(2) fluting page 16 second sheet

Tool & Holding

If the first flake was satisfactorly removed a new platform is made for the second flute and the same method Repeted. The relationship of the downward and outward pressure must be in perfect balance because of the weakening of the artefact by the removal of the first flake ~~the~~ the outward pressure can break the artifact much more easely then before the first flake was removed.

(7) FLOTING Page 16 tool & Holding 1st sheet

The Tool used for removing the fleeting flakes from each side of the artifact is a crutch of hard wood about four feet long with a Block of wood to fit against the The chest of the ~~apertur~~ floker at the other end I use a pointed piece of copper the copper is secured to the shaft by a ferrul to keep it from splitting. The point on the shaft may be of horn, antler Bone or a piece of tough stone.

After the ~~it~~ unflaked artifact is placed in a suitable holding device (I use a carpenters vise) the tip of the flaking tool is placed on the prepared platform of the artifact. The other end of the flaking tool is placed on the chest. with Both Hands When the shaft of the flaking tool is grasped about 10 inches from the point of the tool. The feet are placed on the vise. Then the full weight of the Body is applied to the ~~shaft~~. crutch at the same time pressing the fore arms against the legs and pressing outward. The downward pressure must be greater than the outward pressure to keep the point of the tool from slipping off the platform. If the flake is still not detached one has to slightly lift the body and drop it at the same time exert the proper outward pressure I weigh 172# and with a large artifact ~~it~~ I must use a thrust to detach the flake.

~~Page 2~~

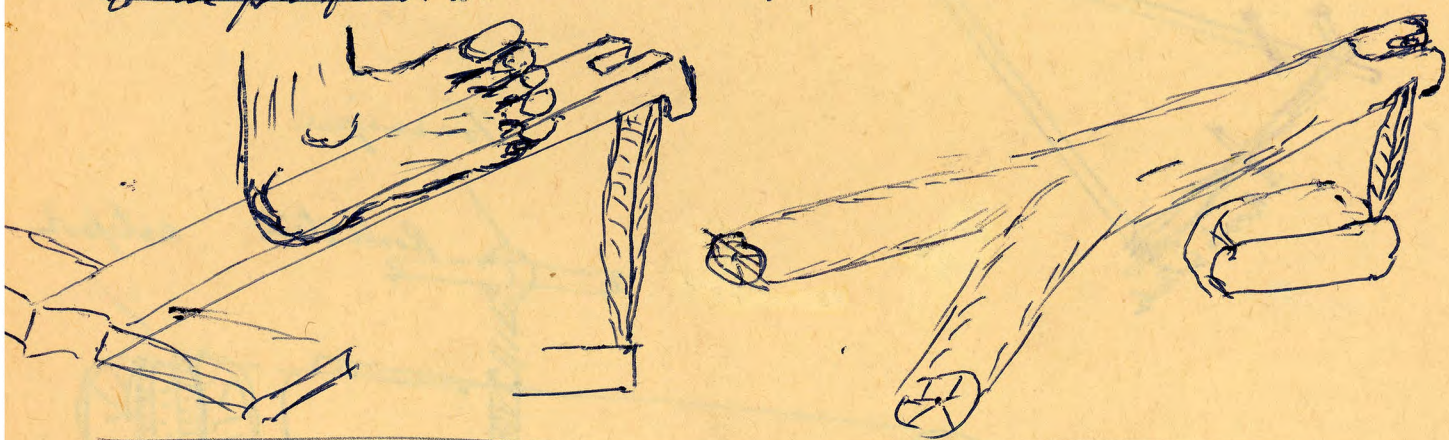
~~Pressure flaking explain~~

~~Hand held Pressure flaking~~

~~Page 1~~ Page 13 (6)

The holding device I use is a Carpenters vise If I did not have this I would use a wedge to split a green limb ~~wood~~ or Root of a tree insert the artifact in the split Remove the wedge and use a Turnogat of thongs and a Rock stick to secure the artifact firmly.

another ~~perhaps~~ method one could use would be to use a piece of hard wood similar to a Boot jack with notches on the under side to be placed on the Base of the artifact with the point on a suitable support and the foot placed on the wood while applying pressure ~~to the platform~~ at the Base of the artifact.



Page 2

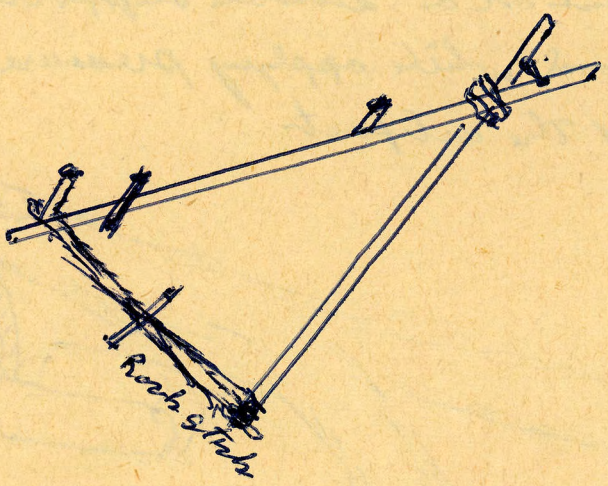
~~I have experimented~~

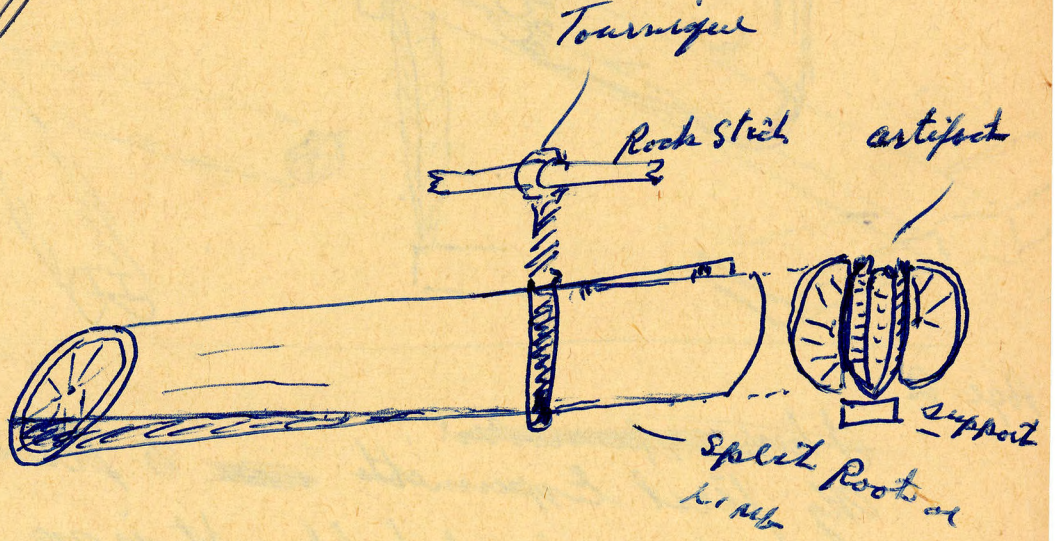
My first Experiments ~~with~~ to flake a projectile (pressure) Point were hand held. It is no problem to thin the Base of a Projectile Point with ~~several~~ flakes removed from ~~either~~ both sides of a Both sides of the which we call basal thinning Basal Portion of an artifact, But to remove a ~~single~~ flake from ~~either~~ Both sides from the base to the tip ~~To the~~ Channel Tip does create multiple Problems; when it is hand held

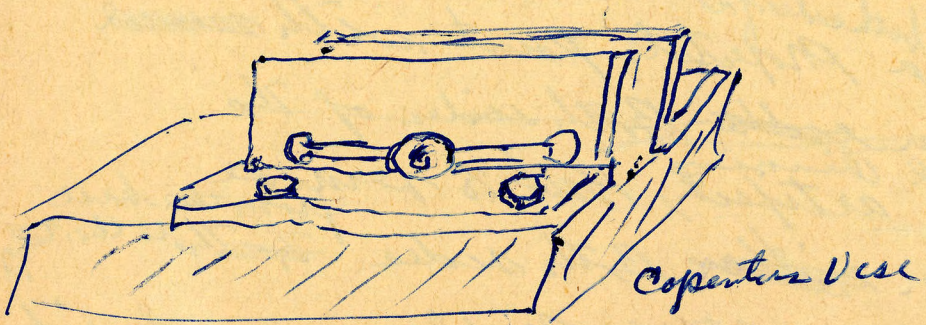
(over)

If the angle is not correct, the artifact will be crushed or the fluting flakes will feather out short. If one will examine the fluting at the top and bottom of a Folsom, he will see how critical the angle is. In order to

another method of holding may have been to have lashed two poles together to create a sissors device to hold the artifact







That is detached undulates and ripples excessively and if it doesn't hinge it will remove the tip. the artifact must be quite thick in order to ~~the~~ remove a flakes from ~~either~~ both sides of the artifact. Using this method the ~~completed~~ finished projectile point has no character of the classic Folsom. The stock is too great to make a thin artifact without breaking. also there is no way to ~~control~~ balance the outward force with the downward force.

No. 2.

a repetition of the above method, with the exception of holding, is to place the artifact on sand ~~then~~, holding it in place with the foot. The shock from the punch and Billett will drive off the tip of the artifact. ~~This~~ This method does give better controll of the angles of the punch but does not ~~of placing the anvil punch~~ If one could insure, ~~devise a method of retaining the tip of the~~ retaining the tip of the artifact Projectile. The use of the anvil may offer a solution whereby one could use this method the succeed in removing a channel flake without severing the tip.

Page 3. (A)

Hand-held

Longitudinal flakes Removed by precussion are common when
I am ~~doing~~ preforming ~~they do~~ the flaking does have a similarity to the
Folsom fluting. ~~lowered~~ these flakes are only to their the
tool prior to pressure flaking. and usualy the preform
is larger than the finished folsom. the Clovis artifact
may have been done in this manner. When using hand-held percussion
~~the~~ the platform
or striking surface is prepared accross the Base
and when one side of the ~~flake~~ artifact has had
the longetudinal flake Removed, the base is re-
flaked to provide a platform for the removal
of the second flake. After the second flake is
Removed, the artifact will have either a square
or slightly concave Base. Again the character
of this flaking has no similarity to Folsom.

It would be peculiar, indeed to find
pressure flake a folsom and then change to percussion flute the
artifact by precussion ~~the entire~~ technique to
Channel flake.

Inderect Precussion

I so far have had little success with
~~Inderect~~ precussion. The methode I have used are
~~hard wood~~ NOT. to place the artifact between the
knees padded with leather, then useing a tine of deer
antler as a punch and another antler Billett ~~stone~~ tool
then the Punch is placed on the prepared platform at the proper
position and struck with the Billett. the flake —

Page 2. FLUTING

Hand held

1. Not, the width of the flake ~~is~~ is almost as wide as the artifact. the strength Required to Remove a flake of that width is almost beond the the muscular power of most human beings to day. the width of a flake determines the amt. of force that is used to detach it — not the length. a flake ½ in wide is about the limit of hand held pressure flaking yet many folsom flutes are in excess of ½".

hand held

2. ~~The~~ the Method of holding creates a problem as the tip canot be supported when it is hand held for the pressure applied is almost Vertical. + therefore it will snip off the tip & break off the tang

pressure

when the artifact is placed in the hand for the thrust to detach the fluting flake, the Base Rests near the ball of the thumb and in center of the palm. As the downward pressure is applied with the inward Pressure, the tang will usualy break before the flake will detach, unless the artifact is quite thick. ~~If this is~~ so, and the 1st flake is removed successfully the flake to remove and if one is lucky ~~even~~ the second flake, this is fine only the completed fluted artifact does not have any character of the folsom. If the fluting was successfull, the ~~the~~ artifact will be thick and the flakes will not reach the Point but will be short. if they do go ~~to the~~ the full length the Tip will be snipped off.

3. Injury described

Let us ~~now consider the fluting process of a Folsom. After~~ one has correctly placed his artifact in the vise, he is now ready to

Shaped, surfaced & stopped, established the proper platform & secured the artifact properly in the vise he

(3) Flake & Blade Blanks and Preforms
Page ~~10~~ 9

~~After the Blades are tested~~ the
The Blades or Blanks are first straightened by percussion using an antler Billet, or a soft hammer stone, as they usualy have a slight curve when removed from the core. Then are shaped by percussion to a rough form of the tool they are to resemble but are slightly larger than the finished product. A pointed Pressure Tool is then used to form the artifact by placing the preform in the left hand which is protected by a leather pad, The edges are then sheared to Provide regularity and a platform for the Retouching of the artifact. The first pressure flaking will remove the irregularities left by the percussion work. and then it must be retouched or reflaked again to make regular even sized flake scars over the surface of the artifact. When completed it must have a smooth surface and be regular in form.

A detailed paper will follow explaining the methods used to produce the different styles and characters of surface flaking.

Following is an explanation and description of the manufacturing methods and techniques I use when making a Folsom projectile point. In this article, I would like to explain some of the problems that I have encountered in making this artifact ~~during the past thirty-five years~~ and my methods of overcoming them.

I am not prepared to say that I have entirely mastered Folsom Man's technique, but this is my way of duplicating a Folsom artifact and, I believe, Folsom Man made his projectile point in a similar manner. There are three schools of thought on the removal of the fluting flake. Some think the preform was held in the hand and the fluting flake removed ~~xxxxxxxxxx~~ by pressure. Others think it was hand held and the fluting flake removed by ~~pressure~~ percussion. Then there are those who contend that the preformed artifact was placed in a vise and the fluting flake removed by pressure.

After trying every conceivable method of removing this flute, I have concluded that Ancient Man placed his preformed and surface-chipped artifact in a HOLDING DEVISE OR CLAMP and removed the flute by pressure. I did not reach this conclusion quickly or alone. As I have said, I tried every conceivable method and technique and have also conferred with other stone knappers, and we are all of the same opinion, i.e.,

Explain see page 13

that Folsom Man used the ~~vise~~ CLAMP and the pressure technique. My 1st experiments in fluting a projectile point were using the hand-held method. It is no problem to thin the base of a projectile point

It is true that a fluting flake can be removed by holding the artifact in the hand and either pressing off the flake or by striking it off by percussion. However, I discard these theories and methods, as this technique provides no means of control and one gets many more broken artifacts than finished products. Also, when using this method, one cannot control the critical angle necessary to remove the flake and it will tend to flute the artifact to the right or left and not parallel to the tip of the projectile point. It will break a large or step fracture on tip Further, the finished product does not have the characteristics of the ancient Folsom artifacts. Also, this method produces more undulations because the hand support is not sufficiently firm and, therefore, allows the artifact to move, causing these undulations in the fluting flake. Furthermore, by using this hand-held method, one cannot produce as thin a projectile point as the original Folsoms. These have been mine and other flintknappers' results and, therefore, we discard the theory that a Folsom or Clovis was fluted by the hand held method.

see book 5 page #3

To further support my theory that the artifact was held in a vise, let us consider the matter of hand-holding. The preform would have to be held in such a manner that the danger of driving the point into the hand and receiving serious injury is great. When I was doing experimental work on Folsom in 1940 at the Ohio State Museum, I was

using a short crutch technique to develop sufficient pressure to flute a Folsom artifact. While doing this, the unfluted preform collapsed and forced the tip of the antler pressure tool entirely thru the palm of my hand. Perhaps this was accidental, but it illustrates the risk that Folsom Man would be subject to if he had used this or the hand-held method. A tremendous amount of pressure must be exerted to remove this flute and, therefore, when the preform is hand-held, there is danger of not merely cutting ~~the hand~~, but of driving the artifact entirely thru the hand. Also, when the preform is hand-held, one cannot exert enough pressure to produce as wide a flake as is found on the normal Folsom. I believe that Folsom Man's hands were too prescious to his survival to think that he would use this method and take this risk. -OVER

I discard the hand-held percussion method because the point of impact between the two barbs at the basal end of the artifact is so small that there is not room enough between these two points to strike with enough force and accuracy to remove the flute. One must bear in mind that the percussion tool must be large enough and have sufficient weight to detach a flake of this size and, therefore, one can readily see that it just would not fit in the small area between the tangs. When using this method, the margin of error is so great that the accuracy required would defeat man's repeating the removal of a series of fluting flakes. When using this

Hand Held pressure Method.

when I hand hold the folsom point for fluting
The artifact is held ~~the~~ so the Tip of the point
is one inch below and
is between the middle ~~of the~~ finger and the third
finger of the left hand with the Base of the point at
the Base of the Palm. The tangs at the Base of the artifact
are on either side of the concavity made by the
Hollow of the Palm. The Hollow of the Palm leaves
a space for the fluting flake when it is detached
from the projectile point. when the downward pressure
is applied by the antler pressure tool the Basal corners
of the artifact are likely to be broken if the artifact
is as thin as most folsoms are.

method, if one accomplishes the fluting on one side, he has so weakened the artifact that it is practically impossible to repeat this operation on the opposite side. Also, after removal of the first flute - using this percussion method - one would have to re-prepare the platform on the opposite side. Since the percussion would have removed not only the flute but also the platform, it would, therefore, be necessary to prepare a new platform, which would be deeper and well inside the barbs and, therefore, practically impossible to reach with the percussion tool. Percussion also causes a shock on the distal end of the artifact and tends to snip off the tip. However, basal thinning may be done with percussion tools, but it certainly does not have the control and accuracy necessary to produce the inherent character of a fine Folsom projectile point. To date, I cannot agree that the Folsom was produce by using a hand-held method or by percussion.

Some may raise an eyebrow when the use of a vise is mentioned, but, certainly, if Folsom Man was able to master this fluting technique, he was able to create a holding device. It is possible that he was very adept at using his feet and he may have used them in some way for holding some sort of a device. When one observes, today, the Indians of Mexico and South America ~~today~~ using their feet for holding and their toes for weaving, it is certainly possible that Folsom man also had good control and use of his feet for helping in the manufacture of his tools. Or he may have used a two-man method. I am now experimenting with these methods, but, to date, I havent found a knapper with ~~sufficient~~ enough knowledge

of the problems involved to help me sufficiently to prove or disprove this theory. I shall continue to work on this method until I have either proved or disproved the theory.

From a flintknappers' viewpoint, I consider the Folsom to represent the highest and most difficult style of flint knapping. Even after evaluating all the types of flake removal, I still consider this splitting a flake - literally three ways - as one of the most difficult of physical and mechanical problems.

I have not had an opportunity to study or review many collections of Folsom work, and it would be a great help if I could examine some of the many fine artifacts now in collections in the U.S.A. Our knowledge of knapping must come from the ~~Indian~~ STONE AGE MAN and since, today, this is a lost art among the remaining tribes, one must learn from a study of artifacts. When a knapper looks at artifacts, he studies the flake scars and tries to visualize what flakes were removed to produce these scars. He also looks for remnants of platforms, studies the angle at which force was applied and the general character of the flaking. He considers, also, the regularity of the flaking and the depth of the bulbs of force and the sequance of flake removal. Too, he studies the character of the edges, the step-fractures or feathering of the flakes and the width of the flake scars in relation to their length. Also important is the form of the artifact in relation to the bending of the flakes. He looks for polishing of edges, point and platform. Of particular interest, is the quality of the

material used and an inspection to determine if the material was heat-treated. If flaws were present in the material, the knapper studies the artifact carefully to determine what Ancient Man did to overcome or remove these flaws. All of this inspection tells a knapper how an artifact was manufactured and is practically the only way we can, today, learn the techniques of flintknapping. Oh, what a help it would be if we could visit Folsom Man's workshop and see his artifacts with a flake assemblage! If I could find such an assemblage in a collection today, I feel I could then learn Folsom's techniques of flake removal. To be able to fit the removed flake back upon the artifact would tell a knapper so much of the technique of manufacture. I hope someday to find such an assemblage and then, perhaps, will discover the fine points of manufacture that are now alluding me.

in 1963 Dr. Marie Wormington of the Denver Museum of Natural History allowed me to examine some of their Folsom material and, from viewing these artifacts, I changed some of my thinking of manufacture. In this collection, some of the artifacts were only partly finished and I discovered a new technique in the making of Folsom. Principally, I noticed that the tips were polished and a bulb of stone was left at the distal end, which would withstand pressure. This has somewhat changed my ideas on manufacture and caused me to revise some of my earlier theories. I felt that the polish was put on the tip to strengthen the stone and that the bulb

was left to permit the artifact to stand the necessary pressure or pressure. After viewing Wormington's collection, I did some experimenting with point support and placement of the artifact in the vise. My experiment was quite successful, but I still have a few problems to work out. However, the character of the ~~max~~ longitudinal flakes that were removed using this new holding method, have the same character shown on the Folsom. Previously, I had felt the tip of the artifact should not be touching on solid material, for I felt this would cause crushing or compression of the flake. However, after seeing the polish on the tips of Wormington's collection, I felt the polish was put there to strengthen the tip and concluded this must be for support purposes. So I placed my artifact in the vise in such a position that the tip was supported by an antler block close to the leading edge. Therefore, when pressure was applied on the platform and the fluting flake was detached, it would clear the antler support and still flute the projectile point to the tip without the customary snipping. By using this method, I found that I got better results and that I did not snip off the tip as often as without the support. I also found that the fluting flakes removed, by this method, had the same characteristics as those removed by Folsom Man.

Following is brief, but step-by-step description of my methods of producing a Folsom artifact.

(1) First I select a piece of stone that is desirable for Folsom manufacture, i.e., something that has a high lustre, that is adaptable for flaking, but without flaws or inclusion. In selecting the stone, one must attempt to get as near perfect a piece as possible. If the stone does not have these natural qualities - such as obsidian or glass - then one may use the thermal treatment such as I described in a paper published in the Vol. 7 of the 1964 edition of the Idaho State University journal "Tebiwa". When using the quartz family minerals it is always desirable to use the thermal method, as they are much tougher and this heat treatment will give them the character of glass or obsidian and make the stone much easier to work. Of course, an artifact can be made without this thermal treatment, but I have found much use of this heating in ancient Folsoms and one gets a more perfect and easier manufactured tool from the treated material. When the thermal treatment is used, it does produce a glassier material and the flake will have greater flexibility, and, therefore, it is easier to guide and will not hinge-fracture as readily as untreated stone. The stone also loses a lot of the toughness after the thermal treatment but will retain its hardness.

type + size stone / thermal treatment

see over

For practice purposes, one can use glass, for it has the same breakage, the same mechanics and the same

The materials we use for making artifacts all have the same physical properties as those used by Folsom Man, so, considering everything was the same, your results will be the same.

physical characteristics of stone.

One should have material that has this glassy texture in order to cause the fluting flake to part when this great amount of pressure is applied. Cohesion is present and, if the material is glassy - either naturally or by tempering - it is much easier to break this cohesion and then follow the flake thru and guide it to produce the shape and the fluting flakes on either side of the artifact.

(3) Blanks & Preforms

If one starts his manufacture with a large block of stone, then he can use the blade technique by using a hammerstone to remove a series of blades which can, then, be worked into artifacts. These we will refer to as blanks. These blades are removed by percussion and this removal is done for economy, for, otherwise, there would be a great waste of good material. I would imagine that Folsom Man also conserved his material in this manner and later used these blanks for making artifacts. After I remove the blades (or blanks) for purposes of making a Folsom, I then temper the removed blades, if I am working with the quartz family minerals. This is my method, but I have found that some of the Indian flakes I have studied seem to have been tempered before they were removed from the core. Ancient Man seems to have used both methods — tempering the stone before removal but ~~at other times~~ he would temper the flakes after ~~Re-tempered after~~ removed them from the core.

I temper my blades after removal from the core, as the larger the size of the block, the harder it is to control the heat - to keep it from cracking or to heat it slowly enough and cool it slowly enough to temper the entire stone without crazing. Ancient Man, however, seems to have mastered this art and we have much to learn about

this tempering process and about the actual chemical, monecular, and mineral changes that take place.

- SEE NOTE

If one starts working with a small piece of stone, then I use what I call the core process and that is to use a hammerstone and strike off all of the surplus material by percussion until I, roughly, have a preform.

(3) (?) After the blanks (or flakes) of suitable size have been detached from the core they are then shaped by percussion or pressure into preforms that will ultimately be pressure flaked into the artifact.

So far, we have started with a rough piece of stone and have now, by using percussion, made our preform. Now we must shape and flake this preform. To do this, I use the pressure technique of pressing the flakes off and shaping the artifact. There are many styles and kinds of pressure techniques, depending on how the hand is held, the support of the stone, the position of the tool and preparation of platforms for retouching. Each one of these will show a different character of surface techniques and, usually, represents different groups of people. These different groups used different methods and techniques for flaking the preform and also for removing the fluting flake. How each group removed this fluting flake, we cannot be sure. All I can give is what knowledge I have acquired from my own experience in flintknapping. There is quite a difference between the character of workmanship on artifacts found at the Lindenmeir Site and those of the Texas finds and some of the Eastern United States. Each group of people seem to have developed a little different technique in the preparation of the artifact prior to fluting.

Shape & Flake

When preparing a preform to produce a Folsom Projectile point, it is desirable either to bring the flakes to the center, producing a ridge from the base to the tip; or one can curve the flakes over and bend them over the surface and past the center. If the artifact is too thin, a flake cannot be pushed all the way thru to the ~~point~~ tip. If it is too thick and the ridge is too high, the fluting will be very narrow. Therefore, the contour of the surface of the artifact has a direct bearing on the width of the flute and the final thinness of the finished artifact. The cross section will be either diamond-shaped, or it will be double convex, and the convexity controls the width of the flake. The surface must be regular or, as the flake is removed, it will cause undulations. They will be similar to the undulations which is the result of ~~caused by~~ fluting by percussion.

In the primary preparation and flaking of the artifact, the edges must be left sufficiently thick along both sides for the final clamping for it must, later, be placed and held in a vise in a particular manner for removing the fluting flakes and these edges must be strong enough to withstand the pressure of the vise.

As I have said, the preform must be shaped and flaked before the fluting can be done. How to shape and flake a preform, pressure flaking, and retouching will be covered in a forthcoming article. This article is concerned, chiefly, with the fluting flake of Folsom which is removed after the pressure-flaking and retouching has been accomplished.

The outward shape is of great importance for the final removal of the fluting flake. Folsom has a wide, blunt shape because the fluting flakes are parallel and, during removal, have a tendancy to spread and, therefore, the shape must be wide. It is no accident that this artifact is short and wide. Folsom man designed it this way to give the artifact added strength, to provide for the guiding and removal of the fluting flakes, and so it would provide clearance for the shaft for easier removal from his game.

(4) Shape

The next step is platform preparation. One must free a platform at the base of the artifact. Starting at the base, one removes, by pressure, enough stone on either side of the center line to leave a projection - or platform. Then I free the platform by removing small flakes on each side of the platform towards the surface from which the fluting flake is to be removed. The platform must be properly centered and in the right position to permit basal hinning. Most of the Folsoms that I have studied have been knfe-edged at the base and just a bare portion of the original platform of the last flake was remaining. This remnant of remaining platform was between the tangs and one could see that the fluting flake had removed all but a small portion of the platform. The angle of the platform is very important for applying pressure. One must figure the angle in relation to the cone of percussion or pressure. We might call it the cone of force.

(5) Platforms

If the platform is projected to clear the base, you have already established your cone out away from the stone, therefore, a more direct downward pressure can be applied without a big bulb of percussion or force going back into the base of the artifact and causing crushing and loss of the tangs on either side where it is held in a vise. After I have prepared the angle of the platform, I polish the surface of the platform by abraiding it with a piece of whetstone. This polishing enables the stone to withstand the necessary pressure without crushing. the platform.

(b) method of holding (insert)

Now we will consider placing the artifact in the vise. One must center the artifactly perfectly in the vise so that the platform is in line with the tip of the artifact. If it is not properly centered, the flake will go off at an angle diagonally. After the platform and the artifact are centered, one must consider the method of holding. I use two pieces of wood in a wood vise for holding the artifact. The angle of placing the artifact in the vise is very critical and, also, it must be held firmly by the vise. Before I secure the stone in the vise, I polish the outward edges of the artifact so it will stand the pressure of the vise. If any irregularities are left on the edge, they could cause fracturing. The edges of the artifact are ground before it is placed in the vise. Grinding of edges may be a multi-purpose operation, but most of the Folsom artifacts appear to be ground. This grinding may have also served to prevent cutting the thongs in the hafting methods.

Let's consider the support of the tip of the artifact in the vise. It is a little difficult to explain the mechanics of this operation. I don't really have the right termonology to explain this, but the Folsoms in Wormington's collection showed polished points. These were apparently discards, as the fluting flake had not been carried the entire length of the artifact, but the polished surface, and quite a quantity of material, still remained on the point. After viewing Wormington's collection, I tried polishing the point and then I placed it in the vise. The point must be pressed down and out to a leading edge of some solid material. The angle of the point when it is set against the leading edge of the support is very critical. And it must be placed exactly right so that the applied pressure on the platform will go straight to the point but still sufficiently away in ~~order to clear the point but still sufficiently away~~ order to clear the point of support and not allow compression or pressure from both ends. This angle cannot be explained other than by illustration and demonstration and one can learn this critical angle of placing the artifact in the vise and on the support and the necessary applied pressure only by trial and error.

If the angle is not correct, the artifact will be crushed or the fluting flakes will feather out short. If one will examine the fluting at the top and bottom of a Folsom, he will see how critical the angle is. In order to flute the artifact, the angle of tolerance is probably within one or two degrees of vertical and this is all the tolerance one has when applying pressure

In making these artifacts, I have destroyed hundreds of them by snipping off the points as the flake, naturally, will spread. So, if it is not supported, when it comes to the end, it will curl back under and one will lose the tip. Apparently, sometimes, Ancient Man recovered the broken artifact and made the stubby type of Folsom by reworking it after the fluting was done. This I have done, myself, when I have snipped off the tip, but still left enough of the body of the artifact to produce a usable tool. However, after the fluting has been done, it is very easy to determine a re-worked point. One can easily see the reworked flakes intersecting with the fluting flake and can readily see ~~where~~ the point has been re-pointed after the longitudinal flakes have been removed.

The fluting flakes leave a concavity down the center of the artifact which forms two parallel ridges down the sides of the artifact so if one is re-working the edge of the tool in any way the flakes will travel over the ridge left by the fluting flakes and destroy the regularity of the Ridge.

describe tools + crutch + placement of crutch

(1) Fluting

After one has shaped, surfaced chipped, established the proper platform and secured the artifact properly in the vise he is then ready to remove the fluting flakes by pressure. One of the most important and critical steps of removal is placing the flaking tool at the proper angle on the established platform. If this angle is not correct, the artifact will be crushed, or the fluting flakes wil feather out short. If one will examine the fluting at the top and bottom of a Folsom, he will see how critical the angle is. In order to flute the artifact, the angle of tolerance is probably within one or two degrees of vertical and this is all the tolerance one has when applying pressure in order for the fluting flake to come thru to the point but still away from it without snipping off the tip.

The pressure tool must be placed on the platform at right angles to the barbs and it should be tilted approximately 2° from vertical towards the knapper. To compute the angle between the platform and the supported tip one must draw an imaginary line so that the axis between these two points will not direct the pressure entirely into the tip. The angle must be at such a degree that the pressure applied will allow the fluting flake to feather and move forward and out away from the artifact sufficiently to avoid removing any material from the tip.

One of the most difficult problems of making this artifact is the final fluting. This is difficult because, by the time this operation takes place, one is working with a formed and flaked tool that is quite thin and, therefore, vulnerable to crushing, breaking and distal end snipping during the fluting process. Even Folsom man encountered this problem, for I have seen evidence of reworked artifacts that show clearly that he apparently xx snipped off the end of his artifact, but then he reworked and re-sharpened it and produced the stubby type Folsom. An Arachaeologist or Flintknapper can readily determine reworked genuine Folsoms, as it is quite apparent where the reworked flakes intersect with the fluting flake after removal.

The angle at which force is applied on the platform is very critical and only the proper angle taken will prevent crushing the artifact. The angle of force must be the exact angle from the platform to the distal end of the artifact, yet just missing the tip. When force is applied at the basal platform, one is also getting force from the polished distal end which, literally, shears the fluting flake from the artifact.

In considering the angle, the downward pressure is applied directly above and exactly in line with the center of the base to the point. The pressure must also be at right angles to the base, for, if it is not at right angles, it can cleve it down the center or the flake will go out sideways. Therefore, the pressure must be directly at right angles to the center of the base. This is very important. When applying downward pressure, one knows by the size of the flute that you are going to remove just how much pressure to apply. For this I use a crutch against my chest and by using a thrust at the same time with an outward pressure, I am able to guide the fluting flake the length of the artifact to the tip. The control of the outward pressure will also conteract the cohesion at the top. It will start the flake tearing loose from the top and then one will guide it with the downward pressure. But straight downward pressure, alone, will not produce a flute - it will crush the artifact. The Pleatform will stand a tremendous amount of downward pressure, but the flake will not be detached unless outward force is used in combination with outward force. As one is applying the downward pressure, this controls the curve of the flake from the base to the point. If you will examine a Folsom and run your fingers from the point to the base, down these grooves, you will find that it will swell in the center which will give you a convexity on both sides on the longitudinal distance of the artifact.

The fluting flake must be bent from the base to the point and in order to control this bending, one must practice with the downward and outward force and gain this knowledge from actual work. This bending takes plase as the fluting flake is being removed by applying downward and outward pressure on the prepared platform. One will acquire a muscular reaction that is almost faster than mental and this reaction is a difficult thing to describe and can be learned by practice. Some call it an impulsive pressure and others have different means of expressing this reaction. They know that something happens, but find it hard to describe exactly what takes place. It is actually a bending of the material and following the flake thru - guiding it thru to the tip.

(8) Second Flake

After one side of the artifact has been fluted, this same fluting method must be applid to the opposite side and the same platform preparation established. If the top of the platform, at the base of the artifact, has been left flush with the tangs - ~~when, [illegible]~~ when one removed the 1st fluting flake, then he must re-prepare the platform for removal of the fluting flake on the opposite side. He must prepare this platform in the same manner as platform preparation for removal of the first flake. The removal of the second flake is much more critical than the first flake because of the area of stone to be detached. The size of the flake from the base to the point, is perhaps as much as thirty times the cross section of the artifact, itself. By the removal of the first fluting flake one has so thinned and weakened the artifact that the breaking point is more critical.

When the second flake is being removed, the platform must be in such a position so that when the second falke is removed , the platform will be detached with the second flake in such a manner as to leave a knife edge at the base of the artifact. When one starts to make Folsoms he, at first, gets many broken artifacts and this breakage is generally a result of improperly applied downward and outward pressure, as well as improperly supported tips.

The secret of successful fluting requires an ability to accurately compute the proper xgn angles and the correct amount of forces, for the least deviation of your angle and outward and downward pressure will either snip off the tip of the artifact or will cause the fluting flake to break off short, or one may even crush the artfact.

(9) Summary

When one makes a summary of the manufacture of the Folsom, it is much easier to explain why they could not be make rather than to tell how they were fabricated. I believe there are some 21 different complexities that have to be next to perfect before one can remove the two fluting flakes of a Folsom.

The knowledge that Ancient Man had of producing these artifacts - and repeteadely doing so - is to be desired and particularly when one consideres at what period of history Folsom Man inhabited this part of the World. As a flintknapper, I continually wonder why the Folsom Point ever disappeared and why the Plains Indians changed their style of artifacts and flaking. As a fabricator, I consider the Folsom to be the most practical of all artifacts in spite of the difficult method of fluting. This artifact was adaptable for serrations, it is easier to haft than the regular lancelate point. By having the flutes on both sides of the projectile point, it would give the shaft clearance for deep penetration. It could be made, as it is, for easy withdrawal or it could be adapted for barbs. It has beautiful balance and it has great strength for its size. It is durable and would withstand much rough handling and it could be projected without breaking the fragil tips .

hazards that are a part of flintknapping. Some of these are: the cutting of the hands, flakes penetrating the flesh danger of silicosis acquired from thedust from the stone. When one is chipping, if he will look towards ~~the~~ the rays of the sun you can easily see a powedry dust arising from the chipping process and this sometimes produces a cough from inhaling this dust.

Another danger is to the eyes, as the flakes tend to fly at all angles and many of the chips will lodge in ~~the~~ on the eyeball. According to Prof Even Giffod Ishi had this trouble, and learned to remove these chips ~~instantly~~ by leaning his head forward and then ~~He dxx developed a method of~~ striking himself on the back of the head and the chip would pop out of the eye immediately. I, of course, use glasses, which provides some protection, but over the years I have learned to tilt my head sideways TWARDS THE NOSE and down and cry out of either eye which acts as an eyewash and ~~easily~~ HELPS remove the chips.

Fortunately, the flakes usually light ~~with~~ on the flat surface ~~in~~ when hitting the eye and do not generally strike ~~the eye~~ with the sharp edge. If one does not blink and keeps the eyelid open, the flake will move towards the nose and then one can wash ~~them~~ it out. However, this is a serious hazard, and must be kept in mind at all times. ~~Generally~~, When one is doing percussion work, unless ~~you~~ he pauses between the time that ~~you dislodge each flake~~ that each flake is dislodged on the backstroke, as ~~you~~ he brings ~~your~~ his percussion tool back up, ~~you~~ he may hit the flake like a baseball bat and thereby throw it into ~~your~~ his face, which may cause a severe and very deep cut.

One wonders, too, ~~with~~ how the Indian children, usually ~~going~~ barefooted ~~just how many of them did~~ avoided ~~pi~~ STEPPING ON sharp flakes and cut ~~their~~ ing feet as they walked or played around the camp or where the Father was doing his knapping.

Do not cross bare legs when doing percussion work.

One very often sees in archaeology papers a reference made to the quality of workmanship in various artifacts. I do not like this RELATONSHIP ~~term~~, as I do not feel we can talk of quality of workmanship when we are comparing different types of points and even material from different groups of peoples and different areas. I always wonder if the writers are making an evaluation of the quality of application of a particular set of flintknapping techniques or are they making valued judgements about wholly different sets of techniques. Are hey considering one set of techniques better than the otherAre these things relative or do they deal with the actual working problems that primitive man encountered. The relationship of the quality of workmanship is dependant on the quality ofmaterial for this plays a great part in what the final outcome of the workmanship produced. Also, we must consider as to what perfection was the preform made before the final flaking or retouching was done. We can only set our values by the retouching, for the flake scars are all that remain when we find our artifacts. The preliminary preparation, of course, has disappeared with be removed flakes. So, if a knapper had made a very excellant preform, he is far ahead of one who is not able to produce a good preform. Then we must consider the reularity of the flakes. Not only the regularity, but the graduation in size. At the very tip they might be extremely small but would become larger and larger as they graduate to the basal portion of the artifact. The man who can control the exact size of these flakes and taper them or cause a graduation in these flakes would certainly be considered as having a better touch than one who produced flakes of all the same size on his artifact. On the other hand, those who can produce a series of ccccc flakes of exactly the same size and width must also be considered to be a very skilled knapper. The man who can produce long and narrow flakes shows even more skill

and narrower
in his work - for the longer/they are xxxxthe more difficult to produce and control. This man would rate highere in the estimation of a knapper than one who could produce a series of short flakes. entirely
Another type of knapping is the ability to curve flakes/over the surface and stop them on the other side before they have sheared off the opposite side. A repitition of this sort of ripple flaking is indicative of a high degree of skill. Again, we have a workman who can feather the flakes out at the center, or the median line of the artifact, thereby forming a ridge down the center. If a man can do this, without them curling over and showing irregularity, he, too, has a high degree of skill. There are many, many techniques and one must consider this when he is talking about quality of workmanship. In evaluating these techniques one must take many factors into consideration. In fact, some techniques can hardly be compared with another. For instance, and
ripple flaking xxxx sharp ridging down the center cannot be compared each
with any other techniques, as it requires entirely different workmanship and techniques. Each would require the same amount of skill, but would produce entirely different types of artifacts. The man who can deeply knotch his artifacts for hafting having very narrow entrances in order to insert his tool to flake these narrow notchings would show a higher degree of skill than the man who would produce a big, wide notch that would take a fairly course tool. Also this would illustrate whether he could take out a single large flake or whether he had to take out numerous small flakes in order to produce notching. One must also consider serrations. There are many types of serrations. Some serrations are done from just one side and some are cerrated from both sides. Some serrations are very deep and some are very narrow and close together. Others will serrate by taking off a flake on one side and then one on another which will produce a saw effect.

Following is an explanation and description of the manufacturing methods and techniques I use when making a Folsom projectile point. In this article, I would like to explain some of the problems that I have encountered in making this artifact during the past thirty-five years and my methods of overcoming them.

I am not prepared to say that I have entirely mastered Folsom Man's technique, but this is my way of duplicating a Folsom artifact and, I believe, Folsom man made his projectile point in ~~this same~~ in a similar manner. Different groups of people used different methods and techniques for flaking the preform and also for removing the fluting flake. How each group removed this fluting flake, we cannot be sure. All I can give is what knowledge I have acquired from my own experience in flintknapping.

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There are two schools of thought on the removal of the fluting flake. Some think the preform was held in the hand and the fluting flake removed either by pressure or percussion. Some think the artifact was placed in a vise and the fluting flake removed by pressure.

After trying every conceivable method of removing this flute, I have concluded that Ancient Man placed his preformed and surface-chipped artifact in a vise and removed the flute by pressure. I did not reach this conclusion quickly or alone. As I have said, I tried every conceivable method and technique and have conferred with other stone knappers, and we are all of the same opinion, i.e., that

Folsom Man used the vise and the pressure technique.

It is true that a fluting flake can be removed by holding the artifact in the hand and either pressing off the flake or by striking it off by percussion, however, I discard these methods, as this technique provides no means of control and one gets more broken artifacts than finished products. Also, ~~with this~~ when using method, one cannot control the critical angle necessary to remove the flake and it will tend to flute the artifact to the right or left and not parallel to the tip of the projectile point. ~~Also~~ Further, the finished product does not have the characteristics of the ancient Folsom artifacts. This method also, produces more undulations because the hand support is not sufficiently firm and allows the artifact to move, causing these undulations in the fluting flake. ~~Also~~ Furthermore, by using this hand-held method, one cannot produce as thin a projectile point as the original Folsoms. These have been my ~~results~~ + other flintknappers results + mine, therefore, we discard the theory that a folsom or clovis was made by the hand held method

Then there is the matter of holding to consider. The preform would have to be held in such a manner that the danger of driving the point into the hand and receiving serious injury is great. When I was doing experimental work on Folsom in 1940 at the Ohio State Museum, I was using a short crutch technique to develop sufficient pressure to flute a folsom artifact. While doing this, the unfluted preform collapsed and forced the tip of the antler pressure tool entirely thru the palm of my hand. Perhaps this was accidental, but it illustrates the risk that Folsom Man would be subject to if he had used this or the hand-held method.

A tremendous amount of pressure must be exerted to remove this flute and, therefore, when the preform is hand-held, there is danger of not merely cutting the hand, but of driving the artifact entirely thru the hand. Also, when the preform is hand-held, one cannot exert enough pressure to produce as wide a flake as is found on the normal Folsom. I believe that Folsom Man's hands were too prescious to his survival to think that he would use this method and take this risk.

I further discard the hand-held percussion method because the point of impact between the two barbs at the basal end of the artifact is so small that there is not room enough between these two points to strike with enough force and accuracy to remove the flute. One must bear in mind that the percussion tool must be large enough and have sufficient weight to detach a flake of this size and, therefore, one can readily see that it just would not fit in the samll area between the tangs. With this method, the margin of error is so great that the accuracy required would defeat man's repeating the removal of a series of fluting flakes. If one accomplishes the fluting on one side, ~~by using this method~~ By using this method, he has so weakened the artifact and has placed his striking platform well inside of the barbs, and, therefore, it is practically impossible to repeat this operation on the opposite side. Percussion also causes a shock on the distal end of the artifact and tends to snip off the tip. However, basal thinning may be done with percussion tools, but it certainly does not have the control and accuracy to produce the inherent character of a fine Folsom projectile point.

he must re-prepare the platform on the opposite side. Since the percussion would have removed not only the flute but also his platform — it would, therefore be necessary for him to prepare a new platform which would be deeper & well inside the borders & , therefore, practically impossible to reach with his percussion tool.

Some may raise an eyebrow when one ~~mentions using a vise~~ the use of a vise is mentioned, but certainly if Folsom man was able to master this fluting technique, he was able to create a holding device. Folsom man ~~was also~~ MAY HAVE BEEN very adept at using his feet and he may have used them in some way for holding some sort of a device. He may even have used a two-man method. I am now experimenting with these methods, but, ~~so far~~ to date, I haven't found a second man with sufficient knowledge of stoneknapping to understand the problems involved. Therefore, there is still work to be done to prove or dis-prove this theory.

Put top of page 8

Describing the making of a Folsom is something that can hardly be put in words, but, rather, must be illustrated or demonstrated. All I can do, when writing, is to describe the problems involved in manufacture and my techniques of overcoming these problems. I would imagine that even Folsom Man, at the inception, did much experimenting before he perfected and mastered this fluting process, but, ultimately, he ~~certainly was the~~ succeded, perhaps [redacted]. because of necessity.

From a flint-knappers viewpoint, I consider the Folsom to represent the highest and most difficult style of flint knapping. Even considering all the types of flake removal, I still consider this splitting a flake - literally three ways, - as one of the most difficult of physical and mechanical problems.

I have not had an opportunity to study or review many collections of Folsom work, and it would be a great help if I could examine some of the many fine artifacts

now in collections in the U.S.A. A Flintknapper learns from the Indians, so, today, he must learn his art from the study of artifacts. When a knapper looks at artifacts, he studies the flake scars and tries to visualize what flakes were removed to produce these flake scars. He also looks for remnants of platforms, studies the angle at which force was applied and the general character of the flaking. He considers, also, the regularity of the flaking and the depth of the bulbs of force and the sequance of flake removal. Too, he studies the character of the edges, the step-fractures or feathering of the flakes and the width of the flake scars in relation to their length. Also important is the form of the artifact in relation to the bending of the flakes. He looks for polishing of edges, point and platform. Of particular interest, is the quality of the material used and an inspection to determine if the material was heat-treated. If flaws were present in the material, the kanpper studies the artifact carefully to determine what Ancient Man did to overcome or remove these flaws. All of this inspection tells a knapper how an artifact was manufactured and is practically the only way we can, today, lear the techniques of flintknapping.

Dr. Marie Wormington of the Denver Museum of Natural History allowed me to examine some of their Folsom material and, from viewing these artifacts, I changed some of my thinking of manufacture. In this collection, some of the artifacts were only partly finished and I discovered a new technique in the making of Folsom.

Principally, I noticed that the tips were polished and a bulb of stone was left at the distal end, which would withstand the pressure. This has somewhat changed my ideas on manufacture and has caused me to revise some of my earlier theories. I felt that the polish was put on the tip to strengthen the stone and that the bulb was left to permit the artifact to stand the necessary pressure.

Oh, what a help it would be if we could visit Folsom Man's workshop and see his artifacts with a flake assemblage! If I could find such an assemblage in a collection today, I feel I could then learn Folsom Man's techniques of this flake removal. To be able to fit the removed flake back upon the artifact would tell a knapper so much of the technique of manufacture. I hope someday to find such an assemblage and then, perhaps, will discover the fine points of manufacture that are now, perhaps, alluding me.

After viewing Wormington's collection, I did some experimenting with point support and placement of the artifact in the vise. My experiment was quite successful, but I still have a few problems to work out. However the character of the longitudinal flakes that were removed have the same character shown on the Folsom. Previously, I had felt the tip of the artifact should not be touching on solid material, for I felt this would cause crushing or compression of the flake. However, after seeing the polish on the tips of Wormington's collection, I felt the polish was put there to strengthen the tip and concluded this must be for support purposes. So I placed my artifact in the vise in such a position that the tip was supported by an antler block close to the leading edge. Therefore, when pressure was

applied on the platform and the fluting flake was detached, it would clear the antler support and still flute the projectile point to the tip without the customary snipping. By using this method I found that I got better results and that I did not snip off the tip as often as without the support. I also found that the fluting flakes removed, by this method, had the same characteristics as thos removed by Folsom Man. One of the biggest problems in manufacturing this artifact is the final fluting of the artifact. This is difficult because, by the time this operation takes place, one is working with a formed and flaked tool that is quite thin, and, therefore, vulnerable to crushing, breaking, and distal end snipping during the fluting process. Even Folsom Man encountered this problem, for I have seen evidence of reworked artifacts that show clearly that he apparently snipped off the end of this artifact, but then reworked and re-sharpened it and produced the stubby-type Folsom. An Archaeologist or Flintknapper can readily determine reworked genuine Folsoms, as it is quite apparent where the reworked flakes intersect with the fluting flake after removal. The angle at which the force is applied on the platform at the base of the artifact is very critical and only the proper angle taken will prevent crushing the artifact. The angle of force must be the exact angle from the platform to the distal end of the artifact, yet just missing the tip. When force is applied at the basal platform, one is also getting force from the polished distal end which, literally, shears the fluting flake from the artifact.

material is glassy, it is much easier to break this cohesion and then follow the flake thru and guide it to produce the fluting flakes on either side of the artifact. I have, however, found instances where the blades were tempered after removal. First they are removed from the natural stone by percussion and then tempered. But a few of the flakes I have studied seem to have been tempered before removal.

However, the larger the size of the block, the harder it is to control the heat - to keep it from cracking or to heat it slowly enough and cool it slowly enough to temper the entire stone without crazing. Ancient Man, however, seems to have mastered this art and we have much to learn about this tempering process and about the actual chemical and mineral changes that take place.

If the original block of stone is large enough, one can use the blade technique and remove a series of blades which can, later, be worked into artifacts. These blades are removed by percussion and this removal is done for economy, for, otherwise, there would be a great waste of good material. I would imagine that Folsom man also conserved his material in this manner and later used these flakes for artifacts.

However, if the stone is small then I use what I call the core process and that is to use a hammerstone and strike off all of the surplus material until I, roughly, have a preform. After the preform has been made, then I use the pressure technique of pressing the flakes off. There are many styles and kinds of pressure techniques, depending on

~~end, which, literally, shears the fluting flake from the artifact~~

See Page 4

My methods of producing a Folsom Artifact are as follows:

(1) Stone + thermal

First I select a piece of stone that is desirable for Folsom manufacture, i.e., something that has a high lustre, that is ~~very friable~~ adaptable for flaking, but without any flaws or inclusions. In selecting the stone, one must attempt to get as near perfect a piece as possible. If the stone does not have these natural qualities - such as obsidian - r. glass then one ~~can~~ MAY use the thermal method ^ on the quartz family minerals such as I described in a paper published in the Vol. 7 OF THE 1964 ~~issue~~ EDITION of the Idaho State University journal "Tebiwa", which will give them the character of glass + obsidian.

~~Glass is also very good for experimenting.~~ I use glass for much of my work, for it has the same breakage, the same mechanics and the same physical characteristics of stone. The quartz family minerals are tougher, however, and, when using these, I resort to the thermal treatment.

When the thermal treatment is used, it does produce a glassier material and the flake will have greater flexibility, and, therefore, it is easier to guide and will not hinge-gracture as readily as untreated stone. The stone also loses a lot of the toughness after the thermal treatment, but still retains its Hardness.

One must have material that has this glassy texture in order to cause the fluting flake to part when this great amount of pressure is applied. Cohesion is present and, if the

how the hand is held, the support of the stone, the position of the tool, and preparation of platforms for the retouching. Each one of these will show a different character of surface techniques and, usually, represents different groups of people. (1) see pg 1 There is quite a difference between the character of workmanship on artifacts found at the Lindenmeir Site and those of the Texas finds and some of the Eastern United States. Each group of people seem to have developed a little different technique in the preparation of the artifact prior to fluting. (3) flaking When Preparing a preform to produce a Folsom Projectile Point, it is desirable either to bring the flakes to the center, producing a ridge from the base to the tip; or one can curve the flakes over and bend them over the surface and past the center. If the artifact is too thin, a flake cannot be pushed all the way thru to the point. If it is too thick and the ridge is too high, the fluting will be very narrow. Therefore, the contour of the surface of the artifact has a direct bearing on the width of the flute and the final thinness of the finished artifact. The cross-section will be either diamond-shaped, or it will be double convex, and the convexity ~~has to do with~~ controls the width of the flake. ~~or the flake is removed~~ The surface must be regular or, as the flake is removed, it will cause undulations. They will be similar to the undulations caused by fluting by percussion.

In the primary preparation, and flaking of the artifact, the edges ~~of the artifact~~ must be left sufficiently thick along both sides for the final ~~support~~ clamping, ~~in the~~ for it must later be placed in a vise ~~or held~~ + held in a particular manner for removing ~~of~~ the fluting flakes. + these edges must be strong enough ~~for support~~. To withstand the pressure of the Vise

(4) outward shape

The outward shape is of great importance for the final removal of the fluting flake. Folsom is the wide, blunt shape because the fluting flakes are parallel. In other words, the Folsom shape adds to the strength and permits the guiding of the fluting flake. If Folsom ~~Folsom~~ were a long, narrow, sharp artifact, the removal of the fluting flake would snip off the tip.

but to help remove the flutes

(5) platform

Del Over

The next step is to free the platform at the Base of the artifact or where the shaft will be ultimately attached. There is a removal of flakes at the base of the artifact similar to faceting - for lack of a better word, we will call it faceting - but the platform must be freed so that the cohesion at the top, where pressure is applied to the platform, will let the fluting flake move forward without crushing. Then I free the platform by the removing of small flakes on either side of the platform towards the side - from which the fluting flake is to be removed. The platform must be properly centered and in the right position to permit basal thinning.

Most of the Folsoms that I have studied have been knife-edged at the base and just a bare portion of the original platform of the last flake was remaining. This remnant of remaining platform was between the tangs and one could see that the fluting flake had removed all but a small portion of the platform.

After I have prepared the angle of the platform, I polish the surface of the platform by abraiding it with a piece of whetstone.

Then
In ~~platform preparation~~, there is a removal of several small flakes at the base of the artifact and around the platform which resemble faceting which frees the platform and helps relieve the cohesion at the top so that when pressure is applied the fluting flake can move forward without crusing and breaking.

Starting at the base ~~which is~~ one remove by pressure enough stone on either side of the center line to leave a projection or platform.

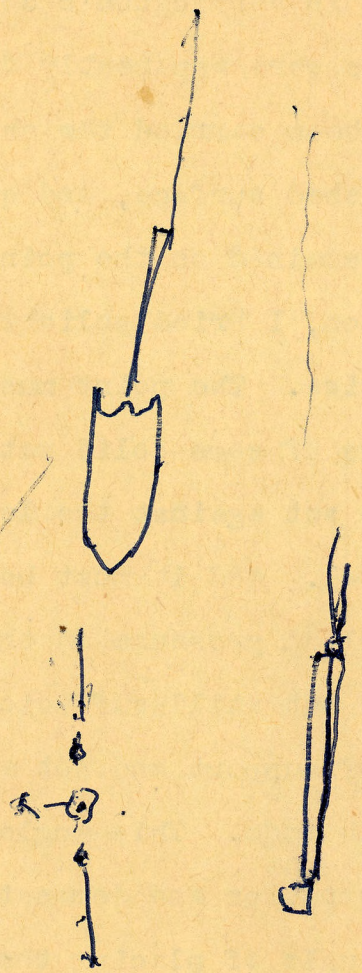
The angle of the platform is very important for applying pressure. One must figure the angle in relation to the cone of percussion or pressure. We might call it the cone of force. If the platform is projected to clear the base, you have already established your cone out away from the stone, therefore, a more direct downward pressure can be applied without a big bulb of percussion or force going back into the base of the artifact and causing crushing and loss of the tangs on either side where ~~this~~ it is held in a vise.

One must center the platform and the artifact perfectly. If it is not properly centered, the flake will go off at an angle diagonally. After the platform and the artifact are centered, one must consider the method of holding. I use two pieces of wood in a wood vise for holding the artifact. The angle of placing the artifact in the vise is very critical and, also, it must be held firmly by the vise. Before I secure the stone in the vise, I polish the edges so it will stand the pressure of the vise. If any irregularities are left on the edge, they could cause fracturing. The edges are ground. Grinding of edges may be a multi-purpose operation, but most of the folsom artifacts appear to be ground. This could prevent cutting the thongs in the hafting methods.

Let's go back to the supporting of the tip of the artifact. It is a little difficult to explain the mechanics of this operation. I don't really have the right termonology to explain this, but the Folsoms in Wormington's collection showed polished points. These were apparently discards, as the fluting flake had not been carried the entire length of the artifact, but the polished surface, and quite a quantity of material, still remained on the point. After viewing Wormingtons' collection, I tried polishing the point, and then I placed it in the vise. The point must be pressed down and out to a leading edge of some solid material. The angle of the point when it is set against the leading edge of the support is very critical. And it must be placed exactly right so that the applied pressure on the platform will go straight to the point but still sufficiently away in order to clear the point of support and not allow compression or pressure from both ends. This angle cannot be explained other than by illustration and demonstration and one can learn this critical angle of placing the artifact in the vise and on the support and the necessary applied pressure only by trial and error.

If the angle is not correct, the artifact will be crushed or the fluting flakes will feather out short. If one will examine the fluting at the top and bottom of a Folsom he will see how critical the angle is. In order to flute the artifact, the angle of tolerance is probably withing one or two degrees of vertical and this is all the tolerance one has when ~~it is removed~~ applying pressure for the fluting flake to come thru to the point but still away from it without snipping off the tip.

see page #7



supported, when it comes to the end, it will curl back under and one will lose the tip. Apparently, sometimes, ancient man recovered the ~~point~~ broken artifact and ~~had~~ made the stubby ~~s~~ type of Folsom by re-working it after the fluting was done. This I have done, myself, when I have snipped off the tip, but still left enough of the body of the artifact to produce a ~~working~~ usable tool. However, after the fluting has been done, it is very easy to determine a re-worked point. One can easily see the reworked flakes intersecting with the fluting flake and ~~one~~ can readily see where the point has been ~~resharpened~~ POINTED after the longitidunal flakes have been removed.

~~2-11 Recently I did some experimenting with the point support. It was quite successful, but I still have a few problems to work out but the character of the longitudinal flakes that were removed have the same character that the Folsom shows.~~

The materials we use for making artifacts all have the same physical properties; as these used by Folsom man so, considering everything was the same, your results will be the same, and if one would think of all these things - I think there is some 21 different things that ~~happen~~ have to be next to perfect before you can accomplish this fluting.

2 ||

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Recently I did some experimenting with point support + placement in the vise. Previously I had felt the tip of the artifact should not be touching on solid material as I felt this was causing slipping + crushing. However, after seeing the polish on the tips of Warrington's collection, I felt the polish was put there to strengthen the tip + concluded this must be for support purposes! Therefore, I placed my artifact in the vise so the tip was supported by _____

_____

_____

and found I got better results + ~~not as many~~ did not snip off the tip as often as without the support. I also found that the longitudinal flakes removed by this method had the same characteristics as those removed by Folsom man.

The PRESSORE tool that I am presently using for this fluting is a copper POINT. It does not slip. Horn is a ~~s~~ little MORE fragile - it does not last ~~so~~ as long and for this experimental work I have used copper. However, horn or ivory will work almost ~~j~~t as well.

In considering the angle that we spoke of previously, the downward pressure is applied directly above and exactly in line with the center of the base to the point. This PRESSORE must also be at right angles to the base for, if it is not at right angles, it can cleve it down the center or ~~your~~ THE flake will go sideways. Therefore, the pressure must be directly at right angles to the center of the base. This is very important. When applying downward pressure, one knows by the size of the flute that you are going to remove how much pressure to apply. For this, I use a crutch against my chest amd by using a thrust at the same time WITH an outward pressure, I am able to guide the~~xflakx~~ fluting flake the length of the artifact to the point. The control of the outward pressure will also CONTERACT ~~detract from~~ the cohesion at the top. It will start the flake tearing loose from the top and then one will guide it with the downward pressure. But straight downward pressure alone will not produce a flute - it will crush the artifact. the platform ~~It~~ will stand a tremendous amount of Downward pressure you must have the outward force ~~along~~ in combination with the ~~down~~ out ward Pressure As one is applying

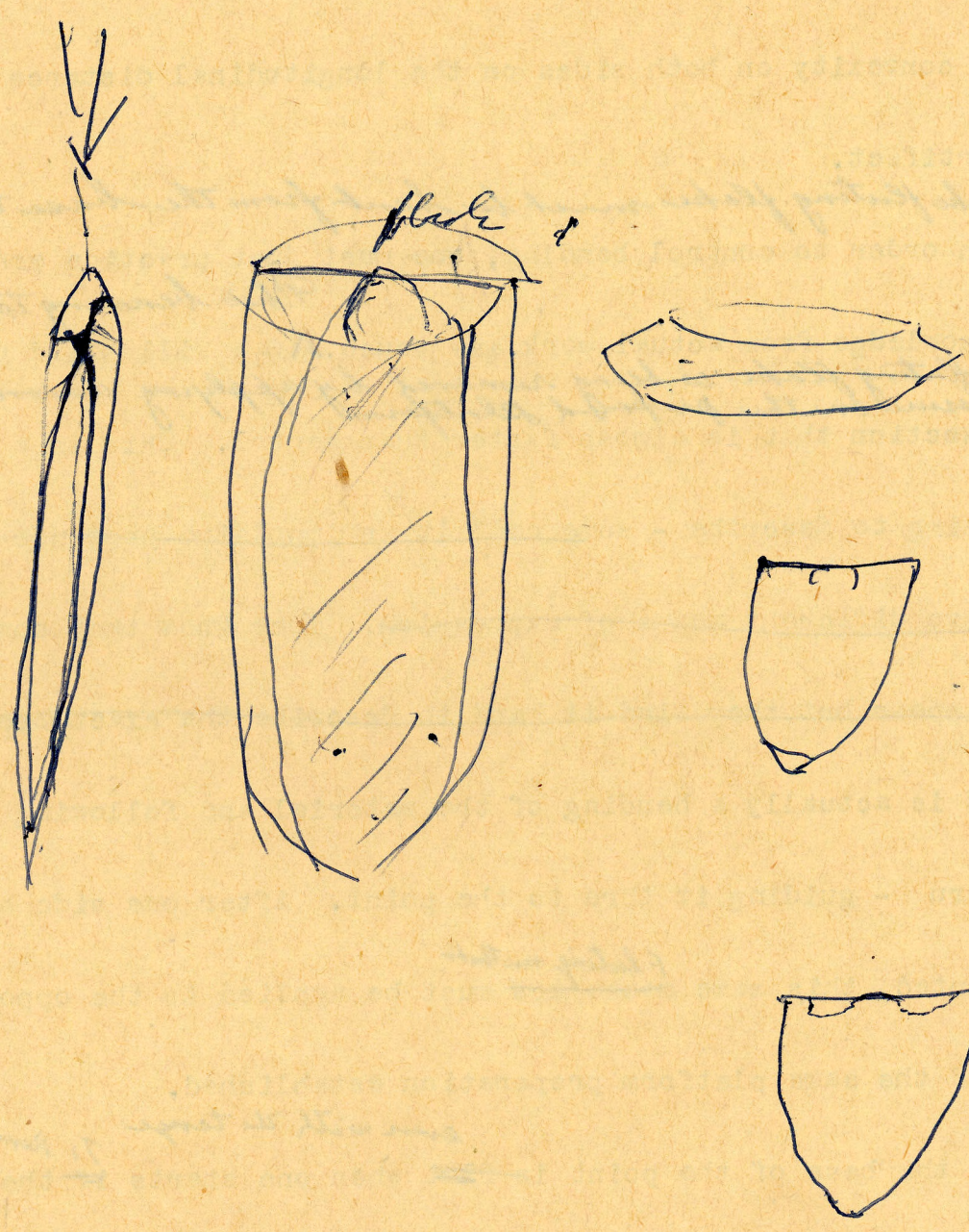
the downward pressure, this controls the curve of the flake from the base to the point. If you will examine a Folsom and run your fingers from the point to the base, down the ~~or~~ groove, you will find that it will swell in the center which will give you a convexity on both sides on the longitudinal distance of the artifact.

The fluting flake must be bent from the base to the point and In order to control bending, one must just practice and gain this knowledge from actual work.and touch. This bending takes place as the fluting flake is being removed by applying downward & outward pressure on the prepared platforms One will build up a muscular reaction that is almost faster than mental. This is a difficult thing to describe - some ~~call it an impulsive pressure and others have different means of expression~~. They know that something ~~happens but they find it hard to describe the exact operation~~. what happens

It is actually a bending of the material and following the flake thru - guiding it thru to the point. After one side has been fluted, this same ~~mechanics~~ Fluting method must be applied to the opposite side and the same platform preparation established.

If the base of the point ~~is flat~~ even with the torge when one starts ~~it~~ To Remove the first flake ~~is removed~~ then the platform must be ~~rearranged~~ REPREPARED and the same ~~thing~~ platform made ~~prepared for~~ on the other side. for the Removal of the second flake The ~~second flake~~ Removal of is much more critical than the first flakebecause the area of the stone that is being

2nd position



DETACHED because ~~broken, or~~ the size of the flake from the base to the point, is ~~maybe as many as~~ PERHAPS MUCH as thirty times ~~your~~ the cross section of the artifact itself. ~~So, when one is handling as brittle a material as agate and glass and obsidian or quartz - as some of them were made -~~ ~~your~~ the pressures are so very critical to avoid resulting in ~~complete~~ breaking the ~~failure~~ artifact, because after one goes to all the work to produce an artifact and just ~~simply~~ because ~~of~~ removing the two flutes down either side of the artifact it is very easy to destroy the point. However, Ancient Man apparently produced these fluted artifacts repetedly. There doesn't seem to be a great deal of phylogony or evolution of the Folsom other than the similarity of the Clovis. Some of the Clovis appear to ~~be~~ genuine almost the same technique as Folsom. I haven't seen many Clovis or Folsoms, but I do happen to have one in my collection that is a very fine example of flintworking.

Fluting requires an ability to figure angles and pressure for the least deviation of your angle and your outward pressure and your downward force must be ~~so~~ perfectly balanced in order to remove the flakes the flull length of the artifact.

When one makes a summary of the manufacture of the Folsom, it is much easier to explain why they could not be made rather than to tell how they were fabricated. To imagine Ancient Man repeteadely producing these points with probably a minimum of mistakes. When you think of some 25 different operations - each one of them have to be almost perfect to thenth degree in order to provide the fluting that will carry out to the distal end. The knowledge that ancient man had of producing these artifacts is ~~xxxxx~~ to be desired and particularly when one considers ~~when~~ at what period of history Folsom Man inhabited this part of the world. As a flintknapper, I continually wonder why the Folsom Point ever disappeared. ~~xxxxxxxxxxThexFlintxxIxxxxxx~~ and ~~one wonders~~ why ~~why~~ the Plains Indians changed their style of ~~points~~ artifacts and flaking. ~~Xxx~~ As a flintknapper, I consider ~~this artif~~ The Folsom act the most practical of all points, ~~if it was not for the~~ in spite of the difficulty encountered in manufacturing and fluting. This artifact was adaptable for serrations, it is ~~much~~ easier to haft than the regular lanceolate point By having the flutes on both sides of the projectile point, it would give the shaft clearance for deep penetration. It could be made, as it is, for easy withdrawal or it could be adapted for barbs. It has beautiful balance - it had great strength for its size. It is durable - it would ~~xxxxx~~ withstand much rough handling and it could be ~~shot~~ projected without breaking the fragil tips that some of our more recent points seem to have.

Qualities of a Flintknapper

A flintknapper must have considerable muscular development and a coordination of the muscles and a knowledge of leverage to produce a Folsom. He must develop a style of holding that is characteristic to this type of work, he must figure out the leverage and the methods of holding. He also must endure the

The importance of flint, and the development of man, one might say that flint could be the mother of man. In all the phylogeny and the development of man, had it not been for the stones of flint or allied materials, ~~mans~~ man's hands through the usage of the flint chips and the tools, ~~could have never~~ man's hands would have been ~~other than~~ like an animal's today.

By the use of the chips, ~~it~~ his hand developed to where he could increase his agility in manual dexterity in the production of better and better tools. There has always been the problem of whether a chip of stone was man-made or natural. By the study of the flakes it can be very definitely decided ~~as to~~ which was man-made and which was natural if there is a group of the artifacts in question available. All of them have a pattern. Man had a pattern and he ~~devloped~~ developed traits and habits in producing these chips. In order to hold one, or support it, certain mechanical features develop in the fracture of the flint. Though we have all of these pieces of stone that were detached in the production of artifacts, or used just as they were, they have very definite characteristics in mechanical features. All the individual flakes have physical features caused by definite mechanical problems dealing with material in types of force and angles of force

that is applied to the stone. There is a pressure or the percussion and there is the resiliency of the tools and the support of the core or the core to be. Each operation or each mechanical thing shows up on the result of the flake. By the classification of these flakes one may determine the angle that the stone was held. By nature it can only be supported in perhaps one or two angles, but when man held it and in order to produce a tool he had many angles and he had to think these all out in order to produce a usable flake of material that had a sharp cutting edge that he could use. By the classification of all of the flakes, one will be able to determine the techniques of manufacture and then we can come to the analysis of the form of the artifact and then we can have the theories of function. This all may play some part in the cultural analysis of the history of mankind.

What we will try to develop is a uniformity of flake terminology. This will create the universal understanding of the result in forms. We may have different terms for certain forms and functions as well as facial distribution. This will allow for greater variation of forms and hafting techniques, without having such sharply define classes, in order to de-

termine the types. It won't make a great deal of difference in some of the functions if there is a little different term, because they will all mean approximately the same thing. But by having a uniformity of the flake terminology in the manufacturing techniques, one will end up with a uniformity in form and hafting techniques. We could, by understanding the mechanics of flake removal, know how much finer factual knowledge is of the manufacturing techniques for classifying to classify the artifacts produced. For a consistent analysis, ~~that could be used by even~~ an electronic data computer, ~~which~~ we will at some day perhaps ~~we will~~ have to use, because ~~of~~ the amount of artifacts found up to date have probably been an infinitesimal part of the amount that were produced. ~~But of the erosion and covering with dust and silt and the soil, we have yet to have represented, if sufficient representative, groups of the artifacts.~~ We have yet to have represented groups of artifacts What we need are, ~~of course,~~ there general and a uniformity in ~~analysed~~ groups in order to determine the group of people. These little by little are showing ~~up~~ even in the last twenty years that ~~the~~ strives ~~have been made~~ made in ~~the way of~~ Archaeology have been tremendous. It is a new science, ~~that one might have the thought first of the~~ one that considers, first, the amount ~~that we find~~ of ~~their~~ finished

artifacts grouped for gen l appearance + uniformity analyzed in order

affected by erosion and covering by dust, silt + soil.

artifacts found, not their rejects, or those that's brought back into their habitation centers, or discards on many of the preforms that were never finished. They may have had flaws in the stone, or were discards, and from these discards in broken artifacts we have to determine the cultural levels. But in these same habitation sites there are many groups of flakes that were used in the manufacturing of these tools, but will show a different characteristic as to what type of tool was made and its uses. By analyzing these flakes, and there are very definite categories that they do fall in, one is going to determine the manufacturing techniques and also the ranges of the people and their facial and cultural techniques.

I would like to know start with flakes and later go on into the method typology or the manufacturing techniques. To get a uniformity of flakes I will call them all flakes, however, we have chips and spalls and fragments and many pieces of flint. But I feel that we should deal with flakes, they being portions of material detached by percussional, pressure, or both from a core or a larger piece of material that is flint. That original flake itself was a resultant flake. We have the problem of determining the difference of breaking by natural phenomena and detached

pieces of stone. The character of the detached pieces of stone or chips done by nature or by the elemnets are very different. Now we will go into the differences of these, but first I would like to outline how we may be able to get fragments of stone whether they are man-made or by nature. But these of the natural ways as a stone may be broken is by the elements of a natural expansion or contraction. Again with certain stones they have an internal pressure such as obsidians. They have an internal pressure of not being a balanced stone. Obsidian has a tendency to recrystallize. In this slow recrystallization process the stone is weakened and there are flakes exfoliated on the outside and leaves a form something like a core. If it is subject to heat sometimes these are similar to the heat fractures. In other natural expansion and contractions as according to freezing, some could even take part with disastrophism of the earth if it is a ledge type of formation of solidified clay and various types of flint in their forms which will go into the geology of flint and flint-like materials. You will have a fracture that some of this is blocking and it will break up in large cubes. The other is the Basalt group that you will

have those that go into a columner crystalline pattern where there is an expansion and contraction or a break away of one mass from the other by shrinkage. You will find that there is no bulb percussion, there are not the lines indicating force and pressure from a given point. ~~Now with~~ certain types of flint ~~they~~ are covered with an opaline, ~~some have~~ a higher water content than others have and in freezing there is this from the freezing, but when the flake is popped off its around a nuclei and has a center. It doesn't all chill and heat at the same time in order to cause this drastic contraction and expansion, but it does give an effect that is readily determinable by studying the type of flake that has been removed. The flake itself usually has a bulbar portion to it, a maternally effect with a nipple in the center. From one point of contraction and expansion will give a very different effect, ~~there~~ This is ~~are~~ a pressure or percussion type of a fracture.

The tides also from the waves striking rocks sometimes the stones are picked up and thrown one against the other. These will be on one angle. They will have a bruising effect on the outside and they are covered with moons. They will have the tendency to become like cobble rocks or

pebbles. The natural thing in a continual churning and abrasing action is to round all the corners. In the rounding of the corners when it becomes completely rounded then the stone will have to be either lifted up or else be struck by another stone in order to fracture. Usually when you have this type of a breakage it will be laying against another stone, not in a loose sand, and it will have a compression style of a breakage which is readily determined. Perhaps some of your very early ~~Evalists~~ eoliths may have been crushed, but if they had a usable flake they are usually right angled flakes and not sharp cutting edge flakes. They're somewhat similar to a Burin type of a flake. These are thick they're not a conchoidal fracture. They will be of the same angle if a stone is wedged and another stone strikes against it. The angle is going to be almost constant and it will not resemble an artifact. Even some of the early ~~Evalists~~ eoliths will be entirely different. If one had a series for studying of the flakes or the nodules themselves, it could be readily determined by studying your force lines and the direction of the forces in your striations and the undulations as to whether it was a man-made produced blow or whether it was from the tides. The same thing also is

in your waterways your alluvial gravels and in talus slopes inside of a mountain tumbling down why they can get battered and bruised, beaten and abraided. But for a repetition of flakes of more than two or three at the same place is certainly very unlikely. With tumble fractures one does have to concern themselves with whether they were a forest fire, range fire and prairie fires started by lightning, brush, etc. or of the natural things that could take place. Now there are stones that have been heated and you will find thermal fractures that haven't been done by man. You will also find accidentally overheated stones. Sometimes even artifacts that have been in the household fire ~~that~~ have been overheated and checked ~~that~~ will be entirely different from man's planned thermal treatment of flakes. So with passed types of natural things that can cause these breaks, they're very different than anything caused by man. I am trying to put the various flakes in their proper categories. This is just a rough draft of the different flakes and later I will try to describe the different methods of use of this particular flake. Each flake has a certain characteristic and these flakes will be separated into their proper categories and later showing

the utilization of these flakes from the simplist sort of a tool until the most complex.

First we have the micro flakes and then the small flakes, medium flakes and large flakes.

Now with the micro flakes we have those that will result from fine retouching such as the edges of scrapers for sharpening and fine retouching notching and ~~serating~~ serrating. It is unfortunate with fine retouching that normally one only has the proximal end of the flake because the distal end and the middles are usually broken. When the tool is retouched it is held in the palm of the hand supported on a piece of protective leather, bark or some media and as the flake is pushed off of the stone it's pressed down and followed through. In doing so, it has a tendency to shatter so those are seldom seen unless one used a very fine screen for their sifting in the sights. But the proximal ends will show a great deal of character. Also with your notching you will get very fine half moon types of flakes for certain types of notching. It is a direct pressure against the edge of the blade and as that is pressed inward and outward, this round half moon flake results. It is very

similar to a regular conchoidal fracture only it will have an indentation in the top that it conforms with the width of the notch itself. With serating the flakes, of course, will be a great deal similar because the notching and serating are very closely associated other than the crushing type of serating.

With the small blades those will be used for small tools. As they are removed from knives and small arrow points, and coming from a core in a repetition they will have formed and will indicate whether they were used as a thinning process in thinning an artifact bi-face or whether they were struck with a billet or struck with a stone. It will also indicate whether they were removed by pressure and the type of platform preparation.

Your medium flakes will be a little larger but will be in the same category.

Before we go to the large flakes I would like to mention about the different specialized flakes that one has. Under the specialized flakes those would be blades which they are still a flake, but since they have such definite characteristics they probably should have a separate classification.

But your blades such as your prismatic blades and some of the work done in Europe and regular blade cultures there was a special technique in the detaching of those. Some of your Central American prismatic obsidian blades, they had a special technique in removing those. There is a platform preparation with some of these but they are very distinct. They have parallel sides to them. Some are single dorsel ridges, that's the ridge that is used in guiding the flake. Some have the two ridges and there will be others that maybe even have three or four. The primary classic type of a blade is a straight parallel side with one, two or more ridges down the center.

The micro blades are thick little triangular pieces probably the usage or the function would be for drills or for small razors. Another very definite technique and these would be difficult to find as it would be almost as hard to locate some of your micro flakes that were used in fine retouching.

But your Burin blades are detached from the edge of a tabular piece of flint, a tabular flake, and these Burin blades have square sides with no ridges. In cross section of these Burin blades will be generally

rectangular because when they detach them they remove the surface on the edge of the flake splitting the flake from one of the leading edges producing a chissel point on the blade itself. These micro blades may carry entirely through or some of the techniques or the methods or characteristics used, or to use a hinge fracture; so, on the Burin itself (not the blade detached,) there shows a series of steps as these were removed. Now where that process has taken place the end character or the distel end of the Burin blade (not to be confused with the Burin flake) I will discuss ~~that~~ later on. These will show a definite character.

When we go into our large blades or with the small, medium and large blades we also have another demension that should be considered. This demension is for the short flake whether its small, medium or large should be a conchoidal flake so the length is equal to the width. A medium flake would be one ~~that~~ where the width would be equal to two times the length. A long flake the width would be equal to three times the length. And the extra long would be four times. So in using this category you can see that in your retouching, if you had a lot of the long ripple flakes carrying past the center and they were very close

together, it gives us a good relationship. Also we have thickness and with the thickness we have the thin and the normal. Under the thick ones we have a category there of a tabular type flake. Now these tabular flakes are the ones with there right angular sides. Now when these are removed from a block of stone or sections of cleaved flakes, or sections of pebbles, sections of cobbles, sections of nodules, those can be reworked and thinned to produce other artifacts. Some of these, of course, will go into the category of possible scrapers. Some types of scrapers I should say will come under this category. Sections of your cleaved flakes where they have a right angle or the flake has broken in the center can be flaked at one end to produce a Burin and, of course, Burin blades will be removed from these Burin flakes.

We also have a straight flake. No matter how straight it is there will always be probably the distel end. It will curve and it will always curve inward towards the nuclei or towards the core of the stone. Because this material ~~being~~ is semi-plastic ~~will~~ as it tears off the edge on the distel end it will always have a projection following back underneath ~~that~~ if the flake was entirely removed. Now if it was broken off

short to use as a thinning flake, it will have a hinge fracture or a rounded edge, which is readily seen. That also will go into one of the scraper type categories. Some of these will feather out and they will be sharp at the edge, but we will have the straight ones and we have a curved one strongly curved. A spiral is where the flake has been bent clear over a curved surface and creates a spiral type flake. Now these flakes all will have one dorsel ridge, two or more dorsel ridges, but not necessarily regular size.

In studying the flakes that have been removed from a core, ~~you~~ will find the proximal end or the end receiving the pressure will show a great deal of character regarding the manufacturing technique. The sizes of platform will indicate the size of area ~~that~~ where the hammerstone or the pressure tool contacts the stone. ~~And by the study of this,~~ Here you can see exactly the surface that contacted the tool used in removing the flake. Some of these the proximal end will all show the preparation before the flake was removed or it will show a prepared platform. There will be a character of the bulb of pressure or percussion. Each one will have a portion of a cone which is, of course, the bulb. There is a scar from percussion

that if its a direct downward percussion that scar will show on the flake right up near the bulb where it received pressure. Now with pressure there will be no scar because this tearing away from the mother piece of rock, or from the nodule, or from the core itself, it pulls away too fast and it will leave that scar that can only be done by percussion. Not all percussion, but if the blow is a direct downward blow and a very deep bulb of percussion you will find the scar. You will also have striations down the sides or rather pointing towards the apex of the blow in the direction of the blow. Those will be radiating from the blow. They will point as to the direction that the force was struck. They also have the angle of the platform to be considered. Whether it was removed from the side of the blade can be determined on there and particularly if a billet or a piece of hammerstone was used. Some of these will polished and some will be abraided. The polished have one purpose, that is, to give the point of impact or pressure strength. If it is abraided, it's so that it will be released similar to ground glass or scoring. As an example, scoring glass with a glass cutter will give you the same effect as abraiding. So if it is

an abraided surface, the flake can be detached and particularly this is used with a pressure technique and in detaching blades or the specialized flakes. Now looking at the character of the distel end of the flake, you will find that some of these are a feathered out edge that goes out to a razor edge all the way around or at least on one leading edge. It will be feathered out and it will be a good surfaceable cutting edge. Also you will find the hinge fracture was produced by a certain technique that will have at the distel end a round hinge as to where it hadn't carried entirely through and the flake you might say wasn't completed. You will have shock fractures that will give you right angles radiating fracture shocks that will not feather out, but they will be at right angles. And usually this will be in a discard group because from shock fractures the stone cannot be depended on. There are internal stresses and strains and is not particularly suitable to further on into tools. However, they can be used for Burins. The end character as the flake leaves the nodule or the core it will take along a certain portion of material so it will be much wider and thicker and heavier than the proximal end where the force was applied. These ends or chips are also used in one of the scraper characters. Certain groups of people pre-

ferred this type of an end for their scraper. Then we also have a thermal treatment of heated and unheated stones. With the heated stones it was a plan prepared probably in one of the household fires underneath sand or soil and heated until the moisture was driven out up to possibly 1000 to 1100 degrees temperature. This can be determined whether this heat method was used in order to produce a more glassy more easeable material, then a normal freshly quarried or untreated piece of stone with the flakes that were fired, (in order to determine) whether they have had this thermal treatment or whether they haven't. For a flake that has been shaped into an arrow point on the under side or on the concave side, there will usually be a facet where it hasn't been retouched. However, if the entire surface of the artifact has been retouched there is no way other than the lustre of the stone. It will resemble opal slightly or be a little closer to the obsidians type of a stone rather than granulite texture. However, you will find quite commonly that there is a portion of this facet on the under side or even on the dorsel side whether it's dorsel or ventral side, but I feel ~~always~~ that the curve side or the concave side of the artifact

will show whether it has been heated because a part of this will be as the original part of the stone before it was heated. After the flakes are taken off it will all be shiny, but if a portion wasn't entirely flaked it will ~~still~~ show the original texture of that stone with the cores. All flaked stone artifacts we might say would be cores if the surface of one or more sides are covered with flake scars. And the cores, of course, do produce flakes and blades.

There are several different types of cores. We have the symmetrical and the conical style of core. Of course, the symmetrical was like your Central American. Your Mexican obsidian industries used a symmetrical core. We have a rectangular core which is your Mississippi Valley and in Siberia some of your deme culture took some of these rectangular cores. They were also again reused possibly as a special type of a scraper or some special function such as a utilitarian function.

Then you have the uniface which is a turtle back and that is, of course, a little similar to your conical core but a flatter artifact. Then the bi-face is where they have been worped all over. Now some of the cores

are entirely utilized so we actually don't see the discards or the cores worp discard. The utilized cores and the flakes detached there from were used for flake tools and various flake tool artifacts. This prismatic flaking or the pressure type flaking was to produce a specialized flake. Your specialized flakes are readily desirable from your normal flakes. You might say the normal flakes were generally done by percussion and your specialized flakes were done by intermediate percussion or intermediate pressure or pressure alone. Materials do play an important part in the flint working techniques or industries of the primitives. The flint and flint-like materials,or that is your silica,forms your micro-crystalline quartzite. There are many different varieties and kinds of flint-like materials. A few of them are Chert, Chalcedony, Jasper, Agate, Petrified Wood, Agatized and Opalized Wood, Quartzite, Ryolites, Lava, Sandstone, Quartz, Crystal and Opal. Now these play an important part in the degree of skill that is shown in the finished artifact. It will be variable from the degree of crystallization. One might say that scale between the two would be the difference between opal and obsidian probably the finest textured of the group. Your

sandstone and quartzite would probably by the most coarse. The only one that doesn't hold true in the degree of workmanship that could be produced with a certain type of material are your crystalline forms such as Quartz Crystal and some of your big Pegmatite quartz. This does have a cleavage plane, there is a conchoidal fracture, but there is a very definite cleavage plane if the crystal has not been divided or the large flake for producing the artifact was taken off with the proper axis of the crystal. This shows a slight step plane in the fracture or the flake removed. With opal and obsidian they're are a very fine grain extremely glassy with very sharp edges. They will have an entirely different edge effect than will your the coarser materials, such as your sandstone, lava, and ryolite.

It's amazing how some of these ancient people were able to fabricate such beautiful tools out of even poor materials, so, therefore, they had greater skill in producing these fine artifacts from very coarse materials than some of the others that had the ideal materials such as obsidian or some of your finer chalcedonies. A heat treated chalcedony has a lot of strength and one has a lot of control. You can

compare obsidian and ignimbrite. Just Ignimbrite the edges will break down and won't stand the pressure. Apparently in the fusing of ~~your~~ volcanic tubes, ~~your~~ fine glass, and with ~~your~~ silica bearing waters, ignimbrite it is not as strong as ~~your~~ straight glassy obsidian. Therefore, if one applies pressure to the edge of an ~~ignimbrite~~ ignimbrite tool it has a tendency to crush before the flake is entirely detached. All of these materials have certain identifiable characteristics. To ancient man there meaning was a great deal different than it is to our mineralogists and geologists of today. Here we have a giant laboratory, the earth. When these minerals were formed it was like stirring up all different kinds of chemicals in association with the silica. And so we will have many variations. Now the variations can prove to our advantage by the proper analysis in the relation of using them for artifacts. The colors some will have a certain amount of more iron than others. There are ~~a lot of~~ different chemical forms and ~~they are so varied that~~ by the proper analysis ~~of these forms~~ certain quarries will ~~start in~~ being outstanding if the material is of some particular form or certain character. Not all of these materials can be traced to that particular quarry because there

is such a tremendous overlap that even your mineralogists will give you many different names for practically the same thing. You can have an agate like Jasper, Jasper-like agate. Opal varies on into the jaspers and the agates, and so to draw hard and fine lines between materials it would be difficult, but a lot of these the sources are quite evident if one has the jaw cliffs of where certain types of flint comes from. You will have limestones that show another type of Chert and flinting materials and your vesicles in the lava rock will have another. The obsidians are quite variable. You take the Mexico obsidian and you take the Glass Butte and Central Oregon type of materials it will be very different from Idaho. Each one apparently has a little different mineral analysis or the constituents that make up these particular minerals are variable. Yet they are characteristic to a certain geographical area where ~~they~~ certain chemicals and chemical salts were present during the formation of that mineral. By knowing the analysis of some of these materials that seem to have distinction, one might well determine geographical range of that material.

It might be one of the other niches in the story of man. Each man, in his search for materials that he could use for the production of artifacts, seems to have covered almost every area. In my search for materials to experiment in flint working, ~~I believe,~~ I have yet to find the site where prehistoric man hasn't been ~~there before me~~. He was able to find the best of the materials. He would leave the stones that would have inclusions and stresses and strains in them. Some of them had cavaties, crystal pockets, and cracks, others had certain cleavage plains. He was able to sort these materials out as he knew which would alter when subject ot heat treatment and in all he had a great deal of skill in his geological comprehension of where these materials were. Apparently, he knew just exactly where to look. They must have had trade routes to these various sources of materials as well, and a lot of trade was no doubt carried on with very desirable materials. These flint-like materials all have identical characteristics. One could assign this material as to origin, ~~and as~~ a breakdown of the types that would probably interest the archaeologists would be the type of stone and the source. The source would be quarries, cobbles, or veins, vesicles in lava rock and neumerous other occurrences. The

texture of the stone is also important, whether it is lustrous and granular and also the color. If these things are known, they may not be of a great deal of importance at the present time but in the future, I feel, that they will have importance in tracing perhaps the geographical area of the particular type of flint-like material.

We've discussed the flakes and the materials. Now the adaptation of these flakes that were removed from the artifact and the surface of the artifact will show the manufacturing techniques, or perhaps you could call it the method typology. We have three things of importance, that is, the surface the edges and the basil aspects. And with all artifacts, of course, we have the dorsel and the ventral sides. The dorsel, I feel, should be the highest ridge if it is not exactly a biface. If there is a flat side on there, the high ridge or the back bone would be the dorsel side. The flat side would be the underside of the artifact, such as with a uniface. Be readily discernible as to which was the dorsel and which was the ventral. The highest round edge or the convex side would be the dorsel and the flat side would be the ventral. Of course, if an artifact was flaked exactly the same on both sides, it would not be discernible between the

two surfaces. One of the sides is irregular or both of the sides are irregular. One can check the irregular flaking which would normally be random flaking. Sometimes even with pressure flaking it is random flaked. Random flaking is used, of course, for preforms and those have no regular control. While your regular flaking shows that they did use control whether it was percussion or pressure. They would be classified as two wide, medium and narrow. Those would be relative as to the length discussed previously under flakes. Some of them will be parallel, some will be a bleak some are double a bleak, that is, with both edge surfaces going through the central part of the artifact itself, slanting towards the basil portion of the artifact. Some are chipped from one edge only. By studying the flakes one can also determine the order that the flakes were removed because there is an overlaping. The size of the flake on your artifact will probably be only half the size of the flake that was actually removed, because there is the overlaping and they do have to have an overlaping if they are going to be a long flake or even a medium flake. They must have a ridge to guide the flake across the surface of the point or the artifact itself. These ridges must be previously established. If one gets a hinge fracture, then it is

difficult or impossible to carry a flake beyond the hinge fracture unless one goes to the other side of the artifact and meets the hinge fracture flake with another flake and removes it. There is just not the quantity of materials to stand the pressure to carry it beyond the hinge fracture. We also have the angle of the artifact, and how thick it is made. Then there are the thinning techniques that show up on these that are fairly flat. One can notice the hinge fractures and you can see the mistakes that they made and sometimes as to how they tried to eliminate the mistakes. Sometimes they were discarded because of hinge fractures. The ripples themselves or the ridges produced by the flakes are variable. Certain techniques will bring out a very sharp groove. Other techniques, the manner that it is held and the way the pressure is applied will eliminate the ripples. Some of this is done by the overlaping and some of it is where a constant ridge is followed and then another retouch after the first retouch was done. They will be able to eliminate some of the ripple or the ridges. These are the little grooves that carry from the edge to the center or over the top of the artifact. Then you can find others where they have purposely released the flake at the center and have picked it up on the other side that leaves a slight indentation at

the center of the artifact. There are indications of techniques used from the slight bulbs of pressure or percussion. If a neat bulb is taken off near the edge when the flake is detached, it will leave a hollowed out surface that will run all the way along the edge of the artifact and will produce a much sharper working edge.

Next are the edges themselves. The edges have so much character as for the function of the tool. By a study of the edge, one can see whether it was used as a knife or how it was broken in use, for instance, if it was a projectile point. In the grinding of the edges some of them are purposely made irregular and some are very regular. In the irregular ones you will find, sometimes, those were used for the manufacturing methods indicating percussion work. Also, the bulb removal alternating from one side to the other of the flakes is indicated in the edge. Some of them are very straight others have a piecrust, a sinuous effect, but are still regular. They may be sinuous, but they can still be a very regular flake and not in the irregular classification. Some have been left razor sharp. All of these indicate manufacturing techniques or usage. Some are dull where they have been abraided in order to produce a constant platform and where it discarded and was never finished.

Some were dulled from usage. With the alternating flakes, the stone was alternated from one side or inverted in the hand. One flake was taken off on one edge, that was turned over, and the flake was taken off of the other. That produces the sinuous effect. Some were ground, the grinding produced a ease of detachment of removing the flake because it was like the ground glass as previously described in the removal of flakes. The polished surfaces assisted in hafting, to keep from cutting the lashings that bound the artifacts to a handle or shaft, ~~and then again~~ also the polishing was used to withstand pressure, that is, it was used to where a great deal of pressure is required in order to carry a very long and narrow flake entirely across the artifact. It has considerably more strength on the polished surface that will withstand the pressure without crushing. If it is a very sharp edge and a pressure is applied, it will crush and shatter in underneath and produce a very sharp hinge fracture ~~which there is no way to remove~~ without reducing the size of the artifact. With the serations there are different manners in the way that the serations were made, of course, the depth that one has they can be very shallow and can be of a normal regularity and a normal depth. Some are spaced differently for they will be very small towards the distel end

of the artifact and gradually up towards the base of the artifact or the proximal end, in a regular manner. The manner of removal with these, some are crushed perhaps, a sharp edge of a piece of agate or flint is used just to press these in. That is indicated by the type of break that the fine little serations were done. Some of them were done just on one side. They went along with their small tool and pressed off these serations just from one side. Others would take one side out then they would turn the stone over and do the same thing. Then the other style is alternating these, similar to altering for the flaking that carried clear through. Some of these are serated as the tool was retouched, that is, a long narrow flake was taken off at the same time that they were serated. But these characters seem to follow in the type of hafting, and the group of people seem to have certain ways that they did their serations. But with this number of different types of serations, I am sure they would fall in various different categories that will add character to the point itself which may determine ~~some of the class~~ the category that the artifact may fall in. With the basil aspects, we have the thinning, fluting, and the hafting techniques, the grinding, the polishing and the manner that the barbs

were put on. With the hafting techniques or this notching, there are several ways that the notches were produced. Some will take it from either side of the notch then leave a platform in the center and take off one large flake in the center. This produces a distinctive edge inside of the notch itself. The others were made with just one single round concoitel flake from one side and the the other. Each time one of these is removed then the platform must be established in order to take off the other side, because one has to go beyond the center of the inside of the notch for the flake to be removed on the other side. And its by removing from one side and the other that the notch is carried on towards the center of the artifact itself. With the basil technique on here would be concave, convex, straight and recurved as well as the platform preparation for fluting. Some of these are ground, some of them are polished. All ~~of these~~ have their place in the typology of artifacts. By study of a flake assemblage from an unoccupational zone or a flint tool manufacturing site, one may classify the flakes to interpret the artifacts produced. The typology of the flakes have a

direct relation with the typology of method or manufacturing, and will assign in a sharper definition where before there has been an overlap of variations of forms and hafting techniques. When the flake form manufacturing methods are typed, one may arrive at functions with a greater degree of accuracy. Since the functions play an important part in typology, one can list the names common to all parts of the world then in certain continents. By using a common term for the main classifications, the present type of artifacts do follow definite similarity of manufacturing attributes.