FIDDLER'S CLICK HERE.

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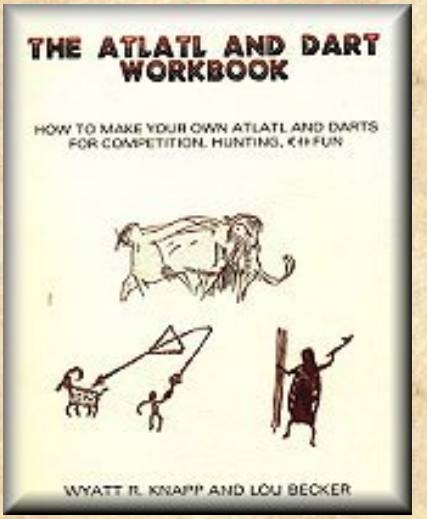
THE ATLATL AND DART WORKBOOK

HOW TO MAKE YOUR OWN ATLATL AND DARTS FOR COMPETITION, HUNTING, AND FUN

WYATT R. KNAPP AND LOU BECKER

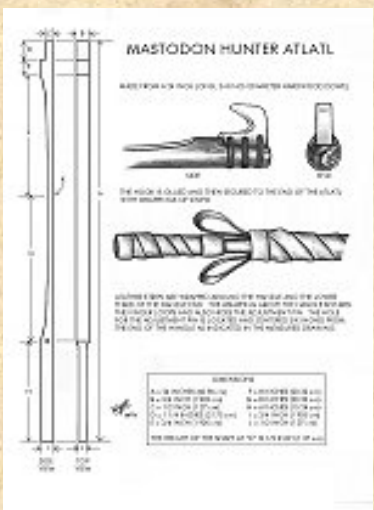
REVIEWS ABOUT THE AUTHORS



Just released from Onagocag Publishing is the book you have been waiting for! A complete reference guide to everything you need to know to build your own atlatl and dart set for hunting, competition, and fun. In this book you'll find plans for four different atlatls and three different darts. This generous, full size 8 1/2" by 11" book has over 90 pages of solid information on this wonderful ancient weapon system. It's chock full of beautiful, measured drawings (metric measurements included), pictures, and step by step written instructions that will guide you through the building process and then show you how to use your new equipment. And it's spiral bound so that it will stay open on your workbench as you reference it.

The variety of designs being used and sold out there can be daunting to the contemporary atlatlist. Some are good. But some are poorly designed and can give a false impression as to the effectiveness of the system. With all of the different ideas about how to make an effective, dependable atlatl and dart system, how does one know how to proceed? How can a person plow through all of the data and designs and come up with a system they can feel confident about using?

That's where this book comes in. In it you will have the benefit of over twenty-eight years of atlatl and dart experimentation, manufacturing, and expertise. The designs



shared have been used to take prizes in competition, and to take game in hunting and fishing situations, throughout the world. These designs work!

Here's an idea of what you get:

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Chapter 2 : Building an early style atlatl.
Chapter 3 : Building a contemporary style atlatl.
Chapter 4 : Two flexible style atlatls.
Chapter 5 : Building an early style dart.
Chapter 6 : Building the modern graphite dart.
Chapter 7 : Building the "Bison Hunter" wooden dart.
Chapter 8 : Atlatl games, safety, and how and where to compete with the atlatl.
Chapter 9 : Hunting and fishing with an atlatl and darts (includes plans for an atlatl fishing reel).

Also included is a handy appendix that gives plans for how to make tools you will need, how to straighten darts, dart fletching tips, International Standard Accuracy Competition (ISAC) rules, a materials source list, and more.

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(Canada, France, & Spain click here for shipping info.)

"OH-NAH-GO-SHOG"

Home

The ORIGINAL MICHIGAN FIDDLERS ASSOCIATION

The Original Michigan Fiddlers Association was formed in 1976 (happy 26th birthday!) with the goal of encouraging and bringing about a greater interest in fiddle music activities throughout the state of Michigan. The OMFA also encourages the collection and preservation of fiddle music along with an appreciation of our musical history. More ...

Please note: Since the OMFA is dedicated to promoting old-time music as traditionally played, only acoustic instruments are used at our jamborees.

JAMBOREE SCHEDULE | PHOTO ALBUM | NEWS AND UPDATES!! | BECOME A MEMBER

LINKS - OMFA related websites.

NEW BOOK FOR SALE !!! The Original Michigan Fiddlers Association is publishing a book called 25 YEARS OF FIDDLING. Check out our "News and Updates" section for more information about the book and how to order.

If you need further information, or would like to get in touch with someone from the Original Michigan Fiddlers Association, you may reach us by U.S. Mail at this address:

ORIGINAL MICHIGAN FIDDLERS ASSOCIATION C/O LONDA HOWE
9090 E. 32ND STREET
NEWAYGO, MI 49337

Or feel free to contact us by e-mail at sanjo@maxnet-usa.net

HOME JAMBOREE SCHEDULE PHOTOS LINKS

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The ORIGINAL MICHIGAN FIDDLERS ASSOCIATION

The Mission Of The OMFA is:

To encourage, co-ordinate and bring about a greater public interest in fiddle music activities throughout the State of Michigan.

To sponsor the observance of fiddle music jamborees for the citizens of the State of Michigan. The theme of these events is to be fiddlers and other musicians playing old time square dance tunes, waltzes, two steps, etc., from years past.

To foster and encourage the collection and preservation of fiddle music and to bring about a greater knowledge and appreciation of our musical history.

HISTORY

A gentleman named Paul Gifford basically set up the format for the fiddle jamboree. He had been to several fiddle events in the U.S. and Canada that consisted mostly of contests. He wanted something for Michigan as well but wanted something just to go to for fun and to celebrate fiddle music. He put his ideas to work and came up with fiddle Jamborees as we know them in Michigan today.

In 1976 Paul made up a list of fiddle players he knew from Michigan as well as other traditional musicians. He contacted them for a meeting and about 20 fiddlers showed up. Some of those involved included Paul Gifford, Ken Staines, Bob Fleck, Jane Allison, and Gene & Esther Cox. The Original Michigan Fiddlers Association was

born.

The first Original Michigan Fiddlers Jamboree was held on May 29, 1976 at the Sheridan High School. The fiddlers were: Frank Mattison, Cloise & Harley Sinclair, Stewart Carmichael, Matt Brown Sr. and Jr., Ken Ellsworth, Bill White, Bill Bigford, Bob Spinner, Ralph Schuster, Bill Webster, Merritt Olson, Fred Elton, Jim Herald, and Gene Belgraph among others. Paul Gifford did the MC work.

The Jamborees have proven to be a popular and friendly forum for presenting the talents of the OMFA's fiddlers and musicians. They have also served as an effective way to bring traditional fiddle music to folks in Michigan. Combined with the open mike and evenings of square dancing, our Jamborees are a spirited and fun way for the OMFA to share and promote our musical traditions and heritage.

At the time of this writing the OMFA is about 400 members strong. Besides promoting old- time music, our association has programs that have provided violins and fiddles to young people, scholarships to Blue Lake and Interlochen, and money for music lessons.

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The ORIGINAL MICHIGAN FIDDLERS ASSOCIATION

JAMBOREE SCHEDULE FOR 2003

Here are the dates and locations of O.M.F.A. Jamborees in Michigan for this year. Generally the fiddle jamboree lasts from 1-5 P.M. and is followed by an open microphone for any who would like to perform music and song. The day ends with an evening of square dancing from 7-10 P.M. Callers, dancers, and musicians are most welcome!

Please note: Since the OMFA is dedicated to promoting old-time music as traditionally played, only acoustic instruments are used at our jamborees.

MARCH 1 - EAST JORDAN FIDDLE JAMBOREE ALTHOUGH THIS IS NOT AN OMFA SPONSORED JAMBOREE, MANY MEMBERS FROM THE OMFA ATTEND. THIS IS A BIG EVENT. EAST JORDAN IS LOCATED IN CHARLEVOIX COUNTY ON LAKE CHARLEVOIX.

THE JAMBOREE IS HELD AT THE JORDON VALLEY EXPRESS WHICH IS LOCATED RIGHT ON THE MAIN HIGHWAY (M66) NEXT TO GLENS MARKET. THERE IS A DINING CENTER AND MCDONALDS INSIDE. THIS JAMBOREE HAS A REPUTATION FOR LARGE SEATING CAPACITY AND A GREAT SOUND SYSTEM.

A GREAT WAY TO KICK OFF A NEW YEAR OF GREAT FIDDLE MUSIC AND DANCE. JAMBOREE BEGINS AT 12:00, OPEN MIC AT 5:00, AND SQUARE AND ROUND DANCING FROM 7:00 TO 10:00. PRIOR TO 7:00 THERE WILL BE SOME SQUARE DANCE LESSONS. FOR FURTHER INFORMATION CONTACT BILL AND DONNA

STEVENS (231) 547- 9153.

APRIL 5- MORLEY MORLEY-STANWOOD HIGH SCHOOL CAFETORIUM. EXIT US 131 AT JEFFERSON ROAD, GO EAST TO MORLEY, THEN NORTH (LEFT) ON OLD U.S 131 THREE MILES TO SCHOOL.

APRIL 26- GRAND RAPIDS HIGHLAND MIDDLE SCHOOL, 4645 CHANDY DRIVE N.E., GRAND RAPIDS.

MAY 3- JOHANNESBURG CHARLETON HALL, 12 MILES EAST OF GAYLORD ON M32.

MAY 17- WEIDMAN- COMMUNITY CENTER. CONTACT MR. GARRETT ..(989) 644-3472.

JUNE 7 - WALLOON LAKE CAMPOUT, 2 1/2 MILES NORTH OF BOYNE FALLS ON U.S. 131.

JUNE 28- HART HART HIGH SCHOOL, JOHNSON STREET.

SEPT. 13- HONOR JAMBOREE WILL BE AT THE PLATT RIVER ASSOC. BUILDING 12990 HONOR HIGHWAY. THIS IS ABOUT FOUR MILES EAST OF HONOR ON M31.

SEPT. 27- NEWBERRY AMERICAN LEGION HALL NEXT TO THE STATE POLICE POST.

OCT. 11- CHEBOYGAN KNIGHTS OF COLUMBUS HALL, JUNCTION OF U.S. 27 AND M33, 3 MILES SOUTH OF TOWN.

OCT. 25- KALKASKA TO BE HELD AT THE KALKASKA FAIRGROUNDS.

NOV. 8- CORAL CORAL COMMUNITY CENTER, BAILEY STREET.

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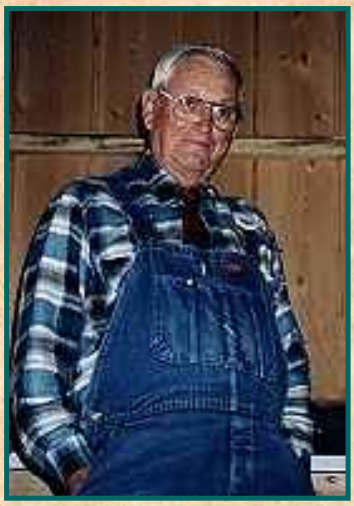
The ORIGINAL MICHIGAN FIDDLERS ASSOCIATION

PHOTO ALBUM

We have a wonderfully diverse group with members of all ages and backgrounds. There are veteran fiddle players and beginners, young folks and seniors, but all are connected by their love of traditional music and dancing.

Some of the pictures below can be clicked on to get a larger view and more information.



More pictures this way ------->

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The ORIGINAL MICHIGAN FIDDLERS ASSOCIATION

LESSONS FROM A PRO

The perpetuation of old time fiddle music is one of the main goals of the OMFA and one that it's members take to heart. Many of our fiddlers are working with younger members to foster a love of fiddle music. Above we see young Søren Hauter of Farwell, Michigan receiving some pointers from top notch fiddler Bob Murphey of Lansing.

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The ORIGINAL MICHIGAN FIDDLERS ASSOCIATION

HOW TO BECOME A MEMBER OF THE ORIGINAL MICHIGAN FIDDLERS ASSOCIATION

Membership is extended to anyone who is known to take an active part in the jamborees or those who follow and support the goals and objectives of the OMFA. Membership term is for any twelve (12) month period and includes four issues of the newsletter. Dues are $5.00 per household per year.

Please send the following information with your dues payment:

NEW ___ RENEWAL ____ DATE _____

NAME _____

ADRESS _____

CITY, STATE, ZIP _____

I AM A FIDDLER ___ OTHER MUSICIAN ___ CALLER ___ DANCER ___ LISTENER ___ INSTRUMENT(S) YOU PLAY _____

AMOUNT ENCLOSED _____ FOR 1 YEAR, OR _____ FOR _____ YEARS.

MAKE CHECK PAYABLE TO:

ORIGINAL MICHIGAN FIDDLERS ASSOCIATION

RETURN FORM TO: SECRETARY LONDA HOWE, 9090 E. 32ND STREET, NEWAYGO, MI 49337.

Thank you for your support!!

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This website designed by Wyatt R. Knapp for the Original Michigan Fiddlers Association and is © 2001. Contact Wyatt at: earp@onagocag.com

The ORIGINAL MICHIGAN FIDDLERS ASSOCIATION

NEWS AND UPDATES

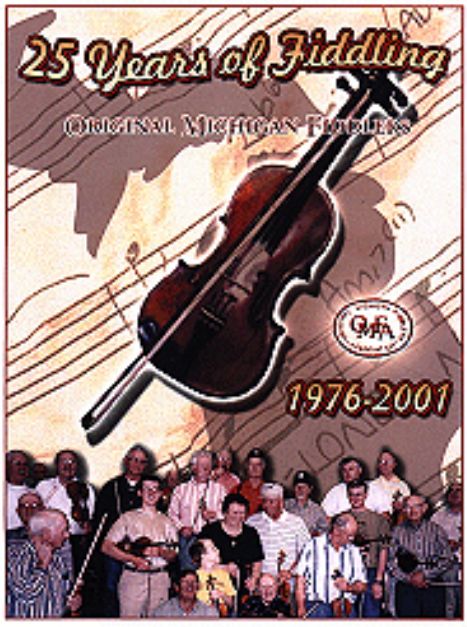
RESTORE DOUGLAS WINS MICHIGAN HERITAGE AWARD

Long time OMFA member Restore Douglas of Big Rapids, Michigan, age 94, was chosen as the winner of a Michigan Heritage Award for 2001. The Michigan Heritage Awards are presented each year to honor Michigan citizens who, with excellence and authenticity, continue the folk traditions of their families or communities through

practice and teaching. Mr. Douglas certainly fits that category and his OMFA collegues, friends, and family congratulate him for this honor and recognition from the Michigan Heritage Awards Program.

OMFA 25TH ANNIVERSARY BOOK RELEASED & WELL RECEIVED!!

The Original Michigan Fiddlers Association has published a book now available for sale as of September 2001. It has been very well received.



Titled *25 YEARS OF FIDDLING*, it contains biographies of OMFA musicians, board members, and jamboree sponsors, as well as photos of the membership, humor, fiddle trivia, stories, and history. As the title suggests, this book has been created and published in honor of our 25 years as an organization.

If you are interested in obtaining copies of the book you may send a card or e-mail to Suzanne using the contact information below. The books are selling for $20.00 each. If you want the book shipped please add $2.00 to cover the cost. We also expect to have books available for purchase at the jamborees. Make checks payable to O.M.F.A. and send the check with your order to:

Suzanne Hauter, P.O. Box 185, Farwell, Michigan 48622
Email - suzannehauter@hotmail.com

Don't miss out on your chance to have this anniversary tribute to the OMFA! We look forward to filling your order!

HOME JAMBOREE SCHEDULE LINKS PHOTOS

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The ORIGINAL MICHIGAN FIDDLERS ASSOCIATION

Wyatt Knapp of Allendale is accompanied by his uncle, Pete Keller of Cross Village. Wyatt's Uncle Pete helped him to learn fiddle and Wyatt is learning many of his family's old tunes. He hopes to pass them down to his children one day. Here he is even holding the fiddle for playing the way his uncle does it!

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The ORIGINAL MICHIGAN FIDDLERS ASSOCIATION

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MEMBER HOMEPAGES

Hawks and Owls Old Time Music

This is the homepage of Omfa member Bruce Ling. Learn about Bruce, his music, his band, and even listen to samples from his great CD of acoustic instrumentals and songs. If you're careful maybe you can even pet "Eatbugs", the guitar savvy cat. This friendly site is worth a visit.

Old Time Music Sites

JAY UNGER & MOLLY MASON

Jay is famous for the hauntingly beautiful tune he wrote entitled "Ashokan Farewell" which was featured in the Ken Burns documentary *The Civil War*.

Jay's playing of the fiddle is the most expressive, and at times the most heartrending, you will ever find. You owe it to yourself to give his music a listen.

Equally talented is the wonderful Molly Mason whose style of guitar accompaniment perfectly compliments Jay's playing. Her arrangments never overpower the fiddle, are sometimes sparse, always right. It's hard to imagine listening to Jay's playing without Molly's fine guitar work as part of the tune. The two cannot be separated.

Lots to see at this website - - concert dates, workshop schedules, dance events, and recordings. Get on their mailing list and get all the news from the land of Ashokan!

The Wheatland Music Organization's mission is to serve as a resource center for the preservation and presentation of traditional music and arts.

WMO's annual music festival is a huge event here in Michigan and tickets are often sold out. Make your plans early to be a part of this great Michigan old-time music tradition!

Site has lot's of information on the organization, events, and how to become a member.

HOME JAMBOREE SCHEDULE PHOTOS

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OUR REVIEWS!!

".... if you have an atlatl part of your library, this book will most definitely need to be there!"

-*Gary L. Fogelman, Editor, Indian Artifact Magazine*

".... a wonderful, information-packed book, great format, and very reader friendly."

-*Sue Harrison, Author of MOTHER EARTH FATHER SKY and the "Ivory Carvers" trilogy.*

“.... a well thought out work with over 40 drawings by Wyatt Knapp and about 50 photographs. Their primary goal was to produce a book describing to the reader how to make "an effective atlatl system that really works," and I believe they have done this -- this and a lot more.”

- *Bill Tate, Editor, THE ATLATL, official newsletter of the World Atlatl Association*

“This book is for those who want to rediscover the joy of the atlatl.... if you are interested in building one this book will instruct on how to do it and do it well... it is well and clearly written.... if you feel the urge to build one, this is the book for you.”

- *Gene Langston, Editor, Primitive Archer Magazine*

"OH-NAH-GO-SHOG"

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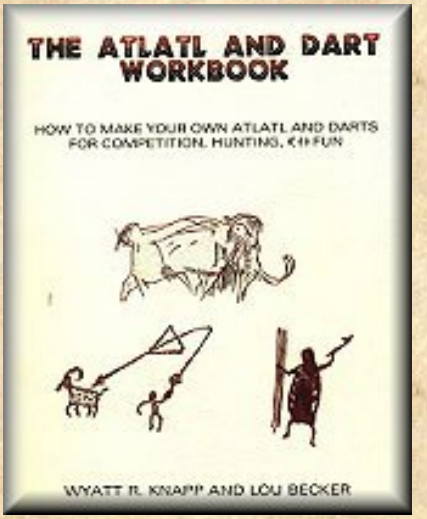

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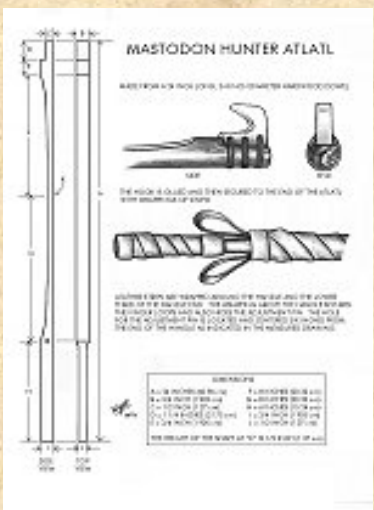

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"OH-NAH-GO-SHOG"

Home

THE ATLATL AND DART WORKBOOK

HOW TO MAKE YOUR OWN ATLATL AND DARTS FOR COMPETITION, HUNTING, AND FUN

WYATT R. KNAPP AND LOU BECKER

ABOUT THE AUTHORS

WYATT KNAPP **is an author, illustrator, and website designer. All his life he has enjoyed a passion for primitive skills, history, and the outdoors. As a young boy he devoured the *Ben Hunt Indian Craft Books* and made as many of the projects in them as he could.**

He later attended *Grand Valley State* in Michigan where he majored in drawing and sculpture, and further explored his interest in both history and anthropology. It was here that he first heard of Ishi, the last Yahi Indian, and knew that there was still hope that he could find information on how to make stone arrowheads.

Wyatt has been published on-line as well as in various books and newspapers, including *The Detroit Free Press*. He is the author of the website "*The History And Primitive Technology Page*" which was one of the select few to be featured in an article on primitive skills which appeared in *Natural History Magazine*. He writes an ongoing column, as well as feature articles for the *Michigan Flintknappers Newsletter*. In addition, Wyatt is the author of the book *Stories Gramp Told*, a collection of his grandfather's reminiscenses about family history and life in the early 1900's.

Wyatt is a member of the *Michigan Flintknappers* and the *World Atlatl Association*. He spends his free time playing guitar, flintknapping, shooting his flintlock muzzleloaders, and exploring primitive skills.

LOU BECKER **has had a lifelong interest in Native American history, archery, and primitive weaponry. He made his first bows and arrows when he was a youngster and even though it was a child's attempt to satisfy his fantasies, the flame of archery and Indian lore was kindled.**

He has taught history since 1976 and owns Bowsport Archery where he makes custom cedar arrows, self bows, replica Indian arrows, and custom atlatl sets. He has made arrows for the movie "Black Robe" and other feature films that required historical accuracy. He is one of the few modern-day hunters to have taken big game animals with the ancient atlatl.

As an outdoor writer, his stories have appeared in magazines such as *Longbow, Traditional Bowhunter, Backwoodsman, Primitive Archer,* and *Outdoor Life*.

Lou is a member of the World Atlatl Association. He was a founding member of the Michigan Atlatl Association and served as its president for many years.

"OH-NAH-GO-SHOG"

BACK TO THE ATLATL AND DART WORKBOOK ORDER INFORMATION PAGE

Pronounce it "ott-lottle"

ATLATL AND DART WORKBOOK

SHIPPING AND HANDLING INFORMATION

Payment for orders outside of the United States should be payed with an international bank check or money order in U.S. dollars for the total amount (book and shipping). Thank you.

CANADA - $4.00 for shipping by air, $8.00 for Global Priority Mail

FRANCE - $12.00 shipping and handling.

SPAIN - $10.00 Global Priority Mail. .

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Home

The History and Primitive Technology Page

"...a good starting place...to learn about humanities mostprimitive survival skills." -NATURAL HISTORY MAGAZINE, Oct.1999

Welcome to The History and Primitive Technology Page.

Primitive is defined as "of or pertaining to an earliest or original stage or state." It does not mean less intelligent, or less creative, or less inventive. On the contrary, the things you will read about at this site will show how wonderfully creative, and extremely patient these early people were. You will be impressed with an amazing machine that was used as a fire-starter. It uses a principle that will be familiar to those who know about deisel engines. You will learn about how extraordinarily beautiful tools can be made from stone, many with edges that are sharper than our finest surgical steel blades.

This is the place to explore, discuss, and exchange information on matters pertaining to history from the stone-age to the turn of the century. It is also intended to be a place that will inspire people who come here to connect again with the world in a purer sense, by experiencing this ancient inventiveness and creativity for themselves.

So step inside...you may find out what those Nazca lines really are. Or find out what it would take to tan a piece of leather, or to be an Aztec who can pierce conquestador armor with a powerful stone-age dart thrower. Included also will be a section on more recent historical mysteries and discussions.

I will be updating here periodically so check back once in a while to see if something new has come up. Also if you want to respond to something you find, feel free to e-mail me. It may be good enough to end up on this page.

Contents

Primitive Technology

 The Firepiston: Ancient Firemaking Machine

 Flintknapping: Observations and Hints, Hafting Glue, Books & Videos.

 Buckskinning Skills: Making Gunflints, Ancient Firemaking Techniques, Etc.

 Learn about the Atlatl and Dart System and the Physics Behind This Powerful Weapon.

 NEW BOOK!! THE ATLATL AND DART WORKBOOK. Plans and information on how to build atlatls and darts and then how to use them for competition, hunting, and fun. Check it out!

 DRUMS AND TOM TOMS. Some drums I have made

History

 The Mysterious Nazca Lines: How Were These Huge Desert Glyphs Made? Ancient Astronauts?

Links

 ** VICTORY!! **Outdoorsmen, Primitive Skills Enthusiasts, Native Americans! Find out here.

 Here's where to go for links to more history and primitive technology

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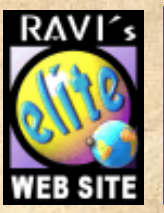
This page works best when viewed with a Netscape Browser... CHOOSE

E-mail me at *earp@onagocag.com*

*****Special thanks to the UCSB Anthropology Website for permission to use their "glyph" bullets.***

This site created by Wyatt R. Knapp, a member of 



explorers since October, 1996

This page was last updated on 21 August 2000.

Click Here to visit my Knapp Family Genealogy Page.

The Firepiston: Ancient Firemaking Machine

I was but a young lad when my father, who'd always taken a keen interest in primitive technology, first told me of the firepiston. He had seen it in a documentary about stone-age natives from jungle islands somewhere in the Pacific. What he described sounded amazing - a tube of wood that could instantly create a hot coal with just a quick push of a plunger-and it had been used for ages.

I tried for many years to find out more about this device. I talked with universities, searched libraries, contacted The National Geographic Society, and even the Smithsonian without success. Finally a query posed to George Hedgepeth of Great Lakes Primitives provided a splendid lead which in turn led to a number of good sources of information on this topic.

In this article I will attempt to bring all of the information from these sources together with the hope that it will be a convenient reference for those who wish to pursue this subject further. We will look at the history of firepiston technology and explore sources that describe how to build or buy one of your own. In addition, addresses for further video or print information will be provided.

How does it work?

Air gets very hot when it is compressed under high pressure. A classic example would be the heat that is created when one uses a bicycle pump. But when the air is compressed in a firepiston it is done so quickly and efficiently that it can reach a temperature in excess of 800 degrees Fahrenheit. This is hot enough to ignite the tinder that is placed in the end of the piston which has been hollowed out to accept it.

Ancient examples of the tube itself are of hardwood, bamboo, or even horn. It is closed on one end, very smooth inside and accurately bored. Equal care is taken in the creation of the associated piston. A "gasket" of wound thread, fiber, or sometimes leather insures a proper seal for successfully creating the compression. This gasket is "greased" to help with the seal and to allow free travel of the piston. Those pacific natives I told you about earlier believed that the firepiston wouldn't work unless it was greased with dog fat. The natives of the Philippines say to use the grease of a wild pig from the jungle. But if you don't have time for a wild pig hunt, or the money to lipo-suction Fido , shortening has been shown to work. You might also want to try a combination of bacon fat mixed with a little candle wax, which is what outdoorsman John Rowlands used on his firepiston.

An article by Richard Jamison in a 1994 issue of Woodsmoke contains a nice description of

how to operate a firepiston:

"...the cylinder is held firmly in the fist of the left hand: a small piece of tinder...is placed in a cavity on the point of the piston, which is just entered into the mouth of the bore; with a sudden stroke of the right hand the piston is forced up the bore, from which it rebounds slightly back with the elasticity of the compressed air, and on being plucked out, which it must be instantly, the tinder is found to be lighted."

As you can probably see, this ancient firemaking machine is utilizing the Diesel principle.

History

By 1865 European explorers had reached the jungles of Indonesia where they found firepiston use well established and widespread. Areas of distribution included Burma, the Malay Peninsula, French Indo-China and Borneo. From some of these areas it made its way to the East Island Archipelagos and the Philippines.

One thing I'd often pondered was the discovery by essentially stone-age people of a technology with such meticulous conditions for successful operation. I finally decided that it could have been an accidental discovery somehow connected to blow gun manufacture. The Woodsmoke article came to the same conclusion adding that perhaps during the process of boring or gauging them, there may have been compression of air that ignited material in the bore or perhaps on the rod. Reference was also made to the fact that oriental blow guns often occur in the same areas where the firepiston is found. In addition, speculation was made that perhaps when making blow guns of bamboo they would use a rod to pop out the nodes between the sections and that the discovery was accidentally made during this operation. In any event, the discovery was made. The distribution of firepistons was so widespread by the time of those first European explorers that it indicates knowledge of the necessary technology for ages. It continues to be used in some areas right up to the present as witnessed by U.S. Navy survival instructor Mel DeWeese.

In the 1970's, Mr. DeWeese and some others landed in a remote jungle village of the Philippines in a helicopter. The natives were quite interested in this event and all came out to see what was going on. They were dressed "in loin cloths and carrying bows and arrows." But despite this primitive aspect one of their number casually pulled out a firepiston and used it to light a cigarette. Mr. DeWeese was instantly intrigued and set about trying to find something the native might want to trade for it. Communication was hindered by the fact that neither could understand the others language. Finally, after much gesturing, the deal was cinched to the satisfaction of both parties when the native agreed to give it to him for a Zippo lighter and (here's the part I like) two pieces of Hubba Bubba bubble gum. What's important about Mel DeWeeses acquisition is that it has been studied and seen in action by many

people and has provided a working pattern for those struggling to make a functional copy. Also it's a testament to the durability of the device. After all these years and countless "lights" it still works.

Europe

Often times in history the same discoveries or inventions are made independently of one another. The firepiston is an example of this. Both the Asian and the European discoveries were accidental, although by different means. The European version was discovered in the early 1800's in connection with the manufacture of air guns in France. It was noticed that when they were discharged in the dark the air guns gave off a light. Later tinder was ignited using the heat generated by charging the airgun. It didn't take too long before the discovery was used to make brass firepistons to show off the effect which in turn led to domestic use as fire starters. In England the effect was used to make what has been termed a "fire syringe." It was slightly different however as the air was compressed through a small aperture to heat things up. But the regular firepiston was also well known.

What killed the firepiston in England and Europe? It would seem that just as it was ready to take the market by a storm, the invention of the wooden kitchen match stole its thunder and relegated it to attics and museums.

Primitive re-enactors and firepistons

During a conversation with Bob Perkins of BPS Engineering, we discussed the plausibility of primitive re-enactors employing firepistons for demonstration and general use at rendevoux. The point was made that in 1807 a patent was given for a firepiston in England. Also, as previously discussed, its use was well known in England and Europe. Magazine articles of the early 1800's also described how to make them. It is not far fetched to think that immigrants from Europe, or someone who had visited there, could have brought the technology or the device to America. It seems to me that those re-enacting the period of the early 1800's should be able to use firepistons since the technology was available to the people of that time. Whether one used the brass models or those of wood or bone would have to be researched so as to insure that they would be in keeping with the era.

Making the Firepiston

One thing I have to mention right from the start is that almost every source I contacted or read described how much care is necessary in making a working firepiston. Also, it is said that there's some technique to working it. John Rowlands warns that "it takes patience and practice and not to be disappointed if your first firepiston doesn't work." Other sources also speak of the need for practice. On the other hand there are those who say that if care is taken

in the manufacture, and easily ignited tinder is used, it shouldn't be a problem. With that said, lets look at a couple of sources that tell how to make firepistons.

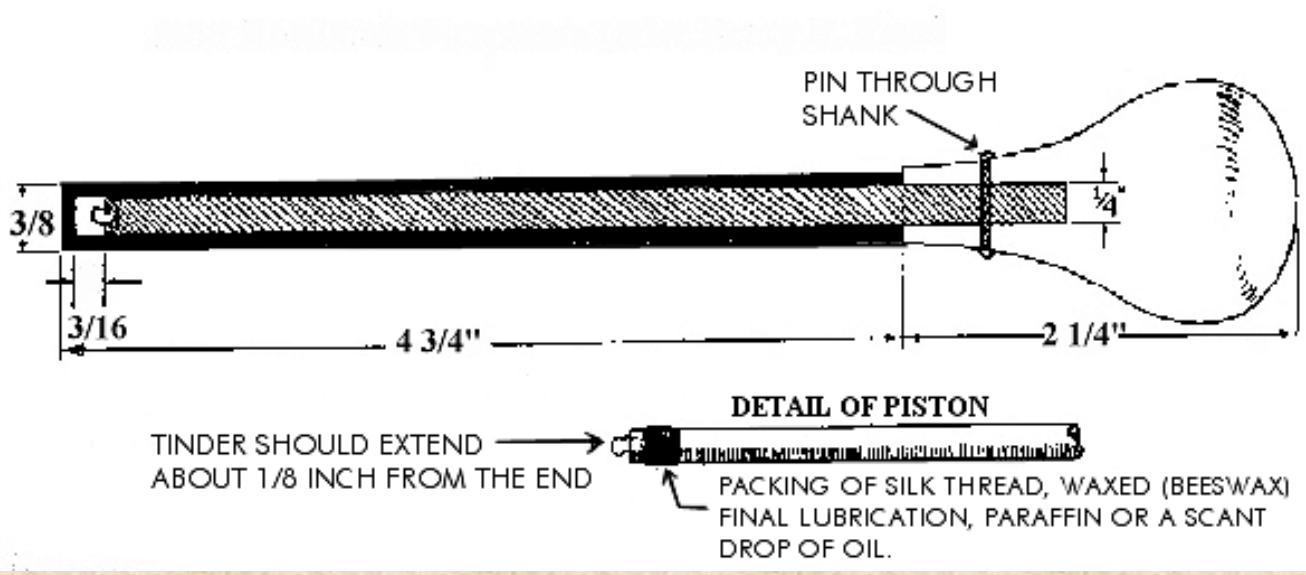
The John Rowlands Firepiston

The book Cache Lake Country by John J. Rowlands (1947) was the first place I found written reference to firepistons after hearing of them from my father. He had a copy of the book but I later found a copy for myself through a used book service. This book is a tremendous store of woodcraft and outdoor knowledge written by a man who spent a lifetime in the unspoiled beauty of the Canadian wilderness.

John made the tube for his firepiston out of a short piece of quarter-inch brass pipe. He said the secret of making it was to have a small, smooth bore with one end closed. Then there must be what he calls "packing" on one end of the piston. This must mean what we've been referring to as the "gasket." He hollowed out the end of the plunger to a depth of no more than one-eighth of an inch and that's where the tinder was inserted. His plunger was made out of a large nail with the end cut off square. He then put a groove around the circumference of the nail as close to the end as possible which served as a place for winding on the thread for the gasket. He made sure the body of the nail was very smooth and then he greased the gasket with the bacon fat and candle wax mixture we discussed earlier. A wooden handle was fastened to the other end of the piston for a grip. I suppose one could either solder the end in the tube or make a threaded plug for it, taking care to adhere to the dimensions specified in the drawing.

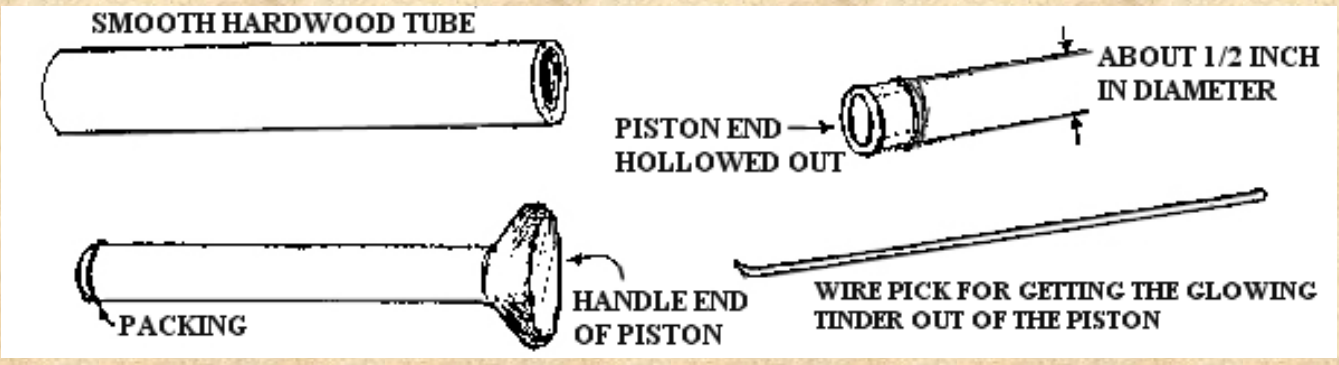
John indicated that the speed and force of the thrust had a lot to do with making it work right. He suggested putting the end against a tree or wall and then giving the handle a quick shove. He used charred cotton rag or finely shredded bark and stressed that they must be absolutely dry.

John Rowlands Firepiston (after Henry B. Kane)



A Traditional Firepiston

Here's a drawing for a traditional wooden firepiston. The cylinder is 4" to 6" long and 3/4" to 1" in diameter. Make the inside diameter around 1/2". Follow the drawing for making the piston. The walls of the bore must be perfectly straight and polished smooth.



Further information:

The Remarkable Firepiston *Woodsmoke (1994) Jamison; Menasha Ridge Press, Birmingham AL ISBN-0-89732-151-0*

A very thorough and interesting article written by Richard Jamison with Mel Deweese. It explores the history of firepistons in Europe and Asia in great depth. It is replete with historical references, patent descriptions, and magazine and journal accounts. Numerous styles and materials that were employed for manufacture of firepistons throughout history are discussed. A section about old casting techniques that were used for creating firepistons is

quite fascinating. There's a nice photo of a firepiston made of bone and wood from Mel Deweese's collection.

The Cache Lake Country *(1947) John J. Rowlands; W. W. Norton and Company, Inc., New York, NY*

You could get a few more details about John Rowlands firepiston but in addition, if you're interested in woodlore and living off the land, you should check this one out. I am not aware that it's still in print but libraries or old book stores may be able to point you toward a copy. Beautiful drawings throughout. If you love the wilderness get a copy of this book.

"The Fire Piston" Annual Smithsonian Report *(1907) Henry Balfour, M.A.*

A discussion of the evolution and history of the firepiston with lots of drawings of original specimens. Reportedly the author has a hard time coming to terms with the idea that primitive cultures could come up with such an advanced means of "getting a light." But he is scientific enough in his method to challenge his own bias-which is admirable for the times.

Bushcraft *(1972) Richard H. Graves; Schocken Books, New York*

Scant reference to the firepiston, but a great deal on finding and making various kinds of tinder which you could then use in one. Also survival skills in general.

Where to buy one

Steve Leung has been making fire pistons for 7 years now and is known throughout the primitive skills world as "Mr. Firepiston." He has many satisfied customers worldwide. Steve makes his beautiful firepistons from many types of exotic woods and materials including everything from bamboo to water buffalo horn, and the finish and functionality are superb. He even makes them out of plexiglass so that you can see the flash of light that ignites the tinder! I have one of his beautiful firepistons made of water buffalo horn and it lights the tinder every time without fail. The bore is straight and polished to a glass finish and unlike some pistons, Steve's work great using tinder fungus (Inonotus Obliquus) so you aren't stuck with only using charcloth to get a light.

There are firepistons available out there that aren't very dependable, or begin to fail after a few lights. I can speak from personal experience when I say you can make your purchase with confidence. You can see samples of Steve's pistons at http://www.geocities.com/firepiston/ and if you would like to buy one he can be reached at firepiston@yahoo.com. See the "internet" section below to learn about more of Steve's firepistons and to find out how you can watch "movies" of his firepistons in action.

Jeff Wagner has recently started making and selling firepistons. I haven't had any personal experience with his firepistons so I can't speak to how well they work, but if you are interested in contacting him for more information about them, you can reach him by e-mail at fire_pistons@hotmail.com.

Video:

A series of videos were made that deal with primitive skills and several of them have to do with various methods of firemaking. The one called Fire #3 deals with the fire plow, the fire saw, and the firepiston. You can order Fire #3 by sending $34.95 + $2.50 P&H to: Woodsmoke, 11401 Willow Hill Drive, Sandy, Utah 84092. Let them know you got the info. from The History and Primitive Technology Page. You can also ask for a brochure of their other video offerings.

Internet:

A very nice page with pictures and MPEGS of firepistons that were made by Steve Leung. Steve's pistons are very dependable and consistant. Check out his plexiglass firepistons. You can see the flash of light as the tinder is ignited. The URL is: http://www.geocities.com/ResearchTriangle/System/5102/

And finally, if you have any questions or comments I will try to help. Feel free to write:
earp@onagocag.com

Click here for more information on primitive firemaking techniques.

Home | Buckskinning | Firemaking | Firepiston
Atlatls | Flintknapping | Links

Buckskinning Skills

Firemaking Brain Tanning

Making Gunflints

Buckskinning Links

Welcome to the buckskinning skills section of The History and Primitive Technology Page. What we're going to do here is look at a few of the buckinning skills that overlap into the "primitive technology" area that this site deals with. For this reason you won't find things like how to build a muzzleloader or powder horn, but making gunflints is explored as it overlaps the area of flintknapping technology. Making period clothing is not here, but the primitive skill of tanning leather for that purpose or other leather needs can be found here.

If you desire information on buckskinning subjects not covered here, a list of related links has been provided.

Atlatls | Flintknapping | Links

FIREMAKING TECHNIQUES

There's no doubt that the ability to make and control fire was one of the greatest technological advancements of mankind after tool making. It was there for warmth, protection, cooking, hunting and even primitive agricultural techniques. The knowledge of how to make fire utilizing primitive methods directly connects us to the people who used these techniques. When you are coaxing fire from some tinder using a coal that you created, and you see the glow get brighter, and you smell that curl of smoke, and the tinder suddenly bursts into flame, you are experiencing exactly what the ancient ones did so very long ago. It's a satisfying feeling to know you can be in the woods and create it without modern means, relying instead on the old ways to bring forth the spark and flame.

We're going to look at several ways of making fire that go from the stone age to the 1800's. Also we'll check out how to make charcloth, punk, and other spark catching tricks.
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The Hand Drill...The Bow Drill...Sparks From Flint...Making Charcloth, Etc...Further Information

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The Hand Drill

In the movie ***Quest For Fire*** a very dramatic scene depicting the hand drill method of firemaking was shown. If you haven't seen it try and rent the video as soon as you can because it not only depicts this method pretty well, but also shows the tremendous importance the ability to possess fire had for early people. This is what we want to think about when we recreate their efforts for ourselves.

You will need two things-a firedrill (or spindle) and a hearth board. Make sure you adhere to any dimensions given as closely as you can. The drill has to be made of stalks from mullein

or yucca. The yucca stalks seem to be the choice in my area. They should be about four feet long and the ends should be trimmed so that the top is about a half inch in diameter. **Make the tip end a tad bigger in diameter** so that it tapers-smaller at the top,bigger at the tip or bottom end. Round off the tip end.

Make your hearth from a wood that isn't resinous or gummy. Use something that won't get shiny and glazed. Make sure it's absolutely dry. Use a board made of something like Ash or White Oak or Cedar. It should be about 1" thick, 4" wide, a somewhere over a foot long. A "V" shaped notch is cut into the board and a circular depression is created at the point of that notch. This is where the tip of the drill will be placed. The edge of the depression should end up being about 1/8" inch from the edge of the hearth.

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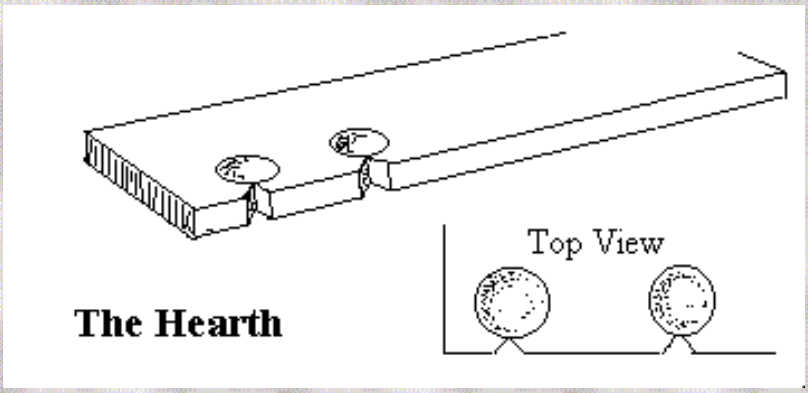


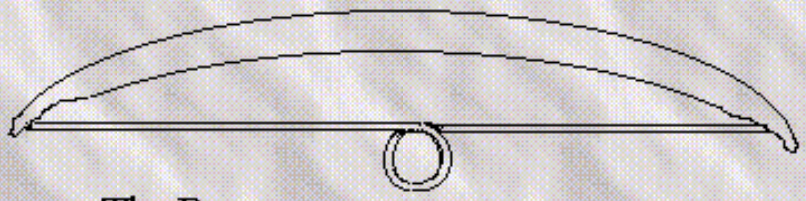
Now you kneel down with your foot resting on one end of the hearth to keep it from moving around. Take your drill and place the tip into one of the depressions. Spin it in the depression by twirling it between your palms as if you were making snakes out of clay-all the while pressing downward. Your hands will push toward the bottom as you do this so you will need to quickly get them back to the top of the drill as fast as you can. You have to do this so that you don't lose the heat you are building up. You keep doing this until you create a charcoal-like, hot dust which collects in the notch and is piled up until it falls into some tinder which has been placed by the edge of the board. This "coal" is then blown on so that the tinder will ignite. It's important that the hot dust can travel out of the depression and down the notch to the tinder.

There are people who can get a fire going from this technique relatively quickly. They have practiced and practiced. A first-timer should understand that it could take a while-15 minutes, probably more. But be persistant and practice the technique as much as you can. Give it a try and don't forget to check out that **Quest For Fire** video for a nice demonstration of this technique.

The Bow Drill

The bow drill method is nice because you can bear down on the drill better. It's easier because the rotation of the drill is close to constant which reduces heat loss and increases efficiency. There are four parts to this set-up; the drill, the bearing block, the hearth, and the bow. The bearing block can be made of wood or soapstone. It's palm sized and has a hollow drilled into it so it can receive the top end of the drill. The top is lubricated with fat or wax or some such thing to help facilitate the rotation by reducing the friction at that end.

The drill isn't as long-only about a foot-and it's just under an inch in diameter. The tip can be rounded over and worked down to about 1/2 inch in diameter. Make your hearth the same as you did for the hand drill method. The bow is made from a heavy piece of branch that is just over an inch in diameter and about 12 and 1/2 inches long. You drill a hole through it about half an inch in from the end and that's where the ends of the cord are attached. Try heavy leather boot lacing for the cord or you can make your own from sinew or a piece of heavy leather.



The Bow

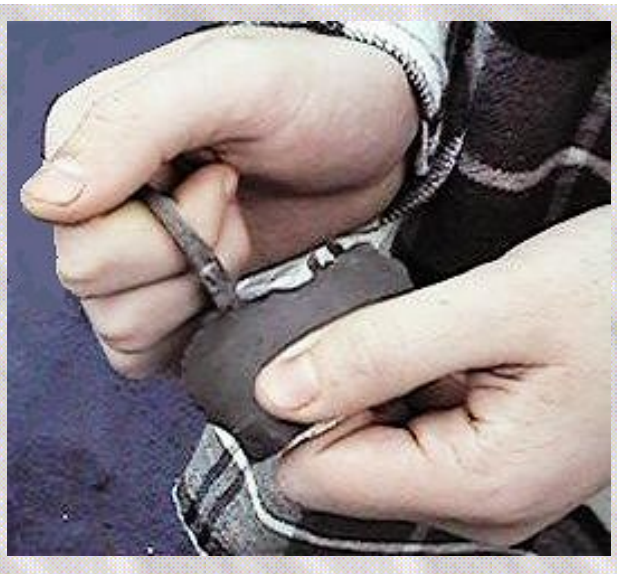
The drill has to be positioned as shown. It can't be on the inside between the cord and the bow. Let it be to the outside.

The cord is looped around the drill as shown above. The bearing block is placed atop the drill. The tip of the drill is then placed in it's proper position on the hearth. Heavy pressure is applied to the drill. The bow is then sawed back and forth continously to spin the drill until the glowing coal is produced as in the hand drill method. Make sure the cord is good and tight around the drill, be persistant, and good luck!

Sparks From Flint

It is the old one. The constant metaphor for great beginnings. The spark.

Long ago the ability to create and make use of hot sparks to make fire was discovered. We can recreate these methods easily today with just a little practice.



Left: *A fire works kit consisting of a striker and a piece of good black flint is shown in its waterproof tinder box. The box has an integral magnifying glass for concentrating the suns light onto tinder when the clouds aren't around. (I have heard of people making lenses out of ice and starting their fires with them.)* ***Right:*** *Proper hold for the striker and flint when striking sparks. Normally a piece of charcloth would be held near the top edge of the flint by the thumb of the left hand.*

Before the introduction of steel, sparks were obtained using a piece of iron pyrite for the striker. It was smacked across the edge of a piece of flint to make sparks which were caught in tinder. Later, steel strikers were employed and used in the same manner. You hold a large piece of flint, with the sharp edge out, in one hand. You then keep a piece of charred tinder in place on top of the flint with your thumb. The flint is then struck a sharp blow with the steel and the resulting sparks are caught in the tinder and then blown on to ignite a nest of dry grass, or other such material, into flame. Be very careful to keep your knuckles away from the sharp edge of that flint or you'll get cut. A material is required that will be very effective in catching sparks and just such a material is next to be discussed.

How To Catch A Spark

The best material for catching a spark is charcloth. It has been used for centuries. I like to make my charcloth from old **cotton** bluejeans. It's an idea I got from Bob Perkins of BPS Engineering. Take an old, empty, one quart paint can and throw it in a fire and let it sit until anything that might have adhered to the sides is burned off. After it cools, take a common size nail and punch a venthole in the lid of the can. What you have now is a container that can be used over and over to make charcloth. Take the pure cotton material and cut it into pieces that are about 4" by 4" in size. Place them loosely into the can and pound the lid on. Throw the can into the fire so that the vent hole isn't blocked. You'll see smoke pour out of the vent hole and sometimes this stuff coming out catches and makes a flame. Don't let the cloth get overcooked or it will be scorched and crumbly and useless. You can tell when it's

done when the smoke pretty much stops coming out of the hole. A wire or coat hanger can be placed around the can to help to get it out when it's done. **Don't open the can yet.** Let it cool first or it may ignite. The cloth has been charred in the absence of enough air so introduction of it at this time would be a bummer. If you look at the cloth and it doesn't seem done, then put it back in the can, seal things up, and throw it in the fire again for a bit till it's right. When you need to use some charcloth, just tear a piece off. Keep your charcloth in a dry container or ziplock bag.

You can do the same thing with the dry, punky wood you find in old stumps. Just take some pieces of it and char it in the can like you did for the cloth.

Further Information

There is so much information on primitive firemaking techniques at ***The Primitive Group*** E-mail archives that you owe it to yourself to check it out. The articles are grouped according to subject matter and the firemaking ones are broken down further into the different techniques. There are firsthand accounts and detailed descriptions. You can go there from my links page.

The best book with information on the firemaking techniques discussed here and several others is ***The Book of Buckskinning II.*** It is put out by Rebel Publishing Company, Texarkana, Texas, and is written in conjunction with ***Muzzleloader Magazine.*** You can order it from any book store. I got my copy from Tandy Leather Company. The section in this book on firemaking is the most comprehensive I've ever seen.

Videos demonstrating about every firemaking technique known are available from ***Woodsmoke,*** 11401 Willow Hill Drive, Sandy, Utah, 84092. They run around thirty-five bucks apiece. You can write them to request what videos are available.

For further information, check out the article on firepistons which is also located at this site.

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MAKING YOUR OWN GUNFLINTS

The cost of high quality gunflints for flintlock muzzleloaders has really gone up. And if a person wants a special size as well then you are usually talking ordering through the mail... and who likes to wait? Well now you can make your own gunflints and have an infinite supply at such a low cost they are practically free.

A great many of the cherts that flintknappers are using to make arrowheads and points work beautifully for settin' off "Ol' Ticklicker", so if you flintknap experiment with the material you are using. From my experience though, the heat-treated stuff wears out very fast. Stick to material that's not heat-treated. I have some flints I made from heat-treated Texas Tan that'll scare you with the shower of sparks they make, but you have to resharpen the edge often. Better is the harder, raw material. I really like to use hornstone (the yellowish colored stuff). The flints I make from it remind me of those fine old French gunflints from the Revolutionary days. I've used a flint made from it all afternoon without a misfire due to dull flint. It was still sharp when I was done. I'm also going to try some knife river chips that I have that look real promising.

Until you find a U.S. chert you like, my advice is to find someone who is selling that transluscent black flint from England. This is the real stuff-it's not chert. It sells for around $2.70 a pound currently and a two pound core of that stuff will make dozens and dozens of gunflints. You can check magazines like ***Primitive Archer*** or ***Muzzle Blasts*** for sources of English and even Danish Flints.

Here's how it's done.

If you are a flintknapper, the easiest way to get blanks for making a gunflint is to look through your debitage pile for flakes that will work after a little trimming. You'll be surprised at how many there are. You just find a flake with a distinct ridge and then trim it to the right

shape and size using pressure flaking techniques. But the classic, age-old method is to work with a core and drive off blades which are then worked into separate gunflints.

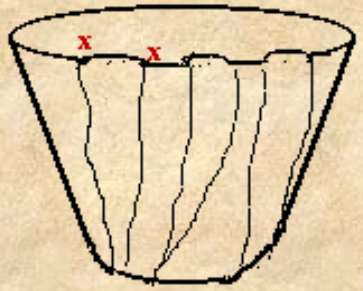

Fig.1

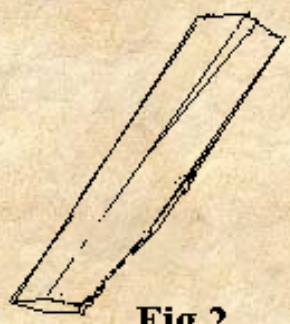

Fig.2

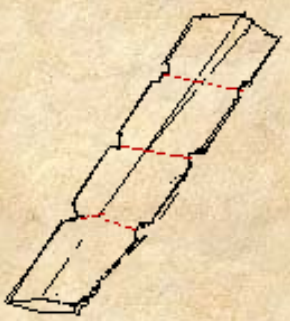

Fig.3

Figure 1 shows a core that has been worked in preparation for taking off blade flakes. It is about the size of a grapefruit. There are some things you need to note about this core. First is the flat top. Also the general shape is cylindrical with the bottom being smaller than the top. Also there are numerous ridges for the shockwave to follow. What you do is drive the blades off the core by direct percussion using the round end of a ballpeen hammer. You hold the core in your hand with the bottom nestled in the palm of your hand (**wear gloves**!). I have also seen people doing this who hold the core nestled between the knees. Of course they had lain a heavy leather apron over the whole region first. In any event, the next thing you do is strike the flat top of the core just back of the edge and where there is a ridge, as shown by the red X's in figure one. After a little practice you should get long, flat blades. Figure 2 shows one of these blades after it has been shaped a bit in preparation for separation into individual gunflints. The blades will be much more irregular than this at first.

The guys who positioned the core to be held by their knees weren't using a ball peen hammer to drive off the flakes. They would place the tip of a straight rod of bone on the spot where they wanted to peel a flake and then they used indirect percussion from a moose antler billet, striking the top of the rod. The shock was tranferred through the rod to the core and a blade came off.

In figure 3 we see that same blade and it has notches nibbled into the edge. When the blade is rapped on the area indicated by the red dotted lines, the blade should break from notch to notch into nice pieces perfect for final shaping into gunflints. Now just clamp one of them into the jaws of your flintlock and watch the shower! Now you can have the fun of making your own gunflints anytime you want.

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Pronounce it "ott-lottle"

SECRETS OF THE ATLATL

Many sources have documented the chilling effect that the atlatl had on the conquistadors who accompanied Cortez on his trek through Mexico in 1520 A.D. The Spanish felt they were the better equipped, state of the art, military machine. The height of armored splendor and firearm technology for the times. And they were in a position to show the natives just what that machine could do. But they met with a terrifying stone-age technology. In the hands of an expert the atlatl could hit a target from up to a hundred yards away. Bad enough in itself but this weapon had the ability to pierce their armor and plow right on through and into their chests, effectively pinning them inside where they could die a slow and agonizing death. Points on the six-foot-long darts were barbed so that they had to be drawn out the other side in order to be removed. You can imagine the terror these things exacted on these men. The records they left vividly told of it. But hundreds of years later atlatls were a mystery and many scholars were doubtful that the stories told by the conquistadors could be true. Those who tried to make atlatls were somewhat disappointed in the performance and the secrets of the atlatl seemed lost in the past.

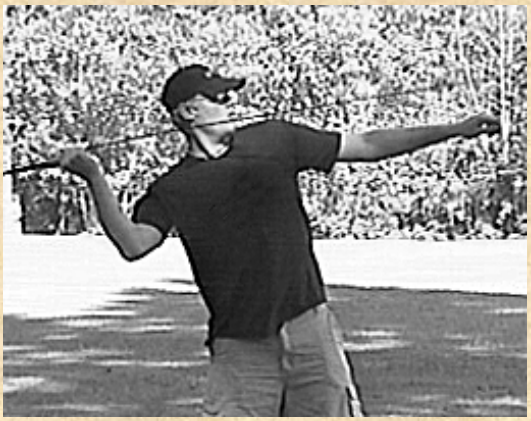
But we've come a long way since the early days of atlatl experimentation. After decades of research we can now boast of atlatl and dart systems that can perform just like those of the ancients. We have a lot of knowledge about the different styles of atlatls that were used historically and a good idea of how the system functions.

It has grown into a bonifide sport with competitions all over the world. Many tournaments are held each year under the auspices of the World Atlatl Association. Why is this sport growing so fast? Because atlatls are fun!

With so many people involved in atlatl research, both professionally and for fun, it's easy to see how competing ideas about how the system best performs would evolve. The History and Technology page will strive to bring the various ideas to this site so that the atlatl enthusiast can be kept current on our understanding of atlatl technology as it develops. For the novice we have provided a brief description of what an atlatl is and how it is used. Below you will find the choices for learning more about the atlatl that are available here so far.

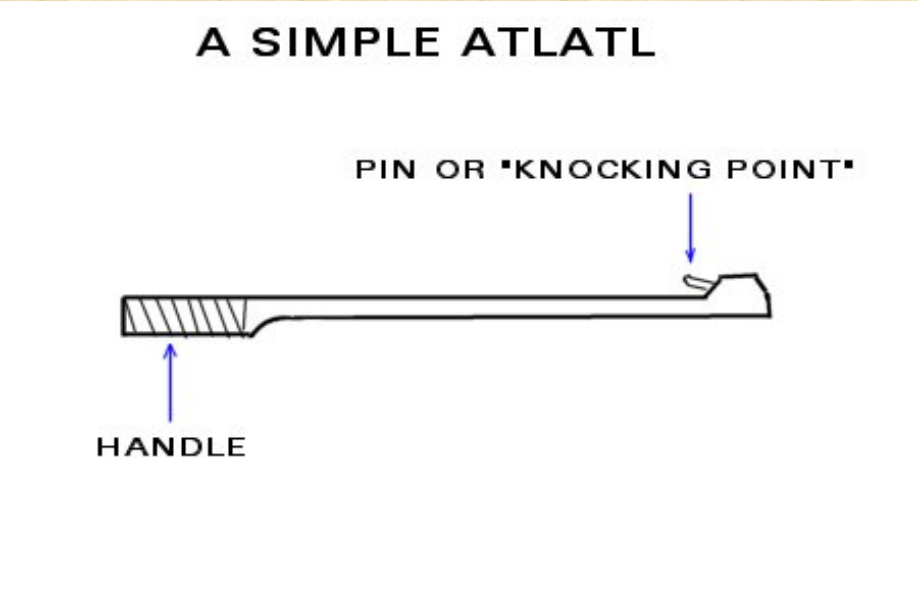
Pronounce it "ott-lottle"

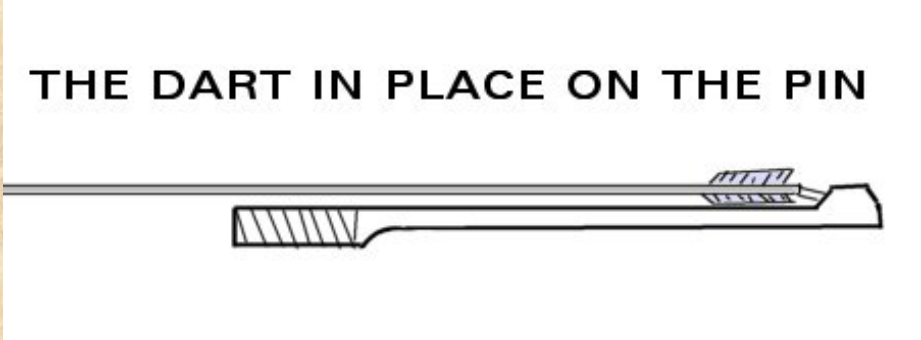
WHAT IS AN ATLATL?



The atlatl is a wooden handle about 24 inches long. At the tip end is a hook, point, or pin. It is used to cast or throw darts with great accuracy and tremendous force. The darts are about 5 or 6 feet long and are flexible and look like oversized arrows. The back end of the dart is hollowed out a bit so that it will fit over the pin on the atlatl. This helps hold it in place but the dart is also held onto the atlatl with the thumb and first finger of the hand that is holding it in preparation for the cast. (There are a few different ways of holding the dart in place. This is only one example.) The arm goes back and then forward. When the atlatl reaches somewhere around the halfway point of the cast the dart springs off of the pin and flys into the air.

The atlatl has been in use for at least 20,000 years and predates the bow and arrow. Compared to the atlatl the bow and arrow is a very new development. The atlatl was used all over the world. Some say that this very effective weapon was a major contributing factor in the extinction of the mega-fauna in the Americas which consisted of the large game animals like the wholly mammoth.





Below is an animated GIF that I made which will help you get an idea of how the system works. The process has been simplified a bit here. In reality the atlatl would swing up and forward as it made it's arc which would add to the force achieved. But you can still see how an atlatl moves a dart. I can almost feel the push of that long dart as it springs from the atlatl. I think I'll go get my atlatl and throw some darts right now!

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Flintknapping

This section of the History and Primitive Technology Page is humbly dedicated to my friend John Geyer, A unique person, a Master Flintknapper, and generous teacher. John, you are missed by all who knew you.

I am a member of a flintknapping club called the Michigan Flintknappers. There are people in this group who are at all levels of skill-from beginner to some really phenomenal stone artisans. I really consider myself lucky to hang out with these people here in Michigan because everyone I've met so far has been extremely helpful, friendly, and supportive.

For two years, when I first started knapping, I would travel every Thursday to Battle Creek where a group of us got together and flintknapped at the home of our friendly and talented host John Geyer. Sometimes we would invite knappers we had heard about to join us. Our Thursday group knapped with artists like Carl Doney and Craig Ratzat. We still get together occasionally and there is much camaraderie and sharing of knapping hints and techniques.

What I'd like to do here is try and get this sharing thing going for you. My intent isn't to try and give you an instruction manual for flintknapping. The marvelous books by D.C. Waldorf and John Whittaker and videos like those by Craig Ratzat can do that much better than I. But I do want to let you know of any hints, techniques, or breakthroughs in understanding the process that I have experienced with the hope that they will be of help.

I am not an expert. I'm still learning. I'm getting some good points and have started to feel more confident about my abilities.I have a lifetime of learning ahead of me. But if anything I put on this page helps you then that would make me happy indeed. We learn faster when we learn together.

Let's see if anything below interests you.

- FLINTKNAPPING TERMS AND DEFINITIONS With some handy tips thrown in for good measure.
- JUST WHAT IS THIS "BELOW THE CENTERLINE" CONCEPT?
- MY POINTS KEEP BREAKING WHEN I START TO GET THEM THIN
- SOME NEW HINTS
- TALKING ABOUT ANGLES
- WHAT KNAPPING TOOLS DO I NEED? (and some you can make)
- A GLUE RECIPE TO USE FOR HAFTING YOUR POINTS
- PICTURES OF SOME POINTS I'VE MADE
- HEAT TREATING STONE-A link to follow.
- WHERE TO GO TO LEARN KNAPPING: Links, Videos, and Books for the inquiring knapper.

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Questions or Comments? E-mail me at: earp@grnet.com

The MICHIGAN FLINTKNAPPERS

THE MICHIGAN FLINTKNAPPERS **are a group dedicated to the study and sharing of information about flintknapping history and replication. They have three formally scheduled meetings--one in the spring, one in the summer, and the last in the fall. Other events are scheduled throughout the year as opportunities become available. There are also some people within the group who get together for informal knap-ins throughout the year.**

An excellent, informative, and large newsletter is published at least twice a year. It includes flintknapping related news and hints, schedules for events, interviews, and much more. I believe you would be hard pressed to find a more informative and interesting newsletter for the flintknapping hobby.

The Michigan Flintknappers are a great group of people who are very helpful and eager to share ideas, techniques, and information.

You may get more information about the Michigan Flintknappers, and how to join the organization, by contacting Bob Love at the following address:

Michigan Flintknappers
C/O Bob Love
8185 Kiowa Trail
Pinkney, Michigan 48169

Click here to look at some pictures from some of our events.

Click here to see a schedule of Michigan Flintknapper events for the coming year.

BACK to the HISTORY AND PRIMITIVE TECHNOLOGY KNAPPING PAGE

MICHIGAN FLINTKNAPPERS EVENT SCHEDULE FOR 2003

APRIL 5 & 6 (Saturday and Sunday) Our spring Knap-in and a gathering of modern flintknappers and students of the primitive technologies. This is a two day event. Saturday is reserved for members of the Michigan Flintknappers and Sunday is open to the public. Flintknapping demonstrations, supplies, books, and modern works to be sold. Atlatl & dart demonstrations. Hamburgers, hot dogs, nachos, chips, coffee, and pop will be available on Sunday. A 3D archery shoot will also be held on Sunday.

Overnight camping available on the Club grounds. Chelsea is just a few miles away with food stores, fast food, restaurants, and a motel.

Knap-in will be held at the Chelsea Rod and Gun Club, 7103 Lingane Road, Chelsea, Michigan, 48118.

Contact Robert Love if you're coming, or plan to spend Saturday on the grounds. Pre-registration required for flintknappers.

Contact Robert Love, 8185 Kiowa Trail, Pinckney, Mi 49169.

DATE TO BE ANNOUNCED Our summer gathering will be held at the Ludington State Park, Ludington, Michigan. Hosted by the Michigan DNR and the Michigan Flintknappers. A Michigan Vehicle State Park sticker is required for entrance and is available at the park.

Take US-131 to Ludington and follow the signs to Ludington State Park

Flintknappers are encouraged to sell their stone-related wares and should be prepared to work outside, if weather permits. Bring a drop cloth to knap over, sack lunch, and beverages. NO ARTIFACTS PLEASE.

Contact Robert Love (see above for his contact information).

DATE TO BE ANNOUNCED Great Lakes Primitives Gathering. A four day

celebration of the ancient technologies. Flintknapping, atlatl and darts, basketmaking, etc. The demonstrations of ancient knowledge will be varied and plentiful. Takes place on Bois Blanc Island, Michigan. Contact Bob love for more information. (See above for his contact information)

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History And Primitive Technology Links

"...Let's do the time-warp again"

Well, here you are! This is a list of links for history and primitive technology buffs like us. Now I'm not going to overwhelm you with hundreds of entries here. My intention is to keep this limited to just the best, can't miss, must see, cream of the crop. Well...'nuff said. Here we go!

"...it's just a jump to the left..."

Primitive Technology

- Native Tech

Dedicated to the celebration and study of Native American technology and art.

- Native American Pottery of the Eastern Forests

This is an excellent primer on the art of pottery as practiced by Eastern American Indians. Everything you need to know from selecting and preparing clay, to decorating and primitive firing techniques.

- American Indian Ethnobotany Database

Here is a very valuable and interesting tool. It's a searchable database that takes any word you submit and looks for references to it in this extensive list of plants and herbs used by the American Indian. Try submitting "willow" or "sinew" to get an idea of how it works and then have fun!

- Native Way

I don't know where to start in describing this phenomenal site. If you want to know what your primitive art replicas should emulate, go here. If you need books and supplies, kits or authentic primitive style collectables this is the site. Check it out and see if I'm not right!

- Ted Baileys Primitive Technology Homepage

Lots of primtive technology links here to browse. Find information on atlatls, boomerangs and throwing sticks, primitive skills, and much more.

- The Primitive Skills Group

This is an e-mail subscription group headed by Andre-Francois Bourbou. I have read their archives and I recommend you do the same. What you will find is high qualitiy discussion and sharing of a broad range of primitive skills and technology. If you like what you see on this introductory page then information is given so that you can subscribe and join in on all the fun and learning as well!

- Lithics-Net

This is a superb site that can only be called an online lithic museum and reference source. A tremendous amount of work has gone into this site in an effort to provide information on point styles, dates, morphology, and general descriptions for about every point you can think of...and the site is still growing!! You can learn about flaking styles, shoulder types, and shapes. And you can search the pictures and descriptions by point name or general shape. A must see site that you will have a hard time leaving.

.

"...and then a step to the right..."

History

- The Stone Pages

An absolutely marvelous site that explores megalithic stone works from England, Ireland, Scotland, France, etc. Find out about Stonehenge and other stone circles, rings, lines, and drawings. Descriptive text accompanies beautiful, haunting photography. A wonderful site!

- The UCSB Anthropology Web Site

This site is so cool. It's got all kinds of great information and an awesome, award winning "Virtual Kiva Tour". You must go here!

- The History of Earth

You travel to the past by way of a nicely rendered time machine control panel.

- The World Of Vikings

The definitive guide to viking resources on the internet.

Don't forget to browse the rest of the pages at this site. There are other links scattered

throughout that may be of interest.

Do you have a link that you think should be here? E-mail me at: *earp@onagocag.com* 
Please let me know if you have any problems accessing any of these links.
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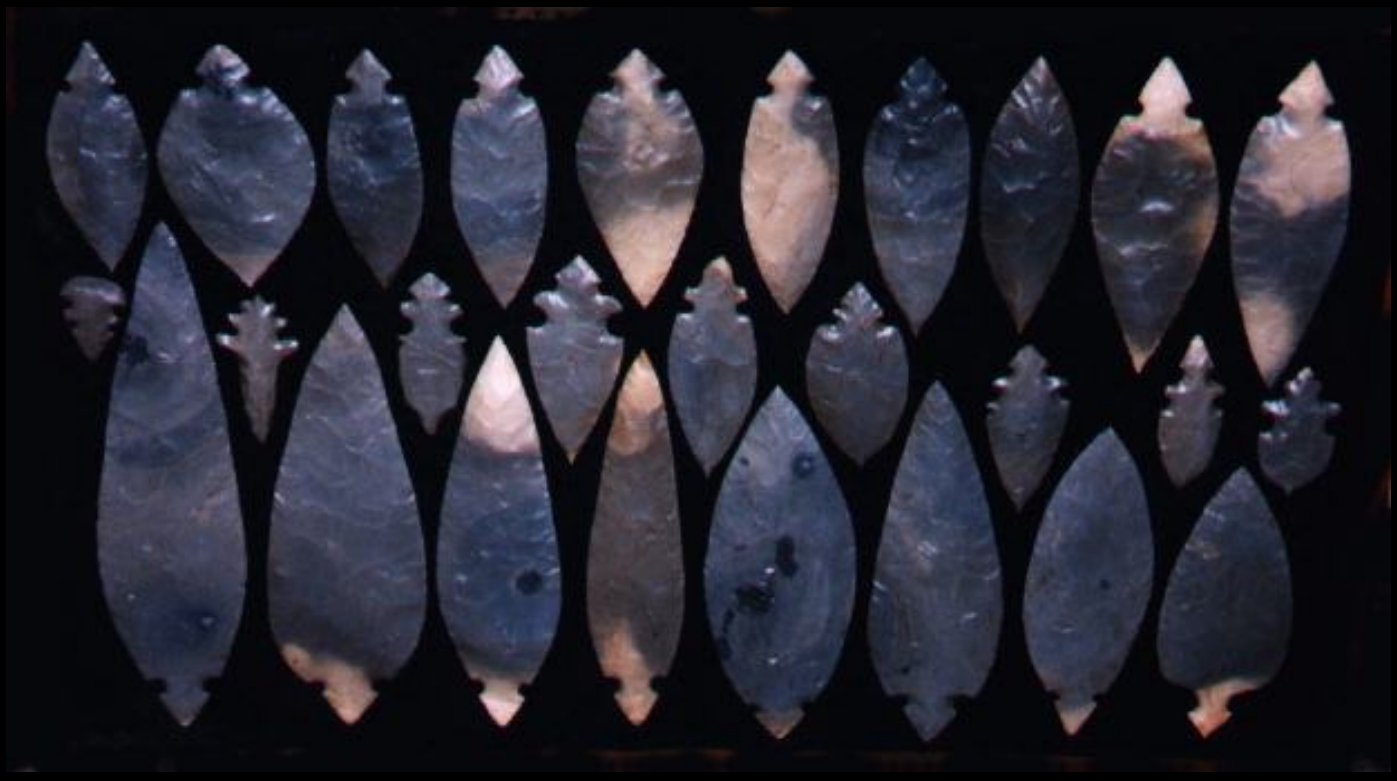
Knapper Spotlight on...

JOHN GEYER
Battle Creek, Michigan

My good friend John Geyer of Battle Creek, Michigan is a fine knapper and his work is in high demand by collectors and sellers. Below are some photos of some of his recent work.

THE GEYER CACHE

The "Geyer Cache" took a month of steady work to produce. Every point in it was made from a single forty-seven pound nodule of Indiana Hornstone that John purchased from Robby Robinson at Jeff Piggs last knap-in in Mexico, Indiana. To help you get a sense of the size of the points in this cache, you should know that the largest one is 8 1\2 inches long.



FIRE GEM POINTS

John also works with raw opal to create beautiful gemstone bifaces. As you can see below,

the quality of the opal is extremely fine with plenty of fire.

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--UNDER CONSTRUCTION--

KNAPPERS GLOSSARY

Here are some words you may run across in conversation or in flintknapping articles.

[A] [B] [C] [D] [E] [F] [G] [H] [I] [J] [K] [L] [M] [N] [O] [P] [Q] [R] [S] [T] [U] [V] [W] [X] [Y] [Z]

A

ABRADE-to dull a platform edge so as to strengthen it in preparation for billet or pressure flaking. Go here to read an article that contains information on abrading. The piece of grinding wheel or stone that is used for abrading is called an "abrader."

ARCHAIC-an American Indian Culture period dating from 3,000 to 10,000 B.P.

B

B.P.-Before the present era.

BARB-long pointed wing-like shoulders that are usually at the base end of a point.

BASE-the hafted end of a point.

BEVEL-a slanted edge pressure flaked into an edge for the purpose of resharpening.

BIFACE- A point that has been worked and shaped on two sides.

BIFURCATED-a basal stem on a point that has been notched up the center so that the base is "split." Click here for a drawing.

BIRD POINTS-are very small arrowheads. Although they are thought by many to have been used for hunting birds, they have been found by archeologists embedded in bodies as if they had been used in warfare.

BILLET- A little "club" used to strike an edge on stone in order to shape it by the removal of flakes. Traditionally made of antler there are currently many knappers who use billets made of copper. Advantages and disadvantages of the two billet materials are often a matter of debate. Click here to see a picture. Actually, only those made of wood should be called "billets." The antler ones are more accurately referred to as "batons." But you'll rarely here

that at a knap-in.

BULB OF PERCUSSION- The initial area, where a flake was struck in order to detach it, is often thicker. The flake then thins down quickly and fans out. That thicker area is called the bulb of percussion.

C

CACHE-a group of points found all together in one place. Usually all the same kind, and unnotched. Possibly they were buried for the purpose of storage or safekeeping until needed.

CENTER LINE- Click here for a detailed description of this term.

CONCHOIDAL FRACTURE-Glass fractures conchoidally. The shock wave produced when the glass is struck fans out from the point of impact and spreads through the glass. The next example I will give has become a cliche' in flintknapping circles, but that is because it perfectly describes conchoidal fracturing. When a pane of glass is hit with a BB from an air rifle, a cone of glass is removed and falls out the other side of the pane. That cone is called a ***herzian cone***. We want to use that cone of force to remove flakes from stone that has the ability to fracture in this manner...***conchoidally.*** The scar from conchoidal fracturing found on the surface of a point is kind of "shell" shaped.

D

DISTAL-The tip end of the point.

E

END SNAP- Sometimes when you hit the base or the tip of your preform, the other end snaps and breaks off. Then you have two points to work on. The preform needs to be supported to dampen the shock to the piece. Click here to go to an article that will help with this problem.

F

FLAKE SCAR-The surface depression left when a flake is removed.

FLINTKNAPPING- An addiction one acquires from pursuing the creation of tools through

the use of stone that can be flaked and fractured conchoidally.

FLUTE-a channel on one or both sides of a point. Made by striking a flake off the base that aims toward the tip. Characteristic of Folsom and Clovis type points.

G

H

HAMMERSTONE- Small roundish stones used as hammers to strike platforms so as to remove flakes. Hard quartzite works nicely. I like to use egg-shaped ones of various sizes. Sometimes banks and other places have landscaping that incorporates round, smooth, quartite hammerstones. I tell you this because that way...you will know what hammerstones look like.

HINGE FRACTURE- Sometimes a flake will not feather out nicely at the end. Instead the resulting scar will terminate abruptly leaving a step. If you don't abrade you can end up with crushed edges that have all kinds of step fractures to contend with.

In addition every subsequent flake that is taken off in that area will terminate there and cause a grotesque stack. Improper angles can also cause steps.

Don't feel bad. I've seen original artifacts that have hinges and bad stacks. If you've already tried removing the hinge by catching it with a flake sent from the opposite side, or putting the flake back in and using indirect percussion, then try prying it off with pressure flaking techniques using a sharp flat "screwdriver" shaped point on your flaker. There are some other methods of questionable traditional nature. For instance; Flat copper breaker bars, curved copper hinge remover tools, grinder machine, etc, etc, etc.

HEAT TREATING-Heating up cherts so that the knappibility improves. Some stone can take a lot of heat treating, some none at all. It was utilized prehistorically as well.

I

J

JUST HIT IT-that's what Dan Belknap tells me when I'm taking too long and looking at a spall, holding off on that first strike because it looks like there might be some cracks in it. "I don't know, Dan...looks like a couple of cracks here. Do you think these will hold?"

"Hit it!" Dan says with a grin, "Whack it a good one!"

K

L

M

N

O

OUTREPASSE'- The platform was pefect. Angle and conditions were optimal. The flake flew across the entire width of the face and went right off the other side...taking a piece of that edge with it. That, my friend, is an "Outrepassé." It is a french term that means "overshoot." They are, at times, an effective and bonifide thinning technique. Just ask contemporary European knappers. Other times, if it comes later when you can't afford to lose any width on the piece, it is a problem. Check your angles and/or the power of your billet strike.

P

PALEO-archeological period lasting from 40,000 to 12,000 B.P.

PLATFORM- The striking place. Or, in the case of pressure flaking, the place where the point of the pressure flaker applies its force. But then again, the best definition I ever saw came from Bob Patton. He called it simply "the impact site." Platforms can be good or bad

depending on the knappers level of experience. You can go here to read an article that contains information on what some requirements are for a good platform.

PREFORM- This is the state that a point is in at any stage before it is a finished. Sometimes a cache will contain many preforms that only need some final edgework or notching to be finished tools.

PRESSURE FLAKING- Flakes are pushed off of a preform edge using pressure from an antler or copper tipped tool. A lot of times this is the final stage of stone tool making as the edge is straightened and sharpened and the final retouch is accomplished.

Q

R

S

STACK-

STEP FRACTURE-

T

U

UNIFACE- A point that has been worked on only one side. This would leave the other side with the original smooth surface from when the flake was removed.

V

VICTIM- The unfortunate person who tries the "Hot Rock and Cold water droplet" legend in an attempt to make a point. A very dangerous pastime with great potential for injury.

W

WOODLAND-an archeological period that goes from 3,000 to 1,300 B.P.

X

Y

Z

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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

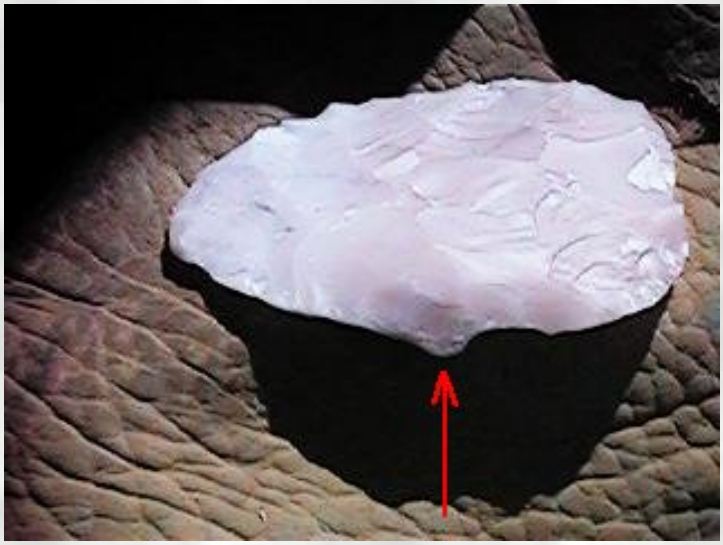
First thing is to make sure that the place where your billet is going to connect is **below the center line**. When you hit below the centerline, a flake comes off. When your preform is thin, and you hit above the center line, it is almost certainly going to break. As the preform gets thinner, it's very 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.

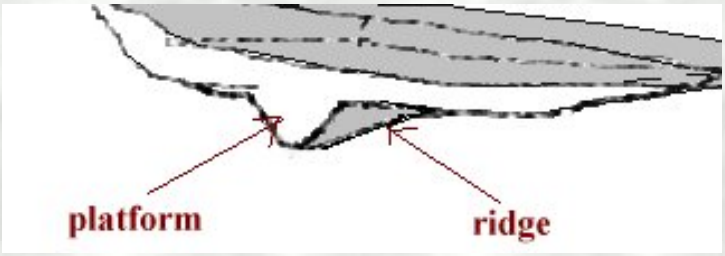
Click here for a detailed explanation of the center line concept.

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!

Click here to see some new hints for improving your traditional knapping technique!

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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.

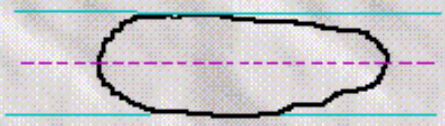

Fig.1

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.

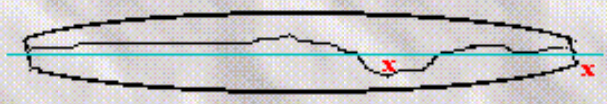

Fig.2

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!

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.

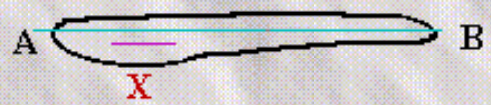

Fig.3

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!

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SOME MORE KNAPPING HINTS

Well it's been a year since I first put up these hints and I need to add a few more things. I've learned some stuff that not only helps to reduce breakage, but also helps to gain more control of some of the variables. The more we can control things the better we are at setting up hits and more accurately predicting the results of those hits.

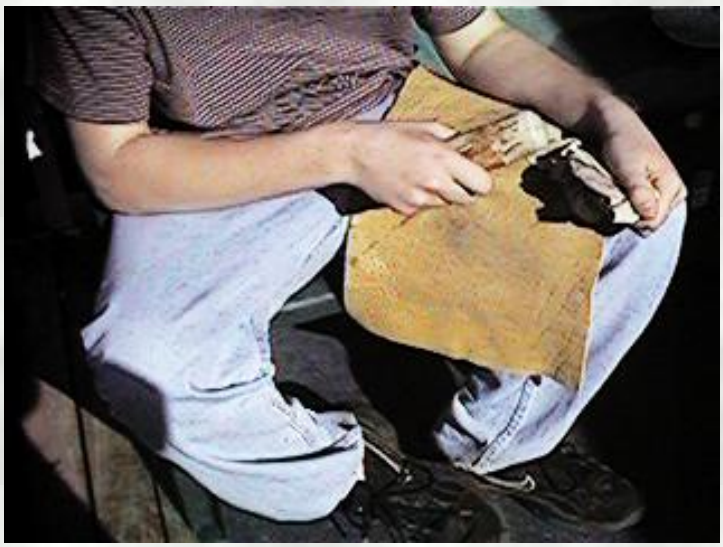
I guess we'll plow right into it!!

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.

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.

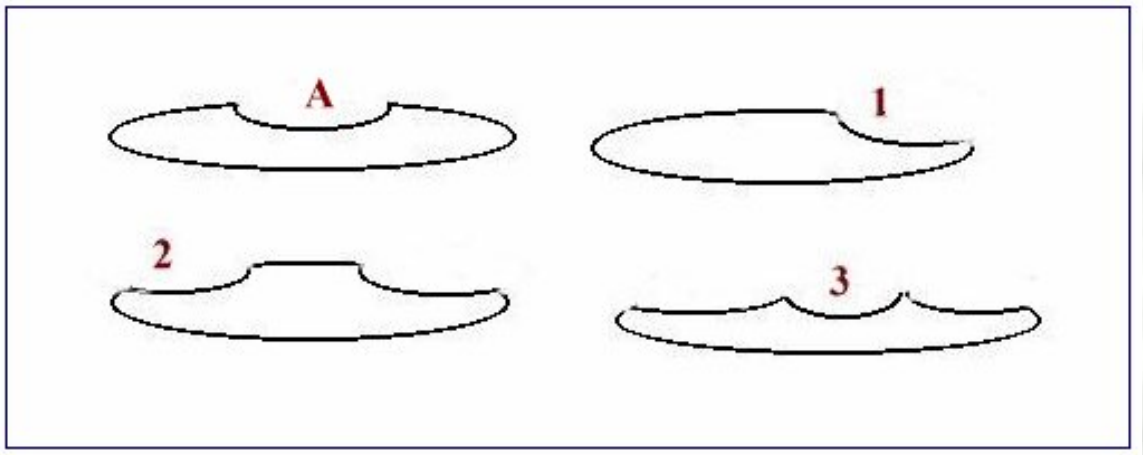
Good Luck and Have Fun!

April 17, 1998

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."

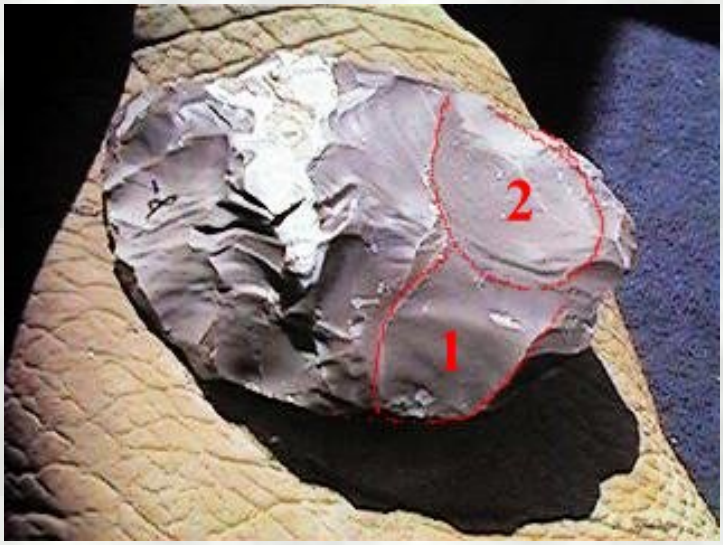
Of course I didn't quite catch on right away. Too many things to absorb. And with all the herzian cones and angles and platform isolation there's a lot of abstract visualization going on anyway. Well you don't have to worry...I'll show you right now what he meant.



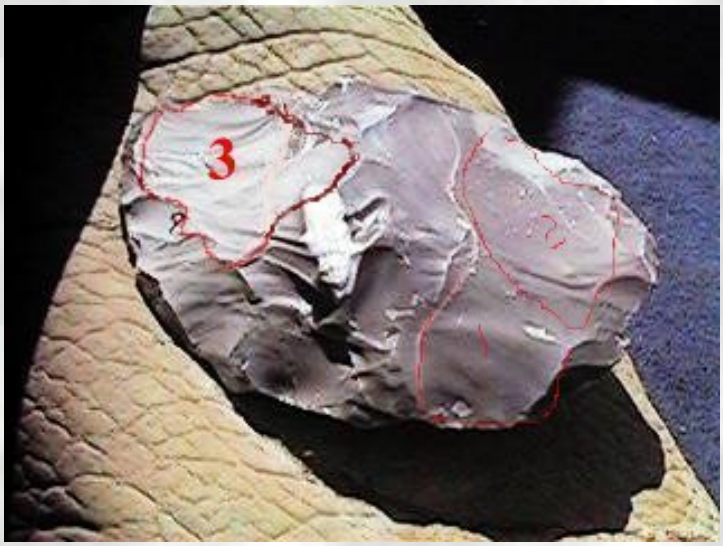
Look at the above illustration. If you were to take a flake out of a preform so that it ended up like figure "A" what do you think would be likely to happen on your next strike? Well, because the preform is so narrow in the center compared to the rest of the preform, it is likely to break in half. Now 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!

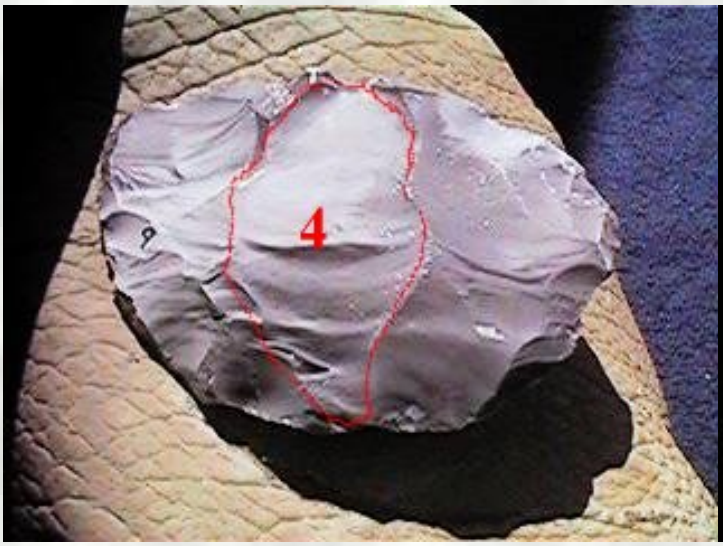
Now lets use all this on a real life example.

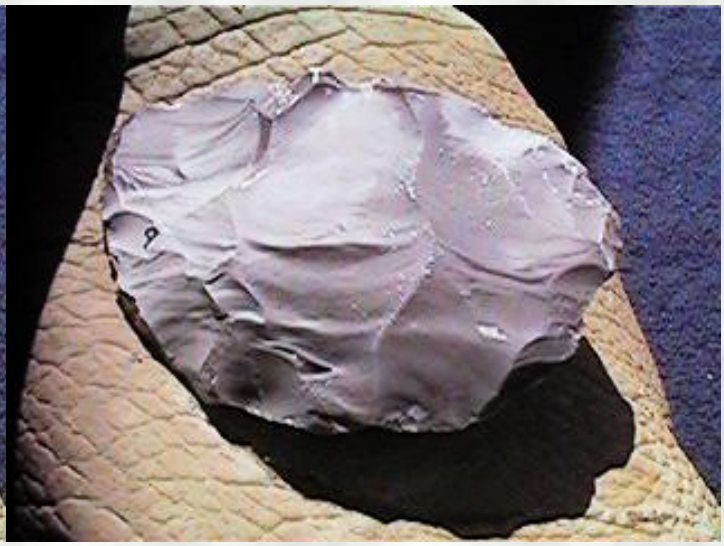


Flakes 1 and 2 are taken from the base end.



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!!

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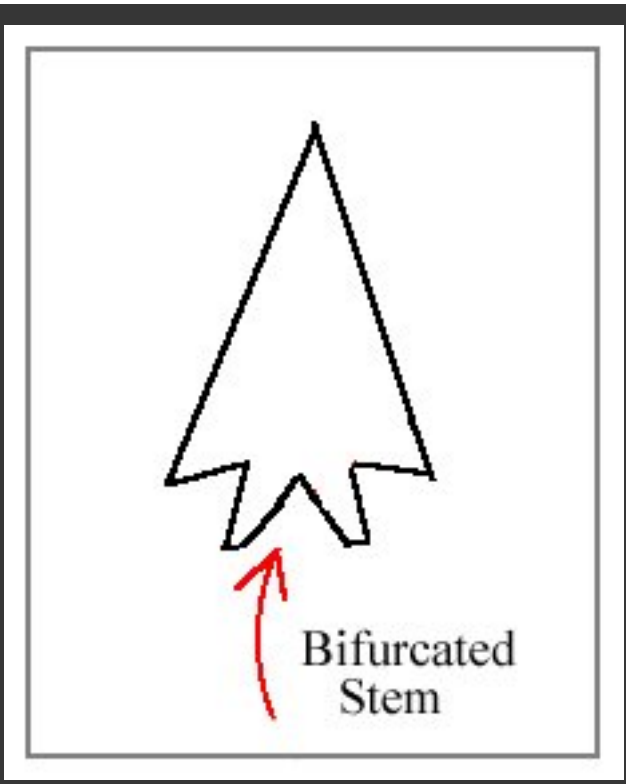

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Billets

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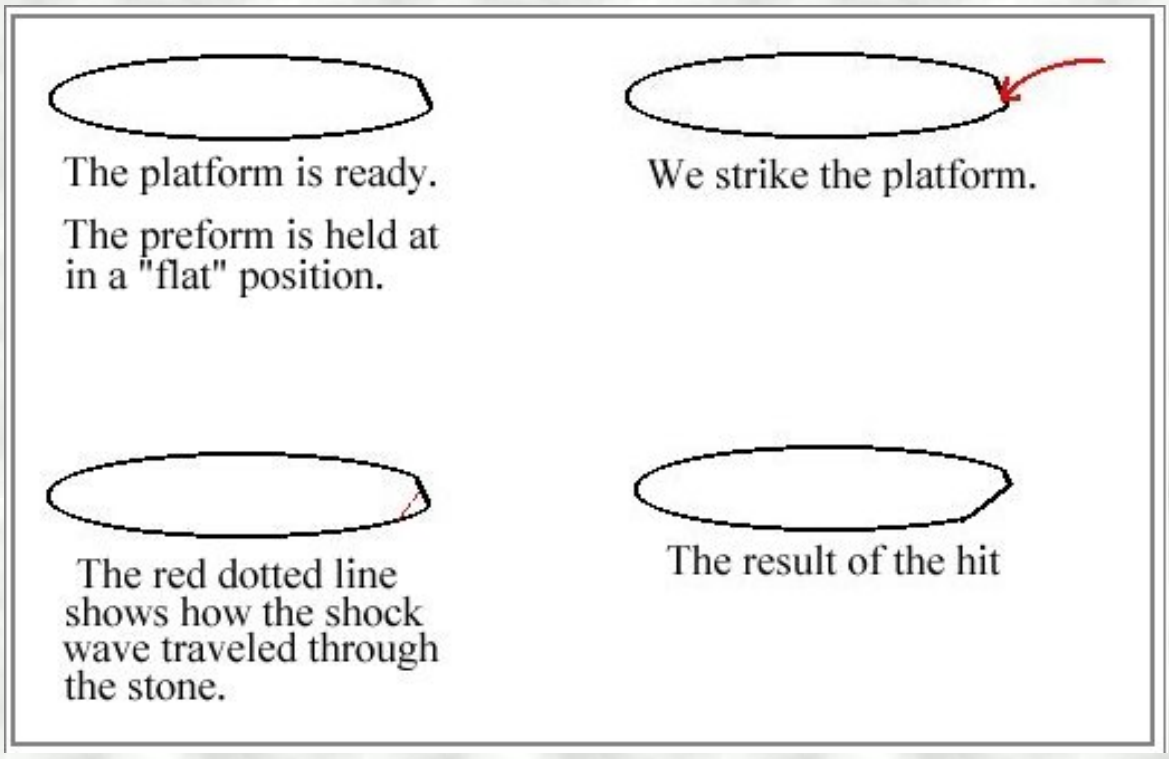
Some Talk About Angles

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.

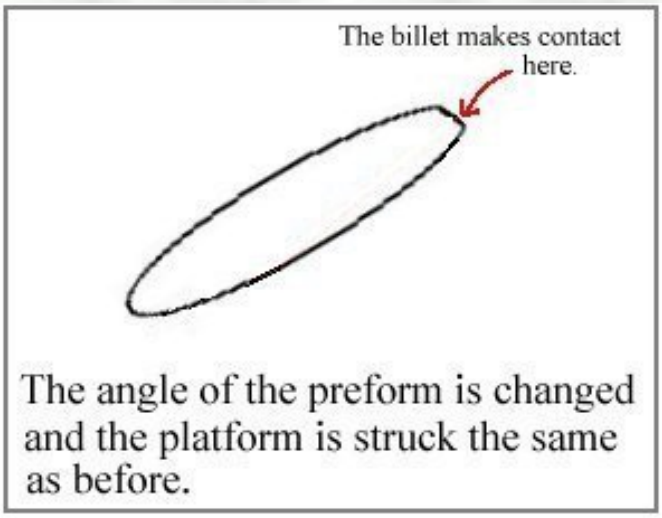
If you tilt your preform at different angles you can control how long your flakes are and how much material you remove. Depending on how much material you are trying to get through you may have to adjust the power of your strike as well. But a lot can be accomplished by understanding how to use different 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.

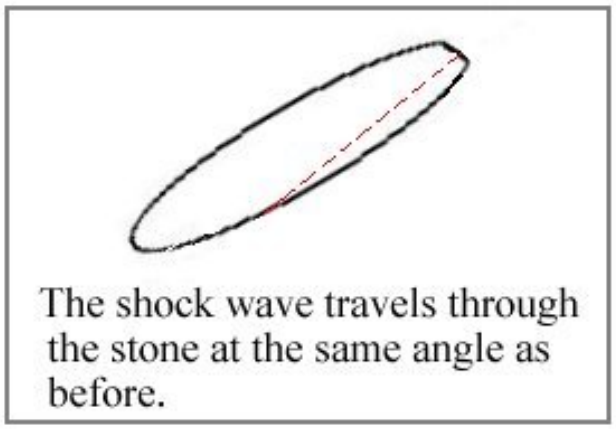


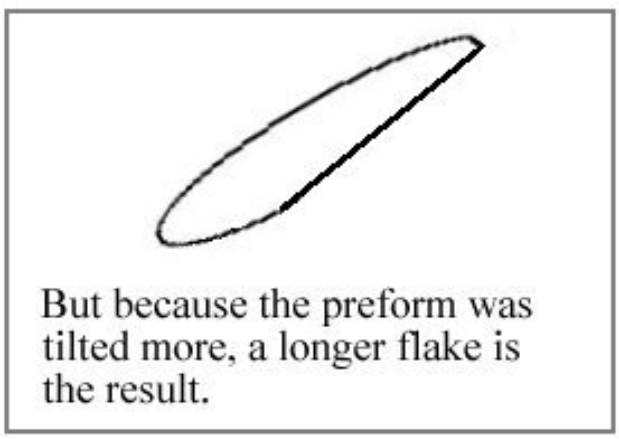
Well, the flake came off. And as you can see, we ended up with a rather shallow result. If we

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 !!

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What Do You Really Need To Start Flintknapping?

By 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.

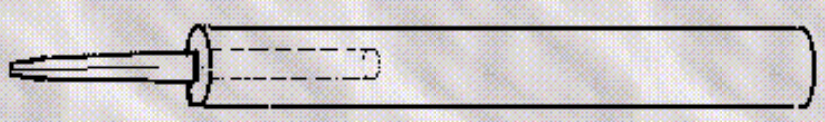
Later on you may find that once in a long while you'll have need of a larger billet for spalling or something, but hey -- try a rock. They're free and lots of abo knappers used them. I think there was probably a lot more hammerstone knappers than we realize in prehistoric times. With practice you'll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

(PHOTO OF MY TOOL KIT COMING SOON)

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.

-Last updated July 8, 2002. Please check back for further updates.

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HAFTING GLUE RECIPE

I've been familiar with a basic pine pitch and ashes recipe for making hafting glue for quite a while but recently I came across a new recipe for it on an e-mail from The Primitive Skills Group. I haven't had a chance to use it for hafting any points yet but I think the tallow is going to provide some added stability. This type of hafting glue is an excellent adhesive with good holding power. Use it in connection with a wrap of sinew for a nice authentic looking hafting job. Here's the recipe:

5 parts pitch
1 part wood ashes
1 part tallow

You can spoon the mixture out on to waxed paper and roll it into a stick and then melt as much as you want to use as needed.

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SOME POINTS I'VE MADE

Here are some points that I've made over the last five years. These are all traditionally knapped pieces, not "flake over grind." Currently my favorite knapping tools comprise a kit made up of the following: An egg-sized hammerstone, a medium baton made of moose antler, a 1 inch diameter (six inch long) antler tine, a copper tipped pressure flaker, and a notching tool. I have other tools that I occassionally bring to bear, but more and more I find myself using only the above listed kit to complete a point.

You can click on the thumbnails to view a larger picture along with a description. Then just use your browser's "back" button to return to this page of the site.

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THE HISTORY AND PRIMITIVE TECHNOLOGY PAGE

A PRETTY CACHE BLADE OF FLINTRIDGE MATERIAL

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THE HISTORY AND PRIMITIVE TECHNOLOGY PAGE

WORKING ON THIS POINT WAS LIKE FLINTKNAPPING A PETRIFIED PINEAPPLE. IT'S MADE FROM SOME PRETTY COLORED FLINTRIDGE MATERIAL THAT WAS CHOCK FULL OF CRACKS, CRYSTALS AND INCLUSIONS. BUT I KINDA' LIKE IT NOW.

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THE HISTORY AND PRIMITIVE TECHNOLOGY PAGE

TEXAS MATERIAL, NOT REALLY THE TRADITIONAL MATERIAL FOR A TURKEY TAIL. I WISH I WOULD HAVE HAD SOME HORNSTONE. STILL, IT HAS A NICE SHAPE.

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THE HISTORY AND PRIMITIVE TECHNOLOGY PAGE

LEFT TO RIGHT: A LITTLE FLINTRIDGE ARROWHEAD, A LITTLE ARROWHEAD MADE OF QUARTZY TEXAS CHERT, AND AN ARROWHEAD THAT I THINK IS MADE OF BURLINGTON - I FORGOT WHAT I MADE THAT ONE OUT OF.

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THE HISTORY AND PRIMITIVE TECHNOLOGY PAGE

A POINT MADE OF FLINTRIDGE MATERIAL. THIS STARTED OUT AS A WHITISH-BROWN PIECE WITH A LOT OF CRACKS IN IT, BUT I KNOCKED IT AROUND UNTIL I GOT TO THE SOLID PART INSIDE AND THERE WAS THIS NICE YELLOW COLOR.

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SOME HEAT TREATED TEXAS WITH LIGHTER INCLUSIONS.

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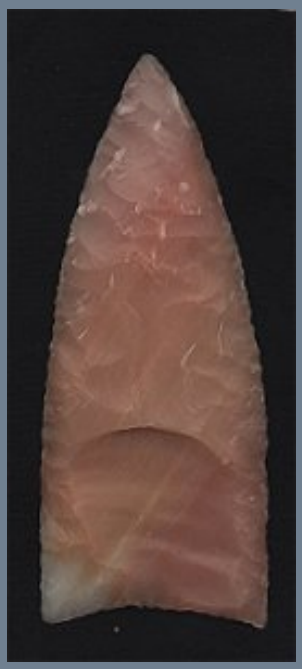

NOVACULITE WITH A BIG FLUTE IN THE BASE.

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LARGE SIDE-NOTCHED POINT MADE FROM FLINTRIDGE MATERIAL

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THE HISTORY AND PRIMITIVE TECHNOLOGY PAGE

A LARGE E-NOTCHED POINT MADE FROM A PIECE OF BURLINGTON. NOT REALLY AUTHENTIC LOOKING, BUT IT WAS ONLY MY THIRD ATTEMPT AT MAKING AN EXPANDED NOTCH STYLE POINT, AND I WAS EXCITED ABOUT IT. THE NOTCHES WERE NOT MADE USING INDIRECT PERCUSSION. THE METHOD I USE FOR NOTCHING WAS TAUGHT TO ME BY ED MOSHER

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MADE FROM NOVACULITE

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A STEMMED POINT OF FLINTRIDGE MATERIAL, AND AN OBSIDIAN POINT THAT'S REMINISCENT OF THE AGATE BASIN STYLE.

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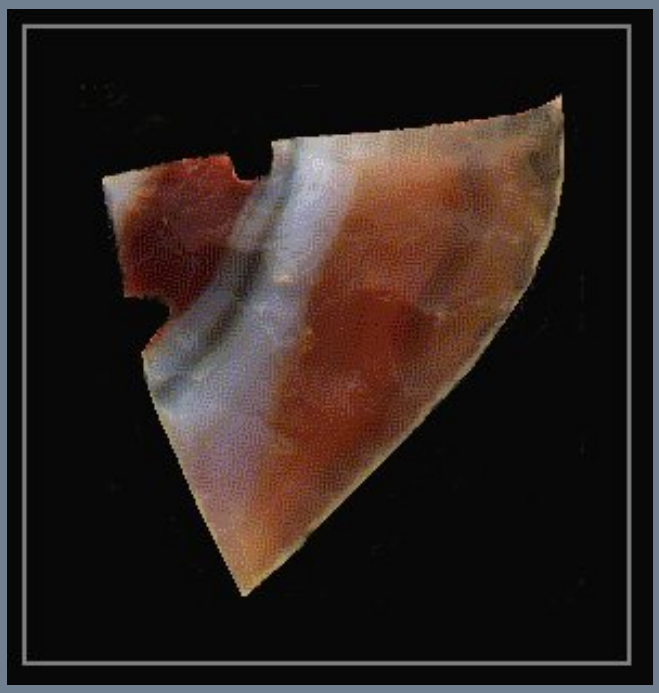

THIS IS A CORNER-TANG KNIFE MADE OF BRAZILIAN AGATE. THIS PICTURE IS ENLARGED. THE POINT IS ACTUALLY ABOUT 1 1/2 INCHES BY 1 1/4 INCHES IN SIZE. IT'S A LITTLE STONE AGE X-ACTO KNIFE.

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MADE FROM SOME NICE BURLINGTON MATERIAL

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THE HISTORY AND PRIMITIVE TECHNOLOGY PAGE

OBSIDIAN KNIFE WITH BEAR JAW HANDLE.

Knapped with traditional methods using an antler baton, and copper tipped and antler tine pressure flakers. I'll have to put up a pic of the knife with some light behind it. The blade is half mahogany and half midnite lace. It looks pretty with the light shining through it. This was a fun knife to make. Thanks to Carl for the Bear Jaw.

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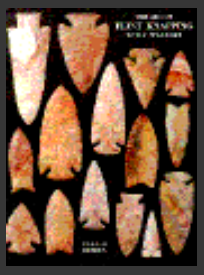
WHERE TO GET THE FLINTKNAPPING BASICS

Here are some things to check out that can help the novice flintknapper to learn the basics. In fact many of these sources will take you right on through to the intermediate and even advanced stages. If I have had personal experience with the source, I'll give a short review.

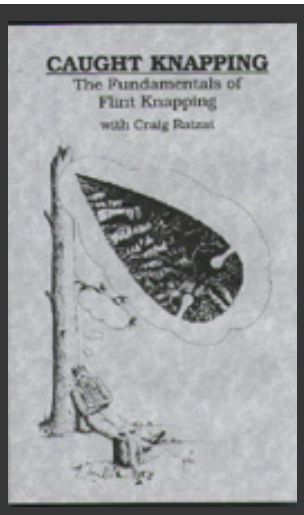
BOOKS



THE ART OF FLINTKNAPPING by D.C. Waldorf

After many years of wishing I knew how to make arrowheads, my father found this book and bought it for me. He also got a copy for himself because he had been longing to learn since he was a kid. D.C.Waldorf is one of THE names in the field of lithic arts. He has spent over 30 years studying the knapping process and in this book he shares what he's learned. Generously illustrated with photos and beautiful line drawings by artist Val Waldorf, you'll learn flintknapping basics like finding and spalling out rock, heat treating hints, tools, billet and pressure flaking techniques, and more.

VIDEOS



CAUGHT KNAPPING - Craig Ratzat

I love this video. Craig Ratzat has a knack for explaining things..and at just the right pace. This video takes you from quarrying material at Glass Buttes all the way to finshed points. Thorough examinations are made of tools, techniques, and terms. An example of Craigs great talent for bringing things into focus is demonstrated not long after the beginning where he shows just what a "cone" looks like. You couldn't ask for a better picture to keep in your mind of it's physical properties. You need this in your flintknapping video library. When I got my copy and found the surprise in the video case, I knew Craig was cool! You'll have to buy the video to find out what I mean.

LINKS

FLINTKNAPPING BASICS - Tim Rast

Clicking the above link takes you to the flintknapping fundamentals section of the marvelous ***KNAPPERS ANONYMOUS WEBSITE.*** You get explanations, pictures, and diagrams that help you understand hard hammer percussion, soft hammer percussion, pressure flaking, and ground tool techniques. Be sure and visit the rest of this fine site as well.

HEAT TREATING STONE

Here is a very nice primer on how to heat treat cherts and other knappable stone the old-fashioned way.. by using techniques that were likely used by ancient knappers. If you can't afford a kiln then forge an even closer connection with those far away times by experiencing this method. Lots of other great information here as well.

Questions, comments, or links to suggest? Please e-mail me at: earp@grnet.com

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Pronounce it "ott-lottle"

THE ATLATL RESEARCH OF BOB PERKINS

Bob Perkins of BPS Engineering has been interested in atlatl and dart mechanics for decades. BPS engineering claims credit for four major and half a dozen minor discoveries in the field, virtually all that is known of the deceptively complicated mechanics of the system. I'm pleased to be able to present Mr. Perkins papers on Atlatl mechanics as part of The History and Primitive Technology Page.

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Atlatl-pronounce it **"ott-lottle."** (Aztec- "Nahuatl" from atla, ***to throw.***)

ATLATL AND DART MECHANICS

Introduction

Over 12,000 years ago, hunters tracking the migrating herds of the last ice age across the frozen tundra of what is now the state of Alaska became the first emigrants to enter the North American Continent. These hunter/gatherers brought with them a weapon that reigned supreme among them and their decendants for thousands of years to come, the atlatl. So powerful and effective was the atlatl that scientists and scholars speculate that it, along with the overkill tactics so common to the human race, caused the extinction of the woolly mammoth in North America.

Largely replaced by the bow and arrow around the birth of Christ, it was still being used by some Native Americans during the Age of Discovery, 500 years ago. When Columbus encountered Natives using the atlatl during his voyages to the New World, Europeans who had long forgotten the weapon soon became familiar with it again. These encounters were most certainly with the business end of the weapon, the European wondering "What was that?" just before dying.

Mechanics

The mechanical function of atlatl technology is the flexible dart. The dart can't launch with good accuracy or thrust if it's rigid. Under acceleration by the atlatl, the dart flexes and compresses like a spring, storing energy to be used to push itself away from the atlatl and launching at velocities that easily exceed 100 mph. When you start your swing with a flexible dart, it humps up, like a hissing cat.The dart will flex and at launch point it will recoil and literally jump off the atlatl.

The great innovation of atlatl weights in the evolution of this technology bears the mark of true genius. By superimposing flexibility into the atlatl shaft and applying a mass to influence the amount of flex during the swing, the energy stored in the spring of the atlatl can be exactly matched to that of the dart. This allowed for a more efficient use of the available energies by forcing the atlatl to push the dart away at the same time the dart is pushing away from the atlatl, much like a diver pushing away from a springboard platform.

Over time, different types of atlatl weights were developed to improve upon this effect. One particular type, commonly known as the bannerstone, used ancient "stealth" technology, and went so far as to silence the zip-like noise caused by the swing of the atlatl.

All of these innovations together make the atlatl the impressive weapon it was historically. It's effectiveness can still be dramatically demonstrated today as well.

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You can send for a catalog featuring atlatls made by BPS Engineering by writing to: BPS Engineering, Box 797, Manhattan, Montana 59741

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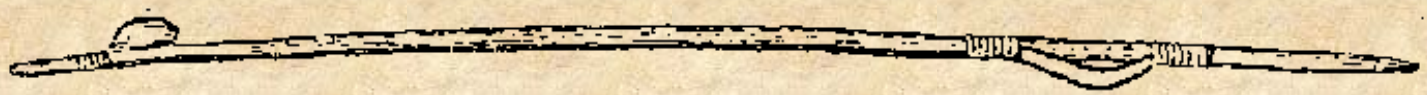


ATLATL WEIGHTS: Function and Classification

INTRODUCTION

Atlatl weights, both known and suspected, are a fascinating and frustrating subject. Based soley on the misinterpretation and lack of understanding surrounding them, and their occurrance in the archealogical record, debate and confusion as to their purpose has set them apart from most other artifacts.

There are a variety of atlatl weight types and suspected types found, interestingly enough, mainly in the United States. Their distribution seems to be contained within the forty-eight states with a little overlap north into Canada and south of the Rio Grande iinto Mexico. But generally, the political boundries of the lower 48 states hold most of the world's alatl weights. As far as I am aware, atlatl weights do not occur outside of North America, although atlatls most certainly do. Atlatls in a variety of styles are found more or less world wide. The earliest examples date to well over 20,000 BP in Europe, and the atlatl is still used today by the natives of Papua, New Guinea and the Australian aborigines. But regardless of where atlatls are found, nowhere other than North America are they found with weights attached to them.

The confusion surrounding atlatl weights begins with the many theories as to their purpose. The most popular of these seems to be that they are a counter balance. This theory suggests that the weight acts as an adjustment to balance the atlatl and dart in the palm of the hand. Many theories have been put forth, mainly based on the idea that the adjustment of the weight would propel the dart a greater distance.

Experimentation with many of these theories tended to show the opposite result until finally the theory of last result, "hunting magic" was applied. When all else fails, it's a charm, the owner believed the atlatl weight possessed "hunting magic." No doubt about it, some weights are quite beautiful and finely polished, and I am sure their owners even believed they possessed magical power. That's just the way we humans are. We're weird like that. However, not all atlatl weights are beautiful. Many are rather crudely finished and some are rounded river rock. Even these could hold some special meaning to someone, but the "charm" theory just doesn"t hold. Atlatl weights have a function, and that function has to so with their mass.

WEIGHT THEORIES

This brings us to the contradiction in the term "atlatl weight". More often than not atlatl weights are referred to in every descriptive term imaginable except-mass. To apply the term 'weight' to an object and neglect to report its mass would seem illogical to a thinking human.

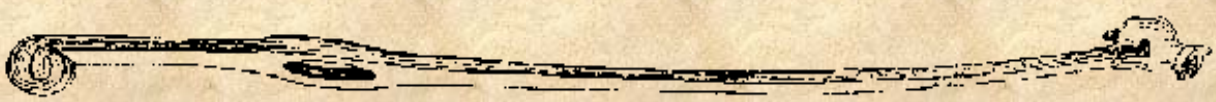
There is also the confusion of what is an atlatl weight. This is more of a word game than a question of function. Depending upon where you live or how you became familiar with atlatl weights you might refer to all weights in general as banner stones, boat stones, counterweights, bird stones, etc.

The center of all this confusion lies with the dispute over the true purpose of the atlatl weight. In my studies I have found that they possess a deceptively advanced technology. The basic technology, the mechanical foundation of the system, is the flexible dart. Over time humans have tinkered and toyed with this system, improving and refining it to a very high degree.

Atlatl weights possess mass and when attached to an atlatl the mass effects the system. But contrary to popular opinion you can't just strap a weight on to any old atlatl and expect a miracle.

Atlatl weights do not possess sufficient mass to significantly influence the speed at which an atlatl is swung in order to affect some degree of timing based on velocity. The fact that a weight increases the moment of inertia of an atlatl is just that, a fact. But what good does it do? Why not make a thicker atlatl? And as far as a counterbalance is concerned, that theory only applies when the atlatl and dart are at rest and not being used. The presence or absence of a weight makes no difference whatsoever as to how long or steady an atlatl and dart can be held.

The purpose of the weights mass is to resist acceleration. In order to understand its function of resisting acceleration a review of the technological evolution of the atlatl and dart must come first.



ACCELERATION

The basic mechanics of the system depend exclusively on the flexibility of the dart. When the dart is accelerated by the atlatl it flexes and stores energy like a spring. At some point during the swing, after the atlatl is no longer accelerating sufficiently to cause further compression of the dart, the dart then uses its stored energy to push itself away from the atlatl. This allows the dart a smooth separation between itself and the atlatl, giving it an effective and powerful launch.

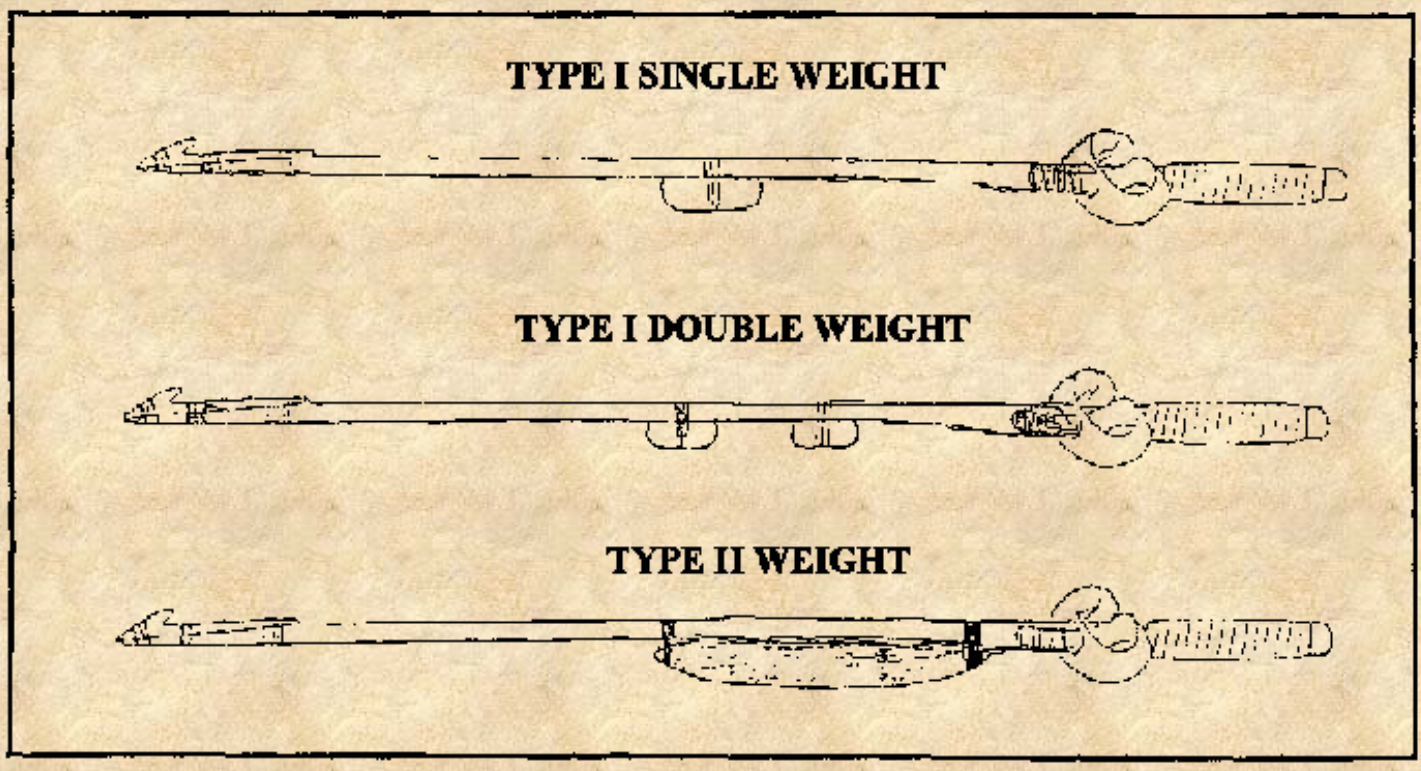
One of the great evolutionary improvements to the system was superimposing flexibility into the atlatl. If this is incorporated successfully into the system, with the degree of flexibility of both atlatl and dart in a functioning relationship with one another, their function will be similar to that of a diver diving from a spring board. In this system the diver's legs are bent, like the dart, and store energy to be used to push away from the diving board. The diving board, like a flexible atlatl, is also bent back, storing energy to be used to push the diver away from the board. With the diver and diving board pushing each other away at the same time, the launch of the diver is considerably higher, smoother, and more powerful than if the diver had used a fixed rigid platform.

When the proper mathematical relationships of length and flexibility between atlatl and dart are achieved, the results are a long and noticeably flexible dart. But the atlatl on the other hand is, at approximately one third the length of the dart, short and somewhat stiff. The proper flexibility of an atlatl is rather subtle. The atlatl which is correctly flexed seems too stiff to be of any benefit. This is where the atlatl weight is applied to the system.

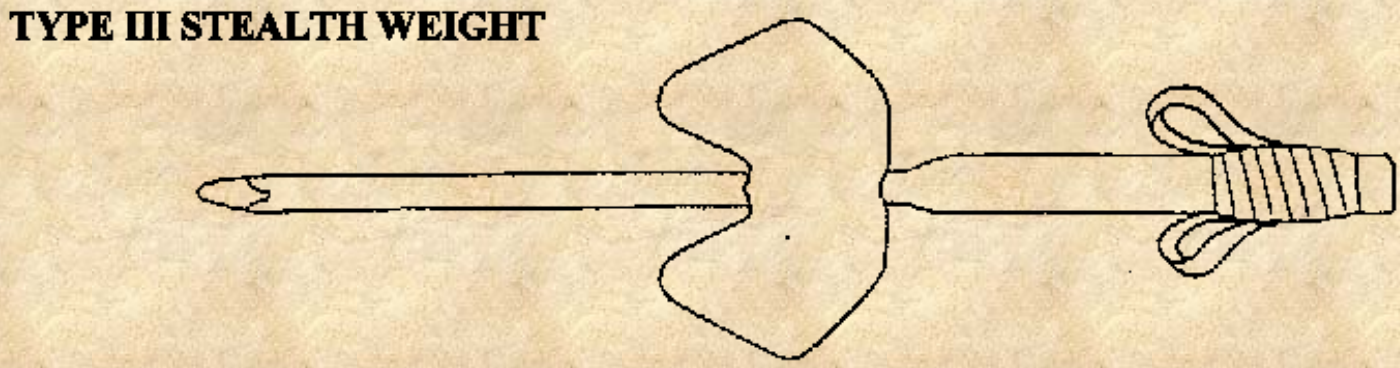
What atlatl weights accomplish in this system with the flexible atlatl is rather sophistocated and ingenious, representing a level of engineering skill which is impressive even by today's standards. Its mass, located approximately in the middle of the atlatl shaft, resists acceleration, (Newton's First Law of Motion) and forces the atlatl to deflect than is possible without it. This enables the atlatl to store more spring energy to be used to push the dart away from the atlatl. The weight's position along the atlatl shaft influences the amount and rate at which energy is stored and released. Therefore, the atlatl weight is a timing device influencing the amount and rate at which the spring energy of an atlatl is stored and released against the spring energy of a dart. That is its primary function. Its effects on the system are not so profound as to propel the dart to a noticeably greater distance or velocity, although higher velocities are achieved. When properly incorporated into the system, the weight improves the performance of that system in terms of efficiency. Smoother, more controlled, and powerful launches make for better accuracy. And ultimately, it is getting to the target that counts.

CLASSIFICATIONS

Now that the atlatl weight function has been firmly established, the problem of classification can be more easily addressed. Archaeologists have attempted to classify weights according to their shape and hafting technique. In this they have failed miserably. Not only have the same weights been placed in a category Type III by one archaeologist and a Class I category by another, but some categories contain only one known example. This being the case I have laid down the framework for a new system of weight classification based solely on function and effect.



The basic atlatl weight, or Type I in the Perkins' atlatl weight classification, is a single point mass weight with a mass of approximately 65 g. No matter how it is grooved, holed, shaped, or hafted to the atlatl its final position is that point at which its mass influences the mechanics of the system. Type II weight causes a finer, more precise response to the flex of the atlatl, accomplishing with one weight what was attempted with several. This brings us to the most fascinating weight to be classified.



The Type III stealth weight is more commonly known as a Banner Stone, and there is some dispute as to whether they are atlatl weights or not. Based mainly on evidence from Indian Knoll, Kentucky where Banner Stones have been recovered in context and in alignment with atlatl hooks and antler handles, I believe that Banner Stones are indeed atlatl weights.

Mechanically the mass of Banner Stones tend to influence the system like a Type I weight, but their shape has the interesting effect of silencing the noise caused by the swing of the atlatl. Usually when

a stick or atlatl is swung, an audible "zip-like" noise is generated. It seems that when a Banner Stone is attached this noise is significantly reduced generating more of a low frequency "woof".

THE EXPERIMENT

Since first discovering this effect I've demonstrated it to several people. At distances of anywhere from 5 to 15 meters I have asked observers to listen for a difference in sound levels between an atlatl equipped with a Type III stealth weight and an atlatl with only a Type I point mass. After three swings with each all observers reported a significant difference in that the stealth atlatl was noticeably quieter than the other. On the offhand chance that my observers were predisposed to report a difference in sound by being asked to "listen", I began asking subsequent observers to "watch" for a difference between the test atlatls.

The fact that these observers were asked to watch for an effect as opposed to listen resulted in a tendency to be more hesistant when reporting what was noticed after having the atlatls swung in front of them. But again in all cases, they reported that the atlatl with the Banner Stone was considerably quieter than the other atlatl. This result suggested that the effect was so profound that observers, led to believe they were looking for an effect with their eyes, none the less noticed an effect with their ears.

I arranged for an electronic sound test to be conducted at the 1992 Rabbit Stick Rendezvous. Sound equipment from Ricks College was made available to me for this purpose. The equipment provided was so sophistocated that its technology had only been available within the past three years. The microphones, about three feet long and four inches in diameter could, on a calm day, more than likely detect the sound of a needle being dropped into a haystack.

I used the same two atlatls as for the observational studies. Each atlatl was swung three times with and without the use of darts. A total of ten separate comparisons were made and recorded on magnetic tape. The five comparisons were made shooting the darts over the head of the technician handling the microphone and all traveled approximately the same distance. This was done in case someone suggested that I was swinging the stealth atlatl differently from the other atlatl. The deviation in throwing was held to an absolute minimum. In fact, I maintained a degree of consistency surprising even to myself, since I was concentrating on NOT hitting the sound man more than anything else during this portion of the experiment. None the less, it should be noted that all darts traveled over the head and landed behind this trusting soul at a surprisingly consistent height and distance respectively.

THE OUTCOME

The data recorded on tape was analyzed by computer and for all ten comparisons the stealth atlatl registered significantly lower sound levels than the unsilenced atlatl.

Although a mathematical module of this effect has not been formulated, the focus of maximum sound suppression seems to be between 20 and 25 meters indicating an effect known as superposition of sound waves. But no matter what the mathematics are, the effect is definitly present.

Although these experiments may not confirm that the effect of sound suppression was the purposeful function related to the shape of banner stones, they certainly go a long way to indicate it. And as far as the actual advantage of noiseless atlatls is concerned, I will leave that to other researchers to contemplate, since they no longer have the "counter balance" theory to consider.

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EFFECTS OF STONE PROJECTILE POINTS AS MASS IN THE ATLATL AND DART SYSTEM

Stone projectile points represent the single most durable artifact occuring in the archaeological record. A great deal of research and speculation have gone into their interpretive qualities. Materials in knapping techniques have been studied, point styles have been typed, categorized, dated, and volumes of information have been published relating directly and indirectly to stone projectile points. But, other than explaning that the sharp edges and point are for piercing hide, flesh, tendon, and smashing bone and cartilage in order to inflict traumatic wounds, their function and effects within the mechanical system of the atlatl and dart have been largely ignored.

The primary consideration of projectile technology is to make a smaller particle go faster. The atlatl and dart is a deceptively complex mechanical system, highly sophistocated even by today's standards, and the mass of the stone projectile point plays an integral role within this system. In the mathematical expression for energy, one half the mass of a particle multiplied by the velocity squared, it can be readily seen that velocity plays a more significant role in increasing energy than mass. Over a time improvements in projectile technology have been marked by making smaller, lighter particles go faster. However important the velocity of a particle is, when analyzing a weapons system the mass of the projectile, its effects within the system, and how that projectile is accelerated, are paramount in the interpretation of that weapons system.

Prehistorically the concept of making smaller projectiles travel faster can be generally traced in the study of stone projectile points with heavier points occuring earlier and lighter points occuring more recently in the archaeological record. Studies of stone points from sites known to have utilized either atlatl or bow and arrow systems has shown a trend toward lighter points for arrows (three grams or less) and heavier points for darts (four grams and greater). Generally speaking the atlatl predates the bow by a considerable margin, and in fact, the atlatl has enjoyed such an extended and widespread tradition that comparatively speaking the bow and arrow is a recent development in projectile technology. In North America the atlatl can be traced back in the archaeological record some 8-10 thousand years, where as the bow has been generally accepted as being introduced only 1500 to 2000 years ago. The atlatl and dart was used in North America longer than any other weapons system to date. Therefore a detailed study of the projectile point mass and its effects on this system, establishing parameters for minimum

and maximum mass will help, through a process of elimination, and distinguishing between arrow, dart, and lance points.

DART MECHANICS

The atlatl and dart is defined as a spring mass mechanical system. (*see **Atlatl and Dart Mechanics** which can be found on the previous menu*). The flexible dart is the mechanical foundation of this system and the mass of the point plays a critical role within it by causing the dart to flex and store spring energy.

When the flexible dart is accelerated by the atlatl the point mass at the opposite end of the dart resists that acceleration and causes the dart to flex and compress, storing spring energy to be used for the launch. The potential energy available to the dart is dependent upon three things, the length and flexibility of the dart itself and the mass of the projectile point at the end of the dart. The mass of the point directly controls the amount of energy available to the system. Without point mass the system will not function to its full potential.

The mathematical perameters of length and flexibility as they relate to the atlatl and dart can result in a number of design variations and performance capabilities. This results in a wide range of point masses that can be used. Somewhat like bullets today, each particular atlatl and dart design requires a particular size projectile point. Basically point mass is proportional to dart length. The longer the dart, the greater the spring force required for efficient operation and the greater point mass required to cause its compression. Once a system is designed and fixed with length and flexibility within functioning perameters the particular mass of the projectile point is fixed and any deviation from that mass will cause the efficiency of the system to deteriorate. The perameters of the point mass for any particular system design can vary from two to three grams, but for peak efficiency a consistant point mass is required. A dart designed to use a six gram projectile point will not function properly with a twelve gram point. It can however, function within acceptable parameters with a five or seven gram point but to its full potential.

POINT MASS DEVIATION

In experiments using darts designed to function most effectively using a point mass of nine grams, a measurable drop in performance was noted when the mass of the point was altered by 1.5 grams. When point mass was increased to 11.5 grams or decreased to 7.5 grams overall distance decreased by 3 to 7 yards from a maximum of approximately 120 yards. Accuracy, being highly subjective, was not tested during this experiment. It was noted however, by an outside observer that launch characteristics did not seem to be as smooth and efficient when point mass was altered from design specifications. This experiment demonstrated the sensitivity of point mass to the overall performance of the system. In the archaeological record the more recent dart points are generally lighter, which if the premise of projectile technology is true, represents a higher degree of sophistocation in the designing of the system. Make a lighter particle go faster. As dart points became lighter in the more recent and advanced systems, the more critical the point mass becomes and the less deviation from design standards can be tolerated. As an example, if a system is designed to use a 12 gram point, mass of 10 to 14 grams can be used efficiently, but if a system is designed for a four gram point the tolerable deviation is less than one gram. It is believed that when ancient people designed their atlatl and dart systems, consistency in this area was taken into consideration and ***manifests itself in the archaeological record as tool traditions.***

TOOL TRADITIONS

Projectile points of a certain tool tradition are primarily identified by style. Size, material, and knapping techniques are noted to a lesser degree, but mass generally not at all. The stated purpose for the various styles is hafting technique and indeed this would seem to be the case due to the variety of notched, stemmed, and fluted points found. Hafting technique certainly plays a role in certain styles of points and the similarity of points of particular tool traditions, but as the primary function, hafting technique falls short when considering the point as a part of a mechanical system.

What can be seen in the similarities of points within a tool tradition when considering the point as part of a mechanical system is production line consistency. For a weapons system of any degree of sophistocation consistency in the manufacture of its various components is paramount for the success of its deployment. It is primarily the mass of the projectile in question which weapons designers have been concerned with.

While studying atlatls and related artifacts at the Smithsonian Institute in Washington D.C., I came across a collection from a site in South Dakota. The collection contained two or three atlatl weights which were my primary interest, but also from the same site were several projectile points and preforms. Three of the points appeared to be new and unused with no indication of resharpening. Two of these points were made from what appeared to be the outer cortex of chert, but the third was definitely knife river flint, an extremely dense, hard material. Width, thickness and notching were all approximately the same but the length of the knife river flint point was a full centimeter shorter than the other two.

In a test of my theory that point mass within the the atlatl and dart system is critical all three were weighed on a digital scale. The results were astounding. All three points weighed essentially the same at 7.6, 7.7, and 7.8 grams respectively. This certainly suggests that mass was an important consideration i the manufacture o fprojectile points. Being that width, thickness, and notching were also approximately the same suggests a secondary importance to these dimensions, with length being adjusted from material type to material type i order to keep mass consistant, standardizing the projectile points of this tool tradition.

Therefore, the similarities between points within a tool tradition can be seen not primarily as a hafting technique or some sort of ceremonial process, but as an attempt to standardize a weapons system's mechanical efficiency.

The fact is stone is not predominantly used in the manufacture of projectile points because of its durability, convenience, or its ability to pierce hide and flesh. Other materials such as bone, antler, and just an old fashioned pointy stick meet these needs and are much easier to work with. ***But stone possess one quality all others do not -- density.*** Projectile points of these other materials can be made to have the same mass as stone points, but they would be larger and less efficient and therefore less desirable than stone.

DART DESIGN

It is the mass of stone points which must be more carefully analyzed in order to gain a more complete understanding of the entire weapon from which it was once an integral part. The lighter the point the more sophistocated the system, but there are limits to the minimum mass which will function in the system. Part of this minimum limit has to do with the materials the

dart is manufactured from. The less dense the dart material, keeping in mind the perameters of length and flexibility, the lighter the point mass that can be successfully used in a dart of that material. I have experimented with several types of dart material and have found that "locally" (Gallatin Valley) red oisier dogwood is best. With this material a dart with a minimum point mass of about five grams can be designed for peak performance. But being that the density of red oisier is .6 kg/L the lighter the projectile point the less influence it has on this material. Dart materials of lesser density, such as cedar, can be designed to function efficiently with lighter point masses.

I have designed darts made from cedar which function efficiently with point masses of three to four grams. Darts of this design were about 54 inches in length and functioned well with 18 to 20 inch atlatls at an effective killing range of about 25 yards. Beyond this it is my opinion, that attempting to design a dart that will function properly with a less than three gram point mass will render the overall mechanics of the system ineffective. As the dart shortens the effective range of the system also shortens in order to maintain the proper timing match between atlatl and dart. Also, being that the atlatl's acceleration is angular rather than linear, less velocity is achieved by the shorter atlatls which are required to function with shorter darts.

It is possible to design a dart that will just function without any point mass at all, but we want atlatls that are efficient. A dart can be made to toss down range but we want something efficient enough to hunt or war with - not a toy.

What I am ultimately trying to point out is that when designing this weapons system many factors must be taken into consideration. And when a particular aspect of this system is considered by itself, such as the point mass, and a minimum requirement it established such as minimum mass, many other inter-relating factors must be considered, such as performance requirements and available materials. If I were required to design an atlatl and dart system to function efficiently using a two gram point mass from locally available materials, I could come up with a design using red oisier dogwood which could have an effective range of ten or fifteen meters. The dart would be approximately one meter in length and the atlatl one third of that length using an influencing atlatl weight mass of 20 grams. But would this be a viable weapon? Probably not.

MAXIMIUM POINT MASS

In considering what is the maximum point mass that can be tolerated in the atlatl and dart system, all aspects of whatwere considered for minimum point mass are reversed. With greater point mass goes greater dart and atlatl length. The aborigines of Australia are known to use darts up to 12 feet in length with correspondingly long atlatls of more than three feet in length. Although I have never had the opportunity to weigh any Australian dart points, I have seen many of them on these extremely long darts in the Smithsonian collections. They are

quite large and certainly in excess of 20 grams, but it is my opinion that systems of thismassive of a design are far less efficient than those of more reasonable dimensions. Also in cases of dart lengths in excess of eight feet, point mass becomes less critical for efficient operation due to the leading mass of the dart material itself helping in compression along the entire length of the dart. Indeed, some Australian darts had no stone points at all and did not appear to be designed for any. Knwing the mechanics of the system the way I do I am sure these darts functioned quite adequuately. So long as the dart is sufficiently flexible, extreme length gives stability. However, it is my opinion that the Australian atlatl systems represent extremely crude technology. One based on brut force rather than efficiency, and merely one step above hand thrown spears in their developement.

CONCLUSION

The mass of the projectile point plays a critical role in the mechanics of the atlatl and dart system. With a sufficiently light dart material a point mass of three grams can be used in an efficient design. With a sufficiently long dart no point mass at all need be applied, but the cumbersome nature of this design and it's inherent lack of efficiency excludes it completely.

The lighter the point mass the more technologically advanced the system. And the more advanced the atlatl system the greater the consistancy of the point mass required for uniform standard performance. A good test of this theory would be to weigh points from a single site of a known culture.

There is also what I call "effective mass." This is the mass of the point after it has been hafted onto a shaft. In experiments conducted in hafting projectile points I have found that the glue, sinew bindings, and the surrounding wood of the notch itself add an average of one gram to the overall mass of the point. So in effect a 2.5 gram point has the effective mass of 3.5 grams. At this weight is it a dart point or an arrow point?

On the high end of distinguishing between dart and lance points the question becomes a bit grey. A 25 gram point could certainly be part of a less technologically advanced atlatl system, but it might also be a lance point or even a knife blade.

In my research I have found that the overall average mass of dart points is approximately 9 grams, and in fact, this is the mass I prefer and use most often in my atlatl and darat systems. But I've also designed systems that use a mass as light as 3 to 4 grams and as heavy as 15 to 20 grams. What I have definitely found is that once a system is designed to use a particular point mass, stick with it. Deviating form that mass or for that matter anything else such as dart length, atlatl length, or flexibility changes the entire feel of the system entirely. This system is so sensitive that changing the length of the dart by so much as one inch changes the entire feel of the system and causes the dart to launch earlier or later in the swing, thus changing its point of impact on the target. ***This is why foreshafts were used.*** When a dart is

launched down range the chances of the stone point breaking upon impact are greater than 50%. Sometimes the breakage can be repaired with some loss of the mass, but still remain within functioning parameters. But if the point snaps and takes part of the haft with it, a one piece dart would be shortened considerably when a new point is rehafted onto it. A shorter dart is a stiffer dart, but with the advent of foreshafts this problem is completely avoided.

Point mass and it's consistancy certainly play an integral role in the mechanics of an atlatl and dart system. But no more so than dart length, dart flexibility, and atlatal weight mass, not tomention the materials that go into the construction of the system. A complete understanding of this impressively complex weapon must be achieved before any single component can be properly analized. So long as it is thought of and referred to a "spear thrower" that will never happen.

You can order a catalog showing the atlatls and darts that BPS Engineering has for sale by writing to them at: BPS Engineering, Box 797, Manhattan, Montana 59741.

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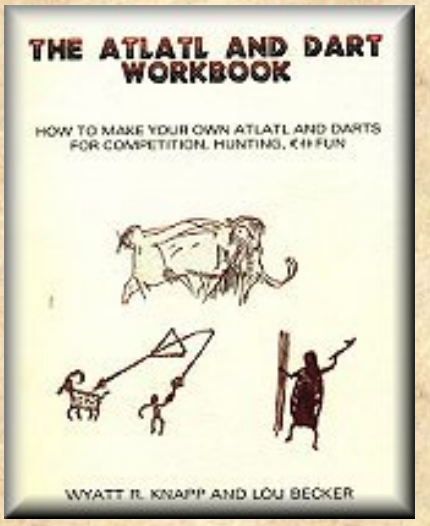
THE ATLATL AND DART WORKBOOK

HOW TO MAKE YOUR OWN ATLATL AND DARTS FOR COMPETITION, HUNTING, AND FUN

WYATT R. KNAPP AND LOU BECKER

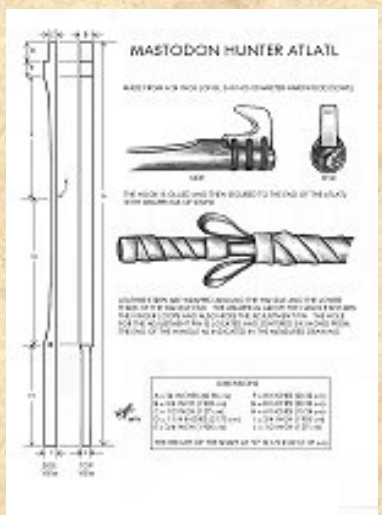
REVIEWS ABOUT THE AUTHORS



Just released from Onagocag Publishing is the book you have been waiting for! A complete reference guide to everything you need to know to build your own atlatl and dart set for hunting, competition, and fun. In this book you'll find plans for four different atlatls and three different darts. This generous, full size 8 1/2" by 11" book has over 90 pages of solid information on this wonderful ancient weapon system. It's chock full of beautiful, measured drawings (metric measurements included), pictures, and step by step written instructions that will guide you through the building process and then show you how to use your new equipment. And it's spiral bound so that it will stay open on your workbench as you reference it.

The variety of designs being used and sold out there can be daunting to the contemporary atlatlist. Some are good. But some are poorly designed and can give a false impression as to the effectiveness of the system. With all of the different ideas about how to make an effective, dependable atlatl and dart system, how does one know how to proceed? How can a person plow through all of the data and designs and come up with a system they can feel confident about using?

That's where this book comes in. In it you will have the benefit of over twenty-eight years of atlatl and dart experimentation, manufacturing, and expertise. The designs



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Chapter 4 : Two flexible style atlatls.
Chapter 5 : Building an early style dart.
Chapter 6 : Building the modern graphite dart.
Chapter 7 : Building the "Bison Hunter" wooden dart.
Chapter 8 : Atlatl games, safety, and how and where to compete with the atlatl.
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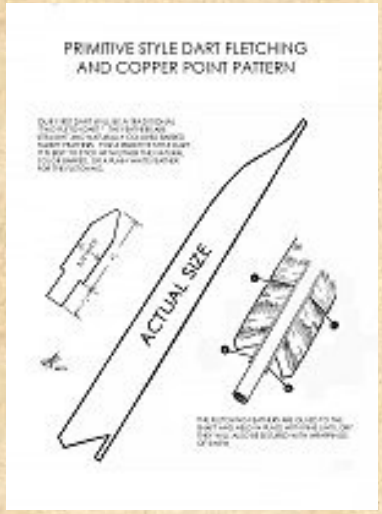

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Home

ANCIENT TANNING METHODS

NOTE: ***What follows is a general outline of what is involved in brain tanning hides. There are many different "formula's" or directions for tanning out there. Some are simpler and some more involved. I heartily recommend following the links at the end of this article for those who want to try brain tanning. Then with a little research you will be more likely to achieve a more specific and successful recipe. -WK-***

Technically speaking, the primitive method of preparing leather for clothing which we will be discussing here isn't really tanning. What one is doing is stretching and working the hide into a usable, stable state. Preservation is asssisted by a smoking process which colors the hide as well.

The hide should be fresh when you begin this process. Old hides or hides that have begun to decompose are not desirable. Don't use them. The first thing you need to do is to soak the hide in clean water for a couple of days. Change the water daily and make sure the hide remains **completely** submerged during the entire soaking process. Rocks are often used to keep the hide weighted down under the water. After a couple days, check the hide and see if the hair is ready to "slip." If you can remove the hair you are ready for the fleshing step. If it doesn't slip you may have to sprinkle wood ashes onto the hide, rub them in, and roll it up with the fur side in. After a day or so test the hide to see if the ashes have done their work and then rinse the hide in cool, clean water. The ashes make a lye which loosen the hair. If you are doing a hide from a deer you shouldn't have to worry about using ashes-two or three days of soaking in the water should do it. The only thing that would make you wait more than three days is if it's real cold outside. Then it could take a few days longer.

Fleshing The Hide

The water is wrung out of the hide and it is put on a fleshing beam. This is a debarked log that is buried into the ground so that it sticks out at an angle that puts the end of it about waist high. Then you scrape every bit of fat, flesh, and hair of the hide. It takes a lot of elbow grease. You are not only removing stuff, but also evening out the thickness of it. You're trying to make things as uniform as you can. Rinse the hide thoroughly in cold water and wring it out. Now lace the hide to a large frame and stretch it tight.

And Now..The Brain In "Brain Tanning"

Mix the brains from the animal into warm water and mash them up into a paste. If you don't have enough brains to make enough paste for your hide you can add liver paste or get some cow brains. Rub the brain mixture into the stretched hide until it is thoroughly saturated and soaked in. Remove the skin from the frame and soak it in water again and then wring it out. Stretch it on the frame again and now the real work begins.

"Breaking The Hide"

There are a couple of ways to "break' the hide. The first is while it is in the frame or stretched between two trees or something, you take a tool that looks like a canoe paddle and use it to push on the hide. You apply pressure inward and push and pull the paddle across every part of the hide. When you do this it breaks down part of the cell structure and leaves the hide soft and supple. Rinse the hide and repeat this step several times before going to the final step of smoking the hide.

Another way that I read in ***The Indian How Book***, is to soak the hide in water and loop it around a tree. Then you take a stick and shove it into the loop and twist and twist the hide until its tight. Then you let it dry, soak it again in water, and repeat the stretching process until its soft and even.

Smoke Coloring and Preservation

Finally, hot coals are covered with wet oak chips, or corn cobs, or beech wood chips. The hide is tented over the smoke and the smoke is made to fully permeate every part of the hide. Be very careful not to let the coals blaze into flame so that your hide doesn't catch on fire or get burned. Watch things carefully and don't leave things alone. When the hide is the shade of brown you want take it down and fold it up for several days and you're done.

Let me say that there are several variations on this method. This is only one. I would strongly suggest that you visit BRAIN TAN.COM. It can be accessed by clicking the URL listed below. There you will find a great deal of information on how to pursue this ancient craft. Good Luck!!

For more information:

Natural tanning and leather resources.

- THE NATIVE TECH TANNING PAGE

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Here are some sites you can explore that should help you find more information on the buckskinning experience. Like information on rendezoux, acoutrements, reenacting and recreation of historical items.

- COON & CROCKETT MUZZLELOADERS HOME PAGE

- THE PEDERSOLI HOME PAGE

This is the online catalog and homepage of master craftsman David Pedersoli. This is the guy who made the flintlock rifle that I use. Pedersoli makes museum quality replicas of historical firearms. He's simply one of the best.

- BUCKSKINS AND BLACKPOWDER!

A great source for information and many links to various buckskinning related themes. Highly recommended!

- Don't forget our regular link page which you can access from the main page. There are other links there that might relate to buckskinning.

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THE WHALE DRUM

I enjoy making tom-toms and drums influenced in style by the ones made traditionally by the American Indians. I especially like Northwest Coast Indian art and try to employ that style of painting on my drums. Above is a very large drum that I made for my son. It has a spruce hoop and I cut the lacings and the top out of rawhide. After punching the holes around the perimeter of the top, I soaked the rawhide in water until thoroughly softened and then stretched it over the hoop. Now it could dry for a few days. I always enjoy the sound of the hoop and the lacings ticking and popping as things tighten up!

After, everything is dry I freehand draw the artwork for the drum on a large piece of drafting paper and then transfer it to the drum head (Aaron said right from the start that he wanted a whale). Using appropriate colors I then paint everything in. (In the picture above that blue color is supposed to be more of a dusty blue color. The camera didn't catch it right.) I think the result makes a beautiful display and they have a really great sound. I've also made a double sided drum out of a hollowed out cotton wood log. Next I think I'm going to try and make a huge drum with my Dad out of half of an old wooden barrel complete with drum skirt and four hanging poles. I bet that thing's gonna ring out!

I really like making them and have done it since I was a young man. But one of my earliest memories is my Dad making me a drum when I was about 4 or 5 years old. I still remember the magical feeling I had when he gave it to me and I first heard the thrilling sound it made! So of course I had to continue this tradition with my own kids!

I'll try and put some information up that tells how to make the beater or drum stick, and I'll also try to get some pictures of my other drums up soon as well.

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The Nazca Lines Revisited: Creation of a Full-Sized Duplicate

Re-creation of a 440-foot Nazca figure on a Kentucky field shows how the Peruvian drawings were most likey made.

Joe Nickell

Joe Nickell teaches writing at the University of Kentucky. A former professional stage magician and private investigator, he is best known for his research on the Turin "shroud" and is author of Verdict on the Shroud, *published by Prometheus books earlier this year.*

Called "Riddles in the Sand" (Discover 1982) they are the famous Nazca lines and giant ground drawings etched across 30 miles of gravel-covered desert near Peru's southern coast.

The huge sketch-pad came to public prominence in Erich von Däniken's *Chariots of the Gods?*--a book that consistently underestimates the abilities of ancient "primitive" peoples and assigns many of their works to visiting extraterrestrials. Von Däniken (1970) argues that the Nazca lines and figures could have been "built according to instructions from aircraft." He adds:"Classical archeology does not admit that the pre-Inca peoples could have had a perfect surveying technique. And the theory that aircraft could have existed in antiquity is sheer humbug to them."

Von Däniken does not consider it humbug, and he obviously envisions flying saucers hovering above and beaming down instructions for the markings to awed primitives in their native tongue. He views the large drawings as "signals" (von Däniken 1970) and the longer and wider of the lines as "landing strips" (von Däniken 1972). But would extraterrestrials create signals for themselves in the shape of spiders and monkeys? And would such "signals" be less than 80 feet long (like some of the smaller Nazca figures)?

As to the "landing strip" notion, Maria Reiche, the German-born mathematician who for years has mapped and attempted to preserve the markings, has a ready rejoinder. Noting that the imagined runways are clear of stones and that the underlying ground is quite soft, she says, "I'm afraid the spacemen would have gotten stuck" (McIntyre 1975).

It is difficult to take von Dänekin seriously, especially since his "theory" is not his own and it originated in jest. Wrote Paul Kosok (1947), the first to study the markings: "When first viewed from the air, [the lines] were nicknamed prehistoric landing fields and jokingly compared with the so-called canals on Mars." Moreover, one cropped photo exhibited by von Däniken (1970), showing an odd configuration "very reminiscent of

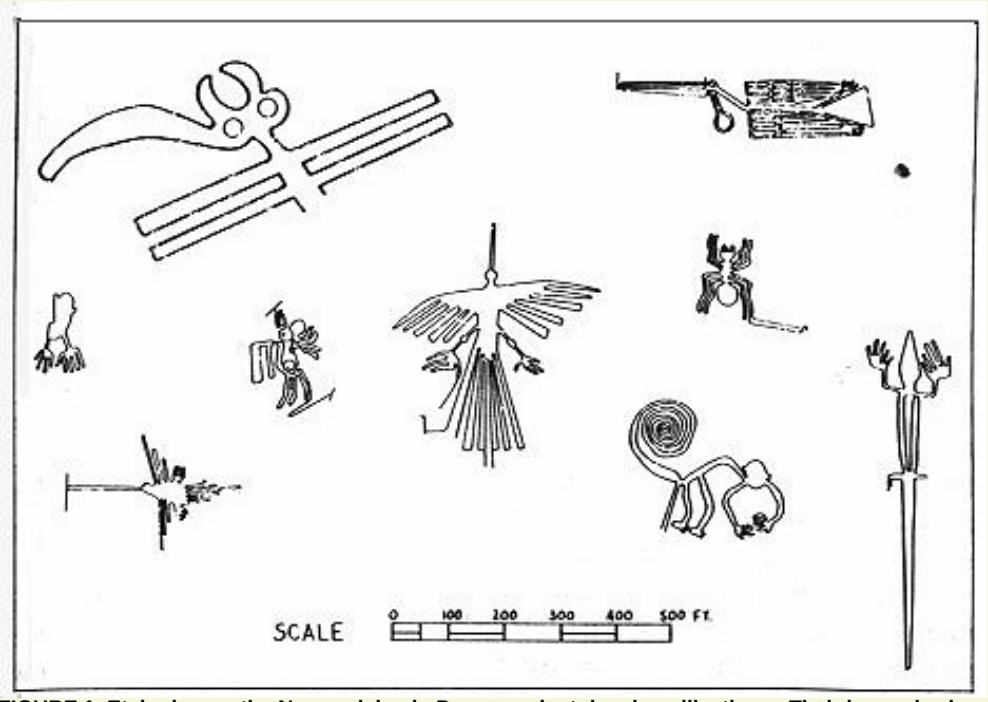

FIGURE 1. Etched upon the Nazca plains in Peru are giant drawings like these. Their large size has fueled speculation that they were drawn with the aid of "ancient astronauts" or by sophisticated surveying techniques, the secrets of which are lost.

the aircraft parking areas in a modern airport," is actually of the knee joint of one of the birds figures (Woodman 1977). (See Figure 1.) The spacecraft that parked there would be tiny indeed.

Closer to earth, but still merely a flight of fancy, in my opinion, is the notion of Jim Woodman (1977) and some of his colleagues from the International Explorers Society that the ancient Nazcas constructed hot-air balloons for "ceremonial flights," from which they could "appreciate the great ground drawings on the *pampas*." If one believes that the theory is also inflated with hot air, one must at least give Woodman credit for the strength of his convictions. Using cloth, rope, and reeds, Woodman and his associates actually made a balloon and gondola similar to those the Nazcas might have made had they actually done so. Woodman and British balloonist Julian Nott then risked their lives in a 300-foot-high fly-over of the Nazca plain. Their balloon was descending rapidly and after they had thrown off more and more sacks of ballast they jumped clear of their craft some ten feet above the *pampas*. Free of the balloonists' weight, the balloon shot skyward and soared almost out of sight, only to finally crash and drag briefly across the ground.

The Nazca markings are indeed a mystery, although we do know who produced them--von Däniken notwithstanding. Conceding that Nazca pottery is found in association with the lines, von Däniken (1970) writes: "But it is surely oversimplifying things to attribute the geometrically arranged lines to the Nazca culture for that reason alone."

No knowledgeable person does. The striking similarity of the stylized figures to those of known Nazca art has been clearly demonstrated (Isbell 1978; 1980). In addition to this iconographic evidence must be added that from carbon-14 analysis: Wooden stakes mark the termination of some of the long lines and one of these was dated to A.D. 525 (±80). This is consistent with the presence of the Nazca Indians who flourished in the area from 200 B.C. to about A.D. 600. Their graves and the ruins of their settlements lie near the drawings.

The questions of who and when aside, the mystery of *why* the markings were made remains, although several hypotheses have been proffered. One is that they represent some form of offerings to the Indian gods (McIntyre 1975). Another is that they form a giant astronomical calendar or "star chart." Writing in *Scientific American*, William H. Isbell (1978) states:

As Reiche has pointed out for many years, certain of the Pampa Colorada lines mark the position of the sun at the summer and winter solstices and certain other lines also appear to have calendrical significance. A computerized analysis of line orientation conducted by Hawkins, although it failed to demonstrate that a majority of the lines have astronomical significance, showed that twice as many of them were oriented with respect to annual solar and lunar extremes than would be expected on the basis of chance.

Isbell himself suggests that an important function of the markings was economic and "related to the drafting of the community labor for public works," although at best that is only a partial explanation.

Still another suggestion (first mentioned by Kosok) comes from art historian Alan Sawyer (McIntyre 1975): "Most figures are composed of a single line that never crosses itself, perhaps the path of a ritual maze. If so, when the Nazcas walked the line, they could have felt they were absorbing the essence of whatever the drawing symbolized." Sawyer is correct in observing that most of the figures are drawn with a continuous, uninterrupted line. But there *are* exceptions, and it is possible that the continuous-line technique is related to the method of producing the figures, as we shall discuss presently.

In any case, these are only some of the hypotheses; whatever meaning(s) we ascribe to the Nazca lines and drawings must be considered in light of other giant ground-markings elsewhere. Even putting aside the Japanese and European ones--e.g., the White Horse of Uffington, England, which is known from as early as the twelfth century (Welfare and Fairley 1980)--we are left with numerous ground drawings in both North and South America.

In South America giant effigies are found in other locales in Peru, for example, and in Chile, in the Atacama Desert (Welfare and Fairley 1980). Interestingly, the plan of the Incan city of Cuzco was laid out in the shape of a puma, and its inhabitants were known as "members of the body of the puma" (Isbell 1978; 1980).

Turning to North America, there is the Great Serpent Mound in Ohio and giant effigies in the American Southwest. In 1978, with the aid of an Indian guide, I was able to view the ground drawings near Blythe, California, in the Mojave Desert. Like the Nazca figures, the Blythe effigies are large and give the impression they were meant to be viewed from the air. Also in common with the Nazca figures, they were formed by clearing away the surface gravel to expose the lighter-colored soil. However, although they are thought to date from a much later period (Setzler 1952), none of the Blythe figures match the size of the largest Nazca drawings; and the human figures and horselike creatures are much cruder in form, typically having solid-area bodies and sticklike appendages--quite unlike the continuous-line drawings of Nazca (yet somewhat similar to some of the Chilean effigies). Moreover, absent from the Blythe site are the "ruler-straight" lines that may or may not have calendrical significance.

In short, there are similarities and dissimilarities between the Nazca and other ground drawings that complicate our attempts to explain them. Certainly the Blythe and other effigies have no attendant von Dänikenesque "runways"; neither do their crude forms suggest they were drawn with the aid of a hovering spacecraft. And there is nothing whatever to warrant the assumption that they were made to be viewed by select native balloonists on aerial sorties.

It seemed to me that a study of *how* the lines were planned and executed might shed some light on the ancient riddle. English explorer and film-maker Tony Morrison has demonstrated that, by using a series of ranging poles, straight lines could be constructed over many miles (Welfare and Fairley 1980). (The long lines "veer from a straight line by only a few yards every mile," reports *Time* [1974].) In fact, along some lines, the remains of posts have been found at roughly one-mile intervals (McIntyre 1975).

By far the most work on the problem of Nazca engineering methods has been done by Maria Reiche (1976). She explains that Nazca artists prepared preliminary drawings on small six-foot-square plots. These plots are still visible near many of the larger figures. The preliminary drawing was then broken down into its component parts for enlargement. Straight lines, she observed, could be made by stretching a rope between two stakes. Circles could easily be scribed by means of a rope anchored to a rock or stake, and more complex curves could be drawn by linking appropriate arcs. As proof, she reports that there are indeed stones or holes at points that are centers for arcs.

But Reiche does not detail the specific means for positioning the stakes that apparently served as the centers for arcs or the end points of straight lines. In her book she wrote, "Ancient Peruvians must have had instruments and equipment which we ignore and which together with ancient knowledge were buried and hidden from they eyes of the conquerors as the one treasure which was not to be surrendered." Be that as it may, Isbell (1978) states: "Maria Reiche, using scale models, has made major advances toward demonstrating how Nazca ground art was produced. Although more research needs to be done, the prehistric engineering skills are no longer completely unknown."

Isbell himself suggests that the Nazcas used a grid system adapted from their weaving experience, a loom "establishing a natural grid within which a figure is placed." All that would be necessary, he observes, would be to simply enlarge the grid to produce the large drawings.

However, as one who has used the grid system countless times (in reproducing large tradmarks and pictorials on billboards--summer work during my high school and college years), I am convinced the grid system was not employed. To mention only one reason, a characteristic of the grid method is that errors or distortions are largely confined to individual squares. Thus, the "condor" drawing in Figure 1--with its askew wings, mismatched feet, and other asymmetrical features--seems not to have been reproduced by means of a grid.

Other, even less likely possibilities would be the plotting of points by a traverse surveying technique (such as is used today to plot a boundary of land) or by triangulation. Having some experience with both of these, I note that such methods depend on the accurate measurement of angles, and there appears to be no evidence that the Nazcas had such a capability.

I decided to attempt to reproduce one of the larger Nazca figures--the 440-foot-long condor in the center of Figure 1--using a means I thought the Nazcas might actually have employed. I was joined in the project by two of my cousins, John May and Sid Haney. The method we chose was quite simple: We would establish a center line and locate points on the drawing by plotting their coordinates. That is, on the small drawing we would measure along the center line from one end (the bird's beak) to a point on the line directly opposite the point to be plotted (say a wing tip). Then we would measure the distance from the center line to the desired point. A given number of units on the small drawing would require the same number of units--larger units--on the large drawing.

For this larger unit we used one gleaned by Maria Reiche from her study of the Nazca drawings and approximately equivalent to 12.68 inches. For measuring on the ground, we prepared ropes marked off with paint into these Nazca "feet," with a knot tied at each ten-"foot" interval for a total length of 100 units. To aid in accuracy in plotting on the ground, we decided to employ a "T" made of two slender strips of wood. With this we could ensure that each measurement made from the center line would be at approximate right-angles to the line.

My father, J. Wendell Nickell, took charge of logistics--including obtaining permission to use a suitable giant "drawing board" (a landfill area in West Liberty, Kentucky, owned by Dr. C. C. Smith, to whom we are grateful) and securing the services of a pilot for the subsequent aerial photography. Since we could not mark the lines by clearing the gravel to expose lighter-colored earth, as the Nazcas did, we planned to simply mark them with white lime, as one marks a playing field. With the addition of my young cousin, Jim Mathis, and my 11-year-old nephew, Conrad Nickell, our work crew of Indians was complete.

On the morning of August 7, 1982, the six of us assembled at the site and immediately began by laying out the center line. Some nine hours, one meal, and much ice-water later, we had plotted and staked the last of 165 points and had connected them with twine.

Here, I think, we differed slightly from the Nazcas, for I seriously doubt they expended just over a mile of string (the total distance traversed by the outline). I rather suspect that they made their furrows (or at least preliminary scratched lines) as they progressed in plotting the various points. We could not do this, since rain threatened and would certainly obliterate our lines of powdered lime. But we did find it helpful (though not essential) to connect our points in sequence, to prevent possible confusion with the stakes sometimes clustered rather closely together. (Otherwise we would have needed only a single long length of cord, to be used for the final marking of each straight line.)

The rains did come, and while no harm was done to our staked-out condor, large puddles (then more rain and still more puddles) prevented our completing our project for about a week. Finally, the ground had dried, the weather forecast was good, and the pilot was on standby. My father and I then spent much of one day marking the lines, finishing just in time to see the airplane circling.

Jerry Mays, a skilled local pilot, then took John and me up in his Cessna for a preliminary look and the taking of photographs, which John accomplished at just under 1,000 feet.

As figure 2 shows, our work was a success. In fact, the results were so accurate that we were convinced that we could have easily produced a more symmetrical figure by this method. Thus it would seem--unless they employed an even simpler method of making the enlargement--that the Nazcas plotted considerably fewer points. That coupled with mere visual estimation of the right angles and less careful measurement (distances might simply be stepped off), could account for the imperfections we observed. Also, an entire small area, such as a foot, could have been done completely freehand. (Our own freehand work was minimal: We produced the circle of the head by scribing it with a rope. All other curves were *marked* freehand; of course we *had* plotted the numerous points that served as guide, although we bypassed stakes slightly in attempting to draw smooth curves.)

It is frequently asserted that the Nazca

FIGURE 2. A duplication of the giant "condor" drawing made full size and utilizing only sticks and cord such as the Nazcas might have employed. The experimental drawing--possibly the world's largest art reproduction--is viewed here from just under 1,000 feet.

drawings are recognizable only from the air. That is not quite true, certainly not of the smaller figures, such as the effigy of the fish, which is only 80 feet long (Reiche 1976). Neither is it true of some drawings--attributed to the Nazca's predecessors--that are found on hill slopes (McIntyre 1975; Isbell 1978, 1980). Here, seemingly, is a clue to how the Nazcas could have been confident of the accuracy of their method of enlargement. Once a technique was found to be successful for producing large drawings on slopes, where they could actually be viewed from the ground, the same technique could be expected to consistantly yeild good results--wherever figures were drawn and whatever their size.

Moreover, even the large drawings can be appreciated to some extent from the ground. With our condor, we were able to see whole portions--such as the body and head, leg and foot, the entire fan of the tail--and thus had determined the figure was reasonably accurate even before our fly-over. We felt that an observer would be able to recognize it as a bird.

To test this possibility, my father took wildlife biologist Harold Barber to the site. Although Barber knew nothing of our project, and Nazca was deliberately not mentioned, on viewing the figure he recognized the drawing as one of the Nazca birds. That he was familiar with the Nazca ground drawings was unfortunate for our experiment (and rain prevented another); but the salient point is that he was able to identify the figure as a bird rather than a spider, fish, monkey, or some other figure. In fact, when he was later shown pictures of several Nazca bird drawings, he immediately and correctly identified ours as the condor.

In summary, we do know that it was the Nazcas who produced the drawings. While their large size does suggest the possibility that they were meant to be viewed from above, as by the Indian gods, the figures can be recognized, at least to some extent, from the ground. The drawings could have been produced by a simple method requiring only materials available to South American Indians centuries ago. The Nazcas probably used a simplified form of this method, with perhaps a significant amount of the work being done freehand. There is no evidence that extraterrestrials were involved; but, if they were, one can only conclude that they seem to have used sticks and cord just as the Indians did.

Acknowledgments

In addition to those mentioned in the text, the author also wishes to thank his mother, Ella T. Nickell; Robert H. van Outer and the University of Kentucky Photographic Services; Carl Burton; and the May Grocery Co. and the Blair Wholesale Grocery Co., both of West Liberty Kentucky.

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The *Committee for the Scientific Investigation of Claims Of the Paranormal* (CSICOP) and its magazine, *The Skeptical Inquirer*, have been around since the 1970's. They continue to be involved in the open-minded and scientific exploration of many of the mysteries that intrigue us. They strive to separate "fact from myth in the flood of occultism and psuedoscience on the scene today." To learn more about this great organization you can visit their website at http://www.csicop.org/si/. Be sure to check it out, you will find it interesting and thought provoking.

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OUTDOORSMEN
KNIFE COLLECTORS
NATIVE AMERICANS
PRIMITIVE SKILLS ENTHUSIASTS
ARE YOU A FELON?
NOT ANYMORE IN MICHIGAN!

* * * VICTORY!! * * *

On December 6, 2000, the Michigan Flintknapper's ammendment to Michigan's concealed weapons law was passed removing the threat of felony prosecution for Michigan's experimental archeologists, hobbiests, flintknappers, arrowhead collectors, and traditional hunters. Our law now exempts double edged, conchoidally fractured stone tools.

I would like to thank all of those from across the country who helped us pass this legislation. Your letters to our representatives and senators helped us obtain this victory and to set a precedent here in Michigan that will help you in your states if something like what we faced ever came up.

THANK YOU FOR YOUR HELP!

History Of Our Amendment

1999-Whether you are a resident of the state of Michigan or not, the following could be of great consequence to you now, or in the near future, if you are someone who enjoys the outdoors and primitive skills. The work currently being undertaken in Michigan could help you to prevent the loss of stone tool making in your state. Please read on and see if you can help to protect our craft and to set a precedent that could help you in the future. Then read how you can help.

Under the current concealed weapons statute in Michigan you are

subject to a felony arrest and a five year prison sentence if you carry, or even have accessible in your vehicle, a stone knife. Because stone or "flint" knives are double-edged they fall into the category of illegal felonious weapons. That needs to be changed!

Senate Bill 1181 (fromerly 415) and House bill 5546 are brief pieces of legislation sponsored by Senator Joanne Emmons and Representative Larry DeVuyst, which will decriminalize the carrying and transport of double-edged stone knives or artifacts.
Unfortunately this won't happen without your help.
These bills will be sent to the Senate Judiciary Committee and a House committee for consideration. For this legislation to move down the path to passage, legislators need to know that it has constituent support and they also need an accurate understanding of the nature of stone tools.

Please take a few moments to write a letter, card, or brief e-mail politely voicing your support of this bill. Key points to make are that stone knives do not present any significant danger to the public because they are relatively fragile and can easily break if used in any violent fashion. In fact, there is no evidence that they have ever been used in any kind of criminal activity. Also, many traditionally minded hunters enjoy using stone knives to field dress their game and would like this matter resolved before the upcoming 1999 hunting season.

Furthermore, flintknapped stone knives are not only a form of Native American art, but also an art form pertaining to every race of ancient man. They are not only collectibles, but also used to study and re-create the past by professionals and non-professionals alike. No matter where your ancestors originated throughout the world, stone

knives were a part of your heritage. Many people who make, collect or use stone knives are involved in educating the public and understanding our past. Let's reform this law so that they, and anyone else who chooses to use or collect stone knives, are not subject to criminal prosecution.

Here's what you can do to help.

Bill passed in December of 2000. Thanks for your help!!

HISTORY: JANUARY 11, 2000

The battle for this bill is still being waged and I wanted to include this update. Here's what's been happening for the last several months.

Since this page was put up last summer a Michigan law enforcement lobby had come come out against the amendment we are seeking. Their objections were most certainly based on emotion and lack of understanding about stone tools, their creation, their durability and function. Last fall we had an opportunity to present our case at a hearing with the committee at the state capital in Lansing, Michigan. We believe were able to finally help them to understand that these are fragile tools that should be regarded more as cutlery than violent stabbing weapons.

Two other promising things happened at this meeting. First, the Michigan State Police signed in as "neutral" in regard to this bill. Secondly, no representatives from the law enforcement lobby bothered to show up, while many representatives from around the state who support our amendment made it there.

Sadly, as part of the agreement by the committee that they would

even hear our case, a vote was not to be taken at that time. The issue would instead be taken under advisement for a possible vote at a later time. So while we made great headway--we are still fighting for a vote. It looks like we won't even get a chance for a vote to be scheduled for our amendment until February. We have to do whatever we can to keep the information from our hearing fresh in the minds of the committee until then, or have lost our momentum and the headway we feel we have made.

Our thanks to all of you have helped us so far. Please continue to think of us and to spread the word. As it stands now, the way this law is written, no flintknapper or arrowhead collector can possess an arrowhead without violating the current law. No Native American can come to a Michigan Pow-wow to sell his stone-knapped art, nor can he wear a flint knife as part of his regalia, without violating current Michigan Law.

This amendment is definitely something we can accomplish--as long as we work together. Please write them if you can and politely urge them to pass Senate Bill 415.

Thank you. -*Wyatt*

History: April 2, 2000

The bill has been reintroduced to the senate and house under the new numbers as described above. It should be scheduled for another committee meeting soon. Your help is needed now more than ever. Please do what you can to help Michigan set a precedent that will help safeguard stone point manufacture for hobbyists, hunters, collectors, Native Americans, and researchers.
Thank You.

December 6, 2000- The ammendment passes.

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