Flint Knapping:

Articles, Tips, and Tutorials from the Internet

Photo from Flintkapping, Art of the Ancients, 2009 Calender, used 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.

Table of Contents

Section 1: Basic Concepts

Section 2: Tools

Section 3: Percussion

Section 4: Pressure Flaking

Section 5: Notching & Fluting

Section 6: Finding & Treating Knappable Stone

Section 7: Displaying & Making Things with Your Points

Section 1: Basic Concepts

Flintknapping Terminology

by Mark Bracken

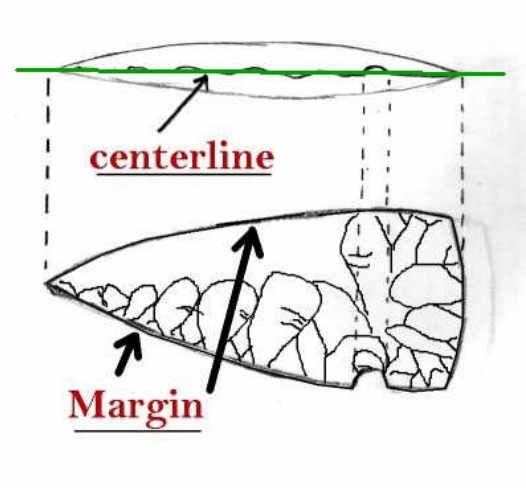
Here are some helpful descriptive terms commonly used in knapping...

• Abrading... The process of polishing the edge of a preform's platform to strengthen it in preparation for flake removal by percussion or pressure flaking.

• Biface... A spall or piece of flint that has been flaked on both sides.

• Bulb... Often called "The bulb of percussion" it is the area very close to the edge or margin of the biface where the flake originates due to pressure or percussion work. It can sometimes be deep and cause significant concavities along the edge. The bulb should be kept at a minimum. See drawing

• Center Line...This term is used to describe the imaginary centerline of a preform as viewed from the blade edge. See drawing



• Cobble...Some flints occur in cobble form. These are irregular shaped but smooth, and are formed in various sizes averaging from one to 5 pounds and are generally covered with a cortex.

• Concave... A"cupped" area on the face of a preform or nodule. This should be avoided until the material around it has been removed thus raising this "negative" area to match the contour of the rest of the Blade or core.

• Convex... The opposite of concaved. It is a rounded raised area. A lens shape is a good example. This is the foundation for good successful flaking!

• Core... The "mother stone" or nodule which spalls are removed from. Also a carefully prepared worked piece of flint that Sharp useable blades are removed from.

• Cortex... The outer "skin" of a flint nodule or spall. Usually a chalky white or brown material ranging from 1" to 1/4" thick.

• Flake... A thin, sometimes broad and sharp piece of stone chipped from a larger biface or preform.

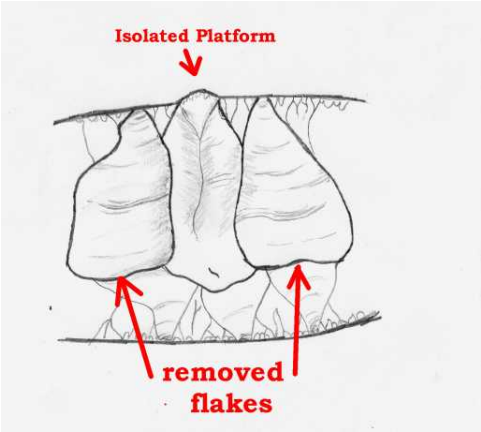
• Flake Scar... This is the "scar" left behind where a flake has been removed.

• Flute Flake... A special flake removed from the base of a blade or preform that travels up the face towards the tip. The purpose of this flake was to create a concaved channel to aid in the special hafting technique of Paleo era points.

• Heat Treating... Flint was often heat treated by North American peoples. Things are no different today! The flint is very slowly heated and cooled to temperatures ranging from 350-700 F, depending on the material quality and type. Not all flints benefit from heat treating. Heat treating gives the flint a glass like attribute making it easier to chip.

• Hinge Fracture... This is an undesirable flake that falls short of it's mark by " rolling" out. See image.

• Isolated Platform... This is a platform that has been "isolated" from the material around it. This is done by carefully chipping the stone away from either side of it. This leaves the platform sticking out a bit. The energy is transfered much farther "down range" using isolations.



• Knapping... The skillful act of chipping flint or making gun flints.

• Margin... The edge or circumference of the biface or preform.

• Nodule... A large to very large smooth or irregular piece of flint.

• Overshot Flake... The affect of a flake that travels from one margin to the other and "clipping" the opposite edge.

• Platform... A platform has 3 main components, this is discussed in "platforms". A carefully prepared area on the edge of a preform to be struck to create the desired flake. Or A naturally occurring area on a rough spall or nodule that would produce a desired flake or spall. Platforms are the key to good knapping.

• Platform Bevel... This is the part of the platform that is actually struck.

• Platform Support... This is the underside of the "bevel". It gives support to the platform at the time of strike.

• Platform deltas... These are the results of flake removal. See drawing

• Preform... A bifaced blade in various stages of reduction.

• Pressure Flaking... The act of removing flakes by pressure using an "Ishi Stick" or flaker.

• Percussion Flaking... Removing flakes by directly striking the stone with a billet.

• Raking and Shearing... Raking is the action of carefully dragging a course abrader or other device to remove "micro" flakes from the edge of a biface or preform to change it's shape or give support to an edge before actual abrading is done prior to percussion or pressure work.

• Spalling... The act of breaking up a nodule or cobble into workable and desirable sized pieces.

• Spalls... The finished untrimmed large flake removed from a larger "mother" stone.

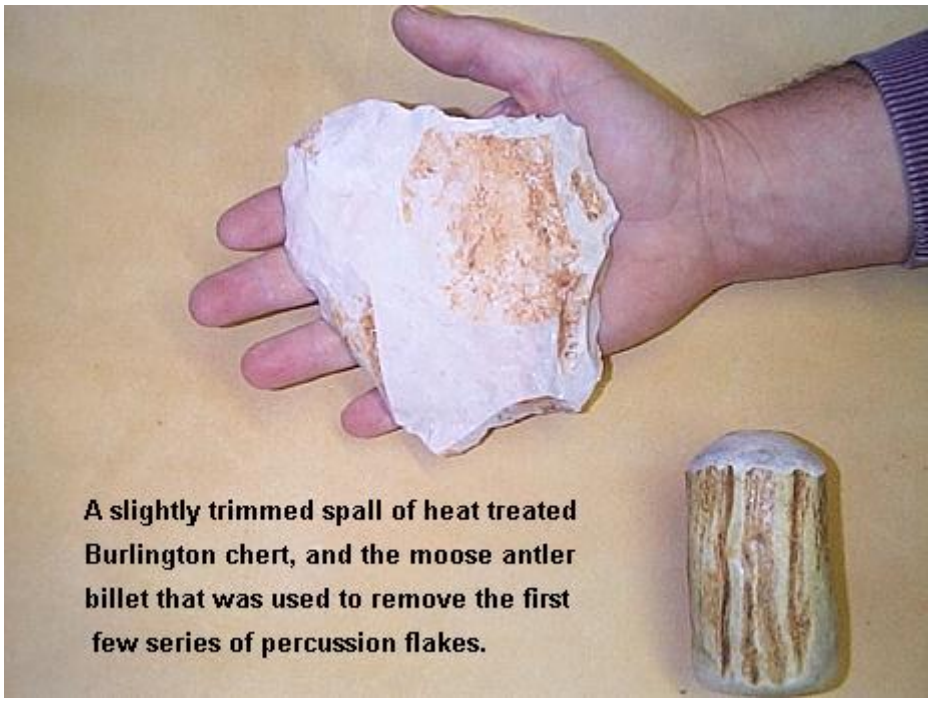
• Stack... Another BAD thing. A series flakes that fall short of a single specific objective. Resulting in multiple failed attempts to remove a specific problem area. Read"Platforms" for preventative measures.

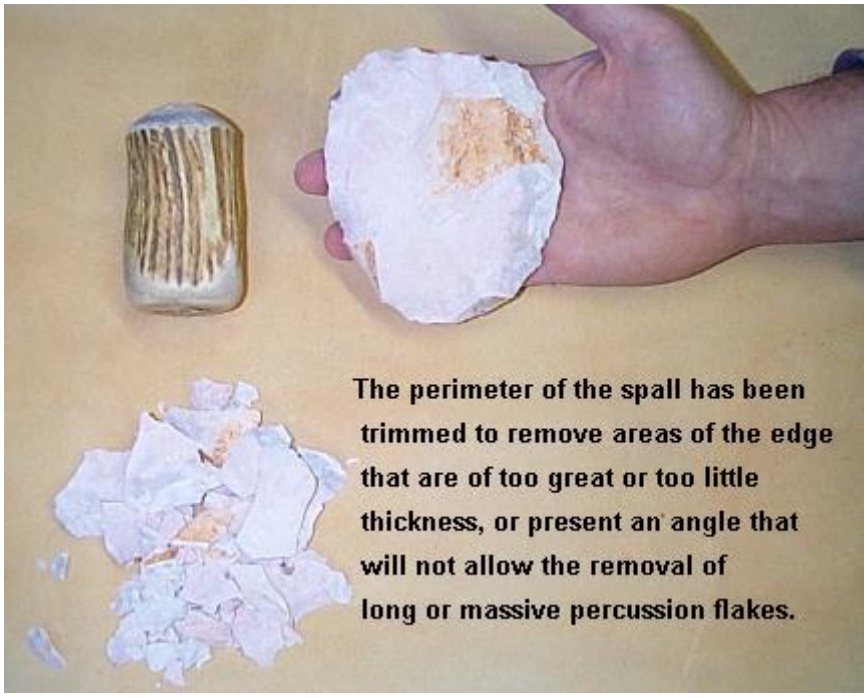
• Step Fracture... A single flake falling short of it's mark by creating a "step" on the surface of the Blade. The thinner you get the more this demon haunts you.

From http://www.flintknappingtools.com/terms.html , March 31, 2010, copied with permission

Reduction Sequence

by Dan Long




The perimeter of the spall has been trimmed to remove areas of the edge that are of too great or too little thickness, or present an angle that will not allow the removal of long or massive percussion flakes.

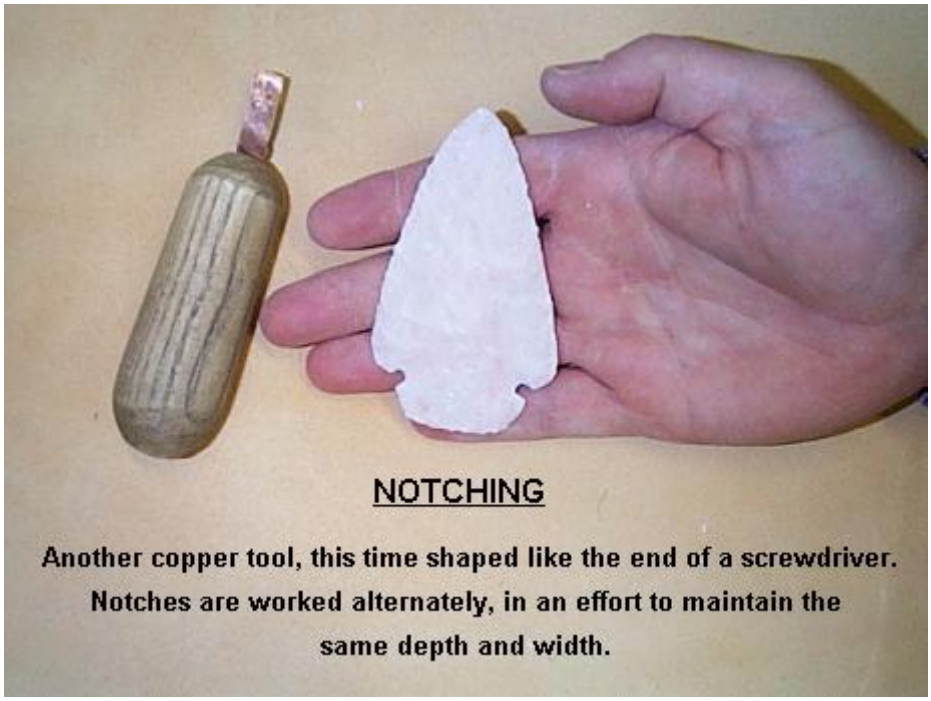

Primary Thinning
More massive, longer flakes that reach beyond the mid-line of the piece, begin to rapidly thin it as it becomes a biface. (Flaked completely on both faces.)


As thinning continues (with a smaller billet), the flakes are less massive but still long, reaching more than halfway across the face.


Moving again to a smaller billet as the biface begins to take shape.
The mass of the billet should be in proportion with the size of the biface and the desired flakes.


The smallest billet used in this reduction for the final percussion flakes.
The corners have been removed from the base of the preform in preparation for corner notching.


PRESSURE FLAKING
A copper tipped tool is used to push small flakes off of the edge for final shaping. The edge is also thinned, sharpened and straightened by this action.



NOTCHING

Another copper tool, this time shaped like the end of a screwdriver. Notches are worked alternately, in an effort to maintain the same depth and width.

With notching, final base and edge retouch complete, the base and insides of the notches are ground smooth in preparation for hafting onto a handle for use as a knife.

From http://knapper_dan.tripod.com/, March 31, 2010, copied with permission

Anatomy of a Platform

by Mark Bracken

Careful and properly built striking platforms are one major key to predictable flake removal. Please note that one must have an understand knapping "terminology" to benefit from this article. Platforms have four basic components. All four components must have the proper characteristics for a flake to be removed predictably, and if it does not, the struck flake (if any) WILL become undesirable. Lets look at the platform's components and why each part is so essential. You must understand that these four components almost always have to be created from scratch. Rarely are they just sitting there waiting for your eager billet! These are also listed in the order they should be made. The descriptions here are intended for bi-facial preform stages but can be applied to spalls. Note that one must be quite proficient with a pressure flaker before you master percussion flaking. This is because great percussion platforms start with good pressure flaking.

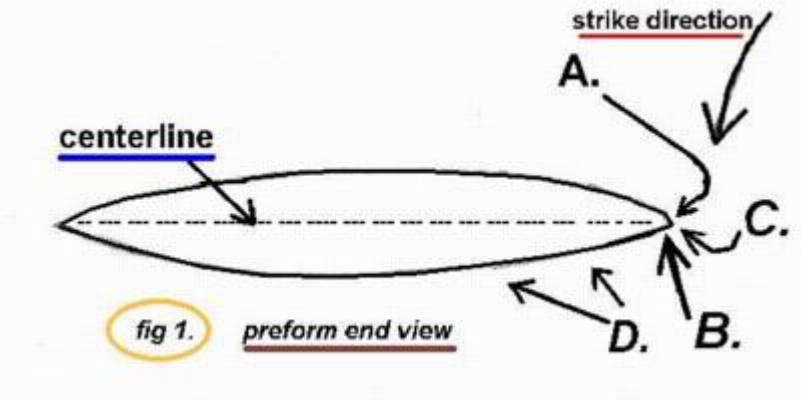


fig 1. preform end view

Now that we have divided the platform into four parts, lets give them all a letter code: "A", "B", "C" and "D", as shown in fig. 1. I will discuss the following topics relating to each platform component.
1. It's purpose and/or function
2. "How to make them"
3. The attributes it should have
4. Trouble shooting... cause and effect of poorly made and or Improperly prepared platforms
Part A

The first we will look at is "A". This is the part commonly referred to as the "bevel". The purpose of the "bevel" is that it serves as the surface that is actually struck to produce the flake. How do we go about making

the bevel? The most accurate way is to use a SHARP pressure flaker. You can use a billet to produce this on an early stage perform or spall. It is highly recommended that you use a pressure flaker to make this part. What attributes should part "A" have? This part should have a bevel some where near 45 degrees. This angle can be changed by making another "pass" or modifying angle of pressure. The bevel should be smooth. What I mean by this is that it should not contain irregular bumps, humps and micro ridges. It should be just as if you used a router on a piece of wood.

Part B

Part "B" gives support to the strike. It is actually made from part "A". There are many ways to make this. The basic idea is that you're actually removing extremely tiny chips off the bottom or underside of the "bevel". (This is the same side the thinning flake will be removed from.) Remember, your not really abrading the edge so much as shaping it. Here's a couple ways of doing this. The first way is to use a course abrader. Just rake the edge downward gently and repeating this process just long enough to feel less resistance as the abrader is raked downward. You can also rake off these "micro" flakes with the edge of your pressure flaker or use a copper bar to do the same thing. Keep in mind this is a very important step! If you rake it too hard or use or use excessive force it will be too strong and will greatly stress the stone upon striking it. Rake thick performs harder than thin ones. If "B" is not raked enough it will cause the platform to crush or cause a step fracture very close to the edge. Too much and you will break it! So don't over do it.

Part C

Moving onto part "C". This part is also made from "A". It is the polished area that your billet actually strikes. It is better described as polished but commonly referred to as abraded. Polishing sounds so much more precise and civilized. To prepare this part properly one must first have created "A" and "B" flawlessly! You simply grind up and down the platform edge. What I mean by this is your grinding from base to tip. Another description of this is if you're holding the preform flat, the grinding motion is horizontal NOT vertical. A vertical motion will destroy the platform. You want to use course abraders for preforms thicker than 5 to 1 width to thickness and a medium abrader for thinner bi-faces. Be cautious not to over grind, this will also cause splits or breakage. Keep in mind... the better you make your platforms... the less grinding they will need!

Part D

Finally part "D". This is what I like to refer to as the "road" the flake will travel down. This must be closely looked at before you decide to remove any material for the purpose of platform construction. If the surface area of part "D" is irregular, then it must be corrected before an attempt at flake removal is made. Simply put, don't waist the time and circumference of your bi-face trying to chip off an area with a stack or concavity. Just work on either side of it. Build platforms to target areas with good convexities. Stay away from concavities. You can modify the surface of your bi-face by pressure flaking if necessary. You must be careful not to cause "micro" steps with your billet or Ishi stick. It will just be more trash for your thinning flake to contend with.
Just remember to take your time and analyze. Be safe and have fun!

From http://www.flintknappingtools.com/platforms.html, March 31, 2010, copied with permission

The Below the Center Line Concept

OK...I'll admit it. Just don't snicker and talk about it to anyone, OK? As a beginner, for the longest time, I just couldn't grasp the concept of the center line. Now I don't claim to be a genius, but still... I see myself as fairly quick on the draw. So what was the deal?

First I was confusing my working edge with the center line. Then when I realized that wasn't always so I had trouble visualizing just where it was. But finally I got it! Now it seems so painfully obvious to me I wonder why I had so much trouble with it. I don't feel too bad though, because on Craig Ratzats video "Caught Knapping" he says that this concept is a difficult one for some to grasp.

Mastering the center line concept can help you become a more successful knapper because it helps reduce breakage due to hitting too high into the mass of a preform. Later, as you gain experience, you will learn how to "cheat with the angles" so that you don't have to lose as much size due to taking off part of your edge to get below the centerline.

Well, let's explore the center line concept.

First of all understand that we're talking about the center line of the mass. Let's say you have a piece of stone worked down until it's fairly elliptical. It's a preform now. Hold the preform so that you're looking at it edge on. The drawing in Figure 1 shows this view.

Fig.1

As we look at this piece edge on, we imagine a line extending across the top surface, and also one skimming the bottom. This is depicted in figure one by the two light blue lines. Now all we do is split the distance between those two lines exactly in half and imagine a line that extends through the stone (purple dotted line in Fig.1). This is the center line of that mass.(Seems like it could be called "The Center Plane")

Here's the deal. Until you have lots of experience you must promise this to your flintknappin' self. EVERY time that you are about to strike a platform CHECK to be sure that the place where your billet will connect is BELOW THE CENTER LINE. Platforms made and struck below the center line make flakes. When you hit above the center line you fold the piece!

Next we can take a look at figure two. It shows a preform with an irregular edge. The center line has been drawn in as a light blue line and, as you can see, sometimes the edge is above the center line and sometimes it is below it.

Fig.2

The two places marked with red X's are safe platforms (striking places). Just for kicks you can imagine the preform in figure two turned upside down. Now where are the safe, below the centerline strikes?

You may wonder why I didn't mark the left side as a safe hit even though there is material below the center line. That's because the angle isn't right on that end for an effective strike. It's leaning the wrong way. Platforms have to be at an angle of less than 90 degrees. You would have to chip or pressure flake at that end until the angle was not only below the center line, but also at an angle less than 90 degrees. But check this out! If you turn the preform upside down you have a platform that fits all the criteria just mentioned. On top of that, if you take a flake off there and then turn the piece back over again, you will not only have thinned one side, but with just a little retouch you will also have prepared a platform for taking a flake off the other side. Nice technique!

Fig.3

Finally, lets look at the dilemma presented here by the preform in Figure 3. It's a common scenario, but with experience it's usually pretty obvious. More often you deal with a more subtle version of this example.

We started our light blue center line at end "B" and extended it across the point to end "A". But look what happened to the line when it got to the "A" end. Suddenly it's not in the center of the mass anymore. If we were to strike a platform at this line the piece would very likely fail. The only thing to do is to move the edge down so that our platform would be below the center line of the mass at that end. The real center line of that end is indicated by the purple line. Now we can hit our platform and, providing we're holding the preform at the proper angle, a flake will be removed and things will be very happy.

So next time when you're working on a nice piece and you strike and nothing happens but a sick "clunk" noise...STOP! Where's your platform? Whew! You lucked out--it didn't break. Now move that platform down and try again! Good Luck and Happy Chipping!

From http://www.onagocag.com/center.html, April 1 2010, Copied with permission

Note: Wyatt R. Knapp is the author of "The New Atlatl and Dart Workbook" to be released Summer 2010.

Flakes from Flat Surfaces

by Jim Winn (January 27, 2003)

I did some more test flaking on obsidian slabs to observe the shape of the flakes removed. Flakes were removed with pressure using an Ishi stick with a copper tip and another with an antler tip on the 1st test. And a 2nd test was performed with percussion using both copper and antler. All of the slabs were photographed afterward showing the slabs as well as the tools used.
The following picture shows the results of the first test done with pressure flaking.

Two slabs that were pressure flaked using an antler tipped Ishi stick are shown on the left. Two more slabs that were pressure flaked using a copper tipped Ishi stick are shown on the right. The slotted rubber/leather pad shown at the bottom was used to support the slabs in the left hand and allowed the flake to travel without interference. The flakes removed with both antler and copper were all elliptical in shape and only slightly longer than their width. I was unable to significantly increase the length to width ratio using copper or antler regardless of the direction or the amount of applied force.

This next picture shows the results of the 2nd test using percussion flaking.

The two slabs on the left were percussion flaked using antler. Those on the right were percussion flaked using solid copper. In both cases all of the flakes removed were elliptical in shape and similar to those removed with pressure flaking. Some of the flakes were slightly wider than their length which was mainly a result of the edge angle (platform) being nearly 90 degrees. These flakes feathered out along the sides and terminated a little short at the distal end. The lower left flake has a platform closer to about 60 degrees and the flake was nearly round in shape.

OK, so what does all this prove? Well, it seems that the type of tool used (copper or antler) as well as the method of removal (percussion or antler) have little impact on the shape of the flake removed! There may be some minor differences that I could not detect, but they are insignificant. Of course, this only applies to a flat surface which provides ideal conditions and repeatability. Is this knowledge of value when removing flakes from an irregular surface, such as a biface? I think it is. That is just my opinion, but the whole purpose of performing a test like this is to gain insight into what can be expected under typical conditions that are not perfect (the surfaces we encounter in bi-facial reduction). I'm going to make the assumption that the shape of a flake removed from any surface has little to do with the type of tool used (copper or antler) or the method of removal (percussion or pressure). Instead, I believe that the primary determining factors in the shape of any flake removed from any surface are primarily a result of the following.

1. The shape of the surface where the flake is to be removed. The flake will follow ridges if they exist and it will fan out on flat surfaces.

2. The point at which the pressure is applied (when pressure flaking) or the point of impact (when percussion flaking). This will determine the initial thickness of the flake as it begins its travel.

3. The amount of applied force. This factor affects the mass and shape of the flake removed. More force is required to initiate fracture as the platform depth is increased (or the depth below the surface at which the pressure flaker makes contact).

4. The direction of applied force, including both the depth (or downward) direction as well as the direction across the face of the bi-face whether it be at 90 degrees or diagonally.

All of these factors directly affect the final shape of the flake detached. The type of material used to initiate the fracture (copper or antler) is mostly a matter of personal preference. The copper will require a stronger more heavily ground platform than the softer antler. And, if a massive flake is to be removed, more force can be applied using percussion instead of pressure due to the strength limitations of the person applying the pressure. If a mechanical levering device is used to apply pressure (such as in fluting), the flake removed should resemble that done by percussion. Again, the flake removed is primarily a result of factors 1 thru 4 above.

The bottom line is the stone simply follows the laws of physics and reacts according to the forces being applied to it. You cannot force a flake on a flat surface to be much longer than its width. You can, however, cause the flake to terminate short by applying pressure (such as with you fingers) to the surface of the flake as it is traveling. This usually results in a step fracture. I have heard of some knappers who are able to extend flake length by applying pressure along either side of the flake as it travels but I am not familiar with this technique and did not try it. My guess is that the flake might terminate short along the sides but continue straight ahead. It would be interesting to see what others are able to do using this or other techniques, and I'd really like to hear from them.

One final picture:

From http://www.flintknappers.com/oldsite/jim_winn_flat_surface.html, April 8, 2010, copied with permission

The Ethical Responsibilities of Modern Flintknappers

Fisher, James V. (2003) "The Ethical Responsibilities of Modern Flintknappers". *The Authentic Artifact Collectors Association Newsletter*. Volume 1, Issue 3.

True or false: *All who engage in modern flintknapping are evil-minded con artists who intend to commit fraud, compromise the archaeological record, and complicate the market for authentic relics*. If you answered true then read no further. If you answered "false" then perhaps you are counted amongst the many collectors with a simple desire to try your own hand at making the types of stone tools you have been finding in fields and creek beds since childhood. You may also have answered "false" if you are one amongst many collectors of authentic relics who has developed an appreciation for the knowledge that can be gained through participation in modern lithic studies involving stone tool reproduction.

I believe that at one time or another most collectors of authentic relics have puzzled in admiration over the methods and techniques that our prehistoric American inhabitants employed to create such lithic treasures. A natural curiosity about the means by which projectile points were made often leads collectors to experimentation and involvement, at variant levels, with flintknapping. The purpose of this article is to offer some advice to collector/knappers that will help to ensure that your endeavors do not lead to further complications in the market for authentic relics, a compromise of the archaeological record, or indirect and unknowing involvement in a third-party transaction where a fellow collector has been subject to outright fraud.

Generally, flintknappers can be divided into three categories, commercial knappers, academic knappers, and hobby enthusiasts. For individuals who engage in flintknapping as either a hobby, academic, or commercial endeavor it should be understood that an ethical responsibility of the highest regard is warranted. I propose a maxim by which all modern flintknappers should abide: *I shall not engage in the production, sale, or trade of reproduction artifacts unless measures are taken to clearly identify and permanently mark them as modern reproductions.*

It is in the interest of setting apart modern reproductions from ancient authentic relics, that the phrase "*clearly identify and permanently mark*" comes to bear. Modern flintknappers must assume the ethical responsibility of taking reasonable measures and precautions that will ensure that the products of their activities are never co-mingled with, or presented as, authentic prehistoric artifacts. That task is far easier said than done. What follows are some suggestions for clearly identifying and permanently marking reproduction artifacts, whether you produced them or acquired them. If you are new to knapping or have not yet committed to marking your work on a regular basis, you might benefit from some additional, friendly advice on how to accomplish this effectively.

Just as serial numbers on guns can be eradicated, so can most attempts to "permanently" mark reproduction points on their surface. With that being said, a very effective, yet perhaps less widely accepted suggestion is for a hole to be drilled completely through a modern point with a diamond tipped drill. There is no argument that this would, in conjunction with additional measures, clearly identify and permanently mark the reproduction as such. Even the most ethical

and well-intended knappers (myself included) are not going to be thrilled about drilling a hole completely through their work. Many modern flintknappers and collectors of modern reproductions regard lithic creations and replica points as art and are hesitant to employ a method of clear identification and permanent marking that substantially detracts from the finished point.

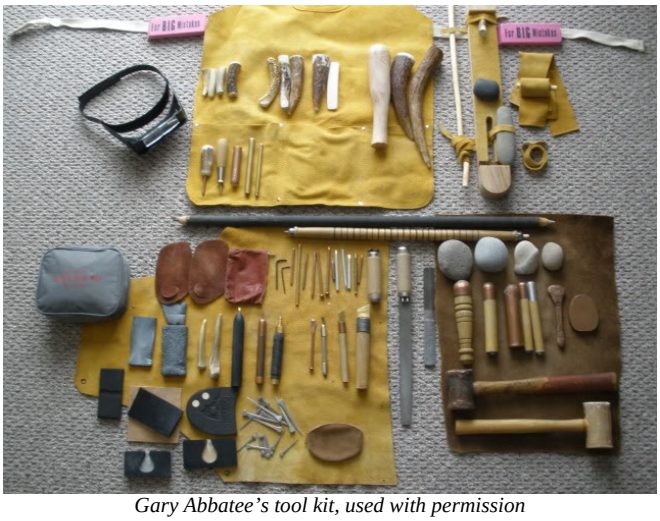
What can and should we *reasonably* expect from modern flintknappers? I personally like the idea of using a diamond tipped scribe or high-speed diamond drill bit to mark reproduction pieces. It is as responsible and permanent an effort as can be reasonably expected. Signing (or initialing) and dating reproductions with a diamond scribe is best done nearer the center of a point where it would be more difficult to remove the mark via additional flaking. I also recommend placing additional markings on the point with permanent black pigment or India ink that has been subsequently coated with clear nail polish. It is not always easy to readily see signatures or markings made with diamond tipped scribes on certain lithic materials. The use of pigment ink will offer a second, more prominent marking that can make the overall effort of clear identification more effective. Individuals who sell modern points are encouraged to mark them with the phrase "Reproduction-For Study Only". While this may not always be practical, particularly on smaller points, a simple "R" would likely suffice when accompanied by a diamond scribed signature (or initials) and the year of manufacture.

The next suggestions for ethical responsibility have more to do with what becomes of a modern reproduction after it has been clearly identified and permanently marked as such. It is imperative that if you choose to sell your modern work that you do so to individuals who can be trusted to continue the responsible custodianship that you have shown. In short, sell nothing to individuals whose motives for buying reproductions may be suspect. I have unfortunately known flintknappers who sold their reproductions to an unknown buyer only to find them listed in the "authentic artifacts" category on a popular online auction site. The modern points were quickly aged and presented as authentic by an unscrupulous dealer only days after they were obtained.

Modern knappers must also be concerned about those reproductions that will never leave their possession – during their life time. Non-commercial hobbyist knappers must also take reasonable steps to clearly identify and permanently mark their creations as modern. Keeping a meticulous record of reproductions in your collection complete with unique catalog numbers can help future heirs to easily distinguish modern reproductions from authentic ancient relics. All knappers must assume an ethical responsibility for clearly identifying and permanently marking creations that are sure to remain intact for countless generations to come.

Unfortunately, unethical knappers and fraudulent dealers will continue to flaunt any suggestions made concerning the management and identification of reproduction artifacts. The purpose of this treatise was to simply further the expectation that all ethical individuals who are involved with modern flintknapping will do their part to ensure the long-term viability of the authentic artifact collecting hobby and the integrity of the archaeological record.

From http://www.creeksideartifacts.com/Ethics/knappingethics.htm, March 31, 2010, copied with permission



Gary Abbatee's tool kit, used with permission

Section 2: Tools

What Do You Really Need To Start Flintknapping?

Wyatt R. Knapp

A FLINTKNAPPER'S TOOL KIT

I've been involved with flintknapping for some time now. I've been through a lot of searching and tool testing. If I've learned one thing it's that **there is no magic tool.** Don't fool yourself by thinking, "Oh, if I only had the tool that so and so uses I'd be able to flintknap." Or, "there must be some tool that makes this simple." Let me tell you, if there was a trick to it that made it easy then everyone would be doing it and it wouldn't be a big deal. Now, come over here and let me whisper the secret of flintknapping success into your ear. Ready? Okay ... **you have to do it a lot.** You have to practice and go through lots of material. And keep trying. You will learn and get better. I promise.

Now, after all these years I feel confident that I can give some good advice on what tools you absolutely need to be a good traditional style knapper. Don't collect a big old bucket of expensive tools and gadgets unless you like that sort of thing. Here's all you really need:

1. A leather pad of thick leather to protect your hand when pressure flaking.

2. A deer antler tine pressure flaker (or a copper tipped one as shown below). Antler tines work very nicely. They wear faster than copper but you get great pressure flakes. If you learn percussion work well, you will only need the pressure flakers for final edge sharpening and retouch anyway.

3. A medium sized antler baton, about 8 inches or so long and about 2 inches across at the business end. Make sure it is a good dense one. Antler is NOT harder to use than copper boppers. Knapping is not easier with copper. It is just as easy to learn to knap with traditional tools than it is with copper billets and such. Try the abo way.

4. A few hammerstones of various sizes. Quartzite or some other hard stone of a nice egg shape. One about 1 1/2 inches long, one about 2 1/2 inches. Also you can add a couple of sandstone ones that will be able to be used on easier material like obsidian or glass. You can usually find hammerstones by gravel pits, the lake shore, etc.

5. An abrader. Either of hard sandstone or a manufactured one.

6. A large thick leather pad to protect your leg while knapping.

7. A notcher. Make it from a cow rib bone, or an antler tine, or make a copper tipped one.

Now you will notice that of all those things, there is only one that would probably constitute a major purchase. That would be the moose antler baton. Prices for good antler batons can vary and there are deals out there. Just make sure the one you choose is good and hard, and dense.

The rest of the stuff on our list can be obtained cheaply, made yourself, or found for free.

These are the only tools you really need in order to flintknap and I have found that these are the ones I rely on over and over again. They could fit in shaving bag or could be rolled up into a small leather parfleche and take up hardly any room at all.

Later on you may find that once in a long while you'll have need of a larger billet for spalling or something, but hey -- try a rock. They're free and lots of abo knappers used them. I think there was probably a lot more hammerstone knappers than we realize in prehistoric times. With practice you'll be surprised how well you can remove flakes with stone tools.

Bottom line: You don't have to break your bank account trying to buy every new tool under the sun in order to turn out beautiful points. Do it the abo way!

A Broomhandle Pressure flaker

Take an old broom or shovel handle and cut off a piece that is a comfortable length for your tool handle. Drill into one end of it to a depth of about 2 inches. The diameter of the hole should match the size of your copper wire (Something about 3/16" diameter is nice, but make all different sizes). Cut the wire so that it when it is put in the hole it extends out about 1 1/2". Hammer the wire to a point at the end. I would also suggest that you hammer some flats into it as shown in the illustration. You may want to add a set screw to hold the copper tip in place.

Copper Tip Pressure Flaker

If you want you can make the handle a couple feet long and turn this into an Ishi stick. Many people feel they can get better leaverage using the longer handle and bracing it under their arm or against their side.

From http://www.onagocag.com/tools.html, April 1 2010, Copied with permission

Note: Wyatt R. Knapp is the author of "The New Atlatl and Dart Workbook" to be released Summer 2010.

Pictures of Modern Tools from Primitive Materials

By Charlie (aka Stonefacescar)

here are the tools that I made and use...

copper ishi stick, hammer for dressing tool tips.

split branch ishi stick

ishi stick adjustment

wrapped

another hammer, encased in rawhide

pressure tools

hand flaker, showing the little bent 'cleat' or 'spur' that locks the tool into the inside of the handle

percussors

raw copper nugget percussor, and a splitting wedge/percussor

antler tine holders

done with these tools

notching tool tip shape..

if you use branches off a tree, instead of dowels, it is easier to split the branch, down center, and it is easier to follow the 'pith' to hollow out the center with stone tools, for the antler or copper tools tips...

hope this helps

Charlie

From http://www.paleoplanet.net/, April 3, 2010

Making a Horseshoe Nail Notcher

By Mark Dellinges

I made this horse shoe nail holder from plumbing supply parts. You'll need a 1/4" hose barb adapter, 1/4' brass pipe nipple,1/4' pipe cap, horse shoe nails, wooden dowel, self cured acrylic resin or epoxy resin, and optional rubber tubing.

Fill the inside of a hose barb adapter about half way up with resin and insert a lubricated horse shoe nail. Allow to set and tap out the nail. Nails of similar type are now interchangeable and have good "side to side" stability.

Now assemble by screwing the hose barb adapter to one end of the pipe, insert the wood dowel and tighten the pipe cap to the other end. Note the good "front to back" stability. If the nail should loosen while in use just tighten the pipe cap.

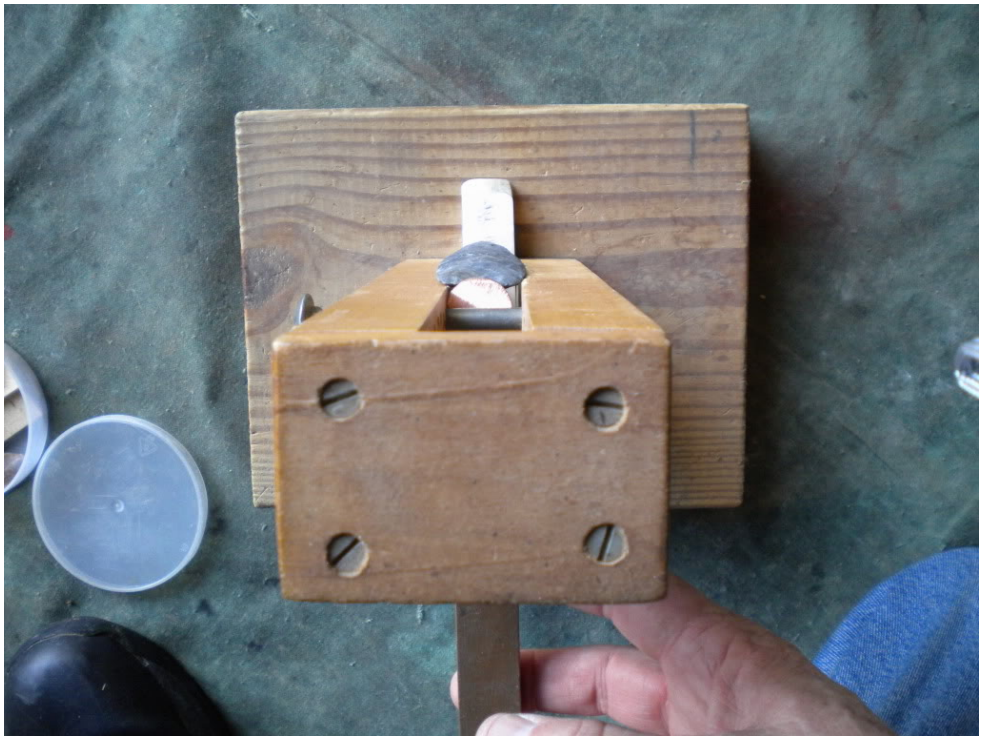
My "narrow entry" notching really improved once I found a way to keep the horse shoe nail vary stable. I hope this helps!

From http://paleoplanet69529.yuku.com/reply/275691#reply-275691, April 4, 2010, copied with permission

Simple Fluting Jig Pictures

By Ken Wallace (aka Paleoman 52)

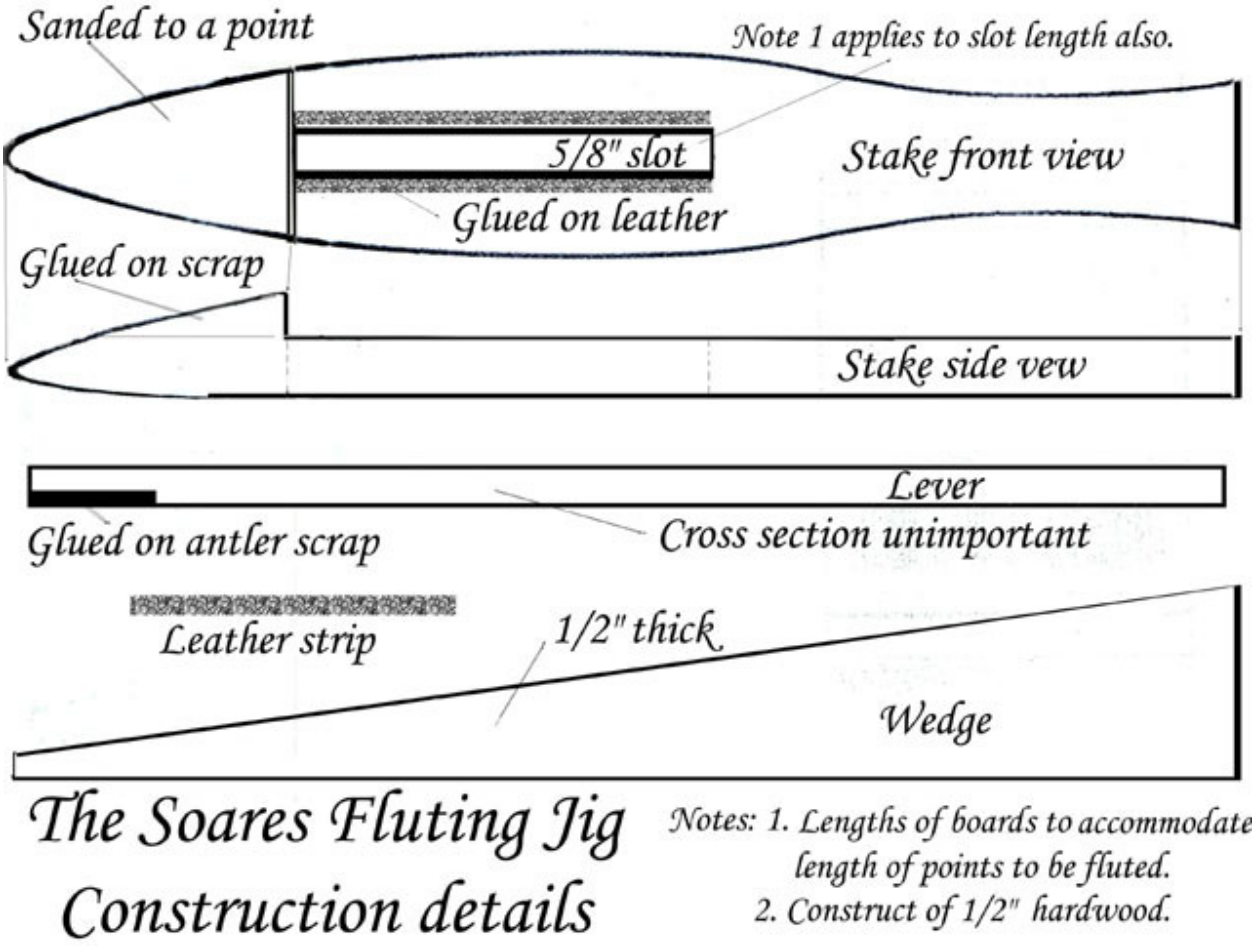
To go along with the thread on fluting nipples I am posting a few pics of the fluting jig I have been using since 1993. As you can see this is a pretty uncomplicated device. The secret to making this jig work well is to be sure to spend as much time as you need to on preparing the fluting nipple. Always make sure that the ears of the point aren't pressing to hard against the uprights because this will cause them to snap off. Also be sure that when you are applying maximum pressure that the bar is almost 90 degrees with the preform. It helps to give a tug on the bar once you've applied to pressure you need to cause the fracture that releases the flake.



From http://paleoplanet69529.yuku.com/reply/294764#reply-294764, April 4, 2010, copied with permission

Tony Soars Fluting Jig

Posted by Richard Meyers (aka Twobear)



From http://paleoplanet69529.yuku.com/reply/294764#reply-294764, April 4, 2010, copied with permission

Rocker Punch Board

By Gary Abbatte (aka rhymeswithwhat)

I have interpreted the research of Dothager to construct a modern set of tools using similar physics and a blending the two Dothager tools into one practical set. The key to his Three Digging Stick Tool is the slot or space between the sticks and the use of a foot lever stick and thong to pull down a larger punch and hold it while striking. His second tool, a small split out branch tool, uses a tied down small punch. Both tools use leather pads or a pad over an anvil stone as an aid to locate the height of a preform or spall and set a striking angle for the punch and billet. Here is my tool set that combines the both lap tools into one with modern materials:

At the top is a large Cow Bone punch and a large Antler punch with a leather pull thong around it . The thong connects to the foot operated pedal stick for holding the punches firmly against the workpiece. The pedal stick and thong also holds the lap board very steady across the top of my legs when seated in working position and applying pedal pressure. The lapboard itself is oak, covered with leather and the other end away from the slot on the board is used for small punches that are tied down using a clove hitched leather strip. The underside of the board that rests on my legs is also covered with leather for comfort.
The tools at the left are my striking tools: A Dogwood Billet, A Moose Tine Billet and a Limestone Billet. Small Antler punches can be seen at the right end of the board and one is fastened down in working position.
Below the Foot lever stick is a variety of leather pads and an anvil stone.

A closer picture of the slotted punch board end.

Billets, anvil and padding.

Small punches at the right end of the board.

Conclusion: This tool set has a lot of potential and I hope to gain skill using it. It is nice and steady on the lap and I can take large thinning flakes and shape preforms out of Onondaga with the set. If you are unfamiliar with rocker punch methods for Flint Knapping take a look at the Dothager video set and see how he uses his tools developed from his research:

http://www.spiritinthewind.com/mike_1.htm

Punch em out!

[To see this tool in use, go to http://s30.photobucket.co...amp;current=punchvid.flv]

From http://paleoplanet69529.yuku.com/topic/29696?page=1, April 4, 2010, copied with permission

Converting a Pottery Kiln to Heat Treat Flint

by Mark Bracken

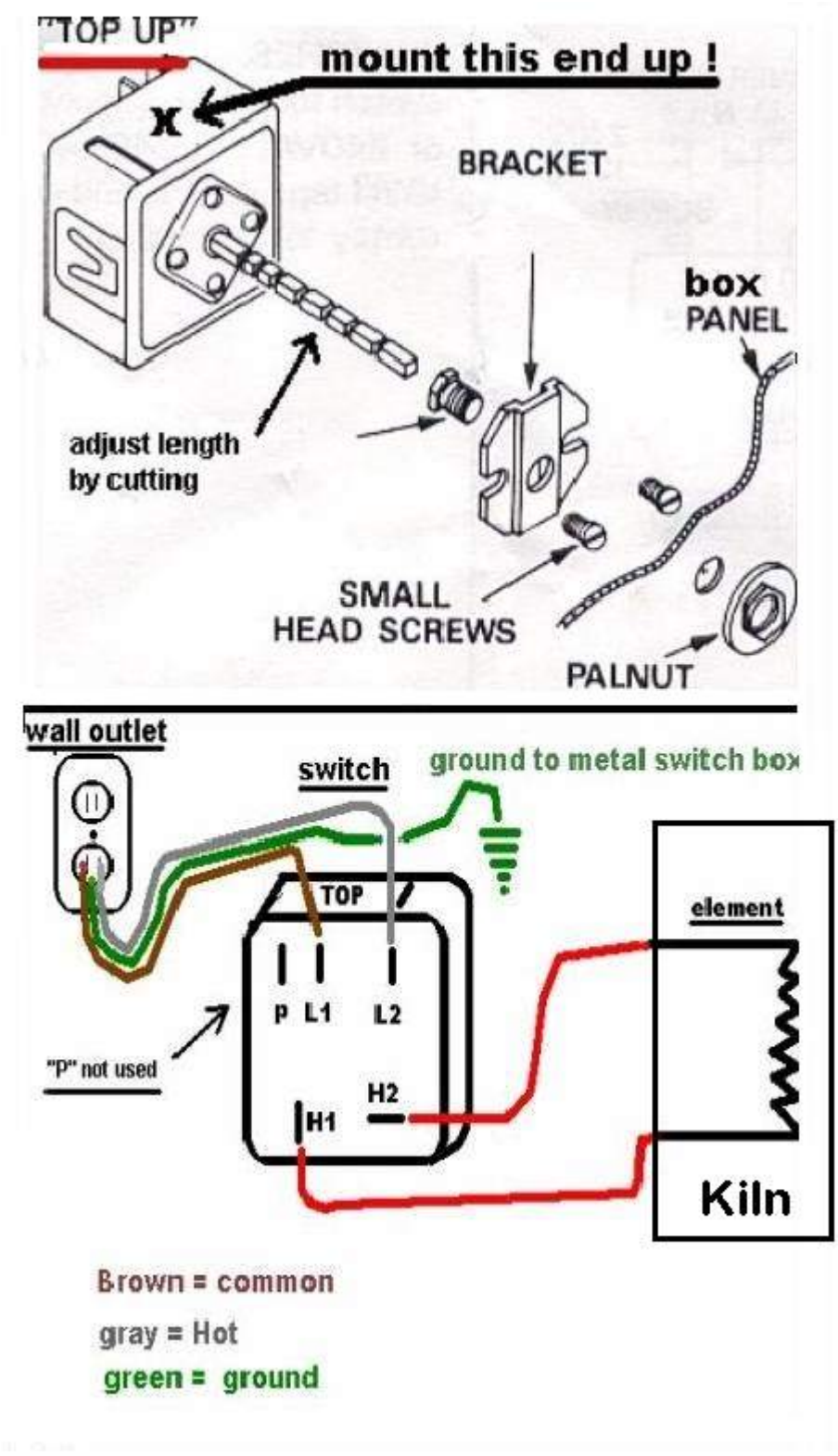
Read this DISCLAIMER Before you Proceed

Any person(s) using informations from this website constitutes acceptance of this agreement.
Advanced electrical knowledge is **REQUIRED** to begin and or complete this kiln modification
Person(s) using this information or any information offered by this web site are fully responsible for the transfer of this said disclaimer to any other persons user(s) of any informations offered by this web site.
The user(s) assumes full responsibility for the proper interpretations and safe use of these information(s).
Informations here are **Not** recommended for children under 18 years of age.
Keep products and all related products away and out of reach from pets and children.
Improper installation, care or use of products could result in property damage, Fire, electrocution, blindness, serious injury or death.
Safety goggles are **required** during this procedure. Avoid inhaling fumes or dust.
Must use proceed with proper ventilation. Must dress properly, wear shoes that completely cover the foot, Full length pants and a shirt are required during installations or modifications.
Must wear heavy leather gloves accompanied.
Consult your physician before you proceed if you suffer from any Breathing illnesses, bleeding disorders, tendentious, carpotunnel or any other discomfort before proceeding.
If problems and or discomfort result, discontinue use and consult your physician.
Do not consume alcohol, drugs or other mind altering substances during this procedure.
If any product defects or excessive product wear are discovered, **do not** attempt to use.
In no event shall the manufacturer(s) or retailer(s) of products used or sold on this web site be liable for incidental or consequential damages or for any other damages to the properties or person(s) of the buyer and or user. The recovery for damages resulting from any and all causes whatsoever, including, but not limited to, misuse, negligence, or strict product liability, will be exclusively limited to the replacement of the product(s) with respect to which losses or damages are claimed or to a refund of any purchase price paid for the products. If you wish to or have purchased products or used information(s) from this web site and **DO NOT** agree and or accept this disclaimer, DO NOT PROCEED. Proceed and or use at your own risk.

Switch Installation

Proceed at your own risk. This switch, Robertshaw 5500-135 commercial infinite switch, is designed for 120v. It can be purchased from any appliance parts store. I recommend the commercial grade switches. Each switch is to be used with one element ranging from 13ohms to 18 ohms. If your kiln holds one 5 Gallon bucket of rock then one switch will be enough. I have a kiln that holds 18 gallons of rock and I have three switches on it. The temps should not be allowed to exceed 800f.
NEVER use the kiln on or near the "high" setting. Use caution when settings are near the "high" setting, the kiln could lock in "high" mode and will cause damage to your stone and possibly element(s). Never operate your kiln near any flammable vapors including, Glues, solvents, fuels or others . Infinite switches produce small sparks as they "toggle" in their operation.
The switches have a dial with numbers from 1 to 6 on them with quarter and half marks on them. The dial settings are NOT temperature settings. For example: You must experiment with your kiln to find out what temperature #4 produces. It might be 375f. Make a chart and write down the final values of each setting. Be sure that you are allowing at least 24-36 hours for your kiln to max out at the dial setting you have selected. Don't become tempted to monkey with the dial when your trying to establish final values for a dial setting. Always fire FULL loads of material.

Read this carefully!!!
If you are unfamiliar with proper and safe installation DO NOT PROCEED
1. Unplug all power before working on your kiln!
2. Mount your switch in a metal box on the side of your kiln. Mount with good and safe clearance from any electrical connections to the element or switch itself.
3. Be sure switch is mounted with the "top" indicator is facing upwards. See diagram below.
4. Use a 14 or 12 gauge cord with ground wire. The best option is to make up a new one or remove one from an old appliance with a ground wire still intact. Washing machine, refrigerator, microwave ect… are suitable.
5. Wire switch as shown in the diagrams below using quality crimp connectors. NO ELECTRICAL tape.
6. Check all connections with a multi-meter to insure there are no "shorts" or "longs".
7. Double check your element to be sure it is in the Ohms operating specifications of this switch as per diagram. Do Not Use old or original elements with this switch. They are not compatible.
8. See diagram Below for details. Please note: the "P" connector is not used on this configuration!
9. Use proper terminal leads on all connections, NEVER use electrical tape! NO connections should be located inside the kiln. All connections should be clear of any metal or conducting parts!



Operate the kiln safely!

1.Never operate kiln on a wooden or flammable or combustible surface.

2.Place kiln elevated on concrete blocks or metal stand. Do NOT set directly on any floor concrete or otherwise!

3.Keep kiln at least 20" from any walls or other objects at all times.
4.Use cement fiberboard on near by walls for an extra-added protection!
5.Use a "dedicated" outlet for each kiln switch on a 15-amp breaker.
6.Never heat-treat large blocks of stone. Stones could violently break apart. This could knock the lid right off a kiln ejecting VERY hot Fragments, creating a serious fire hazard!
7.Keep your kiln out of the weather, Damage to electrical parts will result.
7.Never operate kiln with flammable fumes, liquids, solids or vapors present.
8.Avoid heat-treating in your home or living space. Heating rocks can produce poisonous or harmful vapors, especially if cut on rock saw!
9.ALLWAYS WEAR A RESPIRATOR WHEN LOADING OR UNLOADING YOUR KILN!!! DUST FROM BRICKS AND ROCKS ARE DANGEROUS TO YOUR LUNGS!

-Mark Bracken

_____

From http://www.flintknappingtools.com/heattreating_kiln.html, March 31, 2010, copied with permission

Dan's Cave

Every man needs a place where he can go to "get away from it all" once in awhile, a cave to hide away in; a place for male bonding, making silica dust and washing it down. Whether it's a room in the basement, or, if a guy's lucky enough, a workshop out behind the house. A place, other than the local pub, where your wife will know where to find you.....yet leave you alone to "create", knowing that you really can't get into any serious trouble "out there". This is the story of my "cave" and how it came to be.

I started knapping almost ten years ago now. Back then it was an outside only activity, done on occasion with a hammerstone and some chunks of Onondaga I picked up walking local fields.....oh yeah, and band-aids too of course. I was curious and interested, but the obsession hadn't quite kicked in yet. After some initial struggles (who didn't?) I found a copy of D.C.'s "The Art of Flintknapping" at the Buffalo Museum of Science. I was astounded.....I couldn't believe that such a thing existed. Boy, I thought, I've got it made now! After reading and struggling some more, I came to the conclusion that I just had to have somebody show me how to do this. At about this time I was introduced to Jack Holland, a gentleman well known in both knapping and archaeology circles....."Mr. Lithics". I pretty much just tormented Jack until he was kind enough to invite me to his home to give me a knapping lesson.....I guess it was either that or learn how to deal with a stalker! Jack showed me the basics, saw that I was sincere in my desire to learn, and decided that he should get me on down to meet Ken Wallace, a knapping legend here in the Northeast.

To make a long story, well, a little shorter. Ken and I became fast friends and I was put firmly on the road to learning this "lost art". Having a good teacher accelerated my abilities light years beyond where I would have been had I continued to struggle on my own. I still consider myself extremely fortunate to have met such a skilled knapper, and one who so easily and generously gave of his knowledge, so early in my knapping career.

The first time I visited Ken with Jack, as I sat in his home marvelling at the case after case of work that he put before me, I wondered where all of this magic happened. My question was answered as we moved outside to "the shop". Ken's shop was small, with a low, sloped ceiling and a wooden floor.....I could see small pieces of debitage imbedded in it and caught between the boards. There were things to see in every nook; arrows, darts, antlers, tanned hides, trade beads.....I was overwhelmed!! The day was somewhat of a blur; it would have seemed almost dreamlike looking back at it later that night, had it not been for the paper thin Snyders point that I clutched in my hand....one of Ken's signature pieces and a gift to remember the day by.

Needless to say, I returned home totally pumped up and ready to knap. I looked at my little room in the basement, the one I shared with the boiler. Sure, it was plenty warm, but the light

was poor and ventilation was non-existent (we tend not to open our windows much in Canada in the winter). Of course there was the rickety old garage, which was fine if it wasn't really cold....kept me out of the wind anyway. I didn't have to worry too much about the flakes on the floor either; we didn't put cars in the garage and it had a gravel floor, as the previous owners had removed the old wooden floor after repeated skunk infestations under it. This wasn't the most pleasant place to knap.....I needed a change.

My next attempt at a knapping studio brought me to our cottage, which is on a large river a short distance from the house. I got hold of a huge canvas tarp at a flea market, moved all of the furniture aside and covered the floor with it. This worked fairly well until Spring, when even after repeated vacuuming of the carpeted floor, my wife, who lives in bare feet as soon as it's warm enough to do so, started to "discover" small hidden flakes. Looked like I needed another plan.

It was time to tear the garage down before it fell down and build a new structure; not a garage but a combination workshop/storeroom. I attacked the garage, and to say that it was in trouble is an understatement; I took the whole thing down with no more than a crowbar....there was nothing bigger than a 2x3 in it!

I had designed an L-shaped building with the larger part of the L being the shop and the shorter part the storage area. After visiting the City planning department I found that I could build a much larger structure than I had thought, but I fought the temptation to eat up too much of the backyard (my wife loves her gardens), so I settled on a 16'x20' area for the shop and a 10'x16' area for storage. I knew that these nice even measurements would make construction easier too. I set to excavating for the floating concrete pad that the whole thing would sit on. Things got interesting almost immediately as I found a few flakes of aboriginal debitage in the soil just outside of what would have been the garage, so I know that it wasn't mine. It really wasn't a total surprise as we live less than two blocks from the Niagara River in one direction and about two blocks from a large tributary of it in another. I considered this an incredibly good omen, even more so than if I had found a point; knowing that prehistoric people had knapped right on that spot made it seem perfect. I even incorporated some of the flakes and a couple of my points into the concrete as we poured the pad.

The structure went up fairly quickly, thanks to pre-fab trusses and a friend who just happens to be a carpenter! We included two large windows on opposite walls on either side of the knapping area, and in line with the prevailing wind for flow-through ventilation. I wasn't just building a workshop for all of the things it might be used for.....I was building this thing with knapping as the primary consideration. I'd already decided where I would be sitting to knap; looking at the window that faces the house so I could see and hear my wife when she called me in for a meal. Being in the throws of a heavy knapping session is one of the few things that will cause me to forget to eat!! I've since installed an intercom to take care of these things in the winter months.

In addition to the two large windows for ventilation and light, I installed a 2'x4' skylight directly over the knapping area. If there is one piece of advice I would pass on to anyone considering building or modifying a shop for knapping, it would be to put in a skylight; it makes all the difference in the world.

It was finally time to begin finishing the inside of the shop; wiring, insulation, deciding where the workbench and power tools would reside, and in which corner the kiln would sit. Figuring out all of this ahead of time also helped me to distribute my electrical load evenly throughout.

Now, what to cover the walls with. I had decided to keep the ceiling open to keep the rafters available for storage (glad I did), but I did want to cover the insulation in the walls with something. I didn't really want to mess around with drywall....had to keep reminding myself that this is "just a shop". I looked around for an alternative and came up with a solution.....at work! I'm a lineman for an electrical utility, and our yard at work had a quantity of hydro poles that had outlived there usefulness. They are western red cedar from British Columbia, and some of the guys had started milling them up and making decks out of them, so I thought, "Why not panelling?" I had them milled to 3/4" thick and whatever width each pole provided. Once through a thickness planer to achieve uniform thickness and smooth them out (and bring out the grain beautifully), and they were ready to go up on the wall. They looked, and smelled, great!

The only wall I didn't cover with the planks is the one behind the woodstove, which is a wall of 100 year old bricks I picked up on my travels. Cedar is a fairly soft wood, which was evident after my "shop warming knap-in" when I found small chert flakes actually imbedded in the walls!

I next hung two eight foot, double tube flourescent lights on either side of the knapping area and a ceiling fan directly overhead (more air movement). Feeling that I'd covered just about everything; heat, light, ventilation, communication, storage, even a small beer fridge (gotta wash that silica dust down somehow), I realized that the only thing lacking was a bathroom. I hadn't run plumbing to the shop, and knowing that I had neighbours all around I couldn't use the method that we used at Ken's shop (out the back door). Not wanting to leave a toasty warm shop in January to run to the house, I had to come up with an alternative; so I dug a three foot deep hole outside, drilled a hole through the wall and ran some PVC tubing through it. The end of the tubing was at the bottom of the hole in the ground, which I proceeded to fill with alternating layers of sand, gravel and activated charcoal (for odour control). On the inside end of the tubing is a large funnel (the kind you use for draining your motor oil), and behind that on the wall is a small piece of plexiglass.....a splashguard for those knappers who have trouble "hitting the platform". The first test run gurgled back at me....I hadn't considered the requirement of a drain vent. A small hole drilled into thePVC just before it disappeared under the ground solved that problem, and a"flush" from a jug of vinegar keeps things clean without pouring chemicals into the ground. The "bathroom" is even strategically located in a corner so that the user can be behind the door of the shop for a little privacy.

Adorning the walls are several cases of points that I've traded for or been given over the years, and several posters; The Story in Stone poster of course, Pete Bostrom's Clovis poster, and Val's drawings of the Wenatchee points among others. I even have an award that I was presented with at a knap-in a couple of years ago in Pennsylvania.....it was for being "The First to Arrive".....OK, so I got the dates wrong and went a week early!

Are there any things I'd change in retrospect? Yes, only two: First, I didn't know about "cold start" ballasts for flourescent lights. Seems the lights I hung (the price was right) are made for indoor use only; the air has to be at least 50 degrees for them to operate properly. This is remedied by getting a good fire going in the stove before I settle in to knap.....not a big deal. Secondly, I put a "brushed" finish on the concrete floor, which I thought nothing of until the first time I tried to sweep up flakes.....should've left it smooth. Again, this is taken care of by using a tarp to knap over, which makes clean up easier anyway. All in all I've been very happy with the result, and the knappers that have joined me over the last couple of years have given the place a hearty thumbs up!

If you're considering moving out of the basement or garage, or even modifying an existing space to be more knapper friendly, I hope that some of the suggestions I've put forth here will be of some use to you.

Oh yeah, and don't forget the vinegar!!

From http://knapper_dan.tripod.com/page2.html, April 4, 2010, copied with permission

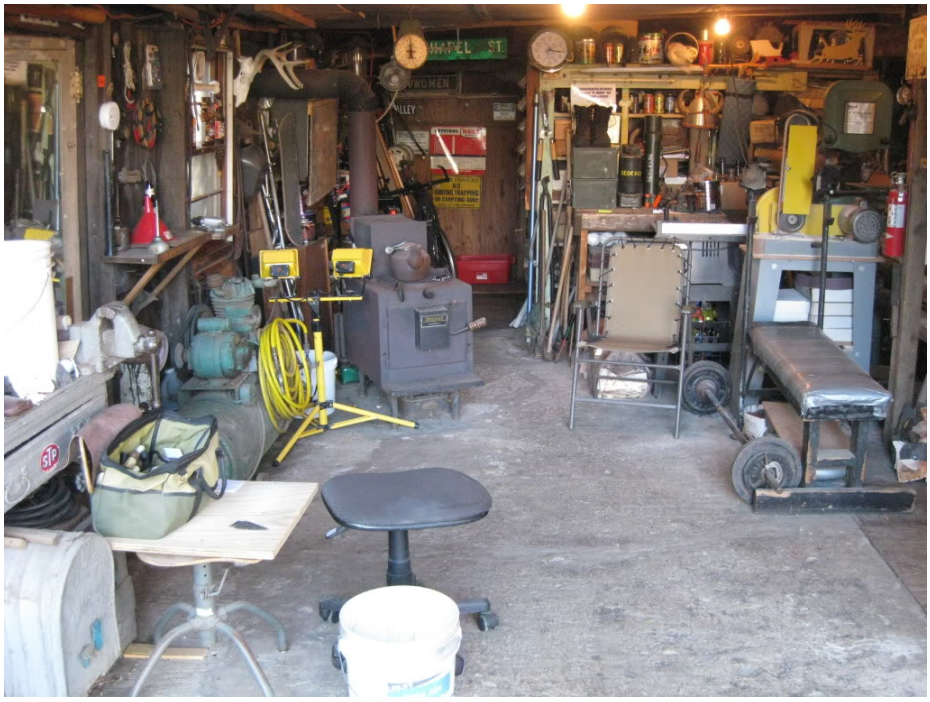
Pictures of Dan's cave from http://www.creeksideartifacts.com/DLKI/index.html

Paleoman52's Man Cave

by Ken Wallace (aka Paleoman52)

When I started this thread last week I forgot to include my outside cave. Here are a few shots of where the magic takes place. Many of you have been here and will recognize it very well, for those of you that have not been here yet, I welcome you to stop by, My cave is always open to you. My only requirement is bring a rock with you, enjoy!

This is the outside of my Cave and it kinda looks like a cave with that big opening and all the different antlers hanging around the front.



This is the area I like to sit during warmer weather and chip out my creations. It has a good view of the neighborhood and sometimes my neighbors spot me here and bring beer to share.

This is in the inner cave where I collect my finished pieces and grab cold ones out of the fridge to celebrate the successful completion of any point that doesn't break.

More views of the inner sanctum of my cave, this is organized but my wife considers it very messy, Hey I know where everything is, that all that counts.

This is my meager rock supply that I have, when this gone I don't chip anymore until someone brings rock to the area, or I travel to a local knapping gathering.

OK this picture kind of speaks for itself. Am I the only one brave enough to show "The Funnel"? This is one of the most popular places in my Cave and is visited at least one or 2 times a day by everyone when we gather for a day of chipping. I'm sure that all caves have different forms of this feature and recently I have rebuilt and improved my "Funnel" to handle more volume when my friend Mike arrives at my place after he drives in from Niagara Falls, NY. If you look closely you can see that there is a handle hanging from the rafter to pull if the need arises and also a miniature toilet on the shelf next to the"Funnel" that has a handle to trip and it is complete with full flushing sounds.

It may not be a place of beauty but it is my Cave and I enjoy every moment I spend out there, I hope you enjoyed your tour!
-Paleoman52-

From http://paleoplanet69529.yuku.com/reply/261940#reply-261940, April 4, 2010, copied with permission

Section 3: Percussion

Percussion Flint Knapping Tutorial

By Tom Sterling

Here's the actual theory put into action. Doc Higgins is holding a piece of "Silver Sheen" obsidian (named because of the gray layers in it) that he's going to turn into a seven inch blade. This is a large, angular and knobby piece of obsidian, a naturally occuring volcanic glass. Native Americans favored this material for stone tools, using it whenever they could obtain it.

Note the heavy leather glove on his left hand, and the thick leather pad on his leg. The flakes he'll be removing are said to be the sharpest edge known to man. Because of the conchoidal breakage characteristics of obsidian, the edge produced is feathered out to an edge one molecule thick, far sharper than the best surgical steel.

Here Doc's about to take the first in a long series of flakes from the obsidian. He's using a solid copper bopper here, and will be hitting about one third of the way up from the bottom of the edge nearest the bopper. The flake will detach from the uderside of the stone. By controlling where he hits the stone, the angle he holds it, the angle he strikes it at, and the force of the blow he will gradually remove unwanted portions, resulting in a beautifully flaked blade with matching flake scars. He's been doing this since about 1990, and is self taught. I've (Tom) been doing this for about two years, and can produce blades only half the size Doc can, and not nearly as pretty. I also break quite a few. For me, a tragic case of theory wildly outstripping performance. While anyone can learn to knap successfully, truly beautiful work requires lots of practice and extreme dedication.

Here Doc has struck off the first large flake and is holding it in the position it came from. You can see the edges as dark black lines. After studying the rock carefully, he has chosen this particular corner because of the ridge you see running under his thumb. Flakes tend to follow ridges quite well, and a skilled knapper can direct which direction a flake will run.

Here is the same flake removed from the rock. Note that it is a portion of that same spall cone we looked at in the beginning when a BB hits plate glass. Doc will simply remove more portions of similar cones at places (and sizes) of his choosing, until he ends up with the desired results.

Here Doc has removed the second flake, overlapping the first and along the edge ridge he created with the first flake.

Here's the rock after Doc has carefully removed almost all of the outer layers (the cortex). Note a little of it still remaining at the right hand end. The cortex is highly weathered and doesn't have that characteristically shiny obsidian surface. The rock is becoming more and more convex in cross section, which is Doc's ultimate aim. Flakes will travel very well over a convex surface, and convex blades have the best characteristics of both strength and sharp edge for durability.

As the edges become thinner and sharper, Doc is paying particular attention to thickening the incredibly sharp edge by abrading it away with a coarse stone. Modern knappers use pieces of grindstone, where prehistoric knappers would have used coarse sandstone. Thickening the edge allows the force of each blow to transfer efficiently into the stone, resulting in a clean break, in the desired place, rather than allowing the sharp but weaker edge to crush. Crushing either fails to detach a flake, or only allows the break to travel part way into the stone, then break off leaving an ugly ledge which will be very difficult to deal with later (a common beginner's mistake). A not to be overlooked advantage to abrading the edge is the stone is much safer to handle. Freshly flaked edges are so sharp you can easily cut yourself and not even notice until the area around you begins to fill with red fluid!

Here's the rock several series of flakes later, at a stage called a "biface." This is the stage at which Native Americans would have used to transport the stone for trading or taking home. Rather than carrying a lot of waste stone (remember, no pickup trucks back then), Native Americans would have reduced the raw stone to this stage, and carried them away in baskets. From this stage, a large knife blade or spear point could be produced at will, and most of the subsequent waste flakes taken off would be recycled as small cutting tools or arrow points.

Here it is from a side view. At this stage, the rock is at least half the weight of the original.

Here's the next stage. Doc has continued to go around the edges and on both faces of the stone removing flakes to further refine the shape. He's been paying especially close attention to removing flakes to help thin the stone.

The same stage edge on. Note how much thinner it is.

Several more rounds of thinning and shaping flakes. Note how much it is starting to look like a knife blade.

Same stage edge on.

More refinement. Doc's carefully programmed flake removals are starting to show up regularly spaced and matching with flakes from the opposite side. Knappers would refer to these as well spaced flake scars. Nicely patterned flake scars produce prettier blades, and are often considered a demonstration of the knapper's prowess.

Edge on. Only a few places to fiddle with and we'll be done.

Here's the "debitage" (waste stone) pile left after finishing the blade. Many of these flakes are useable as cutting tools simply by abrading the side held next to the hand (for safety), or to be made into smaller knives, arrow points, drills, scrapers or other tools. This is also the amount of material a Native American trader would not have had to carry when he (or she) took out only biface stage material.

The finished 7 inch blade. Note the evenly spaced flake scars, matching with other scars from the opposite side, and smooth edges. A beautifully knapped knife blade, or with several knotches at the wide end, hafted onto a spear. All told, several hours of intense concentration, and lots of years of practice in the school of hard knocks, cuts, scrapes and jabs.

Tom Sterling PO Box 1621 Coupeville WA 98239

From http://www.sterlingsculptures.com/Resources_folder/Knapping_folder/Knapping_6.htm, March 31, 2010, copied with permission

Abo Flintknapping Reduction Strategies

by Rick Hamilton
Spirit in the Wind Enterprises

A photo essay on abo flintknapping reduction strategies and techniques utilizing hammerstones and antler billets.

Some notes by the knapper:

This particular piece of Niobrarite had a seam which came apart on me about halfway through the reduction process, resulting in a smaller biface. This triangular cross sectioned, tabular piece would have been very difficult to use a modern lapidary saw on with much efficiency. I picked this piece as it was triangular shaped, with two square edges, and cortex on each face, which allowed for a variety of reduction techniques.

I first edged the piece, than used longitudal primary flakes from the proximal ends to thin and flatten the piece. Then I proceeded to percussion flake removal from the sides. Efficiency is the key to a good reduction process. Your flakes should travel as long as possible. Bob Patten taught me to look at my debitage pile when I was done. If you have mainly large thin flakes you have done a good job. In my opinion this is one of the major differences in antler knapping as opposed to copper and some of the other materials.

Most of the resulting debitage flakes can be used for arrow points and scrapers, or as cutting implements as is. Take a look at the last picture of the series to see the resulting debitage pile from this reduction.

A tabular piece of Republican River material a.k.a. Republican, Niobrarite, Smokey Hill Jasper, Smokey Hill Silicified Chalkstone. The piece is approx. 2 1/2" wide, 4" long, and 1 1/2" thick. The piece is triangular in cross section

The opposing edge showing an angle suitable for a large platform for initial reduction flakes.

Stitching is the process of removing flakes alternately from each face to remove a square edge. A hammerstone was used at this stage.

The opposing edge with a flake removed to help reduce the square edge.

An end view showing the triangular cross section of the piece. A challenge to thin while retaining the width on a piece like this.

A second flake removed from the base (proximal) end to further minimize the square edge utilizing a platform created by the previous flake removal. (the basic technique for blade removal). The platform was on the right hand side of the flake with an antler billet being used.

A hammerstone was used to stitch the remaining edge after the reduction of the two flakes from the proximal end to minimize the square edge

I used a whitetail antler billet and the platform shown to remove the flake and then put back in it's original position. This is the proximal (base) side.

A top view showing the same flake and it's removal scar. Notice it removed the majority of the cortex and traveled nearly the full length of the nodule.

Side view of resultant flake, notice it's flatness which is what you want on primary thinning flakes initiated from either the proximal or distal (point) end.

Opposing face (1) showing a flake removed from the proximal (base) end. It also removed nearly all the cortex from this face very similar to side 1. The flake did break into three pieces but held together enough to travel the full length. Removing your initial primary flakes from the ends thins while also maintaining your width.

Top view showing the flake removed in the previous photo. Notice the chalky portion in the center. There is a seam in there that would cause me problems later on.

A full length or in this case a full width flake (coast to coast) without dipping into the ocean (overshooting). These major secondary flakes are initiated from the sides using some of the platforms created by the earlier stitching of the square edges. Notice the stitching remnants on the edge in the bottom of the photo.

The same flake from a different angle. The platform is on the right hand side of the flake.

This platform is too large for a billet, the piece would probably break. I used a hammerstone to remove a small flake from the bottom on either side of the platform, which created a smaller one that I then removed with a billet.

Initial pressure flake removal to help regularize edge and also to set up more platforms for more percussion flake removal with a smaller antler billet.

The biface after the target thickness has been reached. Percussion has been used almost exclusively to this point. I lost nearly half of the biface just prior to this due to a seam which is quite common in this particular material.

I prepared isolated platforms at this point such as the one above using an antler tine pressure flaker to regularize the edge and also to remove ridges and extra mass.

Isolated pressure flaking platforms created by alternate pressure flake removal from each face while progressing unidirectionally down the edge.

The top half of the biface has been pressure flaked using the platforms shown in the previous photo, I now will create platforms on the bottom edge and pressure flake the remaining half of the face shown. Notice the percussion scar remnants on the bottom half.

We now have a thin biface with nice convexity which could be finished with pressure flaking in a minimal amount of time.

All the primary, secondary, and tertiary flakes from the reduction process to this point. A few of the pressure flakes escaped on me, but for the most part this is the complete debitage pile from the reduction process. These would all have been used as tools or as blanks for points, scrapers, etc.

From http://www.spiritinthewind.com/abo_flintknapping_reduction_stra3.htm, March 31, 2010, copied with permission

Using a Rocker Punch

By Lucas W. Nicholson (aka goose)

Okay.....I took some pics using the rocker punch. A couple are a little blurry, but they should get the point across.

The first one is a pic of the flake I intend to take. My finger is on the platform I'm going to use and it points in the direction of the indirect blow. Notice the spur I left on the opposite face? That is something I do when I plan on getting an overshot. Or in case I get a shorter undesired flake I can remove the remnants from the opposite direction. The spur allows for correct contours and edge thickness and allows the flake a place to dive (when struck correctly). It did not work perfectly in this case as you can see.

This is just an on-edge-view of the biface and the platform. Notice how the platform is lowered and well isolated.

Another pic showing the isolated platform.....

This pic shows everything ready to hit. I am pushing to the right with my left hand and pushing to the left with my right leg. This amount of pressure needs to be adjusted according to the size of flake being removed.

A pull away view just before striking.....

A side view showing approximate angle of punch placement relative to the notch.

A close-up of the notch placement. When seating the punch listen for a "click" and then visually check to make sure your punch is making a sort of spread out contact with the platform. This can be done by slightly rotating the biface angle back and forth until it is just right. What you don't want to do is have the punch just make contact with the very edge of the platform in the back of the notch. This will cause a portion of the platform to shear off resulting in a short flake and what would appear to be an overstrike.

The flake.....

The flake scar.....

These are the tools I used. I would advise against using a carborundum abrader. It will only hinder your progress and allow you to cheat. For this method I used two hammerstones: one for abrading and a narrow one for finite isolation.

From http://paleoplanet69529.yuku.com/reply/278203#reply-278203, April 4, 2010, copied with permisssion

Heavy Hammerstone Spalling – Tripod Setup

By Benjamin Eble

Large nodules are cumbersome to hold in one's lap. If they rest directly upon the ground, they can be very hard to spall. By creating a tripod, the large nodule can be elevated, and the back side of the nodule held down with a foot, while a really heavy hammerstone is used at a low speed to detach large flakes. Here is the nodule.

Here is the nodule in a tripod. (I am holding a flake in place by hand):

Here is another shot of the other end, with the support stone underneath:

Here is a shot of the heavy hammerstone. It is not a "two hander". But, it is pretty heavy:

With one foot on the back side of the nodule, and the nodule edge fairly low, I bring the heavy hammerstone down, and clip the edge at a low speed. A flake detaches. Here are the results:

Here you can see the corner of the flake, where I hit a fault in the rock. Too bad, or the flake would have been bigger.



The tripod support makes it possible to hold one end of the nodule down with one's foot. By using two support stones, it is possible to create support without a direct support that would impede the progress of the flake, while holding the nodule off of the ground. In my case, the flake hit a fault and stopped. Also, by using a really heavy hammerstone, and clipping the edge, it is possible to detach at low speeds, with less shock, shattering, etc. Also, there is absolutely nothing magical about my hammerstone. In fact, it was not a hammerstone until I used it as one. For people who have never used hammerstones, I hope that this tutorial is of a help. Ben

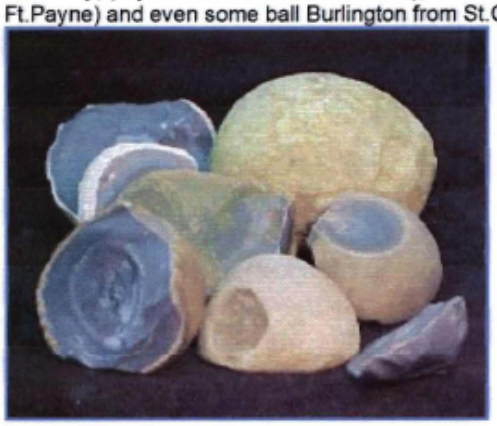
---

From http://paleoplanet69529.yuku.com/topic/32201, April 4, 2010, copied with permission

Ball Flint Reduction

By Gary Merlie

Since I live in the southern half of Illinois, I have been fortunate enough to hunt and work ball flint from Illinois(Cobden), Indiana (Wyandotte), Kentucky, (Wyandotte and St. Genevieve), Tennessee, (St.Genevieve and Ft.Payne) and even some ball Burlington from St.Charles, Mo.



Here is our guinea pig for today, a half ball of Wyandotte from Breckinridge Co. Ky. that Jeff Shelton and I dragged home from the creek a couple years ago.

I first take flakes off all the way around the core to remove cortex, using the flat face as a platform. Continuing like this will produce the so-called "core-struck blades". A large nodule with good mass will produce flat blades. As the mass decreases, the blades start coming off curved.

Crossroads: You can go two ways from here. You could continue removing blades from the core, using the flat side as a platform, until it is becomes an exhausted polyhedral core. Or, you can use the side of the core as a

platform and remove flat flakes and spalls from the face. Pic shows one removal of each type.

I've chosen to remove a large spall from the face by striking the edge. Due to a bad center in the core, this spall only went half way across the face. No problem, as this is a good artifact size spall. The blow to remove the spall came from the upper right of the core.

I've struck off another spall from the face, striking from the opposite side. The core is now flat again, and I now have two spalls for artifacts.

Here's two more flat spalls/flakes taken off the flat side, again using the side as a platform.

As the core becomes reduced and flatter, (the so called "turtle-back") I eventually reduce it into a biface as well. This pic shows the yield from the 4" dia. ball. 3 usable spalls I've turned into bifaces. One unusable spall I discarded, and several flakes that will work up into nice bird points.

I chipped the 3 bifaces into points, and here is what I ended up with, a side notch, a fluted point, and a Thebes.

Depending on what you are setting out to make, flint balls can be an effecient use of flint or a terribly wasteful process. If you don't have a lot of ball flint to waste, and not many people do, I think these balls are best utilized by slabbing with a rock saw.

I hope this small presentation enlightens someone out there just a little. Post any questions you have, and I'll try to answer them if I can. Rockhead

---

From http://opalvalley.com/gary/flint2.hml, May 2, 2006, copied with permission

Preventing Broken Points

It's so discouraging. Seems like everytime you get your points anywhere near a thin stage they break. They endsnap. They fold. Reaching your goal of thinner bifaces is just within your grasp and then it's snatched away in the blink of an eye. Well, I've been there. But I can honestly say that ever since I learned the things in this article, I haven't broken a single point while billet thinning as long as I didn't rush things and I took the time to apply the techniques. That brings up an important thing to remember. **There aren't any shortcuts** to creating those beautiful points. Besides, you don't want to hurry. Flintknapping is fun. Relax and concentrate on really seeing what the stone needs and you'll be happier with the results.

I learned the techniques described here from my good friend Jerry Ulrich, a knapper from Battle Creek, Michigan. After watching me knap a piece down to a 4 to 1 W/T (width to thickness) biface and then break it, he told me that there was no reason to ever break a point that had gotten that far. But I needed to memorize some things and practice them until they became second nature. I did what he said and he was right! I'll list them for you and then we'll discuss how to achieve each one of them. Here they are:

PLATFORM HAS TO BE BELOW THE CENTER LINE
ISOLATE THE PLATFORM
ABRADE
PROVIDE SUPPORT
DAMPEN VIBRATON

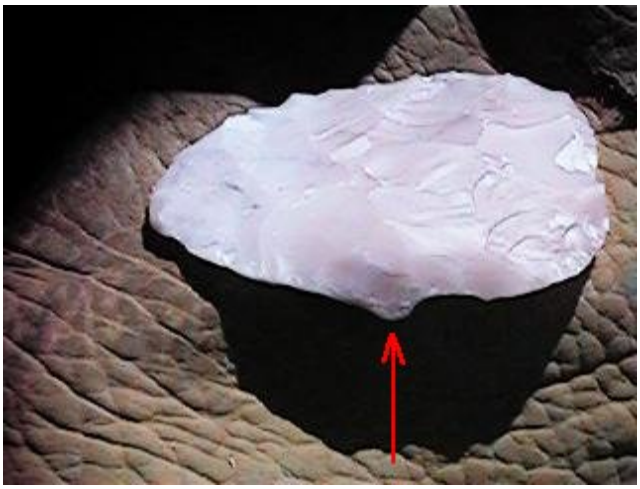
Every time you are going to strike a platform make sure you have done the things in the above checklist.

Platform Is Below The Center Line

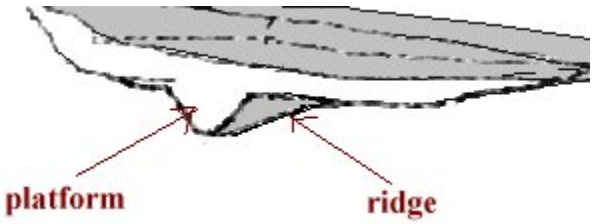
First thing is to make sure that the place where your billet is going to connect is **below the center line**. When you hit below the centerline, a flake comes off. When your preform is thin, and you hit above the center line, it is almost certainly going to break. As the preform gets thinner, it's very important to take a little time and really look at each platform you make. You need to make sure they're right. Do what you can to make every platform as perfect as you can and you'll be rewarded with more predictable results. As you gain experience you'll find that there are times where you might spend five minutes just preparing a platform but the results are well worth it.

Isolate The Platform

Isolating a platform allows your billet to connect with certainty on the exact spot you wish to hit. It allows for concentration of all the force from that blow into that one spot. When using a moose-antler billet, striking properly abraded and isolated platforms results in large, fan-shaped thinning flakes. It's a great technique--especially for beginners.



The above picture shows an isolated and abraded platform ready for the billet. I made this one a bit exaggerated so you can get the idea, but it will still work. You can see that some of the material has been removed from either side of it so that the billet will only catch the platform. Look at it! It's right out there beggin' for it. Don't you just want to hit it? Wait a minute, OK? Let's take care of a couple more things first.



Another example of a platform set up on a ridge. The platform has to be at an angle less than 90 degrees. The relative dimensions of the platform, ridge, and preform in this drawing have been exaggerated for clarity. As the preform gets thinner the platforms get smaller too. Everything gets more subtle as you near the final form.

Abrade

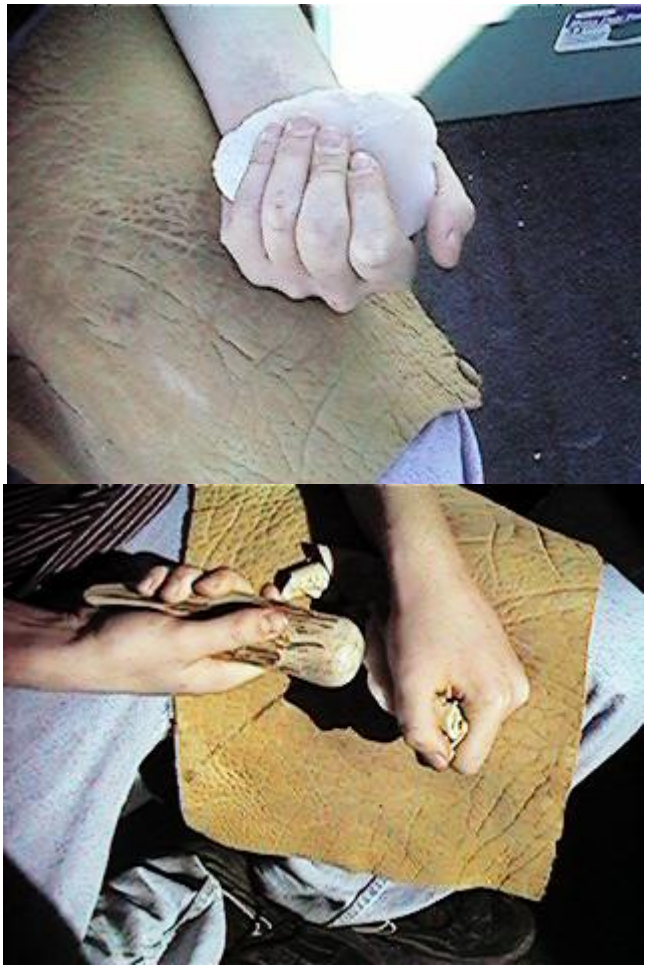
We talked a little about abrading in the last section. You also saw a picture of how our platform looked after it was abraded. We'll use this section to explain **why** we abrade.

Abrading is the rosetta stone of flintknapping. It's the "Eureka, I found it!" So many people who had to learn flintknapping by themselves have told me that when they discovered abrading they advanced "light years." There's good reason for this. An unabraded edge is sharp. It uses up the shock from the billet before it can do any good. Without abrading you end up with a crushed edge and a myriad of step-fractures. Abrading dulls the edge so that it has the strength to hold up under the force of the billet. On top of that, because you're hitting a blunted edge, the shock wave travels cleanly on through the stone. If you pay attention to the angle at which you are holding the piece, a long, wide, thinning flake results.

Here's another trick. Abrade a little on either side of your platforms. Then if somehow you do miss the place you intended to hit, at least you'll still remove a flake rather than damaging the edge.

Provide Support And Dampen Vibration

We're in the home stretch now. The thinner your point gets, the more important these last two rules become. Here's how you hold a preform so as to provide support and dampen vibration when you hit your platforms.



The picture on the left shows how the bottom face of the preform is supported by the fingers. Only the finger that the knapper may be using to apply force for "pulling" a flake is actually applying any kind of real pressure. Mainly the fingers are there to support the whole point so that it holds up to the force of the strike. They also assist in dampening vibration. By the way, don't let your thumb clamp down and put force on the middle of the point. Let it rest closer to the back edge of the piece. That way it doesn't stop the shockwave halfway through and break the piece.

You will notice from the pictures that I like to use a piece of real leather chamois to protect my hand during knapping. I like how it's easier and less bulky to use than a glove and because it's so thin I believe you retain some of the "feel" that a bare handed knapper has. I can't explain this "feel". But you will know what I'm talking about when you "pull" enough flakes and feel the sensation of the shock from the releasing flake. In addition the leather supports the piece in the areas between your fingers and further helps reduce vibration. You double or triple the thickness in areas of the hand where an edge is seated. I strongly recommend protecting your hand- especially for beginners who are getting used to how knapped stone behaves.

The picture on the right shows the billet pressing **hard** and **inward** on the outside edge of the biface. What this does is firmly seat the "back" edge against the hand. Dampening the opposite edge to the one you are hitting does something to the shockwave as it travels through the stone

that helps prevent the point from breaking. On Craig Ratzats video "Caught Knapping" he uses this technique to prevent "endsnap" when hitting the base of a point he was working on. He pressed the end opposite the one he was going to hit against his leg. If you are just holding the point out there without dampening the edge the shockwave does a mean trick and folds the piece or, if you are hitting the base or the tip, it does the "endsnap torture" trick.

After you have seated the back edge it's time to hit your platform. Now before you hit your next platform go through the above list again and then..smack it!

The result of the strike using the techniques described here. The flake was 3 1/2 inches long and traveled all the way across the face to the other side.

Well, there you have it. I think you are going to be very happy with the results if you take these techniques to heart. Using these rules my bifaces went from W/T ratios averaging around 3.5 to 1, to being nicely thinned pieces in the 6/1 range in the course of two weeks-and they're getting thinner. Let me know if this helped you and Happy Chipping!

From http://www.onagocag.com/break.html, April 1 2010, Copied with permission

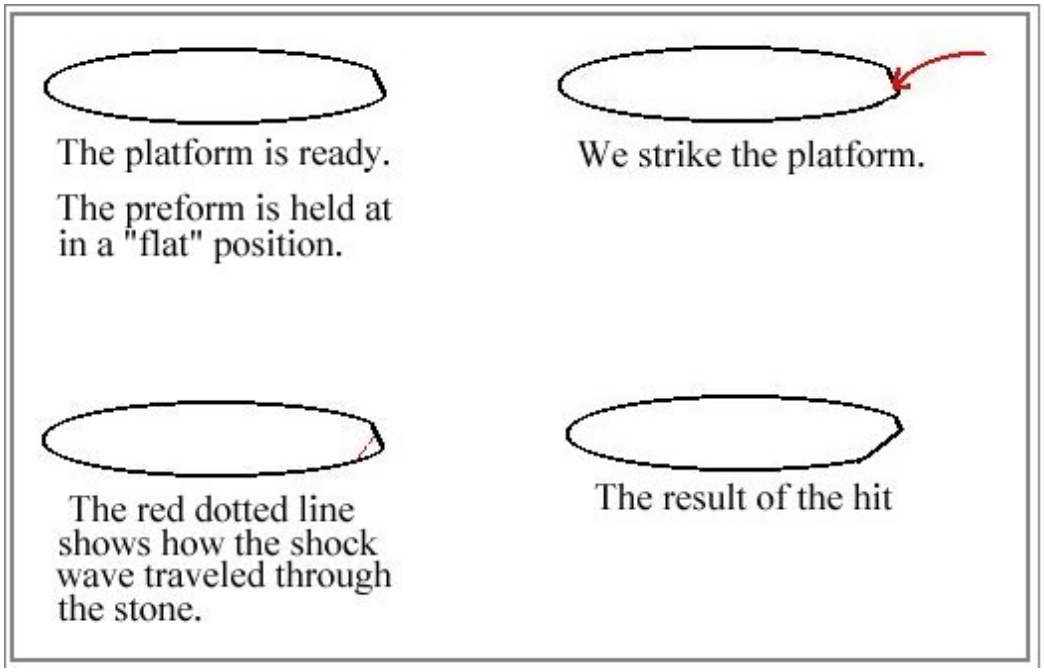
Note: Wyatt R. Knapp is the author of "The New Atlatl and Dart Workbook" to be released Summer 2010.

Some Talk About Angles

Okay...by now you've learned about herzian cones. You know that it is a cone shaped shock wave with sides that expand outward 130° to the point of impact on the stone. You know we use this shock wave, created from a billet strike, to make flakes come off knappable stone. But now we need to learn how to "cheat the angles" to make the best use of this shock wave.

After much practice you have probably standardized your billet swing so that it is coming down at pretty much the same angle all the time. This swing has become natural to you. You are hitting your platforms pretty much the same every time. Since this swing has become a constant, we have an opportunity to have some control over the thinning process and the length of the flakes we take off.

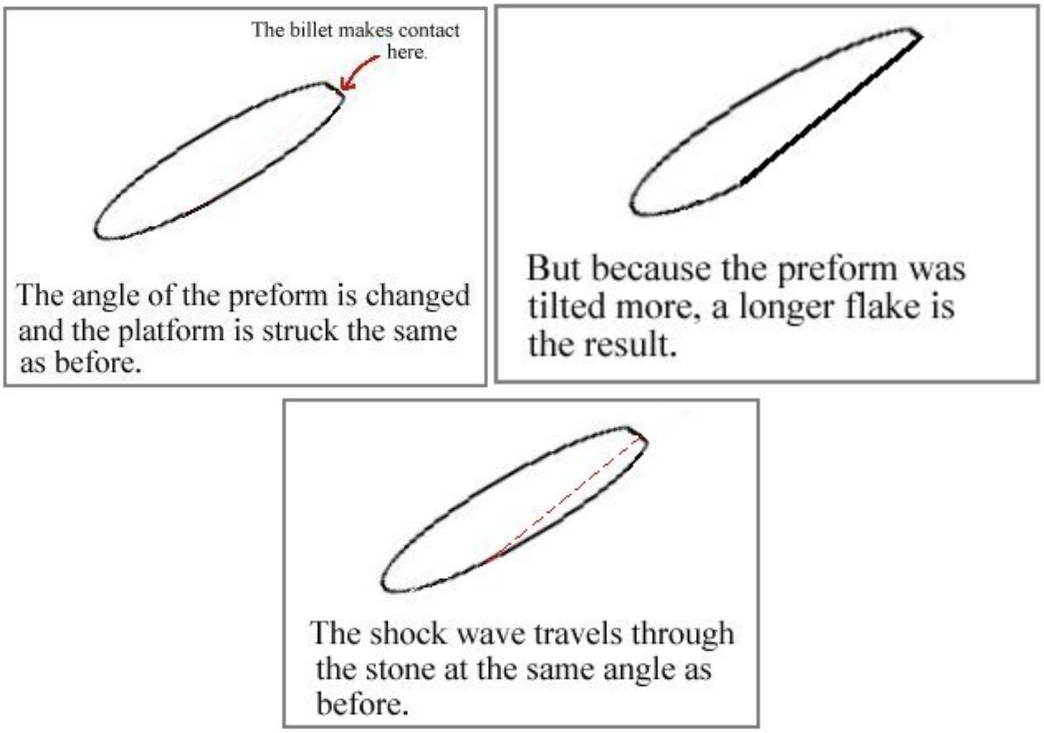
If you tilt your preform at different angles you can control how long your flakes are and how much material you remove. Depending on how much material you are trying to get through you may have to adjust the power of your strike as well. But a lot can be accomplished by understanding how to use different angles. The illustration below depicts a preform as viewed from the base end. The angle of the strike is indicated by the red arrow. Let's see how the shock wave travels through a stone that's held at this "flat " angle.



Well, the flake came off. And as you can see, we ended up with a rather shallow result. If we continue hitting our platforms with the preform held at this angle, it will get smaller and stay

thick. We will get points that look like "turtle backs." This won't do will it? Well, let's change the angle we hold the preform at and see what happens.

In the illustrations below we take the same preform we had before and start all over with it. The angle of the strike is exactly the same as before. The resulting shock wave is at exactly the same angle as in the first example too. The only thing different is that this time we're going to change the angle that the preform is being held at. Let's see what happens.



There we go! Now we took a nice bite out of it and got a flake that went right across the middle. If we keep this up the point will get thinner way faster than it gets narrow. By changing the angle we hold the preform at, we can control how thick and long the flake is that we take off. Just don't hold it at too much of an angle or you'll get a hinge or worse--you'll break the preform in half !

Now I should say that the angles that we showed in the illustrations are just examples. They might work for you. They might not. It depends on the angle of your billet swing. But just experiment with how you hold your preforms and see what angles work for you--and then all you have to do is practice enough to remember them.

Judicious use of this idea can really help you to "take the cap" off those really chunky pieces. Good Luck !!

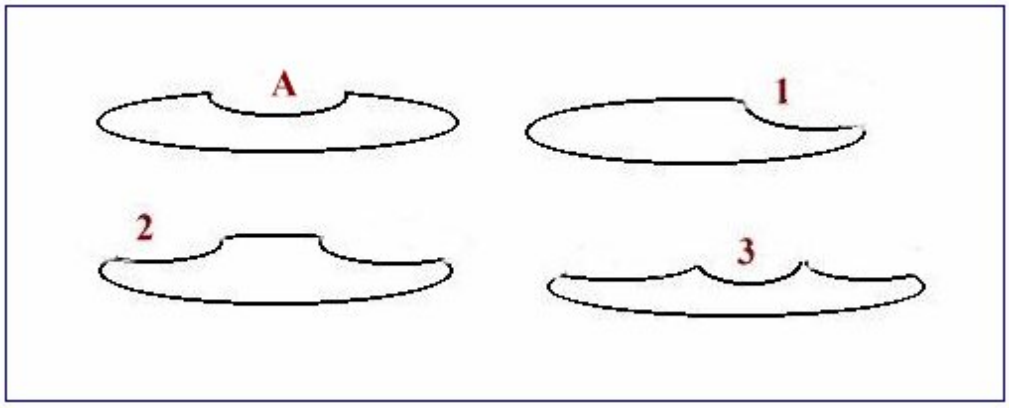
From http://www.onagocag.com/angle.html, April 1 2010, copied with permission.

Note: Wyatt R. Knapp is the author of "The New Atlatl and Dart Workbook" to be released Summer 2010.

Why You Should Work The Ends

and Then The Middle !

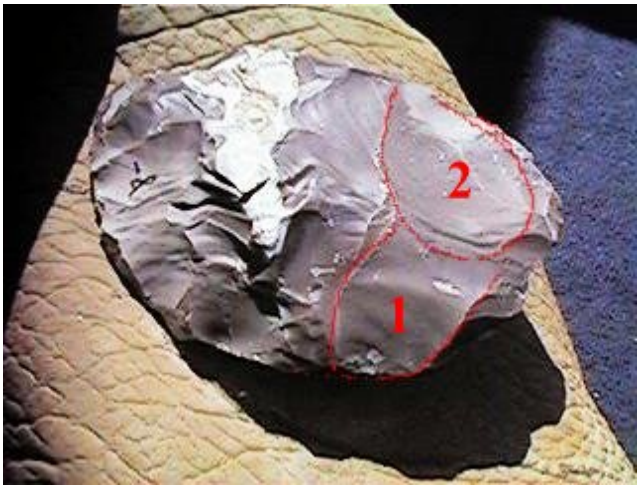
My friend John Geyer told me as a beginner to "always work the ends first, then the middle." Of course I didn't quite catch on right away. Too many things to absorb. And with all the herzian cones and angles and platform isolation there's a lot of abstract visualization going on anyway. Well you don't have to worry...I'll show you right now what he meant.



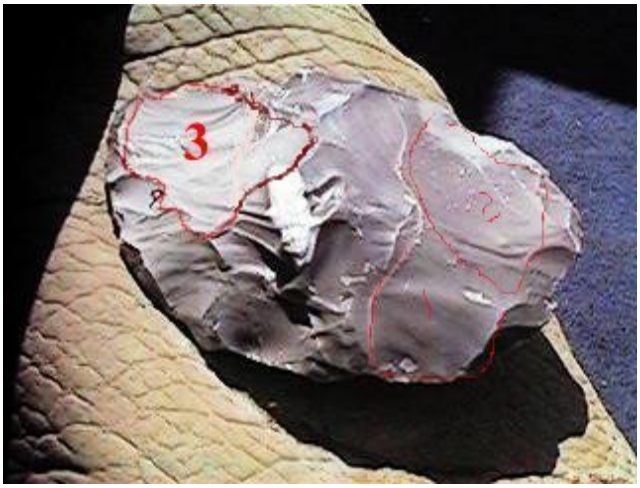
Look at the above illustration. If you were to take a flake out of a preform so that it ended up like figure "A" what do you think would be likely to happen on your next strike? Well, because the preform is so narrow in the center compared to the rest of the preform, it is likely to break in half. Now I drew these examples a little exaggerated for clarification. A real life example could be a lot more subtle. But the result would be the same.

But there is a solution to this trap! Work the ends then the middle. Our first move would be to thin the end like we see in figure 1. Then we would go to the other end and work on that. (fig.2) Finally we would work the middle (fig.3), because now that it has enough bulk to stand up to the strike there's less chance of breakage. And look at the added benefit we achieve. Nice ridges to follow on either side of the middle for our next strikes. When you plan your strikes like this you will notice a more deliberate and "right" look to the scar patterns on your preforms, and they get flat fast!

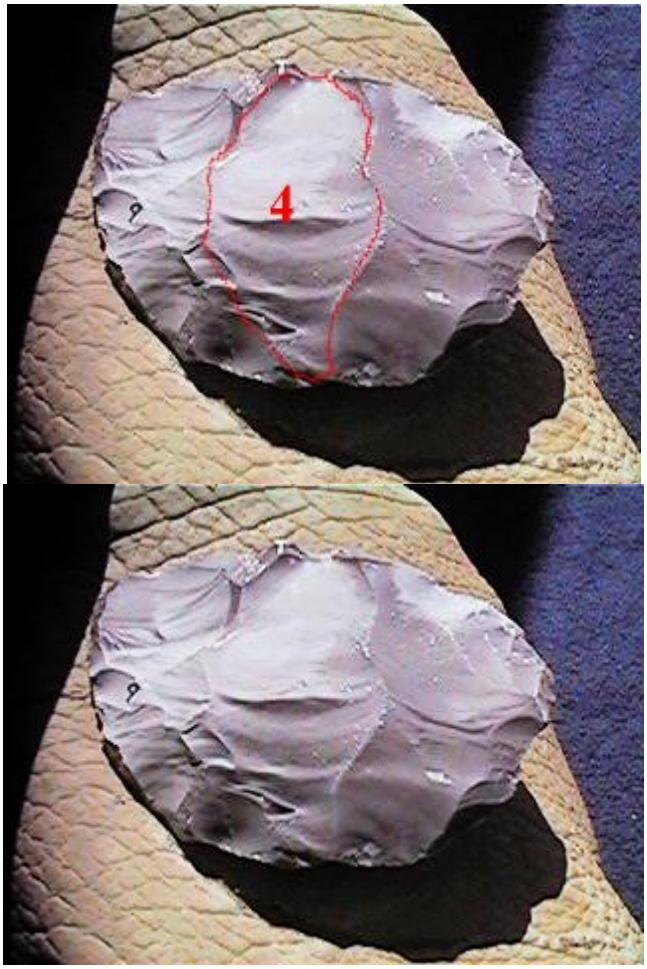
Now lets use all this on a real life example.



Flakes 1 and 2 are taken from the base end.



Flake 3 is taken off the tip.



And now flake 4, the middle, is taken off. Because the middle had such a nice ridge, the flake flew clear across the piece--six inches. This preform is six inches wide and seven and a half inches long. but it has already become quite flat on this side with just a few hits because the techniques we have learned here were followed.

So see if it helps you to "work the ends, and then the middle." Good Luck!!

From http://www.onagocag.com/buff.html, April 1 2010, copied with permission

Note: Wyatt R. Knapp is the author of "The New Atlatl and Dart Workbook" to be released Summer 2010.

Knapping on the Leg

Well, you've probably heard of it already, but I've used this method for a while now and I think its great. Its worth looking at why so many knappers are using it. It isn't the only way to knap, but I have found that I have better control and accuracy this way.

You see, quite often with freehand knapping you are holding your preform out in the air with one hand, and your other hand is holding the billet out there. Then you take your swing and you hope that you kept everything in position during that time and didn't flinch, or tilt the stone, or any of the hundreds of other variables that can occur.

Well, when freehanding it, you can cut down on these variables by resting the wrist of the preform holding hand on your leg. Then anchor the billeting arm by resting the elbow against the side of your body. This way you can adjust the "feed" of your preform into the anchored path of the billet swing.

But you can take it a step further.

Why not rest the preform on your leg where you can easily hold it at the proper angle. Your wrist won't change, the action of making your billet swing won't wiggle things and change them, and you won't flinch at the last second. Remember to still anchor your billeting arm as before. The more you can control the variables, the more accurately you will be able to knap.

The picture above shows how easily the angle can be determined on the knee. The hand would then rest flat on the preform to press it into the pad and prepare it for the strike.

The picture in the section below shows how this all comes together. Notice how easily the preform can be held at the correct angle.

From http://www.onagocag.com/buff.html, April 1 2010, copied with permission

Note: Wyatt R. Knapp is the author of "The New Atlatl and Dart Workbook" to be released Summer 2010.

Buffalo Hide As Leg Pad
and Preform Shock Dampening Tool

You probably noticed the buffalo hide leg pad in the above photos. This hint will work with any leather pad but the buffalo hide seems more supple and thicker, and more perfectly suited to this next tip.

or

When knapping on your leg as described above, you have a very handy tool for support, and shock dampening. Just fold the edge of the lap pad over the preform as shown and seat it into the resulting pocket with your billet. Now when you smack the platform, not only is everything locked into the proper position, but the stone is supported and dampened, and the hand holding the preform is protected. And you didn't have to pick up another pad or put on a glove to accomplish it!

Now there may still be situations where you would want to use the "pull" the flake technique and you would need to adjust your knapping style to accomplish it. But otherwise you may find this style of support helpful. (You may be able to "pull" the flake by pressing and pulling on the area from the bottom and through the leather.)

Knapping on the leg has been a great help for me. I realize that everyone has their own style. But if you have been having trouble with the accuracy of your strikes, or holding the proper angles, give this a try for several knapping sessions and see if you don't find it a big help. Many of the experienced knappers I have seen use this. And if you hit the platforms right you don't have to worry about hurting your leg because most of the shock is used up with the flake detachment. I don't get any bruises or sore legs.

_____

From http://www.onagocag.com/buff.html, April 1 2010, copied with permission for free distribution only

Note: Wyatt R. Knapp is the author of "The New Atlatl and Dart Workbook" to be released Summer 2010.

Photo courtesy of F. Scott Crawford

Section 4: Pressure Flaking

Small Point Pressure Flaking

From http://www.arrowhead-makeyourown.com/, April 6, 2010, copied with permission from "How to Make Your Own Arrowheads"

From Beer Bottle to Arrowhead

By Tim Rast

This page describes how to knap an arrowhead out of a beer bottle bottom. This includes breaking a bottle and working with extremely sharp broken glass.
YOU CAN BE CUT AND SERIOUSLY INJURED.
GOGGLES **MUST** BE WORN AT ALL TIMES.
Kids, ASK YOUR PARENTS TO READ THIS PAGE BEFORE YOU TRY MAKING AN ARROWHEAD.

Ingredients (required):	recommended:
1 Beer Bottle (empty)	
1 Hammerstone	1 hammer
1 Pressure Flaker	1 tarp
1 Notching tool	1 file (for sharpening the pressure flaker)
1 Leather Palm Pad (or heavy denim substitute)	1 abrading stone
1 Pair Goggles	1 dustpan
1 Pair Heavy Leather Gloves	1 broom
1 LARGE box band-aids	

Step 1: Selecting the Bottle

Don't overlook the importance of this first step, finding a good bottle to start with will determine how successful your knapping attempt will be. The best part of the bottle to use is the bottom, because the glass tends to be thicker than the sides of the bottle, and much less curved. So when picking your bottle, pay special attention to the bottom.

1. **Colored glass is better than clear glass**. Its very difficult to see what you are working on when you work clear glass. Amber or green glass bottles work well
2. **Flat bottoms are crucial**. Wine bottles with big kick-ups are not good for knapping. Most bottles have some curvature to the bottom - its best to avoid noticeable concave bottomed bottles in favour of flatter bottoms. (This may entail switching brands of beer - so the decision is not always an easy one)
3. **Avoid bottoms with elaborate embossed markings**, like makers marks, numbers, or other designs. These lumps and bumps can be tricky to get rid of.
4. **Begin with a smaller beer bottle before you try a larger flat bottomed wine bottle**. They are less difficult to hold and its easier to cover a smaller surface with flakes than a larger one. You can work up to wine bottles.

Step 2: Breaking the Bottle

Now you are going to need to break the beer bottle. You want to break it in such a way that the bottom will not be broken. Throwing it against a wall or rock is NOT a good way to start as the bottom is likely to break. Try wrapping it up in a corner of your tarp or a very heavy plastic bag and hitting the shoulder of the bottle with the hammer. NOTE: Wrapping the bottle up like this contains the mess, it does NOT protect you from the broken glass - The breaking glass can cut through the tarp and plastic bag quite easily. **WEAR HEAVY LEATHER GLOVES.**

Its easier to break a bottle by hitting it in the middle, but you have a greater chance of breaking the bottom if you hit it there, so strike the shoulder. If you don't have a hammer, try a hammer stone. Be very careful.

Alternatively, it is possible to cleanly pop the bottom off of a bottle by putting a nail into it (tip down) and shaking it straight up and down with your thumb over the mouth of the bottle. A bigger nail is necessary for wine bottles. I use a round file as a substitute. If successful, the bottom of the bottle will pop out as a sharp glass disc.

Step 3: Cleaning the Hanging Glass off the Bottom

Unwrap your broken bottle. Hopefully the bottom will be in one piece. If it is, it will likely still be attached to sharp glass from the sides of the bottle. You will need to trim these hanging shards off, so that you have a nice flat bottom to work with. Hold the bottom upside down so that the shards hang down. **HOLD THE BOTTOM WITH LEATHER GLOVES OR WITH YOUR LEATHER PALM PAD**. Brush the hanging glass off with your hammerstone or the hammer. If you have a stubborn shard, try changing the angle you are holding the piece before you try striking harder. Don't brush too much, you just want the bottom to be flat - too much brushing will make nasty step fractures. Step fractures are failed flakes which break and end with straight edges, rather than gently feathering out. When you are done, look at the bottom and you will see "dents" on the inside of the bottle where you broke the hanging shards off. These dents are *flake scars*.

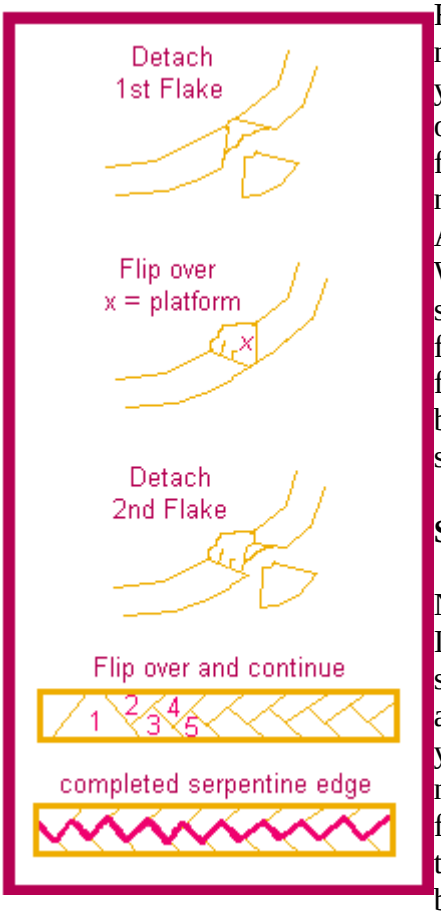
Step 4: The Serpentine Edge - Alternate Flaking

Now the fun begins! To knap an arrowhead out of a bottle bottom you need to 1) make a bifacial edge, 2) cover both faces with flakes, 3) shape it, and 4) notch it (optional). Points 2 & 3 will be discussed in the next section, and you don't have to worry about notching yet. We are going to start by making a bifacial edge all the way around the bottle bottom. A *bifacial edge* is an edge which has been worked on both (bi-) sides or faces. Look at your bottle bottom. If you followed the instructions in step 3, you will only have flakes scars from removed hanging shards on the inside of the bottle bottom, and none on the outside.

Pieces worked only on one side are called *unifacial*.

Ok, lay the bottle bottom flat in the leather pad in the palm of your left hand (if you are right handed), and clamp your fingers down on top, to firmly hold the glass. It doesn't matter which side is up or down, just make sure that the edge you want to start working is exposed. You should have a little sandwich in your hand which goes; fingers, leather, glass, leather, palm. Now rest the back of that hand against the inside of your left knee for support. Using your copper flaker, you want to push down on the edge and detach a flake from the underside of the glass. Don't pry the flake off, push it off. You really have to push hard to get a flake to come off. If detaching the flake hurts or bruises your palm, double or triple up your leather palm pad.

The flake removed will look something like a little half cone, and the flake scar will be a negative cone. You can fit the flake back into the scar to see what I mean by a *positive cone* (flake) and *negative cone* (flake scar). Ok, put your flake somewhere that people won't step on it and get back to your bottle bottom.

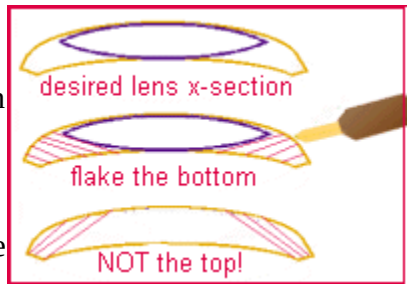


Flip the glass over so that the flake scar that was on the bottom is now on the top. You will use that flake scar as the platform for your next flake. The *platform* is the place where you place the tip of the flaker to push a flake off. You want to place the tip of the flaker to the left or right of the center of the flake scar, so that the next flake you remove will be off to one side of this first flake. Again, push down with the flaker and take another flake off. What you should have now is a bottle bottom, with two flake scars: one on each face. Now flip the glass over again and use the flake scar left from the second flake removal to remove a third flake. Continue to alternate flake around the entire edge of the bottle. When you are done you will have a wavy, bifacial serpentine edge!

Step 5: Shaping

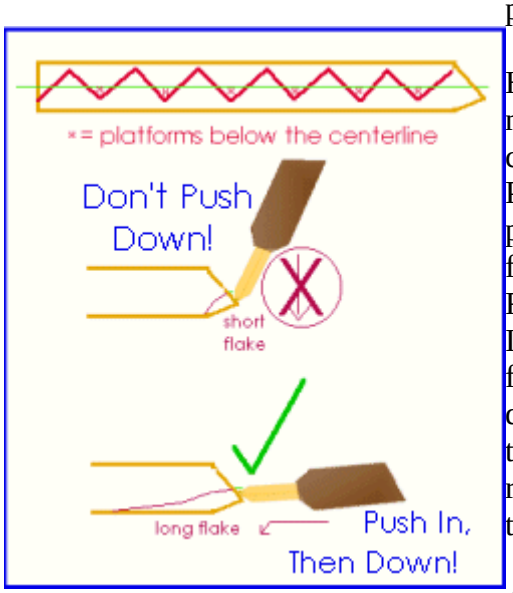
Now you have a wickedly sharp, bifacially worked bottle bottom. It doesn't look anything like an arrowhead yet - why? Its not shaped like one, either in cross-section or outline. The flake scars are only around the edge, they don't cover the face of the glass yet. You need to pressure flake it into shape. To do this, you need to change strategies a little. Instead of taking short chunky flakes off, like you did to make the serpentine edge, you need to take long, flat flakes off, which cover the faces of the bottle bottom, not just the edges. To do this, you change the angle you are flaking. Instead of pushing down, you want to push into the glass.

Shaping - Cross-section



If you look at your beer bottle bottom from the side, you will see that it is now, more or less, hexagonal. It has two flat faces and steep bevelled edges. It will also have a slight curvature to it, with a concavity on the bottom face and a slightly convex top surface. Arrowheads are, most often, lens shaped in cross-section. To achieve this lens shape, you need to get rid of all the concave curvature of the glass. In the process you will also be covering the blank faces with attractive flake scars. Most of the work you need to do is on the bottom, concave side of the glass. It will be very tempting to remove flakes from the upper, convex side because flakes love to travel across convex surfaces. The flakes you remove from the bottom will be very short by comparison, but that's okay. They will get longer as you work at removing the curvature of the glass. Taking beautiful long flakes off of the upper, convex side of the glass will only make the curvature worse.

To remove the cross-section shaping flakes you will need to use the serpentine edge you've created. Creating the serpentine edge has made a whole series of platforms. The wavy edge zigzags up and down across the centerline of the edge. This is important. Your edge has peaks which are above the centerline and valleys which are below the centerline. (Check Wyatt Knapp's discussion of the "Below the Centerline Concept" for more detail) Your edge looks something like this: /\/\/\/\/\ You use the valleys as platforms to take off flakes. Look at you glass and find the peaks and valleys. The valleys are the platforms. Imagine the centerline. Now flip it over. Find the peaks and valleys. Find the platforms.

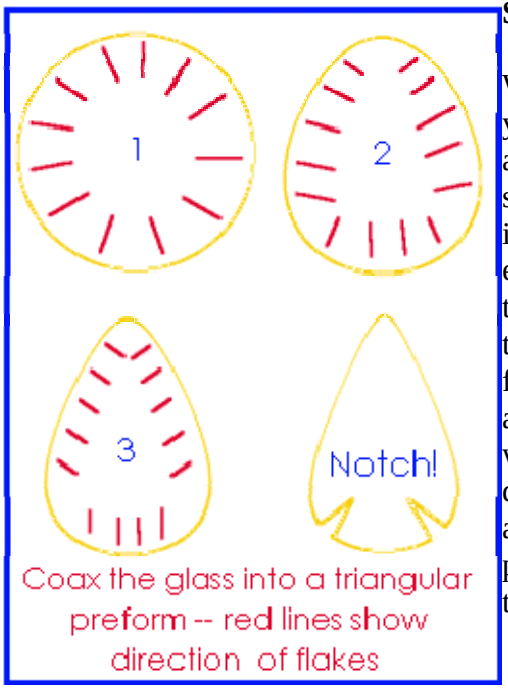


Hold the bottom in your hand, the same as when you made the bifacial serpentine edge. Make sure that the concave face is on the bottom. Find the peaks and valleys. Place the flaker tip against one of the valleys. Instead of pushing down, push into the glass. Push hard, build up a force and then push down a little to detach the flake. Remember push in, then down. Don't flip the glass over. Instead, move to the next valley and remove your next flake. Go all the way around. Then do it again. Don't be discouraged if your flakes aren't very long. You may have to go around the glass 3 or 4 or 5 times before the flakes reach all the way to the center. Everyone's flakes are short the first time around.

As you knap, your edge will get higher and your platforms (the valleys) will become less pronounced. So you will have to make new ones. You can do this a couple of different ways. One way is to use the tip of your flaker to brush up on the edge. This will remove tiny flakes from the upper surface of the edge (WEAR GOGGLES!).

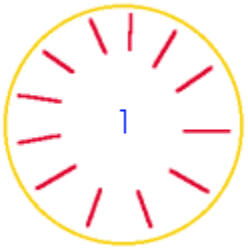
This will get rid of the thin brittle edge, making it stronger and lower. The second way to make new platforms is to grind the edge with an abrading stone. I just use one of my hammerstones. Again, you want to prepare your platforms in the opposite direction that you are flaking. Flip the glass over, so that the face you want to flake is facing up and brush the edge, in a downward motion, with your abrader stone. Flip the glass back over, look for the platforms below the centerline, and keep knapping.

Keep this up until you achieve the desired lens shape. Remember to spend most of your time removing flakes from the concave side. It won't take you very long to cover the convex side with flake scars.



Shaping - Outline

While you are working on the lens shaped cross-section, you will also want to coax your bottle bottom into an arrowhead shape. There are no hard and fast rules for shaping the outline of your arrowhead. If the bottle bottom is circular you can arbitrarily select a pointy end and a base end. Gradually change your circular bottle bottom into a triangle. If your glass is not perfectly round, look for the longest axis, and align your triangle along that. The first step is to stop thinking about the bottle as a circle and start thinking of it as a chubby triangle. Instead of working around and around in a spiral, work from three directions - in from the two sides of your arrowhead and up from the base. When you abrade your platforms, keep the triangle in mind and work towards that goal.



Step 6: Notching

Wow! You made it - you have a lens-shaped triangular arrowhead. All you have left to do is notch it! The notching tools I typically use are sections of coat hanger mounted in broom handles, which have been filed to a chisel shape or copper wire which has been hammered flat (see the Pressure Flaker Page). Pick the point on the edge of the arrowhead where you want to start your notch. Use your notching tool to create a little nick in the edge, the same way you made your first flake on your serpentine edge. Flip it over. Take another flake of in the same place you took the first little flake off. Flip it over and keep doing it. Its the same sort of process as you used to make the serpentine edge, except you are flaking straight into the body of the piece instead of around the edge. Repeat the process for your second notch.

Tip: I like to make both notches at the same time, rather than finishing one and starting on the second one. I find that they turn out more uniform if I work on them together.

_____

From: http://www.cavemanchemistry.com/oldcave/projects/stone/bottle.html, April 2, 2010, copied with permission

How to Make Your Own Arrowhead

"So Easy The Cavemen Did It ... For Thousands Of Years" ... So Can You, With Practice.

Actually, ancestors of all of us used stone for hunting weapons for a very long time. The use of metal only replaced sharpened stone, bone and wood in the last few thousands of years. And then, in most of the world, the knowledge of "flint knapping" became a lost art. It wasn't until the Europeans came to the Americas that Old World eyes once again realized the efficiency of stone arrow heads and knife blades.

MAKING YOUR OWN STONE ARROWHEAD

All knapping begins with a piece of stone. Then you break away the parts of the stone which do not fit the idea you have in mind for the final product. This process is called reduction. The thing is, that once you break a piece off of a stone, you can not put it back. Unlike clay or metal, which can be reshaped, a stone tool is not moldable or bendable or malleable. You break it to change its shape.

To break stone you must obey the laws of physics. I think observant flint knappers first codified knowledge of the physical laws which provide order and predictability to the world around us. Much was discovered by trial and error, and then passed on to students from the masters of stone craft.

For the beginning knapper, making an arrowhead usually begins with a flake of stone. When you order the **Knapping Kit** from **http://www.StoneBreaker-FSC.net**, it supplies several flakes, or chips, of stone such as obsidian and flint. These may include chert from Oklahoma, novaculite from Arkansas, or flint from Texas, and obsidian from Oregon.

STEP ONE

Select a chip from the materials in the kit. Also pick up the leather hand pad. It goes in either your left or right hand, as is appropriate, to protect the palm of your hand from small pieces which you will break off the chip. In addition, you will need either the antler tine or the copper tipped flaking tool. You can work on a bench top if you prefer, so you can stand, or you can work in your hand and sit down. For the first time or two you may find working on a bench gives you better visibility and control.

First, a word about safety.

Use safety glasses and wear leather gloves. Work in an open, well-ventilated area when knapping, preferably outdoors.

Flaked stone is sharp. That is the point. Be careful with flakes, chips and tools. Always have a first aid kit at hand.

Now, look at the chip. You will see that one side is smooth, and the other side has some ridges. The chip illustrates how this kind of stone breaks during the knapping process. When obsidian, or flint or chert or the other fine grained quartz stones are struck with a hammer stone or other implement at the correct angle, the resulting curved flake or chip will tend to follow the ridges on the face of the stone. By harnessing this characteristic of knappable stone, we are able to break the stone in a controlled and intentional manner. The same rules of stone breaking at a large size apply to working with smaller pieces of stone. The only difference is a matter of scale. In addition to striking with a hammer stone, by applying pressure at the edge of the stone, at the beginning of a ridge line, we can "push" off a flake along the ridge. This process is called pressure flaking.

This is the primary kind of force which is used to create an arrowhead from a chip of stone. Once you choose a chip, then we will proceed to prepare the edges of the flake so that you can apply pressure along the edge and push off small flakes.

STEP TWO

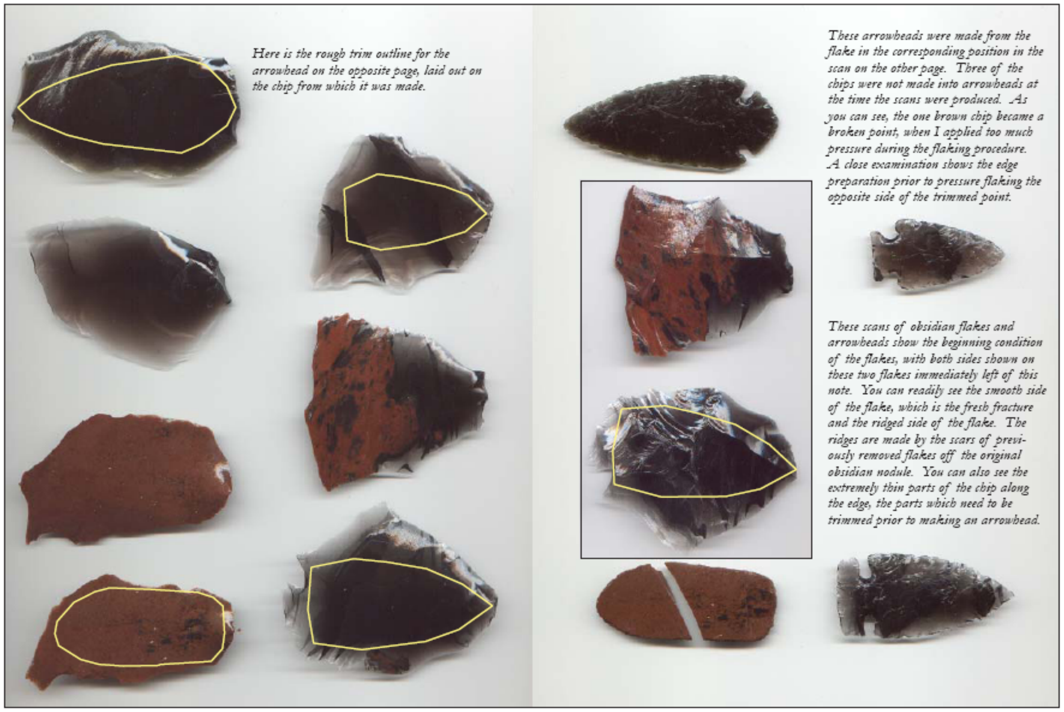
Choose which end of the flake you wish to be the point of the arrowhead. When you look at the smooth underside of the flake you will see a bulbous shape, rounded and slightly higher than most of the flake surface, radiating away from the spot where the stone was struck to knock the chip off the stone. This is called the bulb of percussion.

Usually arrowheads are made with the pointed end at the bulb of percussion, and the base with its notches is located at the other end of the flake. The secret is to use the portion of the flake which is essentially straight. Flakes naturally have some curve, as the chip follows the contour of the original stone surface. Yet, if you look at the flake in profile, from the side along the lengthwise direction of the flake, you can see the natural curve, and you can see what portion of the chip could be used, allowing a straight line to the arrowhead.

STEP THREE

Now, we will use the antler tine to trim the chip to the general shape for the arrowhead. Lay the chip on the leather pad on your work bench. Place the smooth surface down. Then use the side of the narrow end of the tine to begin pressing at the thin edges, along the length of the flake, in a shearing motion along the edge. Hold the antler tine basically parallel with the edge and press down along the edge with the side of the antler. Do not overlap the edge except for a tiny distance, and press down along the edge, breaking off small pieces to trim the thin, curved edges into a straighter line leaving a thicker amount of material along the edge. Just press enough to break small pieces off. You will need to hold the flake in place, but do not press down on it too much, as you can break it. Odds are, you will break some flakes; that is why I am providing 12 flakes in the kit.

This trimming action can quickly provide a flake in nearly the size and shape of your finished point. You can trim it to straight edges in a triangular shape, or to curved edges in more of an oval configuration. Trim the base to fit your shape.



Here is the rough trim outline for the arrowhead on the opposite page, laid out on the chip from which it was made.

These arrowheads were made from the flake in the corresponding position in the scan on the other page. Three of the chips were not made into arrowheads at the time the scans were produced. As you can see, the one brown chip became a broken point, when I applied too much pressure during the flaking procedure. A close examination shows the edge preparation prior to pressure flaking the opposite side of the trimmed point.

These scans of obsidian flakes and arrowheads show the beginning condition of the flakes, with both sides shown on these two flakes immediately left of this note. You can readily see the smooth side of the flake, which is the fresh fracture and the ridged side of the flake. The ridges are made by the scars of previously removed flakes off the original obsidian nodule. You can also see the extremely thin parts of the chip along the edge, the parts which need to be trimmed prior to making an arrowhead.

STEP FOUR

Next, you can use either the antler tine or the copper tipped flaking tool to begin sharpening your arrowhead. First, lay the flake down on the leather pad, to support the flake. This should be done with the smooth face of the chip up, so that the new flakes will be removed from the ridged face of the chip. This will allow you to press against the protuding or leading edge of the stone. You will place the point of the tool against this outer edge. But first, you should roughen or grind this edge a little by rubbing the side of the antler tine or a hard, slightly rough stone along the edge. This will rough up the sharp edge, providing better gripping surface for your tool.

Now, hold the piece in position with two or three fingers. Do not press too hard, just enough to keep it in position. Press the pointed tip of the tool against the edge. Generally, this first flake should be taken off at or near the tip end of the point. The force should basically parallel the face of the chip, aimed toward the center line of the chip. Press against the roughened edge and then push a new flake off of the bottom face of the chip.

It takes a bit of pressure, against the edge, not against the face of the flake. You are essentially prying or pushing a small flake off the chip, running from the edge toward the middle of the chip.

After the flake comes off, turn over the point so you can see what happened. Your objective is a flake which runs to or beyond the centerline of the rough point. Many times the first flake may be short, but it will produce an edge along which your next flake will travel more easily.

For the second flake, move a little ways down along the edge and repeat the pressure process, overlapping the previous flake a little, so that the next flake will run along the ridge left by the first.

Do not press down on the chip too much while you are pressing against the side. Just enough to hold it in position. Too much pressure and you can break the chip at the place where you are prying off a new flake. I know, as I have done this more times than I like to admit. It takes practice. And to know how much is not too much pressure, will also take practice and experience. This includes breaking an unknown number of points in the process!

Now, continue to remove additional flakes in progression along the edge towards the base of the point. Once you have worked your way along one edge, then work along the other edge on the same surface of the arrowhead. When you finish this side, you have what is known as a unifacially worked arrowhead. These are often found, where the stone craftsman only flaked the point or blade on one face, and left the other side as a smooth surface, with little or no additional flaking on that side.

STEP FIVE

Prepare the second surface of the point for pressure flaking by trimming along the new edges. First remove the small triangular protuding edges between the new flakes. These are called "deltas" because of their shape. To remove them, press against their outer edge with the tip of your flaking tool. Just enough to break off the little triangles. Then use a shearing motion along the new edge again, in a motion parallel to the edge, pressing from the smooth face, just along the very edge. Just trim off a little bit of the thin edge, leaving a stengthened edge for additional pressure flaking toward the smooth face of the point.

Next grind or roughen up this edge line as you did before with the other side. This gives your flaking tool a better grip at the edge.

Repeat the pressure flaking process along the smooth face, beginning at the tip again, and working toward the base.

Now you have a basic triangular or oval shaped arrowhead.

STEP SIX

In ancient times, in many parts of the world, you would now be finished. These points were bound into either a split shaft, with glue and/or plant or animal fiber, or into a hollow shaft such as a reed with glue and fiber. However, many points were also notched to facilitate the binding process.

So, you may wish to notch your arrowhead.

There are many different styles and methods. Side notch, corner notch, base notch, etc. Yet all basically remove material from the edge toward the middle, to make a groove or notch for binding.

The process is similar to preparing for pressure flaking, except that you will do this at just two places, in mirrored positions across from each other so that the point remains balanced and symetrical.

First, measure where you want the notches, equally up the edge from the base or from the centerline along the base edge of the point, or at the corners. Make a tiny flake at the edge where you want the first notch. Then mark the other.

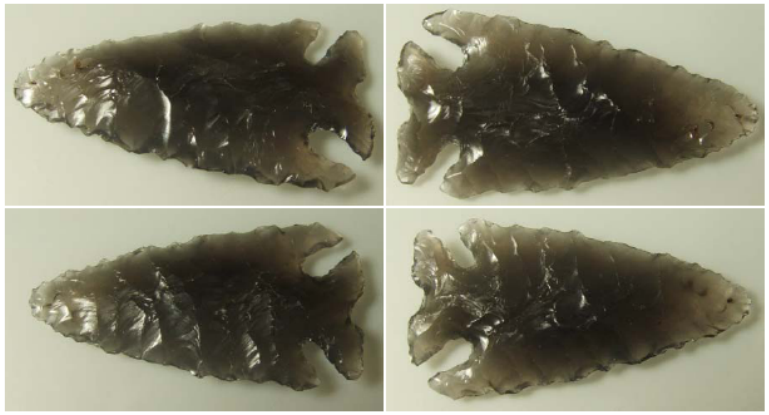
Use the sharp tip of the copper flaker to rough up the edge inside this marking notch. Just enough to get a grip with the tip. Push a flake off the underside of the point from the marking notch in the direction you want the finished notch to proceed. Turn the point over, rough up the edge of the notch and push another directional flake off from the other side. Repeat this channel flake process at the marking notch for the second notch. This will give you a series of guides for finishing the notches.

Now, trim in the end of the guide channel to create an edge to press out the next flake in the notch. You rough up the edge from one face of the point, then turn the point over to press the new notch flake off by prying against the newly roughened edge. Repeat on each notch until you have the notch you want. Do not allow the tool to touch the corners of the notch when you press inside the notch, as this will break off the corners of the notch, or more. Many knappers work a little on one notch, then the other, so that both notches progress evenly toward completion.

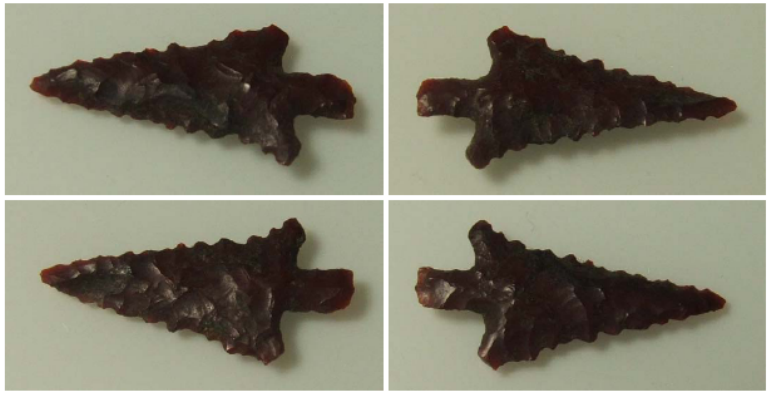
Voila! You have finished your own arrowhead. Congratulations.

Now, do it again. Enjoy.

http://www.StoneBreaker-FSC.net



Here Are Several Examples Of Authentic, Ancient Arrowheads From Oregon ... So You Can See Some Point Designs & The Stone Materials Actually Used Long Ago.



1. Keokuk Chert chip, bulb of percussion is on the left end. Stone from Oklahoma.

2. Keokuk Chert chip, outer surface of the flake.

3. Rough trim along both long edges and across the base, to general shape.

4. Using the side of the copper tip to trim the edge to shape, in a shearing motion.

5. Using the side of the antler tine to trim the edge to shape, in a shearing motion.

6. Holding in position to pressure flake; edge is trimmed and ground for tool grip.

7. See where the first few flakes have been pressed off near the tip end of the chip.

8. Copper tipped flaker in position for next flake removal by pressure.

9. Next flake removed, you can see that the flake broke into a few smaller pieces.

10. Turn the chip over after each flake removal, so you can see the results.

11. First run of flake removals along this edge is complete. Examine your work.

12. The removal of the flakes takes away most of the edge trim, as you can see.

13. Now the first pass along the other side has been completed. Whole side smoother.

17. A look at the smooth side of the point, while still working rough side, pass two.

21. First full pressure flaking pass along one edge of smooth surface.

14. After the new edge is trimmed again and ground for your tool to get good grip.

18. On rough side, completed second pass along second edge, see the "deltas" at edge.

22. First full pressure flaking pass along second edge of smooth surface.

15. Remove a few flakes to thin the bulb of percussion, and straighten the point.

19. On rough side, "deltas" removed, edge trimmed, preparing for smooth side flaking.

23. First full pressure flaking pass along base end of smooth surface.

16. Trimmed, and a second pass along the first side, removing the rough ridges.

20. Edge trimmed and ground, ready for smooth side pressure flaking.

24. Midway through full pressure flaking pass along second edge of rough surface.

25. Early in second full pressure flaking thinning pass, first edge of rough surface.

26. Fracture occurred from too much pressure, where chip was curved, also.

27. Trimmed to a new point, straighter now, ready for more thinning flakes.

28. A view of the rougher side, before more thinning flakes will be removed.

29. The rougher side, after another good run of thinning flakes along both edges.

30. The smooth side, ready for another pass of thinning flakes along each edge.

31. The smooth side, after this pass of thinning flakes along the lower edge.

32. Midway through this pass of thinning pressure flakes along the upper edge.

33. This pass of thinning pressure flakes at the base of smooth side, too.

34. Base of the rough side of point, prepared for thinning pressure flakes.

35. Base of the rough side of the point, after a series of thinning pressure flakes.

36. Base of the smooth side of the point, after a series of thinning pressure flakes.

37. Base of the rough side of the point, corners trimmed for notching process.

39. Rough side, notches completed, base trimmed for attachment to dart shaft.

40. On the smooth side, notches are completed, base is trimmed to finish shape.

38. On the smooth side of the point, long guide flake in upper corner, for notching.

42. On the originally rough side of the arrowhead, the notches are done, the base is trimmed to its finished shape, and a final trimming series of flakes balances the point.

$9.95, U.S. postpaid.
$10.45, Canada postpaid.

From http://www.arrowhead-maker.com/, April 6, 2010, copied with permission

Using Your Legs When Pressure Flaking


Why Use Your Legs In Pressure Flaking? Most People Have A Lot More Available Muscle Power In Their Legs Than Their Arms.

(Continues ...)

While the pressure is fully built up or "loaded", I snap or flick my wrist to initiate the fracture which pushes a flake from the underside of the stone chip.

As the flake releases, the pressure is still on the base of the flake. This helps cause the flake to continue breaking away from the stone, as long as the pressure is maintained. Of course, this happens in an instant.

The "crack" of the breaking stone is a welcome sound, and an indication of a successful effort.

In the follow through the pressure flaker should land basically in a flat position against the leather pad, not pointing in to the pad. This final position also helps to protect your hand.

5. Ground platform on the opposite edge rough side.

6. Inspecting result of pressure flaking near the tip.

7. A new flake has just released under the chip.

8. Here is the flake scar of the previous photograph.

From http://www.arrowhead-makeyourown.com/, April 6, 2010, copied with permission from "How to Make Your Own Arrowheads"

Why Pressure Flakes Fall Short

by Mark Bracken

There are several things to consider when your flakes fall short of your targer or don't run as far as you want. All these tips below are complimentary to each other. They all pieces to the puzzle, they are all importaint.

1. The first is your **flake path.** What I mean is that you have to choose proper places on the bi-face that lend themselves to longer flakes. These gennerally are the highest places on the surface of the bi-face or preform. You must be sure that your choosing ridges and or humps to "guide" the flakes down.

2. The second thing is that you have to **grind** or buff up the edge with your abrading stone just enough to support the pressure your applying to the edge. Too much and it will take excessive force to generate a flake leaving you with a broken preform or a sprained wrist. If you do not grind enough, the edge can crush or create a small chip.

3. The third is that there is quite a bit of "body English" or **follow through** with the pressure flaker's or Ishi stick's use. What I mean is that when you peel a potato with a peeler, you follow the contour of the potato. This is because you want to create a shaving that is all one piece. THis saves time and effort. So, with using the pressure flaker it is no different. You must guide the flaker in the same way. Place the flaker on the edge and slowly build up pressure, then as the flake begins to detach, with a "peeling" action guide the tool tip with a following through action.

4. The fourth thing is that flakes will travel farther if they are pushed in a **oblique** manner. (remember this critical rule...do not chip flakes down a surface that is concaved. It must have some amount of convexity.) If you can... try not to push them strait into the piece. (or a 90 degree angle from the edge) Fakes will rarely cross the center line on the piece.

5. The fifth thing is to **work in a row**. Like shelling corn of a corn cob. Start at the base or tip (depending on the way your holding it) and chip the flakes off in a row. Each flake following the other's scar. Sometimes you will need to skip an area because there is not a good path for the flake to travel on. With each pass down the preform it will become more uniform with less and less high spots.

6. Keep your flaker **sharp**! Your flaker tip can be a number of different types, paddle, flat, chisel, Pounded round to a point, or pounded round to a point with four square edges. The key thing here is that your contact area must be at a minimum. You can't do good pressure work with a dull flaker point. Remember to pound your copper tips NOT grind them. They will stay nice and hard. It's common for it to be necessary to re sharpen a flaker tip many times before the piece is finished.

From http://www.flintknappingtools.com/flaking_tips.html, March 31, 2010, copied with permission

Slab Knapping Tutorial

By Mike Tylzynski (aka Idaho Clovisman)

"ok i will go out and turn the edge on a slab and post a picture..give me a few min..hope this helps now once you tell me you got this part i will show you the same slab set up for a complete pass..

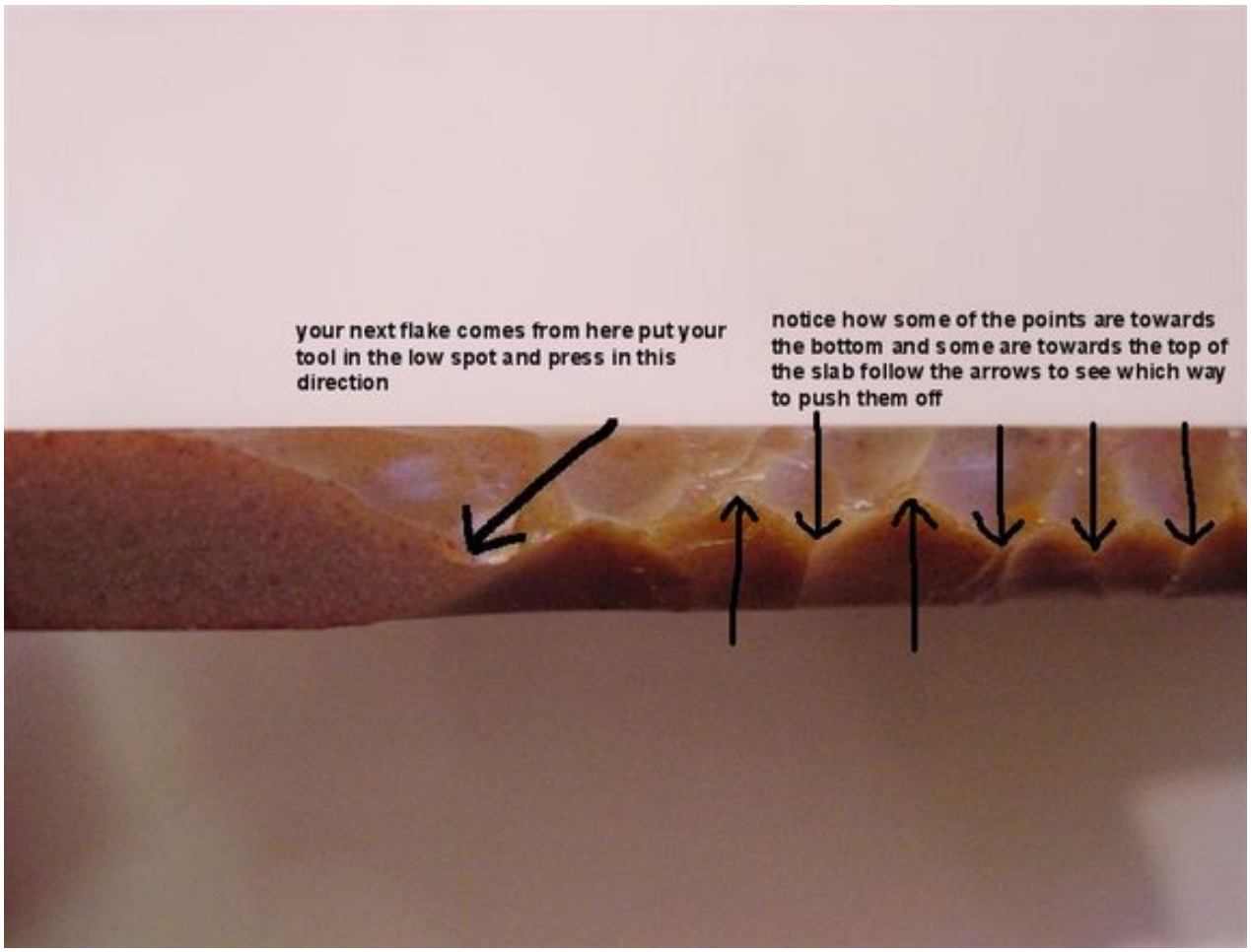


Figure 1


your edge should look like this after
alternating flakes all the way around the slab
Figure 2

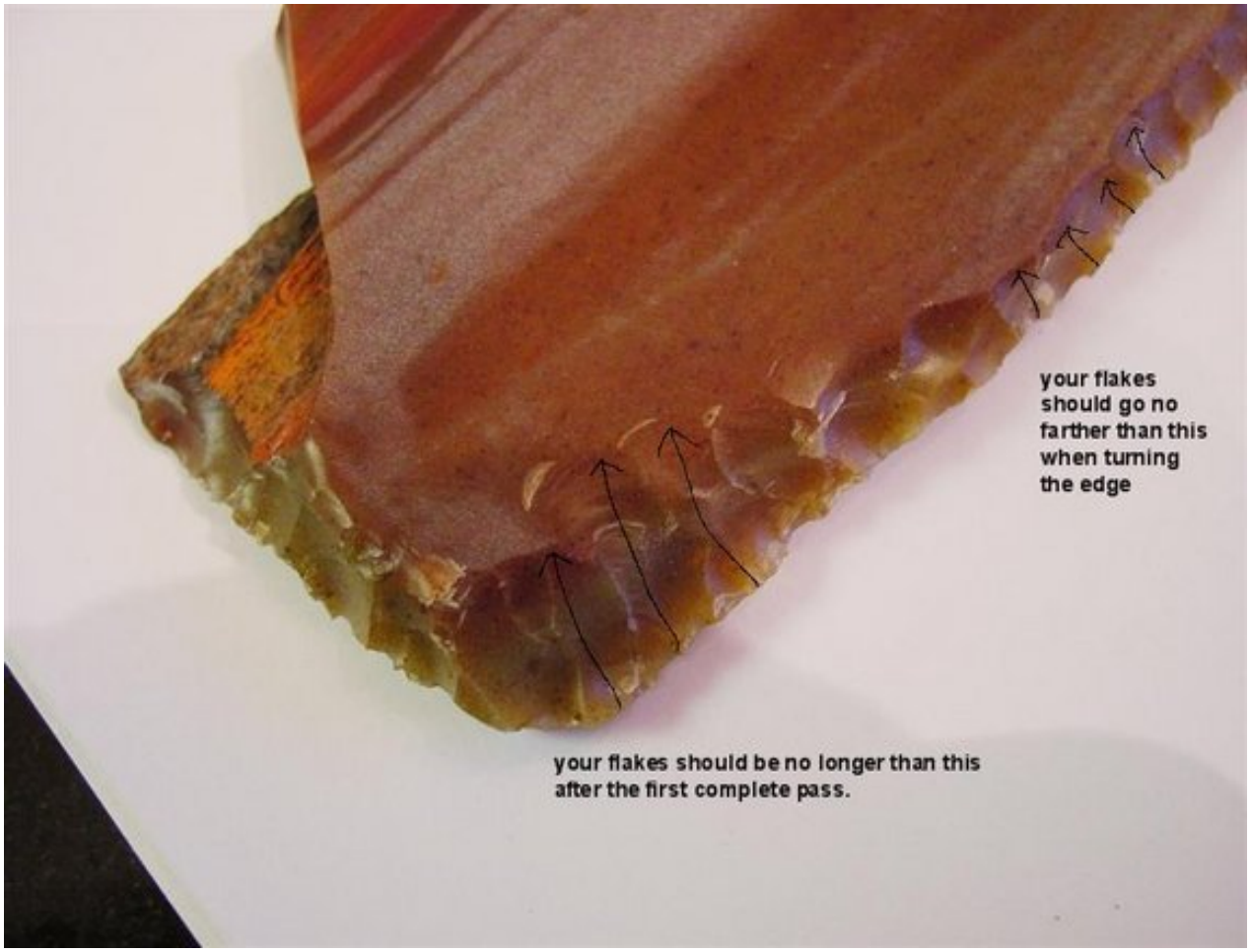

your flakes
should go no
farther than this
when turning
the edge
your flakes should be no longer than this
after the first complete pass.

Figure 3


Ok now this is what your slab
should look like after you have
taken all the highs and lows off
pretty much a straight line in
the middle of the slab Now we
are going to move the edge to
the face we are going to take
flakes off of.

Figure 4


Ok now you have sheared the edge and now you need to grind it and i mean grind it ! note the angle of the grind stone this is to set the angle of the platform so your tool can have a place to push hard without breaking off the edge before the flake is ready to be knapped off.

Figure 5a

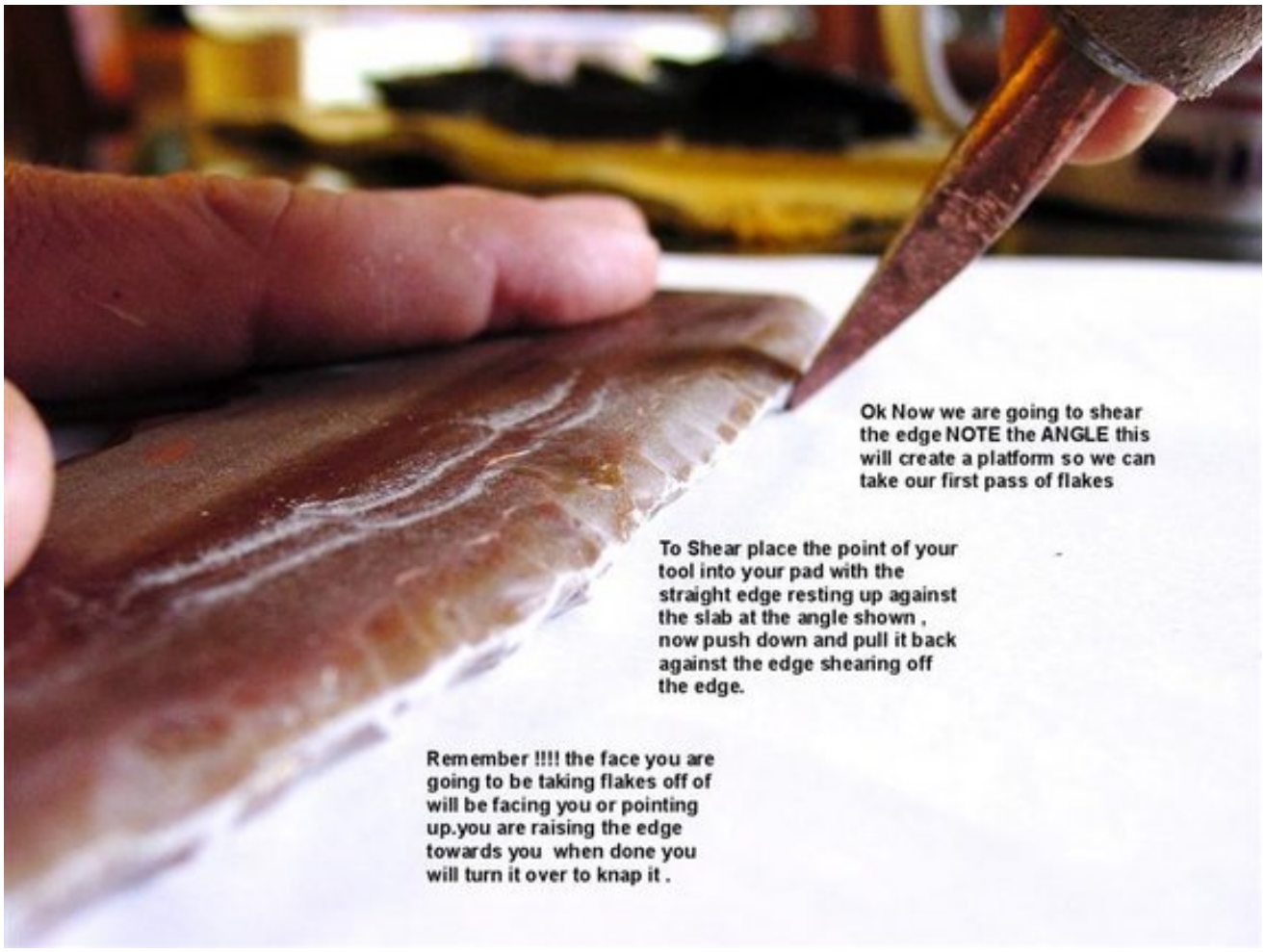

Ok Now we are going to shear the edge NOTE the ANGLE this will create a platform so we can take our first pass of flakes
To Shear place the point of your tool into your pad with the straight edge resting up against the slab at the angle shown , now push down and pull it back against the edge shearing off the edge.
Remember !!!! the face you are going to be taking flakes off of will be facing you or pointing up.you are raising the edge towards you when done you will turn it over to knap it .

Figure 5

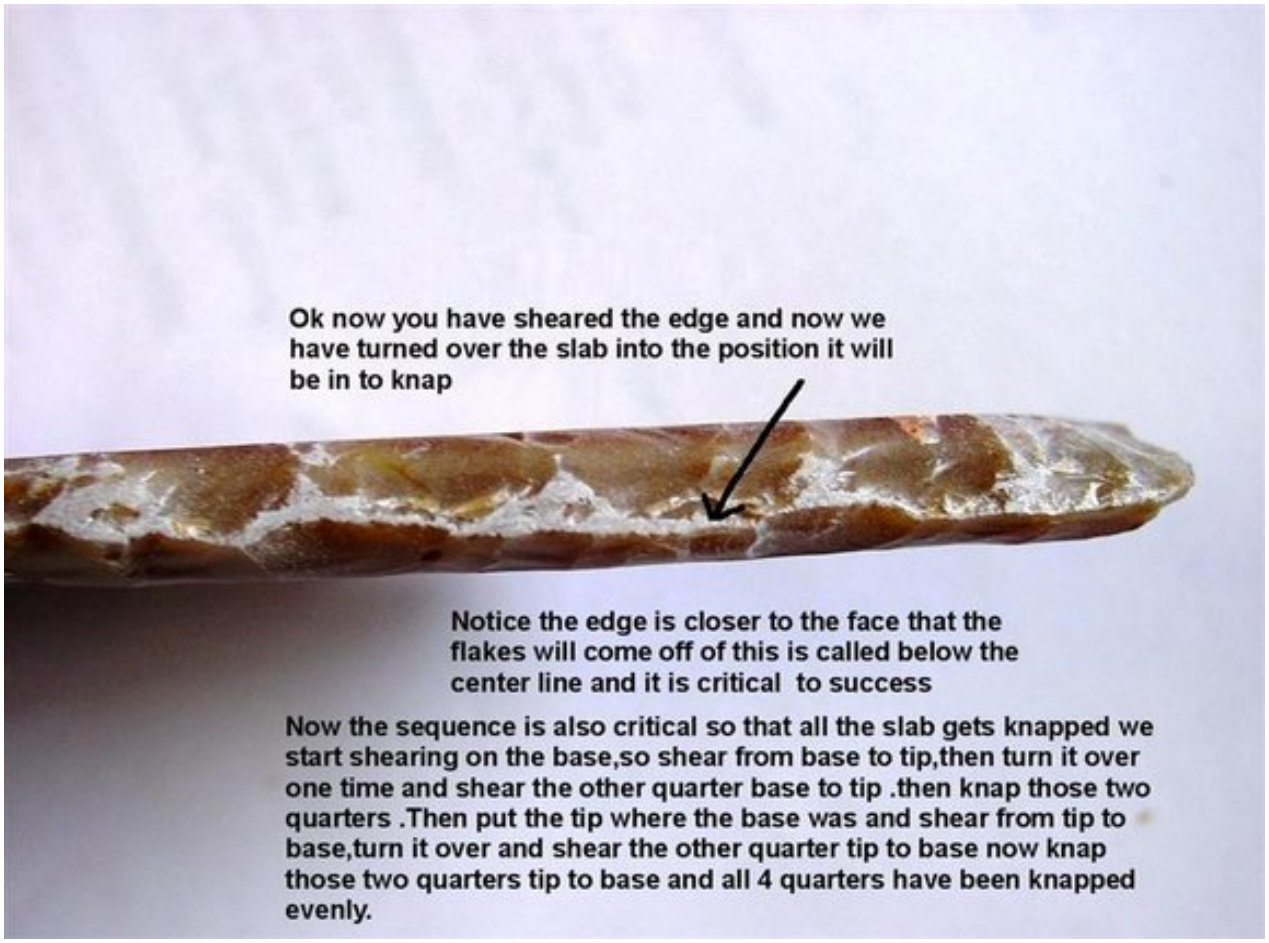

Ok now you have sheared the edge and now we have turned over the slab into the position it will be in to knap
Notice the edge is closer to the face that the flakes will come off of this is called below the center line and it is critical to success
Now the sequence is also critical so that all the slab gets knapped we start shearing on the base,so shear from base to tip,then turn it over one time and shear the other quarter base to tip .then knap those two quarters .Then put the tip where the base was and shear from tip to base,turn it over and shear the other quarter tip to base now knap those two quarters tip to base and all 4 quarters have been knapped evenly.

Figure 6


your tool should be sharp how sharp? as sharp as it
can be without bending! Notice how i hammered out
the tips of my tools i use them as shearing tools too.

Figure 7


these are the tools i use
you may use antler or
whatever adapt and
use what works for you
but remember that
certain ways work
better than others try
them all before you
make up your mind as
to how you will do it.

Figure 8


position is critical notice the left hand is locked against my left leg, the slab does not move! i am holding the slab with just fingertips. My right hand is locked into place and my right elbow is locked against my side. All i have to do is lean over that loads the pressure onto the platform when i have enough pressure i just move my right leg towards the slab and the flake detachs. :)
DO NOT! bend either wrist when trying to detach the flake if you hold the position shown all your upper body is leaning into the pressure flaker transferring the energy to the slab when you move that right leg it will detach..no magic here just good fundamentals the creator gave you a knapping machine use it ....:)

Figure 9

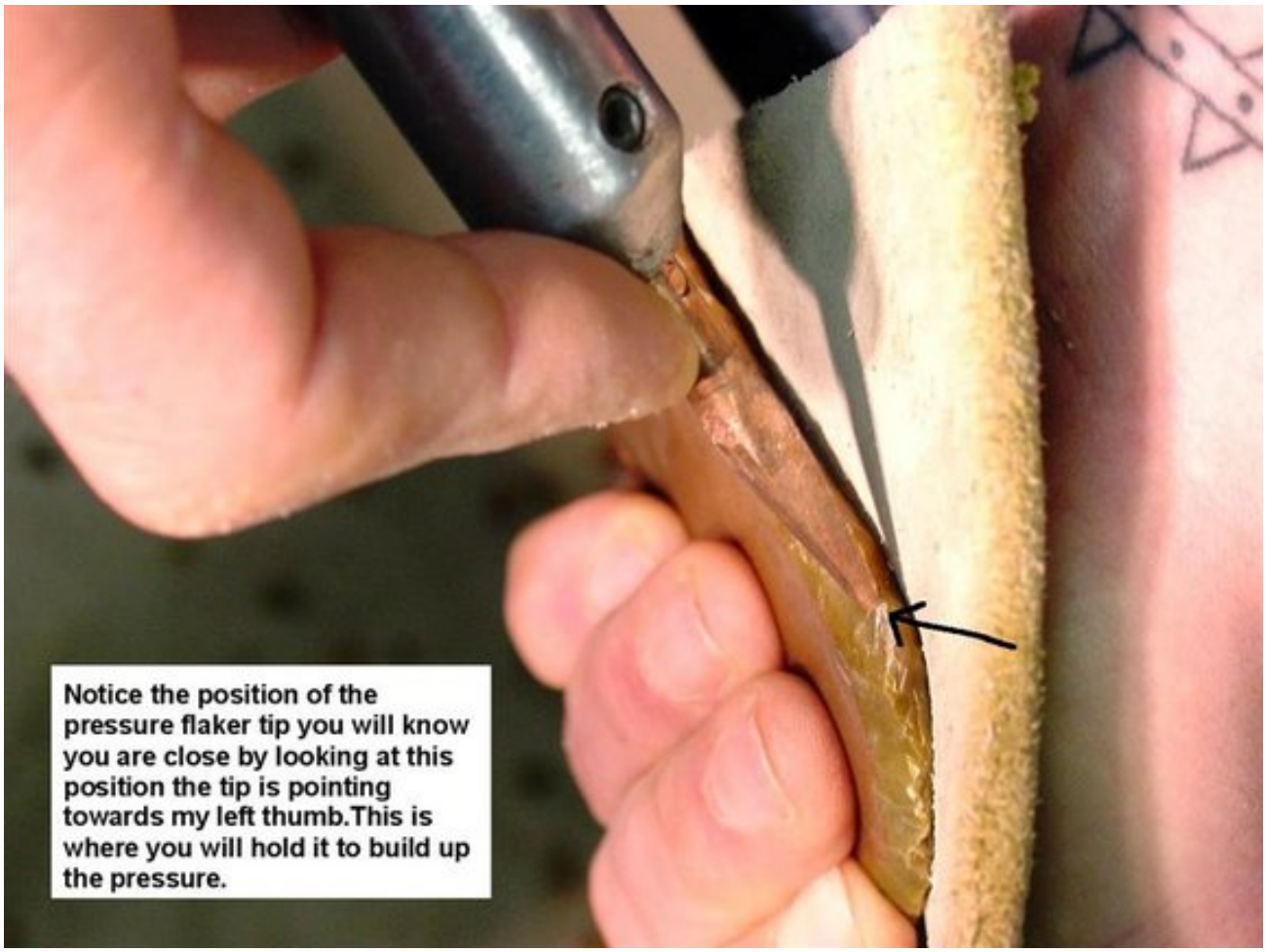

Notice the position of the pressure flaker tip you will know you are close by looking at this position the tip is pointing towards my left thumb.This is where you will hold it to build up the pressure.

Figure 10

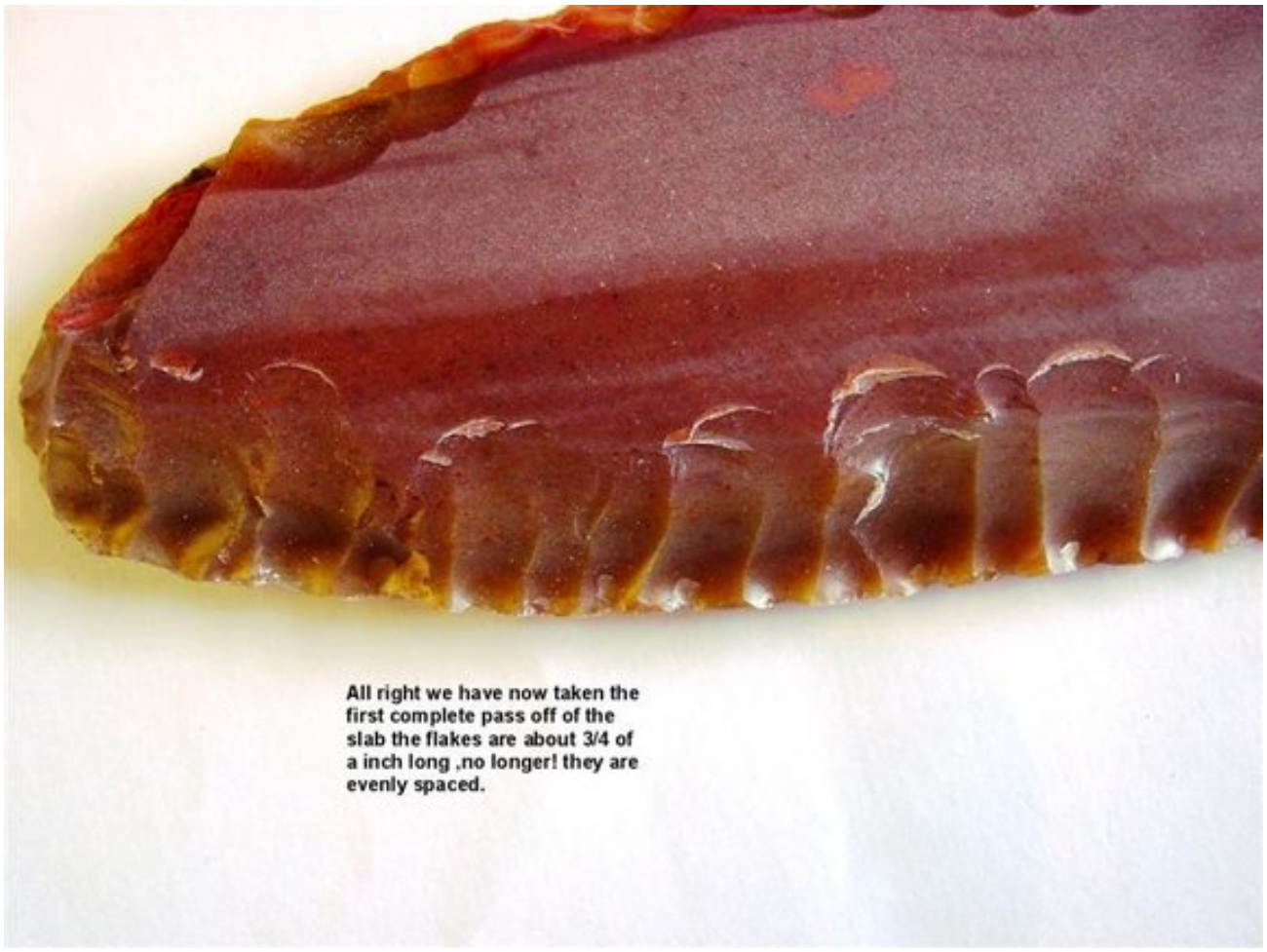

All right we have now taken the
first complete pass off of the
slab the flakes are about 3/4 of
a inch long ,no longer! they are
evenly spaced.

Figure 11

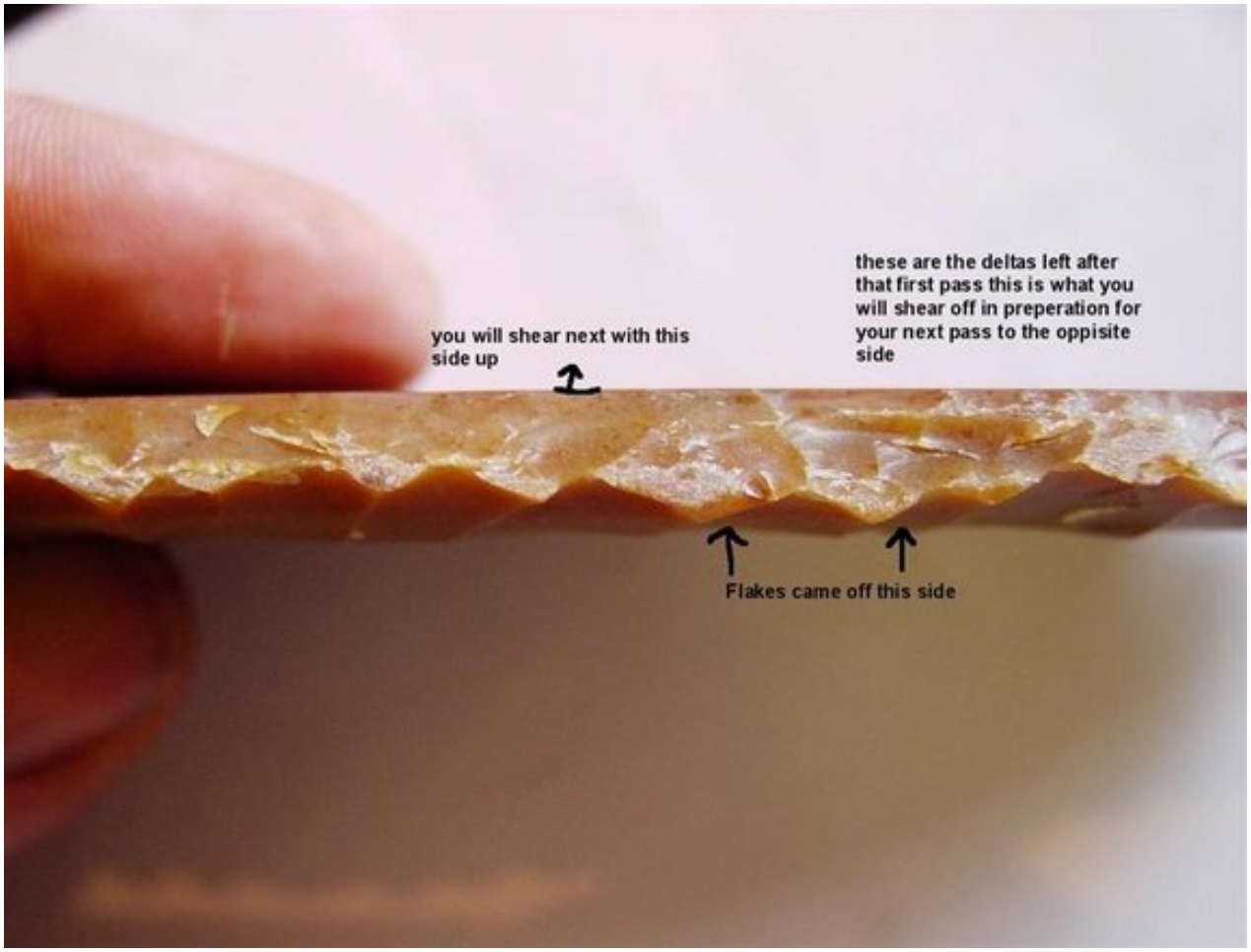

these are the deltas left after that first pass this is what you will shear off in preperation for your next pass to the oppisite side
you will shear next with this side up
Flakes came off this side

Figure 12

Figure 13"

From http://www.paleoplanet.net/, April 3, 2010, copied with permission

Pressure Flaking a Big Blade from a Slab

By Jim Winn (aka Paleoknapperjim)

The following sequence of pics was taken while knapping a large blade from a slab. The idea is to try to show a successful technique and strategy that can produce a large wide blade using very light percussion and heavy pressure flaking. I did a similar tutorial several years ago, but since that time I have developed a better strategy that is capable of producing wider blades with better success. The following outlines the procedure:

This pic shows the slab before being worked. It measures 15 long and thick.
Notice 2 cracks in the lower edge.

P2 I begin by removing the square edge by alternate beveling using a 5/8 thick solid copper billet. Each time a small flake is removed the slab is turned over and another small percussion flake is removed along the edge of the previous flake. This pic shows where I intend to strike to remove the next small flake. Note that the flake to be removed is resting directly and firmly on my leg to dampen the shock to the slab to reduce the chance of breakage. This can be done with pressure flaking also which is less risky but it is very time consuming and tiring. I prefer to just use light percussion.

The square edge has now been removed from the slab. Its rough looking, but the idea here is to just get rid of the square edge so that platforms are created that allow further light percussion to shape the slab. My fingers are pointing to 2 cracks. That edge must be brought in using light percussion until the cracks are gone. Also, only very light percussion can be used next to the cracks or they will run further and possibly break the slab.

The slab now needs to be roughly shaped. Light percussion is used to get the desired shape and symmetry and one side must be chosen to be the first face to get pressure flaked. The goal is to have the edge about 1/8 below the face to be pressure flaked. This picture shows the back face which will be flaked last.

This picture shows the face that we will pressure flake first. Its not perfect, but its good enough! The edge is roughly 1/8 below the face and it has been ground heavily to provide a continuous platform.

I started at the tip and began removing pressure flakes using an Ishi stick. The first 5 flakes do not have to travel far and go nearly to the opposite edge. Now it is time to begin to remove flakes from one edge, then the other. This picture shows the intended flake removal sequence for the next 4 flakes. By removing flakes from one side and then the next, continuous ridges running from edge to edge are created. This allows each flake to travel a bit further. If the flakes are removed down one entire side they will not run as far. Thats OK, but if you are trying to maximize the width of the biface it is better to alternated from one edge to the other with each flake. This same strategy works very well with percussion also.

This pic shows the next 4 pressure flakes after they have been removed.

The blade is now flaked to about the midpoint lengthwise. Time to switch to the base and begin removing flakes from the base back toward the midpoint. The advantage of doing this is that it provides an additional opportunity of correcting any short flakes that may happen. For example, if I get a short flake when working from the base toward the mid section I will stop. I then switch back to the mid section and work toward the base and the problem area. It is a lot easier to correct a short flake when doing this. It gives you a second chance to correct the problem by approaching it from the opposite direction.

P9 This pic shows how the Ishi stick is used. Note that the blade is held firmly on a notched rubber pad. My left hand is resting firmly against my left inner leg. My wrist is bent backward so that the Ishi stick force can be applied toward the opposite edge. In reality, the Ishi stick is actually pointing toward the opposite face, in other words, beyond the opposite edge. This is necessary in order to remove as large a flake as possible. Pressure is built up to about the maximum that I am physically able to apply, and then the left hand is rotated very slightly until the Ishi stick is pointing directly at the opposite edge. At that instant the flake will release. This all happens very quickly. It is impulsive. I have seen many knappers building up pressure slowly and straining till they are almost shaking hoping that the flake will release. It usually does not. So they change the angle of applied force till it is pointing toward the face they are flaking. This always results in a short flake. The flake will ALWAYS follow the applied force at the moment it releases.

This pic shows how the blade is supported on the notched pad. Note that the area where the flake is to be removed MUST be directly over the notch in the pad. If the flake touches the pad at any point, that area will result in a small step fracture. The flakes are elliptical in shape, and the notch in the pad must be elliptical in shape also. Pads that are bought are generally straight sided. Dont buy em, make your own! You want an elliptical shaped notch that is sized just a bit larger than the flake to be removed. If it is too large, too much bending stress is created and the blade may break. If it is too small the flake will step at the point of contact with the pad. Trust me on this one!

OK, this pic shows the continuation of the flaking process from base to the mid section. Notice the intended sequence of flake removal, from one edge to the other to provide nice ridges for the flakes to follow.

The first face is now completely pressure flaked. All traces of the saw marks have been removed. However, this face is still fairly flat and lacks convexity. Therefore the plan is to remove another set of pressure flakes from this same face to provide additional convexity and also to provide a better flaking pattern.

The edge is still close to the face just flaked. A small billet is used to drive off small percussion flakes toward this face and move the edge closer to the centerline. The goal is to create a platform very close to the centerline for the next set of pressure flakes, and then to abrade it very well.

This shows the blade after the 2nd set of pressure flakes has been removed from the same face .It is hard to see in the pic, but this face now has much better convexity. In addition, we have lost very little width in doing this.

The blade is now flipped over and the small billet is used to bring the platform up to about 1/8 of this face using very light percussion flaking. The platform is abraded and pressure flakes are removed with the ishi stick starting from the tip to about the mid section again.

Flakes are now removed starting at the base and working toward the mid section, to meet up with the others. As we progress along the length of the blade, longer and longer flakes must be

removed. To assist with longer flake travel, I often isolate the platforms by removing a small flake on the other side of the platform area, as seen in the pic. This isolated platform will release with a bit less pressure and travel a bit further. It will result in less bending stress being applied to the blade and will reduced the chance of breakage.

This pic shows the flake after is has been removed from the isolated platform. Right on target!

The 2nd face has now been completely pressure flaked. All saw marks have been removed. The hardest part is now over.

The next step is to selectively go around the blade and remove additional sequences of flakes to thin the edge and provide a good contour from edge to edge. In some area the edge may be very thick and more massive flakes will need to be removed. This pic shows such an area. Notice that I am using a finger guard made from leather to support the opposite edge. This not only protects my finger, but it provides support on the opposite edge. As I apply pressure with the Ishi stick I am applying the force directly into my finger support. This greatly reduces the bending stress being applied to the blade and reduces the chances of breakage. This also encourages the flake to travel further, often from edge to edge. The leather provides protection to the finger.

This is one side of the finished blade. It measures 14 5/8 long by 2 5/8 wide by 3/8thick.

This is the other side of the finished blade.

This is the edge view of the blade.

These are all the tools used to make this blade.

Hope this can be of use....jim winn

From http://www.paleoplanet.net/, April 3, 2010, copied with permission

Flake Over Gring (FOG) 101

By Tom Dodge (aka peblpmp)

OK....here goes.....others that FOG may use different techniques but this is what works for me.....

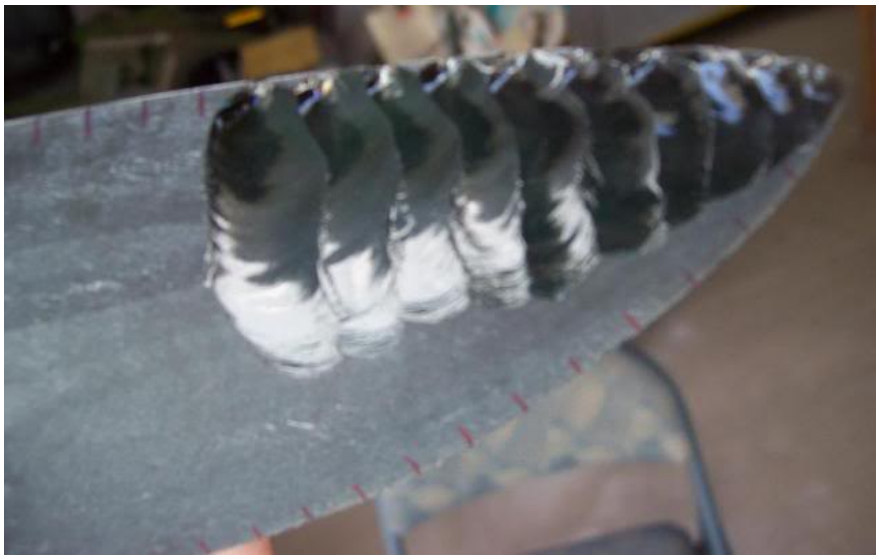
Lots to choose from.....I love cutting rock.....especially obsidian.....every one is different.....in fact, every slice is different

Take a slab, orient it the way you want, mark out the shape and trim with a tile saw. Closer triming here save diamonds later! I slab my own with an 18" Highland Park.

This is the work horse. 10" Poly arbor (very hard to find) with 8" 50 grit wheel and 6" 180 grit wheel.


Grind out the shape then grind both faces into a convex shape. Leaving a median ridge down the middle helps the flakes treminate smoothly. I'm not always successful. Rough it out with the coarse wheel leaving about a 1/16" flat on the edge so you don't rip the edge off. Smooth it out removing all the grind scars with the fine wheel. Start with thicker slabs to allow for grinding removal.

Using the fine wheel, bevel the edge at about 75 to 80 degrees. This edge should be straight with a sharp edge on the side to be flaked. This is your working edge for one face.
Measure and mark, if you want to, the evenly spaced flake locations.



With fine abraider, rough up the working edge and leave the powder on as it helps the copper bite the rock. I use a slotted block and an Ishi stick to flake. Start at one end or the other always flaking into the mass (unflaked portion) side of the previous flake. If you miss a flake or run into other troubles, go to the other end and work back to the booboo; this often helps to better remove "islands" of "frog skin" you missed. Run down one quadrant, then abraid the other edge and run down it.
Remember the centerline rule thingy still applies!!! Try to take every flake exactly the same, ie. same angle, same force, same depth, same everything.

First quadrant.....the thinner and misaligned flake are a result of not doing the same thing every time. It is unforgiving and takes a lot of concentration.

Second quad done.....first side finished.

Back to the grinder (fine wheel) and bevel the working edge back the other way to flake the other face. Repeat above, placing the tip of flaker in the middle (the strongest part) of each delta. No measuring or marking needed as the deltas should be spaced just right.

After all 4 quads are flaked, the edge should look like this.

Back to the grinder (fine wheel) and grind down about 1/16 to 1/8" of the deltas on both sides, leaving a fairly sharp edge for the final retouch.

Retouch the edge, careful to not push in and have the flakes run up the flake scar ridges. Just take off the ground deltas. U B done.....

Other side. Not too bad.

Once again I must thank the omnipresent TwoBears for the rock, which is to die for. There is no way to fully
capture the amazing deep metallic glowing color of this Mexican obsidian with photos. I love obsidian.

FOG has been around about 3500 years. They (Egyptians) just didn't have diamond grinders. They did have beer.
Lots of knappers scoff at FOG knapping for various reasons. I personally could care less. It helps to produce what
I want to produce.

Hope this is informative for anyone who wanted to know.

FOGPimp

_____

From http://paleoplanet69529.yuku.com/topic/23948, April 1, 2010, copied with permission

Parallel Flaking Techniques

by Jim Winn (February 2002)

Over the years, I have developed some ideas or beliefs on what seems to work when it comes to parallel pressure flaking. I may be wrong in my thinking, and invite other opinions or suggestions or what works from other folks. I am sure lots of folks may disagree with my ideas, but I welcome hearing from them so that we can all learn and improve our skills. Hopefully, maybe some of the following may be of use to others, or at least provide something to think about. Here they are:

1) Parallel flaking can be done straight in or obliquely. Either will work, but oblique flaking is more efficient for several reasons. First, the flake will travel further in an oblique direction than straight in. Why? Because the convexity is less when traveling at an angle across the face than straight in. In other words, it is flatter. All other things being equal, flakes travel further as the face becomes flatter (unless it becomes concave, or course). There is a negative side to this: Flake terminations are more likely to terminate in a step or hinge as the face becomes flatter, but measures can be taken to prevent this

2) Flakes will travel further and are more likely to have a feather termination when absolutely nothing is touching the flake as it is being removed. This is why I use a slotted hand pad, so that the flake area to be removed is resting over the slot. After each flake removal the biface needs to be moved so that the next flake is resting over the slot. If this is not done the flake will often terminate in a small fingernail hinge at the point where it meets the pad.

3) The biface is less likely to break during heavy pressure flaking when the flakes travel obliquely across the face instead of straight in. Why? There is more mass below the flake diagonally across the flake then straight in. Also, the flake is less likely to overshoot the opposite margin because the distance is greater. There is one time when this does not apply, and that is when removing flakes close to the tip when the flakes are traveling back toward the tip. In this case the flakes travel a shorter distance and great care must be taken not to overshoot and break the tip off. I have found that placing the tip of the biface on the pad (not over the slot) works well to prevent tip breakage until several flakes have been removed. Why? 2 reasons. One is that the tip is now supported and less likely to recoil and snap. The second is that the pad is touching the flake and prevents it from traveling as far. It may terminate in a fingernail hinge, but this can be removed when working the other edge, from the tip to the base.

4) Either an Ishi stick or a simple hand flaker can be used to do oblique parallel pressure flaking. But only an Ishi stick can remove massive long pressure flakes. Why? Because tremendous pressure can be applied with the Ishi stick, using not only the arm and leg muscles, but the chest, shoulders and back also. (In fact the whole body can be used with the Ishi stick in the traditional manner between the legs). The closer to the crotch, the more power that can be developed, and in addition the more stable everything is. I find the hand flaker more suitable on the smaller points where great pressure is not required and I am sometimes able to get more accuracy with it. Also, the hand flaker can be twisted at the moment of flake release to increase the travel of the flake. But the Ishi stick is a must on the big knife blades (unless your doing percussion of course).

5) Beginning knappers sometimes have trouble getting the flakes to travel as far as desired. They place all their strength into it and still the flake peters out short. Why? Sometimes it is a matter of strength, but more often I believe the cause is insufficient support of the biface, such that it rotates in the hand. The knapper is pressing with all his/her strength with the pressure flaker while the hand supporting the biface allows the biface to rotate slightly. The pressure now is directed outward instead of straight in, it travels a short distance but not to the middle of the point and the result is a thicker biface. The cure is to concentrate on supporting the hand holding the biface such that it remains absolutely fixed while the pressure flaker is applying pressure. The pressure flaker must apply force nearly straight in for a long flake and not be allowed to tilt outward. Again, supporting the hand close to the crotch and on the inside of the leg provides great support. If the knapper is straining and allows the hand to leave the inside of the leg the hand supporting the biface has to rely on the arm muscles alone for support and arm muscles are simply not strong enough to provide fixed support (unless you have 20” biceps!). Basically, the flake will obey the rules of physics and travel where ever the force is directed.

6) Parallel flaking is more efficient than random flaking (both on percussion and pressure). I am not saying is it right or wrong, just more efficient. Ancient knappers used both methods and of course random flaking is the only appropriate method when duplicating certain point styles. Random flaking must of course be used in the early stages of biface reduction to remove unwanted mass which is randomly located. However, by stage 3 or so, ridges can become established and oriented so that successive flakes can follow the ridge left by the remaining flake.

7) When doing parallel pressure flaking it is not necessary to travel all the way from tip to base or visa versa until the final set of pressure flakes is to be removed. Just continue the flaking sequence where mass needs to be removed. If you hit a low spot, skip past it and start where the next mass needs to be removed. Otherwise the point will be bent or twisted when viewed sideways. This was a problem I had in the early days when I would keep going from tip to base and then wonder why the point was not flat! Even on the final set of flakes it is not necessary to travel continuously if there is a low spot and often skipping over it will not even be noticeable (unless you are doing FOG, in which case there wont by any low spots anyway). Also, when doing a sequence of flakes, try to adjust the length and thickness of each flake to the amount of mass needing to be removed.

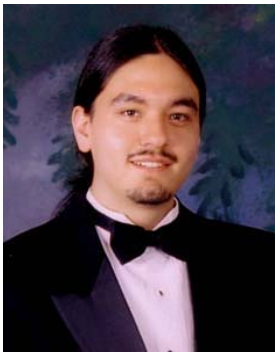
8) Longer flakes are wider flakes. Guess this is obvious! But the spacing needs to be increased between flake removals to prevent the flake from diving into the previous flake scar. I still make this mistake when I don't take the time to inspect each flake removal and adjust the next accordingly.

OK, that is all for now. Lets hear from others. Give me some hell! Really, I know there are probably lots of ways to do things better that I have not thought of, and I think that is what this forum is all about, sharing and learning from one another to improve our skills. Perhaps a folder can be created on pressure flaking tips, another on percussion flaking, fluting, etc.

From http://www.flintknappers.com/oldsite/jim_winn_parallel_flaking.html, April 8, 2010, copied with permission

Micro Flint-Knapping

by Craig Libuse



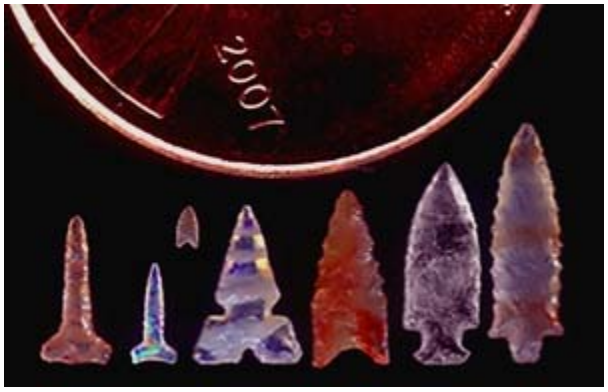
Scaling traditional techniques to extremely small sizes

Dan White (pictured) has been able to create his own form of art, based on what was one of the first forms of art—flint-knapping (shaping stone by breaking off chips). He calls it "micro-knapping". Prehistoric cultures learned early on that flint could be chipped to create sharp edges for knives, arrow and spear tips. The ability to make quality points was critical, as it meant the difference between eating and going hungry. Shape and size varied widely based on use and culture, but the technique has changed very little in thousands of years. Old points are popular among collectors, and some modern craftsmen have taken to duplicating the ancient techniques, but Dan has taken it to the extreme small end of the size scale.

Over the last few years Dan has made over 100 miniature stone arrowheads. He uses a stereo microscope to reproduce the stone-age technology of flint-knapping in miniature. After months of experimenting, headaches, and stabbing himself in the fingers, he has been able to develop a technique where he can make miniature stone arrowheads the size of a grain of rice that have all the same proportions and flaking as the full-size originals. Each miniature takes between 1 and 2 hours to complete.

Tools of a new micro-trade

His tool kit consists of a thick rubber pad, a fine grinding stone, various size small nails/pins for use as pressure flakers and Scotch tape. (He must wrap his finger 4 or 5 times with tape to prevent the smaller nails from stabbing him while flaking). He like to use the most colorful stone he can find for his microscopic arrowheads. First, he starts with a flake of stone about the size and thickness of a nickel. He then begins breaking off large chips with a sharp copper nail to shape the stone down into a bi-facially flaked "pre-form". Once the pre-form is complete it's time to use the smaller nails and pins to shape it down and begin finishing the edgework and notching or fluting. Notching is done with a small nail that has been flattened and sharpened. He makes all the pressure flaking tools with the help of a microscope. Micro-knapping is basically the same as normal flint-knapping in the way each flake has to be removed in a very similar and precise manner.



Seen here are some of Dan's favorite micro points, described from left to right: 1- A T-drill style point made of Kaolin flint from Oklahoma. 2- Another T-drill style made of opal from Australia. 3- His smallest point- a paleo style fluted point made from Alibates chert from Texas. 4- An arrowhead made from striped opal from Australia. 5- A Dalton-style made from Kaolin from Oklahoma. 6- A "bolen bevel" style point made from quartz crystal from Maryland. 7- A stemmed point made from Brazilian agate.

Scarcity of materials leads to miniature craft

Dan has been a collector for most of his life and his interest in ancient stone arrowheads is what eventually lead to his pursuit of flint-knapping. When he first started trying to make arrowheads he had no way to get large pieces of flint to practice with, so he decided to make miniature arrowheads using tiny pieces of stone that had broken off some damaged arrowheads in his collection. As far as he knows, he is the first
person to ever try flint-knapping under a microscope. Since he had never heard of this before, there was no place to go for guidelines or advice.

It took several months to develop his technique and figure out the right tools to make. After much practice and pain, he was able to make a miniature arrowhead under 2 mm long that has sharp edges and is flaked on both sides just like the full-size ones. His smallest arrowhead was considered for the *Guinness Book of World Records*, but because there is no category for arrowheads or flint-knapping (and they didn't feel like creating one) he was turned down. However, some of Dan's work is in the Smithsonian collection and his smallest piece has been photographed by the Smithsonian's photographer. He has sold some individual miniatures to collectors in the past but would rather keep most of them and enjoy them himself, especially since they are so difficult to make.

Early difficulties solved by better tools and techniques

When Dan first started, his only tools were the microscope, a pin for the notching, a pocket knife and some card paper. He would find the thinnest, flattest chip of stone and then shape the edges down with the tip of the knife blade while holding the stone between his fingers in a piece of card paper. The first 10 or 15 were crude looking and not bifacially flaked (flaked equally on both sides). He used the pocket knife for a while before realizing he could never get the results he wanted (bifacial flaking) with such a hard chipping tool. This is when he started using nails and placing the stone on a rubber pad to get longer pressure flakes.

One of Dan's arrowheads is shown here attached to a miniature arrow.

When starting out and trying to teach himself how to make these tiny points, Dan would break two or three for every one he finished. After finally getting the tools and technique just right, he says he can now make two or three (if he's really careful) before he breaks one. According to Dan, "The hardest part is doing the notching and the flute flakes for the Clovis style points. Naturally, most of the breaks happen after much of the work is already finished. If I can get the arrowheads to look good under the microscope, they will look really good to the naked eye, but sometimes I break them on purpose if they don't look just right."

Dan admits that he has dropped a few of them and lost them in his carpet including a couple of his best ones. After spending over an hour looking for one he has to give up in frustration. Even so, he says working this small is worth it.

Here are several examples of Dan White's work:

Dan's tool kit includes:

• A stereo microscope (it's a lot harder to make micro arrowheads without it but it can be done).
• A pressure flaker with a sharp copper nail for making the pre-forms, and some smaller pins and nails for the finer chipping work. Also there's some clear tape used to protect his finger from being poked by the nails while pressure flaking

• A small grinding stone used to grind the edge of the pre-form prior to chipping

• A rubber pad cut from a tire for placing the point on while chipping. On the pad is a red piece of stone typical of the size and shape he likes to start with.

The penny is to show size. The small hafted knife in the center has a turtle bone handle with real sinew keeping the blade on.

Some arrowhead samples of various shapes are shown next to the tip of a toothpick for size reference.

More small points, all of a similar style are shown next to a penny.

This is Dan's smallest arrowhead, a fluted and bi-facially flaked Clovis-style point that measures just over 1 mm. According to archeologist Dr. Dennis Stanford at the Smithsonian and the people at Guinness Book of World Records, this is the smallest knapped stone arrowhead they have ever heard of. This is the only one he has made this small and says he doesn't think he wants to try it again. He made it several years ago and had to hold it down on his pad using a popsicle stick while flaking it with a special tool he made just for this point. It took about 1-1/2 hours to finish.

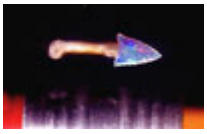
These points are all made from Alibates flint found by Dan's late friend George Chapman near Alibates Flint Quarries National Monument, the famous ancient flint quarry in the Texas panhandle. George lived near the quarry and he would send Dan a pile of small flakes he picked up in exchange for a finished point or two. Dan says this is some of his favorite material to work.

These are some of the first ones Dan made from broken pieces of arrowheads. All are made from a thin flake and are only chipped on the edges.

These three glowing "opals" are all made from Australian Opal from Lightning Ridge.

He has only one picture of himself at work with his microscope. It was taken by Val Waldorf in August, 2002 at Flint Ridge, Ohio for the October, 2002 *Chips* publication for flint-knappers. (Vol.14, #4)

Dan has created other weapon shapes as well, from spear points to daggers. The handles were made out of tiny bones found in owl droppings.



A knife with an arrowhead-like point made from fire opal.

A miniature knife of the type chipped from obsidian.

From http://www.craftsmanshipmuseum.com/White.htm, April 7, 2010, copied with permission

Section 5: Notching & Fluting

Fluting Instructions

by Gary Merlie

This series of pics are a composite of work on 2 different preforms. After each of the flake removals in the first few pics, remember to clean up the little overhangs just like you do when making a biface. There are many critical variables that I could not cover in these few pics. Nipple grinding, cross section of preform, and placement of the lever just to name a few. You will just have to experiment. All of the knapping/fluting was done with copper and modern tools. Fluting abo style is a whole different ball game, a game I have never played. I would love to see a similar layout like this one dedicated to abo style fluting by one of the good abo knappers like Bob Patten. (hint hint) Rockhead

Bevel base toward side to be fluted.

Remove flakes 1 & 2 on the side to be fluted to define nipple. Remove flakes 3 & 4. These are guide flakes to help flute flare out correctly.

Turn point over and remove flakes 5 & 6. These removals isolate nipple.

Remove flakes 7 & 8 from side to be fluted. These removals act as guides, and further isolate nipple.

Turn point over and remove flakes 9 & 10 as needed. These removals regulate the width of the nipple. Remember when making nipples: Define, isolate, regulate, and grind.

This nipple is ground and prepared for fluting. The guide flakes could be better, but it is good material from Harrison Co. Ind. and the flute will probably go.

View of overall preform. Note how nipple is isolated and out towards face to be fluted. Ears are back away from face to be fluted. I grind the ears at this point to keep them from snapping during fluting.

Preform in jig ready to be fluted. Note tip of copper lever on top of nipple. Side to be fluted is facing jig.

Copper lever. This tool has 4 working faces so you don't have to dress it as much.

Close up of copper lever on nipple. Ready to flute.

Preform and flute spall immediately after fluting. This flute ran about 4".

Here's the finished point after the other side was fluted and much pressure flaking was done to give it the distinctive Cumberland fishtail shape. Length is 4 1/2". I rubbed a little mineral oil on it to give it the nice glossy look. Total time to make this point? A lot less than it took to edit and post all these pics!

From http://www.ssrsi.org/Onsite/fluting.htm, March 31, 2010, copied with permission

Hand Fluting

By Bob Patten (aka knapperbob)

I picked a tough piece of raw Utah agate to make a Folsom. The weathered surface is deceiving.

You can see that the stone tears rather than breaking smoothly, but works well otherwise. The unweathered interior looks quite different from the weathered outside.

I used antler baton percussion until the thickness was even and relatively thin. Some length was lost due to careless work.

After the surface was selectively contoured by antler pressure, I gave the base a bevel.

 A little more work and the platform is isolated. I set up a 2 mm gap between the platform and a straight edge to control flute thickness. At this time, I make sure that there are no gaps between the straight edge and the preform crest.

The first platform is ready for fluting.

You can see my view of the fluting anvil, a moose billet resting on top of my calf muscle.

Here, the preform is in place atop the anvil. The blow follows through to land on a heavy leather pad near to the action I normally use while doing regular percussion. My avatar demonstrates the approximate positioning for fluting.

Backlighting shows the translucent nature of this agate.

Unfortunately, I held the preform off center and the first flute peeled to one side.

With just a small adjustment, I have a new platform near the edge of the preform base. Ready for another try in under a minute.

As we say, "the operation was a success, but the patient died." Although the flute went full length, an unfortunately-placed crystal pocket caused the point to snap. With a few thousand years of weathering, this point could have taken on the relatively smooth appearance of the starting quarry blank.

From http://paleoplanet69529.yuku.com/reply/126388#reply-126388, April 4, 2010, copied with permission

Notching Arrowheads

From http://www.arrowhead-makeyourown.com/, April 6, 2010, copied with permission from "How to Make Your Own Arrowheads"

The Basics Of Punch Notching

by Mark Bracken

In the early days of flintknapping, I think we all have tried making notches in our flint points with a punch. All to often and with the greatest of ease, simply split the point in two or blow the ear off. You only have to do this two or three times to develop quite a rash.

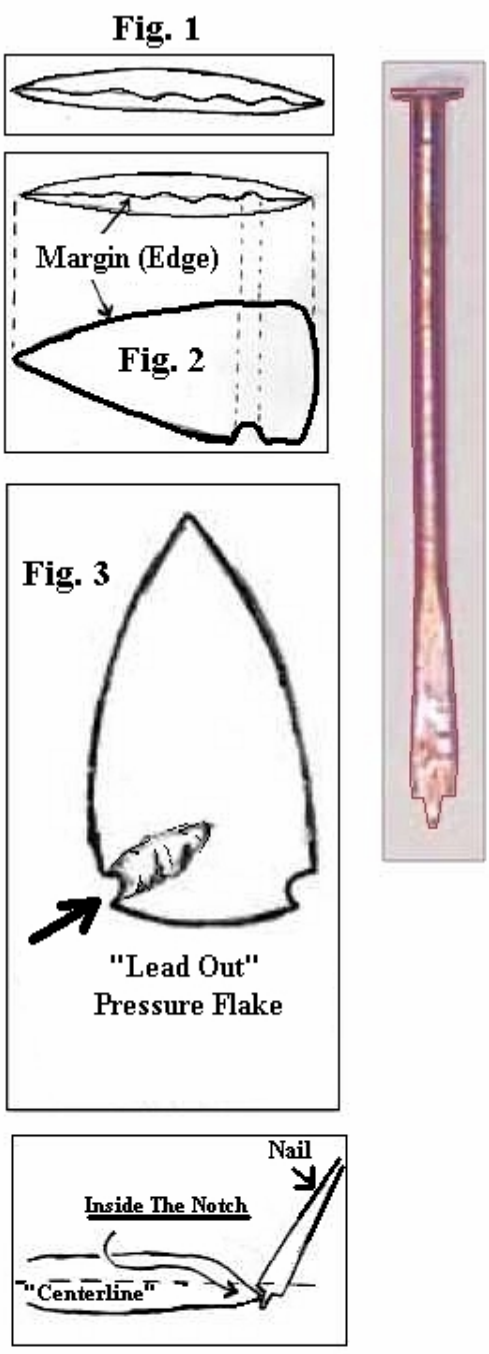
Thank goodness for good friends and flintknappers. About three years ago a knapper from Texas named Dan Theus showed me a thing or two on punch notching. Dan can notch most anything as deep as he wants or needs to with this technique.

Using an Ishi stick or the smaller flakers has its limitations, for example..."dog leg" notches, thick points or very deep notching. Texas style Andice points are a good example of this.
In the artifact world, it appears native American Indians preferred punching their notches. This is based on the flake scars of old points. Successful punching produces large aggressive "c" shaped flakes.

Now Lets take a look at the basic rules you must follow for risk free notching. There are four basic factors for success. These are: Platform setup, grinding, strike angle and velocity. Lets look at basic platform setup.

Fig.1 shows and view of the margin. Note that the margin is not directly located on the imaginary centerline, it is for the most part, closer to the lower face of the preform. This would make any flake removal(s) more successful and less risky. The same thing applies to the tiny margin located within the notch, in a much more critical way.

Look at fig.2. It shows the margin being closer to the top face. (It's up-side-down) The flake should be removed from the "top" of the Bi-face. Having the platform edge below the imaginary centerline is a must for punching! It is the key!



To begin a notch, I like to use my ishi stick to make a "lead out" flake. Shown in Fig 3. This thins the notching area and can be done to "lower" the platform edge, I like to do this on both faces of the preform. This is not necessary but it can be a big help. Keep in mind that the notch platform is basically the same principle as a standard thinning platform.

With your platform ready as described above you must now abrade it. This is critical, even if you are doing minor adjustments to relocate the margin (something that you will occasionally have to do after punching a flake) to favor flaking the best face.

Take a look at fig.4. It shows the shoulder on the nail resting in the notch ready to punch, note that the nail shoulder is located at or slightly below the centerline of the point. Screw this up and the ear is gone! The nail will require file retouch after a few flakes.

Make sure you're not biting too much off by having to broad of a shoulder on your nail. If you have a good low platform, whack the heck out of it. You can use you billet, a chunk of wood, frozen steak or what ever to hit the nail.

A few more tips. The "lower" the platform the more you can change the angle to drive into the preform, and vise versa. Faster hits for bigger flakes and slower for smaller flakes. You can grind with a small flake. The tricky part is readjusting the margin to favor a face.

From http://www.flintknappingtools.com/punch.html, March 31, 2010, copied with permission

Expanding Type Notching Tutorial - Crump Lake Point

By Jim Winn (aka Paleoknapperjim)

I've been planning on doing a notching tutorial for a long time and finally got around to doing it today. Normally most of my notched points are on the small side, but trying to take pics of notching small points would be a challenge, so I chose a Crump Lake type point which is bigger. Crump Lake points are from the Cump lake area of Oregon and are a type of Great Basin side notch point. Many are on display at the Favell Museum in klammath Falls. Most all of them are made from black Dacite, the same material that I chose to use to make this tutorial point. Special thanks go to Chad Ring, friend and fellow knapper who took all of these pics today. This first pic shows the piece of dacite before any flakes have been removed.

Initial percussion flaking begins with Moose antler, sandstone and copper. I find the Moose antler works great in the early stages to rapidly thin the piece, many of the flakes traveling edge to edge or overshot. This picture shows the biface thinned to the desired thickness.

A little more percussion flaking has been done to shape the biface and it is now ready to pressure flake...

This pic shows the biface after the first pass of pressure flaking using an Ishi stick....

This pic shows the biface after the 2nd and final pressure flaking pass. Notice the basal thinning flakes. It is necessary to make the basal area as thin as possible in order to get narrow notches.

Here the opposite face is shown

I normally draw the starting point for my notches on the biface before notching it to be sure to get proper alignment. I use a straight edge at right angles to the long axes of the biface and place a mark on both edges on both faces. Because this point is black, I used white out instead.

The biface is now marked on both edges of both faces...

This is the edge view, showing the thinness near the basal area. This thinness is critical to successful narrow notches...

This pic shows how I support the biface on a small pad. It is very important to have very rigid control and no wiggle room anywhere. The Optivisors help a lot. If your young you may not need them, but in any case you need to be able to see real close up.

I am using a horseshoe nail for notching. This shows the placement of the tip of the notcher for the first flake removal. This first flake it taken by pressing the tip straight down, NOT IN. The idea is to take a very small flake that will set up your platform for the next flake removal on the other face.

This pic shows the first flake removed. As you can see, it is not much of a flake, but it is a starting point and we can now remove a longer flake from the opposite face...

OK, this is the oposite face flake removal, and now we are striving to push a longer flake to thin the area ahead as we go. It is absolutely essential the the tool tip be narrower than the notch. I cant stress this enough. If it is not it will rub the sides of the notch and blow it out. OK, this time I push straight in.

Here is what the 2nd flake removal looks like. It has traveled perhaps 3/16" and thinned the area ahead, looks good...

OK, this pic may look confusing, but here is what is happening. The opposite face (not shown) is where I just removed the last flake. Before removing another long flake it is necessary to get the edge of the platform as close to the face you are flaking as possible. To do this I push straight in very gently at 90 degrees to the face, just removing tiny flakes to bring the edge up. This will allow the next flake to release with less force and travel further. I NEVER grind my notches. Grinding them will stall them out and so much force will be required to remove the next flake that it will likely blow out the notch.

OK, we flip the biface over and push off another long flake on the opposite face. Again, I am pushing straight in to remove a long flake and thin the area ahead...

Here is the flake removed, not as long as I wanted but good enough...

This becomes repititous, but here I am pushing at 90 degrees to the face again to bring the platform up to the face so that i can remove another long flake...

The biface is flipped over and we push straight in again to remove another long flake...

Here is the flake removed. This one traveled nice and far and really thinned the area ahead very well. This will make it much easier to continue. It is much easier and less risky to remove a short flake, but short flakes make it much harder to remove a flake from the opposite face. You pay the price when you go to remove the next flake. It is better to be aggressive and remove a big flake or things are sure to go wrong in a hurry..

Now we switch techniques. As the notch gets further in from the edge, it is too risky to push straight in. If the tool tip even touches the edges it will blow them off. So now we come up from underneath. Place the tool tip up on the platform and apply the force straight in as before. If the tool tip is too sharp it may bend, so you may need to file the tip a bit duller at this point. However, it still must be narrower than the notch.

Here is the flake removed. Again it travelled far and the area ahead is nice and thin and will be easy to notch...

OK, now it is time to begin expanding the notch. So now I take 2 flakes side by side on each face. Here is the first flake removal, again coming up from beneath with the tool tip...

Here is the 2nd flake removal. Notice I have moved the tool tip to the other side of the notch end.

Here are the 2 flakes just removed...

We flip the biface over and remove 2 more side by side flakes. here is the first flake removal.

Here is the 2nd flake removal...

We flip the biface over and continue. From hear on, I may remove 1, 2, 3 or more flakes on each face, whatever is needed to open the notch up to the desired thickness. This part is relatively easy.

Here is the first notch completed. Now I will follow the same procedure for the 2nd notch. Note: Normally I do both notches at the same time. It is much easier to maintain symmetry by having them travel along at the same pace, rather than trying to make the 2nd notch match the first. Also, if you stall the notch out but are in far enough you can stop and call it good enough...

Here the 2nd notch is completed. Notice that I did manage to blow off a tiny pice of the 2nd opening. This happened when the tool tip accidentally touched the opening, it does not take much to blow them off!

Opposite face shown here...

Here are all the tools used to make the point from start to finish

This is another view of the notching tool unassembled. I shaped and cut a plastic bolt to a bullet shape and then heated up a horseshoe nail repeatedly over the stove and inserted it into the bolt tip until it penetrated all the way through. This fits the nail like a mold and nails are easily replaced. The handle is steel pipe with the same diameter as the bolt and makes a snug fit. A wooden dowell is glued inside the pipe to act as a stop for the bolt and nail

One final word, this is not necessarily the best way to notch a point, it is just one way of many possible ways. I tried many different techniques, most ended in failure, and after many attempts this is what is working best for me at this time...

From http://paleoplanet69529.yuku.com/topic/4139, April 1, 2010, copied with permission

Photo courtesy of F. Scott Crawford

Section 6: Finding & Treating Knappable Stone

Where Can I find Flint?

by Mark Bracken

Hunting flint is one of my favorite things to do. It's an adventure every time I go on a rock hunt! Over the years I have searched far and wide for the finest and most colorful materials for knapping. Many times I have come up empty handed and an empty gas tank. I always wondered where the "Mother Lode" was or if such a thing existed. In my quest, over the years, I have found some fantastic flint sources. It is a lot of hard work yet very satisfying experience.

Here are some tips for *your* next rock hunt!

The best advise I can give to the "flint hunter" is this: familiarize yourself with geological maps of the areas you plan to hunt. Look everywhere, in plowed fields, look in the gravel of creek and river bottoms, construction sites, under bridges and eroded roadside ditches. Be sure to get permission from land owners first! I assure you it is not worth the risk. The rewards are greater when material is gathered with a blessing from the land owner. Beware of "freeze fractured" flint. This is flint that has been exposed to freezing and literally frozen. The problem starts with this. Flint and all other stones contain moisture deep within the stone, when the temperature falls well below 32 f. the result of the expanding freezing moisture is fractures the flint. This is a bad thing for knappers. This material is useless unless the pieces are large enough to knap. You want pure crack free stone. It can be a serious challenge to find high grade stone. If you plan on getting material from construction sites, get them before it freezes. These stones have never been exposed to freezing temperatures and when they do, they will likely suffer. Searching creek and river bottoms can be a lot of fun. Take a big copper billet and start testing the gravel to see what is inside. You never know what you might find!

In summary, do a lot of research. Talk to artifact hunters, they know what the flints look like from their area. Don't waist your time in areas where there is no flint to be found. Don't expect other knappers to reveal their sources. Many a knapper has spent years to find their "honey holes". Remember, always get the land owners permission to hunt rocks on their property! Try to hunt areas that have not been exposed to freezing. Use common sense, have safety equipment along. Take Band-Aids, gloves, safety glasses and long pants. Just take a day off work and get a tank full of gas and have fun exploring the country side. It's great fun! you never know what you might find!

If you don't have much luck or just don't have the time you can get good material from reputable rock dealers. You want to learn more about modern knapping? Simply search this site or view the Links page.

From http://www.flintknappingtools.com/where_flint.html, March 31, 2010, copied with permission

Flintknapping Buyer's Tips

by Wilkie Collins

These tips could save you hundreds of dollars

1) Many people who sell knapping stone do not know how to grade it very well for flintknapping.

Silica is available at about 3 cents per pound in the form of gravel and up to 1500 dollars per pound in the form of semiprecious stones. Knappable silica is somewhere between these two figures in value, and the skill of the vendor at stone grading and his familiarity with the specific stone he sells are your only reliable access to value. Someone who offers you graded stone for less than a dollar a pound is probably offering you what most flintknappers would call "gravel".

2) For best value, purchase your supplies and tools from one dealer, especially while you are learning the basics.

Knapping materials vary, and purchasing your tools from the dealer that offers the stone can help to ensure success. Some billets don't work well with everything.

3) Learn to flintknap with the best material you can acquire, then move on to experimenting with all of the lower grade materials that may look more like the stone your own local Indians had to use 'cause they couldn't get the good stuff.

Heated Arkansas novaculite is a near perfect stone for the beginning flintknapper. Novaculite is less brittle than obsidian and is much safer to use. It is far more consistent than chert, can be reliably heated to knappability, and is consistently available in larger high grade pieces than other forms of silica.

Students typically learn faster with heated novaculite and experienced knappers who demonstrate look extremely competent when using novaculite as opposed to less consistent materials.

We do not recommend obsidian for beginnning flintknapping because:

a) It behaves too much like glass, and one is generally better trained by using a material more like natural stone, and

b) It is very dangerous to chip and will leave you bleeding.

5) **Whenever possible, obtain your stone from the people who mined it, and who mined it FOR FLINTKNAPPING.**

If the person who supplies your knapping stone has purchased it second or third hand, the likelihood is great that you are getting second or third rate materials. While many dealers may protest that their stone is "#1 quality", if they did not do the mining and are not experienced flintknappers they might not even know what the best material looks like.

Questions to ask your knapping stone dealer:

a) Is this stone heated?

If it is not, it will probably be very difficult to work especially for a beginner. The exception is obsidian.

There is a tremendous difference in material that *CAN* be worked raw and material that can *EASILY* be worked raw. After teaching hundreds of students our advice is that your first 50 lbs of material be graded and heated.

b) Is this material spalled and bifaced?

If it is not, it CANNOT be graded as well as processed material, and is a risky buy. Most beginners ruin more material than they successfully spall (strike into large flakes) from blocks.

Don't be snookered into "comparing apples to oranges". Knapping material sold as a ten pound, six inch block for a dollar a pound *might* not make even a single 4 inch spall. But if you buy #1 graded spalled material with the size listed you will know what you are getting and might get several four inch spalls *PER POUND*. Two pounds of $5.00 per pound material could very easily yield you more usable stone than 10 or 12 pounds of blocks or poorly graded stone.

The rule of thumb for knapping stone value goes basically as follows:

RAW stone is generally worth less than 50 cents per pound.

SPALLING the stone into prime spalls adds about a dollar a pound to the value.

HEATING the stone adds another dollar or so to the value of the stone.

CLEANING and BIFACING the stone rapidly adds to the value.

If your dealer has been in business for a long time, you usually get your dollar's worth in higher priced stone.

c) What is your spall width to thickness ratio?

If they do not know what you are talking about, they probably cannot grade stone effectively. Slight variation in the thickness of spalls or flakes can mean many more or less pieces per pound and much lower value.

d) How much of this stone have you personally used for flintknapping?

A dealer/flintknapper will have used many pounds of his favorite materials.

From http://www.nativewayonline.com/fkfast.htm, March 31, 2010, copied with permission

Heat Treatment

By Travis Smolinski

Heat treatment in itself is an art. How it was discovered by the old teachers is unknown but it was a significant invention, just as water treatment was.

There are many discussions on why it works, but I will only add my theory and say no more, "because it does". Treating stone allows difficult stone to become workable. Agates like Brazilian or Montana turn from blood vessel poppers into glass. This obviously has an effect on the final tool or weapon. So if you are planning on making a good sturdy axe, don't treat it. But it does not have a significant enough effect that it deteriorates the effectiveness in scrapers, knives, arrowheads or the like. It simply makes the flint knappers job more easy.

- Fire
- Bar-b-que
- Oven/Roaster
- Kiln
- Temperatures
- Special Notes

Some types of stone are also affected by water treatment. While I do not have enough stone to experiment with this process, one should try leaving some pieces in a bucket of water for a couple of weeks and test the results.

It should be noted that in regards to heat treatment, different types of stone require different temperatures. Others, such as Obsidian, require none.

1) Fire

The old teachers use to build a pit under their fire, or in the side of a hill next to it. This was there Kiln. You should dig a fire pit large enough for the material that you would consistently be treating. Now bury the spalls (etc.) under a bed sand. A fire is now built over it. It doesn't have to be large enough to alert the fire department, just so that it heats the coals up good enough to allow them to burn throughout the night. While some people scrape all the coals off, re-layer the spalls, performs, etc., add more sand and re-light the fire, I usually skip this step and keep the fire going nicely throughout the day. After a day or more the stone is dug up and checked to see if it has been sufficiently heat treated.

Where you place them in the bed of sand will depend on what temperature they require. It has been said that 1" under the sand produces about 600 degrees of heat and will decrease about 50 degrees for every half inch deeper. Of course this assumes that all the sand is equal and that the fire is spread evenly. The edges of the sand pit would experience less heat if the fire were not over it enough.

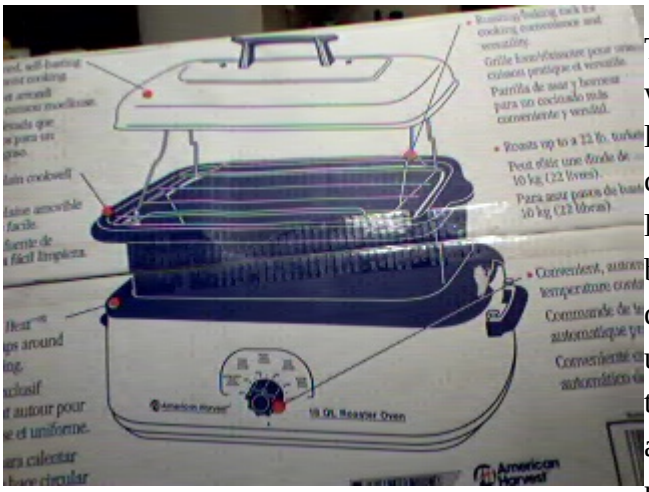
- My first experiment at heat treatment involved a fire pit. First I dug a hole into the ground, filled it with about half a foot of sand and then layered the rocks so that they wouldn't be touching each other. Finally more sand and then we built a fire on top of it and roasted marshmallows. The next day I dug it up and noticed that there didn't appear to be much color change. Further examination of the rocks proved this as there was no change in the ease of pressure flaking the stones. Perhaps the fire wasn't hot enough?

2) Bar-b-Q

I have a small bar-b-q that I filled with sand and layered the stones accordingly. Then I lit a sufficient amount of charcoals (covered in lighter fluid) and let them burn over night. However, while I have heard that this works too, I was unsuccessful. I just can not seem to get the fire hot enough. This time I used less sand but had the same results.

- A friend told me that he cooks novaculite (requires 700-950 degrees F.) on the bar-b-que. Haven't tried it yet.

3) Oven/Roaster



The same goes for the oven, but after the wife banned me, I got a turkey roaster and love it and would not go back. It is larger so I can put more in, spread them out differently, leave the sand in it and not worry about burning out the internal mechanisms. The 18 quart ones have temperature gauges that goes up to 450, or 550 on the more difficult ones to find. You can get the temperature up an additional 100 - 150 degrees more by removing the middle pan. They can go anywhere from $40 to $300. The one pictured above was purchased brand-new for about $45; A significant savings from a kiln!

It is simple to use. Spread the slabs (preforms) out, slabs on their side, and pour sand over then making sure they do not touch one another. Note that hotter temperatures will be generated at the very bottom of the sand (reverse from the fire method) and the sides.

I found that the best method was to:

- Heat roaster (with sand and rocks) for two hours at 100 degrees
- Bring it up 50 degrees every hour
- Once it reaches the desired temperature leave for an hour and reverses the process; Or,
- Once it reaches the desired temperature leave it there for a couple of hours and turn it off.

The above last two points really depends on the stone. Sometimes when it reaches the desired temp, it is heated perfectly. Other times, it needs to be maintained at that heat for a certain period of time. If you surpass it on some stones, they turn to dust.

Since I do not get a lot of material, I usually try and throw pieces that require 450-550 degrees together and hope for the best. I have only lost one piece of jasper and a couple small slabs of wood using this approach.

Note: Some people do not even use the sand with mixed results. They just throw the stone in and get to it. Basically the sand does two things. One it maintains the heat evenly, allowing the temperature to slowly raise and cool. And two it keeps the stone from touching one another. Both achieve the same goal by preventing surprises to the stone that might cause it to explode or crack. Since I buy rock, I will not take any chances of breakage and will stick to the sand.

When I first tried heat treatment I wanted quick and dirty rules, "how much-how long". But I quickly learnt that different rocks need different temps and hold times. To make it worse, the same stone is NEVER the same and batches of the same rock, i.e. Brazilian Agate, may lead to different results for each slab.

3) Kiln

If you are fortunate enough to have the funds and enough material to justify purchasing a kiln, you are one of the lucky ones, otherwise you will struggle using the traditional approach or a oven. Using a kiln is very predictable and easy to measure the results. With computerized controls and an even temperature spread, you should be able to achieve the results with much greater success and ease. For a kiln be prepared to be shelling out around $1,000. I, unfortunately, am not one of the lucky ones so I cannot offer and more information on kilns.

Stone Cooking Temperatures

Here are some temperatures that I picked up and saved over the years - don't know why as I can't get most of this stuff, just hopeful I guess.

- Agate Brazilian - 450-500
- Agate India - 500
- Agate Mexican - 500
- Agate Montana - 550
- Agate Moss - 450
- Alibates - 425-500
- Bloodstone - 500
- Burlington - 600-650
- Coral - 450-600
- Dacite - NONE
- Flint Ridge - 500-600 (set the roaster at 200 degrees for two hrs then increase until the max temp. is reached and leave it for 12 to 24 hours)
- Flint - Fort Hood - 400-550
- Flint - Georgetown (Blue and Black) - NONE
- Flint - Georgetown Banded - NONE to 400
- Flint - Knife River - 350 - 450 (Do **NOT** overheat or it could pot lid)
- Flint - Danish - 300 -350
- Flint - British - 300 -350 (hold time could be 6 hours)
- Jasper Red - 500 (very hard stuff to work)

- Jasper Sunset 450-475
- Jasper Fancy 450-500
- Jasper Picture 525
- Kay County - 500-600
- Novaculate - 700-900
- Obsidian - NONE
- Pedernales - 450
- Petrified Wood - 300-450

Special Notes on Heat Treatment

- All rocks are different! There is no fool proof temperature or procedure as rocks form with different minerals, flaws, cracks, moisture, etc. in them and all are different. Therefore, what might work for the majority, may not work for some. This is especially the case for petrified wood and some jaspers.
- Be careful as rocks can explode. The best ways to prevent/prepare for this are to make sure that they are thinned down first and dry (moist rocks will have a higher chance of breaking). Also, if you can, use a metal roaster with a lid. That way if it does explode, it won't go through the glass. Just joking, explosions usually means that the rocks crack and pop and do not react like a grenade.
- Make sure that your significant other doesn't know, or at-least doesn't plan on using the oven for a day or so. It may stink, especially the sand!
- Keep windows open as the oven generates a lot of heat. In addition, this cooking process soon filled up the apartment (and hallway I am sure) with the smell of cooking rocks!
- Turn off your fire alarm. From midnight until 1 a.m., when the oven was at its hottest, my alarm kept going off waking up the neighbors. I would have been caught dead in my tracks if the fire department was called out. However, make sure that you **put the battery back in afterwards** the next day or when the place cools down a bit. If your windows are open, then you may be able to skip this process.
- NEVER leave it unattended!

From http://www.sparrowcreek.com/Heat_Treatment.htm, April 6, 2010, copied with permission

Heat Treating Tips and Temperatures

by Mark Bracken

Why do we heat treat? Heat treating alters knapable material that is otherwise unchippable and transforms it to a glass like characteristic. Heat treating will also improve the colors of some flints. Browns can become reds, grays can become blues yellows become orange and so on. It's an oxidation of the minerals in the stone. Soak heating (heating for 36-48 hours at a constant temp) is not necessary but will further enhance this knapability and color change. Not all materials can be heat treated. An example of this is the black and bluish Kentucky "Horn Stone".

For the sake of simplicity, we will call all knapable stone "flints" regardless of what they are. Remember that there are different grades of all materials, So the chart below has ranges for each type and or grade. It is also important to understand that these temperatures are for spalls or pieces that are absolutely no thicker than 2 inches.

Heating thicker pieces requires lower temps and a kiln with NO air leaks. Preforms, seem to be able to take hotter temps than spalls. This is likely because of there uniform shape. The preforms can be fairly thick. This is a nice advantage for knappers who have attractive flints that knap like concrete when there raw. They can be preformed and then heated with little risk of damage.

If a material is not on the chart, experiment with it. If it seems high grade and you still want to heat it to get that glass like look or workability then start with low temps (around 350f.). A rule of thumb is this: white or gray flints take hotter temps than darker flints.

Moisture content is ever present throughout the stone in ALL flints. Some materials indicated below are very sensitive to heat due to this. They require a special drying process. With out this drying process listed below, your flint will be destroyed.

Most of our Coastal Plains (including the Jaspers and Corals) flints need special care because of this. It is not total necessary but worth it! For example: on the chart below, Flint River" chert can be heated to 450-460f. This is with the drying process. If you don't want to go through the trouble of the drying, then the max temp must be lowered to 350f. Any hotter and it WILL become damaged. Now then, if you dry it, and following my instructions below, then the stone can be heated to 450f. This is fact.

The final result for this drying process is better color and knapability with this particular type of stone. If you have heated your flint and it has not improved, you can always re heat the flint to hotter temps but you can never go back. Once you have over heated the stone, the damage is done.

I have had experiences where I know I have heated flint just a bit too hot. The stone became very unpredictable and easily developed splits at the point of impact on the platform. After some tears, the rock was put in a bucket and forgotten about for over a year. I could not bring myself to trim through it and salvage what I could. Then, after it was re discovered a year later, hidden away in my shop, I tested the flint with a billet. The same pieces that had chipped uncontrollably now became very manageable. It was awesome I might add. This has happened to me twice now and I am certain that some of the stresses caused in heating had come out of the stone over time.

*Highly recommended drying as per directions below.
Any deviation from this will result in blown flint! That I guarantee!
First the flint must be dried…This takes about a week so be patient
Take the flint up slow and down slow, no faster than 50 degrees an hour!

Step 1. run up to 250 F and NO higher,. and allow to cool to room temperature.
Step 2. run up to 250 F. and NO higher, allow to cool to room temperature.
Step 3. run up to 250 F. and NO higher, allow to cool to room temperature.
Step 4. run up to 250 F. and NO higher, allow to cool to room temperature.

Step 5. The final heating will go to 450 for high grade material
For lesser grades 460-470. {Thin Slabs may go higher}

Do Not heat whole rocks or spalls thicker than ¾ of an inch.
Please remember…If I said it here, I mean it!

Basic flint heat treating instructions
Be sure the kiln is packed full with NO room for more stone. If you need to top the kiln off, get anything of poor grade to fill it up, even a brick will do! This insures that the flint will ramp up and cool slow with limited air currents within the kiln. (This causes temperature shock, which can blow up or crack your flint).
Take the flint up slowly and down slow, no faster than 50 degrees an hour.
Hold time at finished temps should be at least 3 hours. (No need to hold it longer unless your going for enhanced color)
Do Not heat whole rocks or spalls thicker than 2 inches.

Basic Kiln safety
Operate your kiln safely!
1. Never operate kiln on a wooden or flammable surface. Use cement blocks.
2. Place kiln elevated on concrete blocks with holes in them or a proper metal stand. Do NOT set directly on any floor!
3. Keep kiln at least 20" from any walls or other objects at all times.
4. Use cement fiberboard on near by walls for an extra-added protection!
5. Use a "dedicated" outlet for each kiln switch on a 15-amp breaker.
6. Never heat-treat large blocks of stone. Stones could violently break apart. This could knock the lid right off a kiln ejecting VERY hot Fragments, creating a serious fire hazard!
7. Keep your kiln out of the weather, Damage to electrical parts will result.
7. Never operate kiln with flammable fumes, liquids or vapors present.
8. Avoid heat-treating in your home or living space. Heating rocks can produce poisonous or harmful vapors, even if not cut on rock saws!
9. ALWAYS WEAR A RESPIRATOR WHEN LOADING OR UNLOADING YOUR KILN!!! DUST FROM BRICKS AND ROCKS ARE DANGEROUS TO YOUR LUNGS!

Below I have classified the materials into three grades:
"**A**" = High grade, sometimes very knappable in the raw state. A slight to good gloss.
"**B**" = Medium grade, a dry texture. Gritty when you scratch it with your fingernail. No gloss
"**C**" = Quite dry in appearance. Coarse and very difficult to knap.
All Temperatures ar Fahrenheit
Some common (but not all) of North America's lithics...

*Southern Alabama Coastal Plains Corals found in water Cherts Rivers or oceans	A	500-530	North Dakota "Knife River" Fossil cattails	A	350-380
	B	530-600		B	
	C	650-700		C	
Texas "Ft. Hood" *Coastal Plains Fla. fossil stramatolites Corals found on land	A	500-520	Arkansas Novaculite	A	
	B	550		B	
	C	600-630		C	
Texas Edwards Plateau River cobbles	A	350	Ohio "Coshocton" flint	A	
	B	400-450		B	
	C	450-650		C	
*Tennessee Coastal Plains Cherts found on land	A	450-530	Ohio "Flint Ridge" flint	A	
	B	530-575		B	
	C	575-650		C	
Coastal Plains Chalcedony found in water (kal-sed-ni)	A	350	Ohio "Flint Ridge Chalcedony"	A	
Coastal Plains Jaspers	A	450-500	*Midwest "Burlington" chert	A	500-540
	B	500-575		B	540-580
	C	575-750		C	580-630
*Coastal Plains "Flint River" Chert	A	440-450	Texas "Georgetown"	A	350-360
	B	450-480			
	C	480-515			
*Florida Cherts	A	500-540	Texas "Alibates"	A	450-530
	B	540-600			
	C	600-700			

Some flints that will not heat treat:

North Dakota "Rainy Buttes" Fossil wood
Kentucky "Horn stone"
Tennessee "Ft. Payne Chert", "Dover Chert"
Pa. Ny. Ontario "Onondaga"

-Mark Bracken

_____

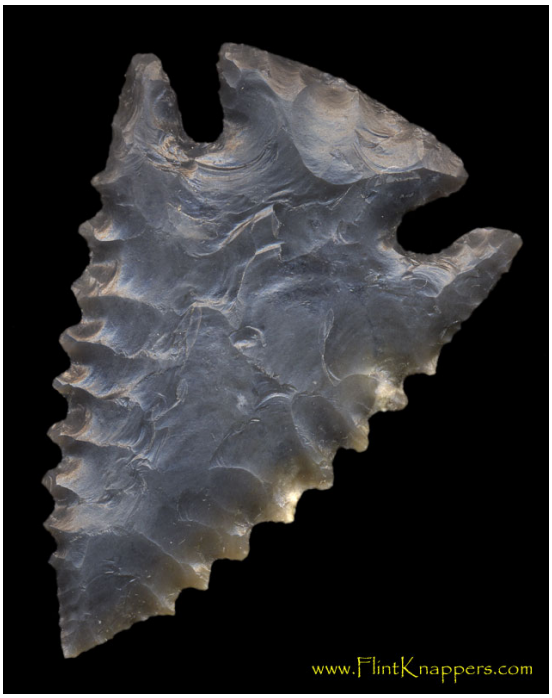
From http://www.flintknappingtools.com/heattreating_temps.html, March 31, 2010, copied with permission

Photo of Steve Nissly's keeeper case, copied with permission

Section 7: Displaying & Making Things with Your Points

Photographing Your Points

By Michael Miller (aka mjflinty)



I use my flatbed scanner to make the pictures of my points. The trick is to leave the lid up and to do it at night and turn off all the lights in the room. Be sure to clean the glass well first. Sometimes I do end up with a smudge or some dust and I'll use Photoshop to clean it up. One fun thing to do is to use different materials (e.g. paper, fabric, etc) and lay it on top the points to create a backdrop effect.

From http://paleoplanet69529.yuku.com/topic/33645, April 7, 2010, copied with permission

Point Displays with Girl Power

By Gary Abbatte (aka rhymeswithwhat)

My loving heart partner Mary B. has been a very talented artist since before I met her in 1965 when we were sophomores in high school. It is a love story how we got together just this January after all these years. Mary was the girl of my dreams that made me studder and trip over my own feet all through high school. We never even dated then, I was too shy to ask the nicest, most beautiful girl in the world out on a date.She gets all the credit for imagineering this new point display technique. I told her my point displays were boring and looked like every body else's and that they were plain with the points all in straight rows. Then I asked her for some help. My display boxes were at her home for safe keeping while I was moving to my new apartment this spring. When I saw what she has done, I was amazed and very grateful. She has made my work look better than it is!

Here are some photos and tips on what Mary has done:

The display boxes when new have a white fiber pad, like the material that home heating filters are made from. The pads are springy but just plain white.

First Mary sprinkles a thin layer of base color of decorative sand over over the pad in the box. The colored sand is available at hobby and craft stores. It is also used in model railroad landscapes and rail-beds.

After the base color, a contrasting decorative color is sprinkled in a free hand design or pattern. Kitchen seasoning sprinkle bottles work nice for applying the sand, one sprinkle bottle for each color is needed.

Before the points are set in place, a spray adhesive is applied to the sand design. Commercial spray adhesive can be used but a mix of Elmer's clear dry glue one part. to 4 or 5 parts water in a dollar store plant misting pump spray bottle works great to apply the glue/water mix to the sand for fixing the design.to stay in place.

After arranging the points on the sand, replace the glass windowed cover and leave to dry for several days.

The sand and points and have stayed very stable through car travel to both the Bald Eagle and the Letchworth Knap-ins. That is a lot of driving vibration, but all has stayed pretty stable.

The instructions I gave will work with the Glue/Water mix by just spraying the sand to dampen like I have done with model railroad landscape.. A different technique is used with commercial spray glue. First spray the pad and apply sand and lightly shake off what does not stay. Build in layers with commercial spray glue like 3M.

A very few flier specks of sand have been easily brushed away with the Artist Brush of my Mary.

ThankYou Mary. I think she loves me too.

From http://paleoplanet69529.yuku.com/topic/28623, April 7, 2010, copied with permission

New Look for Display Case

By Steve Colby (aka Mutt.vets)

I was really impressed with Gary's post "Point's Display With Girl Power" and they way it made his points look better. http://paleoplanet69529.yuku.com/topic/28623 I usually just shove in a piece of white foam and line up my points like a bunch of little soldiers. Well, after seeing Gary's post I felt that I needed to do something with my display box. But, I didn't want to mess with sand and glue. But then I saw this krylon paint called "stone" Krylon Stone Paint

I painted the foam pad and then just cut it out to fit into the case. Beware, if you put it on really thick, it take FOREVER to dry .....

Well, I think the whole thing turned out pretty decent. And, it has the same style of look as the ones in Gary's post. But, this is the cheater's easy way to do it .....LOL

Here's how it turned out ..... Hope your's is a success. Enjoy Mutt

From http://paleoplanet69529.yuku.com/reply/252039#reply-252039, April 7, 2010, copied with permission

Cord Wrapping for an Arrowhead Necklace

By Kyle (aka Potholes Primitive)

I make necklaces for friends by stringing the cordage right to the arrowhead. I came up with this technique myself. I start by tying a hangman's noose and then wrap the point with the resulting loop and pull the noose tight. The way the point is wrapped is difficult to explain, but the example in the photo is loose so you can kind of see how in the picture. You'll probably need to play with it a while to figure it out. The result is a point that hangs straight down and a knot that won't come loose. It sure beats just tying a clove-hitch around the point like I see in novelty shops.

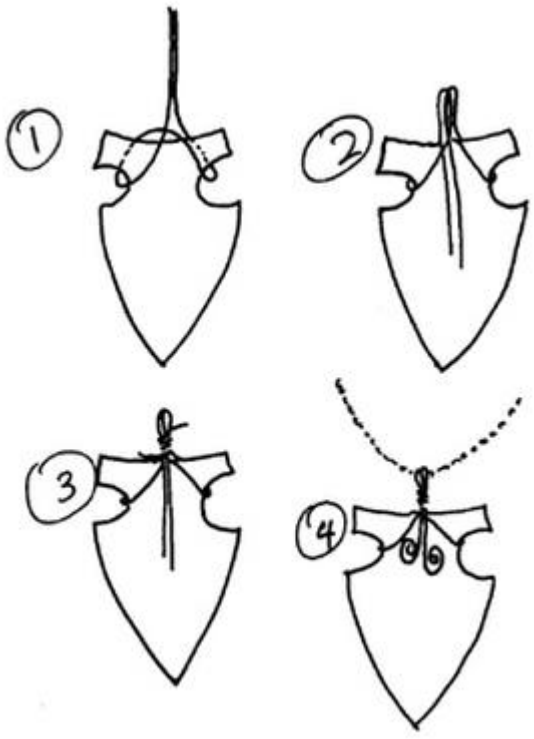
This necklace only has one wrap between the notches. I do two now because I think it looks better. Again, this one hasn't been cinched up all the way. The finished necklace will look almost seamless. If you can't figure it out, tell me and I'll try do draw instructions on paint.

From http://paleoplanet69529.yuku.com/reply/31455#reply-31455, April 6, 2010

Wire Wrapping for an Arrowhead Necklace

By Jim (aka Flyfish)

This is what I do with wire. I don't remember where the drawing came from. Wish I could remember so I could give the credit.



From http://paleoplanet69529.yuku.com/reply/31455#reply-31455, April 6, 2010

For a video demonstration of this technique,
see http://www.youtube.com/user/mjflinty#p/a/u/1/d3AWa5GGkjA

Hafting Blades into Knives

By Travis Smolinski

Warning: Working with antler and bone dust can be hazardous. Always wear safety glasses and a mask. While I have had no problems as of yet, I have heard horror stories about people who have received awful infections from antler dust. If you have any cuts make sure they are sealed off completely.

Modern Methods

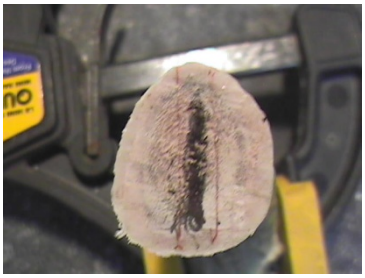
Wood and Antler

As wood and antler can be hafted the same way, I will discuss them both here. The main difference is that wood is easier and can be done without any use of power tools. Antler can too but it just takes a lot longer and is tougher on the tools. Stone is also done in the same way but high powered drills and diamond tools are needed.

http://www.sparrowcreek.com/KH1.JPG

Here is a typical style of blade that you see and an antler that I used a saw to cut it to the size I wanted. The first thing we need to do is to place the blade to the knife and determine where the best fit is. Once we see how the knife should be (general look) we place the blade to the area we need to cut.

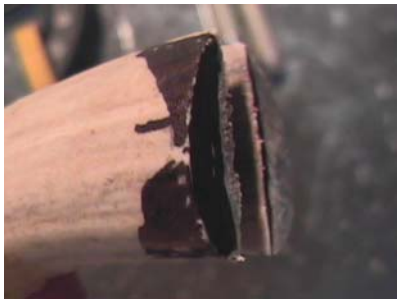
What we are doing here is finding the area that needs to be worked to fit the blade. We then hold the blade in place and take a marker and draw out the circle where the blade will fit. If we are going to make a slot then we want to determine the thickest width of the tang (the area to be hafted) and draw two cut lines. The finished markings will look like this.



Now we have two choices. One choice is to use a drill with various sizes of bits and drill out several holes to the depth o f the tang. You can clean up the hole marks with knives and files. The hole will look like this. Then the knife will fit in the hole. Epoxy or pine pitch will hold it into place.

The other method is just as easy. With the straight lines marked you can use a jig or hand saw. First measure the tang and mark it on both the bottom and top of the handle to give you a clear vision of where to cut. The best method is to cut thin and then use a file to scrape away slowly where the tang is still wide. This method will make a tight fit and is superior to the one I will describe. The only draw back is that it could take 2 hours to do. I use to do this method all of the time till I realized that epoxy is strong and the lashing material will hide the cuts. Therefore, I mostly use the quicker method.

Now take your saw and cut each line from start to mark. The n go down the center and angle it to each side to remove all the middle antler. You can now cut off the remaining pieces with a hand saw. You can finally clean it out with a file making sure not to remove too much from the sides. Test your blade into the slot to make sure it fits and nothing more needs to be removed.



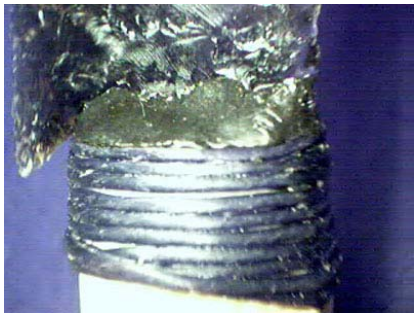
Now as an optional method we can round the sides of th e antler. Take your marker and mark the areas to be removed. Now take it to the grinder and remove these areas as well as cleaning up anything on the base of the antler. If you have no grinder then this can be done with steel rasps and 60 grit sand paper. I did the hand method for years and it can be done but takes a lot longer. Finally, once in shape, take 120 grit then 220 gri t sand paper and sand it down smooth.

Now the antler handle is almost finished. We need to polish it. There are two methods to use. If you don't have a power buffer then get some polyeurethane spray of semi-gloss, or gloss if you want a high finish. Spray it on after reading the instructions. You will then have to wait 72 hours before proceeding. The other method is take it to your power cloth buffer and add tripoli, a brown soap like substance. Buff it and be careful to hold it good or it will throw it. Also, I always get static shocks that causes me to jump.

Now that we have a finished handle it is time to haft the blade. I got a little careless on this one as doing two things (taking pics) was too much for my little attention span. But it is a good mistake as it shows you how to overcome problems. What I did was cut too much off so that the blade wobbles in the hafting area. This can easily be fixed by adding some wood braces That will be taken out and added after the glue has been placed in the slot.

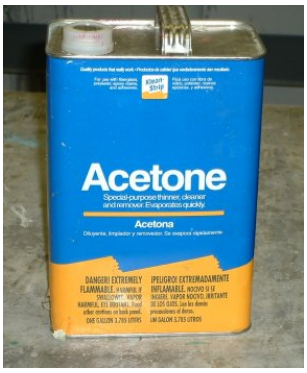
So that we don't have a big mess it is best to tape off the blade and antler. Now we take viscous (non runny) 5- minute epoxy. One option is to add black India ink, available at any craft store. Only add enough to color the epoxy. This will turn it black and when it dries it will look very similar to pine pitch. Set a timer for 15 minut es and fill in the slot completely with the glue. Now we do a little clean up making sure none of the glue runs and let it sit for 10 minutes. If you made the mistake like I did and the blade does not sit still then you will have to watch it moving it back into place.

Ding Ding! The timer goes off. Immediately set it again for another 15 minutes. The glue should be like play dough now. Remove the tape. Now clean up the glue with a flattened nail or similar. What you are doing here is making sure there are no lumps, no glue away from the hafting area and finally that the hafting area is completely covered. A good thing to do is to lick your finger and push down on the glue spreading it evenly. This will give it a smooth look. Also we are still constantly making sure that the knife remains even and straight, i.e. the blade isn't leaning crooked to one side or the other. It is important to do this slowly and never forcefully. This is why it is important to do it slowly from the start. If you wait too long the glue will have set too much and you can crack the wood handle or break off the tang.



When the timer goes off again check to see that the glue is dry. Once it is, you can lash on any material that you desire. I have used hemp cord, simulated sinew, leather straps and even wool from my wife's sewing cit. A little bit of Elmer's glue will help it stay in place.

Now we let it dry for an hour or so just to make sure. Also, acetone will help take off any spilled glue. And its done.



From http://www.sparrowcreek.com/Hafting_Knives.htm, April 6, 2010, copied with permission