Flint Knapping: Making Specific Point Types

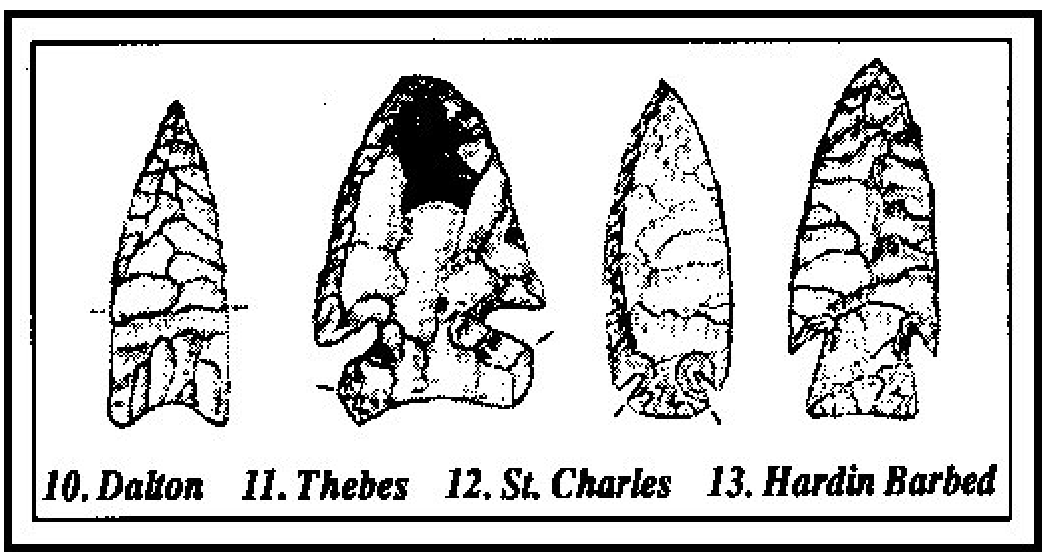


Image by Daniel K Higginbottom, from: http://www.tcinternet.net/users/cbailey/lithic1.html, copied with permission

Compiled/Edited by Michael Lynn

Photo of Tim Dillard teaching me at the
Center for American Archaeology in Kampsville, IL

Dedicated to all those who have taught someone else about the art of flint knapping, especially to my primary teachers – Bruce Boda, Tim Dillard, Mike McGrath and Steve Nissly. This is my attempt to pay forward.

Flint Knapping: Making Specific Point Types

Making the Adena

By Lucas W. Nicholson (aka goose)

Here is a new (not resharpened) Adena made from Knife River by Marty Reuter. I will state what I know about the style, but I'm sure many others know something about this point style as well and I encourage them to share that knowledge with us. After all, the ultimate goal here is to properly replicate to such a degree that the only thing being different from this point and one made in ancient times is age itself. We are not after a cookie-cutter shape, template or profile but rather the smaller details of which authenticators would look for, other than age to type the point correctly.

Fortunately for this type there doesn't really seem to be a whole lot to it. The included pics show an edge view for thickness variation, and a side view for pattern dissection. This was finished with antler raw but hammerstone was probably the tool of choice then followed with antler pressure. Just remove the deltas and high spots shaping as you go, making sure not to obliterate the percussion scars. Marty tells me about how they may have possibly used a skinny narrow hammerstone for the notch area which tends to be kind of steep and thick. Also, variants of this type will exist over a very wide region so something like shorter tails could be a correct variant, depending on region of course.

I would recommend working any available piece of rock to practice this point style with. Remember practice comes before mastery!

I think I'm going to use hammerstones for all percussion on raw Burlington or maybe Root Beer. I may finish it with antler pressure or maybe indirect punch.....not sure yet. I want to get the feel of some others' thoughts before I dive completely in.

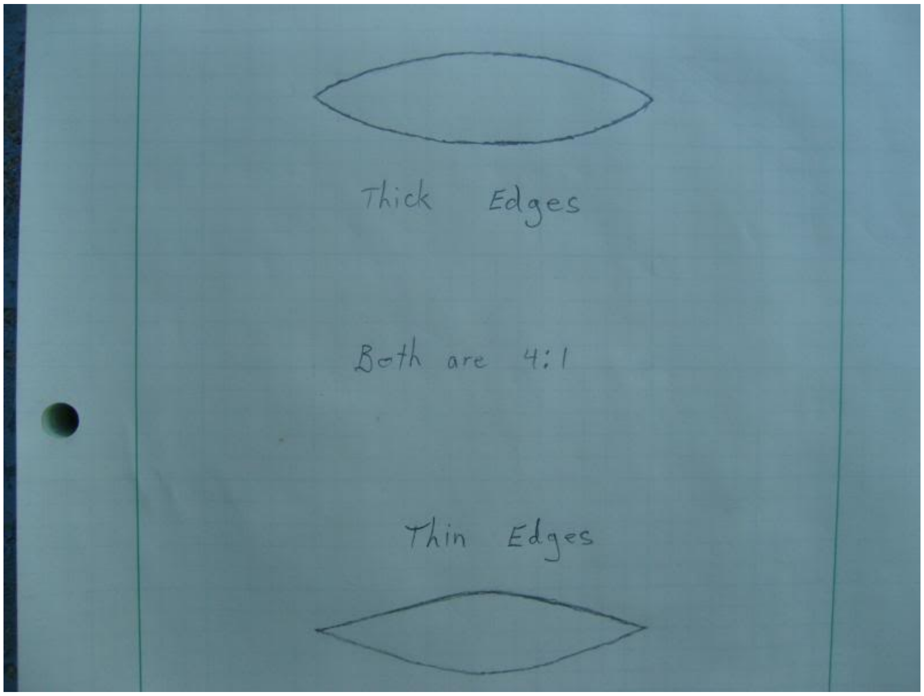
Of course copper will be the tool of choice for the modern knappers who participate and I hope they will!

Good Luck and post em up!

Obviously, as many have stated there are several different varieties of Adena's. I will add some things that have come to me after viewing several of the pictures posted.

A thinner edge is a better more efficient tool than a thick edge....just like any knife blade. I don't think everyone knows the difference though, so I've posted a pic of a drawing to try to show the difference. The real difference can be seen better with the point in the hand. Both cross sections have the same w/t ratio. The one with the thicker edge usually is created by over pressuring the piece after percussion. I think a lot of people including myself try to make the blade as symmetrical as possible after percussion so we pressure flake until it has perfect symmetry.......this is how the thick edge is created. Thin edges can be achieved by pressure but they have got to produce longer, more straight in flakes. When any flake is taken a bulb is produced, and the deepest part of the bulb will be the thinnest area of the edge. This is why so many originals have very little pressure flaking over percussion. Thin edges are what the old ones were after.

I didn't draw a pic showing the cross section from tip to base....I forgot. But it would show the thickest area for this point style to be just above the shoulders, which is typical for many point types. This only makes sense, because the hafting area should be thin for ease in hafting. The base ultimately would have a nice even taper to it. Also the base of the adena wouldn't be pressure flaked in, but percussioned in instead. Some of the small flakes that look like pressure aren't pressure at all. They could be little hammerstone flakes or punch flakes. Even the notch's/shoulders can be made correctly without pressure at all. That is not to say that at the very end a person couldn't use a little pressure to finish and refine the hafting area.....this would be okay too.



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Making an Agee Point

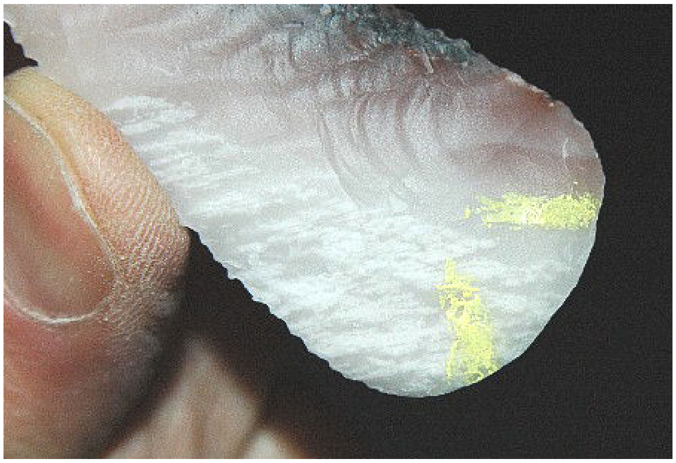
by Jim Miller

The Overstreet Indian Arrowheads Identification and Price Guide describes the Agee Point as "The finest, most exquisite arrow point made in the United States." This step-by-step tutorial demonstrates how to make one.

The first step is to make a relatively thin percussion preform (a sawed slab works fine too) in the general shape shown below. It is particularly important that the basal area be thin, for later notching. The preform below is made out of Arkansas novaculite and is about 2.2 inches long.

The next step is to thin the preform and develop a symmetrical teardrop shape with pressure flaking of both faces. After preparing a continuous platform all the way around the preform, I start at the base and run a series of flakes all the way around one side, ending again at the base. Then I shear the edge, switch to the other side, prepare a continuous pressure flaking platform, and repeat the same process. After the first pass of pressure flaking, the preform should look something like the one below.

The notches on Agee Points are relatively deep and narrow. It's best to do the notching before doing further edgework. I mark the intended notch locations on both sides of the preform with a pencil, so that I produce the notch symmetry that I'm trying to achieve.



Next, finish the notching. I use a copper-tipped pressure flaker with the copper filed flat, so that the copper can enter the notches without touching the sides of the notches. Notching is one of the two riskiest parts of making an Agee Point. Be sure to have a good platform set up for each successive notching flake, so that the flakes don't stall out or expand to remove part of the stem or ear.

After notching, make a second pass of pressure flaking on each side to shape the edges into the general outline of an Agee Point.

The final step is to take a third (or fourth, if necessary) pass of pressure flaking on both sides to produce the classic shape of an Agee Point. This is the second risky part of making an Agee Point. As the blade gets narrower, it's easy to snap it in half while pressure flaking. Be sure not to put too much downward pressure in the central portion of the narrow blade to reduce risk of breakage. The final product should look something like the point below.

This novaculite was translucent, producing a very dramatic point with backlighting…

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Making a Calf Creek

By Mike Tylzynski (aka Idaho Clovisman)

Well being new here not sure what all has been covered but i was thinking why not start a point type thread where we post not only pictures of the point type but also hints and tips for making the point type. So i am going to start off with one of my favorites lately the Calf Creek...What Little i know about making this point type I owe to Jim Redfern. He is a good teacher...

Ok the main thing is the preform has to be thin and the center line well established (this will come into play later when Notching..) the best way I have found to really get em thin 7 to 1 or up to 10 to 1 is do the base first taking flakes off just like a flute on a clovis .By holding the point against your leg and then striking off the flakes like flutes.1st flake from either corner towards the center then the other corner then last the center.(Make sure your center line is low to the side you are striking ,spanking any point on the rear end is dangerous). Then go around the point taking thinning flakes that go over half way accross (keeping the preform flat and thin) blending them into the flakes taken from the base.repeat on the other side untill you get as thin as you either dare or want. Then go all around the edge with a presure flaker straighting the edge preparing for notching.

Notching: to mark where the two notches will go take a ink pen and mark the center on the bottom of the preform making sure it is in alignment with the tip (look from tip to base in a straight line then mark the middle on the base at the edge). Then go half way from the center (the mark you just made) to the outside edge on each side and make a mark again on the base. So now you have three marks on the very bottom of the base one in the middle and one on each side in between the middle mark and the outside edge of the point these last two marks are where your notches will go. whatever way you prefer to notch then proceed and here is the hard part you MUST make sure before each notching flake that the platform is below CENTER LINE or you WILL break or split the piece.....do not worry about big C flakes take your time the object is to get deep and you are in no hurry if you get tired take a break. Good luck...

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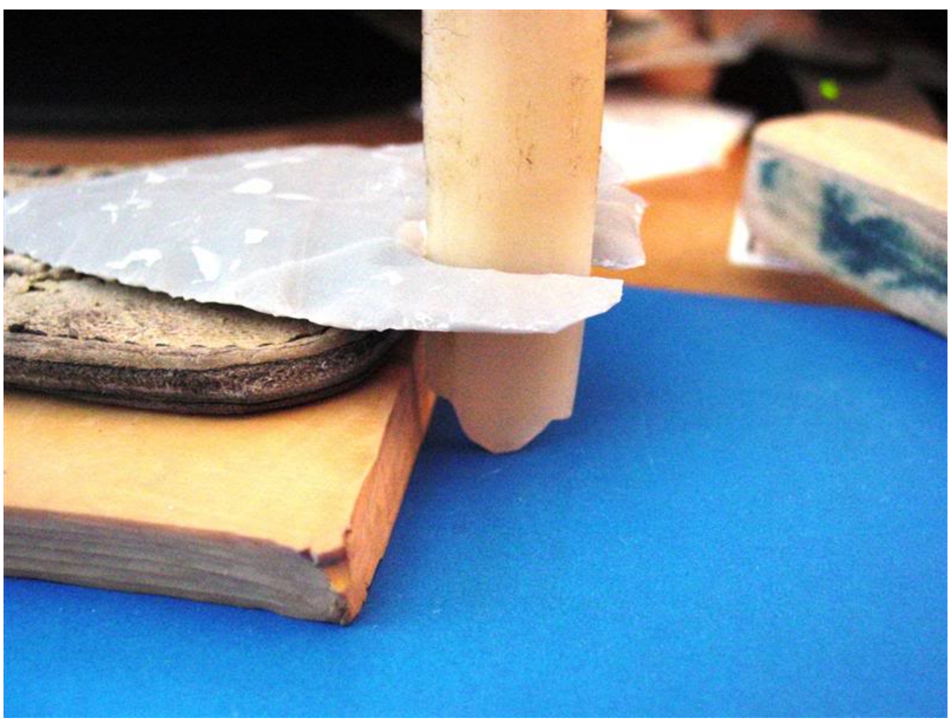
Well punching it is the way I feel they made these calf creeks. Jim Redfern and I looked at a collection of originals and they seemed to have been punched as well by the flake scar pattern . You can use a piece of bone or a copper nail in either case make one end screwdriver shape make sure you have a below center line platform lay the punch on the edge of the platform at a angle maybe a little over 45 to 60 degrees and tap it sharply with a hard wood mallet maybe 6 inches long by 1 inch wide you do not have to hit hard but you do have to hit sharply this will take out a c shaped cone I will try and make some pictures of doing this ...

Here ya go Marty...ok the first pic is of the tools I use the second is of the shape of the punch and the third is make sure that your punch goes through the notch to the pad underneath WITHOUT touching the sides of the notch...if you have questions ask it will be easier than me trying to explain how I do it ...Oh and the way the point is laying is the position I notch it in I lay my little finger on the tip of the point so my hand is resting on top of it and grasp the punch with my thumb and index finger..



Here is the angle if you are not sure...

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CLOVIS PROJECTILE POINT MANUFACTURE:

A PERSPECTIVE FROM THE READY/LINCOLN HILLS SITE, 11JY46, JERSEY COUNTY, ILLINOIS

By Juliet E. Morrow

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Introduction

While many lithic analyses have documented various aspects of Clovis lithic technology from a variety of archaeological contexts in widely scattered locations across North America (e.g., Bradley 1982, 1993; Green 1953; Young and Collins 1989; Collins 1990; Sanders 1990; Willig 1993), much of our current understanding of Clovis biface manufacture is based primarily on information derived from artifact caches from western North America (Frison 1991; Gramly 1993; Woods and Titmus 1985; Lahren and Bonnichsen 1974; Wilke, Flenniken, and Ozbun 1 994; Stanford and Jodry 1988). Some of these researchers have observed that Clovis knappers employed a highly distinctive biface reduction strategy. This being the case, Clovis lithic assemblages should be easily recognized wherever they occur. Defined technologically, the Clovis complex is represented in many localities across eastern North America. One of these localities is the Ready site, which contains an extensive early Paleoindian habitation/workshop component.

The large assemblage of Paleoindian chipped stone artifacts collected from the Ready site (1 1JY46) in Jersey County, Illinois, contains the full range of Clovis fluted biface manufacturing steps. As such, the assemblage allows one to document in detail the fluted point manufacturing sequence employed at the site. This study discusses the sequence of Clovis fluted biface production as interpreted from the Ready site assemblage. More detailed analyses of the Ready site assemblage are planned, and the present study should be seen as a preliminary view of the site.

The Ready site is perhaps better known to the professional archaeological community as the Lincoln Hills site. Although the site was recorded as the Scenic Hill site in 1958 by Patrick Munson (Illinois Site Files), archaeologists soon referred to it as the Lincoln Hills site, presumably based on its location within the Lincoln Hills physiographic area (see Howard 1988; Koldehoff

1983; Wiant and Winters 1991). The Lincoln Hills physiographic area is a section of the Ozark Plateau province that extends into Illinois along the Mississippi River (Willman et al. 1975). Herein the site is referred to simply as Ready in honor of Jesse Ready, who discovered the site and surface collected there for many years, and also because the site is best known locally as the Ready site.

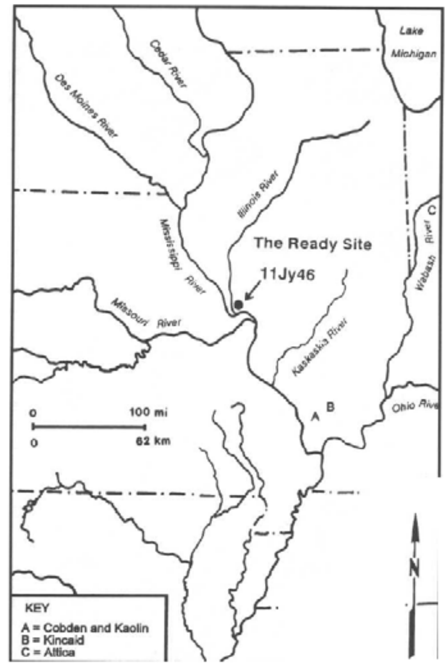

Fig. 1. Map showing the locations of the Ready site and selected exotic raw material sources.

The Ready site is situated atop a high upland plateau intersected by the headwater drainages of several small first-order streams north of Grafton, Illinois (Fig. 1). The site once covered at least 2 ha in area and exhibited dense concentrations of chipped stone flaking debris and rejected bifaces. Portions of the site have been disturbed by recent construction, but much of it remains as fallow cropland. To date, no formal geomorphological or archaeological testing has been conducted on the Ready site, but much information can be derived from artifacts recovered by various individuals over many years of surface collecting. Most notable among these surface collections is that of Jesse Ready.

Ready began surface collecting the site in the late 1960s. He continued to collect it for approximately ten years until the property was sold and he was denied access to the site. Ready's collection from the site (n=588 pieces) consists almost entirely of worked chipped stone artifacts. Aware of the significance of the site early on, he was careful to keep all the artifacts he had surface collected from the site separate from material recovered from other locations.

The Jesse Ready collection was studied by Howard Winters and Michael Wiant in the 1970s (Wiant and Winters 1991). All of the artifacts from the site in Ready's possession were labeled with sequential catalog numbers, and a general inventory of the collection was assembled in 1981 by Brad Koldehoff, who describes the site in his discussion (1983) of Paleoindian lithic raw material utilization in southwestern Illinois. Calvin Howard (1988) has also examined the Ready collection and published an article discussing the fluting technology, and Greg Perdun (1988) has written a brief description of the site accompanied by photographs of some of the artifacts in Ready's collection.

In order to collect data for my doctoral research on Paleoindian lithic technology, I visited Ready in 1992 to record detailed morphological and metric data on all of his artifacts from the site. In addition to most of the artifacts that had been previously listed on Koldehoff's inventory, there were many

artifacts that Ready had recovered since his collection was cataloged in 1981. These new specimens, as well as twenty-two specimens from the site in the collection of Greg Perdun, were also recorded. Thanks in large part to the efforts of Perdun, I examined four additional collections from the site and have included them in my data sample. A total of 694 artifacts from the Ready site in six individual collections have been recorded. These artifacts consist almost entirely of whole and fragmentary projectile points and bifaces in all stages of manufacture, as well as formal flake tools (e.g., end scrapers, side scrapers). Considered in their totality, these collections contain hundreds of Paleoindian artifacts. Also represented in these collections are a minority of artifacts (n=30 projectile points/knives) diagnostic of later prehistoric periods ranging from Early Archaic to Mississippian.
Based on typological comparison with western Clovis bifaces and bifacial preforms, the majority of artifacts recovered from the Ready site appears to relate to the Early Paleoindian period, ca. 11,200 to 10,900 B.P. (Tankersley and Morrow 1993; Morrow and Morrow 1993).

Lithic Raw Material Sources

Several chert-bearing bedrock formations of Mississippian age are exposed near the Ready site. The bluffs and dissected stream valleys located a short distance from the site cut through the Burlington limestone, a bedrock unit containing large nodules and thick beds of generally white to light gray or cream-colored chert with slight to moderate translucency (Meyers 1970; Willman et al. 1975). This chert varies in quality, but it can be, and often is, very finely textured and readily knappable. Residual or lag deposits of high-quality Burlington chert are particularly common in the headwaters of secondary drainages in the uplands of southern Jersey County.

Closer to the bluff bases and in the lower portions of the secondary side valleys, both the Fern Glen Formation (underlying the Burlington) and Chouteau Formation (underlying the Fern Glen) are exposed. While chert is available from both of these formations (Rubey 1952; Willman et al. 1975), it is generally less abundant and routinely occurs in smaller nodules than the chert in the Burlington. Fern Glen chert typically ranges from pale gray to greenish or pale bluish gray and is opaque to slightly translucent. The chert derived from the Chouteau formation is almost uniformly light to medium gray in color and opaque.

The Cape Aux Gres faulted flexure cuts across this area of western Illinois (Rubey 1952) a short distance south of the Ready site. Along the up-thrust side of this fault line, various Devonian and Silurian formations are exposed. These earlier Paleozoic formations generally contain little, if any, knappable chert. Within the down-thrust portions of the bedrock south of the fault, the St. Louis Formation is exposed, particularly in neighboring Madison County. Various forms of bedded and nodular chert are sporadically available from this forma tion. Sinkholes developed into the St. Louis limestone are widely scattered in the uplands of southern Jersey and southern Madison counties.

Lithic Raw Material Use

Since the artifacts collected from the Ready site were recovered exclusively from the surface, and because the site is clearly multicomponent, the following discussion of the lithic raw materials represented in the site assemblage makes particular reference to those specimens that are most unquestionably associated with the Pa leoindian use of the site: fluted points and fluted preforms. The majority of the 224 fluted bifaces recorded from the Ready site are manufacturing rejects. Finished fluted points are comparatively uncommon (Table 1).

TABLE 1

Raw Material Frequencies In the Fluted Bitace Assemblage at the Ready Site

Caregnry	Ravi, material*								
	BURL	ICBL	FNGN	CHOU	STLS	RINC,	ATCA	INDFT	Total
First flute removed	57	6	1	—	1	—	—	—	65
Lateral trimming, I	17	—	1	1	—	—	—	1	20
Second flute removal	50	2			—	—	—	--	52
Lateral trimming, 11	33	1	1	—	2	—	—	1	38
Finished Clovis points	13	3	1	—	—	1	1	1	20
Other fluted points	5	1	—	1	—	1	—	1	8
Reworked point tips	2	1	—	—	—	—	—	—	3
Indeterminate fluted bifaces	17	1	—	—	—	—	—	—	18
Total	*194*	*15*	*4*	*2*	*3*	*2*	*1*	*3*	*224*
Yercenrage	*86.9*	*6.7*	*1.8*	*0.9*	*1.3*	*0.9*	*0,4*	*1.3*	

*BURL = Burlington; ICBL = "ley Blue" (cf. Carbondale Formation); FNGN = Fern Glen; cttou = Chouteau; sTLs = St. Louis; KING = Kincaid; ATCA = Attica: INDET = Indeterminate.

Due to the proximity of the Ready site to residual or lag deposits of high-quality Burlington chert, it is not surprising that this material dominates the entire site assemblage. Considering only the fluted points and preforms from the site, some 86.5 percent are made of Burlington chert. An occasional fluted biface in the collection will exhibit traces of incidental (unintentional) exposure to heat but not one of these artifacts appears to have been intentionally heat treated. Judging from the large numbers of unfluted, but potentially Early Paleoindian stage 2 and 3 bifaces recovered from the site, all stages of point production are well represented in this local raw material.

The second most common lithic raw material in the Ready site assemblage is an unidentified moderately translucent, lustrous, medium gray to dark bluish gray chert with mottled brownish and/or grayish streaks and scattered micro-fossils. This "icy-blue" chert appears to be restricted to the Pal eoindian assemblage. It represents 6.7 percent of the fluted biface assemblage and also occurs in the form of unfluted stage 2 and 3 bifaces. This lithic material conforms closely to the range of manufacturing stages represented by Burlington chert and may have been derived from a local source area. The translucency, mottling, luster, and color of this unidentified chert is virtually identical to chert of the Carbondale Formation, also known as Blair or St. David chert (Brad Koldehoff, personal communication 1994). Outcrops of Carbondale Formation in closest proximity to the Ready site occur in eastern Jersey and southern Calhoun Counties, but whether or not these outcrops contain knappable chert is not yet known. The nearest known outcrops of the Carbondale Formation are located roughly 120 km to the south of the Ready site, in Randolph County, Illinois.

Fluted bifaces manufactured from other locally available cherts are present, but far less common, in the site assemblage. Chouteau, Fern Glen, and St. Louis chert are represented by a mere handful of specimens comprising only 4 percent of the assemblage. Like the Burlington and "icy-blue" cherts, these local and semi-local cherts occur in the form of both finished implements and manufacturing rejects.

Exotic lithic raw materials are even less common among the fluted bifaces. Two finished fluted points of Kincaid chert derived from source areas in southern Illinois and a single finished and heavily resharpened point of Attica chert from western Indiana are present in the assemblage (see Fig. 1).

Other exotic lithic raw materials are represented among the various flake tools recovered from the site, and these may also be related to the Paleoindian occupation. These include a unifacially retouched flake of Cobden chert from southern Illinois, a unifacially retouched flake of what may be St. Genevieve (cf. Munfordville or Kentucky Blue) chert from western Kentucky, and two end scrapers (and possibly two late-stage biface fragments) of Kaolin chert from southern Illinois. It is worth noting that all of these exotic raw materials occur predominantly in the form of finished lithic implements.

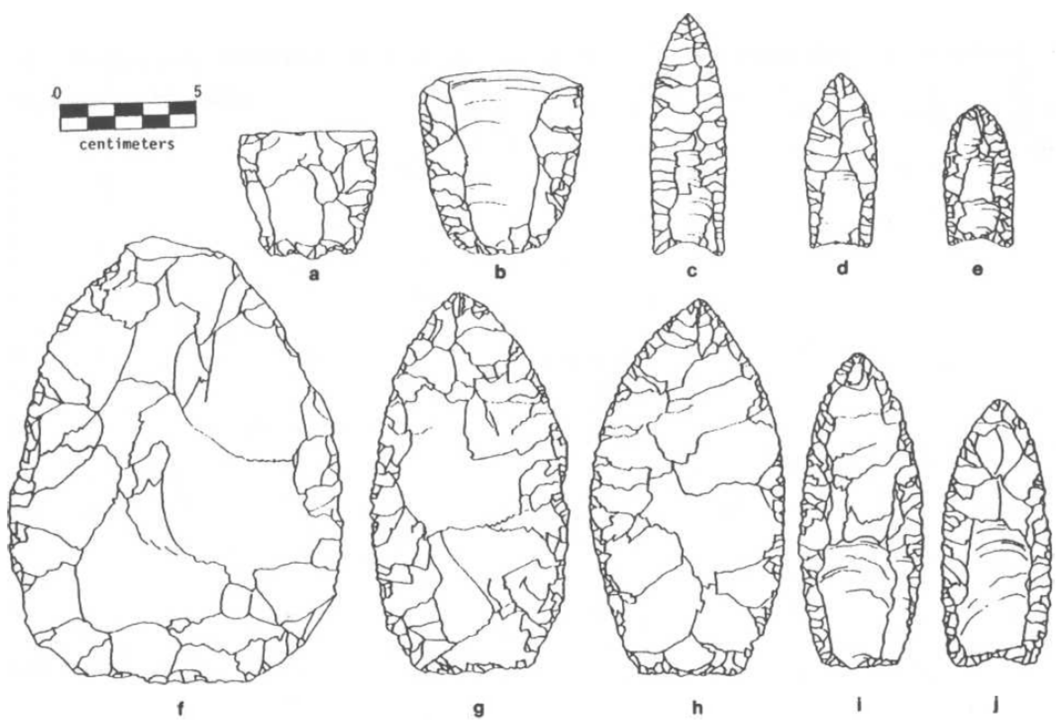

Fig. 2. Selected Paleoindian bifaces from the Ready site: a) stage 4 prefonn with striking platform prepared for first flute removal. end shocked; h) stage 4 preform overshot during the first flute removal: r, cl, el stage 5 finished fluted points; f) stage 2 biface; g, h] stage 3 preform. second flute removed.

Typology of the Ready Site Fluted Points

A total of twenty-eight finished/nearly finished fluted projectile points were recovered from the Ready site. Twenty of these fluted points conform closely to descriptions of the Clovis type (Haynes 1980; Howard 1990; Roosa 1955; Wormington 1957). These points exhibit slightly excurvate to parallel sides; slightly to moderately concave bases; and simple, multiple, or composite flutes that usually extend about one-fourth to one-half of the length of the point (Fig. 2c, d, e). All specimens are fluted on both faces, and half of these specimens exhibit slightly flaring basal ears. The lower portions of the lateral and basal edges are typically moderately to heavily ground. Unresharpened or minimally resharpened points in this group average 71 mm in length, 27 mm in width, and 7.8 mm in thickness.

The remaining eight finished or nearly finished fluted points exhibit various morphologies. One specimen exhibits a more deeply concave base and more markedly excurvate sides. One small, very thin point is fluted on one face nearly to the tip and exhibits very slightly flaring basal ears. This point resembles those described as Barnes points in the Great Lakes region (Dellar and Ellis 1988). A similar small, very thin point with much shorter flutes is also represented in the Ready site assemblage. Four of the remaining fluted points are very small (38 to 49 mm in length) with triangular to ovate outlines. In some typologies, these points might be interpreted as representing post-Clovis (e.g., Holcombe) use of the site (see Fitting et al. 1965; Dellar 1989). However, the presence of three reworked broken tips of finished fluted points (one with a fluting platform prepared on a newly refashioned basal edge) suggests an alternative interpretation (Fig. 3). I propose that at least some of these small and distinctively shaped fluted points may represent recycled Clovis point tips. This model for recycling broken tips could account for the small "Clovis Type 11" points excavated from Blackwater Draw Locality No. 1 (Nester 1972:97). The final remaining fluted point is also comparatively short (54 mm in length) and exhibits a steeply retouched basal edge with a single small flute removed from one face. This latter point may also represent a reworked point tip.

Fig. 3. Recycling and repair of broken Clovis points. Top: Distal end of original point repaired by fluting *base. Bottom.* Proximal end of original point repaired by removing flakes to form a new point

Fluted Point Manufacture at the Ready Site

The manufacture of fluted projectile points is a subject that has commanded a great deal of attention from both archaeologists and modern flintknappers. Various researchers have described the reduction sequence employed in making fluted Clovis points based both on archaeological assemblages and replication experiments (e.g., Bradley 1991; Callahan 1979; Roosa 1965; Sanders 1 990; Whitthoft 1952). Traditionally, fluting has been seen as one of the last steps in the manufacture of Clovis points (Callahan 1979:116, 164; Sanders 1 990:44). Several researchers assert that Clovis points were fluted from a "beveled" base without an isolated striking platform (e.g., Collins 1990; Roosa 1965). Although Howard (1988:396) states that there are several Ready site specimens that "apparently were fluted from beveled basal striking platforms," the channel flake scar attributes on these specimens indicate removal from a well isolated striking platform. Data generated from the Ready site assemblage offer an alternative model for Clovis fluted biface manufacture. The following description of this reduction sequence uses terminology comparable to the manufacturing stages established by Callahan (1979).

Stage 1: Tabular and Flake Blanks

The initial blanks selected for fluted point manufacture (stage 1) at the Ready site are not well represented in the surface collections examined for this study, since the collections consist almost entirely of modified specimens. However, based on remnants of the original blank surfaces present on several early-stage bifaces, both naturally occurring tabular spalis as well as flake blanks appear to have been used. Both of these reduction strategies were employed in order to accommodate the characteristics of the locally available Burlington chert, which occurs naturally in the form of flat spalls and large blocks.

Bifaces made on selected flake blanks are generally smaller and often required minimal percussion to reach the approximate shape and proportions of a stage 3 or even stage 4 biface. Flake blanks enable the flintknapper to skip many of the traditionally recognized "early stage" biface manufacturing steps. Using selective and localized soft hammer percussion thinning and trimming, most flake blanks can assume the size and shape of a point preform while retaining patches of the original flake blank surface.

Stage 2: Initial Edging and Trimming

Large, tabular spalls furnished the initial blanks for several of the large stage 2 bifaces in the assemblage. The first step toward reducing these large spalls into bifaces involved the removal of prominent ridges and humps. In concert with this, a roughly bifacial edge was established over all or most of the piece's periphery. Large patches of the original spall surface frequently remain on one or both sides of stage 2 bifaces from the Ready site. Based on flake scar characteristics and experimental replication, stage 2 biface reduction was probably accomplished using hard and perhaps some soft hammer percussion (T. Morrow 1992).

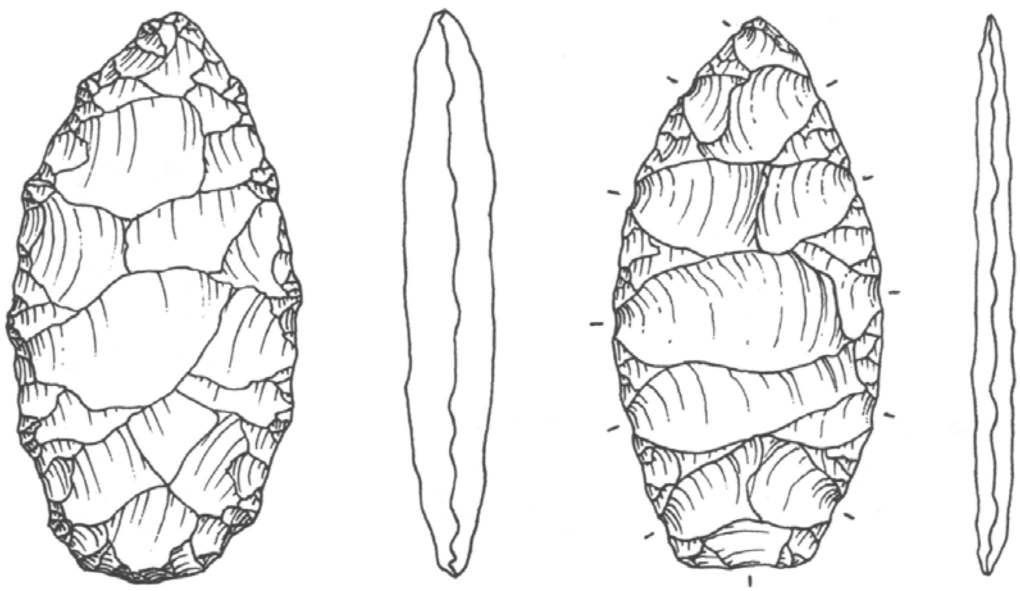

Fig. 4. Stage 3, primary thinning.

Stage 3: Primary Thinning and Shaping

It is during the primary thinning stage, stage 3, that the Clovis biface begins to take on its distinctive appearance. Following the initial edging and trimming, stage 2 bifaces were further reduced by the removal of deep, transverse percussion thinning flakes. This primary thinning produced large, fully flaked stage 3 bifacial blanks with a regularized cross-section and a roughly ovate outline (Fig. 2g, h). In some cases, the flake removals were on opposing faces from opposite edges, as seen on many Western Clovis bifaces (Bradley 1982, Frison 1991, Gramly 1993), and in others they appear to have been more random. This type of intensive biface thinning produces broad bifaces with flattened cross sections and a flaking pattern consisting of several very large, relatively widely spaced, long, deep flake scars. This biface thinning strategy is a hallmark of Clovis lithic technology and is perhaps no less diagnostic of Clovis lithic assemblages than the Clovis point itself.

The key to Clovis biface thinning lies in specially prepared striking platforms. Preparation of striking platforms was a critical step in the successful removal of biface thinning flakes. Isolation of the striking platform focuses the percussion blow precisely where the knapper chooses to remove a flake and channels the energy into a specific path behind the flake removal. Striking platforms may be oriented in both the vertical and horizontal dimension.

Placement of the striking platform in relation to the center plane of the biface determines the depth of the flake initiation and influences the subsequent length and mass of the flake removed (cf. Callahan 1979). Experimental replication indicates that the removal of large biface thinning flakes from an edge that lies near the center plane of the biface quite frequently results in lateral fracture (T. Morrow 1992).

According to Callahan (1979:34, table 1Ic), centered platforms are "ideal for primary thinning" because flakes struck off such platforms may travel to the center of the biface and there is less chance of breakage. Platforms "below center" are "ideal for secondary thinning" because flakes can span the entire width of the biface and there is minimal chance of breakage. It appears that Clovis knappers mitigated the risk of breakage that would normally have occurred through the use of center plane striking platforms by extensively isolating them in the horizontal dimension.

Clovis striking platforms are well isolated lobes that are positioned in the center plane of the biface and typically project at least 2 to 3 mm from the biface edge. These isolated lobes occur around the entire circumference of the biface at fairly widely spaced intervals and typically are aligned with prominent ridge crests located between previous flake removals. Good examples of these isolated platform lobes can be seen on the Badger Mountain fluted biface found near Fast Wenatchee, Washington (Gramly 1993:51), as well as some of the Richey cache fluted bifaces (Gramly 1993:27, 32, 33; see Johnson 1993). Soft hammer percussion flakes detached using this type of striking platform have deep, narrow initiations (Fig. 4) and often span a large portion of the width of the biface, sometimes terminating in an outre posse, wherein a portion of the opposite edge of the biface is also removed. Using this flaking technique, it is possible to greatly reduce the thickness of a biface with a minimum number of flake removals (T. Morrow 1992; Johnson 1993).

This biface thinning strategy is characteristic of large Clovis bifaces and large Clovis points recovered from the Anzick site (Lahren and Bonnichsen 1 974; Wilke, Flenniken, and Ozbun 1994) and in the Fenn (Frison 1991), Richey (Mehringer 1988; Gramly 1993), and Simon (Butler 1963; Woods and Titmus 1985) caches. Refitted flakes from the Sheaman site in Wyoming also demonstrate this technique (Bradley 1982).

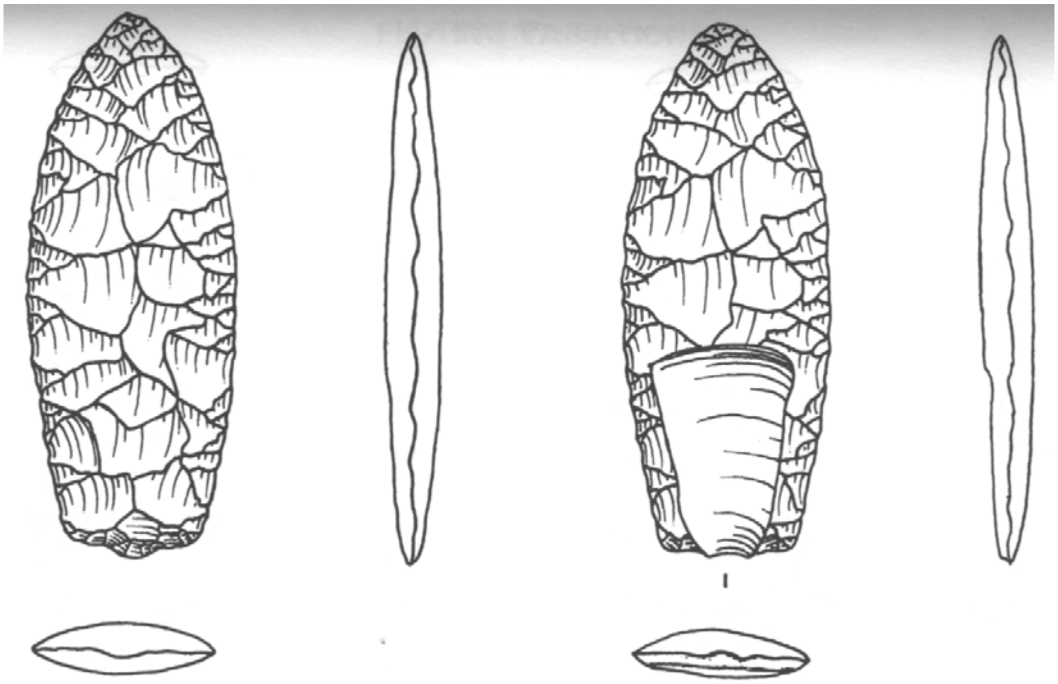

Fig. 5. Stage 4, first flute removed.

Stage 4: Secondary Shaping and Fluting

Following the primary thinning step, stage 3 bifaces were trimmed and shaped into fairly regular stage 4 preforms with a distinctive rowboat-shaped outline (Fig. 2i, j). The relatively flat crass-section produced by the deep, transverse percussion thinning during stage 3 was modified by marginal lateral percussion trimming. This was necessary in order to obtain a more lenticular or biconvex cross-section. A convex surface is preferable to a flat surface for suc cessful flute removal. Selectively trimmed and shaped bifaces made from flake blanks often already exhibit the general shape and proportions of stage 4 preforms.

It is at this stage that the reduction sequence indicated by the Ready assemblage diverges from the traditional view of Clovis point manufacture (e.g., Callahan 1979). Rather than leave the relatively risky step of fluting to the final stage of point production, Clovis knappers at the Ready site prepared these still-thick and comparatively large stage 4 preforms directly for the removal of channel flakes. Stage 4 preforms prepared for the removal of the first flute in the Ready assemblage have a distinctive shape and size. The flaking pattern is such that many of the traces of deep transverse percussion thinning have been removed by subsequent lateral percussion. The base is generally markedly to moderately convex. Stage 4 preforms are on average 30 percent longer, 40 percent wider, and 25 percent thicker than the finished fluted point. At the timing of the first flute removal, stage 4 bifaces made of Burlington chert average 103 mm in length, 43 mm in width, and 10.7 mm in thickness (Fig. 5). Those manufactured of other lithic raw material, such as unidentified "icy-blue" chert or Fern Glen chert average somewhat smaller in size, probably reflecting the generally smaller size of pieces of stone available.

Striking platforms prepared for the first flute removal are intact on ten spec imens from the Ready site (Fig. 2a). These platforms are isolated lobes placed at or near the center of the typically convex basal edge, and they are morpho logically similar to the platforms prepared for removal of deep transverse lat eral thinning flakes. The flute scars exhibit the same deep, narrow initiation characteristic of the transverse thinning flake scars. The initiation paints of virtually all flute scars present on the Ready site fluted preforms indicate their removal from well-isolated platforms placed at or near the biface center plane.

A Clovis preform base, broken by overshot during the first flute removal, is among the relatively small assemblage of artifacts excavated from the Kimmswick site (23JE354) in east central Missouri (Graham et al. 1981; Hajic et al. 1989). The Kimmswick fluted Clovis preform is virtually identical to dozens that have been collected from the surface of the Ready site.

Fluting was most likely accomplished by soft hammer percussion (T. Morrow 1992). Extant fluting platforms on the Ready site preforms are lightly to moderately ground. The convexity of the basal edge along with the well-isolated fluting platform would have facilitated the use of direct percussion. Flutes removed from these large preforms are large and bald. Flutes exceeding 50 mm in length and 30 mm in width are not uncommon on the fluted preforms from the Ready site. Flute scars often expand rapidly from their initiation at the isolated platform and in many cases "roll in" and terminate in a step or hinge fracture. These deep flute terminations can create a structural weak spot in the body of the biface. These weak spots were often eliminated prior to the fluting of the second face and this was most often accomplished by the removal of one or more lateral thinning flakes. Bradley (1993:254) considers this lateral removal of a step or hinge fracture at the end of a flute scar to be "a diagnostic trait of High Plains Clovis point manufacture."

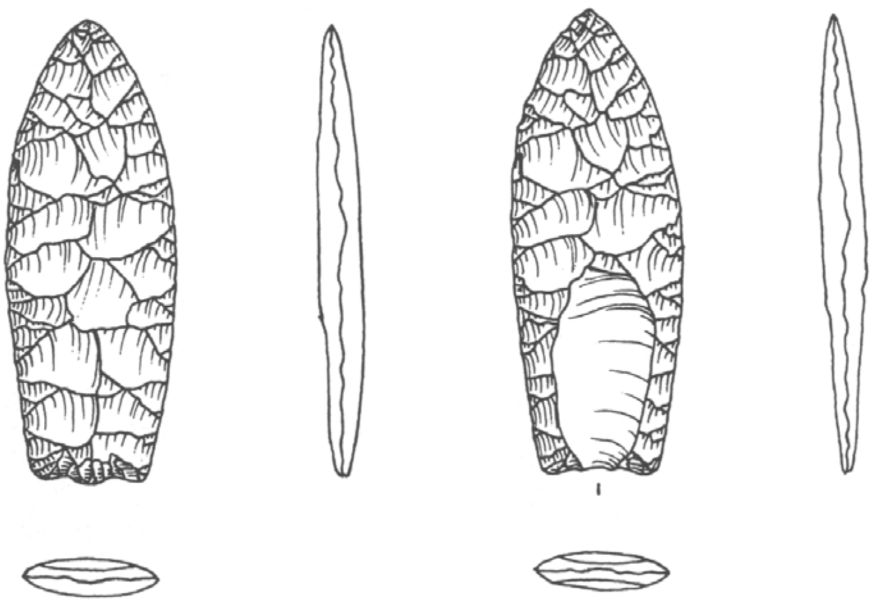

Fig. 6. Stage 4, second flute removed.

After the first flute was successfully removed, further basal and lateral flaking was undertaken. Striking platforms prepared for the second flute removal from the opposite face are intact on three specimens from the Ready site. These platforms are similar to those prepared for the first flute removal, but there is a tendency for the basal edge to be straighter or even slightly concave. As a result of the basal and lateral flaking that followed the first flute removal, by the time the stage 4 preforms were prepared for removal of the second flute they were slightly smaller (Fig. 6). At this position in the reduction sequence, Burlington chert specimens average about 95 mm in length, 38 mm in width, and 8.9 mm in thickness.

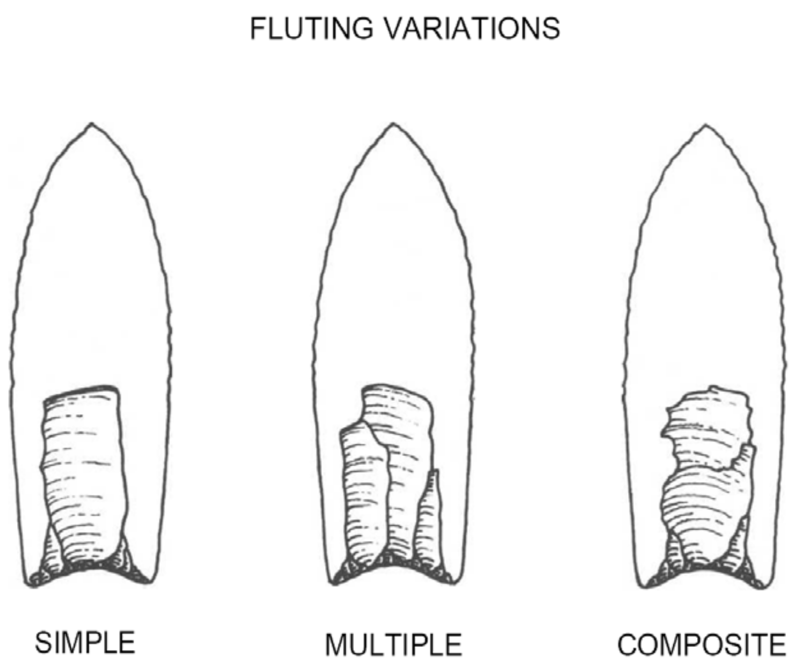

Fig. 7. Fluting variations typical of Clovis and related fluted point forms.

Stage 5: Final Thinning and Shaping

With the second flute successfully removed, the final stage 5 thinning and shaping was conducted. During this stage, the entire periphery of the preform was reflaked by light soft hammer percussion producing a thinner, finely tapered point. This series of flake removals was carefully executed so as to leave the major portions of the flute scars intact while bringing the rest of the body of the point to the approximate thickness of the finished form, In most cases, whole edge, rather than isolated, platforms appear to have been used during Stage 5 thinning and shaping. Some specimens at this stage, however, do exhibit flake scar initiations indicative of well-isolated platforms. Most of the finished fluted points from Ready exhibit simple flutes, but in cases where stage 4 fluting had not sufficiently thinned and tapered the haft element of the biface, one or both of the faces were re fluted. Re fluting or "secondary fluting"

may have been accomplished by indirect percussion since the basal edge of the biface, at this stage, is moderately concave. Secondary flute scars are small in comparison to the flutes typically removed during stage 4. The fact that there are no examples in the Ready assemblage of preforms broken during sec ondary fluting suggests that there is a low risk for breakage during this step. A substantial portion of the initial flute scar usually remains intact ahead of the secondary flute and typically the two scars blend smoothly together, giving the appearance of a single channel scar. I refer to this fluting variation as "com posite fluting" to differentiate it from multiple fluting, in which two or more flutes have been removed side by side (Fig. 7). Multiple flutes are present on a minority of finished fluted points from the Ready site. Similar to "the Barnes finishing technique" described by Roosa (1965:92), composite flutes also occur on a number of Western Clovis bifaces (Frison 1991: fig. 2.34, Haury et al. 1959:17; Mallouf 1989;fig. 11; Titmus and Woods 1993:fig. 3a.; Woods and Titmus 1985 -fig, 6c, d).

Stage 6: Edge Retouch and Haft Grinding

The final steps in manufacturing the fluted biface included pressure retouch along all of the biface edges and the grinding of the haft element. Pressure flaking was employed to straighten both lateral and basal edges. In most cases, pressure flaking was restricted to retouching the edge and reducing the height of crests remaining from former percussion flake removals. Most of the finished Clovis points from the Ready site exhibit moderate to heavy grinding of the basal edges and the lower portions of the lateral blade edges adjacent to the flutes.

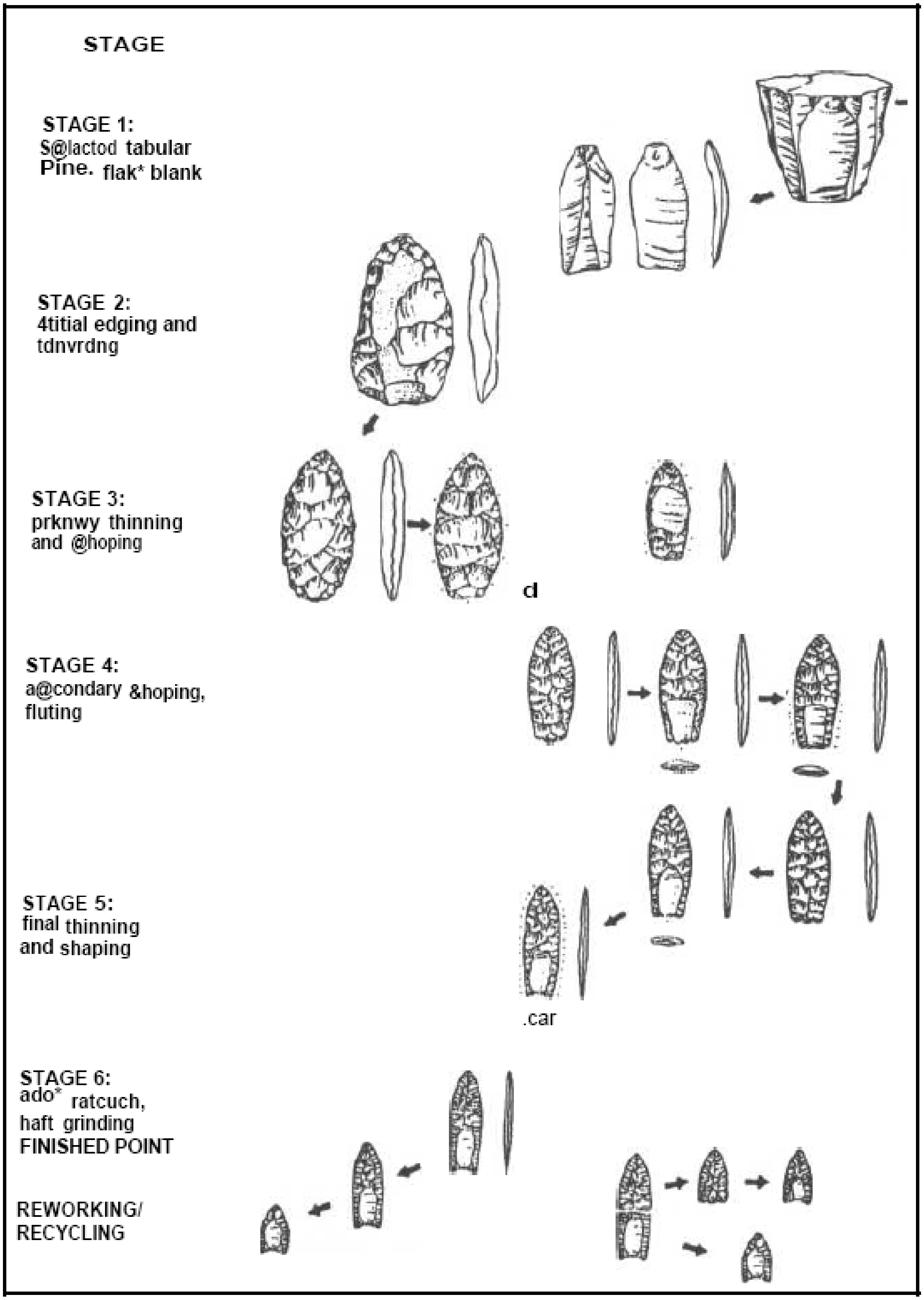

Fig. 8. Fluted point manufacturing sequenee model based on the Ready site, I I JY4fi.

Conclusions

In summary, many of the characteristic biface reduction strategies employed by Clovis knappers across the western United States are well represented in the Paleoindian assemblage from the Ready site. These strategies include the preparation of well-isolated striking platforms, maximum biface thinning with a minimum number of flake removals, fluting from a well-isolated striking platform (as opposed to a beveled base), and post-fluting lateral trimming and shaping. Significantly, Ready is not the only site east of the Mississippi River that exhibits technological hallmarks of the Clovis complex. On purely technological grounds. the Clovis complex is widely represented in many parts of eastern North America. Sites that have yielded fluted points and fluted preforms analogous to those from the Ready site include Adams (Sanders 1990) and Ledford/Roeder (Tankersley 1989) in Kentucky, Welling (Prufer and Wright 1970; Tankersley 1989) in Ohio, Wells Creek (Dragoo 1973) and Carson-Conn-Short (Booster and Norton 1993) in Tennessee.

In light of this observation, Roosa's (1965) statement that there are few if any true Clovis points cast of the Mississippi River was premature. Roosa and others who have followed his lead are correct in identifying other styles of fluted points from eastern North America that are indeed distinct from Clovis (e.g., Gainey, games, Holcombe, Cumberland, etc.). However, the widespread distribution of the distinctive hallmarks of Clovis chipped stone technology east of the Mississippi River suggests that the early Paleoindian occupation of much of this region is closely related, culturally and chronologically, with that of western North America.

The sequencing and specific aspects of Clovis point manufacture have been interpreted in a variety of ways (e.g., Callahan 1979; Roosa 1965; Sanders 1 990; Howard 1988). The fluted point manufacturing sequence represented at the Ready site provides an alternative model of Clovis point manufacture (Fig. 8). Paleoindian knappers at the Ready site adapted their reduction strategy to cope with the everpresent uncertainties involved in fluted point production. Rather than removing flutes from preforms that were nearly finished, fluting was accomplished at a more intermediate stage in the reduction sequence. This practice effectively reduced the amount of time invested in a preform prior to potential breakage during fluting. As well, since the flutes were being removed from preforms that were substantially wider and thicker than the finished product, breakage resulting from the fluting process was probably also reduced.

The quantity of artifacts representing all stages of biface manufacture recovered from the Ready site indicates that the procurement and processing of chert resources was a major focus of Paleoindian activity on this site. Hundreds of stage 2 and 3 bifaces and biface fragments are present in the surface collections examined for this study. The majority of these bifaces probably relate to the

Paleoindian use of the site based on their size, proportions, and flaking pattern. Through further analysis and by comparison with excavated Early, Middle, and Late Paleoindian assemblages, it may be possible to isolate artifacts related to the Early Paleoindian component from those of later components. Until this more intensive study is completed, any interpretations of the early stages of Paleoindian biface manufacture are tentative.

The fluted point preforms at the Ready site also provide some insights into the organization of Early Paleoindian lithic technology. Although at present we cannot determine the number of early-stage biface blanks that were manufactured by Paleoindians at the Ready site for transport and reduction elsewhere, the abundance of late-stage fluted preforms at the site clearly indicates that fluted projectile points, and probably many of them, were being manufactured directly at this quarry/workshop site. This observation would suggest that one of the major products being transported away from the Ready site was finished fluted points.

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Crowfield Points

by Michael McGrath

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Crowfield points are a lower great lakes Paleo phenomena whose distribution is from Ontario, Canada down into Pennsylvania, throughout the eastern great lakes regions and sparsely into Ohio. Probable Crowfields may even have been found as far east as at the Reagan site in Vermont. Many call the Crowfield point our Northeastern equivalent to the Folsom point, but there are many differences that make the Crowfield point a distinct projectile of its own.

Crowfields range from 40-65 mm in length (1 ¾ inches – 2 ½ inches approx.), 22-35 mm in maximum width (1 inch – 1 ½ inches approx.), 3-5 mm think (less than ¼ inch – a little over ¼ inch approx.), with a basal width of 13-23 mm (1/2 inch – a little less than an inch approx.). This all approximates to a pentagonal type shape and an extremely thin point (Fig. 1, Type Site Crowfield cast profile). Oh and did I mention that these babies have multiple flutes! The average Crowfield is 54 mm long (approx. 2 ¼ inches), 30.8 mm wide (approx. 1 ½ inches), 4.6 mm thick (approx. ¼ inch), with a basal width of 17.9 mm (approx. a little less than ¾ of an inch). A proper Crowfield should also have needle like ears, shallow basal concavity, and a flat biconvex to plano convex cross section. The multiple flutes (2 -3 per side) should extend ½ - ¾ of the length of the point. Around the base and ears, there should also be short, abrupt retouch flakes similar to a Folsom point and parallel to the retouch flakes on the opposite basal side. Basal grinding is usually moderate to heavy. Most Crowfield points were made from Onondaga Chert, with some others being made of Collingwood (Fossil Hill Formation), Upper Mercer chert, Kettle point chert, and southern most ones being made from Pennsylvania Jasper on rare occasions.

Figure 1

Crowfield points are very rare finds, and are a very valuable artifact. The type site for Crowfields was the Crowfield site that is located just west of London, Ontario, Canada. This site was excavated by professional Canadian archaeologist Chris Ellis, and avocational archaeologist D. Brian Deller between 1981 and 1982. This site produced some 4,500 fractured artifact fragments, much of which was in a cache uncovered during the exploration. A lot of work went into matching up those fragments to produce 182 + Crowfield era artifacts with a few mostly whole and assembled Crowfield points (Fig. 2 & 3 cast from type site).


Figure 2


Figure 3

Another site in Canada that had a heavy Paleo Crowfield showing was the Bolton Site. Ellis and Deller also excavated this site during the summer of 1990. The Bolton Site lies southwest of Strathroy, Ontario. Some Crowfields and Crowfield performs were recovered there along with 28 channel flakes (flutes).

To make a proper Crowfield point, the modern knapper should start with a nice flat spall of Onondaga Chert. The spall should be quite thin to start, and light percussion work should be carried out with opposing flakes taken from each side until you have a reasonably thin and convex piece. From the shoulder of the piece toward the tip, it's important to send your flakes from the tip at an angle into the piece instead of parallel or opposing each other. This is important because it thins the tip and allows the flute to a thin area to terminate without taking the tip off should your flute run that far. If your preform is already really thin, these angular flakes can be removed with a pressure flaker. This method was stumbled upon by Dan Long after studying many of the originals. Dan also work the piece from the shoulders toward the base with opposing flakes to build a median ridge with which to flute. When I do this percussion work, I often produce the usual tear drop piece or perform and turn it so that the "tip" is the base and the "base" is the tip of the Crowfield. The method is probably not in line with the ancient ones, but it works for me as you can see in figure 4. These reproductions represent my best attempts to produce Crowfields.


Figure 4

Now that the “easy” work is done it’s time to flute! Fluting can be done with a jig or by percussion. I’ve used a jig and found it difficult to pop off multiple flutes with any success due to the thinness of the Crowfield preform. Canadian knapper Dan Long uses a fluting jig with great success (Fig. 5). He first removes a central flute or main flute and then removes secondary flutes on either side by utilizing the outer ridges left by the central or main flute. Each knapper should try multiple ways of fluting to see what works best for them. Three strategies can be employed to flute a Crowfield: The first being Dan’s way as described above, the second one involves preparing two or even three fluting nipples on the same side and removing them starting with the two outside nipples and then finishing with the center one or a knapper could simply prepare a fluting nipple on each side like is normally done on a Folsom or Clovis point and see what results you get from there and then go after secondary flutes if the knapper is so inclined. I favor the multiple fluting nipple method when I make them using direct percussion with my ¼ inch copper bopper. If you think “Oh gosh, I’m fluting this thing” it will psych you out, so I just “pretend” I’m taking a basal thinning flake and hit the fluting nipple platform in that manner. I’ve found my direct percussion fluting is more successful by thinking “basal thinning flake” than setting up the big dramatic flute.



Figure 5

If per chance your Crowfield has survived the multiple flutes, now it’s time to finish up the base with those abrupt Folsom like pressure flakes to make needle like ears and to clean up the piece over all. Basal grinding should be moderate to heavy when finishing the base. Don’t over pressure flake the tip and the blade. I usually finish up the tip with a little pentagonal edge jutting out like some of the originals had, but certainly your basic pentagonal shape is also acceptable and that’s how Dan Long makes his.

I’m not an expert at knapping Crowfields, but I’ve had some success with this difficult point type. I made a break through when I started looking at many pictures of Crowfields and noticed that most were not perfectly multiply fluted on both sides. Most were fluted great on one side with some fluting on the other. Another impediment for me was the Chautauqua Crowfield point cast (See Val’s illustration) from Pete Bostrom’s Lithic Casting Lab website. At 3 mm thick, it was at the extreme end of thinness with the average being 4.6 mm. It’s length was 73 mm (approx. 2 ¾ inches) which was also way beyond the average Crowfield length. The Chautauqua Crowfield was also well fluted with one flute extending nearly to the tip!. I thought this cast was the norm until research revealed that it pushes the limits on just about all Crowfield characteristics. Even the Chautauqua knapper had a hard time getting flutes to come off the second side due to the thinness of the piece. Realizing that the Chautauqua Crowfield was the holy grail of Crowfields really freed me to just go for it and be happy with what I had in the end like most ancient Crowfield knappers probably did. The results are that I set to making my Crowfields thinking like a Paleo hunter. I want my base to be extremely thin and will flute only the amount of times necessary to accomplish that. For some Crowfields I make, I wind up with two flutes on one side and short basal flutes on the other side. Or, sometimes it's one good flute on one side with 2 shorter flutes on the other. I think you get the picture here. For more research on Crowfields, you can look up the below web links:

http.//anthropology.uwaca/cje/Crowfield.htm

www.ssc.uwo.ca/assoc/oas/points/crow.html

If you want a challenge, try a Crowfield. It's an under knapped point type that I'd like to see some of our master knappers attempt. So, what do you say Jim Redfearn, D.C. Waldorf, Dan Theus?

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Personal Communications with Dan Long, 2010

Photos of Casts and some points from Dan Long, 2010

Decaturs: How to do the Base

By Curtis Smith

I was able to get a couple Decaturs made today. I got some pics of doing the base for those that were asking.

First you notch the base slightly.

Then I hold the point in one hand upright on my pressure flaking pad and use the other hand with the pressure flake to push the burin flake off the base.

And here's the result.

Then I finish up the pressure flaking on the blade and other fine tuning. And this is what I ended up with.

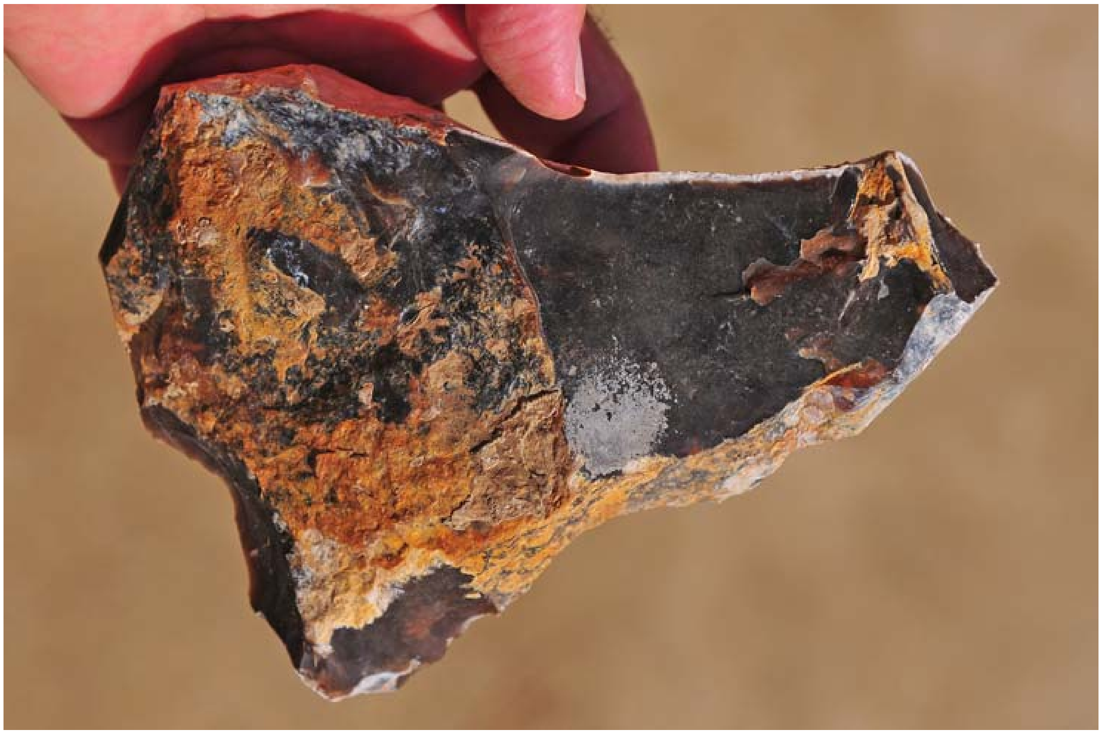
from: http://paleoplanet69529.yuku.com/topic/37527, accessed 10-21-10, copied with permission

Making an Eden

By Woody Blackwell (aka knife river flint)

Okay, guys. Here are a bunch of pics taken the last day or three. I'm not supposed to be doing any heavy pressure flaking for another 10 days or so (some torn muscles), but once I get this stuff on my mind -- well, you guys know how addictive silica is. 🙂The material is a tab of raw KRF in a somewhat challenging shape. I tried to get a classic Eden out of it -- one with a diamond cross section, good median ridge, and pressure flakes that slightly overlapped.

This is the raw tab. The challenge was to quickly reduce the thickness at the wide end and to maintain as much width as possible at the narrow end.



After some percussion work, some minor plates and potlids turned loose but didn't cause any problems. It's not the best piece of KRF, but it's not bad. I'd give it an 8 out of 10.

Some of the square edges were tricky to work around, in part because of the softer cortex which absorbed percussion strikes. I didn't want to zig-zag (might lose too much width), so I went with isolated platforms prepared with pressure flaking. Other platforms were also isolated, but prepared with percussion nibbling.

The thick, blocky areas are mostly gone, but now have to start making the preform's longitudinal cross section as smooth as possible. More to come!

More percussion done and the lengthwise-cross section is looking pretty fair. All the platforms were isolated with pressure. If I'd been thinking, I would have grabbed a couple photos of platforms ready to be hit. Sorry -- it didn't occur to me at the time.

You might be able to see that I'm adding more pressure work. I'm running a few flakes up the ridges beween percussion scars to start smooth the side-to-side contours. As the contours become more regular, then the flakes become longer. I don't want them to hit the centerline, though, as I'm trying to protect that lengthwise contour. It goes like that for about three passes on each face, pulling the sides in, chasing a nice silhouette, and building up to a nice diamond cross-section. It sounds like a real juggling act, but these tasks are all complementary and fit together nicely.

For a while, it's kinda free-form knapping -- a little pressure here, a little percussion there -- but always with the goal of making all the contours as smooth as possible. Can't have high spots, low spots, steps or hinges. It's GOT to be clean! But now the real pressure flaking begins. Still refining the contours, dodging/removing low spots, and trying to lay the groundwork for a nice pattern.

Here's the cross-section so far. Not bad. It's a little thick, but the last pass on each face will clip the top of the median ridge and reduce the thickness.

The next few shots are close-ups of the edge prep. I'm using a copper-tipped Ishi stick and I build a continuous platform. To make each flake look just like the one that came before, then the edge (and contours!) has to be as smooth and clean as possible. I spend a lot of time on edge prep, taking tiny flakes off both face of the preform to get the thickness and angles just right. Then the platform grinding: I use a fine abrader that won't eat up the edge with rough chattering. It's the same mantra that's been used in every step: make it clean, smooth, and consistent.

A copper-tipped flaker is not correct for Edens, I know. Someday I'd like to do this with abo tools. We're moving to Colorado Springs next summer and I'm sure Bob Patten (who lives just up the road) will be a big influence on my choice of tools.

After three go-rounds of that, it's time for the final pass. The emphasis is on angles: the angle you hold the preform (don't let it move!!!), the angle the pressure flaker engages the edge (how deep are the flakes?), and the angle of the Ishi stick (pushing vs popping while controlling the direction of each flake) As with everything else on this point type, it's consistency that matters.

But remember, this is now the final pass. You've been working for hours to get here, fussing over every flake. Now if there's one flake out of place, it will show. A little burin on the copper tip might cause a short flake. Or a double flake. Or crush the edge. Push in too much and you might clip off the median ridge. Back off a little and you won't even make it to the ridge. Let the preform rotate in your hand and the flake won't match the others. Let the flake terminate against your pad and it'll end in an ugly fingernail step. Don't set the copper tip too deep, but don't set it too shallow. Get the spacing right, or you won't get overlapping flakes with the little "turns." And don't forget, this is all going on Paleo Planet... No pressure. 🙂

See the stepped flake on the lower edge? You probably heard me groan. Now it's time for the final edge retouch. Nibble the stem into the lower edges. Raise the basal edge toward one face, grind it lightly, and take four or five pressure flakes that angle across the stem. If done right, they will form a little triangle in the hafting area. The longest flakes will be the last one or two. Reverse that little process for the other side of the hafting area. Grind the stem and basal edges and you're finished. It's not the best I've ever made, but it's not bad. It'll do just fine for now. And at least I'm done.

From http://paleoplanet69529.yuku.com/topic/47549/Question-for-Woody, accessed 11/3/2011, copied with permission

Miscellaneous Related Posts on Flaking and Eden
from http://paleoplanet69529.yuku.com/topic/32821/Eden-pressure-flaking-question?page=2

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The terminations of final eden pressure flaking often do not terminate right at the middle, but just before it on the nicest ones. It can look deceiving. I think the trick for these is to have pretty rigid support so that the angle and pressure of every flake is the same. Overlap of the flakes seems to be about half or better on the finishing sets as well, in this manner you can throw the flakes a bit diagonally but they appear to be straight because the bottom of the subsequent flakes tearing pattern. I think it's important to work in series in bevel fashion, meaning don't do one side, then the other but bevel fashion. The thickness of the body, like most cody comlex stuff maintains pretty thick to an anvil near the tip then tapers fairly abruptly to the tip. They are really narrow points. Problem I have is building them too wide and ending up with too thin a cross section because my early pressure sets go too far and I also have a problem with my anvil system making the taper to the tip generally too gradually and thinning the tip too much. It's hard to hold them w/out a block when they get really narrow. Takes a good hard bone to do the last 2 edges w/out lipping or turning the edges too much from brushing the deltas of the 1st 2 sets which can ruin the effect of the 1st 2 sets. Things are difficult. I haven't ever made one that was anywhere as good as the nicest ones. Bob has made some really nice ones, and Greg Nunn has a picture one in his replica points on his website. He might be able to help you also if you email him.

- Marty Reuder (aka Just a Flake)

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There are a few different flavors of Edens. The ones from the Horner site are beautifully made but use a "skip a flake" pattern. A bit hard to explain, but the pressure flakes are not sequential. The Edens most of us are familiar with are the parallel sided jobbers with sequentially pressure work, with the flakes slightly overlapping to create a dogleg effect. And then there are the Edens with a wavy edge, where the deltas from one face are used as the platforms for the opposite face. Firstviews are closely related to Edens, but a little wider and thicker. The flakes appear to be more closely spaced, but that may be because they are longer (I haven't sat down to measure them -- something I need to do!).

(This is my third edit of this post!) Something Bob Patten told me years ago really applies here: a well-made Eden (or First View) will balance perfectly on the median ridge. It's cool to watch one rock back and forth and then settle down on that clean ridge.

I start with the cleanest preform I can percuss and then endure several rounds of pressure flaking on each face. Slotted pad. Two slots actually -- one near the pad's end for the tip and base sections. One thing I've found is that if the points sides are actually parallel the point will look like it contracts toward the base. If it expands by a mm or two, it will look "right."

Last tip: pay close attention to the bases of old ones. Four or five flakes angle forward from the basal edge create a thinning triangle. Pretty cool little feature.

Here are some from about four or five months ago. Raw KRF. The two on the left are more in the First View family.

- Woody Blackwell (aka knife river flint)

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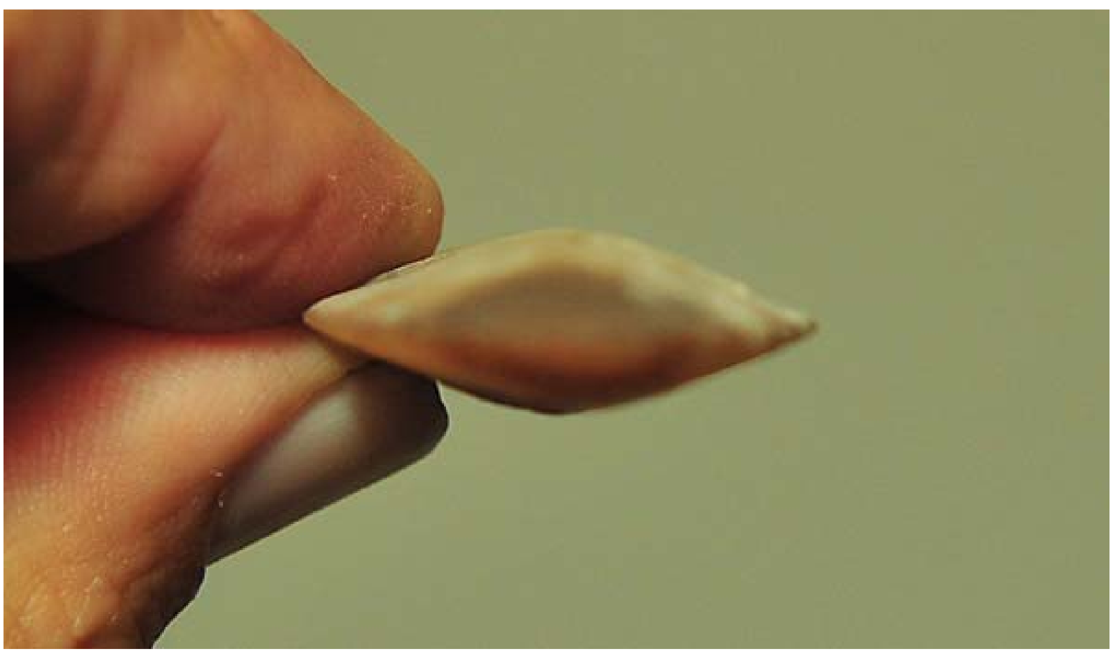
Here are some pics of casts of three Edens and one Firstview. They're great old pieces from the collections of Bert Mountain, Perry Anderson, and Virgil Russell. The points are from Colorado and Wyoming. The point on the left is a Firstview made of Alibates and found in the Texas panhandle. I think these are the style that most of the folks on the thread are discussing. Diamond-shaped cross section and strong median ridge.



- Woody Blackwell (aka knife river flint)

FOLSOM POINT MANUFACTURE

by Tony Baker

revised 8/14/98

This document discusses and displays the process of Folsom point manufacture. This is a rewrite of a document that was first conceived and written in March, 1996. The same artifacts used in the first edition have been retained here, but their images have been greatly improved. Additionally, this rewrite contains considerably more text than the original.

The manufacturing process of a Folsom point is in reality the sum of a number of smaller processes termed "stages". In the book *FOLSOM TOOLS AND TECHNOLOGY at the Hanson Site, Wyoming* by George C. Frison and Bruce A. Bradley, eleven different stages of manufacture were identified. Some of these stages are well represented in the archaeological record while others are absent. Based on the stages that are represented it is possible to infer the other stages and understand how the point was made. These eleven stages are:

1. Blank.
2. Initial shaping & thinning.
3. Pressure shaping & thinning.
4. Specialized pressure shaping & thinning of one face (Face A).
5. Channel platform preparation (Face A).
6. Channel flake removal (Face A).
7. Pressure shaping & thinning of second face (Face B).
8. Channel platform preparation (Face B).
9. Channel flake removal (Face B).
10. Post fluting retouch.
11. Margin polishing

These stages do not represent equal amounts of effort or time. For example, Stage 6 and Stage 9 are one flake removals while Stages 4 & 7 require the removal of many flakes. As a result, a failure during a many-flake-removal stage can occur at the beginning, middle or end of the stage. However, failure can only occur during the removal of the channel flake in Stages 6 or 9. A failure means the artifact was abandoned and left for the archaeologist to find.

Although Stages 6 and 9 have a duration of only an instance in time, these are the two Stages that are the most common in the archaeological record. Apparently mistakes in the other stages could be worked around and a successful outcome was still possible. A mistake in Stage 6 or 9 was generally fatal.

Another factor affecting the number of the artifacts from the various stages in the archaeological record is the ability of the archaeologist to recognize an artifact from a given stage. To emphasize this point, I do not have any artifacts that I can say, with certainty, represent any of the first five (5) stages. Remnants of failures from these stages could have been utilized in other tools or they may look so similar to other artifacts and I can't recognize them.

I use the nomenclature of "Face A" and "Face B" to denote a particular face. Face A is the face from which the first channel flake is removed. Face B is the face from which the second is removed. All images in this document have been created in chronological order. The artifact face on the right, next to the scale, is always the most recent face to have been worked by the knapper. In the images of channel flakes the ventral face is on the right, next to the scale.

The quality of the images varies from artifact to artifact. This is primarily a function of the material. When it is difficult to see the chipping pattern on the real artifact, it is even more difficult to photograph the pattern. In creating the images in this document, I often sacrificed the color of the material, by using two different color light sources, to display the chipping pattern.

Finally, all artifacts were found in camp sites (manufacturing sites), in contrast to hunting sites. All images are of authentic artifacts and there are no plastic casts depicted. The number of images in the following stages somewhat parallels the number of artifacts in the various stages in the archaeological record. As stated above, I do not have any artifacts from the first five (5) stages.

Stage 6--Channel Flake Removal (Face A)

Stage 6 artifacts represent failures during the removal of the first channel flake. Most of the time this failure was the result of the channel flake plunging (diving) into the preform before it had traveled an acceptable length. This plunging breaks the preform into two or more pieces. A plunging flake is also termed a "reverse hinge flake" or an "outrepassé flake". Based on the work of Dr. Andrew Pelcin[1], I believe this type of failure was the result of the channel flake having too much energy and was forced to plunge into the preform to expend the additional energy. Occasionally, a channel flake did not have enough energy to traverse the preform much less plunge into it. The result was a flute that was too short and/or narrow. This low energy failure is rare in the archaeological record because the preform was probably reworked and a second attempt at fluting Face A was made.

Another characteristic of Stage 6 is the lack of work on Face B. In the archaeological record Face B was only crudely prepared or not worked at all at the time Face A was fluted. Stage 6 was very difficult and had a high risk of failure. This difficulty is evident in the archaeological record by the fact Stage 6 artifacts are the second most abundant[2] . I have watched many modern replicators (knappers) and Stages 6 and 9 are where their failures occur. As a result of Stage 6 being a high failure event, the Folsom knapper spent the minimum effort getting to Stage 6. This lack of preparation of Face B prior to fluting Face A is one of the concepts misunderstood by most of the modern replicators. Most replicators prepare both faces for fluting prior to fluting Face A.

In summary, Stage 6 failures are characterized by evidence of a fluting attempt on Face A and minimal work on Face B. There are two other minor characteristics which will be developed below.

http://www.ele.net/stg_6_1.jpgThis artifact, a proximal fragment of a preform, is a classic Stage 6 failure. The channel flake has plunged into the body of the preform and broke it too short to be utilized (right image). Also, note how the flute has cut into the smaller collateral flake scars which are a product of Stage 4 (Specialized pressure shaping & thinning)[3]. Collateral flakes scars cut perpendicular by the flute is a classical appearance of a Folsom preform.

Face B's workmanship (left image) was minimal biface thinning. Note how irregular it is. Another characteristic of Stage 6, apparent on this artifact but not mentioned in the above general discussion, is the platform preparation (Stage 5). Note, the proximal edge in the left image is shiny. This is caused by the light reflecting off of the beveled edge that is part of the platform preparation for the removal of Face A's channel flake. In the Stage 8 failures, the bevel was reversed but the channel flake has not yet been removed from Face B.

http://www.ele.net/stg_6_2.jpgThis artifact is the distal fragment (tip) of a preform. Note, the termination of the channel flake scar on the bottom of the right image. If the reader's viewer is good, one can also see the collateral flake scars from Stage 4 on this same face. In the left image there are no collateral flakes scars indicating that Stage 7 has not been performed. Therefore, this distal fragment was created during Stage 6. It is possible that the missing proximal portion of the preform was long enough that the knapper was able to continue to make the point. Whether this occurred or not, this distal fragment was discarded during Stage 6.

My father use to refer to these distal fragments as "snapped tips". He believed the knapper purposely snapped them off the preform after it had been fluted on both sides. After watching numerous modern replicators, attempting to make Folsom points, I am convinced these usually came off naturally during the fluting stages. If they did not, I believe the knapper just worked them away during the post fluting retouch (Stage 10).

http://www.ele.net/stg_6_3.jpgThis artifact is made from obsidian[4]. It is two pieces that fit together and represents a split proximal fragment. Face A (right image) is extremely informative because it demonstrates how the channel flake plunged into the preform and broke it into several pieces. In this example, the preform was not only terminated too soon, it was split during the fluting process[5]. The collateral flake scars are also very evident on the right side of the right image.

Face B (left image) is virtually flat. It is the remnant of a large biface thinning flake. This is an extreme example of the minimal work on Face B before fluting Face A.

http://www.ele.net/stg_6_4.jpg**Yes, I know the artifact is upside-down in this image**[6]. Ignoring this, many would argue that this obsidian artifact is not a proximal fragment of a Folsom preform. However, I believe it is. It has all the characteristics: **1)** Face A's channel flake did plunge into the preform although it looks like it died near the edge (right image), **2)** there is collateral flaking on Face A, **3)** there is minimal work on Face B (left edge), and **4)** the proximal edge (top edge) of Face B is beveled in order to create a platform to remove the channel flake. Any artifact that can exhibit these four characteristics is most certainly a Folsom preform that was destroyed during Stage 6.

Additional Information

[1] Pelcin, Andrew

> 1996 Controlled Experiments in the Production of Flake Attributes. Ph.D. Dissertation, Department of Anthropology, University of Pennsylvania, Philadelphia, Pennsylvania.

[2] Stage 9 are the most abundant, representing about 50% of the failures in the archaeological record. Stage 6 failures account for about 45%.

[3] Stages 4 and 7 (Specialized pressure shaping & thinning of the face) had the purpose of creating a ridge down the longitudinal axis of the preform's face. As all knappers know, "flakes follow ridges" and these two stages created the ridges for the channel flakes to follow.

[4] A number of years ago, it was believed that the Folsom people did not make points from obsidian. I don't know where this concept came from, but it was totally wrong. In New Mexico, where obsidian is abundant, the Folsom people often used it.

[5] Split preforms are a common failure mode in the archaeological record. They occur during the fluting stages and obviously result in a failure.

[6] I left this image upside-down on purpose. During my formative years of holding and viewing artifacts, I learned to view projectiles with the tip (distal end) down. To this day, I still am most comfortable with the tip down. I know this is against convention, so I must concentrate when I make pictures of points. Occasionally, I will inadvertently make a mistake as I have done here

and have to redo the image. I chose not to correct this one so I could write what I am writing here. I am sure someone else, out there, is plagued with the same upside-down syndrome and I wanted to let them know they are not alone.

Stage 7--Pressure Shaping & Thinning of Second Face (Face B)

At the successful completion of Stage 6, the preform had been fluted on Face A (bottom in the image) and Face B (top) was usually a flat or irregular surface. Stage 7 had the purpose of creating a ridge on Face B for the second channel flake to follow when it was removed. This was accomplished with controlled pressure flaking which removed small flakes from Face B. These flakes originated at the lateral edges and terminated in the center of the face. During the process, Face B became convex and the preform became thinner and narrower[1].

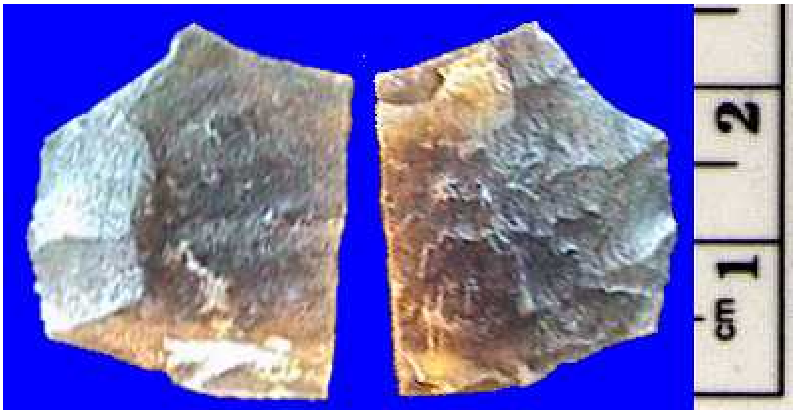
The cross-section labeled "Stage 7" in the image attempts to depict the preform at the end of that Stage. The solid line on Face B represents the top of the ridges between the pressure flake scars. The dotted line represents the bottom of the pressure flakes scars. The difference between the two lines was the thickness of the pressure flakes. Near the preform's lateral edges the pressure flakes were thick because of the "bulb of force". As they approach the center of the Face they thinned out. The cross-section defined by the dotted line depicts a ridge on Face B and this was the ridge the channel flake was designed to follow when it was removed[2].

Stage 7 and Stage 4 were identical processes except they were applied to different faces. Stage 7 artifacts represent about 5% of the failures in the archaeological record and I have no Stage 4 artifacts. This lack of artifacts from these two Stages suggests that they were easily accomplished and/or had a low risk of failure.

Stage 7 artifacts are characterized as preforms with a single flute on Face A and some evidence of pressure flake shaping on Face B. Stage 7 artifacts retain the remnants of the platform that was created and used to remove the channel flake from Face A . In different words, the bevel created in Stage 5 on the proximal edge of the preform is still present on Stage 7 artifacts.

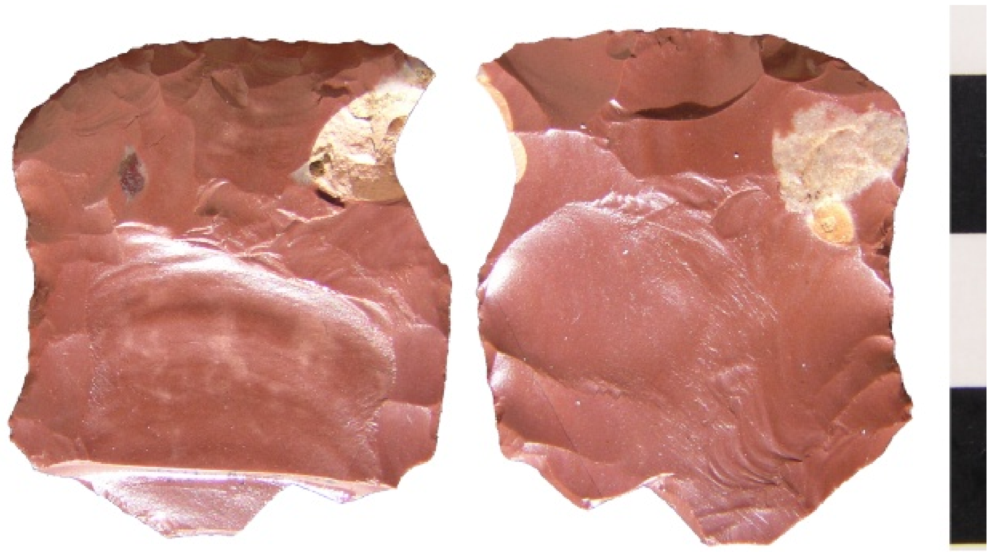
http://www.ele.net/stg_7_1.jpgThis artifact, a proximal fragment of a preform, is a classic Stage 7 failure. The channel flake has been removed from Face A (left image) and the pressure flake shaping is visible on Face B (right image). Failure occurred while performing the pressure flaking. The presence of this pressure flake shaping permits one to assume that the Face A channel flake was successfully removed to the satisfaction of the Folsom knapper. The bevel in the basal concavity (difficult to see in this image) was prepared for the removal of the Face A channel flake. This is proof that this was not a failure during Stage 8--Channel platform preparation (Face B).

http://www.ele.net/stg_7_2.jpgThis is another proximal fragment. Face A (left image) was successfully fluted because the pressure flake shaping of Face B (right image) had been initiated. It had not progressed as far as in the first image before failure. Note, the remnants of the original percussion work (Stage 3) in the lower right corner (right image). One can see the beginnings of the pressure flake shaping in the scar coming in from the middle of the right edge (right image). This meets one from the left side in the center that was almost lost with the failure. Finally, the proximal edge (right image) is still beveled from removing the Face A channel flake.



http://www.ele.net/stg_7_3.jpgThis is a split, midsection fragment. The image is not the best, but I have included it to allow me to discuss if this artifact belongs to Stage 7 or not. Face A (left image) had been successfully fluted (Stage 6). I know this because there is pressure flake shaping on Face B (right image). Additionally, the pressure flake shaping appears to be complete over the entire artifact. So did this artifact failure during Stage 7 (pressure flake shaping) or during a subsequent stage? Since the proximal edge is not present I cannot determine if the platform for channel flake B's removal was prepared (Stage 8). It is also possible Stage 8 was completed and this failure represents Stage 9. So did this failure occur during Stage 7, 8 or 9?

I suggest the failure occurred during the channel flake removal from Face B (Stage 9). I further suggest it was caused by the Face B channel flake plunging into the preform. There are three reasons for this opinion. The first is that Stage 9 failures are the most numerous in the archaeological record and, therefore, probability favors this choice. The second is that split preforms were a common failure mode during channel flake removal. The last and strongest reason is the break on the proximal edge (bottom) which is curved in a manner that is identical to the shape of breaks associated with channel flakes plunging into the preform[3]. (I apologize for the difficulty in viewing the break on this artifact. The next image has a better view of the same kind of break.)



http://www.ele.net/stg_7_5.jpgA distal fragment of a preform that failed during Stage 9, "Channel flake removal (Face B)". This artifact is shown here to further depict the pressure work on Face B (right image) prior to channel flake removal. The channel flake scar in the left image is on Face A. An interesting feature of this artifact is the break on the proximal edge (bottom) of the left image. This is where the Face B channel flake plunged into the preform and broke off (snapped off) the distal end.

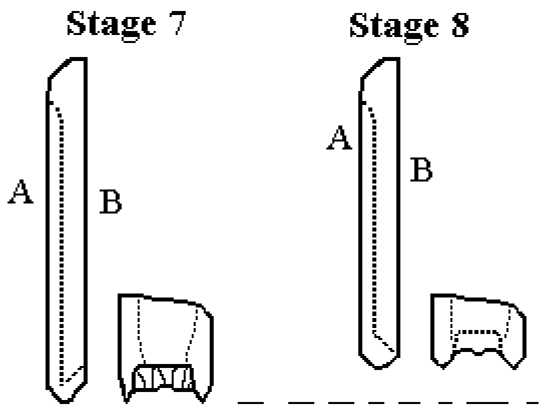
Additional Information

[1] The extreme distal end (tip) of the preform was usually not pressured shape, but left unworked. This left a thicker mass at the tip of the preform. Additionally, the distal edge was usually ground (rubbed on a stone) and often purposely or naturally beveled. These characteristics have led archaeologists to suggest the distal end of the preform was held against an anvil when the channel flakes were removed.

[2] Verbal communications from Dr. Bruce Bradley between 5 and 10 years ago.

[3] The distal fragment of the obsidian preform in the 3rd image on the Stage 6 page is the identical failure.

Stage 8--Channel Platform Preparation (Face B)

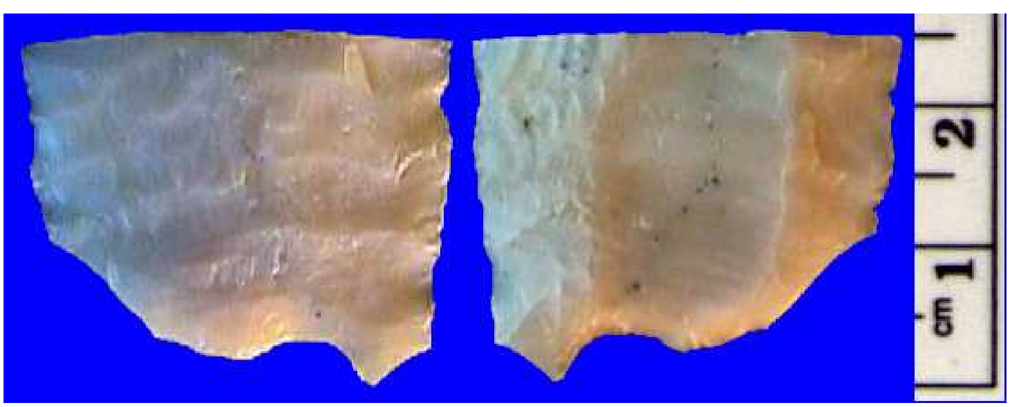


At the beginning of Stage 8, the remnants of the striking platform for the removal of the channel flake from Face A were still present. During Stage 8 these remnants were obliterated by the creation of a new striking platform for the removal of the channel flake from Face B.

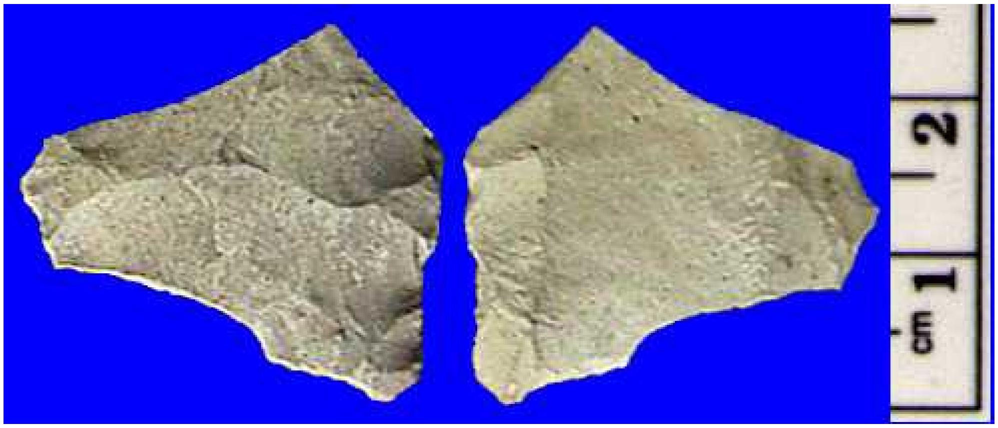
The most obvious change in the preform during Stage 8 was the reversal of the bevel on the proximal edge (bottom). In the diagram, I have depicted the edge and Face B views of a preform at the completion of Stage 7 and Stage 8. Dotted lines show hidden lines: the long vertical in the edge views is the channel flake scar on Face A, and the short, diagonal near the bottom (edge view) is the bevel in the concavity on the proximal edge. The angle of the bevel was reversed and the preform was shortened during Stage 8. In reversing the bevel the Folsom knapper had to work (chip) into the proximal edge and consequently shortened the preform.[1]

The platform was created in the center of the proximal edge as the bevel was being reversed. It was then ground.[2] It is depicted as the "nipple" in the Face B view of Stage 8. When the channel flake was removed, a small concavity was created where the platform had been located. (The platform went with the channel flake.) I have depicted this concavity in the Face B view of Stage 7 which was the location of the platform for the Face A channel flake.

Stage 8 and the similar Stage 5 artifacts are very rare in the archaeological record, less than 1% of the failed preforms. The two artifacts shown on this page are the only examples I have of Stage 8. I have none from Stage 5. Based on their scarcity, these two Stages must have been relatively easy to execute.



http://www.ele.net/stg_8_1.jpgThis artifact is a proximal fragment of a preform that was broken while reversing the bevel on the proximal edge. The bevel reversal appears to have been almost finished when the right ear (right image) snapped off. At that time the platform had been shaped, but not ground. I suggest the preform snapped across the body at the same time the right ear snapped off. Otherwise, the knapper might have started over re-beveling the proximal edge. Compare this bevel to the second image on the Stage 7 page. Note how the bevel is on the opposite face.



http://www.ele.net/stg_8_2.jpgThis artifact is a proximal fragment of a preform that has a similar failure morphology. The right ear in the right image is snapped off. The difference between this artifact and the first one is that this artifact is missing the beginnings of the platform.

Since the platform is missing, I am not sure that this failure actually occurred during Stage 8. The platform could have been finished and the failure occurred during Stage 9--Channel Flake Removal (Face B). The break on the distal end is not straight across so it probably did not occur at the time the ear was broken off. This is the type of break that occurs when the preform was lying on a flat surface and was struck in the center of its face with a rock. See Stage 10 for more discussion on this topic.

This artifact is very thin and the bevel on Face A is very difficult to see. In fact, when I first wrote this page, several years ago, I didn't notice the bevel and I classified this as a Stage 7 failure.

Additional Information

[1] The proximal edge was usually deeply concave after the creation of the bevel. It reminds me of the head of a horned owl with the lateral edges protruding far above the striking platform. Folsom replicators refer to these horns as "ears" and these ears interfere with the striking of the platform. If the replicators use percussion to remove the channel flake they must use a hammer that is narrow enough to fit between the ears. Often a misdirected blow will hit an ear ("ear strike") and destroy the preform. As a result, many replicators favor a punch that can be place on

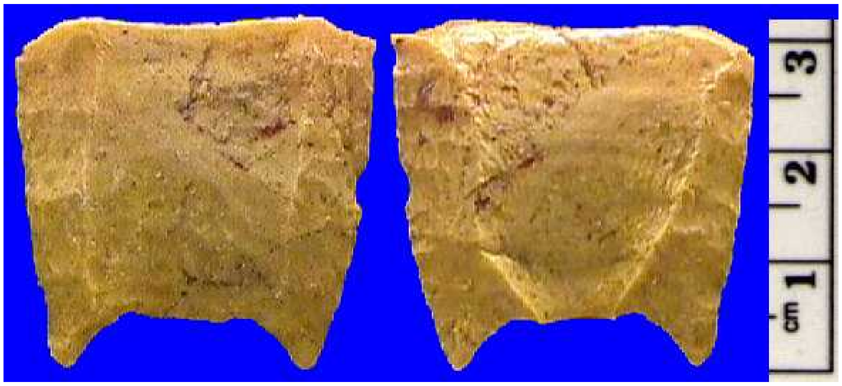
the platform before delivering the blow or applying the pressure. So, why did the Folsom knappers create this problem for themselves, when they could easily have made the proximal edge straight or even convex?

[2] The word "ground" is misleading. A more descriptive word used by Bob Patten is "polished". The platform was polished and this often removed the beveling facets. Patten has suggested the polishing was done with a chip from the preform and not a coarser grained rock.

Stage 9--Channel Flake Removal (Face B)

The theme throughout this document is that artifacts representing the various stages of Folsom Point manufacture are failures of that process. Stage 9 and Stage 6 had the vast majority of these failures. Stage 9 failures represent 50% of the preforms in the archaeological record and Stage 6 represent 45%. Stage 9 produced the most failures because the preforms were thinner at the time of fluting. Both Stages consisted of only a single blow that removed the channel flake and, therefore, the two have the same failure modes. (Refer back to Stage 6 for more details of these modes.)

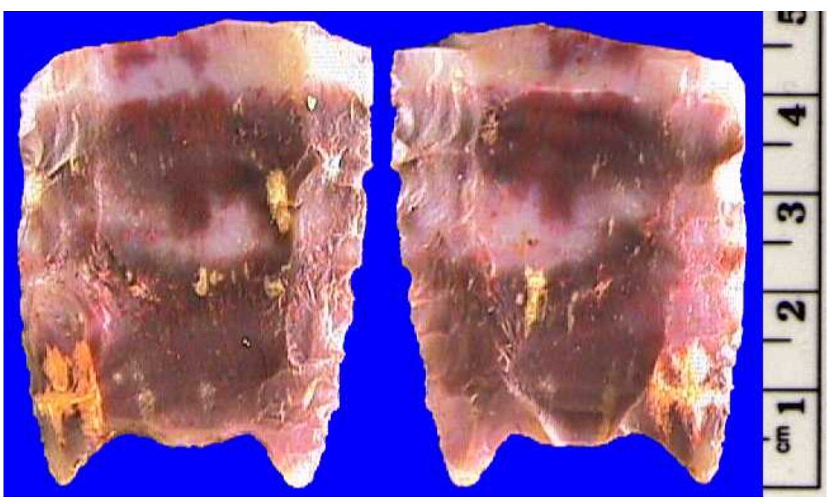
http://www.ele.net/stg_9_1.jpgThis is a proximal fragment of a preform resulting from the Face B channel flake plunging into the body during removal (right image). The lateral edges of the preform are not symmetrical and, as a result, the channel flake scars are not symmetrical. However, I do not believe this asymmetry caused the failure. This knapper was just not as concerned about the symmetry as the knappers of the other preforms shown here. This asymmetrical shape is unusual, but not rare.



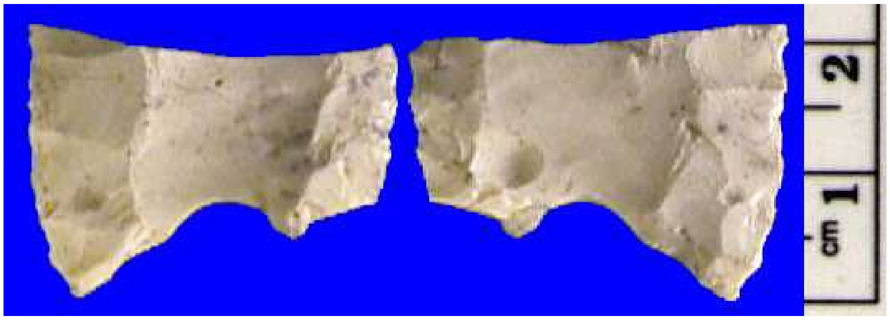
http://www.ele.net/stg_9_2.jpgThis is also a proximal fragment resulting from the Face B channel flake plunging into the body of the preform during removal. Unlike the preform above, this one is extremely symmetrical. It consists of three pieces glued together. The break lines between the fragments run from a point in the middle of the right edge in the left image (left edge in the right image) and fan out toward the proximal and distal edges. Did this preform break in this manner during the channel flake removal or was it broken subsequently? I believe it was later and was intentional. These fragments are "pie" shaped wedges which make good burins. Additionally, these wedges are commonly found in Folsom assemblages and made from bifaces, flakes and other flat tools[1]. I believe this preform was broken in this manner to obtain these wedges.

http://www.ele.net/stg_9_3.jpgThis split proximal fragment was a real catastrophe. The Face B channel flake not only plunged into the preform, the preform was simultaneously split during the fluting process. Splits similar to this occured ocasionally and probably resulted from the knapper's flaking tool following through and hitting the preform after the channel flake had been removed.

This preform is also interesting because the large fragment from the midsection was later used as a spokeshave. The spokeshave is the concavity located on the right edge in the left image (left edge in the right image). A spokeshave is a tool used to shape round wooden shafts like the spokes in a wheel on a wooden wagon. Obviously, this spokeshave worked smaller shafts.



http://www.ele.net/stg_9_4.jpgThis is my favorite preform. It is another proximal fragment that resulted from the Face B channel flake plunging into the body. It was found on the edge of a high ridge that had a view for 40 miles in 270 degrees of direction. It was an isolated find and there was no other chipping associated with it, Paleo or otherwise. At first it appears to be made of Alibates. However, the material is a petrified wood that is foreign to the area in which it was found. What was this preform doing in this isolated spot that had such a fabulous view? It wasn't made there because there was no other chipping debris. Was it transported to this location after the fluting attempt failed? Was it transported there by the Folsom knapper, by another Folsom person, or by a person of a later culture?



http://www.ele.net/stg_9_5.jpgThis is a proximal fragment without evidence of the Face B channel flake plunging into the body. The break at the distal edge occurred after Face B was fluted. The right ear in the left image is missing. This may have occurred at the time of fluting Face B, but I am not sure. I do not have an explanation for the condition of this preform.

http://www.ele.net/stg_9_6.jpgThis is a proximal fragment of a small preform. It is similar to the preform immediately above, in that the flute on Face B was successfully remove. Unlike the one above, this one was purposely broken. I know this because of the discontinuity (knee) in the distal edge of the preform. This is where the force was applied. It was probably laid on a hard surface and hit in the middle of the face with another rock. The reason for smashing the preform is unknown. Some people have suggested it was to create the pie shaped wedges discussed above. Others have suggested it was done ritualistically. (Check out Stage 10 for more discussion of the ritualistic subject.) There is also the possibility a cow stepped on it.

http://www.ele.net/stg_9_7.jpgThis is almost a whole preform and very problematic. First, the flute scars demonstrate one of the occasional deviations from the normal fluting pattern. Face A (?) was fluted from the proximal end. Face B was fluted from the distal end and since the flake scar did not extent to the proximal end, the preform was then thinned from the proximal end.

After the fluting and thinning, this preform was beveled and serrated on the lateral edges. Preforms similar to this with beveled, serrated edges are very rare in the archaeological record. I have see two others besides this one. Bob Patten has suggested this was part of Stage 10--Post Fluting Retouch. If this is correct it is a procedure to quickly trim the lateral edges. Finally, this preform appears to have been purposely smashed with a blow to the face. Note the knee and missing wedge from the midsection of the artifact.

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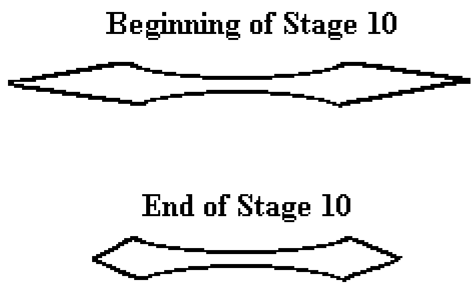
[1] These pie shaped wedges are referred to as "radial break tools" in *FOLSOM TOOLS AND TECHNOLOGY at the Hanson Site, Wyoming* by George C. Frison and Bruce A. Bradley (1980:96-99).

Stage 10--Post Fluting Retouch



Stage 10 was low risk and therefore failures from this stage are rare in the archaeological record (less than 1%). This is the only artifact I have from this stage and I would not have it except for some extreme luck (described later).

During the execution of Stage 10, the lateral edges were trimmed and the preform was narrowed as shown in the diagram of the cross-section. This trimming was done with fine pressure flaking that sometimes exceeded 20 flake scars per inch. I have seen numerous collections that contain Folsom preforms that failed during Stage 9. Often their owners believe these preforms are finished points and they don't realize that the fine retouch is missing. Most of the time, if the fine edge retouch is missing, the point was never finished.

http://www.ele.net/stg_10_1.jpgThis preform is made of petrified wood and consists of four fragments that fit together. It is from the end of Stage 10 because the pressure retouch (15 scars per inch) has been finished. However, the lateral edges were never ground (Stage 11). It was then broken with a blow to Face A. The point of impact was at the knee on the broken edge of the split midsection.

The preform was found on a featureless spot on the landscape and not in a campsite. There were no hills, ridges, low spots for water or anything else that would separate this location from any other location within a radius of a half mile. It was just pure luck that I was walking across this area and spotted a fragment of this preform.

Over a period of five (5) years and numerous visits to this site, it has yielded five fragments of the preform, four of which are in the image. The fifth piece is a fragment of the lateral edge but it does not attach to the others. Additionally, a fragment of the channel flake from face A and five (5) biface thinning flakes were found. The entire recovered assemblage was from the direct manufacture of this artifact.

I propose the following scenario: For whatever his/her reasons the point maker walked away from camp to this isolated place and began making this point. He/she created the preform and then successfully removed the channel flakes from both faces as evidenced by a fragment that fits into Face A and the preform being fluted on both sides. Next, the Post Fluting Retouch (Stage 10) was performed. Finally, instead of finishing the point by grinding the lateral edges on the proximal end (Stage 11--Marginal Polishing), this craftsmans intentionally and inexplicably destroyed the point by striking Face A while the preform was lying on an anvil.

Stage 11--Margin Polishing

Stage 11 was the final stage in the manufacture of a Folsom Point and, therefore, points found at the completion of this stage are finished. Stage 11 was so simple that it is rare to find a point in the archaeological record that was lost during the execution of this stage.

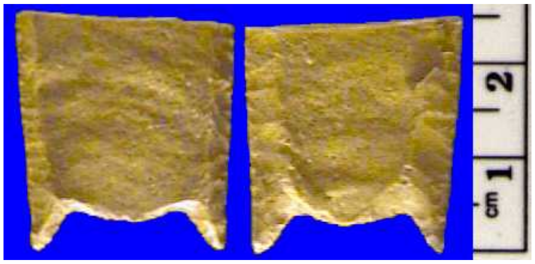
Stage 11 consisted of smoothing the sharp, lateral edges by grinding[1] (rubbing) the edges on another stone. This grinding was performed from the base (proximal end) to the widest portion of the point which was usually about two-thirds of the distance toward the tip (distal end). Often the proximal edge (base) of the point was also ground.

This lateral and sometimes proximal edge grinding is not unique to the Folsom Point. It is a characteristic of all Paleoindian points and early archaic points from the Western States. The common explanation for its presence is it dulled the sharp edges so they would not cut the sinew (string) that attached the point to the shaft. If this theory is correct, it would imply that the Folsom Point was hafted for about two-thirds of its length and only the distal one-third of the point would have extended beyond the shaft. However, the archaeological record suggests there is a problem with this theory.

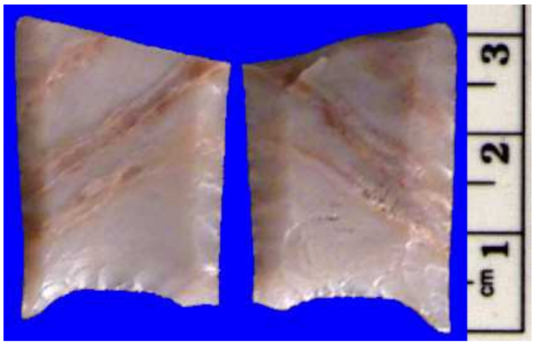
Consider the points illustrated on this page. They were all found in campsites and not in kill sites. They do not represent two-thirds of the point, but generally something less. In these sites and other Paleoindian campsites (not just Folsom sites) the number of bases generally far outnumber the tips (distal fragments.) An explanation for this distribution is that the projectiles were broken away from the campsite. The tips were left in the field and the hunter returned to the campsite to remove the bases from the shafts. The contradicting fact is that most of the bases found in the campsites represent about one-third to one-half of the total length of the point. This distance most likely represents the extent of the hafting. So this contradiction begs the obvious question, "why were the points ground beyond where they were to be hafted?".

Another less popular theory attempting to explain the purpose of the grinding was that it was done to shave the width of the base so the point could be firmly inserted into a socket type haft. The problem with this theory is that it dictates a point with a manufactured width of extremely close tolerances. This would be difficult to achieve on a routine bases. If I had to choose between this theory and the first, I would choose this one. However, I really am not satisfied with it, either, but I do not have a better one to offer.

http://www.ele.net/stg_11_1.jpgThis is a proximal fragment of a finished Folsom point (end of Stage 11) made from Cumbres Pass chert. The post fluting retouch (Stage 10) produced about 16 flake scars per inch and the lateral edges were ground beyond the break. The proximal edge was also ground. The point broke on impact and an impact scar is visible in the left image. This is the first Folsom Point I found and therefore it is also my favorite.

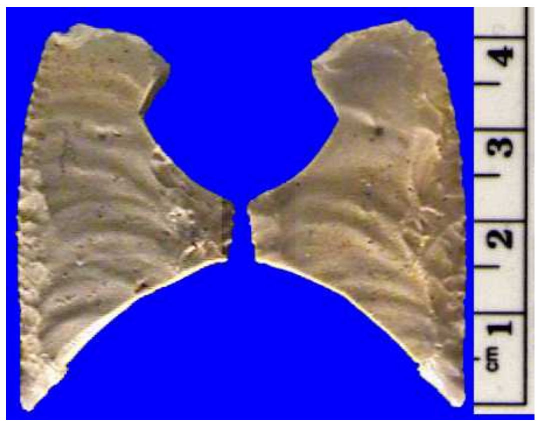


http://www.ele.net/stg_11_2.jpgThis is a proximal fragment of a finished point made from a brown jasper. The post fluting retouch produced about 20 flake scars per inch and the lateral edges were ground beyond the break. The proximal edge was not ground. The point broke on impact and an impact scar is visible in the right image.



http://www.ele.net/stg_11_3.jpgThis is a proximal fragment of a finished point made from Alibates chert. The post fluting retouch produced about 13 flake scars per inch and the lateral edges were ground beyond the break. The proximal edge was lightly ground. The point broke on impact and a impact scar is barely visible in the left side of the right image. Also, the ear on the right side (left image) is missing.

.ele.net/stg_11_4.jpgThis is a split
fragment of a finished(?) Folsom point
Lake Valley chert. The right ear (left
a large portion of that side of the base is
The left ear (left image) is intact. The
where the two images appear to be
is the only portion of the lateral edge for
The post fluting retouch produced about
scars per inch, 16 on one face and 20 on



http://www
proximal
made from
image) and
missing.
location
"kissing"
that side.
18 flake
the other.

This point is also problematic. The entire left lateral edge (left image) is lightly ground except for the last 0.5 cm. of the distal end. This is what I would expect. The problem is the "kissing" right edge (left image) is NOT ground. The only way I can explain one edge being ground and the other not, is to suggest the destruction of the point occurred between the grinding of the two lateral edges. The odds of destroying the point during the routine process of grinding the lateral edges is extremely low. Additionally, the morphology of the failure is very strange. All this leads me to suggest this point was purposely destroyed before it was finished (ground on both edges.) The reader should also notice the negative knee in the break on the distal portion of the point and then re-read Stage 10.

http://www.ele.net/stg_11_6.jpgThis is a proximal fragment of a finished point made from obsidian. Obsidian Folsom points are rare or nonexistent in most states, however, in New Mexico around Albuquerque they are quite common. Notice the point is only fluted on one side which is uncommon, but not rare. The post fluting retouch produced about 15 flake scars per inch on the fluted side. The non-fluted side has a different type of retouch. The lateral edges and proximal edges are heavily ground. The grinding on the lateral edges extends beyond the break.

http://www.ele.net/stg_11_5.jpgThis is another proximal fragment of a finished, obsidian point. The ear is broken on the left edge and the one on the right is missing (left image). The post fluting retouch produced about 17 flake scars per inch. This point is very informative about the hafting length. It has been resharpened by a right hand bevel. This right hand bevel begins about 0.4 cm. down from the distal edge. Therefore, the haft had to end before the beveling began.

I saved this point for last because it is the exception to the rule. It was NOT ground on the lateral or proximal edges. So Stage 11 was omitted in the construction of this point. The reader may ask, "how do I know the point was finished?". The answer is because it was resharpened. Therefore, it was hafted, used, broken, resharpened and broken again.

Additional Information

[1] I have chosen to used the word "grinding" in lieu of "marginal polishing". I have use "grinding" my entire life and found this page impossible to write using the words marginal polishing. I used it in the title to be consistent with the primary source *FOLSOM TOOLS AND TECHNOLOGY at the Hanson Site, Wyoming* by George C. Frison and Bruce A. Bradley.

Channel flakes--byproduct of Stages 6 and 9

Channel flakes are the single flakes that were removed during Stage 6 and Stage 9. Their scars are the flutes on each face of the Folsom point. Unlike the other byproducts (flakes) of manufacture, channel flakes are diagnostic of Folsom. They are as diagnostic as the preform or the finished point.

A channel flake is a long, thin, narrow flake; length--40 mm[1], width--15 mm, and thickness--1.9 mm (Wilmsen and Roberts 1978:100). It is obviously unifacial. Its most diagnostic characteristic is the flake scar pattern on the dorsal face which resulted from the controlled pressure shaping of the preform during Stages 4 or Stage 7. These scars are oriented perpendicular to the long axis of the channel flake and terminate at the center of the dorsal face. They originated from beyond the lateral edges.

Channel flakes are never found intact and very seldom are all fragments of a single flake recovered. I have never seen an intact one nor all the fragments to a whole one. Several knappers have told me that most of the time the channel flakes they produce come off in pieces during the fluting process. I speculate that one of the reasons they break on creation or shortly thereafter is that they are so thin. The general consensus is they are usually broken into three (3) or more fragments.

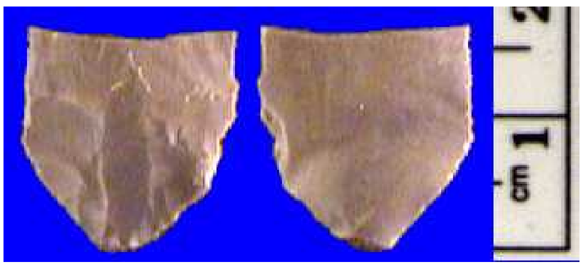
The examples of channel flakes shown on this page were partly selected for their photogenic qualities. As a result, five (5) of the six (6) examples are jasper. Additionally, they tend to be slightly larger than the average dimensions presented above .

Proximal Fragments

Cotterell and Kamminga (1987) identified three (3) types of flake initiations in their paper *The Formation of Flakes*. Channel flakes were produced by two of these initiations; Hertzian Cone and Bending. These two initiations produce very different results. The cone initiation produces a larger flake (greater mass) than the bending initiation for the same size striking platform[2]. My data indicate that 60% of the channel flakes in the archaeological record are cone initiations and 40% are bending. They also show that 75% of the preforms failed during the removal of a cone initiated channel flake. (Successfully fluted preforms and finished points have their proximal end reworked so the type of initiation cannot be determined.) Based on this information, I believe the Folsom knappers were doing everything possible to remove a channel flake with a bending initiation. This statement applies even more for the fluting of Face B since the preform was thinner and more delicate at that time. One way to encourage a bending initiation is to cause the angle of blow to be greater than 90 degrees (Pelcin 1998). Still, causing a bending initiation was not automatic because chance still plays a large role.

Examples of Cone Initiations

http://www.ele.net/chflk_1.jpgThis is a proximal fragment of a channel flake made from a red jasper. The indented right, distal edge in the left image has been used or worked. The flake scar pattern on the dorsal face (left image) places this artifact in the group identified by Wilmsen and Roberts (1978:101) as "characterized solely by scars that are laterally oriented across the dorsal face." At the Lindenmeier Site, this group represented 85% of the channel flakes. Measurements on this channel flake are 18.4 mm (est.) wide and 1.8 mm thick.



http://www.ele.net/chflk_4.jpgThis is a proximal fragment of a channel flake made from a brown jasper. The left lateral edge in the left image has been backed (very fine work) to enable the flake to be held with the finger on this edge. The right edge was then used for cutting. The channel flake belongs in Wilmsen and Roberts' other category that "display longitudinally directed scars superimposed upon the lateral pattern on the proximal ends." This group represents the other 15% of the channel flakes. Measurements for this channel flake are 14.7 mm wide and 2.1 mm thick.

Examples of Bending Initiations

http://www.ele.net/chflk_2.jpgThis is a proximal fragment of a channel flake made from Lake Valley chert. Notice how much larger the platform is compared to the two cone initiations above. Also, note the "lip" at the intersection of the ventral face and the striking platfrom (right image). The larger platform "lip", and the "necking" just above the platform, are characteristics of a bending initiation. This channel flake belongs in Wilmsen and Roberts' "longitudinally directed scars" category. Measurements are 16.1 mm wide and 2.1 mm thick.

http://www.ele.net/chflk_3.jpgThis is a proximal fragment of a channel flake made from a brown jasper. It belongs to Wilmsen and Roberts' "laterally oriented" category. This channel flake is also the best example of an extremely polished (ground) striking platform. I know the reader can't see this polish in the image so you will have to take my word that this platform has had all the facets completely obliterated. (Return to Stage 8 for more information on platform polishing.) Measurements are 16.8 mm wide and 1.7 mm thick.

Midsection Fragments

http://www.ele.net/chflk_5.jpgThis is a midsection fragment of a channel flake made from brown jasper. It is an unusually large artifact. Conceivably, it could have been twice as long as it is here. It is made of four fragments that are glued together. Notice the most distal fragment (top in images) is a different color. This piece was in a different environment from the other three (3) after they were separated. Possibly it was in a fire. Measurements are 21.3 mm wide and 2.7 mm thick.

http://www.ele.net/chflk_6.jpgThis is a midsection fragment of a channel flake made from brown jasper. It consists of two pieces that were found approximately 200 meters apart. For many years they laid separated in the same box until about seven years ago when it was discovered the two fit together. At that discovery I began to believed these fragments had been separated at the time of manufacture since the right edge (left image) of each fragment has a different pattern of retouch. However, about three (3) years ago I learned from Dr. John Clark of BYU (1995:pers. com.) that these two pieces made an artifact that was similar to hafted, blade knives from Mexico. These blade knives were tapered, as is this channel flake, so they could be reversed in the haft. I now believe that this artifact was a hafted, reversible knife. Measurements are 18.5 mm (est.) and 2.6 mm thick.

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1996 *Controlled Experiments in the Production of Flake Attributes.* Ph.D. Dissertation, Department of Anthropology, University of Pennsylvania, Philadelphia, Pennsylvania.

1998 The Successful Removal of A Folsom Channel Flake: The Role of Angle of Blow. Paper read at the 63rd Annual Meeting, Society of American Archaeology. Seattle, Washington.

Wilmsen, E. N., and F. H. H. Roberts

1978 Lindenmeier, 1934-1974. *Smithsonian Contributions to Anthropology No. **24***.

Notes

[1] Length is a difficult statistic to obtain since there are few if any, whole channel flakes. The 40 mm average I report in this document is my best estimate based on flute scars and an indirect method by which the sum of the length of all fragments are divided by the number of scars on preforms and finished points.

[2] In Pelcin's Dissertation research, he conducted a number of experiments varying the angle of blow. He discovered that there were two types of flakes being created, based on the relationship between platform thickness and flake mass (1996: Figures 104-112). At the time he believed the two types might be cone and bending initiations, but this opinion did not make it into print. Subsequent work has convinced him that his original belief was correct.

How to Make Your Own "Gunther" Style Arrowhead

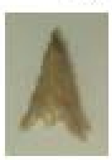
by F. Scott Crawford

1. Obsidian chip. Outer face with ridges and rough edges.

2. Trimmed chip. Removed thin and irregular edges by shearing pressure with the side edge of copper tipped flaker.

3. Reverse, smooth side of trimmed chip.

4. A different view of the underside of the chip. Upper right corner is original point of impact when the chip was knocked off the larger chunk. It will be the tip.



5. Edge of the chip has been ground down a little to afford a better flaking tool grip and strengthen the edge to allow pressure without crushing.

6. First pass of pressure flakes along the ground edge. Started at the tip end, working along edge toward the base.

7. Midway through the first pass of pressure flakes along the second edge, working from the tip toward the base.

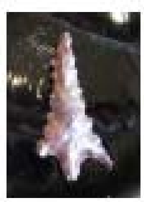
8. First pass along second edge is now complete, plus the first pass across the base, at the bottom of the photograph.

9. First pass is complete along all three edges of top side of chip. The planned tip of the arrowhead is at the bottom right.

10. Here is the underside of the piece. Now we will trim a little all along the edges to straighten the line of the edge.

11. On the smooth underside, once we have trimmed back the sharp edges a little, to bring the working edge for pressure flaking closer to the smooth face. By shearing and trimming some small, short flakes off along the edge, traveling toward the first surface of the chip.

12. Now the edge along this side has been ground for tool grip and to strengthen the edge to handle the pressure without crushing.



13. And now the edge along the other side has been ground down some, for tool grip and strength.

14. First pass along first edge of the underside surface is now complete, started at the tip, working toward base.

15. First pass along second edge of the underside surface is now complete. My pressure for one flake removal was too aggressive and the tool was positioned a little too high up on the edge, so it took a bite out of the edge.

16. I removed a series of shearing chips and small chips along the edge on both sides of the curved bite, to re-straighten the edge. It is now ground along the new edge for another series of pressure flakes to further thin the point in its revised shape.

17. A second view of the revised edge, all straightened and no remaining problem from the bite out of the side.

18. A second pass along the upper edge of the first side of the point preform.

19. A different angle of the same work, so you can see how the main flakes are spaced along the edge. Then the small "delta" triangles of remaining stone between the main flakes are removed.

20. Now the base edge has been trimmed and ground in preparation for removal of the initial guide flakes for the base notches of the arrowhead.

21. Using a smaller tipped flaking tool, the first notching flakes have been pushed from the base, aiming up into the mass of the point material.

22. A different angle so that you can see where the initial guide flakes for the notches have been removed.

23. Trim the edge inside the guide flakes from the same side as you applied the pressure to remove the flakes. This will bring the edge for the second flakes closer to the un-notched surface, and strengthen the edge in preparation for pressure.

24. You can see the edge inside the initial notch flakes, trimmed in preparation to remove guide flakes from the other surface of the point. Pressure will be applied with a smaller flaking tool tip at this prepared edge.

25. The two notching flakes on the other side. The first ran clear across at an angle and overshot the edge on the left of the photograph. The second crossed the first.

26. The second notching flake on this side, from the notch to the right, divided, and part ran up to the right and part ran left, crossing over the first overshot flake.

27. The first side notch flakes, after the other side initial flakes. The edges are trimmed again inside the flakes for more notching work.

28. A little more deepening to the notches, then clean up the shape of the barbs. Some trimming of the base, to the planned narrow shape.

29. The notch to the left of the photo has been trimmed inside the notch to prepare and strengthen the edge, for removal of one more thinning flake from other side.

30. The additional thinning flake has been removed from this side of the point, seen here at the notch to the right of the photograph.

31. A different view of the recent notch flake removal. Compare to image 26. Now the notches are deeper, and the barbs more sweeping in form.

32. The other face of the point. Notches and barbs are essentially finished, until after the serrations are made along the edges of the arrowhead.

33. Using a small, relatively sharp-tipped tool, make the initial small serration notches, spaced evenly. I prefer holding the point on a flat surface, on leather.

34. Using the tip of the tool, roughen the edge inside the initial serrations, working from the same side as when making the new serrations.

35. This will prepare for making deeper serrations on the other face of the arrow-head. Here, I am ready to make the deeper serrations on this visible surface.

36. Now we can see the flakes removed on this side, from the inside edge of the serrations. You can see why we need to use a small, sharp pointed tool.

37. Back to the other surface of the arrowhead, to get a better view of the serrations along this first edge.

38. A different angle on the same face. We can see that careful use of the narrow, sharp tool makes nice, deep serrations without damaging the points.

39. Here I have made the initial spacing chip removals for the serrations along the second edge of the arrowhead. Rough up the inside edges from this same side.

40. Then turn over the point and push against the inside edges of the serrations to remove tiny chips to deepen and sharpen the inside of the serrations.

41. The serrations along this side fall in line with the flake scars of the main shaping and thinning flakes, as can be seen along this edge.

42. A different angle so we can see the finished serrations along both edges of the arrowhead.

43. Here we can see the last tiny serrations made at the tip of the barbs.

44. The arrowhead is finished. It now measures just 15/16" in length along the side toward the bottom of the photo, 1" along the other side, and about 7/8" from tip of barb to tip of barb.

Swept-Wing Gunther Arrowhead From The Columbia Basin In Oregon

For your viewing pleasure, check out this swept-wing Gunther arrowhead! Those wickedly long barbs, the slicing, incurvate edges, the needle-tipped point. (Oh well, the needle-tipped point is not really there, but you can see it in your mind's eye, can't you?) It looks like some type of carnelian agate or other semi-translucent quartz. This ancient arrowhead presents many aspects of the Gunther arrowheads which have captured the imagination of both authentic point collectors and modern flint knappers everywhere. The inset photographs are actual size images. This Gunther arrowhead comes from the collection of Pat Welch and her daughter, Jennifer Peterson. It was discovered in the Columbia Basin in Oregon in 1962.

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from: http://www.arrowhead-makeyourown.com/, accessed 10-21-10, copied with permission

Making the Mighty Susquehanna Point

by Michael E. McGrath

In the Northeast, there are perhaps few points that have the following that the Susquehanna Point does. Its grip on collectors and knappers alike can be a tight one. Prices for authentic Susquehanna Points and its cousin the Perkiomen are rising as is interest in these points, therefore it's prudent for Northeastern knappers to understand and master how to replicate this beautiful point. It is my hope that this writing will aide those replication efforts. Figure 1 shows my best three Susquehannas. The largest one measures 6 ½ inches long and 2 ½ inches wide at the shoulders and is made of New York Esopus Chert. The middle one is made from Texas Georgetown flint and measures 4 ½ inches long with a shoulder width of 1 ¾ inches. The smallest one represents the smaller necked Pennsylvania Susquehannas. It's made of Esopus Chert also and measures 4 ¼ inches long and 1 ½ inches across the shoulders.

The Susquehanna Point is a Transitional Woodland Stage point dating from 1,300 B.C. – 1,000 B.C. with a distribution from the lower Susquehanna Valley of Pennsylvania up into Central New York State. Sparse findings of Susquehannas have been made as far south as the

Chesapeake Bay region of Maryland, but the main concentrations of this point center around the Susquehanna River basin areas and its tributaries. Susquehannas are most often made of Esopus Chert from Eastern New York State, Eastern Onondaga Chert from Eastern New York State, Western Onondaga from the Lake Erie areas of New York State, Rhyolite from Southern Pennsylvania, and Pennsylvania Jasper from the Reading area of East Pennsylvania. It has been put forward that the Susquehanna came from the Lehigh Broad points of Pennsylvania and also from the Late Archaic Snook Kill Point from New York. Many times, Susquehanna points are found in and around Perkiomen points and with the soapstone bowls of the Northeast. The originals I've found in the Chenango River Valley areas line up with this line of thinking (fig. 2)

Susquehanna Points come in a few different types. The Susquehanna Broad Point is a large well made point with a triangular blade, straight or excurvate edges, sharp angled shoulders, with contracting base necks that come to a fishtail like base proper. The “Clipped Wing” Susquehanna is described the same as the Susquehanna Broad Point except that the pointy shoulders have been removed. Their size can vary from 1 ½ -8 inches in length with an average length of 2 ½ - 3 inches with a width to thickness ratio of 5/1 with some being much thinner and, of course, some being thicker.

I believe within the Susquehanna point that there are even subtypes yet to be defined. There are noticeable differences between the Pennsylvania Susquehannas and the ones found in New York State. Chiefly, the basal areas of the stems or necks are much broader than their Pennsylvania brothers. These broader necked Susquehannas are particularly found in the areas surrounding Greene, NY and Afton, NY. I forward the idea that these broader necked and based points should have the name Central New York Susquehanna Points, while the Pennsylvania Susquehannas should retain the old name. Western and Eastern New York Susquehannas also differ in shape, but I don’t have enough knowledge of either of those variants to comment further. Some even believe that the Susquehanna Point is related to the Ohio Astabula point that has a much longer and thinner neck. While the two points have similarities, it is still debatable that they are in fact related by anything more than the shape of the point. Strong evidence of this objection would be found in the severe lack of Susquehannas in Western New York. Perhaps Western movement of the Susquehanna point happened through Pennsylvania, but that debate is left for someone else to probe.

To make a proper textbook Susquehanna point, knappers should start with a native NY or PA material. I always shoot to make a long exaggerated pointed perform with broad percussion flakes doing 90 % of the work (picture figure 3 without the angular removals on the shoulder).

Then I take my percussion billet and put an angle on the base to put a point on the shoulders section and also to make the basal bottom square (fig. 3). Figure 4 shows some authentic Susquehanna perform bases broken before they were ever finished. The next step is very, very important. Take your pressure flaker of choice (I use an ishi stick) and run basal thinning flakes from the bottom of the base up to the shoulders. I usually take 3 on each face of the base. The number of basal thinning flakes should not extend quite to the ears of the squared base so that your ears will not be paper thin during the finishing stages. The reasoning behind these flakes is to obviously thin the base, but also to do this thinning prior to having the delicate ears that will be there when finishing. Trust me, you'll think it's thin enough until you get done notching the neck section of the finished point and then you'll be faced with taking a risky flake that could take off an ear in an effort to thin the base. I notch the ears and neck area prior to finishing the blade so that I can then move the tip left or right in order to balance the piece. The notches on a Susquehanna look deceivingly easy, but like the Hardin point, it either looks right or doesn't, there is no in between. If Yoda were instructing you at this point he'd say "Notch right or notch not, there is no try!" To notch, I start with the angular pressure flakes that extend from the shoulders down into the neck area. Push the flakes at an approximate 45 degree angle in toward the center of the neck but upwards. The neck should decrease in thickness as it tapers from the shoulders to the base. Here is where you can make fatal mistakes that make your Susquehanna not look right. Most bad modern replicas that I see make the notches too angular like a "greater than" or "less than" symbol (< or >). This type of notching treatment gives the Susquehanna point no neck at all. Many of these "no neck" replicas also make the mistake of having the basal ears extend out to nearly the full width of the shoulders which is also incorrect. Many knappers also make the necks too long therefore making their attempt similar to an Ashtabula point (sorry, you Ohio guys may have trouble not going there). To pull this off correctly, the knapper must remember to make the edge extending from the shoulder to the top of the neck longer than the edge extending from the bottom of the neck to the basal ear. The length of the edge of neck should be about the same as the length of the edge that extends from the neck bottom to the ear with the edge extending from the shoulder to the neck being twice that length approximately.

If you've been successful notching the Susquehanna Point, you would proceed to finishing it. The base should be ground moderately too heavily. I've found originals with both of those grinding treatments. This basal grinding can extend up to the shoulders or not, again, both methods have been found on the originals. I do not grind much further than the neck. When you finish the blade section of the point extending from the shoulders to the tip, it is important to make sure that the blade edges reduce in a triangular fashion to the point. This is another area modern knappers have trouble with. They make the blade edges too excurvate when they should more resemble a triangle that has had someone stretch it out by holding the base and pulling the tip up with ones fingers. When finishing the edge, it's also important to not pressure flake the blade to death. The Transitional and Woodland cultures of New York and Pennsylvania did a great deal of their point knapping with broad percussion flakes. A proper textbook Susquehanna should be shaped and finished with small pressure flakes that do not disturb the percussion flake scars very much yet shape and define the edge properly. I personally do not worry a whole lot about the width to thickness ratio of my Susquehannas, but keep in mind, most Susquehannas were reasonably thin especially with the smaller examples.

Susquehannas have been a passion of mine for a long time, and many have asked me to write about how I make them. I found it difficult to write about the process because much of it is by feel and much of it has to do with handling so many originals that I've found. For those of us who love the Susquehanna, we affectionately refer to them as "Susqys" or "Susqies" or if you are French I guess that would be "Susque". One thing is for sure though, once you get the Susquehanna fever, its only cure comes with making enough of them to satisfy the fever's appetite each year. Good Luck!

Story in Stone, Flint Types of the Central and Southern U.S., D.C. Waldorf, Valerie Waldorf, 1987, Mound Builder Books

The Archaeology of New York State, William Ritchie, 1980, Harbor Hill Books

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