Popeye', it would be inadvisable to attempt pressure flaking without the support of the body, for excessive muscular strain of the arm can be extremely painful and recovery slow.

Plate 12. Magnified pressure flaking debitage.



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Section 13

BLADE CORE TECHNOLOGY

It is the view of many archaeologists, that during prehistoric times, the progression to blade technology heralded the most economical utilisation of flint. This description certainly fits for the non flint areas where almost every scrap of material transported to sites was made use of. It certainly fits for the recent gun flint industry of which we have an accurate description, but in areas where flint was abundant, the question goes unanswered; why were so many of the blades which were manufactured in the flint areas apparently discarded? Perhaps cores were worked for the production of just one or two blades that met specific dimensions. Sites have been archaeologically examined where core debitage, including many fine blades, can be refitted.

Today's knappers who choose to replicate these prehistoric techniques are faced with a variety of methods and tools with which to experiment. The following instruction is offered as a guideline only, for though the forthcoming methods have been proven, similar results may be obtained by adopting quite different approaches.

Instruction can be consolidated by first considering the large blade core, for if it runs successfully it will pass through the intermediate stage of being medium sized and hopefully continue on to microlithic proportions.

The knapper, having selected a large nodule hopefully free from thermal damage, should decide in which direction the blades may best run. If the nodule bears suitable features, the knapper would do well at this stage to set up a striking platform by making a detachment similar to those shown in Fig's 3 & 10. A blade core vvill need to taper away from the striking platform and any ungainly projections should be removed. All these detachments and pre-shaping removals may be achieved with the aid of a hard hammerstone. If the early removal of parallel sided blades is the requirement, then the core will need to be crested. The knapper should have decided where the front of the core is to be, and needs now, starting from the base of the core where there is likely to be a suitable platform, to proceed with the careful removal of alternate flakes and work in this fashion back toward the striking platform. By cresting the core, the knapper creates an exaggerated facet, and all blades and flakes are prone to easy removal if they can be forced to travel along facets.

Long blades from large cores are best detached with the aid of a heavy soft hammer or soft hammerstone. Sufficient weight is extremely important here, for the velocity of percussion needs to be kept to a minimum. Too much velocity may result with the production of the desired removal, but in the form of several pieces instead of just one.

Before any detachments are made, the knapper may elect to produce blades that all display a pronounced curve when regarded in profile, or perhaps the knapper may wish to produce blades that present a much straighter appearance. The more intrusive percussion will result in straight blades, whereas oblique percussion will produce blades which maintain the curvature set up by the cresting operation. The knapper may find that the easiest way to control the angle of percussion will be to alter the position of the core while maintaining the familiar and comfortable striking action. For example, a core supported on top of the knee, would receive pressure at a different angle to a core held to one side of the knee. The motion of the percussor describes an arc, therefore the earlier the motion is interrupted, the more acute or intrusive will be the angle of pressure. The knapper, as well as being able to select the tangent at which to present the core to the arc of percussion, can also opt to tilt the core one way or another. These are the methods which will dictate the control of the removals.

The first blade to be removed will carry the crest. It will leave the core scarred with two straight facets, so here the knapper faces a choice. To remove two blades consecutively, both of which will carry a single facet on their dorsal surfaces; or to strike the core's platform between the two facets, thus removing one flake which will carry a double facet on the dorsal side, See Fig 15.

Figure 15

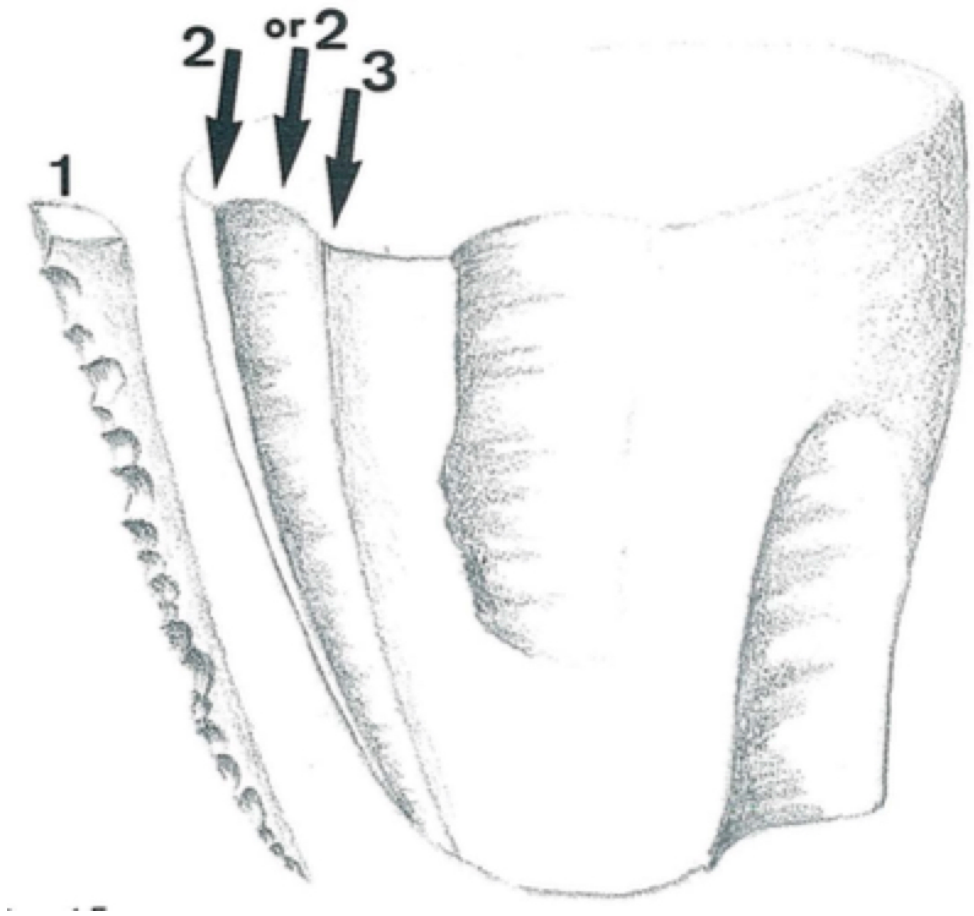

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Plate 13a Blade core showing removal facets

Plate 13b Platform abrasion and isolation..

Plate 14. Indirect percussion.

If thick blades are required from the core, then accurate blows aimed well into the platforms should yield the desired result and very little platform preparation will be necessary to secure their production. If however the knapper should require to replicate long delicate blades, then the careful preparation, abrasion and isolation of platforms will be essential. An abrasive pebble, slim enough to fit between the core's facets, will probably meet all of the knapper's preparation requirements. See Plate 13b.

Blade, after blade, after blade, may be detached from a well prepared core, and as work progresses the core gets smaller and the blades get shorter. When the core reaches a medium size; i.e. when it produces blades that measure between 100 mm and 60 mm in length, a different method of detachment may be considered. See Plate 14.

Indirect percussion describes the use of a 'punch' which can be positioned between the force and the striking platform. The punch, (often made from antler), aids accuracy by allowing the knapper to carefully set the direction and also the platform position of the pressure that is about to be administered. The punch can be driven by anything that will substitute for a mallet. After having gained control of this operation, the knapper should see signs of greater regularity about the blade material. Bulbs of percussion will be small but pronounced and the blade edges should become noticeably closer to parallel.

The blade core may be termed as having reached microlithic proportions after it has been reduced sufficiently for the production of blades measuring 40 mm and less in length.

Work on the core may be continued by extending the use of indirect percussion, and a change to a smaller punch will serve to maintain a correct perspective.

Enthusiastic knappers may wish to attempt to pressure flake the core at this stage. Such an operation would require excessive pressure, and in order to achieve this, the knapper would need to resort to the use of body weight against the platform. Therefore certain devices would need to be manufactured before blade production could continue.

a. Provision would need to be made for comfort in areas where the flaker might contact the knapper's chest or abdomen.

b. In order to apply body weight to the core, the knapper would need to be stood in a half bent position, and an extension to reach from the knapper's waistline to ground level would need to be made to fit the flaker.

c. A device would need to be manufactured that would firmly house the core at ground level.

All the standard principles of blade technology and pressure flaking will still apply to the above method. The knapper will gain the use of added pressure but vvill be positioned quite some distance from the work. "Try it!"

It is worth mentioning that all the methods discussed have been tested and proven successful, but it still remains to be said that the task can equally well be achieved, purely by using the soft hammer and accurate direct percussion.

PROBLEMS WITH BLADE TECHNOLOGY

The knapper may not always have to hand, the ideal piece of material for setting up a blade core. At times the platform may have to be established after the cresting has been dealt with. The result may be a composite platform which will need constant redressing and adjustment throughout the life of the core. This adjustment is referred to as platform rejuvenation.

Step and hinge fractures are sure to present themselves during the course of blade manufacture, if only to annoy the knapper. They may be dealt with in either of the following ways. In order not to completely destroy the facet pattern on a well running core, it may be convenient to prepare a platform at the base of the core where the previously made blades were terminating. Using the fresh platform, a blade is directed along the offending facet in order to undercut the fault.

From that point onward the core is technically referred to as a 'Bipolar core', meaning, it now has two striking platforms.

In the event of failing to remove the step/hinge fracture from the core, it may be necessary to destroy the facet pattern by undercutting the imperfection with the removal of an exceptionally thick flake. This being so, the core, or at least part of it, may then need to be re-crested. This process is referred to as 'core rejuvenation'

Core rejuvenation, is a term used to describe any severe alteration to the original layout of the blade core. For example, the knapper may avoid defeat by the selection of a fresh platform entirely, from which to continue with the reshaping of the core.

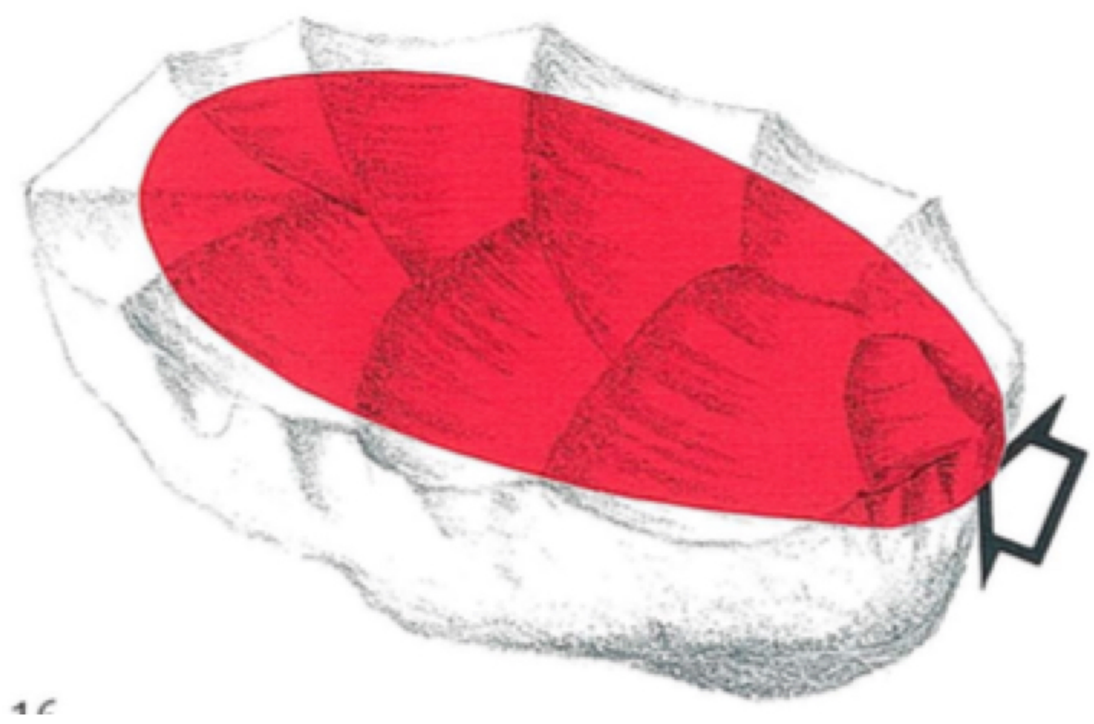
Section 14 FLAKE CORE TECHNOLOGY

Knappers who search through the piles of debitage produced from bifacial flaking, find very little material ideally suited for the production of projectile points or bifacially flaked knives.

The prehistoric past offers several examples of designer flakes that were produced from especially prepared cores.

The Levalloisian technique, (see movie) meant the preparation of the flint surface of a split nodule in order to produce a controlled convexity, facet and platform that would ensure a predictable removal. A levallois flake is rarely produced by fortuitism. The flake is straight in profile, convex on both surfaces, with one side flaked from the preparation and the other showing a smooth ventral surface. With the exception of the striking platform, the circumference of the flake is substantially sharp. The levallois flake presents a perfect preform upon which to conduct secondary work as well as being a useful tool in is mm right. See Fig 16.

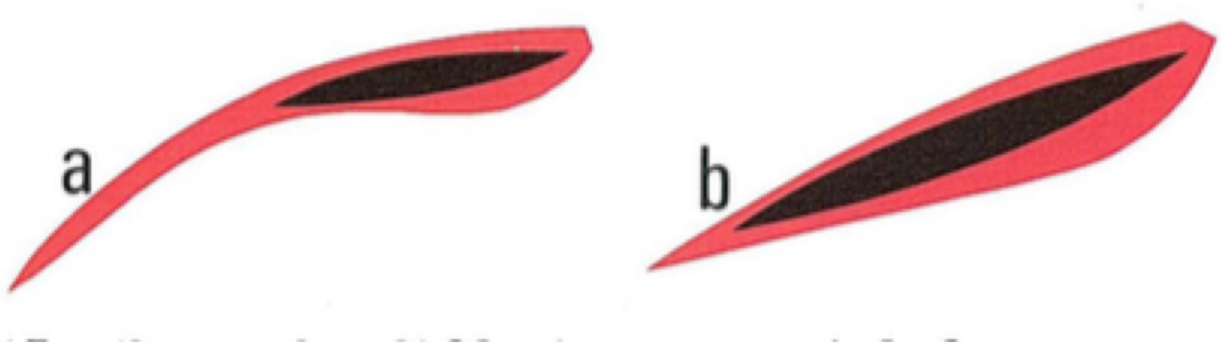
Figure 16



If a platform is prepared at edge of the ventral surface of a substantial flake, the subsequent removal will, in addition to being straight, possess two ventral surfaces. Both surfaces will be slightly convex and neither will bear any flake scars. Flakes such as these make ideal blanks for the manufacture of arrow heads. See Fig 17.

Fig 17. Shows the differing potential for secondary work.

Figure 17



a.= Flake from bifacial debitage . b.= Prepared flake.

Figure 17

Plate 15. Left/prepared flake. Right/waste flake.

click to see animation of Levallois technique

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Dedication

I dedicate this book to my wife Val, who has destroyed more vacuum cleaners than any other woman that I know