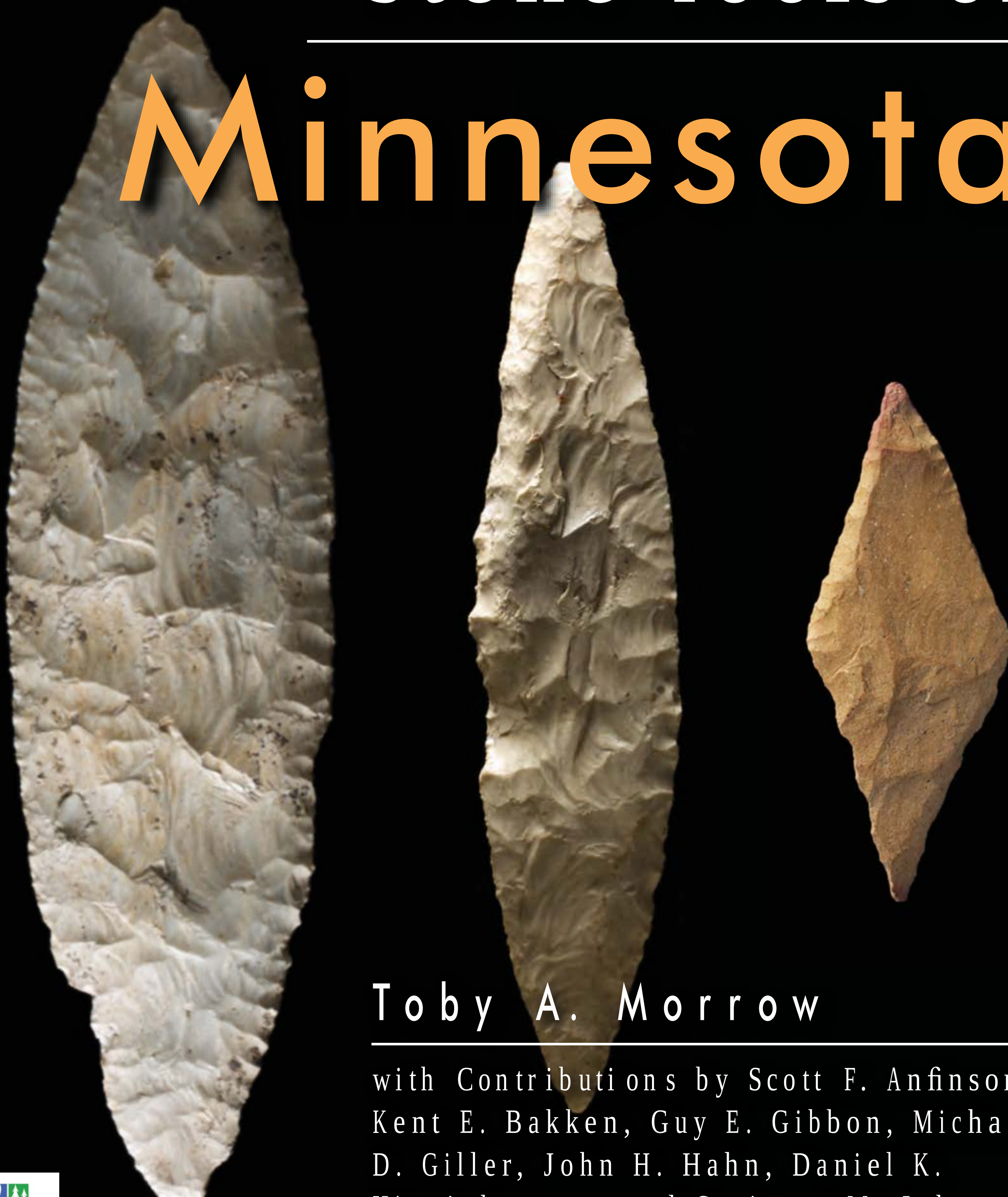
Stone Tools of Minnesota



Toby A. Morrow

with Contributions by Scott F. Anfinson, Kent E. Bakken, Guy E. Gibbon, Michael D. Giller, John H. Hahn, Daniel K. Higginbottom, and Craig M. Johnson

CLEAN WATER LAND & LEGACY AMENDMENT

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By

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Acknowledgements

I want to thank the Board of the Statewide Survey of Historical and Archaeological Sites for the opportunity to work on this project entitled "Handbook of Minnesota Prehistoric Stone Tools." I have always been fascinated by archaeology and, in particular, stone artifacts. It was an honor, a privilege, and a real joy to see literally thousands of artifacts in the repositories of the Minnesota Historical Society and other institutions across the state. I learn something new every time I get see and examine such large collections. What started out as what was supposed to be a relatively simple, straightforward guide to the various kinds of stone tools that are found across Minnesota turned into something more—this book is the result.

First and foremost, I must thank my two colleagues in this endeavor. Michael Giller and John Hahn contributed so much in so many ways. They worked together taking the artifact photographs contained in this book. Their pictures say far more than my few descriptive paragraphs ever could. John organized the data collected from thousands of artifacts and nearly 10,000 individual photographs. Michael's inked illustrations and his dedication to the style and layout of the book add such a professional polish. Michael and John, thank you so much for indulging me when, at the end of the day, I brought out yet another tray of artifacts for you to photograph.

While we were in contact with a variety of institutions across the state, unfortunately, we only had time to visit a few. I am deeply indebted to the Minnesota Historical Society and the Office of the State Archaeologist, in particular Pat Emerson, Bruce Koenen, LeRoy Gonsior, and Scott F. Anfinson, for their hospitality and assistance. After several trips to Fort Snelling, I was beginning to feel at home. Susan and Steve Mulholland of the Duluth Archaeological Center and Lee Johnson and Heather Hoffman of the Heritage Resource Management program of the Superior National Forest gave us access to artifacts collected from across the northeast quarter of the state. Adam Smith of the Stearns History Museum granted us an up-close look at the many interesting objects found in and around St. Cloud. Dave Radford, Jerry Katzenmeyer, and Tom Wanous made it possible for use to see and photograph artifacts in the huge and spectacular Owen Johnson Collection at Myre–Big Island State Park. Dennis Glynn graciously invited us into his home in Faribault to take pictures of his bannerstones and other artifacts from Rice County and his son Mark even brought over his collection for us to see. My only regret is that we did not have time to visit with more private collectors across the state. I also thank my friend, Jeff Ulch, and the staff at the Calkins Nature Center, Iowa Falls, Iowa, for allowing us to include some artifacts from the Ulch Collection.

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Finally, my heart goes out to all the staff at Wapsi Valley Archaeology in Anamosa. Nurit and Michael Finn were so supportive and patient in allowing us to give birth to this monster. Working under some formidable time constraints, Cooper Jacks did a great job editing the text. Eleisha Barnett did the final formatting of the book that follows.

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Introduction

Toby A. Morrow

Stone tools are universal. Every person reading this book has ancestors who made and used stone tools. Most of the objects illustrated and described in this book were made by Native American people who called Minnesota home for thousands of years. As such, we will be discussing artifact types and styles as well as history, all specific to this part of the country. While this book is intended to be a guide to the stone artifacts of the State of Minnesota, it covers many general concepts and principles that apply to stone tools found anywhere.

Stone tools are important to archaeology. They represent much of our earliest evidence for human behavior; the first stone tools were made in Africa around three million years ago. Stone tools endure where other materials like tooth, bone, shell, wood, and hide can easily disintegrate over time. Stone tools are common and diverse. They reflect a wide range of raw materials, manufacturing techniques and tool-using activities. The study of stone tools and stone tool technology is called lithic analysis.

Stone tools are artifacts. An artifact is anything made or modified by human action. Artifacts include a beautifully flaked six-inch spear point and the one thousand or so chips and spalls that were created producing it. A ground and polished stone axe is an artifact just as much as the tough pecking hammer and abrading slab that were used to make it. Artifacts are products and byproducts. Some artifacts are complex and elaborate, consuming a great amount of time and effort to make. These can be thought of as formal tools. Others are nothing more than naturally shaped rocks or chips that were picked up and put to use just as they were. The latter, in contrast, would be considered informal tools.

Stone tools are generally divided into two broad categories: chipped stone and ground stone. Chipped stone tools are made from a limited range of raw materials like chert, quartzite, and obsidian by percussion and pressure flaking. Most projectile points—spear, dart, and arrow tips—found in Minnesota are chipped stone. Ground stone tools are artifacts made from a broader range of commonly tougher, grainier rock types. Most ground stone tools were made by varying combinations of pecking, grinding, cutting, drilling, and polishing, but the category also includes simple cobble tools.

Whether butchering a bison, felling a tree, or planing or sawing a piece of seasoned hardwood, stone tools can do almost anything that hand tools with steel blades can. People are often quite impressed by how effectively stone tools work in the hands of an experienced user. One of the greatest differences between stone tools and those made of metal is durability. While stone can be very hard, it is also brittle to some degree, so when put under sufficient stress, stone breaks. For this reason, stone tools typically will not survive a lot of overly forceful use. Metal is typically ductile and not nearly so brittle, so most metals will bend long before they break. A metal tool can withstand a level of abuse that would completely destroy a stone tool.

While we tend to think of stone as a tremendously hard and timeless material, it does wear away and break. For this reason, many stone tools need quite frequent maintenance. Broken tips need to be repaired. Dulled edges need to be resharpened. Damaged bits need to be fixed. Therefore, stone tools are often said to have "use lives"—spans of time from their first use to the moment they are finally lost or discarded. The alteration of a tool through its use life and its gradual attrition through tool maintenance is succinctly expressed as the "Frison effect," so named in honor of Wyoming archaeologist George C. Frison (Jelinek 1976). Stone tools that have undergone considerable modification via the Frison effect (Figure 1.1) are often said to be "curated tools," tools that were kept around, tended to, and used over an extended period. In contrast are "expedient tools," tools that were used briefly and then discarded.

Many stone tools were hafted, or set in handles, for use. Handles provided a grip that was safer, more comfortable, or both, and allowed added weight and leverage to be applied to a task (e.g., Morrow 1996a). Some handles were manufactured out of bone or antler, but most were probably made of wood. There are scattered examples of ancient stone tools that have been found, some in dry caves or in waterlogged conditions, with handles and lashings intact. These, along with certain artifacts in more recent ethnographic collections, give us a pretty clear idea of how some stone tools were hafted and used. For certain other artifacts, their functions and hafting configurations are somewhat more conjectural. Several illustrations of reconstructed tools and their handles will be seen throughout this book. It is important to distinguish and remember that the stone bit (e.g., an end scraper) was often the disposable component of the composite tool and that the handle (e.g., a polished elk antler handle) was intended to be reused (Figure 1.2).

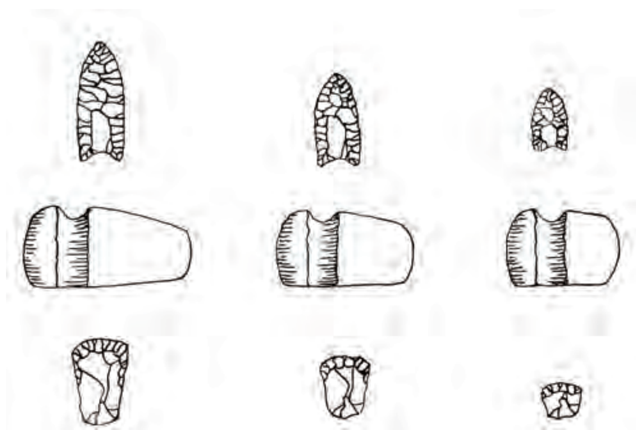


Figure 1.1. The Frison Effect in various stone artifacts. From top to bottom, a Clovis point, a three-quarter grooved axe, and an end scraper.

This book is organized from the ground up, so to speak. A brief overview of geology with special reference to Minnesota is presented in Chapter 2. In Chapter 3, Scott Anfinson provides a summary of the history of lithic studies in the state. Chipped stone tool technology and the variety of chipped stone tools found across the state are described in Chapter 4. The various projectile point types represented across Minnesota are illustrated and described in Chapter 5. The varieties of chipped stone raw materials that are found in the state are illustrated and described in Chapter

6. Ground stone tools and ground stone technology are discussed in Chapter 7. Finally, Chapter 8 offers some thoughts for future directions in Minnesota lithic studies.

Illustrations of hundreds of stone tools found throughout the State of Minnesota accompany this book. In order to convey as clearly as possible the actual nature and appearance of the piece, the majority of photographs show the artifacts at actual size. Also, a side view or cross section accompanies most of these artifact photographs. The photographs should give a better idea of what the three-dimensional tool actually looks like. Many of these artifacts are from institutional collections including the Minnesota Historical Society (MHS), the University of Minnesota (UMn), the Stearns History Museum (SHM), the Duluth Archaeology Center (DAC), the Superior National Forest Learning Center (SNF), the Science Museum of Minnesota (SMM), and Myre–Big Island State Park (MBISP).

No single book can convey the full range of information available on stone tools, technologies and lithic analysis. Entire volumes can be (and in several cases *have* been) written on the subjects covered here in single chapters. This book presents a broad overview, an introduction to stone tools, and a handy reference for archaeologists, students, collectors, and anyone else interested in Minnesota archaeology. Additional references suggested for further reading on discussions of chipped stone tools, technology, and analysis include Andrefsky (2001, 2005), Odell (1996, 2003), Surovell (2012), and Kooyman (2000). For additional information on projectile point types, Boszhardt (2010), Justice (1987), Morrow (1984), Taylor (2006), and Schanen and Hunzicker (2013) are recommended. For how-to information on flintknapping, Callahan (1979), Waldorf (1979), and Whittaker (1994) are suggested. Adams (2002) is recommended reading on ground stone tools. For more information regarding the archaeology of Minnesota and the region as a whole, read Anfinson (1997), Gibbon (2012), Johnson (1988), and Theler and Boszhardt (2003).

There are also several Internet resources that can enhance one's knowledge of and appreciation for stone tools. Pete Bostrom's Lithic Casting Lab website (lithiccastinglab.com) showcases stone artifacts from around the world and provides useful discussion. Tim Rast's blog (elfshotgallery.blogspot.com) is a fascinating diary covering his varied replications of a potpourri of traditional Canadian and Artic stone, bone, ivory, antler, and wooden artifacts. Closer to home, Larry Kinsella has a website (flintknapper.com) presenting his thoughts and experiments with all sorts of Midwestern stone tools, especially ground stone axes and celts and atlatls. Speaking of atlatls, John Whittaker shares his vast knowledge of spear throwers and other Stone Age topics through his web page (http://www/grinnell.edu/academic/anthropology/jwweb). The late Tony Baker assembled an excellent website discussing technical aspects of stone tools and early North American archaeology (www.ele.net).

Before moving on, some specific preliminary topics are presented.

Objects Commonly Mistaken for Stone Tools

In addition to presenting information on the varieties of stone tools found across the state, it is worth discussing the range of objects that well-meaning laypersons often misidentify as stone artifacts. Probably most experienced archaeologists have at one time or another had to tell enthusiastic and hopeful finders that their "Native American relics" were just plain rocks. There are recurrent patterns in the kinds of natural stone objects people notice and take home believing they have something cultural.

Rocks, quite literally, come in all shapes and sizes. In any pile of variegated gravel will be some pieces that, for any number of reasons, catch the eye of the beholder. Many people mistakenly believe that right angles and perfect circles do not exist in nature. A round, egg-shaped, square, rectangular, or triangular rock cannot happen by chance, they reason, so it must have been made that way by people. As will be seen later in this book, stone artifacts bear fairly unambiguous signs that they were intentionally shaped, have been used for a purpose, or both.

Among the most common "artifacts" shown to archaeologists are oddly shaped rocks that are most remarkable to their owners because they "fit perfectly in your hand." Typically, these rocks have no obvious modification from flaking, pecking, or grinding, they show no wear resulting from use, and, even more condemningly, they usually seem to have little or no actual functional capacity—just what was it that people were supposed to be doing with this so-elegantly-designed tool? The reader may recall reading earlier in this book that many stone tools were set in handles, meaning fitting in one's hand is a weak argument for a rock being a tool. Since the early twentieth century, substantial research has been put into understanding the functionality of the human hand (Schlesinger 1919; Napier 1956; MacKenzie and Iberall 1994). Many of these studies were directed toward the design of better prosthetic replacements for amputees, but today this research is also applied to making robotic hands. Schlesinger (1919) divided human grip into six basic types of prehension, and each of these can have its own nuances and variations. To summarize, the human hand is such a remarkably flexible and adaptive structure that it is probably more difficult to find a cobble that will *not* fit in the hand.

Rocks exhibiting holes or grooves draw much attention. These too can result from completely natural processes. A hole commonly forms when an inclusion like a fossil or concretion weathers out. The roots of trees and other plants exude weak natural acids that over time can etch grooves and sinuous holes into carbonate rocks like limestone (Mottershead and Viles 2004). Natural holes do not show the rotary striations characteristic of holes drilled by humans. Grooves can weather into rocks that have a seam or layer of softer or less chemically resistant material going through them. These seams or layers will usually exhibit a noticeable change in mineral content or grain size compared to the surrounding rock matrix.

Figure 1.3. An Omarolluk cobble.

Figure 1.4. Weathered iron concretion (limonite) fragment with a "human face."

Grayish-colored cobbles with perfectly round holes in them are commonly found in south-central Canada and the mid-continental United States (Figure 1.3). Often interpreted as fire-starting rocks, nutting stones, or specialized grinding mortars, these completely natural rocks are known as omarolluks or "omars." Their name comes from the Omarolluk Formation outcropping on the east side of Hudson Bay in Canada. These are graywacke cobbles with rounded holes derived from the presence of softer, spherical concretions of calcium carbonate that have weathered and leached out. These spherical concretions are particular to the Omarolluk Formation graywacke. Occasionally, an omarolluk cobble will exhibit actual wear from being used as a hammerstone (battering on its ends) or a mano (smoothing and polish on a flat surface), but this use wear has nothing to do with the perfectly round holes. As an aside, geologists use the distribution of these highly distinctive omarolluk cobbles to trace the paths taken by ice age glaciers (Prest et al. 2000). Omarolluks occur throughout Minnesota and other Midwestern states and are quite common.

Anyone who has ever lain on his or her back on a pleasant spring day and watched the fluffy cumulus clouds roll by while looking for human faces, elephants, or unicorns has experienced pareidolia. The human mind is preconditioned to take the images one sees and make organizational sense out of them (Guthrie 1993). The Rorschach inkblot test is explicitly based on the phenomenon. Pareidolia entails imagining things that are not really there. There may be no actual human face in sight, but these are not hallucinations. The mind is simply filtering two darker splotches that happen to be in about the right place and reinterpreting them as eyes and focusing attention on a more or less horizontal line beneath them that can serve as a mouth and, *voila*, a face comes into view. The "Man in the Moon" is a classic example of this. Many cases of supposed stone effigies are the result of pareidolia. While no websites in particular will be called out here by name, there are a number where one will find numerous images of imaginary stone birds, bears, dogs, turtles, and human faces that show absolutely no indications of having been intentionally carved or altered by humans in any way. These objects also often only vaguely resemble the forms that they are said to be. If it is necessary to point out where the eyes, ears, nose, mouth, et cetera are on a supposed effigy, it is probably just a rock (Figure 1.4). Carved stone effigies are actually rare and generally will not require any imagination to identify them (Figure 1.5).

Figure 1.5. Small catlinite animal effigy, possibly a mouse? (MHS Artifact 780-162-14, catlinite, Wilford Site, 21ML12, Mille Lacs County, MN.)

Another common category of purported artifacts occurs in the form of naturally chipped or flaked pieces. These are a bit trickier than the other presumed stone tools described above. Chert and similar raw materials were used the world over to make chipped stone tools. The same properties that make these materials workable for humans also make them susceptible to chipping and other modifications by natural forces. Chert nodules or fragments can be broken by the pressure exerted by the weight of

Figure 1.6. A typical "eolith," a naturally fractured piece of chert.

the rock and sediments covering them; popped apart into random cubes, wedges, and potlid spalls by freeze-thaw cycles; and banged together in landslides and fast-flowing streams. The sharp corners and edges on these fragmented pieces are especially vulnerable to additional chipping and damage that can closely resemble lithic use wear or intentional human retouch. The simple act of trampling, whether by humans or any other large animal, can create what convincingly appear to be worked edges. Crudely chipped flints began to attract much scientific attention in the Old World toward the end of nineteenth century. Called eoliths ("dawn stones"), they were used to argue for a hominid presence in England dating back to the Pliocene (5.3 to 2.6 million years ago). A French archaeologist named Marcellin Boule argued in 1905 that these stones were not artifacts and that they were the product of natural processes. Shortly thereafter, Samuel Hazeldine Warren (1905) conducted experiments and essentially confirmed Boule's case that the eoliths were natural.

One would think (or at least hope) that the whole eolith debate was settled a century ago, but sadly, this is not the case. Naturally fractured and secondarily "retouched" pieces are commonly found in concentrated gravel deposits (Figure 1.6). Unfortunately, cherry-picking the chipped rocks that look the most like genuine artifacts from such deposits has a long and storied history. The preponderance of evidence is that this is precisely what has been done at Calico Hills, California, where chipped stone "artifacts" are purported to be as much as 200,000 years old (e.g., Duvall and Venner 1979; Payen 1982). A less spectacular case occurred in 2007 near Walker in Cass County, Minnesota, where supposed chipped stone tools were recovered from 13,000- to 14,000-year-old glacial outwash deposits (National Association of Tribal Historic Preservation Officers 2016). Scott Anfinson (2007) argued convincingly that these are naturally flaked chert pieces and that they are not evidence for a Pre-Clovis presence in north-central Minnesota. Chipped stone objects that are "crude" or "iffy" to begin with should be treated with extreme skepticism if they were derived from gravelly deposits.

An archaeologist should not be surprised if he or she gets a suspicious look and a defensive or even insulted reaction after telling someone that their "perfectly obvious stone tool" is nothing more than a naturally formed rock. There are just some people who refuse to be dissuaded, no matter what they are shown or told. This is true of some laypeople, but archaeologists are not exempt. Calico Hills still has its ardent supporters (e.g., Hardaker 2007), and the same is apparently true of the Walker Site (National Association of Tribal Historic Preservation Officers 2016).

Rocks of all sorts abound in the world around us, and Mother Nature can do a variety of things to them that might resemble human workmanship. A thorough knowledge of what actual stone tools look like and a thoughtful consideration of where things come from will help weed out these spurious "artifacts."

THE FACTS ABOUT FAKES

People have been making copies of prehistoric stone artifacts since the nineteenth century. The following discussion will describe some of the more common and most obvious kinds of fake stone artifacts as well as touch on the contemporary situation. Today, there are so many modern-made pieces on the market that there are a number of people who offer their services to "authenticate" prehistoric artifacts. While these authenticators are all experienced and knowledgeable individuals, they are not infallible. It can essentially be guaranteed that there are modern stoneworkers out there who know their stuff, make artifacts authentically in the correct style, and have the ability to create convincing patina and surface deposits, sometimes fooling authenticators.

The unusual, polished, "problematical" stone objects of the Eastern Woodlands inspired a lot of early bogus pieces. Bannerstones, birdstones, and gorgets were common targets for reproduction. Early artifact forgers were not so mindful of style and materials, and their efforts often stand out because of it. Holes were drilled with hand crank or power drills and obviously do not look like prehistoric holes made with a chipped stone drill or a hollow cane. Artificers making replicas of grooved axes and hammers circumvented the pecking stage and turned them straight out on a grinding wheel (Figure 1.7). Ground stone fakes are usually pretty obvious, in part, because making them the authentic way would take so much time. Catlinite pipes have a continuous history of manufacture going back to at least to Middle Woodland times, and where one would draw the line between authentic and replica seems quite arbitrary.

Figure 1.7. An elongated cobble with a groove around it made with a grinding wheel. (SCM Artifact 88.27.1, probably diorite or diabase.)

"Gray Ghosts" is the name given to a very common form of reproduction projectile points and knives. They derive their name from the typical color of Edwards Plateau Chert, a raw material of Texas, from which most of them were made. Most accounts attribute these to a central Texas man named Bryan Reinhardt (Whittaker and Stafford 1999; Bostrom 2015). Around 1950, Reinhardt acquired his first lapidary saw and began sawing large nodules of high-quality gray chert into flat slabs. He had purportedly devised a jig and a complex lever flaking system that he used to chip off the sawn surfaces and then steeply retouched the pieces to the desired outline shape. Reinhardt reportedly sold his "ceremonial spear points" by the inch and many were up to eight or nine inches (20 or 23 cm) long. Because they were made so differently from authentic points, they are fairly obvious reproductions (Figure 1.8). Being made from cut slabs, they are completely flat with a straight profile from one end to the other and a flattened cross section. They were often made in shapes that exaggerated the styles of authentic artifacts and resemble a caricature of a point or knife rather than the real thing. These characteristics plus their great size and gray Texas material make them unmistakable. It has been estimated that between 1950 and 1982 Reinhardt manufactured up to 100,000 "Gray Ghosts" (Bostrom 2015). These reproductions are widely distributed, and they show up in many older collections. Some local history museums have fine collections of these giant oddities that they unknowingly and proudly display as the real thing.

Figure 1.8. A "Gray Ghost" corner tang knife. (SHM Artifact 83.6.11, Edwards Plateau Chert.)

Marvin McCormick was an early American flintknapper who started reproducing chipped stone points during the Great Depression (Whittaker 2004; Bostrom 2015). Hailing from southeastern Colorado, McCormick did the bulk of his work using colorful Alibates Chert from the Texas Panhandle. Fluted points became his specialty and "McCormick Folsoms" are now the stuff of legend. McCormick's manufacturing techniques were a bit different than that used by Paleoindian Folsom point makers. He used copper pressure flakers to shape a nearly finished leaf-shaped point preform and then beveled the base and set up a nib to drive of the flute with a copper rod punch. Then the base beveling and set up was repeated for the reverse flute. McCormick Folsom points are usually twice as thick as authentic Folsom points and often have narrower, ribbon-like flutes. They also lack the fine pressure retouch used to finish most authentic Folsom points. Like "Gray Ghosts," "McCormick Folsoms" have a remarkable geographic distribution. A couple of these might have made it into a statewide survey of Early Paleoindian points in Minnesota (Buhta et al. 2011:69).

Figure 1.9. Modern-made arrowheads from Mexico (top) and India (bottom), purchased at the Fort Snelling Gift Shop.

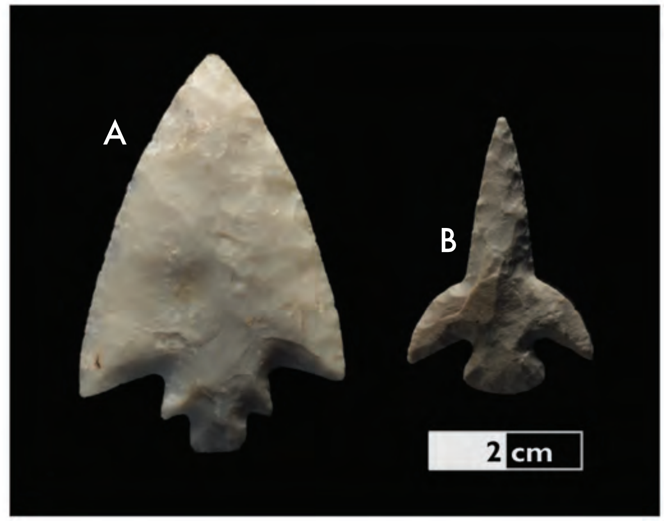


Figure 1.10. Re-chipped chert eccentrics. ([A] MBISP Artifact SP89176, unidentified chert; [B] MBISP Artifact SP89123, unidentified chert.)

Gift shops targeting tourists and museum visitors frequently have a basket of crudely made arrowheads for sale for a dollar or two each. As early as the 1970s, these were being mass produced in Mexico. They tend to be made of black obsidian, dull tan chert, or reddish-brown rhyolite (Figure 1.9). These are always made on a flake, usually unifacial, and exhibit no effort to trim the base or remove any ventral flake curvature—in side view they are distinctly curved, asymmetrical, or both. On earlier specimens, crude side notches were chipped in by pressure flaking, but on more recently made ones, the notches are sawed in with a power grinder. In the past decade or so, bifacially pressure-flaked points made in India have become quite common. These genuine "Indian" arrowheads are better made than the Mexican points but still do not quite look like the real thing. These "Made in India" points (and some actually do come with a sticker) are made from a wide range of semiprecious agates and jaspers and are quite colorful (see Figure 1.9).

Two commonly seen categories of fakes are chipped stone effigies and eccentrics. While prehistoric chipped stone effigies do exist, they are extremely uncommon. Chipped and then ground and polished lizard effigies are occasionally found in Illinois and Missouri (Bostrom 2015). Modern chipped effigies tend to be in the form of thunderbirds—wide, chipped artifacts with outstretched wings—and turtles with a head and four legs. Chipped stone fishhooks are another common fake (although at least one authentic chipped stone fishhook is known from central Iowa). Fake eccentrics are fanciful forms with extra notches and elaborate outline shapes that rarely, if ever, occur in the United States. These were most often re-chipped on damaged or broken authentic artifacts. The fresh flaking is often cleaner and not as glossy as the original flaked surfaces (Figure 1.10). Elaborate, large and small eccentrics are, however, found in Belize and neighboring areas of Central America in the center of Classic Maya distribution (Sharer and Traxler 2006; Bostrom 2015).

Prior to the 1970s, there were not many flintknappers around. Today that has changed. Whittaker and Stafford (1999) estimated that there were at least 5,000 individuals in the United States who were actively involved in flintknapping and that somewhere between 750,000 and 1.5 million new stone points were being made each year. That was over fifteen years ago, and with the growth of the Internet, especially the how-to demonstration videos on YouTube, those numbers may be even higher today. What this means is modern-made stone projectile points are more common than ever.

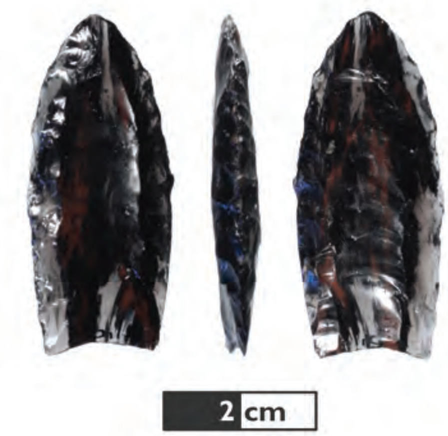


Figure 1.11. Replica Folsom point. (SHM Artifact 86.1.4, mahogany obsidian, purportedly from California.)

Many of these modern-made points are the creations of people who are true artisans who have no intention of accurately replicating prehistoric styles (see Whittaker 2004; Bostrom 2015). Others mimic as best they can the original artifact designs they are reproducing. Sometimes modern-made points are identifiable by an informed and close examination detects flaking patterns, the presence of heat treatment, or the use of specific raw materials that are inappropriate to the style being represented. Figure 1.11 shows a replica Folsom-style point made of variegated black, clear, and mahogany obsidian from the Stearns County History Center collections. Documentation accompanying this point states that it was purchased in California, which is appropriate because the attractive obsidian from which it is made was almost certainly collected from northern California or Oregon. Aside from the point having a bit of a heavy thickness for a Folsom point (it somewhat resembles a "McCormick Folsom"), that raw material calls it out as a fake. Folsom points are never found anywhere near where this kind of obsidian is found. To reiterate though, not all modern reproductions will be so readily detected. In other words, *caveat emptor* (let the buyer beware).

How We Know What We Know

Stone tools are strange and exotic things to most people today. These tools are so far removed from our daily lives that making useful objects by breaking or wearing down a rock is difficult to even imagine. How do we know what these things are? How were they made and used?

Ethnographic Sources

Five centuries ago, when Europeans set off to explore the globe and subsequently colonize it, they encountered indigenous peoples who were unlike them. Many of these new and unfamiliar peoples made and used stone tools. Most early explorers like Columbus, Coronado, De Soto, and Cook and their crews were too focused on economic goals—finding treasure, discovering new trade routes and the like—to concern themselves much with recording things about these native peoples. When they did, they tended to focus on their appearance, dress, and strange customs, often portraying these things in flowery, derogatory, and condescending language. Only seldom did these European interlopers write about mundane arts and crafts, and these accounts are typically brief, confusing, or both. The European scribes did not understand stone tool manufacture any more than most people do today, and their accounts have limited utility (Fletcher 1970). The Spanish, for example, offer several mentions and obtuse descriptions of the manufacture of obsidian blades (in this case, long, narrow, ribbon-like flakes) in Mesoamerica (Whittaker 1994:221–223). A pioneering modern flintknapper named Don Crabtree tried to replicate the technique using a long chest crutch to push long slivers off obsidian cores (Crabtree 1968). Later, John Clark (1982) devised a very different method—using a hooked shaft to pull the blades off the core—that seems to better fit the sketchy Spanish accounts and yields remarkably consistent results.

As the United States grew westward in the nineteenth century, some people took up the task of recording aspects of Native American lifeways, languages, and customs. Some of these accounts mention stone artifacts. For example, in 1832 George Catlin witnessed and described the Mandan use of a two- to three-inch- (5.1 to 7.6 cm) diameter ring of stone in a lively game called "tchung-kee." Unfortunately, few of these accounts provide much detail on the subject of stone tool technology, in part probably because by the mid- to late 1800s many Native American groups had converted over to using guns and European-made metal tools. An exception is a California Native American man known to the world as Ishi (Kroeber 1961). He was one of the last of his ancestral group the Yahi and retained all the traditional life skills he had learned and used, among them flintknapping. Ishi spent the last five years of his life at the University of California in Berkeley where he frequently demonstrated making stone points at the Museum of Anthropology. The elegant, side-notched pressure flaked points he made out of obsidian and bottle glass are much admired today (Bostrom 2015). Tragically, Ishi died of tuberculosis in 1916.

Across the world there are widely scattered groups of people who have actually made and used stone tools as part of their everyday lives up until the recent past or even still today. There are several enlightening studies focusing on them, including those exploring the simple flake tool industries of the Aborigines living in Australia's Western Desert (Hayden and Nelson 1979; Gould 1980; Cane 1992) and contemporary people of the Maya Highlands of Central America (Hayden and Nelson 1981). Several studies have been done on traditional hide workers in Ethiopia who use hafted end scrapers made of obsidian and glass (Gallagher 1977; Weedman 2002; Shott and Weedman 2007). Schick and Toth (1993) provide an in depth look at the chipped and ground stone adze and axe makers of New Guinea. Whittaker, Kamp, and Yilmaz (2009) present a description and discussion of the use of stone blade inserts on grain-threshing sleds in Turkey.

Experimental Archaeology

Because of the limited nature of the available ethnographic literature pertaining to stone tools, archaeologists turn to experimental archaeology for answers (see Coles 1973, 1979). Experimental archaeology involves replicating an artifact or an activity as it was done in the past. A large part of what we know about stone tools is derived from experiments.

There are two general approaches to conducting experiments in archaeology. One is explicitly scientific and aims to isolate variables and completely remove the human element. The many studies of fracture mechanics are a good example of this approach (e.g., Speth 1972, 1981; Dibble and Whittaker 1981; Dibble 1985, 1997; Resek et al. 2011; Magnani et al. 2014). The other approach involves hands-on replication of artifacts, tool-using activities, or both. These latter types of experimental studies are quite varied, ranging from hurling spears tipped with replica Clovis points at a culled African elephant (Frison 1989) to building a Late Woodland Pamunkey house using only replicated, period-appropriate stone, bone, and antler tools (Callahan 1981). These kinds of experiments yield tools and debris derived from known actions that can then be compared directly to archeological specimens.

Lithic Use Wear and Residue Studies

One important concern for archaeologists regarding stone tools is determining exactly how a stone tool was used in prehistory. The morphology (shape) as well as methods and characteristic results of manufacture provide a degree of insight. For example, a small- to medium-sized tool with a flat to rounded end with a sharp bevel is typically referred to as an end scraper. Some assume that these prehistoric tools were used to scrape excess meat and fibers from animal skins during the tanning process, as they indeed were. However, these tools were also sometimes used for scraping both wood and bone, could have been used as cutting tools, or may have been completely unused. Considering that nearly all modern humans have used a specific tool to complete a task for which it was not intended, such as using a coin or chisel as a screwdriver or a screwdriver as an awl, why should one assume that prehistoric people were not equally quick to adopt a tool for expedient use?

If researchers are able to discern what an individual tool was actually used for, they can then apply that knowledge to overall site distributions in order to identify special work areas. For example, if a portion of a prehistoric site has an abundance of scrapers used on meat and hide as well as numerous cutting tools, that portion of the site may have served as an animal butchering/processing area.

A great deal of conjecture was used by archaeologists and laypersons alike in determining use wear during the infancy of the subject, much of it based on morphology, macroscopic inspection, intuition, and, to be fair, some ethnographic evidence. However, the main characteristic considered in the identification of prehistoric stone tool usage was morphology. Though this approach does have some merit, it can be misleading in that it assumes, for example, that a single tool that appeared to be useful as a hide scraper must necessarily have been utilized in only that manner (Odell 2003). Macroscopic visual inspection of edge damage was also one of the main determinants of prehistoric tool use.

Use-Wear Analysis

Macroscopic Analysis

Tool use can be identified in different ways. One such way is through macroscopic examination of edge damage caused by usage, typically with a hand lens with 10x magnification. In this process, the examiner looks for any damage done to the edge of the tool. This damage can take the form of chipping, fracturing, rounding, polishing, or any other resultant edge modification.

This analysis is typically done using a comparative sample set of artifact replicas created by the researcher and utilized on various materials such as wood, bone, meat, hide, grasses, etc. The researcher then compares these samples with the archaeological samples to determine which most closely resemble one another. In addition to the specific contact material, the motion of use is examined: whittling, planing, scraping, boring, chopping, adzing, graving, wedging, sawing, or cutting (Keeley 1980).

Microscopic Analysis

All references to guns and cannoli aside, Soviet scientist Sergei Semenov was the godfather of microscopic lithic use-wear analysis. Semenov began his use-wear analysis in 1934 by creating a control group of stone tools and experimenting with those tools on various materials in order to ascertain the type and amount of wear that tool use on specific materials incurs (Semenov 1985). This was a watershed moment not just for lithic analysis but for the entire archaeological community. For the first time, archaeologists could identify stone tool use based on empirical evidence. The value of this insight transcended the artifact itself to provide further information on feature formation, site usage, and even prehistoric behaviors. As archaeologists Keeley and Donahue would one day attest, "no other branch of technical analysis in our discipline—not lithic technology, not faunal analysis, not ceramic analysis—has publicly demonstrated that it is capable of supporting most of the inferences its practitioners claim they can draw from the archaeological record" (Keeley and Donahue 1988). In essence, this form of analysis provided the most verifiable evidence of prehistoric human behavior.

In the United States, Ahler (1971) conducted some of the first research explicitly aimed at determining the functions of hafted bifaces that are typically called projectile points. In 1980, Lawrence Keeley authored the first full and comprehensive treatise on a scientific approach to stone tool use-wear analysis in the United States with his publication *Experimental Determination of Stone Tool Usage*. The 1985 publication *Use-Wear Analysis of Flaked Stone Tools* by Patrick C. Vaughan built on the earlier work of others such as Keeley but greatly expanded on the method of the experimentation and examination of stone tools. The practice is essentially the same as macroscopic with the exception of a microscope. The artifacts are cleaned with various solutions to remove residues and oils and are then placed under a stereoscopic microscope to identify striations, polishes, and other indicators that are too small to view with the naked eye.

To assess the validity and usefulness of use-wear analysis, Young and Bamforth (1990) conducted a blind test of *macro*scopic use-wear identification in which nine experienced archaeologists with broad interests and training were asked to identify, without the aid of magnification, the use or non-use of a variety of 11 experimental tools of various degrees of actual use or non-use. Additionally, participants were asked to identify whether or not the tools had been used on hard materials, such as wood or bone, or on softer materials, such as meat or hide. The results of this study show that of the possible 144 macroscopic inferences (tools 1, 3, 7, and 10 were used on multiple edges for a total of 16 edges of identification), only 36 (25%) were accurately identified (Young and Bamforth 1990). This contrasts sharply with the 85 to 95 percent accurately identified tool use in blind tests of *micro*scopic use-wear analysis (Bamforth 1988). This also means that, given the 36 correct identifications of the nine research participants, each participant on average only identified four tools correctly, with "…most participants (77.8%) correctly identifying the unaltered, unused flake, far fewer correctly identifying the altered unused flakes (25%) and the edges used on harder materials (27.7%), and very few correctly identifying the edges used on softer materials (11.1%)" (Young and Bamforth 1990). This shows, then, that while use can be identified through macro-examination, the use of microscopic examination often provides a more accurate picture of prehistoric behavior.

Other studies worth noting have dealt with post-depositional effects on the viability of use-wear studies. Further studies of edge damage and their hallmarks have been conducted to further the macroscopic and microscopic examination approaches to use-wear analysis, including the edge damage effects of post-depositional trampling and soil movement on artifacts (Nielsen 1991; Shea and Klenck 1993; McBrearty et al. 1998).

Residue Analysis

Use-wear analysis is not the only method of stone tool examination, however. Within the last few decades, researchers have begun determining tool usage through examination of the organic residues left behind on the tools from processing various plants and animals.

Plant Residues

Starches: When processing plants, certain chemical markers remain on the tools used for that processing. Starches are the dominant food storage preference for plants, especially in root plants (potatoes, turnips, etc.) and seeds. These residues can be identified on tools used to cut plants, on grinding stone used to process them, and even on the ceramics used in the cooking process. These starches can be viewed through a light microscope with a high magnification of 200x or greater (Fullagar 2014). This method has been used to identify maize starch granules to determine with the aid of radiocarbon dating, the process of maize (*Zea mays* L.) domestication in Ecuador (Zarrillo et al. 2008) and Honduras (Haslam 2003), millet (*Setaria* spp.) use in China (Yang et al. 2012), manioc (*Manihot esculenta*), potato (*Solanum* sp.), chili pepper (*Capsicum* spp.), arrowroot (*Maranta arundinacea*), and algarrobo (*Prosopis* sp.) consumption in Peru (Duncan et al. 2009).

Raphides: Another type of plant residue left behind on stone tools is raphides, small needle-like crystals made of calcium oxalate (Bradbury and Nixon 1998; Fullagar 2014). Raphides are typically present in root crops such as taro (*Colocasia esculenta*) and tannia (*Xanthosoma sagittifolium*). Much like starches, raphides can adhere to processing tools and remain for extended periods of time. The raphides, when present, may be used to identify particular plants.

Phytoliths: Yet another residual indicator of plant processing is phytolithic residue. Phytoliths are still another silicate formed when silica dissolves in groundwater and is absorbed through plant roots as monosilicic acid before being transported to the epidermal layer and deposited mostly in the aboveground portions of the plant (Rowe and Kershaw 2008). Some researchers have suggested that the phytoliths help provide structural support to a plant, and still others believe the presence of the bio-silicate may deter herbivores (Shillito 2013). Much like starches and raphide analysis, phytoliths can often be differentiated from one another through use of a high-magnification light microscope. And again, like starches and raphides, the greater the surface area of the tool that comes into contact with the material during processing, and the greater the duration of that contact, the better the opportunity for the residues to accrue to an extent that they can be studied. For instance, if a blade is used to cut grasses, that blade is in contact with the grass very briefly. By contrast, if a grinding stone is being used to grind corn into meal, the grinding stone is in contact with the plant material for a longer duration. The grinding stone is also using more of its overall surface area during this process, compared with the cutting edge of a blade. Both of these factors can play a role in the accumulation of plant residues.

Other Plant Residues: Some plants have distinctive chemical signatures that are indicative not of foodstuffs but of other uses. For example, resins left behind from the hafting of blades or projectile points can still be identified today using many of the same methods described above. Some resins have been identified through a process of gas chromatography–mass spectrometry (Mathe et al. 2004).

ANIMAL RESIDUES

For obvious reasons, feather and hair remains can be quite useful in the identification of tool usage, assuming of course that these remains did not adhere to the tool after its deposition into the archaeological record. Often the identification of specific species is possible through this identification, helping to fill in gaps in the recreation of prehistoric hunting and dietary practices.

Blood residues are a useful means of identifying tool usage. It might seem unlikely that blood residue could possibly last for any significant period of time, but under the right conditions this residue can survive for thousands of years (Kooyman et al. 1992). As with much of the archaeological record, the environmental conditions are a critical determinant of preservation of blood residue. Highly acidic or alkaline soils are not conducive to extended preservation, while dry, sheltered sites are conducive. At least one cave site in South Africa has yielded stone tools with preserved animal residues that are more than 60,000 years old (Lombard and Phillipson 2010). When identifying tool usage, it is typically the proteins and amino acids that are tested through a process known as electrophoresis in which prepared animal anti-sera are used to identify unknown animal proteins (Newman and Julig 1989). Essentially, the blood residue is added to various chemicals (a specific chemical or anti-sera for specific animal genus) to see whether there is a reaction. In at least one instance the residual blood of a grizzly bear has been identified through analysis of crystallized hemoglobin recovered from stone tools (Loy 1983).

All of these forms of analyses are useful in determining the use of stone tools and hopefully, by extension, the behaviors and practices of prehistoric people. When used in conjunction, they can fill in gaps in our understanding of the people, wildlife, and environment of the past.

2

A BRIEF PRIMER IN GEOLOGY

TOBY MORROW

Every stone tool begins with a rock, and rocks are the stuff of geology. Therefore, it will be useful to have a working knowledge of basic geology. It is also important to have some familiarity with the specific geology of the locale in which one is working.

First, some basic definitions are in order. A mineral is an inorganic solid that has a specific structure and chemical composition. A rock is a solid aggregate of one or more minerals. A rock being made up of several minerals in combination is a comparatively easy concept to grasp. In a rock predominantly made up of one mineral, that mineral has been altered or deposited in such a way that it no longer exhibits all the properties of the parent mineral. Quartzite, for example, is a metamorphic rock that almost entirely comprises the mineral quartz.

While on the subject of definitions, some geologists and laypersons use the word "stone" somewhat differently. To many, rock and stone are synonymous and interchangeable. Some geologists refrain from using the word stone without an adjoining modifier as in limestone or sandstone. For others, the distinction is more tactile: a cliff is made of rock, a stone is a piece of rock you can pick up and move. This book uses both terms, tending to adhere more to the geologic distinction.

MINERALS

All minerals have specific defining characteristics and properties. Among other things, these include cleavage, fracture, hardness, specific gravity, and streak. Cleavage refers to the tendency of some minerals to break along predetermined plains of weakness that are inherent in their crystalline structure. Mica minerals like biotite or muscovite that have flat crystals that will peel apart in thin sheets exhibit basal cleavage. Orthoclase will cleave in two directions, roughly at right angles to each other. The minerals galena, a lead ore, and halite, the mineral name for table salt, have cubic cleavage and will break in three directions but only at right angles. Calcite has perfect rhombohedral cleavage and breaks in three directions at non-right angles.

Fracture describes the way a mineral breaks when it has no internal planes of weakness. There are generally two types of fracture: conchoidal and irregular. Conchoidal fracture is a smooth break resembling the shell of a mussel. Quartz in its many varied forms exhibits good to excellent conchoidal fracture. As the reader will see, this fracture type is the basis for all chipped stone tool technology. Irregular fractures, to contrast, are rough and uneven compared to good conchoidal breaks.

Hardness defines the relative ability of a solid to resist scratching or abrasion. A commonly used system for describing hardness is a scale devised in 1812 by a German geologist named Frederich Mohs. The Mohs scale is an ordinal scale of hardness ranging from 1 (the softest) to 10 (the hardest):

TABLE 2.1. Mohs Scale of Hardness.

1	Talc
2	Gypsum
3	Calcite
4	Fluorite
5	Apatite
6	Orthoclase
7	Quartz
8	Topaz
9	Corundum
10	Diamond

Each increment in the Mohs scale is harder than those below: gypsum will scratch talc, calcite will scratch gypsum, etc. Some general rules for employing this scale involve the use of everyday objects. The human fingernail has a hardness slightly over 2, so the fingernail will scratch talc and gypsum but not calcite. A copper penny (cent) has a hardness of around 3.5 and will scratch calcite. Be aware that the United States Mint stopped making copper pennies in 1984, and today they are made of copper-plated zinc. A common carpenter's nail measures at about 4.5. At 7 on the Mohs scale, quartz will scratch ordinary window glass or the blade of a steel pocketknife, which both have hardnesses around 5.5. It should be noted that Mohs scale is a relative, ordinal scale and does not represent actual hardness. A diamond is not 10 times harder than talc; according to the Vickers hardness test, it is closer to 5,000 times harder. Note also that quartz, a mineral that will become very familiar to the reader, at 7 on Mohs scale (around one-tenth the hardness of a diamond according to the Vickers hardness test), is one of the hardest common minerals. Harder topaz, corundum (the mineral from which rubies and sapphires derive), and diamond are much scarcer.

Specific gravity refers to the relative density of material and its weight per unit volume. This measurement is calculated as the weight of a substance relative to an equal volume of water that is assigned the value of 1. Most common minerals have a specific gravity of 2.5 to 3.5, meaning they are 2.5 to 3.5 times denser and heavier than water. Metallic minerals are heavier. Hematite, a common iron mineral, has a specific gravity around 5.0 to 5.3. Galena, a lead ore, weighs around 7.4 times as much as an equivalent volume of water.

On the note of hematite, this is one of the minerals that can be identified by the streak test. This test involves a streak plate of unglazed porcelain, a plate hard enough that many minerals will rub off on to it, leaving a streak of powdered mineral. Most minerals have a streak that is essentially the same color as the solid piece. Hematite, which can be nearly black in color, always leaves a reddish streak. Powdered hematite has another name, red ocher.

Around 4,000 different minerals have been described the world over. Table 2.2 presents a few of those that are most relevant to Minnesota and this book.

TABLE 2.2. Important Minerals of Minnesota and the Surrounding Region.

Mineral Name	**Chemical Formula**	**Cleavage**	**Hardness**	**Specific Gravity**	**Remarks**
Amphibole (Hornblende)	$(CaNa)_{2\text{-}3}(Mg, Fe, Al)_5(Al,Si)_8O_{22}(OH,F)_2$	Imperfect, two directions	5.5–6.0	2.9–3.4	Common constituent of igneous and metamorphic rocks
Biotite	$K(Mg,Fe)_3AlSi_3O_{10}(OH)_2$	One direction, basal	2.5–3.0	2.8–3.4	Common constituent of igneous and metamorphic rocks
Calcite	$Ca(CO_3)$	Three directions, rhomboidal	3.0	2.7	Main constituent of limestone
Cerussite	$PbCO_3$	Two directions	3.0–3.5	6.6	Lead ore
Chalcopyrite	$CuFeS_2$	Indistinct	3.5	4.1–4.3	Copper ore
Copper (Native)	Cu	None	2.5–3.0	8.9	Essentially pure metal
Dolomite	$CaMg(CO_3)_2$	Three directions, rhomboidal	3.5–4.0	2.8–2.9	Common replacement of limestone
Galena	PbS	Three directions, cubic	2.5	7.2–7.6	Lead ore
Garnet (Almandine)	$Fe_3Al_2Si_3O_{12}$	None (Conchoidal fracture)	4.1–4.3	7.0–8.0	Commonly seen in schists
Goethite	FeO(OH)	One direction	3.3–4.3	5.0–5.5	Iron ore
Gypsum (Selenite)	$CaSO_{4\text{-}2}(H_2O)$	Three directions	2.0	2.3	Source for plaster

Mineral Name	Chemical Formula	Cleavage	Hardness	Specific Gravity	Remarks
Hematite	Fe_2O_3	None (Conchoidal fracture)	6.5	5.0–5.3	Iron ore, red ocher
Kaolinite	$Al_2Si_2O_5(OH)_4$	One direction	1.5–2.0	2.6	Kaolin clay
Limonite	$FeO(OH)\text{-}nH_2O$	None	4.0–5.5	2.7–4.5	Iron ore, yellow ocher
Magnetite	$Fe{+}{+}Fe{+}{+}{+}_2O_4$	None	5.5–6.0	5.1–5.2	Iron ore
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$	One direction, basal	2.0–2.5	2.8–2.9	Common constituent of igneous and metamorphic rocks
Olivine	$(Mg,Fe)_2SiO_4$	Two directions	6.5–7.0	3.3–3.4	Common constituent of igneous and metamorphic rocks
Orthoclase	$KAlSi_3O_8$	Two directions	6.0	2.6	Common constituent of igneous and metamorphic rocks
Plagioclase	$(Na,Ca)(Si,Al)_4O_8$	Two directions	6.0–6.5	2.6–2.8	Common constituent of igneous and metamorphic rocks
Pyrite	FeS_2	Poor	6.5	5.0	Iron ore
Pyroxene (Augite)	$(Ca,Na)(Mg,Fe,Al,Ti)(Si,Al)_2O_6$	Two directions	5.0–6.5	3.2–3.6	Common constituent of igneous and metamorphic rocks
Quartz	SiO_2	None (Conchoidal fracture)	7.0	2.6–2.7	Quartz, chert, sandstone, also a common constituent of igneous and metamorphic rocks
Smithsonite	$ZnCO_3$	Three directions	4.5	4.4–4.5	Zinc ore
Sphalerite	$(Zn,Fe)S$	Three directions	3.5–4.0	3.9–4.2	Zinc ore

Of the various minerals listed in Table 2.2, the amphiboles, potassium-rich feldspars (e.g., orthoclase), sodium-rich feldspars (e.g., plagioclase), micas (e.g., biotite and muscovite), olivine, quartz, the pyroxenes, and calcite are considered important rock-forming minerals. They are the major constituents of the various igneous, sedimentary, and metamorphic rocks that form the Earth's crust. Those rich in silica (e.g., quartz) and alumina in combination with silica (e.g., the feldspars) have played a crucial role in the early development of human technologies. Siliceous rocks, especially quartz and its many cryptocrystalline forms known as flint, chert, jasper, and various silicified rocks are among the most common materials that were used to make chipped stone tools around the world. The chemical decomposition of orthoclase, plagioclase, and related feldspars is one of the most common clay-forming processes, providing the raw material from which pottery and bricks are made.

Some of the other minerals, particularly the metallic ones, have historically been, and in some cases continue to be, economically valuable ores. Hematite and magnetite are an important source of iron that played a central role in the development of the iron industry in northeastern Minnesota. Limonite and pyrite are also potential sources of iron but are less desirable. Commonly occurring with the related mineral geothite, limonite is a comparatively low-grade iron ore but is used commercially as a source of yellow pigment. Pyrite is rarely used as an iron ore because sulfuric acid is a common and troublesome by-product of its processing. Today, most of the iron produced in northern Minnesota is derived from a material called taconite, commonly a mix of hematite and magnetite incorporating a considerable volume of silica (quartz). Separating the iron from the silica in taconite requires special processing technology involving crushing the ore into a fine powder and the use of powerful magnets (Minnesota Department of Natural Resources 2016).

Lead and zinc ores are common in the Upper Mississippi Valley lead-zinc district, a region covering parts of northeast Iowa, northwest Illinois, and southwestern Wisconsin. The sulfide ores galena (lead) and sphalerite (zinc) along with the carbonate ores cerussite (lead) and smithsonite (zinc) were concentrated by hydrothermal action in crevices and pockets developed mostly in the middle Ordovician age Galena Group limestones/dolomites. The mining of lead goes back to at least the 1780s in the area of Dubuque, Iowa (Lyon 1991:260–262). Lead was the primary metal sought through the early to mid-1800s, but the most readily accessible lead ores were played out by the end of the nineteenth century. The mining industry continued in the region by focusing on the zinc ores, and these were mined well into the twentieth century (Lyon 1991:494).

Copper is another metallic element of some significance to the Great Lakes area. Native copper, essentially pure copper metal, naturally occurs in pellets, nuggets, sheets, and even huge masses in parts of Michigan's Upper Peninsula, and some copper mineralization extends southward into northern Wisconsin. Copper mining was historically a major industry in and around Michigan's Keweenaw Peninsula (Thurner 1994); however, the last commercial copper mine in Michigan closed in 1995. The sulfide ores pyrrohotite (iron), chalcopyrite (copper), and pentlandite (iron and nickel) are sufficiently concentrated in the magmatic Duluth Complex of northeast Minnesota to be economically valuable (MN.gov 2013). However, as is the case with pyrite, extracting metal from sulfide ores entails some quite negative environmental risks and proposals to begin mining the Duluth Complex deposits came under intense scrutiny.

Most of these metallic ores were of relatively little use to the Native Americans living in the region before European contact. Hematite was commonly used as a source for red ocher pigment, and dense nodular hematite, possibly imported into the area from Pennsylvanian age deposits in southern Iowa and northern Missouri, was used to fashion ground and polished axes, celts, and adzes. Well-silicified jasper taconite, though essentially useless as an iron ore, was an important material for making chipped stone tools in northeastern Minnesota. Galena and pyrite crystals are sometimes found on Pre-Contact archaeological sites. From Middle Archaic times forward, Native Americans made use of the pure native copper found in abundance around Lake Superior, annealing and hammering into a variety of tools and ornaments that were widely traded across much of eastern and central North America. Pre-Contact copper work is well represented in the Minnesota archaeological record, and an in-depth study of this industry is in and of itself worthy of its own volume. While copper is a mineral and therefore undeniably related to rocks and geology, it is also a metal, so copper artifacts are not included here.

Igneous Rocks

Igneous rocks are formed by the cooling and solidification of molten mineral matter derived from beneath the earth's surface. The melting of rock material is governed by temperature, pressure, and composition. Minerals melt at their own unique temperatures, and increasing pressure can slow the melting process and raise the melting point. Once rock is melted, or more appropriately, partially melted, its mineral constituents segregate. Heavier minerals sink, pushing lighter minerals upward. This vertical segregation determines the composition of the igneous rocks that will be formed when the molten magma cools and solidifies.

Igneous rocks are classified by their grain size and mineral makeup. Magma that cools slowly allows mineral grains to form crystals, and the more gradual the cooling, the larger the crystals generally end up. Igneous rocks with crystalline grains clearly visible to the unaided eye are called intrusive igneous rocks while those whose mineral grains are too small to see are called extrusive igneous rocks. Intrusive igneous rocks with very large mineral grains (over 2.5 cm or 1 inch across) are called pegmatite. Igneous rocks containing notably larger crystalline grains within a finer-grained matrix are called porphyry. The larger mineral grains in porphyry are commonly called phenocrysts.

Granite is an intrusive igneous rock that is speckled with readily visible crystal grains of the minerals orthoclase feldspar (off-white to pink or red), quartz (usually colorless), plagioclase feldspar (white or light gray), muscovite mica (platy, golden), biotite mica (platy, black), and the amphiboles (dark gray, dark green or black). If magma having the same mineral composition is forced to the earth's surface and cooled more quickly, crystallization will be too rapid to form grains that are clearly visible to the unaided eye. This extrusive igneous rock is called rhyolite and may be gray, reddish, greenish, or bluish in color. If that same extruded magma is quickly chilled so that crystallization is minimal, the result is a natural volcanic glass called obsidian.

Granite, rhyolite, and obsidian are at one end of the compositional scale used to classify igneous rocks. They represent the felsic end of the continuum composed mostly of lighter, less dense minerals that crystalize out at lower temperatures, predominantly potassium-rich feldspars and quartz. Felsic igneous rocks with high concentrations of quartz are called syenite.

At the other end of scale are igneous rocks made up of predominantly heavy, denser minerals like pyroxene and olivine that crystalize at higher temperatures that tend to give these rocks an overall greenish, bluish, or dark gray color. This is the mafic end of the continuum, and gabbro is the intrusive rock with visible crystal grains while basalt is the extrusive, fine-grained version.

Igneous rocks with a composition intermediate between felsic and mafic are diorite (intrusive) and andesite (extrusive). Rock compositionally in between granite and diorite are often called granodiorite, and those between rhyolite and andesite are known as tonalite. Very fine-grained extrusive igneous rocks can be difficult to identify without thin sectioning or chemical analysis. In the field, geologists sometimes employ the more generic term felsite for these materials.

Sedimentary Rocks

Sedimentary rocks are formed from broken-down rock material such as gravel, sand, silt, or clay or are the result of organic or inorganic chemical precipitates. Clastic sedimentary rocks are composed of mineral grains that have usually been deposited by moving water as in a stream. Sediment particles suspended in flowing water become winnowed out and sorted by size. As a stream slows down, increasingly smaller particles are released. Extremely minute suspended clay particles will eventually settle out of stagnant water. In this way, sand, silt, and clay are sorted out and concentrated. These deposits can become lithified—turned into stone—by being compacted by pressure from overlying deposits; by being cemented by various solutions, including calcium carbonate, silica, iron oxide, or clay minerals; or by a combination of the two.

Clastic sedimentary rocks are classified by their grain size and parent material. The following size ranges are used by convention:

TABLE 2.3. Conventional Ranges for Sediment Grain Size.

Material	Size Range (mm)
Boulder	>200
Cobble	63–200
Gravel	2–23
Sand	2–0.02
Silt	0.02–0.002
Clay	<0.002

Conglomerates contain rounded pebbles or even cobbles and boulders in a disarrayed cemented matrix. If these rock fragments are angular in shape, the material is called a breccia. Sedimentary rock made of compacted and cemented sand is known as sandstone. Most sandstones are composed almost entirely of quartz grains, and these are referred to as quartz sandstones, quartz arenite, or sometimes orthoquartzite. Sandstones containing a large proportion of feldspar grains are arkosic sandstone. Largely unsorted sand size grains of various mineral compositions cemented in a mud or clay matrix are referred to as graywacke. Consolidated silt is called siltstone; if a mixture of silt- and clay-sized particles is present, the lithified form may be called a mudstone. Shale is the term used for mudstone that is laminated and fissile (can easily be split apart into layers). Hardened, lithified clay is called a claystone.

Other types of sedimentary rock formed by precipitation. The banded iron formations of the northeastern Minnesota Animikie Group were likely formed in seawater when oxygen released by photosynthetic cyanobacteria combined with dissolved iron, forming iron oxide (Konhauser et al. 2002). The iron oxide settled, or precipitated, onto the ocean floor, forming layers that reflect cyclic variations in oxygen content. All of this happened an estimated two billion years ago, long before there were any more complex life forms, many of which first appear during the Cambrian Period over 500 million years ago. This is an example of a chemically precipitated sedimentary rock.

Following the Cambrian Explosion, as it is sometimes called, various marine life forms developed and evolved, some of them forming hard skeletons of silica, calcium carbonate, or phosphate. These organisms contributed their incorporated mineral matter into the ocean floor in life, as in the building of a coral reef of calcium carbonate, and in death, as in the shells of brachiopods and the plates and columnals of crinoids. These skeletal remains may be deposited more or less intact and fossilized, or they may undergo mechanical and chemical erosion and be converted into lime mud. Limestone is a very common sedimentary rock that can be composed almost entirely of calcite (calcium carbonate) derived from marine invertebrates. When limestone is exposed to magnesium-rich solutions under pressure, it is often chemically converted into dolomite. Many of the older Paleozoic limestones, such as those underlying the southeastern corner of Minnesota, have been altered to dolomite. As minerals, calcite and dolomite are very much alike, but dolomite has a somewhat less pronounced and slower reaction to weak acids like hydrochloric acid or vinegar.

Silica is another common material in sedimentary rocks. The ultimate source of this silica, whether it is from the dissolution of silica-bearing minerals, the disintegrated shells of diatoms, or ash fall from a volcanic eruption, is difficult to know and likely varied from one situational context to another. Regardless of its origin, dissolved silica seems to be an abundant and practically ubiquitous substance in the earth's crust. Under the correct temperatures, pressures, and pH levels, this material is believed to form a silica gel that is essentially a form of opal. This silica fills voids, infiltrates the physical structure of a rock, and can completely replace its chemical composition. Upon completing this intrusion, water is released from the opal solution, and it solidifies into microcrystalline or cryptocrystalline quartz. This solidified material forms nodules and contiguous beds in limestone/dolomite deposits. In some cases, entire masses of rock formations are infused with a silica cement, as is the case with Hixton Silicified Sandstone. But these processes of silicification do not happen only in sedimentary rocks. Lake Superior Agate, Minnesota's state gemstone, was formed by the gradual secretion of layer upon layer of silica (in this case chalcedony) into the rounded holes left by gas bubbles in basaltic lava.

Microcrystalline or cryptocrystalline quartz goes by many names, some of which are geologically valid and useful while others are confusing and contradictory. These names principally include chert, flint, jasper, hornstone, novaculite, and chalcedony. People often ask what the difference is between chert and flint, and the answers vary tremendously. To some, flint is the purer, better-quality material while chert is the duller, rougher variety. Some claim that flint is dark colored while chert is light colored. To some British geologists who are justifiably proud of their beloved cliffs, the only true flint comes from the chalk deposits at Dover. In reality, there is no way, structural, chemical, or otherwise, to distinguish chert and flint; they are essentially the same thing. Chert is the more widely used term in North America while in Europe more materials are referred to as flint. Most of the specific raw materials mentioned in this book will be called chert. An exception to this, made out of deference to tradition more than to science, is Knife River Flint since that name rolls off the tongue more easily than "Knife River Chert" or its more geologically accurate designation, "Golden Valley Silicified Lignite." Jasper is a name frequently used for colorful, especially red, yellow, and rich brown chert, but it is still essentially chert. Hornstone is a name once commonly used for gray or blue-gray chert, as in Indiana Hornstone or Kentucky Hornstone. Novaculite is a name sometimes applied to massive bedded siliceous deposits, as is the case for Arkansas Novaculite. Unfortunately, this distinction will not be clear in a chip or hand specimen once it has been removed from an outcrop. Kaolin Chert of southern Illinois was also called novaculite in some of the early archaeological literature. Some specific raw materials have their own custom-made nicknames: jaspillite is a sometimes alternate name for jasper taconite from the area of Thunder Bay, Ontario, and niobrarite has been used as a name for the rich brown-colored chert ("jasper") that comes from the Smoky Hill Member of the Niobrara Formation in north-central Kansas and south-central Nebraska.

The only microcrystalline/cryptocrystalline quartz category that appears to be geologically sound is chalcedony, but even this term has been abused and overused. To many people, chalcedony refers to a noticeably translucent chert. In many archaeological reports written before the 1970s, the designation "brown chalcedony" was commonly but not necessarily always synonymous with what is now widely known as Knife River Flint. Chalcedony is not necessarily more translucent than chert, but it oftentimes is. What truly differentiates chalcedony from chert is the microscopic arrangement of the tiny quartz crystals each contains. In chert, these crystals have no real organization and are more or less amorphous. In chalcedony, the quartz crystals have a fibrous or radial orientation. Unfortunately, this difference is only readily visible in thin sections under magnification. This crystalline structure can, however, give chalcedony, especially banded chalcedony (like Lake Superior Agate), a stubborn graininess that is noticeable when attempting to knap the material. For whatever reason, this interference with fracture seems to go away when the material is properly heat treated.

Sedimentary rocks are capable of preserving fossils, something that is generally impossible in most igneous and metamorphic rocks. In most limestones and dolomites, the siliceous replacement resulting in chert does not alter the structure or details of most fossil inclusions. Therefore, the same invertebrate remains used by geologists to cross-correlate sedimentary units across space can sometimes be used to narrow down or even identify the geologic and geographic origin of a chert artifact. This book will not belabor the potential value of fossils in archaeological lithic studies, but the reader is very much encouraged to develop some familiarity with invertebrate paleontology. The observant and informed reader may even see a fenestrate bryozoa, a crinoid columnal, or a fusulinid of the genus *Triticites* in the photographs of artifacts included in this book.

Metamorphic Rocks

Metamorphic rocks are pre-existing rocks that have been subsequently altered by heat and/or pressure. That pre-existing rock might be an igneous rock (metavolcanic) or a sedimentary rock (metasedimentary). Particular parent rocks tend to metamorphose into specific metamorphic rocks. Some metamorphic rocks are nonfoliated and tend not to exhibit a laminated or planar structure. Sedimentary sandstone becomes quartzite and limestone (and dolomite) becomes marble. A red metamorphosed claystone interbedded between massive layers of hard pink/red Sioux Quartzite is found in a localized area of southwestern Minnesota. This material is the famed red pipestone called catlinite that was mined near the city of Pipestone (Rapp 2002:131).

Igneous rocks can also be affected by metamorphism. Lightly metamorphosed basalt in northeastern Minnesota is often referred to as greenstone. More intensively altered basalt can become amphibolite or hornfels, a dark, heavy, and coarse-grained metavolcanic rock.

Many metamorphic rocks are foliated and do exhibit a distinctly layered appearance. One of the more complex metasedimentary transformations involves the response of mudstone and shale to ever-increasing levels of heat and pressure. At the less intense end of the metamorphic grade scale, these materials become a harder but still visually similar metamorphic rock called slate. Under increasing metamorphism, certain minerals begin to recrystallize and become more readily recognizable. If platy mica grains begin to form shiny surfaces along foliation planes, the material is known as phylite. When the crystals become readily visible, about the size of flecks of pepper, the result is schist, a weak, platy material with layering of mica, feldspar, and quartz grains. Under extreme metamorphic heat and pressure, schist can be transformed into gneiss, a coarse-grained rock with a typically banded and contorted appearance. Gneiss actually looks much more like striped granite than it does its original shale or mudstone parent rock.

Focus on Minnesota

Much of the northern two-thirds of Minnesota is underlain by igneous and metamorphic rocks of Precambrian age. These represent the southern lip of the Canadian Shield, a huge area where the very geologic core of North America is exposed at the surface. In Minnesota, these rock masses are contorted and broken by numerous faults resulting from regional tectonic forces. Because of the extensive cover of glacial till and outwash deposits and glacial lake sediments, bedrock is not exposed at the surface over much of the state. The relative timeframes of concern here are presented in Table 2.4. For additional information, *Geology of Minnesota: A Guide for Teachers* (Morey and Dahlberg 1995) is highly recommended. Figure 2.1 provides a map of Minnesota's bedrock geology.

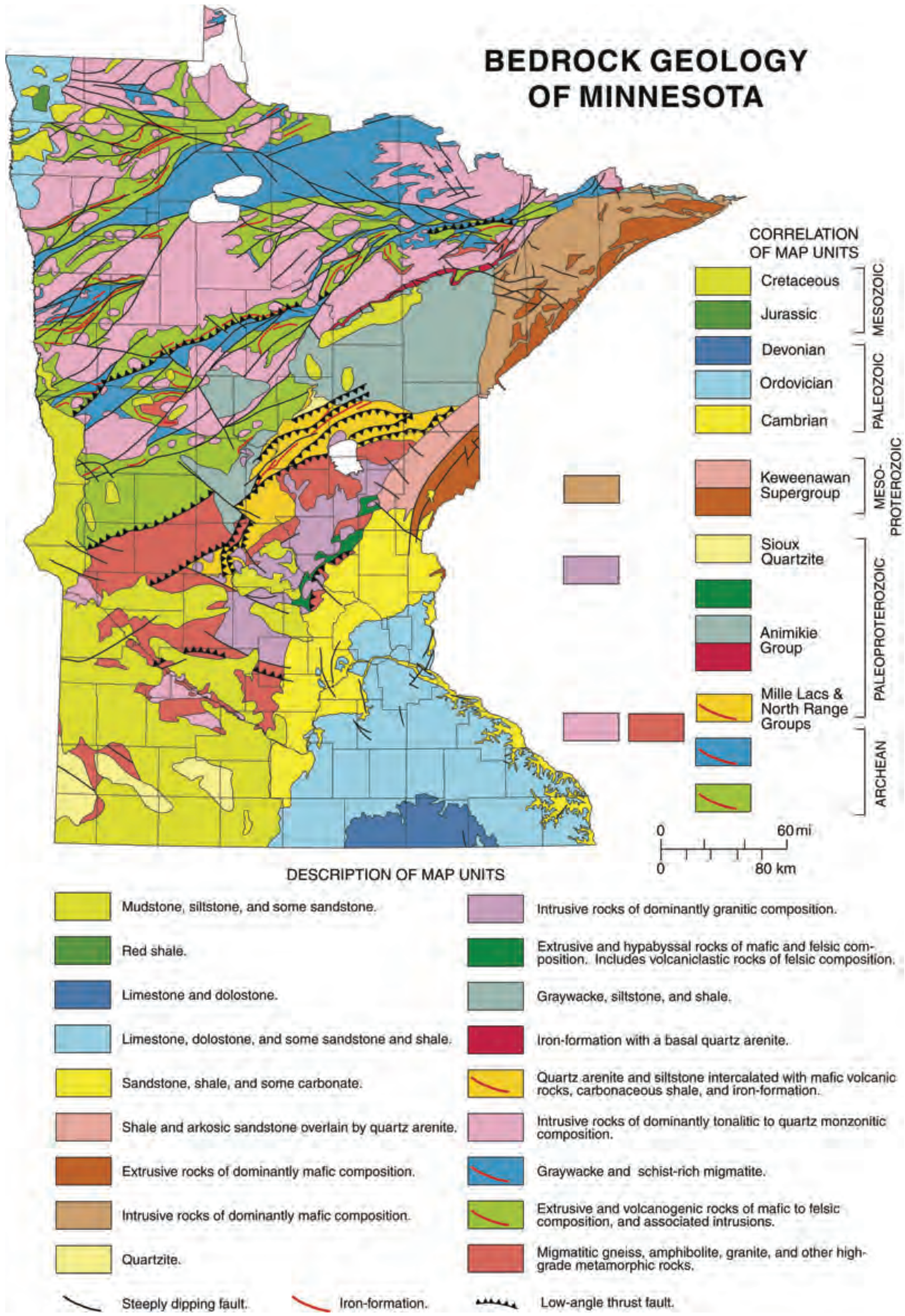


Figure 2.1. Bedrock Geology of Minnesota. From Minnesota Geological Survey (1997).

TABLE 2.4. Geologic Timeframe for Minnesota.

Era	Period	Age (millions of years)
Quaternary	Pleistocene/Holocene	2.6 to present
Mesozoic	Cretaceous	146 to 66
	Jurassic	201 to 145
Paleozoic	Devonian	419 to 359
	Ordovician	485 to 443
	Cambrian	541 to 485
Proterozoic	Middle Proterozoic	1,600 to 1,000
	Early Proterozoic	2,500 to 1,600
Archean		Older than 2,500

The earliest Precambrian is referred to as the Archean. The most ancient rocks in Minnesota are high-grade metamorphic rocks gneiss and amphibolite that lie beneath the central and south-central part of the state. These rocks began forming as early as 3.6 billion years ago. The bedrock beneath most of northern Minnesota consists of extrusive igneous rocks with felsic (e.g., rhyolite, andesite) and mafic (e.g., basalt) compositions along with graywacke derived from the decomposition and sedimentary redeposition of these rocks. These are interspersed with belts and pockets of intrusive igneous rocks with a predominantly quartz-rich felsic composition. Belts of schist and granitic rocks occur in the northernmost portions of the state. These are younger Archean rocks, dating to 2.75 to 2.67 billion years ago.

Early Proterozoic rocks are concentrated in the eastern and northeastern parts of the state. The geology here is complex and includes belts and pockets of quartz arenite, graywacke, siltstone, and shale intercalated with zones of mafic igneous rocks. The Animikie Group includes extensive iron formation deposits that are mined in Fillmore County (Morey and Dahlberg 1995). An extensive portion of central Minnesota is underlain by granite that is quarried for building stone in the vicinity of St. Cloud. Pink/red Sioux Quartzite is exposed at the surface in parts of southwestern Minnesota. This hard, distinctive rock is mined along the Minnesota River for road and concrete aggregate. The Sioux Quartzite is also the source for catlinite in the vicinity of Pipestone, Minnesota.

Middle Proterozoic age rocks are limited to the northeastern part of the state. The Duluth Complex in extreme northeastern Minnesota is made up of intrusive and extrusive igneous rocks with a predominantly mafic composition (e.g., gabbro and basalt). It is here that extensive reserves of copper and nickel ore are attracting mining interest. Minnesota's state gemstone, the Lake Superior Agate, formed in vesicles—cavities created by gas bubbles—in the basaltic lava associated with the Middle Proterozoic.

The southeastern part of Minnesota is underlain by Paleozoic age sedimentary rocks. The Paleozoic is traditionally divided into seven periods; in descending age they are Cambrian, Ordovician, Silurian, Devonian, Mississippian, Pennsylvanian, and Permian. Only Cambrian, Ordovician, and Devonian rocks are exposed in Minnesota. Cambrian age sandstone and shale along with some minor dolomite beds outcrop along the Mississippi River and some of its tributaries. Ordovician age rocks including the Prairie du Chien Group dolomites, sandstones, and the Galena group carbonates are more widely exposed in the southeastern part of the state. The Prairie du Chien and Galena groups both locally contain appreciable quantities of chert suitable for making chipped stone tools. Silurian age rocks do not appear in Minnesota, though they are widely exposed in adjacent Iowa and northern Illinois. The Blanding, Hopkinton, and Scotch Grove formations of the Silurian system in northeast Iowa also contain large amounts of chert that were used for tools. A small area adjacent to the to the Iowa-Minnesota border is underlain by Devonian age rocks consisting predominantly of limestone and dolomite. Grand Meadow chert, a material extensively quarried in Mower County, is attributed to the Devonian Cedar Valley Group. In Minnesota today, the limestones and dolomites of the Paleozoic are quarried mostly for crushed rock aggregate.

Some Mesozoic rocks are also represented in the state. There is a small area of red shale in the northwestern corner of the state that is attributed to the Jurassic period. The bedrock under a large part of southwestern Minnesota consists of mudstone, siltstone, and sandstone of Cretaceous age. Owing to the substantial deposits of later unconsolidated sediments of Quaternary age, these rocks are not visible at the surface. There are no rocks or deposits in Minnesota that are associated with the gap of some 65 million years between the Cretaceous and the Quaternary. These either were never deposited or have been stripped completely away by erosion.

Excepting the southeastern corner of the state, all of Minnesota was subjected to effects of continental glaciation during the Pleistocene, or Ice Age. While we think of ice as a rigid solid, it can, quite slowly, exhibit plastic flow. During the Pleistocene, masses of ice built up over Canada, well over a mile thick in some places. The massive weight of this frozen water compressed it and forced it outward. The results were moving, continent-wide glaciers.

Glaciers act somewhat like giant bulldozers, pushing, and scraping at anything in their path. The maximum advance of a glacial mass is usually marked by a ridge of displaced material called a terminal moraine. Glaciers can also behave somewhat like a vacuum cleaner. In a process called plucking, glaciers break off and pick up loose rocks as they press forward. The bottom surface of a moving glacier encounters friction against the ground beneath, slowing its forward momentum relative to the rest of the ice mass above. The bottom of the leading edge of the glacier tends to tuck in and roll under itself, a process called folding, incorporating loose rocks and earthen material into the larger ice mass.

There have been multiple glacial advances and retreats across Minnesota, but only the latest ones are easy to study. The traces of earlier glacial episodes tend to be largely erased by any subsequent ice advance. The latest glacial sub-period is known as the Wisconsin, when glaciers covered the vast majority of Minnesota, much of the Dakotas, northern, and eastern Wisconsin and extended southward into central Iowa.

majority of Minnesota, much of the Dakotas, northern, and eastern Wisconsin and extended southward into central Iowa.

While glaciers advance by compression and plastic flow, they "retreat" by melting. The Wisconsin glaciers melted away slowly for thousands of years. Ice had receded from most of Minnesota between 13,000 and 15,000 years ago. The northernmost part of the state was probably not ice-free until 12,000 or so years ago. The Great Lakes basins, including that of Lake Superior, were probably not thawed for another millennium or two. When these glaciers melted, rock and soil material that had been encased in them were dropped, forming a ground moraine. This melting resulted in huge quantities of meltwater, and the water and any suspended rock or sediment was released as proglacial outwash. Meltwater accumulated into low areas where there was no sufficient outflow and formed proglacial lakes. The largest of these, Lake Agassiz, incrementally affected up to 900,000 square kilometers (350,000 square miles) of western and northern Minnesota, eastern North Dakota, and a large part of south-central Canada.

Glacial deposits over much of Minnesota are dozens of meters or hundreds of feet thick. While this effectively covers and hides any underlying bedrock, the terminal and ground moraines are full of gravelly glacial till. Glacial till was the predominant local source of stone over the vast majority of Minnesota. Though cherty materials in these secondary sources tend to occur in small and flawed pieces, glacial till also contains a diverse array of other stone cobbles suitable for making ground stone tools. Today, glacial till and glacial outwash are prominent sources of sand and gravel. The northwestern part of Minnesota was submerged under glacial Lake Agassiz, and there are virtually no rocks available in this region as the till was buried by lake bottom sediments.

3

A History of Lithic Analysis in Minnesota

SCOTT F. ANFINSON, MINNESOTA STATE ARCHAEOLOGIST

A GLOBAL PERSPECTIVE

Stone tools have been around longer than humans. Recent finds in the Turkana Basin in east Africa suggest that the manufacture of stone tool dates to at least 3.3 million years ago. This means that the people who first settled Minnesota beginning perhaps 14,000 years ago were part of a manufacturing tradition spanning millions of years. If something hand sized could be made of stone, it had been done somewhere at some time regardless of the type of raw material, how it was shaped, or the function it served.

The archaeological study of stone tools is relatively recent. For thousands of years people have known that stone tools were used by ancient peoples prior to the use of metal implements, but the importance of studying these tools was not explicit until the 1830s when Danish scholar Christian Thompson divided early human history into three ages—Stone, Bronze, and Iron. The subdivision of the European Stone Age into Paleolithic (old), Mesolithic (middle), and Neolithic (new) stages soon followed. With this scheme, humans all over the world could be fit into a relative timescale prior to the association with written texts or a clearly defined stratigraphic sequence. Originally embedded in the three-age scheme were also evolutionary assumptions regarding associated economies, social structures, and religious beliefs. "Stone Age peoples" were assumed to have simple cultures. This evolutionary view has been proven to be erroneous. Some people using stone tools grew crops, had stratified societies, and had complex religious practices.

Stone tool manufacture and use is so important to archaeology because stone is so durable. Archaeological time limits are defined by remnants of cultural behavior and that time period begins with and is dominated throughout by stone tool use. Formed tools made of perishable materials like wood and bone may predate the manufacture of stone tools, but organics rapidly decay and discoveries of early perishable material tools are rare. Furthermore, with stone we not only have the tools themselves, but the much more common debris of their manufacture.

The analysis of stone tools and stone tool manufacture is called *lithic analysis*, from the Greek root word *lithikos* (or *lithos*), meaning stone. Stone tools come in two basic varieties, ground and chipped. Ground stone tools are made by shaping a crystalline or granular rock (e.g., granite, sandstone) through repeated pounding (pecking) or grinding (abrading) with another rock of similar composition. Often the unmodified rock to be shaped into a tool is similar in form and size to the final product. A maul, one of the more common ground stone tools, is most useful when securely attached to an arm-length stick, so by pecking out a groove in a hard rock it can be more effectively hafted to the stick. In addition to mauls, typical ground stone tools are axes, abraders, adzes, and food processing implements like manos and metates. They are usually larger and heavier than chipped stone tools and are less portable.

Chipped stone tools are usually made from raw materials that are somewhat glass-like in appearance, most notably cherts and chalcedonies. They are made by careful reduction of a large stone (core) into a smaller piece. Initial reduction is done by pounding (percussion flaking), but final reduction can be done by pushing on an edge with a sharpened implement like piece of elk antler (pressure flaking). The debris from the reduction is called *debitage*. Chipped stone tools come in many shapes and sizes. Typical chipped stone tools are projectile points, knives, and scrapers. Most lithic analysis is focused on chipped stone tools and the byproducts of their manufacture as the methods of construction and the final products show more variation in form and purpose and are thus more culturally informative.

With the concept of the Stone Age came two early debates about stone tools (Kooyman 2000:4). First of all, researchers were puzzled how chipped stone could be so expertly fashioned without the use of metal tools. Second, there were lots of pieces of stone found all over the world that resembled stone tools, but there was no methodology to determine which stones were products of natural processes and which were indeed manufactured by humans; we now refer to the purely natural examples as *eoliths* or *geofacts*.

Today there are many individuals both professional and avocational who know how to make stone tools, but a century ago flintknappers were rare among both archaeological researchers and aboriginal peoples. By the middle of the nineteenth century, metal tools had replaced stone tools in much of the world. There were still a few makers of gunflints in England, but this was a very specialized craft using modern metal tools with little variation in raw materials and products.

The first question concerning the method of manufacture of stone tools was basically answered by the turn of the twentieth century when it was ethnographically demonstrated that non-metal tools could be used to produce flaked tools. A few "Stone Age peoples" still existed when anthropologists began to document their way of life. Ethnographic studies of people still making stone tools were not common, however, and most date to the latter half of the twentieth century. Most of these studies were done in Australia, New Guinea, Africa, Mexico, or South America. In the United States, anthropologist Alfred Kroeber was fortunate in 1911 to stumble across Ishi, one of the last members of the Yahi tribe in northern California. Ishi still knew how to manufacture tools of stone using traditional methods and he shared this knowledge with some of Kroeber's archaeological associates (e.g., Nelson 1916).

The question of natural versus culturally modified pieces of stone was hotly debated in the late nineteenth century and is still a matter of some debate. William H. Holmes of the Smithsonian Institution was an early skeptic of many reported early American stone tool finds and attempted to prove his views by closely examining manufacturing stages. By the mid-twentieth century, knapping experimentation (mainly in Europe) and ethnographic studies not only helped to determine how culturally modified stone could be distinguished from natural stone but began to demonstrate the actual methods used by ancient knappers.

Once a stone tool was determined to be the product of human manufacture and use, such tools could be classified by shape and function. This was important for several reasons. Tools of similar shape and function could be used to identify particular time periods or cultural complexes. These tools were soon put into formal types and the types used as historical index markers to assign archaeological sites or assemblages within sites to particular prehistoric cultures. In North America, projectile points were particularly useful, especially for pre-ceramic cultures.

The function of a stone tool was important because it could be used to speculate about prehistoric economies, material culture, and way of life. The presence of scrapers and knives indicated animal processing while stone hoes indicated horticulture. Gravers, axes, celts, and burins could be used to suggest woodworking. The presence of many bulky and heavy tools, especially those used to process seeds like manos and metates, could suggest a more sedentary lifestyle. Assumptions about function and form produced new debates about the prehistoric reality of historical index types and the true function of a tool based on its shape alone.

In 1927, distinctive lanceolate projectile points were found embedded in the ribs of an extinct form of bison near Folsom, New Mexico. These points, named *Folsom* points, were the first clear evidence for the Pleistocene occupation of North America. In 1932, points somewhat resembling Folsom were found with mammoth remains near the town of Clovis, New Mexico, and these points, named *Clovis*, pushed New World human occupation even earlier. Clovis and Folsom established a pattern of naming early archaeological complexes after distinctive projectile point types and began a still-existing archaeological obsession with finding the earliest settlers of the New World.

Clovis and Folsom points were also early examples of archaeological types. Types are distinctive artifacts, usually points or pottery that share multiple attributes and are assumed to represent cultural affinities in the past. Taking this notion to the extreme, types were thought to be associated with distinct cultures or particular ethnic groups and could be used to identify these cultures or groups who occupied a particular time and location. These types were called *historical index types*. The first half of the twentieth century was the great age of historical index types in American archaeology. In North America, hundreds of projectile point types were named, some based on only one or two distinctive examples that appeared to be indicative of a particular time period or cultural complex. Eventually, complex statistics were applied to standard projectile point attributes (e.g., length, notch location) to provide a more scientific basis for these types.

By the early 1960s, the trend in archaeology was moving away from artifact description, especially type definition, and focusing more on cultural processes (often referred to as New Archaeology). Radiocarbon dating also made cultural history less dependent on historical index types. In 1964, a conference was held in France that brought together some of the world's best lithic analysts and flintknappers including Francois Bordes from France, an expert in percussion flaking, and Don Crabtree from the United States, an expert in pressure flaking. Also in 1964, Sergei Semenov's 1957 Russian publication *Lithic Technology* was published in an English version. Semenov's work is viewed as very influential to the study of stone tools.

The French lithic conference and Semenov's publication can be viewed as the beginning of modern lithic studies, as they took the study of stone tools beyond just determining basic function or defining historical index types. It began to provide detailed insights into the manufacturing sequence of stone tools and the reasons for variation within assemblages of the same time period and locality, opening the potential for deeper and broader insights into past human behavior. Also in the mid-twentieth century, stone tool finds by Louis and Mary Leakey at Olduvai Gorge in Kenya associated with the bones of ancient human ancestors pushed stone tool manufacture beyond a million years ago. It also brought stone tool research to the attention of the general public through articles in *National Geographic*.

By the late 1970s, the study of lithic technology focused on two avenues of research: 1) use-wear analysis to better understand tool function and 2) the replication of classic tool types (e.g., Folsom points) to better understand the manufacturing process for insights into behavior and chronology. Finding the original sources of regional lithics also grew in importance moving beyond just general categories (e.g., chert, chalcedony) to specific types of stone associated with specific localities (e.g., Hixton Quartzite).

Today, lithic analysis is a wide-ranging field with several dedicated scientific journals, a number of excellent textbooks, and a broad spectrum of professional analysts and enthusiastic avocationals. Lithic analysis is taught as standalone courses at major universities. Knappers' guilds have emerged, attracting both professional archaeologists and highly skilled avocationals. Developments in Minnesota have reflected all of these trends. The locations of some important archaeological sites in Minnesota are provided in Figure 3.1.

Early Minnesota Lithic Studies

Minnesota has a deep history of the study of stone tools and their manufacture. The earliest European visitors to Minnesota noted the use of stone tools by the state's aboriginal inhabitants. In 1680, Louis Hennepin described the use of stone tools by the Dakota at Lake Mille Lacs. In 1766, Jonathan Carver recorded Dakota use of stone tools in the Minnesota River Valley. In 1836, George Catlin visited the famed pipestone quarries in southwestern Minnesota where a red stone was quarried by many Midwestern Native American tribes for pipe manufacture; the raw material was eventually named for him—catlinite.

Figure 3.1. Some important archaeological sites in Minnesota.

In 1849, the Minnesota Historical Society was founded with duties that included the collection and preservation of antiquities. One of the earliest standing committees at the Minnesota Historical Society was that of Archaeology with members like Alfred Hill (founder of the Northwestern Archaeological Survey, 1880–1895) and Jacob Brower, a member of the state legislature and avid avocational archaeologist. Hill hired Theodore Lewis in 1880 to undertake surveys to find and map fast-disappearing archaeological sites in the Upper Midwest. Over the next 15 years, most of Lewis' work focused on mounds, but he also recorded and collected artifacts from prehistoric village sites.

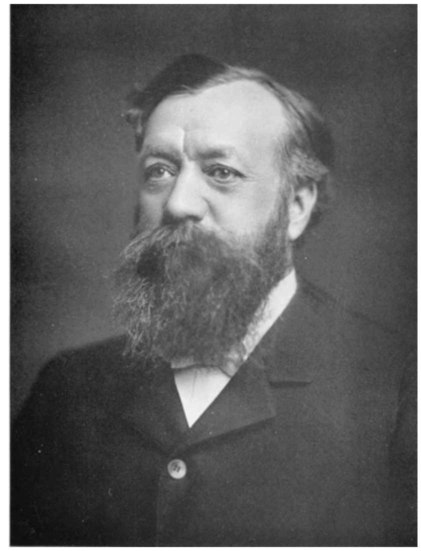


Figure 3.2. Portrait of Newton Winchell.

Minnesota archaeology was fortunate to have Newton Winchell (Figure 3.2) as the first State Geologist. Winchell was not only interested in archaeology early in his career, but after his retirement as State Geologist, he became the staff archaeologist for the Minnesota Historical Society. As State Geologist beginning in 1872, Winchell's primary duty was to record the mineral resources county by county throughout the state to assess economic potential. In the annual and final reports of the Minnesota Geological Survey, Winchell also often noted archaeological manifestations in various counties.

In his 1877 annual geology report, Winchell discussed possible prehistoric quartz artifacts found at Little Falls in a section entitled "Primitive Man at Little Falls: The Stone Cutters" (Winchell 1878:53–58). This is the first scientific lithic analysis done in Minnesota. The same year Winchell's report was published, a schoolteacher named Frances Eliza Babbitt (Figure 3.3) arrived in Little Falls. Babbitt is notable for not only continuing the scientific study of the Little Falls Quartzes but also the fact that she was one of the first women in the country to do high-level archaeological work, earning the respect of contemporary male colleagues (cf. Chester 2002).

Aware of Winchell's description of the Little Falls Quartzes, Babbitt made her own field examination and defined a washout area along the Mississippi River in Little Falls she called "the notch" where there was a concentration of quartz artifacts. She thought the relative crudity of the artifacts suggested they were very old, classifying them as Paleolithic. After corresponding with a number of Minnesota (Newton Winchell, Warren Upham) and national experts (Frederick Putnam, Charles Abbott), in 1880 she began a series of talks and publications describing the quartz artifacts.

Babbitt's publications were in major American scientific journals including the *Proceedings of the American Association for the Advancement of Science*, *American Naturalist*, and *Science*. These brought her to the attention of archaeologists on both sides of the American Paleolithic Debate (Chester 2002:170). The most vocal critic of an American Paleolithic was W. H. Holmes of the Bureau of American Ethnology (BAE). Holmes produced the first detailed American lithic analysis with his *Natural History of Flaked Stone Implements* in 1894. Holmes (1893) dismissed the "Babbitt quartzes" as "modern workshop residue."

Babbitt's interest in the Little Falls Quartzes was picked up by other early Minnesota archaeologists. T.H. Lewis, who had been involved in Minnesota archaeology since 1880, published an article in the *American Antiquarian* in 1887. Jacob Brower, a central Minnesota attorney and legislator, became fascinated with archaeology late in his life and joined the staff of the Minnesota Historical Society as its first archaeologist. Brower mapped mound groups in areas not covered by the Hill-Lewis surveys and produced a number of book-length publications at the turn of the century. In *Kakabikansing* (1902), Brower discussed the Little Falls quartzes in detail and praised Babbitt's work. The same year, Warren Upham, a geological assistant of Winchell, discussed the Little Falls artifacts in an article in the *American Geologist*.

Figure 3.3. Portrait of Eliza Babbitt.

The Minnesota Historical Society began amassing a significant collection of prehistoric lithic artifacts in the latter half of the nineteenth century and early twentieth century. When Lewis left Minnesota in 1895, his artifact collections remained in private hands until Edward Mitchell purchased the collection in 1906 and donated it to the Minnesota Historical Society. Brower's original artifact collections had been destroyed in a fire in the State Capitol in 1896, but over the next 10 years he gathered new artifacts for the Historical Society, mainly from central Minnesota.

With the publication of his final report of the Geological Survey in 1900, Winchell increasingly turned his interest to archaeology. He succeeded Jacob Brower as the Minnesota Historical Society archaeologist in 1906. Winchell was the first researcher to produce a comprehensive overview of prehistoric stone tools in Minnesota. In his landmark volume *The Aborigines of Minnesota* (1911), he devoted 80 pages to descriptions and photographs of stone tools in the collections of the Minnesota Historical Society. He classified the tools by raw material, shape, and probable use.

Winchell attempted to gain national attention for his stone tool expertise with his 1913 publication *The Weathering of Aboriginal Stone Artifacts: A Consideration of the Paleoliths of Kansas*. The Kansas stone tools had been brought to Winchell's attention by Jacob Brower. Winchell concluded that there were four stages of occupation in the Kansas River Valley: Early Paleolithic, Paleolithic, Early Neolithic, and Neolithic and that the oldest of the complexes was Pleistocene in age. Unfortunately, many of the objects Winchell examined were recent fakes, and later surveys to find the Kansas sites described by Brower came up empty (Reynolds 2008; Hawley 2010).

Minnesota Lithic Studies in the Age of the First Professionals

Winchell's 1911 publication can be thought of as the end of the first period of Minnesota lithic analysis and the beginning of the second period. The first period was basically dominated by avocational interest in the prehistoric Native Americans of Minnesota, while the second saw the beginning of professionalism in both how archaeological sites and the artifacts they produced were treated. Winchell's *Aborigines* was published the year after Warren K. Moorehead's two-volume work *The Stone Age in North America*.

The first professional-quality excavation of a Minnesota archaeological site was arranged by Newton Winchell. In 1913, he hired William Nickerson to excavate the Cambria Site on a Minnesota River terrace west of Mankato. Nickerson's full-time job was with a railroad in Iowa, but he had learned basic archaeological techniques from F. W. Putnam of the Smithsonian Institution. After additional excavations at Cambria in 1916, Nickerson's 1917 report included descriptions of tools, with stone and bone lumped together in categories by assumed gender association and function: tools used by men, tools used by women, weapons used in war, objects of dress and ornament, and gaming devices (Nickerson 1988). What made Nickerson's work innovative was the artifacts had been recovered by carefully controlled excavation, although his analysis of the lithic artifacts was not very different from that of Winchell.

In 1928, the University of Minnesota began training archaeologists under anthropologist Albert Jenks. The timing coincided with the finds of Folsom and Clovis points in the American Southwest. Jenks (1937) was lucky in that three accidental finds of human skeletal remains during his tenure appeared to be associated with the earliest human inhabitants in Minnesota. One of them, Browns Valley Man, was found with a cache of finely made lanceolate bifaces of brown flint (Figure 3.4). Just as Minnesota had entered the New World Paleolithic debate with the Little Falls quartzes, with the finds of supposedly early skeletons, Minnesota again got national attention for research into "early man in the New World." Even today, Browns Valley is one of the few Minnesota sites mentioned in national textbooks.

Jenks and his students did not take a great interest in stone tools beyond those projectile points apparently associated with "early man." An exception was University of Minnesota student Ernest Berg who undertook a study of raw materials used for prehistoric tools, including copper (Berg 1935, 1945). Berg (1938) also published a study of catlinite in the *American Mineralogist*.

Figure 3.4. Drawings of Browns Valley Points (Jenks 1937).

In 1938, Jenks' assistant Lloyd Wilford, who had a PhD from Harvard specializing in archaeology, took over the University of Minnesota program. As Minnesota's first truly professional archaeologist, Wilford began to visit artifact collectors throughout the state to find where sites were located and to excavate sites in the state's various regions. Wilford's main area of expertise was skeletal analysis, although he gradually became interested in ceramics. Unlike Jenks, he was not very interested in the earliest inhabitants of Minnesota, the stone-focused people, but emphasized excavations of ceramic-period mounds and habitation sites.

In his village site reports, which are mostly unpublished, Wilford typically talked about the ceramics first and then described "the artifacts," which included patterned tools of stone and bone. Other materials such as animal bone, mussel shells, and lithic debris usually were only briefly mentioned, if at all. Stone tools were divided into chipped or ground, then functional categories, and finally subdivisions by form. Chipped stone tools were typically classed by Wilford as arrowheads, end scrapers, side scrapers, knives, and drills. Projectile points were usually put into categories by basal form: stemmed, side-notched, corner-notched, and triangular (unnotched).

Raw materials for chipped stone tools were usually mentioned by Wilford in his site reports and he occasionally put raw material into tables along with functional type, projectile point form, or stratigraphic level. Very basic raw material categories were used; usually chalcedony, chert, and quartzite. There was typically little description of color except with respect to "translucent brown chalcedony" (what we now call *Knife River Flint*), which Wilford recognized as coming from the Missouri River region in the Dakotas. In his later site reports, Wilford would put projectile points into formal groups by shape, but during Wilford's 30 years of doing Minnesota archaeology, he never named a single formal stone tool type and this was during the "age of types."

A few stone tool-focused articles by avocational archaeologists appeared in *The Minnesota Archaeologist* in the late 1930s, the 1940s, and the 1950s. In 1937, George Flaskerd's article illustrated a method of classifying projectile points based on form as suggested by Thomas Wilson in 1899. In 1945, an entire issue of *The Minnesota Archaeologist* was dedicated to stone tools with articles by Ernest Berg on raw materials (basically his 1935 thesis) and E. S. Macgowan on how prehistoric Minnesota Native Americans were forced to make stone tools from glacial pebbles because he thought there were no suitable bedrock sources in the state. In 1950, Fred Lawshe discussed the efficiency of prehistoric stone tools and documented the first attempts in Minnesota to actually make stone tools, although his attempts at knapping were very basic. Most lithic articles in popular journals of the time simply reported on surface finds of early, rare, or odd stone tools, especially Paleoindian projectile points.

Elden Johnson, a student of Wilford's, succeeded him at the University of Minnesota in 1959. Johnson had written his master's thesis on Yanktonai ethnography at University of Minnesota and then done doctoral work at Yale University, where he had once again specialized in ethnography rather than archaeology.

As the chief Minnesota archaeologist over the next 30 years, Johnson was primarily interested in Dakota origins, especially the development of their use of wild rice. Like Wilford, he was not particularly interested in the pre-ceramic cultures in Minnesota, although he did an early study of copper artifact distribution in northwestern Minnesota (Johnson 1964) and co-authored a paper on Late Paleoindian lithics with a graduate student (Neumann and Johnson 1979). However, in 1964 Johnson made a trip to Pakistan where he did a preliminary survey to look for Paleolithic sites

(Johnson 1973), but his attempt to return to the Indian subcontinent in 1979 was cancelled due to the Soviet invasion of Afghanistan.

Johnson's Minnesota site lithic descriptions and analysis were much like Wilford's: basic descriptions of tool types by functional categories, shapes, and elemental raw materials, sometimes including color. Some of Johnson's students did produce lithic studies as part of their broader work, although any analysis was typically very basic. This would include Johnson and Hendrickson (1960), Jensen and Birch (1963), Watrall (1968a, b), Bleed (1969), Shay (1971), Stoltman (1971), Peterson (1973), and Webster (1973).

Regional lithic studies during this period were basically descriptive with the eventual objective to assign various formal and informal types to specific cultural and temporal contexts. The tool types became the principal "diagnostics" to associate non-ceramic prehistoric sites and horizons with particular cultural complexes. Many of these assignments as they exist in the current site inventory are probably flawed because they are based on assumptions inappropriately derived from studies in adjacent states or poorly-dated Minnesota finds.

Very few lithic types have been named in Minnesota with the notable exception of *Browns Valley Points* named by Frank Roberts in 1940 and confirmed by Marie Wormington in 1957. Minnesota archaeologists themselves have named very few formal projectile point types with the only exceptions of *Cross Lake Triangular* and *St. Croix Corner Notched* from Christy Caine's master's thesis study of artifact collections from sites in the Snake River Valley in east-central Minnesota (Caine 1969, 1974). Only Caine's St. Croix type survives in general usage.

Minnesota Lithic Studies in the Age of Processual Archaeology and CRM

In the late 1960s and early 1970s, Minnesota archaeology exhibited impressive growth, partially due to the rapid acceleration of cultural resource management (CRM) and partially due to the addition of archaeology programs at most state universities. At the Minnesota Historical Society, a Trunk Highway Archaeological Survey was started in 1968 and a County-Municipal Highway Survey in 1975. Full-time DNR archaeological programs soon followed with State Parks in 1984 and Trails and Waterways in 1985. In the late 1970s, both national forests in Minnesota hired full-time archaeologists. Privately owned CRM firms also began to appear in the late 1970s, as well as a four-year Statewide Archaeological Survey funded by the Legislature and housed at the Minnesota SHPO.

At the Universities, Richard Lane came to St. Cloud State and Alan Brew to Bemidji State in 1969. In 1971, Richard Strachan came to Mankato State, and in 1973, Ken Ames came to Moorhead State. Also in 1973, Guy Gibbon and Janet Spector joined Elden Johnson at the University of Minnesota and Joe Hudak was hired by the Science Museum of Minnesota. In 1975, Mike Michlovic replaced Ames at Moorhead State. Thus by the middle of the 1970s, robust academic programs throughout Minnesota began to attract undergraduate and graduate students to the profession of archaeology.

The dramatic expansion and reorientation of Minnesota archaeology in the 1970s initiated a third period of lithic analysis. Not only was the sample size greatly expanded in terms of numbers of sites recorded, numbers of artifacts to study, and numbers of avocational collections documented, but new attention was focused on the production of stone tools, both in terms of details of the manufacturing processes and raw material sources. A new interest in lithic studies in Minnesota was centered in the CRM profession because so many of the newly discovered sites threatened by public projects were "lithic scatters," sites that had yielded only stone tools and/or the debris of their manufacture.

The Minnesota Trunk Highway survey led by Les Peterson was especially active in the area of lithic studies mainly due to the interests and efforts of LeRoy Gonsior. Gonsior started a raw material comparative collection at the Minnesota Historical Society in 1988. This collection has been continually expanded by Gonsior, Kent Bakken, Dan Wendt, Bruce Koenen, and others. Other early CRM initiatives included Alan Brew and Bill Yourd's (1977) examination of an Early Prehistoric site in Roseau County (21RO7) for the Army Corps of Engineers.

All of the new academic archaeologists hired in the late 1960s and 1970s were prehistorians, but most, like their university predecessors in Minnesota, were initially only marginally interested in lithic analysis. An exception was Mike Michlovic at Moorhead State who was broadly interested in lithic artifact taxonomy as illustrated in his doctoral dissertation (Michlovic 1975). Michlovic soon produced a detailed lithic analysis of his 1976 Lake Bronson Site (21KT1) excavations (Anfinson et al. 1978). He subsequently described the lithics from his excavations at a number of deeply buried pre-ceramic horizons in the Red River Valley (e.g., Michlovic 1986, 1987). Several of Michlovic's students, most notably Kent Bakken and Bruce Koenen, became key contributors to Minnesota lithic studies.

Timothy Ready of the Science Museum of Minnesota reinvigorated interest in raw material types with his 1981 CMA presentation defining a new variety of chert in southeastern Minnesota. Also at the Science Museum, Orrin Shane (1978) was interested in Paleoindian artifacts from Minnesota and hired an artist to produce detailed drawings of key finds (Figure 3.5). Shane was also interested in the Grand Meadow Quarry site in southeastern Minnesota. Clark Dobbs looked at functional classes of stone tools to help define Oneota settlement patterns in southern Minnesota (Dobbs 1984; Dobbs and Shane 1982).

On the avocational front, in 1989 the Minnesota Knappers Guild was founded. This resulted in the annual Pine City Knap-In and a publication called *The Platform* produced until 1994. A number of stone tool enthusiasts like Dan Wendt, Rod Johnson, Jim

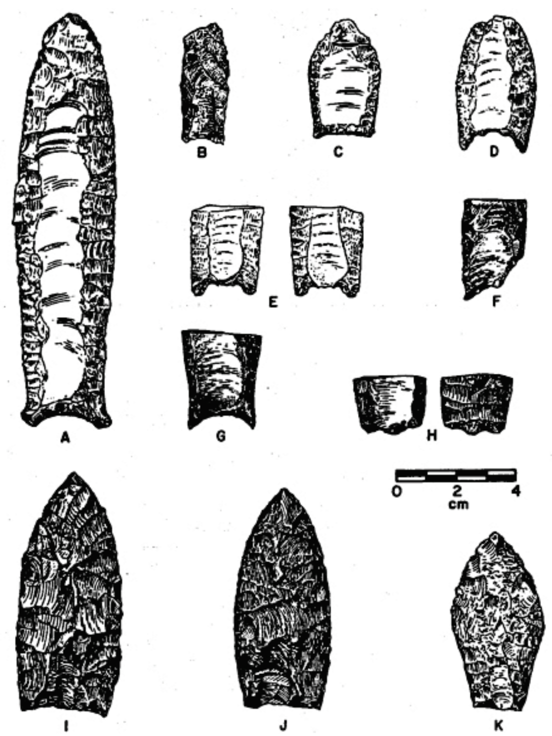


Figure 3.5. Drawings of Minnesota Paleo points (Shane 1978).

Regan, and Tony Romano experimented with knapping technology and published some of the results of their efforts in *The Minnesota Archaeologist*.

Modern Lithic Studies in Minnesota

In the early 1990s, Minnesota entered a new age of stone tool studies when interest in identifying raw material sources expanded, knapping experimentation got more sophisticated, and lithic analysis began to use highly technical approaches. These trends were reinforced and expanded when Minnesota universities began to hire stone tool specialists in their archaeology programs. Gillian Monnier and Gilbert Tostevin came to the University of Minnesota in 2002 and Mark Muniz to St. Cloud State University in 2008.

The Trunk Highway Archaeology program once again led the way in new Minnesota lithic studies. Archaeological excavations at Bradbury Brook on Trunk Highway 169 in 1990 uncovered a Late Paleoindian stone tool workshop. A detailed analysis of the site (21ML42) by Riaz Malik and Kent Bakken was published in *The Minnesota Archaeologist* in 1999. In southeastern Minnesota, surveys on Trunk Highway 52 located a series of extensive stone tool workshops, resulting in studies of raw material types and reduction stages by LeRoy Gonsior (1994) and a study of how to evaluate the importance of lithic scatter sites by Scott Anfinson (1994). Mitigation excavations at the East Terrace Site (21BN6) on a new Trunk Highway 15 bridge north of St. Cloud resulted in a study by Craig Johnson (1994) of regional stone tool assemblages and utilized debitage mass analysis pioneered by his mentor Stan Ahler.

A number of non-CRM reports in the 1990s also investigated stone tool use and production in Minnesota. Master's-level theses by Mike Magner (1994) and Frank Florin (1996) looked at Late Paleoindian complexes. Publications by Scott Anfinson (1997) and Harrison et al. (1995) looked at regional lithics in southwestern and northeastern Minnesota. Guy Gibbon, Dan Higginbottom, and Craig Johnson produced an unpublished manuscript in 1997 entitled *Stone Projectile Points of Minnesota*, which is the basis of an important part of this Stone Tool Handbook.

Moving into the twenty-first century, avocationals began to take leadership roles in Minnesota lithic analysis. At the forefront of this effort is Dan Wendt, a chemical engineer by training and a valued contributor to Minnesota archaeology since the 1980s (e.g., Wendt 1986, 1988). In the twenty-first century, Wendt, a highly skilled knapper, began to take over responsibility for the Minnesota Historical Society lithic comparative collection and write articles on raw materials and prehistoric knapping techniques (e.g., Wendt 2013, 2014). Wendt along with knapper Rod Johnson have become fixtures at public events like Archaeology Week and the Pine City Knap-in demonstrating their knapping skills.

A number of professional archaeologists also continue to make major contributions to lithic studies in Minnesota. Pat Emerson with the Minnesota Historical Society Archaeology Department has led efforts to produce a CD of high-quality photographs of raw material and stone tool types. Bruce Koenen with the Office of the State Archaeologist (OSA) organizes stone tool workshops and gives knapping demonstrations to high school and college students. Kent Bakken's 2011 PhD dissertation has helped us understand temporal and spatial distributions of raw material types in Minnesota. While initial studies of Minnesota raw materials focused on southeastern Minnesota, more recent efforts have focused on the northeastern part of the state as reported in a number of articles in *The Minnesota Archaeologist* (e.g., Mulholland and Menuey 2000; Clayton and Hoffman 2009; Klawiter and Mulholland 2009; Kurth 2013). Craig Johnson with the Minnesota Department of Transportation has initiated an update of Anfinson's (1994) Lithic Scatter Multiple Property Documentation Form, to be completed in 2016.

Innovative techniques to analyze lithics continue to appear and some of these have been used in Minnesota. Mark Doperalski (2013) tested the limitations of macroscopic lithic raw material identification and parent nodule assignment from the materials from the Pedersen Site (21LN2) in southwestern Minnesota. Ellery Frahm of the University of Minnesota has been developing and applying high-tech methods such as electron microscope scanning to identify residues left behind on stone tools. Gillian Monnier of the University of Minnesota is also using electron microscopes to investigate use wear on stone tools.

Artifact illustration also continues to improve. Winchell (1911) did not include drawings of Minnesota stone tools only photographs. In 1917, Nickerson's report on his Cambria excavations included only rough outline drawings of the stone tools (Nickerson 1988). Jenks' report (1937) on the Browns Valley Site contained some of the first detailed drawings of Minnesota stone tools produced in Minnesota (see Figure 3.4).

Quality drawings of stone tools continue to remain valuable to publications showing fine-scale reduction details. In the 1970s, photographic images of stone tools improved with the use of magnesium coatings on the artifacts (e.g., Shay 1971), but this probably permanently damaged the artifacts and was soon discontinued. Today, Gil Tostevin and others at the University of Minnesota have been using 3D laser scanning to examine flaking techniques on stone tools producing colorful computer-generated illustrations.

Classification of artifacts is still important in archaeology both to place sites within named complexes and to identify tool function for interpretation of cultural behavior (Andrefsky 2005:62), but it is unlikely many formal new types will be named in Minnesota even with the continuation of the recent burst of activity in lithic analysis. Stone tool types tend to be broadly distributed geographically and archaeologists in states and provinces adjacent to Minnesota have been quite prolific in naming types. Variations of these types no doubt are found in Minnesota and perhaps formal varieties of types could be named just as they are with prehistoric ceramics. More importantly, knowledge about the timing of the appearance and disappearance of these neighborhood types in Minnesota will continue to improve, as will the same information for the continental types associated with the Paleoindian period.

For now, Minnesota archaeology is greatly benefiting from the lithic analysis revolution thanks to the long-term practical efforts of LeRoy Gonsior, Dan Wendt, Bruce Koenen, Kent Bakken, Craig Johnson, and others, as well as the emerging academic contributions by Muniz, Monnier, and Tostevin and their students. This new stone tool understanding is built on the foundations laid by Francis Babbitt and Newton Winchell over a century ago. While their analyses may have been flawed, they brought attention to Minnesota archaeology and the need for the scientific study of stone tools.

4

Chipped Stone Tools

Toby A. Morrow

Chipped stone tools and the debris resulting from their manufacture and maintenance are, especially in the Upper Midwest, the most common artifacts found on Pre-Contact archaeological sites. In many cases, they are in fact the only (or virtually the only) physical evidence that is found. Among other things, the category of chipped stone tools includes projectile points—the familiar "arrowheads" as many call them—that are found by farm kids and avidly sought by artifact collectors. Projectile points are the tips attached to spears, arrows, and darts and vary so tremendously in their size, shape, workmanship, and other characteristics that archaeologists find them useful in estimating the age of a particular site and assigning them to a regional cultural tradition. Like pottery fragments, they are also time-diagnostic artifacts, though unlike ceramics, projectile points are present during the earliest occupation of North America. Projectile points are diverse, complex, and important enough to warrant their own chapter in this handbook.

But chipped stone artifacts comprise so much more than the sharpened tips used on hunting weapons. Chipped stone implements can be fashioned into a myriad of forms sporting sharp tool edges useful in day-to-day tasks like animal butchery, hide scraping, and woodworking. Chipped stone tools served as knives, saws, scrapers, planes, axes, wedges, drills, and gravers.

Raw Materials

Chipped stone tools are made out of a somewhat restricted range of rocks and minerals exhibiting specific properties that allow them to be flaked into shape and trimmed to create the desired functional edges. The process of making chipped stone tools is often called flintknapping, regardless of the actual material being worked. Suitable raw materials include chert, quartz, quartzite, obsidian, and certain other finer-grained igneous, sedimentary, and metamorphic rocks. Of these materials, the most important in many parts of the world is chert, along with the related microcrystalline quartz varieties often called flint and jasper as well as some chalcedonies. The specific chipped stone raw materials commonly seen in Minnesota are presented in detail in Chapter 7 of this handbook. Glass is common and very familiar in our daily lives, and it has all the properties that make it an ideal flaking material. To a lesser degree, porcelain can also be used, though it is somewhat soft. Many beginning modern flintknappers hone their skills on these two readily available modern materials.

All of these materials share certain characteristics, including conchoidal fracture, isotropism, hardness, and brittleness. Conchoidal fracture refers to a solid's ability to break in a shell-like manner. Applying sufficient force will initiate a crack that removes a chip—more properly called a flake—with concentric ripples or undulations radiating away from the source of the impact or pressure, appearing much like the radial growth lines on a mussel shell. Conchoidal fracture is essentially the opposite and absence of cleavage. Materials with conchoidal fracture have none of the predetermined planes of weakness that are inherent in so many minerals. This leads to the second property, isotropism, which refers to the uniform internal structure of a substance such that it is identical in all directions and orientations. An isotropic material with conchoidal fracture can be broken in any direction, and the manipulation and control of this property allows the toolmaker to create the desired form.

The latter two qualities, hardness and brittleness, might strike one as being opposite ends of the same spectrum and thus redundant and opposite expressions of the same idea, but they are actually measuring two distinct properties. In the mineralogical sense, hardness refers to a material's resistance to abrasion, how easily a material may be worn or ground away. Brittleness is a material's relative susceptibility to fracture, that is, how far a solid can be deformed or bent before it breaks. Window glass and the steel of a pocketknife blade have approximately the same hardness, but glass is obviously far more brittle. Relative hardness is desirable in chipped stone raw material so that the resultant tool will be able to saw, cut, or scrape whatever material is being worked, be it soft animal hide, seasoned hardwood, bone, or antler. The most commonly used natural materials in chipped stone technology have hardnesses ranging from about 5 to 7 on the Mohs scale. Some degree of brittleness is also required of chipped stone material so that it can be readily fashioned by percussion and/or pressure flaking.

The relative degree of brittleness in chipped stone technology is a two-sided issue that must be balanced to optimize tool manufacture and performance. Generally speaking, the more finely grained a knappable material is, the easier it is to flake. Obsidian, natural volcanic glass, is essentially amorphous, has little or no crystalline structure, and is extremely brittle, often even more so than synthetic glass. In contrast, coarser-textured metamorphic quartzite can be very tough, almost concrete-like. In comparison to the amount of force required to flake a piece of quartzite, the force needed to fracture obsidian might seem like a mere tap. The relative degree of brittleness that makes some materials easier to flake than others—seemingly making them more ideal for tool making—also has a distinct downside. The same reduced fracture toughness that makes stone easier to flake also renders the sharp edges of a tool more fragile and susceptible to chipping and breaking during use and also makes the entire tool more vulnerable to breakage and total failure. Obsidian might be a fine choice of material for a razor-sharp knife employed in the light-duty slicing of an animal or vegetable material that is relatively soft. Obsidian would, however, be a rather foolish choice for making an axe to chop down a tree or a hoe blade to till hardened soil. Quartzite, being less brittle, could be expected to better withstand the rigors of such hard usage.

Chert and similar raw materials are generally midway along this spectrum of material brittleness. Even so, here there is a wide range in the degrees of brittleness exhibited by these naturally occurring materials—some are simply easier to work than others. Within a particular type of chert from a particular source area there is often some degree of variation in grain size and relative ease of flaking. Sometimes there are differences even within the same piece of material.

As ceramic specialists are so quick to point out, stone tool manufacture is a reductive technology. A tool is created by removing chunks and bits and pieces from a piece of stone, a process that is very different from the additive technology of building a clay pot. A stone tool can never be larger than the rock representing its starting point. This makes initial piece or package size very important. Just as raw materials vary in their overall flaking qualities, they also come in a wide range of sizes and shapes. Some materials, like Knife Lake Siltstone or Hixton Silicified Sandstone, are more or less massive and occur in the form of large angular blocks. Some, like Knife River Flint, are bedded and occur in tabular masses. Some materials, like Burlington Chert, may be bedded or nodular, but the majority of cherts occur in the form of isolated nodules. These nodules occur in a variety of shapes—some are spherical, others are generally ovoid, and some are of a highly irregular and convoluted form. Nodules also vary in size from one source to another. Burlington Chert often occurs in massive beds and nodules up to 50 cm (19.7 inches) thick. Other materials, like Galena Chert or Grand Meadow Chert, are found in masses that seldom exceed the size of a softball.

Quite clearly, pieces of raw material that are free of any major flaws are a prerequisite for making chipped stone tools. Virtually all rocks are porous to some degree and will absorb minute amounts of water. Freeze-thaw cycles can be particularly detrimental to chert and similar materials. The moisture held inside a stone expands when it freezes, exerting pressure that can create cracks in the material. With repeated thawing and freezing, the cracks grow and can become so prevalent that they ruin a piece of material's potential for flintknapping. When such pieces are struck, they simply disintegrate into irregular chunks and splinters. Severely cracked pieces of knappable stone can be weeded out by a simple field test. When a badly cracked piece is held lightly and tapped with a hammerstone, it emits a distinct clacking sound, like the sound of a train on railroad tracks. A ringing or bell-like sound will signal what is likely a solid, un-cracked piece of material. Even where large pieces of material seem abundant, only a minority of them might be sound and usable.

Heat Treatment

A variety of cherts and chalcedonies can be altered by a process called heat treatment, which renders them finer grained and easier to flake. This technique will not, however, bring about any positive changes in materials like crystalline quartz, quartzite, silicified sandstone, or most igneous or metamorphic rocks. The process involves burying chert pieces in an insulating medium like sand or dry, fine earth and baking them beneath a fire that is maintained long enough to thoroughly heat the stone to a temperature that causes the desired alteration. The heating and subsequent cooling must be gradual as any rapid change in temperature will predictably cause catastrophic cracking or even violent explosions and ruin the material. The material being heat treated is usually partially reduced—made into flake blanks and/or rough bifaces—so that they can be heated more evenly. Some cherts alter at lower temperatures than others, so some familiarity and experience with a particular material is usually advantageous. Generally, most cherts take on noticeable changes at temperatures between 260 and 315 degrees Celsius (500 and 600 degrees Fahrenheit), but some may require 425 degrees Celsius (800 degrees Fahrenheit) or more. Successfully heat-treated chert will be noticeably finer-grained, even somewhat glossy, on subsequently flaked surfaces. The luster of the exterior surfaces present when the piece was subjected to heating is not altered. The material is more glasslike, fractures more easily than before, and often exhibits a change in color. Originally cream-colored, yellowish, tan, or brown chert is usually altered to a more reddish hue.

The degree to which different cherts respond to heat also varies from one variety to another. As a general rule, cherts that are fine grained and easily workable in their raw or natural state do not change as radically, and in fact, some are so sensitive to thermal stresses that the process commonly destroys them. Alternatively, dull-lustered, tough cherts like Maynes Creek Chert from central Iowa and Mill Creek Chert from southern Illinois are so changed by heat treatment that they are scarcely recognizable when compared to the original material. Some common materials in the glacial till across parts of Minnesota, like Tongue River Silica and Swan River Chert, are extremely tough to knap in their raw state and were routinely heat treated to make them more workable.

Exactly how heat treatment achieves this goal is a question that has been pondered by many. It is extremely unlikely that the quartz component in chert is fused or recrystallized as the mineral quartz has a melting point of over 1,650 degrees Celsius (3,000 degrees Fahrenheit)—far hotter than any campfire. One suggestion is that heating induces micro-fractures—cracks too small for the unaided eye to see—through the material, weakening its structure and reducing its tensile strength. If this were the case, it should be possible to heat treat materials like silicified sandstone or metamorphic quartzite, but it is not. The fact that many of the more silica-pure cherts often appear to change less significantly than the duller, more impure cherts favors the explanation that heat treatment is affecting the non-quartz impurities, probably fusing them in a flux and glaze-like fashion.

Figure 4.1. Burned Paleoindian projectile points. ([A] MHS Artifact: 21PN11; burned Hixton Silicified Sandstone; Pine Co., MN; [B] MHS Artifact: 39-26; burned Knife River Flint; Pelican Rapids, MN.)

A critical distinction that is too often ignored is the difference between intentional heat treatment and incidental heating (Figure 4.1). The purposeful thermal pretreatment of chert or similar material is a rather involved process intended to alter its knapping properties. As such, heat treatment has cultural and technological implications and meaning. Incidental heating or burning can happen by accident or even without human intervention. A campfire might be built over an area containing previously discarded chipped stone tools, and flaking debris or some pieces of chert might be unintentionally kicked or scuffed into the area of a fire. Grass, brush, and forest fires can all occur naturally, and such fires will roast or burn any exposed stone material in their path. Obviously, recording heat as a presence/absence attribute will not distinguish the intentional from the incidental. One might also consider the unusual circumstances in which chipped stone artifacts were "killed" or sacrificed in mortuary cremations (e.g., Mason and Irwin 1960; Ritzenthaler 1972; Loebel and Hill 2012).

Does heat treatment improve a raw material as is so often asserted? Heat-treated chert is stereotypically much easier to flake and is often much slicker and more colorful than the naturally occurring material, so if one is making a stone tool to look at, the altered material would seem ideal. If one is making a stone tool to do a certain job, especially a rigorous one, or if one wants a long-lasting, durable stone tool, heat treatment might not be a good option. There is tremendous variation in the frequency of heat treatment seen through the archaeological record of the Upper Midwest. Intentional thermal pretreatment of chert is essentially unheard of in Early Paleoindian as well as in *most* Late Paleoindian and Early Archaic chipped stone technologies. This cannot be attributed to an ignorance of the process since heat treatment was well known at least as early as 10,500 to 10,000 years ago and is frequently seen on Dalton points made of various moderate-quality cherts. By Middle and Late Archaic times, heat treatment was a common and regular practice in many areas, a trend that generally continued into the following Woodland and Late Prehistoric periods.

The infrequency of heat treatment early on and its increasing popularity over time might reflect a couple of things. Early, apparently highly mobile hunter-gatherers generally preferred high-quality raw materials that occurred in large, unflawed masses—the best of the best—and these desirable, high-quality packages of premium rock are quite spottily distributed across the Upper Midwest and Northern Plains regions. During these earlier times, people living across Minnesota were making routine use of raw materials derived from distant source areas such as Knife River Flint from west-central North Dakota, Hixton Silicified Sandstone from west-central Wisconsin, and Burlington Chert from sources in southeastern Iowa, western Illinois, or Missouri (Bakken 2011). From these materials, early hunter-gatherers made comparatively large chipped stone tools intended to withstand numerous resharpenings and repairs and last a long time. People maintained the mobility and regional contacts that made this kind of technology possible. Heat treatment, which weakens a raw material and makes it less durable, simply does not meld well with this type of adaptation.

As time went on, there are quite salient indications, most obvious in the general absence of high-quality exotic raw materials, that people were living less mobile lifestyles, probably traveling within much more restricted home ranges or territories, and no longer had ready access to stone from far-off places. Faced with these circumstances, people turned to the lower-quality and often-smaller pieces of material available locally. Under these conditions, chipped stone tool durability probably became less of a concern or even a futile goal. Heat treatment rendered locally available but less desirable lumps of "second string" stone easier to flake, and the practice became routine.

Making Chipped Stone Tools

Fracture mechanics, the physics involved in breaking solid materials, has been extensively studied under controlled laboratory conditions. Hammers, typically a steel ball, have been dropped from varying heights onto flawless, variously shaped masses of glass and other materials at various angles to decipher the factors that control how a flake is broken off and what determines the resulting size and shape of the piece removed (Hayden 1979). A Hertzian cone, the round, cone-shaped piece broken off when a hard object impacts a flat surface on a brittle solid, is often employed as the analogy for flake removal. One may have seen the scar left by a Hertzian cone on a thick plate glass window that was struck by a pebble or BB at high velocity (Figure 4.2). The point of impact is marked by a small, circular hole from which the fracture propagated and radiated, removing a rounded dome from the opposite side. A similar impact near the edge of a piece of glass will remove a half cone—a piece that has the attributes of a flake removed in the manufacture of a chipped stone tool. The culmination of a series of fracture mechanics studies have determined that the angle of the edge of a piece, the angle at which it is struck, and the point at which impact occurs all play a role in determining the length, thickness, and configuration of a flake. If that were all there is to flintknapping, this discussion could end here, but ancient people were not dropping ball bearings on pre-shaped pieces of glass.

Figure 4.2. Hertzian cone fracture on a windowpane.

The spall of material removed from a parent mass is called a flake, and the parent mass is called a core (Figure 4.3). A flake will generally exhibit several characteristics indicating how it was detached. A flake will have a dorsal surface and a ventral surface. The dorsal, or outside, surface is a portion of what was the exterior of the parent mass or core right before the flake was removed. The ventral, or interior, surface is the planar to slightly curving belly of the piece created by the flake's removal. If a flake is complete, it will exhibit a striking point or platform at one end, from which the fracture front flowed (Figure 4.4). This is the proximal portion of the flake. There *may or may not* be a noticeable swelling on the ventral side adjacent to the striking platform called a bulb of percussion. These bulbs sometimes exhibit a small irregularity called an eraillure. From the striking platform and the position and orientation of the force, the fracture front emanates, leaving radiating undulations reminiscent of the ripples created when a pebble is dropped into a still pond. These ripples or undulations are usually most pronounced near the distal end of the flake, that is, the opposite end from the striking platform. Rough, usually small, linear striations called hackles may be present, usually along one side of the flake interior. These hackles are aligned at right angles to the ripples or undulations.

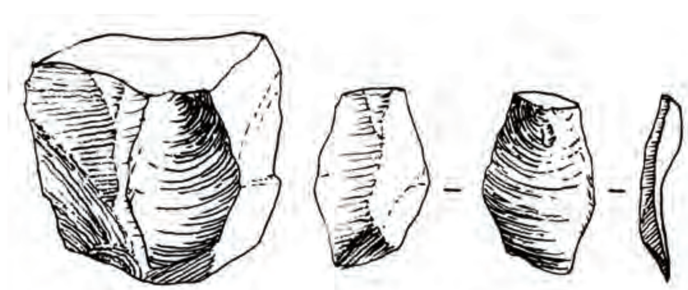


Figure 4.3. Core (left) with flake removal (right).

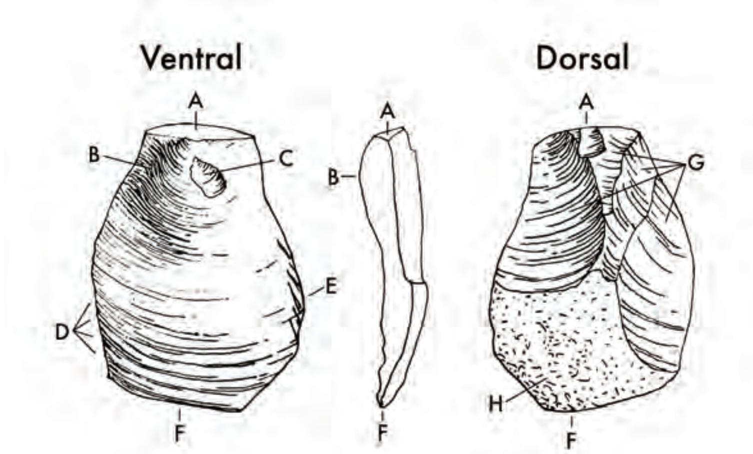


Figure 4.4. Anatomy of a flake. (A) Striking platform. (B) Percussion bulb. (C) Eraillure. (D) Ripples or undulations. (E) Hackles. (F) Terminus. (G) Negative flake scars. (H) Cortex.

The distal end of a flake may take on various configurations (Figure 4.5). A typical type of distal morphology that is also generally seen as the most desirable type is called a feather termination, wherein the flake simply tapers away from the surface of the core. Common types of less agreeable results are referred to as step and hinge fractures. A step fracture occurs when a flake breaks off or snaps partway through the fracture propagation, leaving behind a near-90-degree "step" on the surface of the core. A hinge fracture results when the fracture front rolls outward away from the core, creating a markedly concave gouge on the core. Both step and hinge fractures typically result from a flake being misdirected into a core, having been struck with too little force, at an angle too steep, and/or across a surface that was too flat or concave. Depending on their severity, step and hinge fractures can seriously ruin a core's potential for further reduction. Any flake removed directly into a pronounced step or hinge fracture along the same orientation of the original mistake will compound the error. The most effective way of eliminating a step or hinge fracture is to remove it with a flake struck off to the side or a flake removed from the opposite end. A step or hinge fracture occurs when a flake falls short of its intended goal. The opposite of this is called an overshot or *outré passé*, wherein the flake spans the entire width of a core and clips off part of the opposite end. Overshots can be extremely detrimental as in when they remove a substantial portion of a core or even split a piece in half. Such fractures are commonly the result of an overly ambitious attempt at removing an especially massive flake. Minor overshots where only a small lip of the opposite edge is removed are less troublesome. It should be noted that while feather, hinge, and overshot terminations can be readily distinguished on the distal ends of flakes, it is virtually impossible to reliably separate step fracture terminations from flakes that were successfully removed in their entirety but broke during removal. A step fracture is, after all, a broken flake with its distal portion remaining attached to the core.

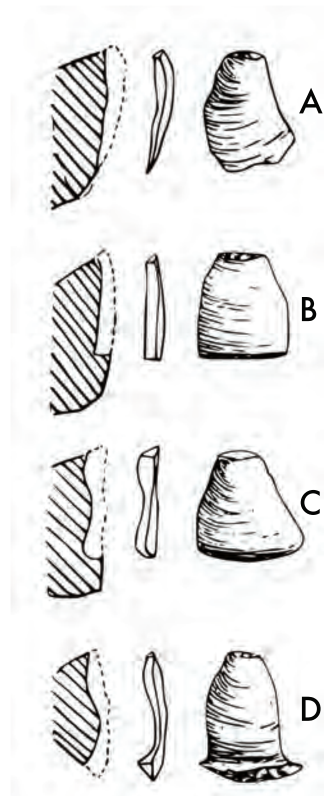


Figure 4.5. Flake terminations. (A) Feather. (B) Step. (C) Hinge. (D) Overshot.

The degree to which most of these morphological features are discernable on a flake or core is very much related to the material from which it was made. Very fine-grained materials, like glassy obsidian, reproduce in detail all of the fine ripples, hackles, and other features resulting from the fracture front propagation. These things are generally visible on fine-grained cherts but become increasingly subtle or even nonexistent on coarser materials like metamorphic quartzite or basalt. The commonly cross-fractured nature of quartz cobbles collected from glacial till deposits renders such characteristics very difficult to discern on either the flakes or the resulting cores.

TECHNIQUES

There are generally four basic techniques that are used in chipped stone tool manufacture: hard hammer direct percussion, soft hammer direct percussion, indirect percussion, and pressure. In the same order, these methods also correlate somewhat with the degree of control a stoneworker exerts in the process. Hard hammers are fairly heavy-handed tools that yield typically rough results. Pressure flaking is extremely controlled and can be used to create exquisite, even aesthetic, patterns. It is perhaps no coincidence that the general sequence of hard hammer, soft hammer, indirect percussion, and pressure roughly follows the trajectory of the development of stone tool technology over the last three million years or so.

Hard Hammer Direct Percussion: Hard hammer direct percussion flaking involves the use of another stone that is struck directly at a preselected spot on the material being flaked. There are variations in holding techniques. The core can be held in the hand, rested on the thigh, or set atop a stone anvil (Figure 4.6). The third variation, referred to as bipolar percussion, is stereotypically seen as a means of dealing with smaller masses of materials that are too small to comfortably and safely hold in the hand during percussion. The technique is analogous to cracking a nut with a hammer. While this view of bipolar percussion flaking is certainly valid, the frequent presence of battered anvil stones on quarry/reduction sites indicates that larger masses of material were also occasionally worked this way. Selection of the spot to strike and the angle of impact are critical. An edge on a piece of material where two surfaces meet at an angle of less than 90 degrees is practically a prerequisite for flake removal. More obtuse edges tend to deflect the percussion blow, and little more than a peck mark or divot is usually the result. Naturally occurring knappable stone may or may not present convenient surfaces and edges suitable for flaking, and if they do not, then such surfaces and edges must be created. Intact spherical nodules and rounded, irregular cobbles will require some fragmentation

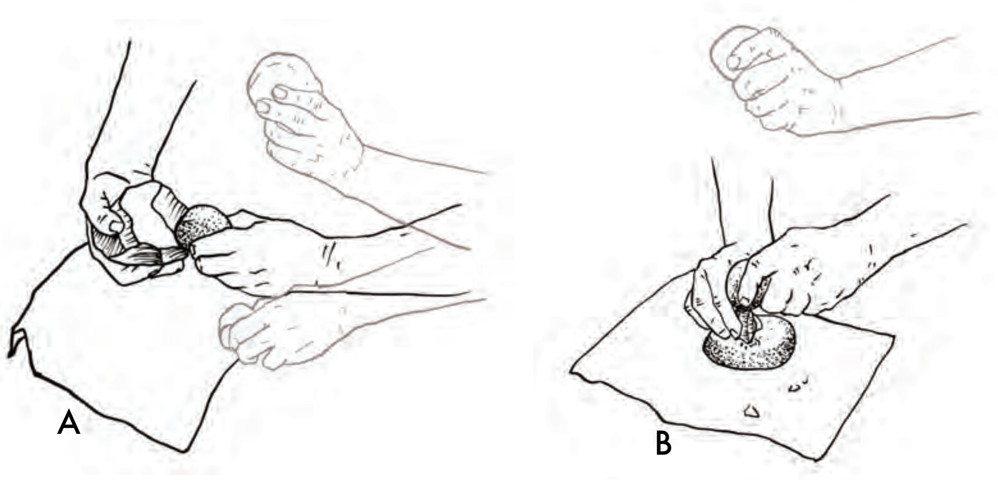


Figure 4.6. Hard hammer direct percussion. (A) Freehand. (B) Bipolar percussion.

before any controlled flaking can take place. Splitting or even smashing a such a piece with a massive blow or cracking it intentionally with fire can be used, in an admittedly haphazard way, to create angles and faces on a piece of material. The angle between the two faces forming the striking platform in part determines the flake that the hammerstone will remove. Fracture mechanics studies have shown that steeper striking platform angles generally yield longer flakes (Dibble and Whittaker 1981).

Once a suitable edge has been picked, the point and angle of impact must be chosen. Generally speaking, the steeper the angle of the strike, the longer the flake removed. However, an angle that is overly steep means the removed flake may gouge deeply and terminate abruptly in an undesirable step or hinge fracture. The ideal angle of the strike is in part determined by the relative hardness of the hammer and the attributes of the desired flake (or alternatively, the morphology of the resulting core). In a classic Hertzian cone, the fracture surfaces generally radiate outward at around 50 degrees from the point of impact, creating a 100-degree cone (Speth 1972). Thus, when striking with a very hard hammer, like a steel ball, a 50-degree angle of attack might be required. With increasingly softer hammer materials, for example, a continuum from quartzite to basalt to compact limestone or sandstone, the strike must be adjusted to an increasingly shallow angle. With the angle selected, the point of impact is another critical decision. The distance between the actual edge of a piece and the spot where the impact is delivered essentially determines the overall mass of a flake. A flake removed from a point very close to the edge of a piece will be thin and often shorter, narrower, or both. A flake struck from more of an interior position will be thicker and potentially longer, wider, or both.

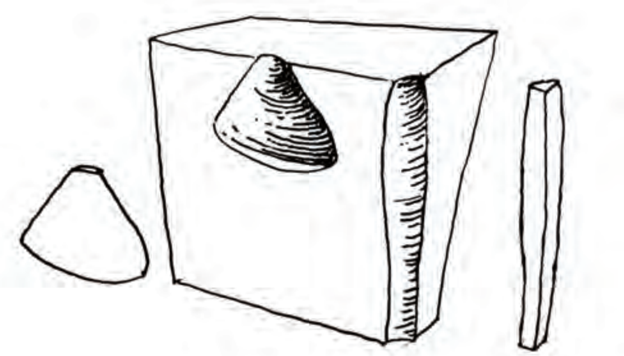


Figure 4.7. Core topography in relation to flake shape.

Thus far, this discussion of hard hammer flaking has largely followed the conclusions drawn from fracture mechanics studies, but there are many other aspects of flintknapping that contribute to the control and success of flake removal. Although it has been downplayed recently (Magnani et al. 2014) exploiting core topography is one of the most critical factors. Figure 4.7 shows the predictable flake removals that can be expected across different surfaces of a core. Put simply, flakes follow ridges and other linear rises and have little trouble traveling along slightly convex surfaces. A flake removal aligned correctly with a straight linear ridge will run roughly parallel to it and, given enough energy, will span its length; this is how blade flakes were made. A flake struck across a flat surface will undoubtedly flare out widely, rendering it relatively short. A flake removed at a 90-degree angle opposing a strong linear ridge or into a concave, saddle-shaped contour will almost certainly step or hinge. Striking platform shaping and isolation can focus the energy imparted by a hammer and ensure a cleaner more successful flake removal. An experienced flintknapper can deliberately trim and adjust the surface contours of a piece, set and isolate a striking platform, and draw the outline of the flake about to be removed. While fracture mechanics has clarified some aspects of chipped stone tool manufacture, mastery of flintknapping—past or present—is more than a matter of angles. All of the factors discussed above must be carefully balanced and orchestrated by the toolmaker, and these characteristics become even more vital in the more advanced techniques like soft hammer or pressure flaking.

Figure 4.8. Soft hammer direct percussion.

Soft Hammer Direct Percussion: By convention, soft hammer percussion flaking involves the use of a hammer that is made of a material other than stone, typically one of antler, bone, or ivory (Figure 4.8). While such organic materials are typically softer than most stones used for direct percussion, they do overlap in hardness with some of the softer materials like limestone and sandstone. A sizable faction of modern flintknappers use heavy copper billets for this task, but these do not appear to be authentic in terms of the actual tools used in prehistory. Arguably, these "copper-boppers," as they are often called, are more interested in the art of flintknapping rather than the science. The principal difference between hard and soft hammer flaking is that, while a very hard percussor induces an almost instantaneous fracture, a softer hammer (be it organic or inorganic) tends to sink in and "take a bite" before the fracture begins. The end result of the latter is a flake with a bending, rather than a cone, type of initiation.

Soft hammers behave quite differently from harder hammers. Whereas the angle of a strike using a very hard hammer is relatively steep (about 50 degrees), a soft hammer will successfully remove a flake at a much shallower angle (about 10 degrees). While a hard hammer strikes a spot and a removes a flake, a soft hammer connects with the edge and essentially "pulls" a flake off. This ever-so-slightly prolonged contact between the core's edge and the soft hammer requires the striking platform edge to be sturdy enough not to simply shatter and splinter on contact. For this reason, soft hammer striking platforms often show dulling and blunting, both to strengthen the edge and to smooth out any minor edge irregularities that might disrupt flake initiation.

The steeper the edge angles on a hard hammer core and the farther into the interior the hammerstone strikes, the longer the flakes that are removed. In soft hammer percussion, the position of the edge relative to the overall configuration of the surface to be flaked and the shallowness of the angle it is struck at largely determine the length of the flake. While striking platform isolation is helpful in hard hammer flaking, it is practically essential for precise control in soft hammer percussion. This is accomplished by aligning a specific location on the edge of a piece with a ridge or linear convexity on the face to be flaked and trimming away excess stone along the edge adjacent to that spot. It can be cogently argued that a well-isolated, positioned and prepared striking platform supersedes any advantage resulting from the perfect blow at the perfect angle. However, combining the ideal platform with the ideal hammer and the ideal technique surely would yield superior results. In other words, percussion flaking is a very complex balancing act, the many different aspects of which become all the more critical in the use of soft hammer percussors.

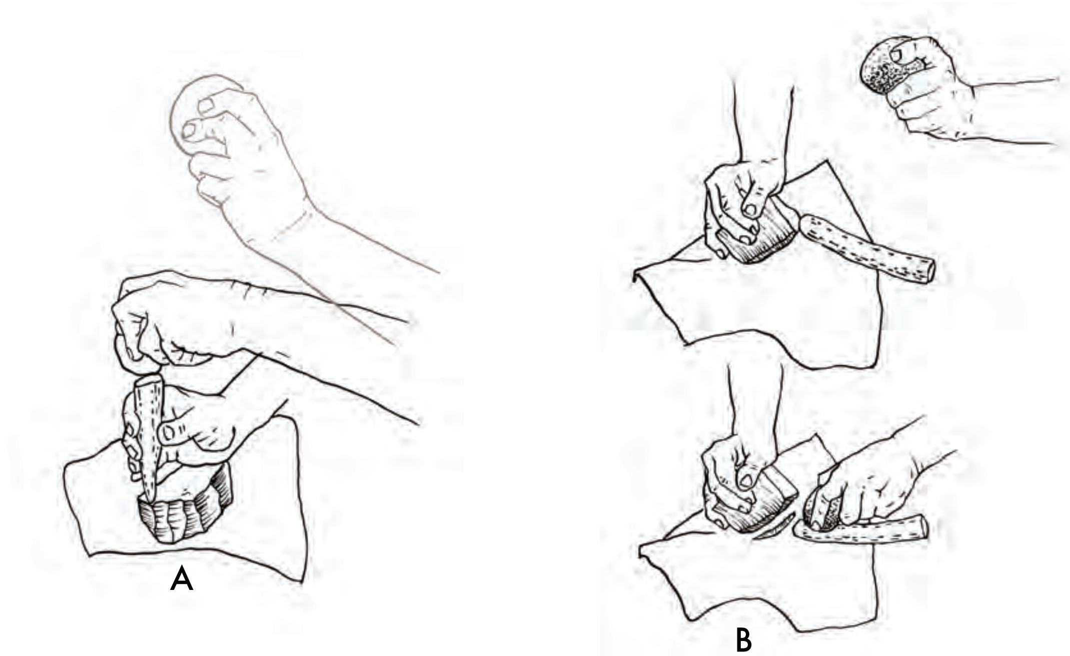


Figure 4.9. Indirect percussion. (A) Inline punch method. (B) Rocker punch method.

Indirect Percussion: Indirect percussion involves the use of a hammer and an intermediate tool like a bone or antler punch to remove flakes. In this technique, many of the aspects of soft hammer flaking are essentially combined with the precision of pressure flaking. One general method consists of using a punch aligned with the flake to be removed (Figure 4.9). Another technique, sometimes called "rocker punching," employs an antler punch at a nearly right angle to the core being flaked. Both methods seem to work with less careful striking platform preparation, but the resulting flakes are generally similar to those created by soft hammer percussion. There are advantages and disadvantages to indirect percussion flaking. One advantage is that the punch can be placed precisely where the knapper wants to remove the flake, meaning the chance of missing a striking platform with a misplaced blow is greatly lessened. However, a noticeable amount of force is lost, or dissipated, between the hammer and the material being flaked, meaning that a decidedly stronger impact is often required. Since this can be wearing on the punches, many modern flintknappers use hafted copper rods as a substitute. Furthermore, indirect percussion can be somewhat cumbersome and awkward, sometimes seeming to require three rather than two hands. Nonetheless, indirect percussion was probably employed to perform some very complex flake removals including, for instance, the fluting of a Folsom point preform; creating the deep, bold notches on a Thebes knife; or driving off thin, parallel-sided bladelets from a Hopewell blade core.

Figure 4.10. Pressure flaking with an antler tine.

Pressure Flaking: Pressure flaking involves exactly what its name suggests, pressing flakes off by applying a gradually increasing loading force into the edge of a piece (Figure 4.10). A generally pointed or spatulate-ended tool of antler or a shaped piece of bone is usually used as the flaking tool. Cut antler tines with worn and blunted tips are the most common form of pressure flaker found on North American archaeological sites. Many of the so-called bone "quill flatteners" identified in so many archaeological reports were probably also used as pressure flakers, especially in creating the delicate notches seen on many Late Prehistoric arrow point styles. Many modern flintknappers use hafted copper rods as pressure flakers, probably because the copper is somewhat more durable and requires less maintenance than a bone or antler tip. There have been a few worked pieces of native copper found on archaeological sites across the Great Lakes and Midwest that have been interpreted as pressure flaking tools; however, such artifacts are generally quite rare.

Because the size of flakes removed by pressure is limited by the amount of force a human body can generate, pressure flakes tend to be comparatively small and thin. Even so, on many materials, an adept flintknapper can squeeze off a one- or two-inch-long flake with relative ease. For larger flake removals, an elongated handle, the so-called "Ishi stick," can be employed, as can an array of elaborate devices designed to increase leverage, some them being quite contrived and archaeologically unlikely (see Whittaker 1994:236).

The piece of stone being worked can be held in the hand or held down on the thigh during pressure flaking. A stout leather pad is a near necessity to keep from driving razor-sharp splinters of stone into one's skin. All of the general principals involved in percussion flaking are also important in pressure flaking, perhaps even more so. The direction that the force is applied is quite critical. The direction squeezed is almost exactly the direction that the flake is pushed off. A steep angle will remove a short flake, ideal for creating a stout scraper edge. Nearly in-line pressure is applied to remove a long flake that travels far into the interior of a piece, creating a more acute edge. For longer, more controlled pressure flake removals, the preparation of the platform edge is important, just as it is for soft hammer percussion flaking. Such modifications might include blunting/abrading the platform edge so it does not simply collapse and platform isolation so the flake is channeled directly into its intended path.

Pressure flaking is generally the final step in making a refined chipped stone tool. It can be used to true up and sharpen a tool's working edges, for example, the keen edges needed on an end scraper or bifacial knife. Similarly, pressure flaking can refresh tool edges dulled during use. The technique can also be applied to trimming, shaping, and further refining the contours of a projectile point. Long pressure flakes can be removed from the slight ridges remaining between percussion flake removals, leaving behind a much smoother plan view, profile, and cross section. In extreme cases, the entire surface of a point preform is smoothed over by the removal of sequential pressure flakes. With each successive pass of pressure flaking, the flake removals can be ever more tightly controlled, creating the beautiful collateral and oblique flaking patterns seen on many Late Paleoindian point styles. While pressure flaking is commonly applied as a finishing and resharpening technique, some tools like chipped stone adzes or hoes can be made and maintained almost completely by percussion flaking, especially by soft hammer percussion. Further, many implements, such as end scrapers and light, thin arrow points, were often made from selected flakes completely by pressure flaking.

Flakes and Shatter

Flakes are the pieces that are removed from a parent mass called the core. Oftentimes, especially in the earlier, heavier-handed knapping, pieces that are not technically flakes are also produced. These pieces, called shatter, do not exhibit striking platforms or a single clear face of detachment, and the direction of their removal cannot be discerned. Together, flakes and shatter are known as flaking debris or debitage. Shatter is often thought to represent the chunkier pieces, but it can be nearly any shape. Cracks or internal flaws in a piece of material are a common cause of shatter. Shatter can also be produced by frost fractures in the material or exposure to fire. A very typical result of these thermally induced fractures is called a potlid. While a potlid might at first seem to resemble a flake, it has no striking platform or any discernable point of percussion.

Chipped stone tool manufacture is a messy process. Hundreds or even thousands of chips, chunks, and splinters can be left behind from the production of a single complex tool. These litter many a Pre-Contact habitation site and are often the first clue when such a place has been discovered. Historically, such material was interpreted as uninteresting refuse, and well into the mid-twentieth century was not even routinely saved during archaeological excavations. The researchers of old probably did not imagine that one might be able to relate a particular piece of raw material to a localized source area, identify what tools were being made at a site, investigate how some of these pieces were used in the daily lives of the people occupying a site, or even determine the degree to which an archaeological site is pristine and discrete or thoroughly mixed and multicomponent.

Over the years, a variety of approaches have been devised for analyzing debitage, the flaking debris left from the manufacture and maintenance of chipped stone tools. Entire books and volumes of collected articles have been published on the subject (Andrefsky 2001; Odell 2003; Hall and Larson, eds. 2004), but only some of the more common approaches will be discussed here. Perhaps the most widely used (and abused) system for categorizing debitage is the primary-secondary-tertiary model wherein the relative amount of original, natural cortical surface on the outside, or dorsal, surface of a flake determines its category. A primary flake's entire dorsal surface is covered with cortex, a secondary flake has some dorsal cortex, and tertiary (or interior) flakes lack any cortex. Though based on what is seemingly common sense—the original outside of a piece of stone is progressively chipped away as the piece is reduced—this approach to debitage analysis can be nonetheless overly simplistic, naïve, and misleading. As the previous discussion noted, lithic raw materials come in widely varying shapes and sizes, and this directly determines the relative proportion of cortex to interior present on an unaltered, naturally occurring piece of material. A flat, tabular piece of material like Croton Tabular Chert from southeastern Iowa has two broad surfaces completely covered with a chalky rind cortex. A large, blocky fragment of Burlington Chert derived from the center of a naturally fractured nodule may, despite its size and unmodified condition, exhibit no cortex at all. A finished point made of the former may still (and often does) retain some of the original cortex while the earliest flakes removed from the latter piece would be categorized as tertiary flakes. Ultimately, the presence, absence, or relative abundance of dorsal cortex reveals much more about the size and shape of the material being worked than it does about any technological operation. The distinction between primary/nodular cortex and secondary/weathered cortex might, however, provide some details regarding the type of raw material source (e.g., a bedrock or residuum exposure versus stream gravel or glacial till).

Another relatively straightforward means of debitage analysis is the so-called interpretation-free method proposed by Sullivan and Rozen (1985). In this approach, the relative fragmentation of flaking debris is quantified. Sullivan and Rozen tabulated the relative frequencies of complete flakes, proximal flake fragments retaining a point of applied force (i.e., striking platform), distal flake fragments without a point of applied force and "debris," a category in which no single interior (ventral) surface is discernable (i.e., shatter). Sullivan and Rozen reasoned that different lithic reduction activities such as intensive core reduction or tool manufacture would result in differing quantities of the four recognized debitage categories. While their approach was designed to simplify analysis and foster objectivity, the method has been roundly critiqued by most who have tested it against experimental data (Amick and Mauldin 1989; Ensor and Roemer 1989; Prentiss and Romanski 1989). The four categories employed appear to have few reliable relationships to any particular technological variables, and their frequencies are greatly affected by raw material type, reduction technique, and even the degree of human or animal trampling.

One widely used approach to debitage analysis is the mass analysis method devised by Ahler (1989). This technique is based on a wide array of experimental and archaeological data, and its theoretical underpinnings are rather sound. All flintknapping activities produce quantities of flaking debris in a wide range of sizes. A considerable amount of very small flaking debris is created during hard hammer core reduction, just as with more delicate and refined flaking. Mass analysis first involves sorting collections of flaking debris by size by passing them through a series of graduated screens measuring 1 inch (Grade 1), 1/2 inch (Grade 2), 1/4 inch (Grade 3), and 1/8 inch (Grade 4). The rationale behind this analytical scheme is that different flintknapping operations—hard hammer percussion reduction of a blocky core versus pressure flaking of a flake tool, for example—will produce varying frequencies of debris in these different size grades and that the debris within those size grades will be quantitatively different. While there will be some very small debitage in all sorted collections, the flaking debris in the same size grade from the heavy flaking of earlier stages will be proportionately thicker, chunkier, and heavier than that created during more refined reduction. The technique has been shown to dramatically demonstrate the differences between reduction technologies at the Knife River Flint quarries and nearby Late Prehistoric village sites in North Dakota (Ahler 1986).

However, mass analysis is not without its limitations. Mass analysis essentially measures the collective averages within a given debitage collection and is thus very prone to false readings resulting from the mixture of debris from very different flintknapping operations. The mixed debris resulting from hard hammer core reduction and tool resharpening by pressure flaking would to mass analysis appears to represent an intermediate stage of tool production like biface thinning. Other complications with mass analysis that have arisen include the effects of raw material piece size and overall texture and flaking quality, both of which can skew the analysis.

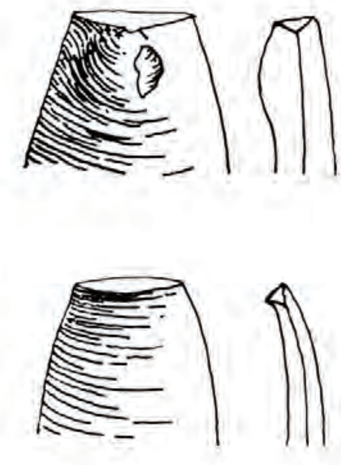


Figure 4.11. Cone (top) and bending (bottom) flake initiations.

The more labor-intensive approaches to analyzing debitage involve examining and recording information at the level of the individual flake. There are generally two fundamentally different ways this is done. One entails sorting flakes into a series of discrete morphological categories: hard hammer flake, soft hammer flake, bipolar flake, biface thinning flake, pressure flake, et cetera. These categories, while seemingly straightforward in their derivation, are nonetheless based on a kaleidoscope of morphological features with the underlying assumption that specific attributes are diagnostic of specific flintknapping operations. Hard hammer flakes *tend* to exhibit pronounced percussion bulbs, and soft hammer flakes *tend* to exhibit bending, lipped flake initiations (Figure 4.11). Bipolar flakes *tend* to exhibit crushing on both ends, and pressure flakes are *generally* small. Unfortunately, specific flake attributes are free to vary somewhat independently, and this inevitably leads to a conundrum for the lithic analyst. Where, for example, does this flake with an obvious bending initiation *and* a sizable bulb of percussion go? How is one to distinguish a pressure flake from a small flake created during percussion knapping? Ultimately, such polythetic flake typologies often degenerate into a series of subjective decisions.

An even more intensive approach to individual flake analysis, potentially the most informative as well, involves recording multiple attributes on each flake. This could include some system of coding or even measuring the various characteristics on a flake. Non-metric variables might include striking platform attributes like lipping (e.g., absent, moderate, prominent), bulb of percussion (absent, diffuse, prominent), eraillure scar (present, absent), striking platform edge abrasion (absent, light, moderate, heavy), and striking platform edge crushing/collapse (absent, partial, complete). Flake scar counts on the striking platform and on the dorsal surface of a flake can be quite informative in that they precisely record the condition and morphology of the parent core at the instant the flake was removed. Naturally, some flaking debris—distal flake fragments and shatter—will lack any striking platform attributes, so it might be useful to incorporate Sullivan and Rozen's (1985) fragmentation categories into the analysis. One might, with appropriate caution, introduce the presence/absence of cortex and, even more relevantly, type of cortex (primary/nodular, secondary/weathered).

Many of the above attributes will covary somewhat with each other and with the relative size of the flake. Larger flakes have the potential to exhibit more flake scars than very small flakes, for example. Therefore, metric attributes can provide a valuable compliment to the morphological study of debitage. Some standard measurements include flake length, width, and thickness, as well as striking platform, width, thickness, and weight. One can use these basic measurements to calculate several interesting ratios. The proportion of a flake's overall width to the width of its striking platform, for instance, can provide a rather potent means of quantifying the degree of precision exercised in flintknapping, and such a proportion might even prove to be somewhat time diagnostic. Early Paleoindian Clovis flintknappers, for example, prepared meticulous and isolated striking platforms in order to strike off massive thinning flakes from large bifaces and large, elongated blades from prepared polyhedral cores. One of the axioms of fracture mechanics (Dibble 1985, 1997) is that larger flakes will have proportionately larger striking platforms; however, people were clearly capable of altering and controlling this variable as the striking platforms on many Clovis flakes are tiny compared to the mass of the flake.

Various angles can also be measured such as those of the striking platform and the lateral flake edges. The analyst will quickly come to the realization that while measuring the exterior striking platform angle on the majority of heavy, hard hammer flakes might be straightforward, it may be next to impossible to measure the same angle on the curving, smoothed, and ground striking platforms set up to remove a thinning flake from a biface.

The characteristics exhibited across the ventral surface of a flake are expressed in reverse on the core from which the piece was removed, leaving behind what is commonly called a negative flake scar. It is for this reason that refitting, a generally underutilized analytical technique in North American archaeology, is possible. Reattaching flakes to cores or to other flakes provides a rather decisive means of understanding chipped stone tool technology among other things such as site formation processes and the relationships between one part or level of an archaeological site to another.

Cores

While the simple definitions of a flake as the piece removed and a core as the parent piece from which the flake has been removed might seem very straightforward, the distinction can become somewhat murky in practice. In the broadest sense, the block of chert from which a flake blank has been removed is a core, and the flake blank itself becomes a core once some flakes have been removed from it. In other words, any knapped piece of stone is, by this broad definition, a core. Technically then, even an end scraper from which several sharpening and resharpening flakes have been removed could be called a core. Clearly, this all-encompassing definition is cumbersome and even a little mind-bending.

A working definition of a core is a mass of knappable material from which a *usable* flake has been removed. In this case, "usable" means a flake that can be made into a tool through further reduction or one that can be used without modification as a tool. As a concept, usable is certainly a relative term that is conditioned by various factors such as the overall character of the tools and technology typical of a given group at a given time, as well the raw material quality and the size of pieces available. In Paleoindian and Early Archaic times, people who were used to making rather large, refined projectile points and tools routinely discarded many moderate-sized flakes that would have been perfectly acceptable to later groups who were accustomed to making and using smaller tools. There are many ethnographic and archaeological examples of lithic materials being scavenged from the debris left by earlier occupants at habitation and quarry sites (e.g., Amick 2007). Under conditions where lithic raw material is scarce or is available only in small masses, smaller flakes may have been used out of necessity, and the lithic tools themselves were often extensively resharpened and recycled.

A serviceable core, one that will yield several usable flakes, can take many forms. A raw material's overall piece or package size, the shape of naturally occurring nodules or fragments and overall flaking quality can limit the particular approaches taken. Here, chipped stone technology moves beyond the various techniques employed in creating flakes and applies them in a systematic or strategic way. There are basically four types of core reduction strategies—blocky or amorphous cores, bipolar cores, blade cores, and bifacial cores—and each category has its own particular costs and advantages (Morrow 1997).

The most elemental core reduction strategy involves the sequential removal of flakes in an unpatterned and opportunistic way. The available angles and edges on a piece are used as striking platforms, and the resulting blocky or amorphous cores exhibit negative flake scars of varying sizes, shapes, and orientations. Reduction ceases when the core can no longer yield flakes of the desired shapes and sizes. The flakes resulting from the reduction of a blocky or amorphous core will be highly variable, just as the ratio of waste to usable material will be.

Bipolar cores are typically small in size, reflecting the common use of this reduction strategy in situations where suitable raw materials are scarce and occur in small pieces. Bipolar cores are reduced by percussion against an anvil stone. As a result, the cores, and often the flakes removed from them, typically have a wedge or columnar shape and exhibit platform crushing and flake scars emanating from opposing ends. The expended bipolar cores, sometimes called *pieces esquillees* (Figure 4.12), could themselves be used as tools such as wedges or, in the case of more tabular specimens, be further trimmed and reduced into tools like scrapers or small projectile points. Of the four general core reduction strategies enumerated here, bipolar is the most haphazard and wasteful, but at the same time it can be applied to smaller units of material that would be difficult or impossible to reduce in a more specialized manner.

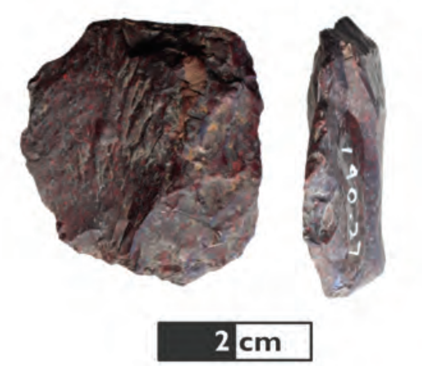


Figure 4.12. A bipolar core or piece esquillee.

Blade cores are the most specialized and demanding of the four core reduction techniques discussed here (Figure 4.13). Blade cores are prepared cores from which elongated flakes, called blades, are sequentially removed. This core reduction strategy is best suited to fine-grained, high-quality raw materials with good flaking qualities. Core setup is meticulous wherein a columnar, conical, or wedge shape is carefully prepared with a flat, broad platform on one end (or sometimes both) opposing straight, linear ridges running down the length of the core. These ridges guide the blade removal, leaving behind parallel ridges that in turn can be used to remove additional blades. The defining characteristic of *true* blade core technology is the serial production of many blades. Such reduction continues until no more blades of the desired size can be removed. Blade core technology is an extremely efficient way of extracting usable flakes from a core. Once the blade core is set up, there is relatively little waste. However, the remaining exhausted blade core is generally unusable.

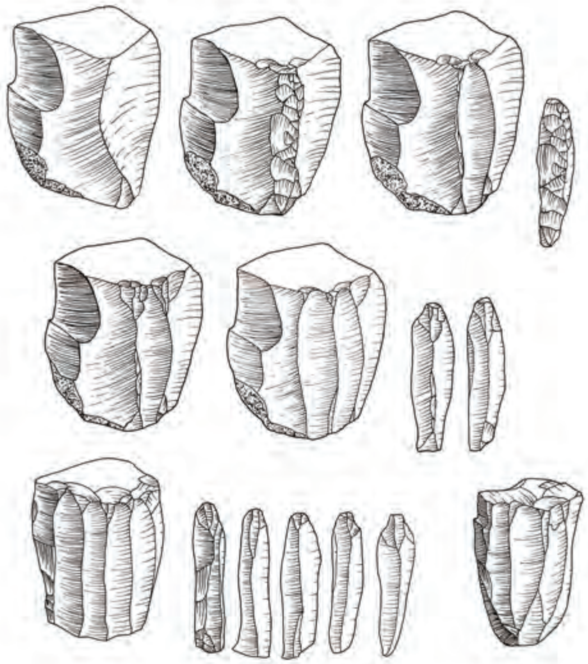


Figure 4.13. Blade core preparation and reduction.

Some comment on what is and what is not a blade is warranted. To some, a blade is any flake that is at least twice as long as it is wide. This simplistic definition of what constitutes a blade is to be discouraged. Elongated flakes can result from nearly any core reduction strategy, and flakes with lateral retouch can take on the same proportions. Calling just any long, narrow flake a "blade" (or even "bladelike") dilutes the meaning and intent of the term and inevitably conjures up the idea that specialized blade core technologies were present where they certainly were not. In the absence of the blade cores themselves, it is not so easy to distinguish true blades from fortuitously elongated flakes. Blades removed from specially prepared polyhedral cores will usually exhibit one or more parallel or nearly parallel, elongated ridges or arrises running the length of their dorsal face. When still present, striking platforms are small, tightly prepared, and usually ground, reflecting the level of care and detail involved in each blade removal. Blade core technology, in the strict sense advocated here, is relatively uncommon in the archaeological record of the mid-continental United States. Large blades were a cornerstone of Early Paleoindian Clovis technology (Collins 1999), but these do not appear to have persisted into subsequent Paleoindian or Early Archaic technologies. Medium-sized blades made from conical or horse-hoof-shaped cores are abundant on many Middle Woodland Hopewell-related sites in Illinois and Ohio (Montet-White 1968; Nolan et al. 2007). Microblade cores were employed in the vicinity of Cahokia in Illinois for the express purpose of creating small drill bits.

The final core reduction strategy discussed here, bifacial core reduction, is quite prevalent across the Upper Midwest, especially in the earlier periods of prehistory. This is not simply an alternate way of reducing a core as some have misinterpreted it (e.g., Prasciunas 2007); rather, it is a truly integrated system where the artificial distinction between core and tool comes into focus. Simultaneously, bifacial cores were a source of usable flakes as well as the blank or preform for a future tool (Kelly 1988). Bifacial tools, projectile points and knives in particular, dominate the chipped stone tool technologies

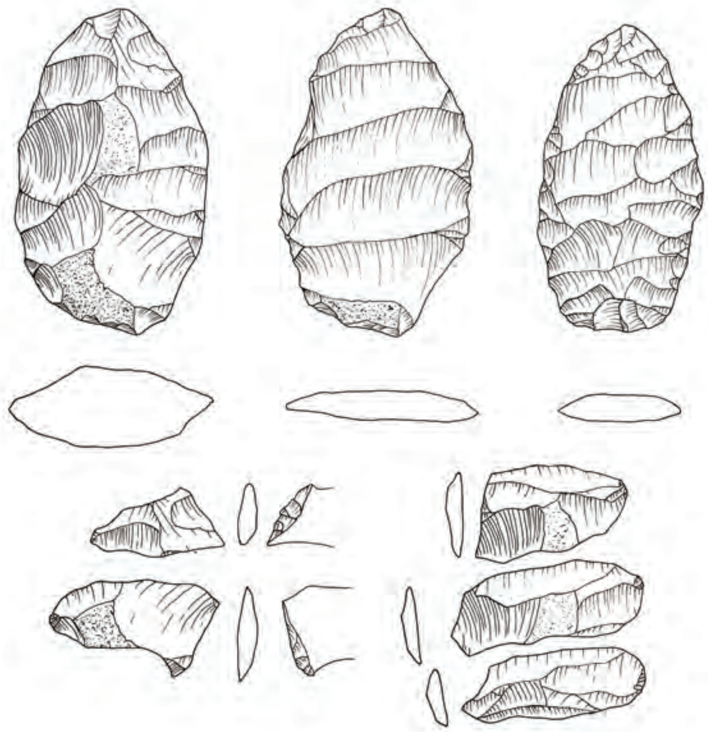


Figure 4.14. Clovis-style bifacial core reduction.

found throughout most of North America. But while bifaces are commonplace, not all bifaces are equally suited for being viable cores. Scale is critical here. A large bifacial blank of good quality material can yield numerous thinning and shaping flakes that can be put to use or serve as blanks for a variety of tools. In contrast, a small bifacial preform for an inch-long arrow point has little or no potential to produce any flakes large enough to be useful. Bifacial core technology was taken to its zenith in Early Paleoindian, especially Clovis, times (Figure 4.14). Through strategic manipulation of striking platform alignment, position, and isolation, Clovis knappers reduced large bifaces of high-quality material through the removal of massive thinning flakes, some of which ended in an overshot or *outré passé* termination. This was more than an impressive way of thinning and flattening a biface or a demonstration of virtuosic skill. The so-removed flakes were ideal for making a variety of flake tools. The remaining bifacial core was then further reduced into a large knife or a Clovis point. Because the volume of waste relative to the amount of stone used, this aspect of Clovis chipped stone tool technology was magnificently suited to a mobile lifestyle. Bifacial core technology, wherein the biface is both core and blank/preform, was an important component of most other Paleoindian and Early Archaic technologies in the Midwest, although it gradually became less formal. To one degree or another, it is seen in all, or at least most, later periods where large to medium-sized bifacial tools were being made.

Flakes as Tools

With the ground breaking use-wear research of Semenov (1985) and those that followed his lead (Hayden 1979; Keeley 1980; Vaughan 1985) it gradually became clear that many of these so-called "waste flakes" had actually been used as tools. Utilized flakes, that is, flakes whose only modifications are derived from their direct use for a given task or tasks, are quite often the most numerous chipped stone tools recovered from an archaeological site. With rare exceptions, these quintessentially informal flake tools outnumber the more patterned chipped stone artifacts. Archaeological and ethnographic research clearly demonstrate the overall importance of flakes in Stone Age economies.

Flake tools are often envisioned to have been hastily selected, briefly used, and readily discarded implements. This may be the case for many but certainly not all. Some flakes, particularly larger ones, might possess several expansive working edges that can be used for various tasks and repeatedly rejuvenated through resharpening. It is possible, indeed quite likely, that some relatively simple flake tools were retained in an individual's personal gear for a considerable time and used for many purposes.

Flakes might be chosen from the debris left behind during a previous tool-making or core reduction episode. Alternatively, a flake of predetermined size and proportions can be skillfully removed from a core specifically for the purpose of being used as a tool. Generally speaking, several factors influence the selection of a flake for use as a tool. For one, larger flakes, ones that can easily be held and manipulated in the hand, may be preferable. Alternatively, somewhat smaller flakes can be hafted to a variety of handles. Flakes should have particular edge attributes suited to the task at hand or edges that can be easily retouched and modified to the desired configuration. A straight, sharp, acute, and unretouched flake edge is ideal for cutting/slicing softer materials like meat, fresh hide, or soft treated leather. A unifacially or bifacially retouched edge is almost always more jagged and much duller than the unaltered edge of a freshly struck flake. Accordingly, retouched edges tend to work more like a saw. A stout, steeper flake edge is more useful in scraping or planing harder substances like seasoned wood, bone, or antler. A piece with a sharp corner or spur might be selected for use as an engraving or boring tool. A wedge-shaped scrap could be chosen for use as a wedge to split wood, bone, or antler. A quick, if perhaps a bit draconian, means of producing tools with steep, near-90-degree edges, sharp corners, and/or wedge-like shapes is known as radial fracture. In this procedure, a spot somewhere interior on a flake, or sometimes even a biface, is struck with enough force to break the piece into several fragments. Radial fragmentation was certainly used to create tools, but it was also used on occasion to ceremonially "kill" artifacts presumably deposited as some sort of offering (e.g., Ellis and Deller 2002).

Chipped Stone Tool Categories

The following pages will introduce a wide variety of chipped stone tools. Generally, these artifacts are traditionally divided into unifaces, which are tools that are worked on only one face, and bifaces, which are tools that are worked on both faces. Some chipped stone tools are highly specific and time-diagnostic. Others are more ubiquitous through time and might be expected on nearly any site of nearly any Pre-Contact period.

Blades and Blade Cores

True blade core technology seems to be exceptionally rare in Minnesota. No blade cores, whether Clovis, Hopewell, or others, were seen during the collections search conducted for this book, and none appear to have been reported in the literature. Viable candidates for flakes that are true blades (i.e., elongated flakes that were serially removed from a prepared core) were similarly absent. Theler and Boszhardt (2003:117) do indicate that a blade core was recovered from a Hopewell mound in southwestern Wisconsin. It is therefore possible that Hopewell blades could be found on Middle Woodland sites in adjacent southeastern Minnesota. If this is the case, these will be true and obvious blades. If complete, they will probably be between about 40 and 70 mm (1.57 and 2.76 inches) long, 10 and 15 mm (0.39 and 0.59 inches) wide, and approximately 2 to 3 mm (0.08 and 0.12 inches) thick. Hopewell blades were almost universally made of superior-quality raw material such as Cobden Chert, Flint Ridge Chert, or heat-treated Burlington Chert.

The most compelling case for true blade technology in Minnesota is the recovery of eight prismatic blades from an apparent cache near Pelland in Koochiching County, northern Minnesota (Stoltman 1971). All eight blades, as well as an end scraper found in the same area, were made of Knife River Flint. Collins (1999:166) discusses these specimens in relation to Clovis blade assemblages from other parts of the United States and indicates that the Pelland blades are remarkably similar. He does note, however, that the Pelland blades exhibit a considerable amount of lateral retouch, and it is difficult to say how much the widths of the original flakes had been reduced. These blades have tentatively been identified as Clovis blades, but it has been suggested that the find location was submerged beneath glacial Lake Agassiz during Clovis times (Huckell and Kilby 2014).

GUNFLINTS

Compared to many other parts of the mid-continental Unites States, Minnesota was a real hub of social and economic activity in the late eighteenth and early nineteenth century. This was due in large part to the fur trade where Euro-American goods were given to Native Americans, in Minnesota principally the Ojibwe and the Dakota, in exchange for furs, especially the highly prized beaver pelts. Firearms were introduced to the region at this time, and the firearms of the day were flintlocks.

The first true flintlock mechanisms were developed in the early 1600s in France. Muskets and rifles using this system became popular all over Europe and eventually the world. Flintlocks had been the mainstay firearm for sport, hunting, and warfare for nearly 200 years when they were eventually superseded in the mid-1800s by the percussion cap firing system. The flintlock mechanism basically consists of a spring-loaded hammer clamping a flint in its jaws, which strikes a vertical steel plate called a frizzen, showering sparks into the gunpowder in the pan below, thus igniting the charge packed behind the bullet in the gun's muzzle (Figure 4.15.)

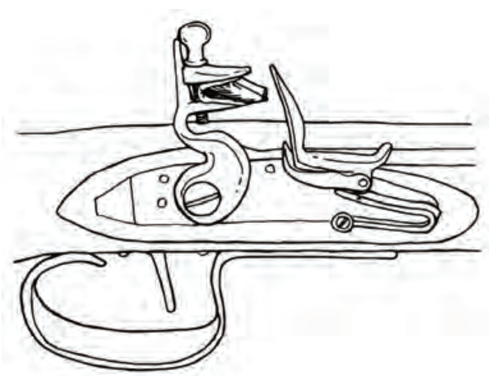


Figure 4.15. Flintlock mechanism.

The manufacture of gunflints for use in flintlock firearms developed into a real industry in the late eighteenth century. While many European countries had their own cottage industries for producing flints, none dominated the gunflint market as England and France did. In part this was due to geologic circumstances. The area around Brandon, England, has an abundance of high-quality gray to black flint, and there is an extensive supply of excellent tan to brown flint in the region about Le Grand Pressigny, France. Gunflints made in these two areas account for the overwhelming majority of gunflints that are found on early historic sites in the United States.

Early on, gunflints were just selected out of randomly knapped flakes with little care or forethought going into their production. By the end of the eighteenth century, two more systematic techniques had been developed. The simplest of these was the production of spall flints. These were made by knocking squat, tabular spalls off of the edges of cores with a steel hammer. The resulting spalls exhibit a very prominent cone of force, and the whole ventral surface of the flake is more or less a diffuse bulb of percussion. These flakes were then roughly trimmed to the desired shape and size, using a smaller steel hammer or pliers.

The most systematic means of making gunflints was knocking elongated blades off a cone-shaped core, again using a steel hammer (Figure 4.16). The blades were then set atop a steel bar mounted vertically, and the blade was snapped into segments using another smaller steel hammer. The latter operation is quite analogous to radial fracturing as discussed previously. As a result, several gunflints could be made from one flake. It is written that an experienced knapper could make 3,000 to 4,000 flints a day. The snapped blade segments often exhibit bold demi-cones at the point of percussion; these are analogous to the Hertzian cones discussed earlier in this chapter.

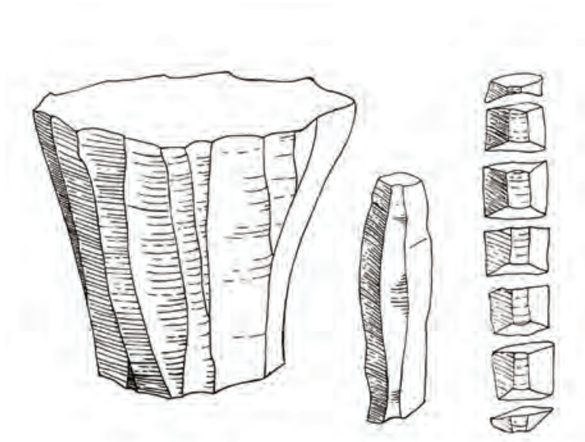


Figure 4.16. Snapped blade gunflint production.

Spall and blade flints were made in both England and France (Figure 4.17). There is a general trend suggesting that flints made on blades dominated in the later production of gunflints, but spall flints never seem to have been totally abandoned. English and French gunflints can usually be distinguished from each other by color and style. English flint is characteristically medium gray, dark gray and/or almost black in color and slightly translucent. French flints are usually a yellowish tan to brown color, often described as honey colored, and this material is more translucent than the English flint. English flints are rectangular, usually square or nearly so in plan view with minimal retouch on the sides. The typical French flint, whether made from a spall or a blade segment, is often more extensively retouched and heel shaped. This retouch is unifacial and is concentrated on the butt end of the flint, opposite the striking edge. Superficially at least, a French gunflint resembles an end scraper.

Gunflints were clamped into the jaws of the flintlock hammer and cushioned by a leather or lead patch. In use, the edge striking the frizzen is crushed and splintered. Just how many shots could be fired with the same gunflint is probably variable and depends on the situation. As a rule of thumb, the shooter can probably count on 10 to 15 good shots before the sparking diminishes and the flint needs to be adjusted or flipped over. A partially used-up flint might have been discarded and replaced if a new flint was close at hand. If no such replacement was available, the old, mostly spent flint could be readjusted and turned with another, less battered edge aligned to strike. In the heat of battle, one could imagine that tinkering with the flint would be postponed in favor of more pressing concerns.

Both Native Americans and Euro-Americans used flintlock firearms. During the collections search conducted for this book, we specifically sought out Native-made gunflints, that is, gunflints made out of local raw material rather than imported from Europe. We did not see any good examples but did note that bipolar cores or *pieces esquillees* were often mistaken to be possible gunflints. None of the bipolar pieces examined exhibited the kind of crushing and mashing usually seen on the used gunflints.

Figure 4.17. Gunflints. (A) French spall, (B) French blade, (C) English blade. ([A] MHS Artifacts: 085-51-63,64,65; Grand Pressigny Flint; 21LW6, Fort St. Charles, Lake of the Woods Co., MN; [B] MHS Artifacts: 359.190.6; 1987.151.146; 1987.151.1.142; 359.126.23; Grand Pressigny Flint; 21RW11, Lower Sioux Agency, Redwood Co., MN; [C] MHS Artifacts: 359.1216.4; 359.514.9; 359.126.19; Brandon Flint; Historic Fort Snelling, Hennepin Co., MN.)

End Scrapers

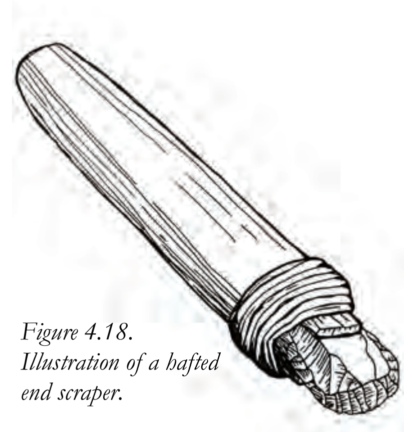


Figure 4.18. Illustration of a hafted end scraper.

End scrapers are a very common, predominantly unifacial, type of flake tool. They were typically made on large to medium-sized flakes. The flakes selected for making end scrapers commonly exhibit some ventral curvature, and this is most evident on freshly made specimens that have not been extensively resharpened. One end of the flake, usually that opposite of the striking platform, is retouched unifacially, forming a rounded to snub-nosed scraping edge. Sometimes, this is the only modification to the selected flake blank. In most cases, however, the lateral sides of the flake have been trimmed, usually unifacially, to give the piece a more symmetrical plan view. Some are trianguloid, some are rectangular, and some are rounded. The retouch is commonly limited to the dorsal side of the flake blank, but some flaking may be present on the ventral side if needed to flatten out or taper the butt end of the tool. The bilateral symmetry exhibited by most end scrapers as well as the trimming and shaping work commonly done on the tool's non-working or butt end strongly suggests that these tools were hafted for use. Progressive resharpening of dulled tool edges gradually reduces the length of these tools, eventually to a point where the haft begins to interfere with the tool's performance.

End scrapers were made of essentially any of the raw materials used for chipped stone tools. However, finer-grained and in some cases heat-treated materials that can yield a keener edge seem to have been preferred.

While end scrapers can be used effectively to scrape or plane a variety of materials such as seasoned wood, bone, or antler, the overwhelming evidence from ethnographic sources and use-wear analyses indicates that the principle function of most of these tools (in North America, at least) was in hide working. Though some refer to these tools as "thumb scrapers," they were likely almost always used in a haft; they are very ineffective as handheld tools. A common scraper haft form seen across the Northern Plains is an L-shaped handle made out of the lower portion of an elk antler. Handles may also have been made out of antler tine by cutting a recessed notch on one end. Other handles could be made of wood. There are a few studies on how regularly an end scraper needs to be resharpened in use. One can expect that about one millimeter (0.04 inches) of length will be lost every time a dulled end scraper is resharpened. In general, resharpening appears to have been rather frequent, a factor probably contributing to the abundance of these tools on many sites. Some end scrapers exhibit very heavy rounding and dulling of the working edge—use wear that is clear to the naked eye. This degree of edge wear is seen on tools that were probably used in the final breaking of a hide rather than to scrape off any hair or dermal matter (Schultz 1992).

While end scrapers are somewhat time diagnostic in some parts of the United States, in Minnesota it appears that they might be expected on archaeological sites of nearly any period from Early Paleoindian through Protohistoric. There may be some temporally sensitive variables in morphology and/or raw material use, but if such variation exists—and it may not (Taylor 2006)—it awaits future study. End scrapers were also frequently made on broken or repurposed projectile points. These reworked examples are time diagnostic and have the same basal characteristics of the original point type.

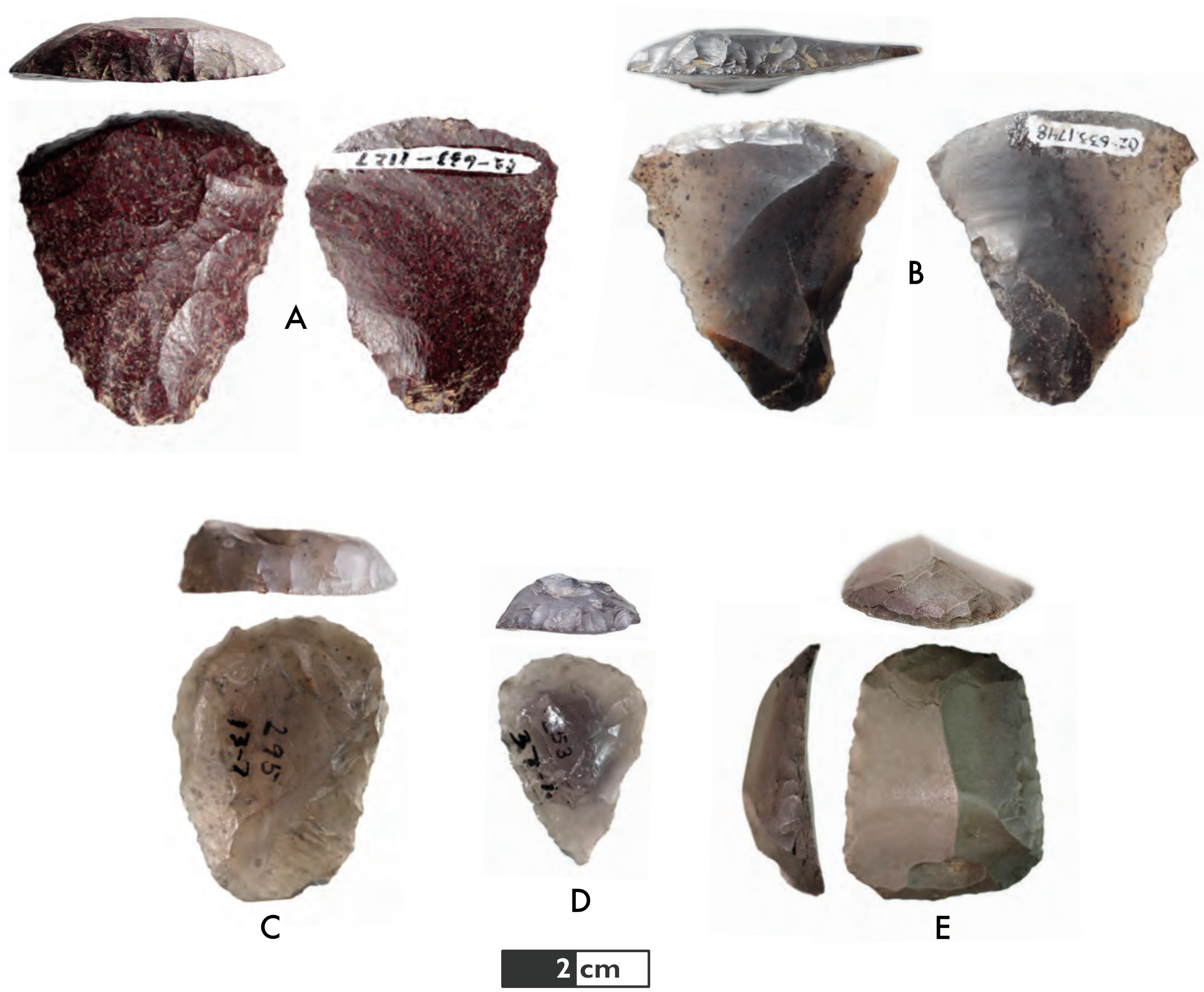


Figure 4.19. Selected end scrapers. ([A] SNF Artifact: 02-633-1127; Jasper Taconite; Gordon Site, MN; [B] SNF Artifact: 02-633-1748; unheated Gunflint Silica; Gordon Site, MN; [C] MHS Artifact: 13-7; unheated Gunflint Silica; Ramsey Co., MN; [D] MHS Artifact: 37-1; unheated Gunflint Silica; Dakota Co., MN; [E] MHS Artifact: 2-2 163; Knife Lake Siltstone; Anoka Co., MN.)

Logan Creek Scrapers

Logan Creek scrapers are essentially end scrapers with side-notched hafts. They are named for the Logan Creek Site in eastern Nebraska (Kivett 1959, 1962a, b). Though the proximal ends of these tools are essentially identical to the bases of Middle Archaic age side-notched projectile points, these are not reworked or repurposed points. While the flaking on the hafting area is often bifacial, the working end or bit portions are totally unifacial.

Logan Creek scrapers were probably hafted in a manner similar to other end scrapers and were likely used in the same manner.

Logan Creek scrapers are a generally uncommon artifact form. Only a few examples were seen during the collection searches conducted for this book. However, they are found sporadically over a wide area including eastern Nebraska, Iowa, southern Minnesota, and Illinois. As one might expect from the haft similarities, these tools are diagnostic of the Middle Archaic period. They appear to be routinely associated with side-notched Middle Archaic point forms in Illinois. Radiocarbon dates from the Logan Creek type site in Nebraska range from 7350 to 6000 B.P. (Kivett 1959, 1962a, b).

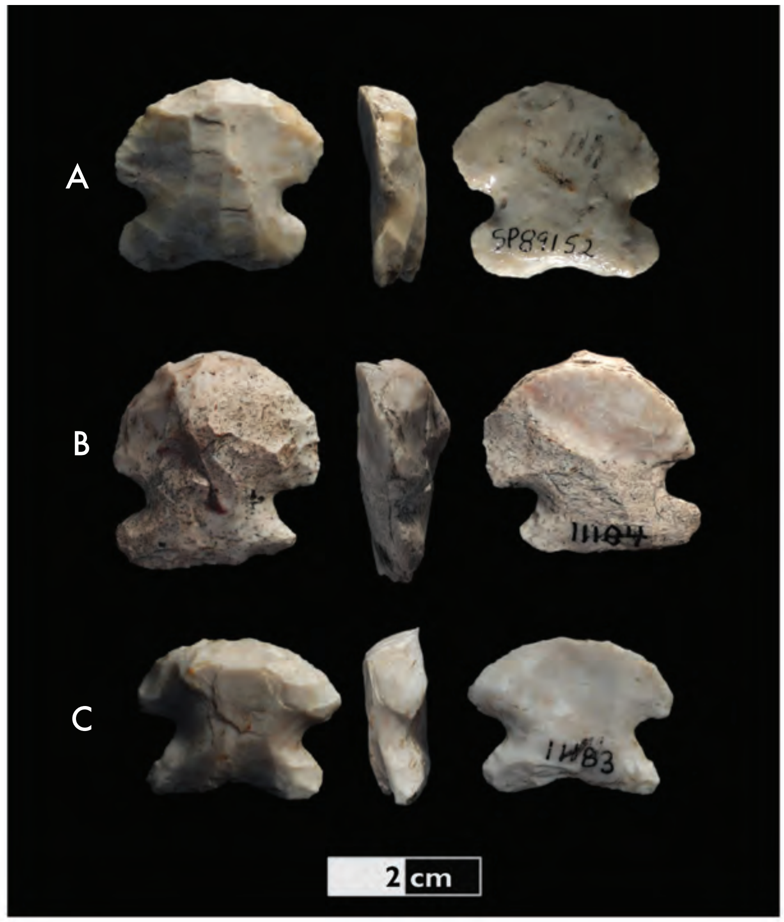


Figure 4.20. Logan Creek scrapers. ([A] MBISP Artifact: 11186; heat-treated Burlington Chert; Grass Lake, MN; [B] MBISP Artifact: 11184; heat-treated Burlington Chert; Freeborn Co., MN; [C] MBISP Artifact: 11183; heat-treated, possibly Burlington Chert or Prairie du Chien Chert; Grass Lake, MN.)

SIDE SCRAPERS

Side scrapers are another common category of unifacial tool. Essentially, these consist of a flake with retouch concentrated along one or sometimes both sides of a flake. The retouch is usually concentrated on the dorsal side of the flake blank. These tools have a variety of sizes and shapes. They can range from less than 2 cm (0.8 inches) long to well over 10 or 15 cm (3.9 or 5.9 inches), provided an adequate-sized flake blank. These tools may be roughly elongated, trianguloid, or irregular in plan view. The worked edges may take on different configurations, but most have a straight to slightly convex contour. Concave scraper edges, commonly called spokeshaves, may also occur. A single retouched flake may exhibit numerous and varied retouched edges.

Figure 4.21. Illustration of a hafted side scraper.

Side scrapers are basic unifacial tools that probably served in a variety of functions. Many were probably used in hand without a handle, but some may have been hafted. These tools could have been used to scrape hides, but they are far less ideal for that task than are hafted end scrapers. The regularized unifacial edges and the overall elongated configuration of many side scrapers would render them ideal for scraping/planing wood, much like using a drawknife. Use-wear studies have also demonstrated that many side scrapers were used as knives, and they can indeed be effective tools for butchering and dismembering game.

Large, unifacial side scrapers made on flat, broad flake blanks derived from large bifacial cores are a characteristic tool found in many Early Paleoindian, Late Paleoindian, and Early Archaic assemblages. These are not necessarily time diagnostic since similar, often somewhat smaller, tools are found on Pre-Contact sites of all ages.

Figure 4.22. Selected side scrapers. ([A] SNF Artifact: 02-633-24; Jasper Taconite; Gordon Site, MN; [B] SNF Artifact: 02-744; Jasper Taconite.)

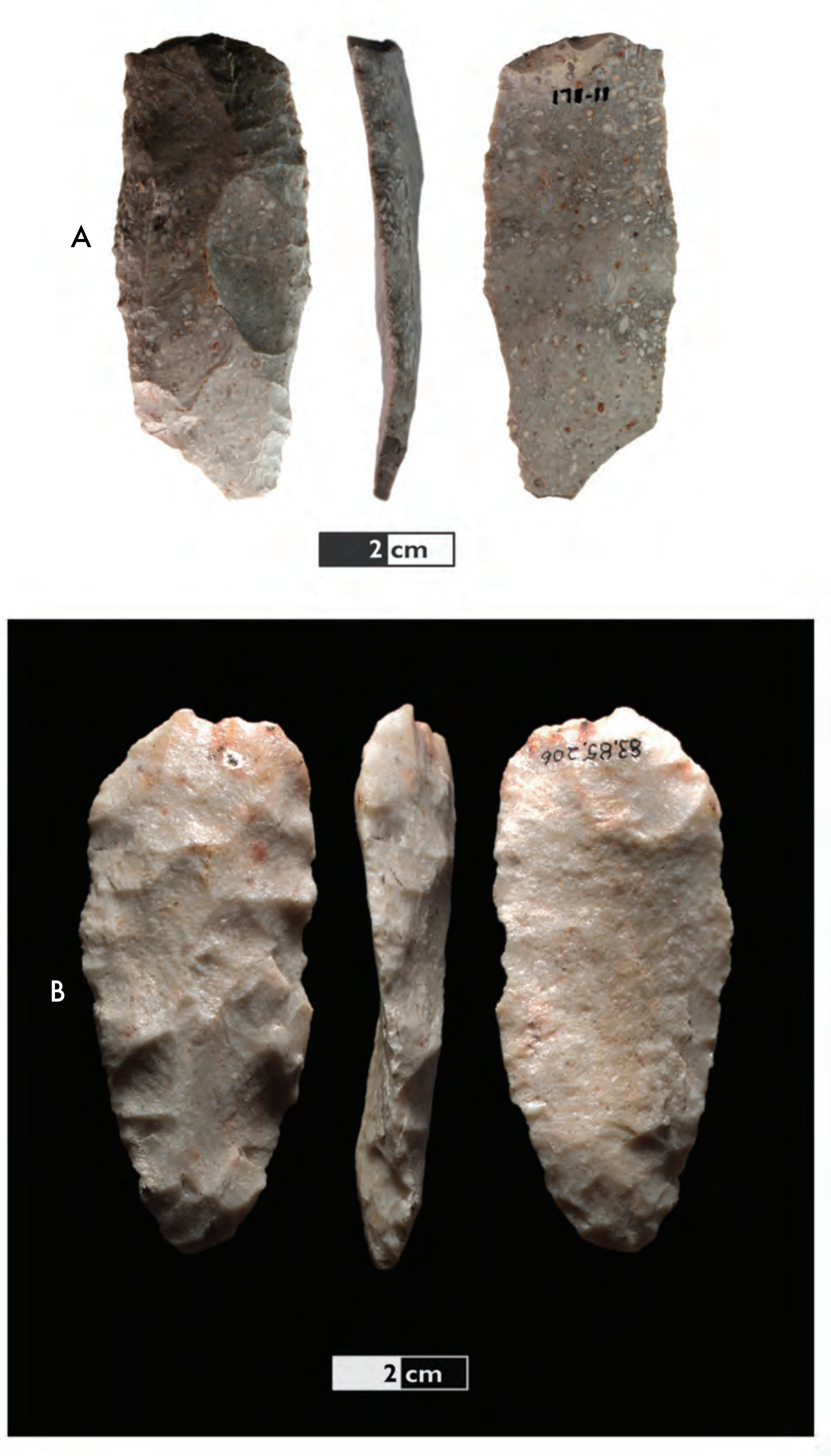


Figure 4.23. Selected side scrapers. ([A] MHS Artifact: 171-11; unheated Plattsmouth Chert; Faribault Co. MN; [B] SCHM Artifact: 83.85.206; heat-treated Shakopee Chert; Meeker Co., MN.)

Gravers

Gravers are chipped stone tools with small, sharp tips. These do not appear to be particularly common tools in Minnesota, or perhaps they are not being routinely recognized. Stereotypical gravers are made on medium-sized flakes with one or more unifacially chipped, sharp spurs. No tools of this description were seen in the collections search done for this book. However, some examples of graver tips flaked onto repurposed projectile points were observed, and one is illustrated here. Another simple graver made on the pointed end of a flake is also shown.

Gravers were used to incise, score, and slot materials such as wood, bone, and antler. Examples made on flakes may have been used unhafted, but those made on projectile points were most likely used with attached foreshafts.

Gravers with single or multiple spurs made on flakes are characteristically found in Early Paleoindian assemblages, but similar tools are also present in Late Paleoindian and Early Archaic sites. They are usually much less common than other tool types. Examples made on projectile points, such as the ones shown here, can generally be assumed to date to the same timeframe as the respective point types represented.

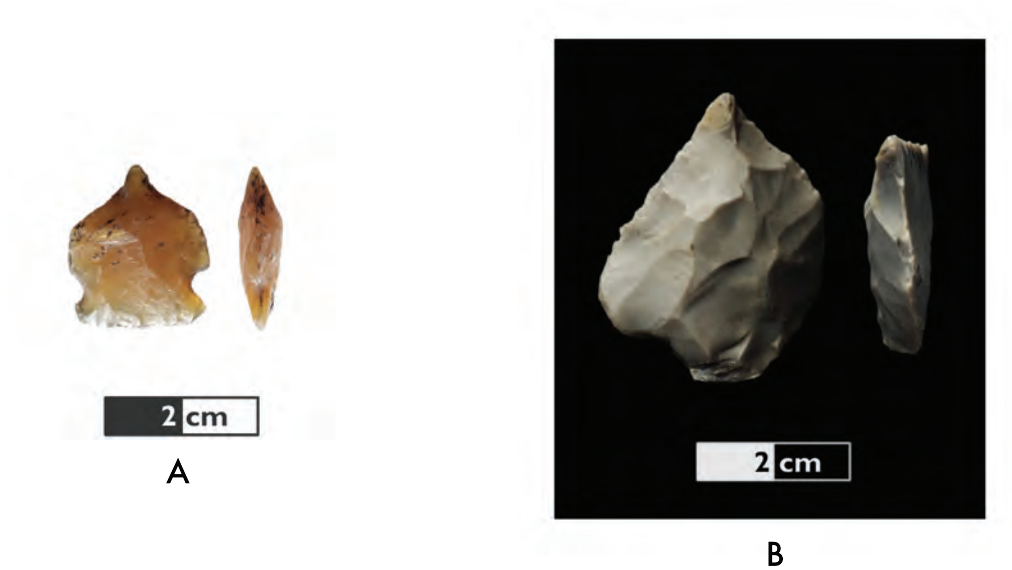


Figure 4.24. Selected gravers. Note: specimen A was manufactured from a Besant point. ([A] SCHM Artifact: 83.85.84; unheated chalcedony; Meeker Co., MN; [B] MBISP Artifact: 21065; unheated Grand Meadow Chert; Rice Lake, MN.)

UNFINISHED BIFACES

Bifaces are chipped stone artifacts with flaking on both opposing surfaces. There are many forms of bifacial tools including projectile points, knives, adzes, hoes, and drills. Bifaces and biface fragments are among the most commonly found worked pieces of chipped stone found on Midwestern archaeological sites. The manufacture of a bifacial tool is a protracted process fraught with potential mishaps. For this reason, bifaces and pieces of them that were not yet finished as formal, functional tools are often found. Callahan (1979) provides a commonly cited sequence for biface manufacturing technology. There is a debate on whether distinct biface stages, such as those proposed by Callahan, reflect the actual intentions of their makers or are simply a convenient classification system applied by archaeologists.

Distinguishing a finished from an unfinished biface is usually rather straightforward. The edges of unfinished bifaces are very irregular and sinuous when viewed edge-on. In order to be fully functional, a biface's edges must be trimmed, trued up and straightened. Figure 4.25 shows two bifaces, one with an unfinished edge and the other finished. Generally, unfinished bifaces can be readily separated into two groups. Early-stage bifaces are thicker, less refined pieces with a profile and plan view that is not yet close to the intended end product. These can conveniently be called blanks. Late-stage bifaces are more refined, usually thinner, and have taken on the approximate shape and size of the finished bifacial tool. These can be called preforms.

The reason that a particular biface was never finished varies. Bifacial blanks were commonly roughed out at quarry sites where quantities of usable material were available. This roughing-out stage generates considerable amounts of flaking debris and quickly weeds out any pieces that have cracks or other severe flaws. Inevitably, bifaces will be accidentally broken or suffer irrecoverable step or hinge fractures. Some bifaces, though complete, may end up being too small to be finished into the intended target tool. All of these misfit pieces will typically be abandoned at the quarry/workshop. Finished bifacial tools are generally uncommon on most quarry sites. Roughed-out bifaces that passed muster were carried away to be made into finished formal tools later, traded to other groups, or both. There are practical reasons for this practice. First, it reduces the time spent at the quarry and away from other pursuits. Given adequate raw material, a good supply of roughed-out bifaces could easily be made in a few hours. Finishing each one into a finished projectile point, knife, or other formal tool would take considerably longer. Even more importantly, bifaces, especially larger ones, are quite viable cores, as discussed previously. Having these unfinished blanks on hand ensures that there will be a future supply of freshly struck, sharp flakes. Large, typically ovate bifaces like those shown in Figures 4.28 and 4.29 are often called quarry blanks or trade blanks. These are early-stage bifaces that in Callahan's (1979) system would be called stage 2 bifaces.

But not all bifaces start out at a quarry site where raw material is abundant. Doubtless, people kept their eyes open for usable material that might be found in glacial till or stream gravel. Such pieces would be collected, most likely after being tapped and tested for soundness and, if necessary, being roughed out to reduce their weight.

Bifaces made of local and exotic raw materials were gradually reduced into finished tools. As bifaces are made thinner, as is typical in the production of a projectile point or knife preform, they also become more fragile. Many a modern flintknapper can relate to the frustration of snapping a piece in two when it was almost finished. For this reason, bifaces in all stages of manufacture might be found at a given site. Even though an unfortunate mishap may have curtailed the completion of an intended bifacial tool, the fragments could be reclaimed and used as other tools such as scraper planes or wedges.

Bifaces in a variety of forms are found on Pre-Contact archaeological sites of all ages. The sizes and shapes of unfinished bifaces, particularly late-stage bifaces, are generally proportionate to the finished tools characteristic of a given technology at a given time. Bifaces intended to become large projectile points will be larger than the preforms for smaller points. Lanceolate point preforms will be more elongated than the preforms of wider notched or stemmed points (Figure 4.30). In this way, biface assemblages can be temporally diagnostic, at least in a limited way, especially when combined with data on raw materials and heat treatment that also covary over time.

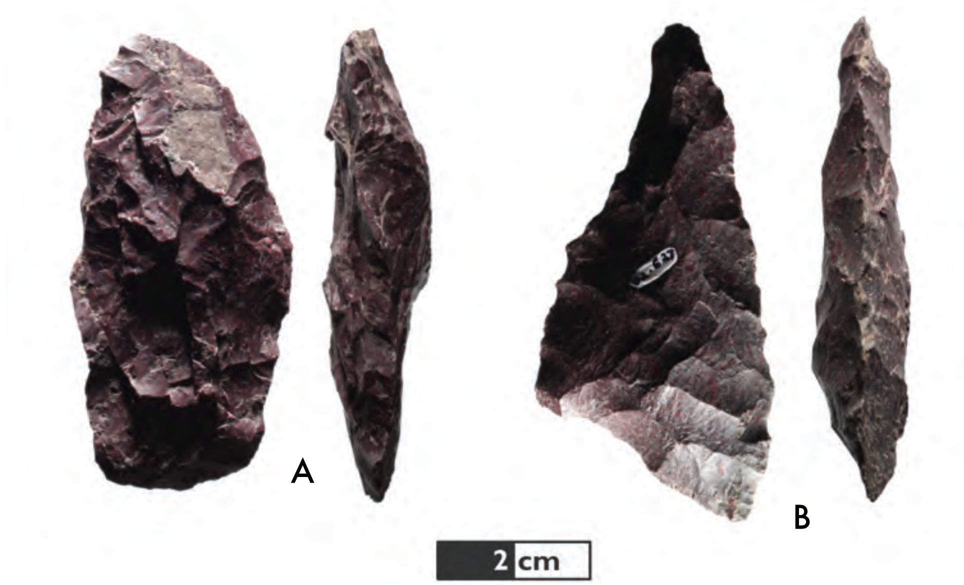


Figure 4.25. Selected unfinished (A) and finished/reworked (B) bifaces. ([A] SNF Artifact: 640 02-147; Jasper Taconite; unknown provenience; [B] SNF Artifact: 1294 02-627; Jasper Taconite; Round Lake Point, MN.)

Figure 4.26. Selected early stage (A) and late stage (B) unfinished bifaces. ([A] SNF Artifact: 02-08 1/5; Basalt (?); Lake Co., MN; [B] SNF Artifact: 1-1/5; Knife Lake Siltstone; unknown provenience.)

Figure 4.27. Quarry blank. (MHS Artifact: 39-9; Knife River Flint; Pelican Rapids, MN.)

Figure 4.28. Quarry blank. (SCHM Artifact: 83.85.195; unheated Burlington Chert; Meeker Co., MN.)

Figure 4.29. Quarry blank. (MHS Artifact: 1984.41.19; unheated Wyandotte Chert (Indiana Hornstone); unknown provenience.)

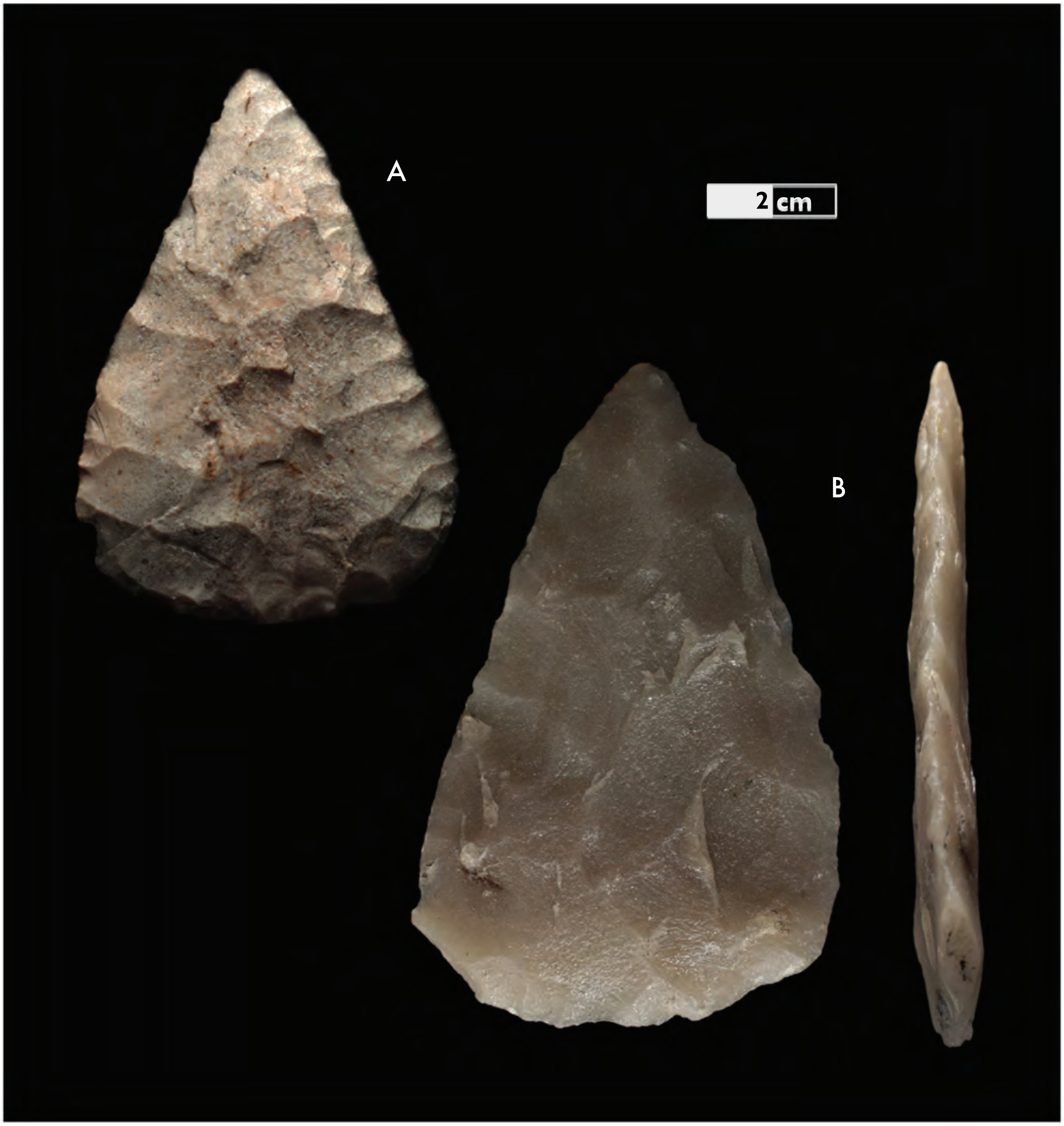


Figure 4.30. North blades. These are late stage preforms for Middle Woodland Snyders points. ([A] Glynn Collection; heat-treated Prairie du Chien Chert; Rice Co., MN; [B] MBISP Artifact: 89101; Hixton Silicified Sandstone; Viola, WI.)

BIFACIAL KNIVES

Bifacial knives are one of the more common chipped stone tools one will encounter. These can be distinguished from unfinished bifacial blanks and preforms by the presence of trimmed and straightened, functional edges. Sometimes only one edge on one side will be trued up and straight, leaving the opposite edge rough and unfinished. In some instances, the edge along one side is dulled to prevent cutting the hand during use. Some knives, especially larger ones, were used in hand without an attached handle. Others were obviously modified for hafting.

A common general rule used for distinguishing finished bifaces that were knives from ones that were projectile points is the idea that knives are asymmetrical while points are symmetrical. This idea might seem logical, but it is misguided. While projectile points do tend to have bilateral symmetry, there is no reason that a knife cannot. While archaeologists are fond of classificatory pigeonholes, it is entirely possible for a hafted biface to be used as both a knife and a projectile point (see Ahler 1971). This, in fact, is a cornerstone of Early Archaic hafted biface technology. Dalton points, St. Charles points, and Hardin points among other Early Archaic styles, frequently exhibit impact fractures providing definitive evidence for their use as projectile tips. The lateral edges of these same tools also show dulling from cutting use and sequential resharpening, typically through alternate, unifacial beveling. At the same time, there are Early Archaic styles such as Thebes that virtually never show impact damage, and these hafted tools were almost certainly used solely as knives. Beyond the Early Archaic period, just about any large to medium-sized projectile point, hafted to a detachable foreshaft, could be employed as a knife.

There are many different types of bifacial knives, some rather generic in form and others being time diagnostic. Some of the less distinctive varieties are discussed in the following pages. More specific types are then presented individually.

Figure 4.31. Bifacial knife. (SNF Artifact: 08-081-1/5; Knife Lake Siltstone; Lake Co., MN.)

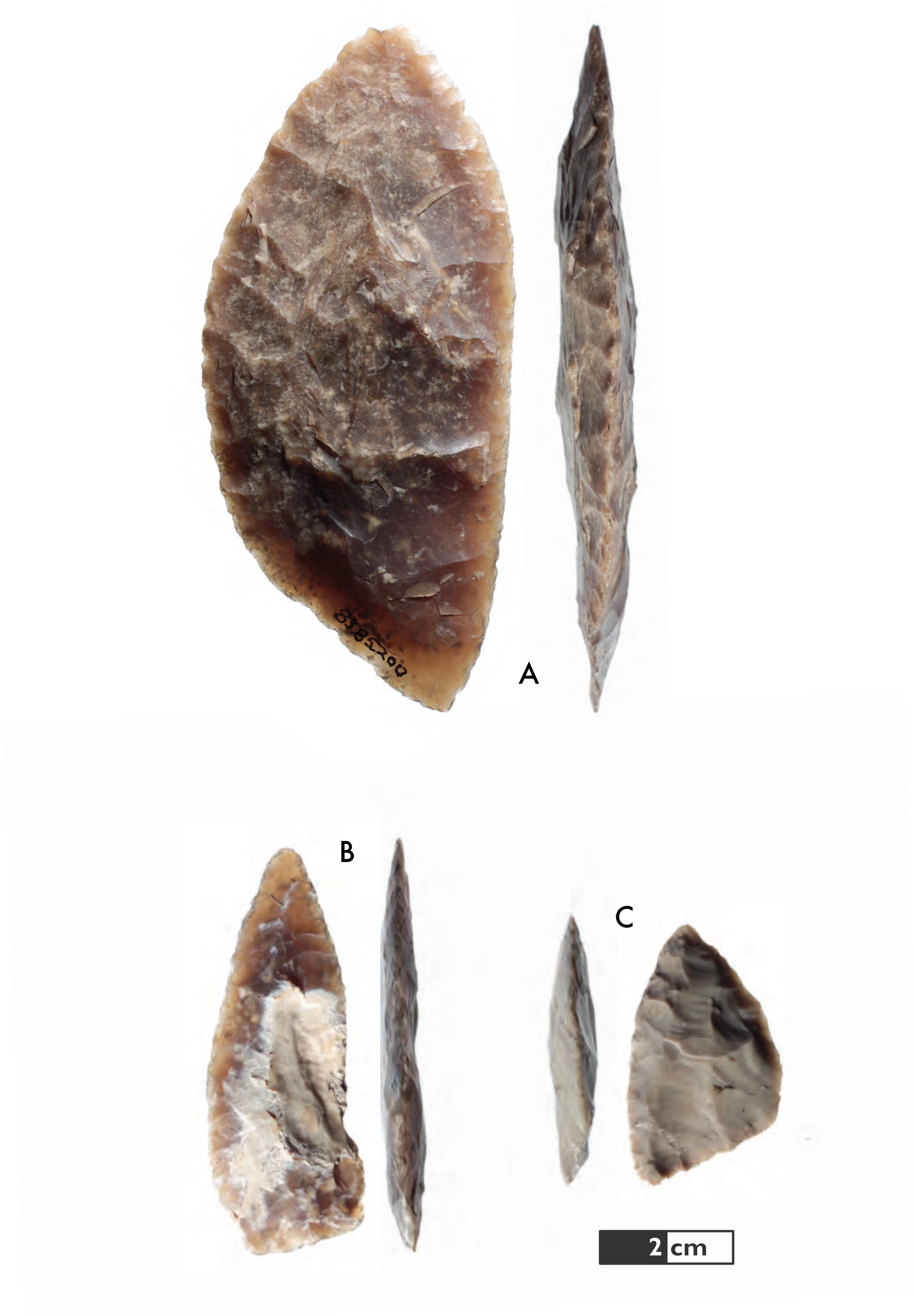


Figure 4.32. Selected bifacial knives. ([A] SCHM Artifact: 83.85.200; Knife River Flint; Meeker Co., MN; [B] SCHM Artifact: 83.85.199; Knife River Flint; Meeker Co., MN; [C] SCHM Artifact: 83.85.225; unheated Grand Meadow Chert; Meeker Co., MN.)

Figure 4.33. Selected bifacial knives. ([A] MHS Artifact: 28-56; Knife Lake Siltstone; unknown provenience; [B] UMn Artifact: 39-16; Knife River Flint; Pelican Rapids, MN.)

Ultrathin Knives

Ultrathin knives, as their name implies, are exceptionally thin for their size. These tools started to be recognized at Early Paleoindian Folsom sites in Colorado and North Dakota in the 1990s (Jodry 1998; Root et al. 1999). Ultrathin knives are generally ovate to somewhat bi-pointed or pear-shaped in plan view and are broad relative to their length. They typically range from 80 to 150 mm (3.2 to 6 inches) in length and 50 to 90 mm (2 to 3.5 inches) in width. Despite their breadth and overall size, ultrathin knives are typically only 3 to 6 mm (0.1 to 0.2 inches) thick. An ultrathin knife's surfaces are covered by flat, expanding thinning flakes that plunge toward the center or midline of the biface. The flake scars often exhibit prominent undulations near their distal or terminal ends, and the scars tend to dip in or dive before terminating. This flaking pattern often creates a configuration where the center of the biface is slightly thinner than the body surrounding it.

Because of their extremely refined workmanship, ultrathin knives were made exclusively out of superior-grade knappable stone. Specimens found across the northern plains are commonly made out of Knife River Flint, Rainy Buttes Silicified Wood, Flattop Chalcedony (now referred to as White River Group Silicates), or Hartville Uplift Chert. Heat treatment appears to be wholly absent.

Ultrathin knives were very refined cutting tools. Jodry (1998) suggests that they were primarily used by Folsom people to butcher and fillet bison and prepare meat strips for making jerky. These tools were used unhafted. Root and coauthors (Root et al. 1999) note the relative abundance of radial fracture tools in the Folsom materials at the Knife River Flint quarry sites in western North Dakota. Many of these radially fragmented pieces were flakes, but several were fragments of ultrathin knives.

Most of the literature about ultrathin knives discusses them as an integral component of Folsom tool technology, and these tools have been documented from New Mexico, Texas, Oklahoma, Colorado, and North Dakota. Thin knives very reminiscent of these Folsom ultrathins may not be totally limited to the Great Plains region. A similar knife, this one resharpened by alternate beveling, was among the materials found among the burned fluted points and other tools at the Crowfield Site in southeastern Ontario (Deller and Ellis 1984). Taylor (2006:398) cautions that similar knives might also be found in later cultural complexes in the Northern Plains.

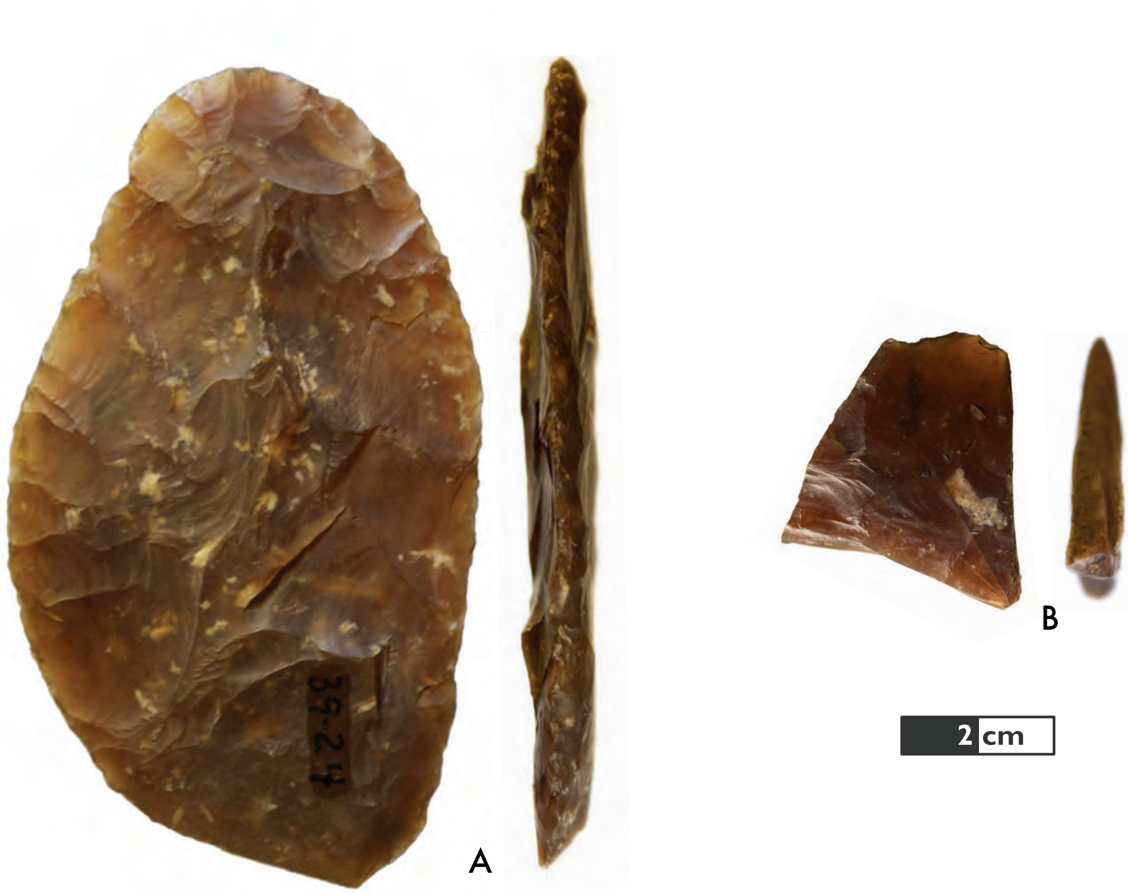


Figure 4.34. Ultrathins. Note: radial fracture in specimen B. ([A] UMn Artifact: 39-24; Knife River Flint; Pelican Rapids, MN; [B] UMn Artifact: 615; Knife River Flint; 21PN11, Pine Co., MN.)

THEBES KNIVES

Thebes knives are a highly distinctive artifact form. These are large to medium-sized, relatively thick, notched forms named by Howard D. Winters (1967) after specimens found near Thebes, Illinois (Perino 1971; DeRegnaucourt 1991).

Thebes knives have broad, relatively flattened blades and proportionately long and wide bases or stems. They are often characterized as being corner notched, and while some truly are, in reality most have diagonally upward-oriented side notches, the difference being the point at which the notch enters the piece. The notches are deep and relatively narrow and demarcate a base that commonly has rounded basal corners. While the flaking on the blade portion often appears somewhat ungainly and irregular, the basal portions are usually carefully shaped and trimmed. The basal edge may be straight, slightly concave, convex, or recurved. The basal edge and corners are typically heavily ground. The very interiors of the notch scars are also ground dull, a useful trait for identifying broken specimens. The blade portions are covered by random flake scars of varying sizes that give them an irregularly flattened cross section. Overall plan view varies considerably from one example to the next, some being relatively squat and short and others being very elongated. This shape variation is accentuated by progressive resharpening, which is common on Thebes knives. Resharpening was done almost exclusively by unifacial alternate beveling, usually with the flaking visible on the left edge of the blade when the tip is oriented up. Heavily resharpened Thebes knives have a distinctly rhomboidal cross section. They typically range from 50 to 180 mm (2 to 7 inches) in length and between 40 and 75 mm (1.5 and 3 inches) in width with much of this variation in size and proportions being due to resharpening. Most specimens are 0.8 to 1.2 cm (0.3 to 0.5 inches) thick.

Thebes knives were made from a variety of local and non-local raw materials. Burlington chert and the cream and speckled varieties of Maynes Creek chert were used extensively in Iowa. Examples of Prairie du Chien Chert, Galena Chert, the various Silurian Cherts of the Upper Mississippi Valley, and Hixton Silicified Sandstone are also common. Though some authors state that some Thebes knives were heat treated (e.g., DeRegnaucourt 1991:117), hundreds of these artifacts from across Illinois, Iowa, Missouri, and Wisconsin clearly indicate otherwise. It seems likely that that the natural color range and glossiness of some unaltered raw materials may have been underappreciated, that incidentally heated points were mistaken for heat-treated ones, or that the analytical sample was tainted with modern reproductions. It can be said with virtually no hesitation that heat treatment was *not* a part of Thebes technology.

The fact that Thebes knives were hafted cutting tools and not projectile points is based largely on the complete absence of tip impact fractures and other compressional breaks or damage resulting from projectile use. The often-extensive blade edge resharpening clearly supports a knife function. These were probably general utility cutting and sawing tools used in a variety of activities.

Thebes knives are a very Midwestern style found over a large region from southeastern Ontario, Michigan, and Ohio to Kentucky, southern Indiana and Illinois, most of Missouri and Iowa, and the southern half of Wisconsin. They are sparsely represented in southeastern Minnesota. It was long suspected that Thebes knives were of Early Archaic age based on their overall appearance as well as their occasional recovery from deep levels in Midwestern caves and rockshelters such as Graham Cave

Figure 4.35. Selected Thebes knives. ([A] Glynn Collection; unheated Maynes Creek Speckled Chert; Rice Co., MN; [B] MHS Artifact: 948.A368.3; unheated Burlington Chert; Douglas Co., MN; [C] MBISP Artifact: 16545; unheated Maynes Creek Cream Chert; Geneva Lake, MN.)

in Missouri (Logan 1952) and Modoc Rockshelter in Illinois (Fowler and Winters 1956; Fowler 1959). Projectile point guides commonly give age ranges of around 8000 to 6000 B.C.E. (e.g., Morrow 1984; DeRegnaucourt 1991). Some Wisconsin archaeologists (e.g., Goldstein and Osborn 1988) have suggested that these tools extended into the Middle Archaic timeframe (6000 to 3000 B.C.E.). Thebes knives have been securely radiocarbon dated from a sealed site context to 9500 to 8700 B.P. at the Twin Ditch Site in west-central Illinois (Morrow 1996b). At Twin Ditch, multiple Thebes knives were found in association with several St. Charles points and chipped stone "Dalton" adzes.

Thebes knives are an integral component of the Thebes Cluster in the Upper Midwest and are directly associated with St. Charles projectile points. They are morphologically equivalent to specimens called Cache Diagonal Notched in southern Illinois (Winters 1967) that are not to be confused with the Early Archaic side-notched Cache River type. There are some variations of Thebes knives found in the eastern part of the type's range that are referred to as "Dogleg" and "E-Notched." Thebes knives are probably coeval with deeply notched Lost Lake points (knives?) in the southeast.

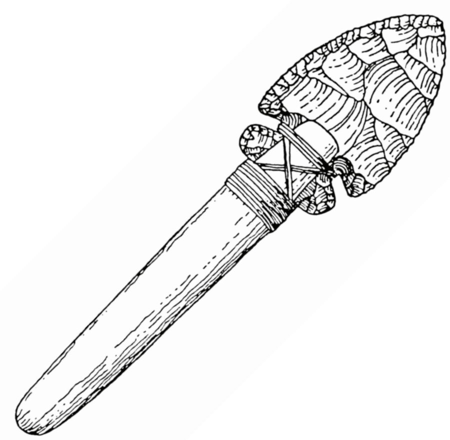


Figure 4.36. Illustration of a hafted Thebes knife.

BASS KNIVES

Bass knives are named for the Bass Site in Grant County, Wisconsin (Stoltman et al. 1984).

Bass knives are large to medium-sized, relatively flattened, teardrop-shaped to triangular knives. They have a random flaking pattern much like that seen on Thebes knives. In fact, they closely resemble Thebes knives without the notches. The basal edge may be slightly convex to straight, rarely slightly concave. There is usually no basal or haft grinding. Bass knives are difficult to recognize if they have not been resharpened. When they have been resharpened by unifacial alternate beveling, usually visible on the left side with the tip held up, they are fairly distinctive. The alternately beveled resharpened edge typically runs from the tip down to the point of maximum width, which on most specimens is close to the full length of the blade. They typically measure 50 to 130 mm (2 to 5 inches) long, 32 to 64 mm (1.25 to 2.5 inches) wide, and 7 to 12 mm (0.3 to 0.5 inches) thick.

Bass knives were made from a range of local and nonlocal raw materials. Burlington Chert, Galena Chert, and Prairie du Chien Chert appear to be the most prevalent. They do not appear to have been heat treated.

Bass knives were probably generally utility cutting and sawing tools. Though they exhibit no obvious modifications for hafting, they were likely attached to stout, slotted handles and held in place by some form of adhesive like pine pitch or birch tar. Benn and Thompson's (2009:500, 501, 509) assertion that Bass (Grundy) Knives are preforms is completely unfounded.

Bass knives are clearly associated with Hardin points at the Bass Site in southwestern Wisconsin (Stoltman et al. 1984). This implies that they are the same age, and a date range of 9000 to 8500 B.P. is proposed here. Similar beveled knives appear with Kirk corner-notched points at some sites in the eastern Midwest and the Southeast (Broyles 1971; Stafford and Cantin 2009), and this is consistent with this timeframe.

Bass knives are morphologically equivalent to Grundy knives described in Iowa (Morrow 1984). Knives of a more elongated beveled form that appears to be common across the southeastern United States are referred to as Stanfield knives.

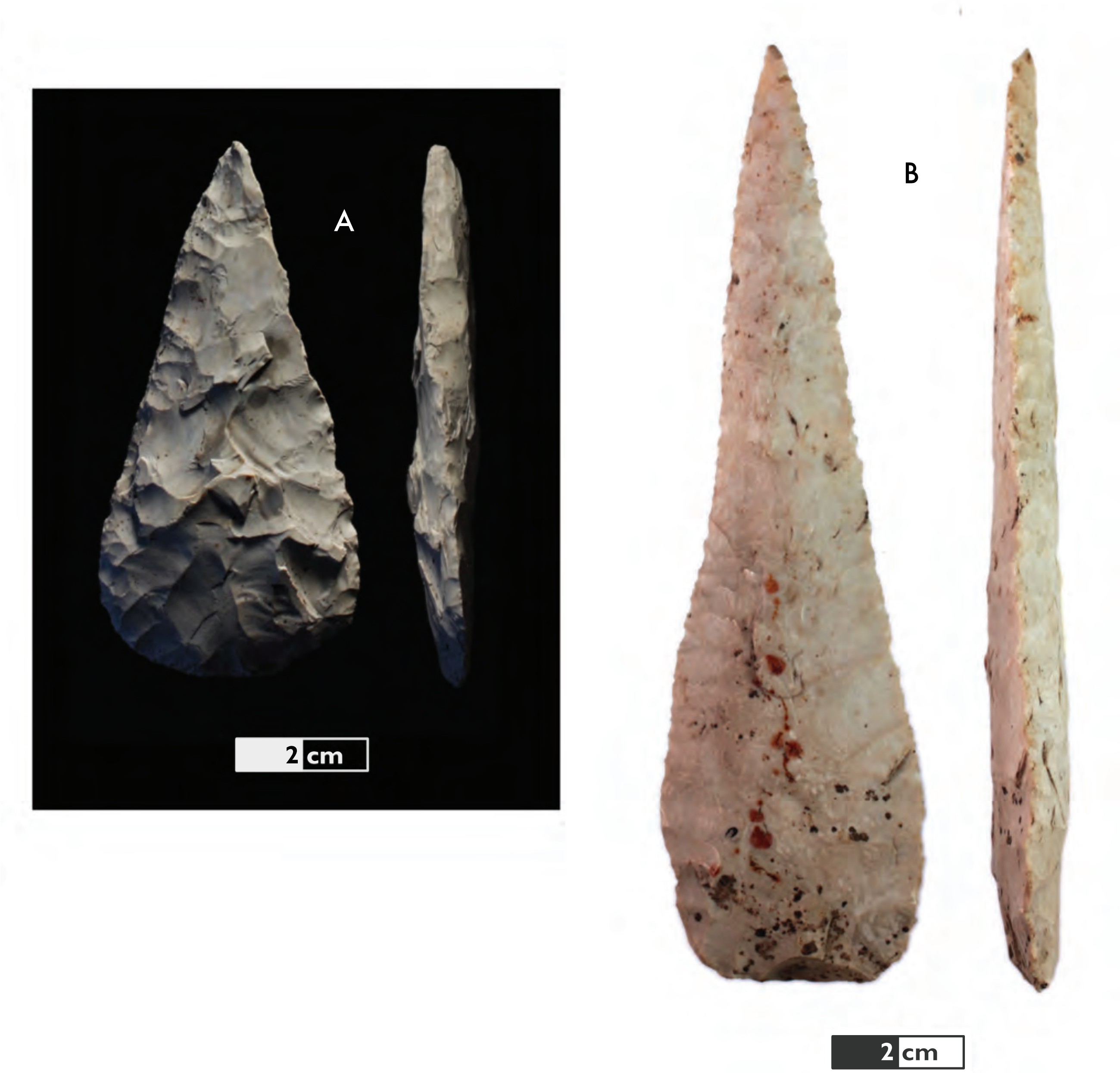


Figure 4.37. Selected Bass knives. ([A] SCHM Artifact: 83.85.203; unheated Maynes Creek Cream Chert, unknown provenience; [B] MHS Artifact: 29-15; unheated Burlington Chert; unknown provenience.)

CODY KNIVES

Cody knives are named after the Cody Complex, which derives its name from Cody, Wyoming (Wormington 1957:128). The Cody Complex includes Cody knives and Alberta, Scottsbluff, and Eden projectile points.

Cody knives are unusual, stemmed, asymmetrical knives. They exhibit a blade edge that is angled or canted to one side. In some cases, these knives were made from reworked Alberta or Scottsbluff points, and one of the distal edges is relatively straight and vertical. Most, however, appear to have been originally made as asymmetrical knives with the entire blade portion leaning to one side. Of the latter specimens, some were made on large flakes and retain portions of the beginning blank surface. Some Cody knives exhibit shoulders on both sides, others have a distinct shoulder on one side only, and still others have been resharpened to the extent that the shoulder(s) are no longer apparent. Cody knives exhibit haft forms that generally mimic the stemmed lanceolate points with which they are associated. Some have elongated stems resembling those seen on Alberta points while others have shorter, squatter stems that are typical of Scottsbluff points. A rare and extremely interesting variation on this theme is the occurrence of Cody-style knives in the western Great Lakes region that have knobbed or eared bases. These are directly analogous to the Cody Eared point varieties that are prevalent across much of Minnesota and Wisconsin. Cody knives vary wildly in size, but most are not overly large. Length appears to range from 32 to 100 mm (1.25 to 4 inches) in length and 25 to 50 mm (1 to 2 inches) in width with a thickness between 4 and 7 mm (0.15 and 0.3 inches).

Cody knives are rare in Minnesota, so it is difficult to discuss raw material use. Both of the eared examples illustrated here were made of Hixton Silicified Sandstone, which, by chance, was a favorite material for the manufacture of Cody Eared projectile points.

Cody knives were hafted cutting tools. Whether they had a generalized or a specialized function is subject to future study.

Cody knives appear to co-occur with the full distribution of the Cody Complex across the High Plains (Taylor 2006). Minnesota and Wisconsin can be added to this range to incorporate the Great Lakes expression of the complex (e.g., Morrow 1999). They date from between 9500 and 8400 B.P (Taylor 2006).

Taylor (2006:233) distinguishes between true Cody knives made specifically as knives and Red River knives that are reworked Cody Complex projectile points.

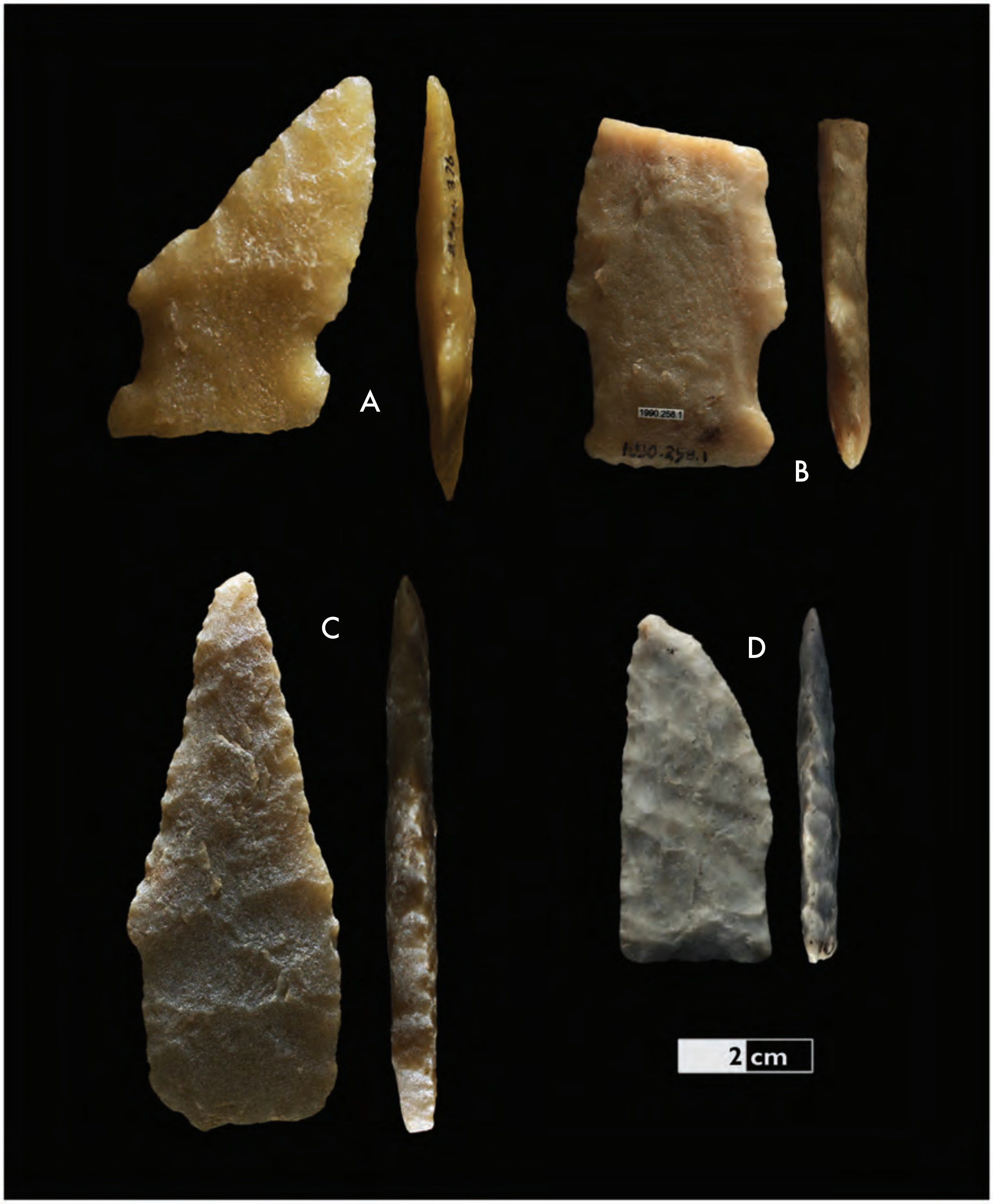


Figure 4.38. Cody knives. ([A] UMn Artifact: 244-376; Hixton Silicified Sandstone; 21BE2, Blue Earth Co., MN; [B] MHS Artifact: 1990.258.; Hixton Silicified Sandstone; Yellow Medicine Co., MN; [C] MHS Artifact: 15.4 1789; Bijou Hills Silicified Sediment; Fillmore Co., MN; [D] MBISP Artifact: 02452.0; unheated Shell Rock Chert; Freeborn Co., MN.)

HARAHEY KNIVES

Harahey knives are named after a legendary village visited by the Coronado Expedition in 1541 during their search for the Seven Cities of Gold otherwise known as Quivira.

Harahey knives are generally large, elongated bifacial knives. They are originally made as long, ellipsoid, or bi-pointed forms but take on their distinctive four-beveled appearance with progressive resharpenings. They are generally well made with flattened lenticular cross sections that become markedly rhomboidal in later use stages. Unifacial alternate beveling was applied to four sectors of the knife, eventually giving it a diamond-shaped plan view. They appear to range from 60 to 200 mm (2.5 to 8 inches) in length, this dimension varying in concert with degrees of resharpening. Resharpening can also greatly affect width. Originally made between 40 and 80 mm (1.6 and 3.1 inches) wide, some are reduced to only 15 mm (0.6 inches) in width. Most examples appear to fall between 5 and 8 mm (0.2 and 0.3 inches) in thickness.

Both local and exotic raw materials are represented in the small number of Harahey knives observed in Minnesota. Of interest, one of them from the Owen Johnson collection is made of Smoky Hill Chert (a.k.a. Republican River Jasper) a raw material that harkens from the core area of the Central Plains Tradition in southern Nebraska and northern Kansas.

Because all edges of the Harahey knives were used and resharpened, these tools were used in hand without hafting.

Minnesota is likely near the extreme northern range for this knife type. Harahey knives are generally most common in the Central and Southern Plains regions from Texas to Nebraska, and a few have been documented in Iowa and Missouri.

Harahey knives are diagnostic of several Late Prehistoric complexes across the Southern and Central Plains. Logan and Ritterbush (2006) provide a date range of 1200 to 1450 C.E.

Harahey knives are also sometimes called four-bevel knives or double-bevel knives.

Figure 4.39. Harahey knives. ([A] MHS Artifact: 29-11 4677; unheated Burlington Chert; Morrison Co., MN; [B] MHS Artifact: 47-23 A257; unheated Burlington Chert; Winona Co., MN; [C] MBISP Artifact: 00344; unheated Smoky Hill Chert; Albert Lea Lake, MN.)

DRILLS

Drills are relatively uncommon tools compared to projectile points, knives, and scrapers. They occur in a wide variety: simple, straight, rod-shaped drills or drills with irregular knobby bases may have been made into these forms from scratch, but the vast majority of these drills were made from reworked (repurposed) projectile points or knives. As such, many drills retain the basal portions of the projectile points or knives from which they were made. Thus, many drills can be identified to their respective point types and are time diagnostic. A common form is called a T-drill, made from the side-notched point varieties typical of the Middle Archaic and early Late Archaic periods. Most drills measure between 24 and 100 mm (1 and 4 inches) in length, but being fragile tools, the longer specimens are seldom found whole.

The same range of raw materials used to make projectile points will be represented among the associated drills. The frequency of heat treatment varies with the respective point types involved.

Drills were used in a rotary fashion to make holes in a variety of substances like wood, bone, antler, shell, and stone. These tools were used hafted. With most being made on former projectile points, drills could be fashioned onto points still while they were still attached to their detachable foreshafts. This foreshaft then becomes a convenient shank. Drills were probably spun between the palms since the evidence for the use of things like pump drills is sparse in North America south of the Arctic.

Drills in one form or another occur throughout Minnesota. These are tools that make their first appearance early in the Late Paleoindian/Early Archaic era. They were a standard, albeit not necessarily common, form of tool from that point forward.

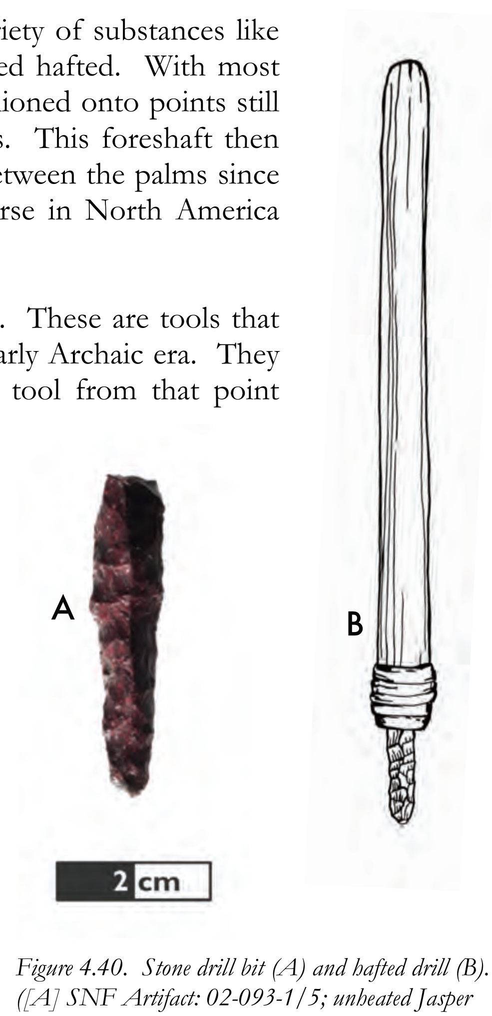


Figure 4.40. Stone drill bit (A) and hafted drill (B). ([A] SNF Artifact: 02-093-1/5; unheated Jasper Taconite; unknown provenience.)

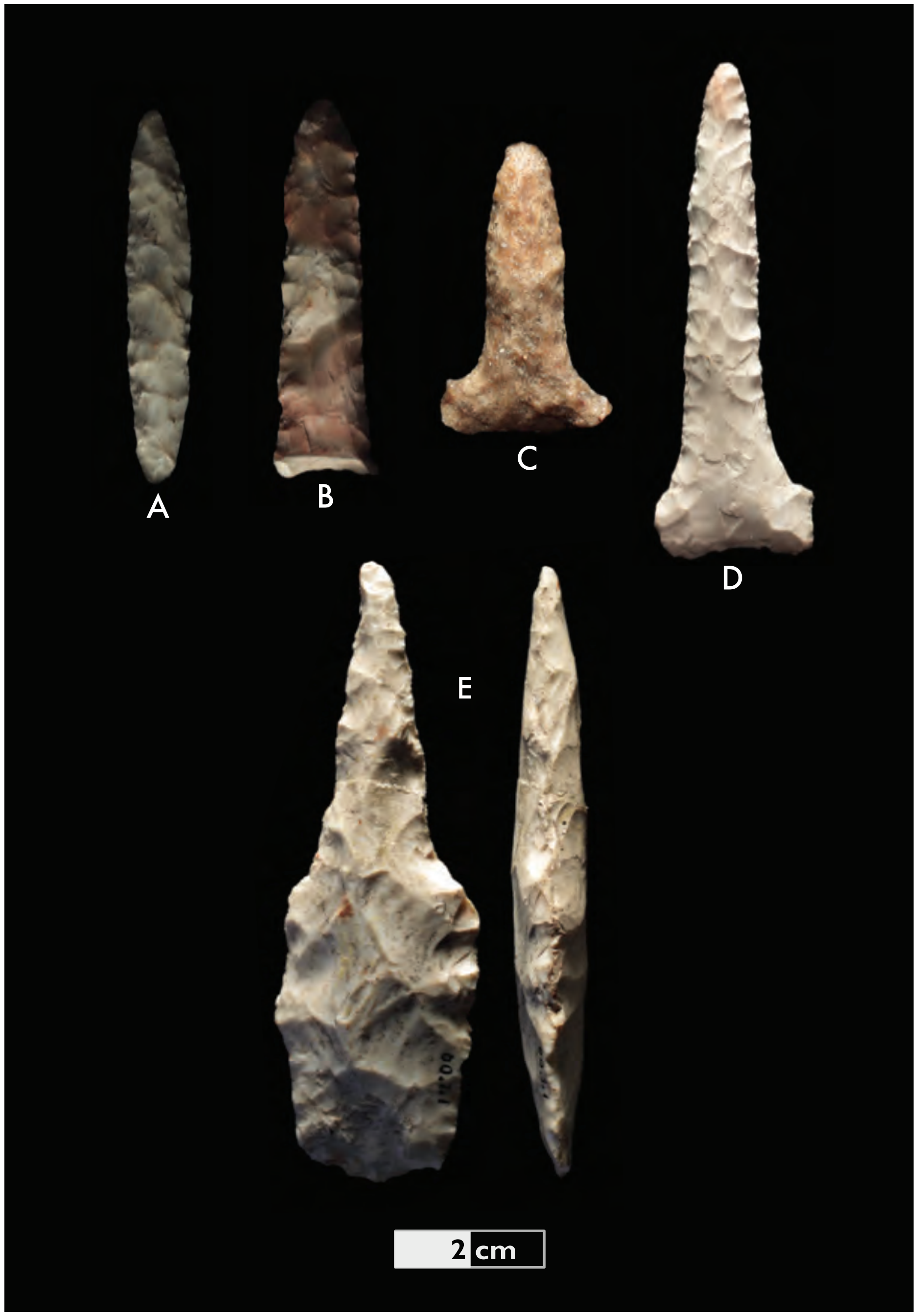


Figure 4.41. Selected drills. ([A] Glynn Collection Artifact; unheated Grand Meadow Chert; Rice Co., MN; [B] Glynn Collection Artifact; heat-treated unidentified chert; Rice Co., MN; [C] Glynn Collection Artifact; heat-treated Prairie du Chien Chert; Rice Co., MN; [D] Glynn Collection Artifact; heat-treated Maynes Creek Cream Chert; Rice Co., MN; [E] SCHM Artifact: 1960.7.1; unheated Burlington Chert; near Mankato, MN.)

Dalton Adzes

Dalton adzes are so named for the Dalton points with which they are frequently found (Morse and Goodyear 1973). Dalton points, in turn, were named by Chapman (1948) in honor of Judge S. P. Dalton of Jefferson City, Missouri, who collected many of these points in southern Missouri.

Figure 4.42. Illustration of a hafted Dalton adze.

Dalton adzes are fairly hefty chipped stone tools with a generally humpbacked appearance. They have an elongated form, usually tapering slightly away from the bit end. Classic examples have a markedly plano-convex cross section, but some are more lenticular or tabular. The bit edges are slightly to strongly convex and beveled on the under (flatter) side of the adze. On most examples, the lateral edges along the full length of the tool are heavily ground. This was to prevent the edges from cutting the lashing materials used to haft them to their handles. Most Dalton adzes range from 75 to 150 mm (3 to 6 inches) in length, 38 to 64 mm (1.5 to 2.5 inches) in width, and 19 to 44 mm (0.75 and 1.75 inches) thick.

Dalton adzes were wood-chopping tools, and they were among the earliest such tools in North America (Morse and Goodyear 1973). They were hafted to wooden handles shaped like the number 7. A flattened area or shelf was cut into the top of the handle to accept the flattened belly of the adze and the blade was strapped down with rawhide lashings or strong cordage. They are remarkably effective wood chopping tools but must be repaired and resharpened often when the bit edges suffer dents or nicks from use. Eventually, the adze may be sharpened down to the lashings and have to be replaced, just as is the case with hafted end scrapers.

Dalton adzes can be made of a range of cherts including but not limited to Burlington Chert, Galena Chert, and Maynes Creek Cream or Speckled Chert. They are rarely if ever heat treated. The heavy chopping use these tools endured would make heat treatment very undesirable.

Dalton-style adzes do not appear to be an overly abundant artifact in Minnesota. However, they can probably be expected wherever eastern-style Early Archaic point/knife types like Dalton, Thebes, St. Charles, and Hardin are found.

Though they are called Dalton adzes—and they certainly are found in association with Dalton points—they are not exclusive to the early portion of the Late Paleoindian/Early Archaic era. These are a type of diagnostic wood-chopping tool that preceded the widespread appearance of pecked and ground stone axes around 7500 B.P. They are commonly found in association with Dalton points, dating from the earliest Early Archaic beginning in roughly 10,500 B.P., and they are a common tool category in subsequent Early Archaic sites where Thebes Cluster artifacts (Morrow 1996b) and Hardin points (Stoltman et al. 1984) are found. Dalton adzes, or tools very similar to them, continued to be made and used into the early Middle Archaic period (Nolan and Fishel 2009:418). They appear to vanish from tool inventories at the time that ground stone axes become common. Thus a total time span of 10,500 to circa 7000 B.P. is suggested for this form of chipped stone adze.

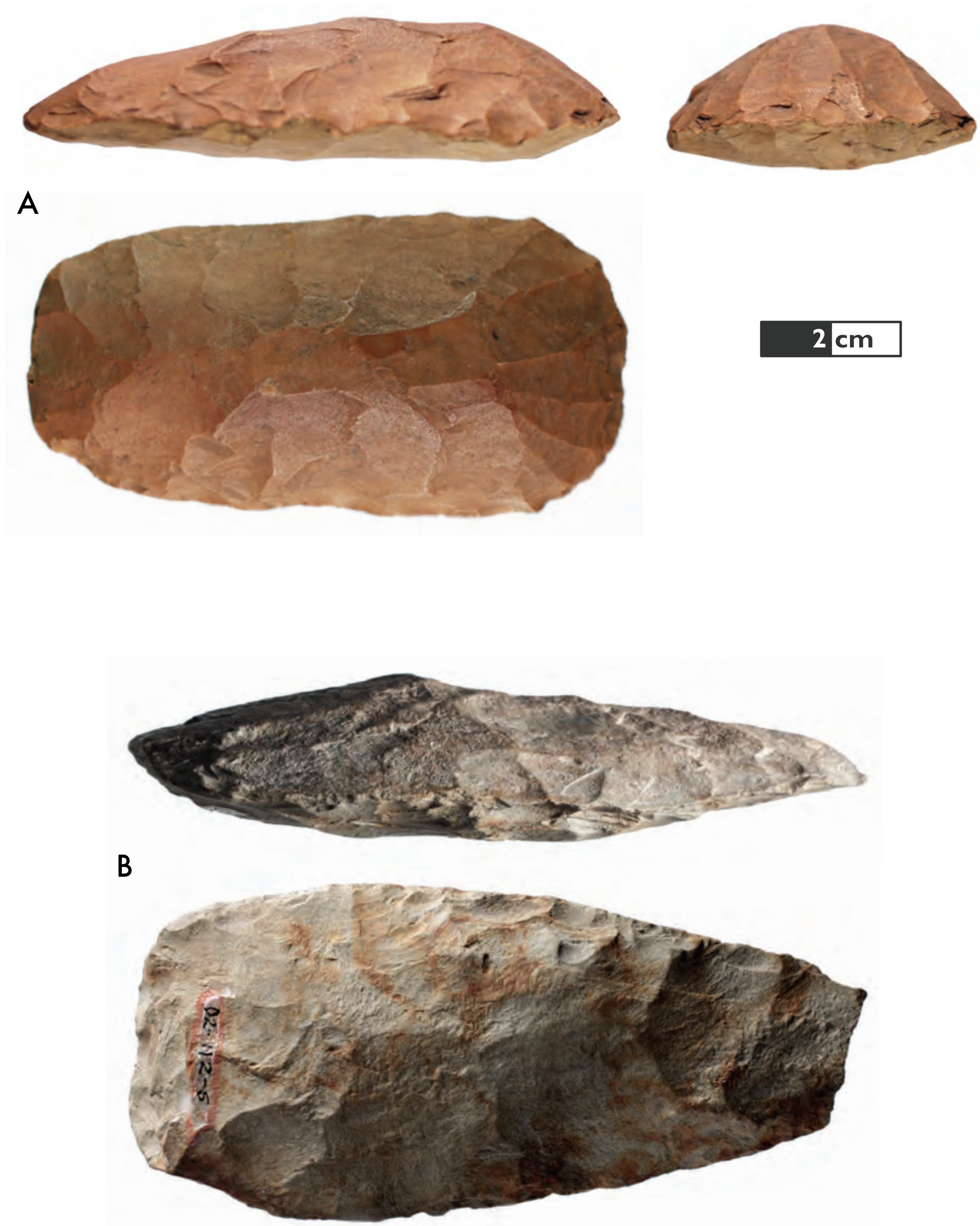


Figure 4.43. Selected Dalton adze (A) and Dalton-like adze (B). [A] MHS Artifact: 16-2 A366; unidentified tan chert; unknown provenience; ([B] SNF Artifact: 02-112-5; Knife Lake Siltstone; unknown provenience.)

Trihedral Adzes

Trihedral adzes are a distinctive form of chipped stone adze characteristic of the western Great Lakes region. These are generally large, elongated tools that have a flat bottom and a sharply keeled dorsal side. This characteristic gives them a trihedral or three-sided cross section. They may be bifacial but in some cases the flat belly appears to be largely unmodified. The blades often taper toward the butt and bit ends. The bit edges are convex and often somewhat narrow giving the tool a somewhat beaked appearance. They can measure up to 150 to 200 mm (6 to 8 inches) in length, but most specimens are somewhat smaller. They may be 25 to 50 mm (1 to 2 inches) wide, and quite frequently they are thicker than they are wide, enhancing their overall keeled appearance.

Trihedral adzes were generally knapped out of the materials that were available in large, workable masses. In northern Minnesota, this means raw materials like Knife Lake Siltstone and Basalt. A similar, but somewhat smaller example from Cook County was made of jasper taconite.

Trihedral adzes were probably hafted in a manner similar to other adzes on a handle shaped like a "T" or a "7." They would appear to be a northern equivalent of the Dalton adzes used to the south.

These tools appear to be especially common in St. Louis County of northeastern Minnesota where they are attributed to the Late Paleoindian Reservoir Lakes Complex (Harrison 1995). Trihedral adzes have also been reported from northwestern Ontario (Fox 1977). Somewhat similar adzes are associated with Late Paleoindian Cody Sites in eastern Wisconsin (Kuehn and Clark 2012). The Bradbury Brook Site in Mille Lacs County in east-central Minnesota was primarily a reduction site for secondary boulders of Knife Lake siltstone where a chipped stone adze and the base of an Alberta point are associated with a radiocarbon date of 9220 B.P. (Malik and Bakken 1999). A date range of 9500 to 7000 B.P. is proposed here for this form of adze.

Figure 4.44. Trihedral adze. (SNF Artifact: 1729.1; Greenstone; Cook Co., MN.)

Figure 4.45. Selected trihedral adzes. ([A] SNF Artifact: 02-056; Greenstone; unknown provenience; [B] SNF Artifact: 05-473; Knife Lake Siltstone; Cherry Lake, MN.)

HOES AND SPADES

A chipped stone hoe or spade would be an extreme rarity in Minnesota; no intact examples of this type of tool were seen in the collections search done for this book. What did come to light, however, were two reworked fragments that were at one time pieces of a large chipped stone hoe blade.

Chipped stone hoes were an important agricultural tool in and around Cahokia in western Illinois. These tools were large, even huge, bifaces made from a limited suite of raw materials largely determined by their massive size requirement. Some were made of Burlington Chert from the St. Louis vicinity, Kaolin Chert from southern Illinois, and Dover Chert from Tennessee. By far, Mill Creek Chert from southern Illinois was the most important raw material in the Mississippian hoe trade (Cobb 1989). Two general forms of digging implements were made. St. Clair-style hoes are roughly circular in plan view and side notched toward one end. These are the smaller of the two forms, generally being 100 to 180 mm (4 to 7 inches) long and nearly as wide. The larger form, often called spades, are more elongated, lack any notches, and can be overall elliptical or flaring and bell shaped in plan view. These larger hoes measure up to 300 mm (12 inches) and longer. The definitive identifying character of chipped stone hoes is their use wear. With extensive use, hoes take on a polish commonly referred to as silica gloss.

The two specimens in the Minnesota Historical Society collections are fragments from much larger bifaces made of unheated Mill Creek Chert. Both exhibit extensive areas covered with the distinctive silica gloss polish. The two pieces have been roughly reworked by percussion, one of them into a chipped, celt-like form. In all probability, these are fragments of one or two different hoes that accidentally broke and were salvaged.

Figure 4.47. Chipped stone hoe, reworked bit portion. (MHS Artifact: 16-6; unheated Mill Creek Chert; Freeborn Co., MN.)

Figure 4.46. Chipped stone hoe. (MHS Artifact: 14-6; unheated Mill Creek Chert; MN.)

5

PROJECTILE POINTS

TOBY A. MORROW

WITH CONTRIBUTIONS BY GUY E. GIBBON, CRAIG M. JOHNSON, AND DANIEL K. HIGGINBOTTOM

Projectile points—arrowheads and spearheads—are the objects that come to mind when most people think of Native American artifacts. We have seen that there are a great many other kinds of stone tools, but projectile points in particular get a lot of attention from archaeologists and collectors alike. Projectile points come in a tremendous variety of shapes, sizes, and styles; archaeologists call these types. Specific projectile point types are time diagnostic, meaning that they were made during a specific period of time in a particular geographic range. As such, they provide a means of assessing the age of an archaeological site and determining whether a site was occupied during a single period (single component) or is the result of many unrelated occupations over time (multicomponent). While distinctive pottery sherds are more preferentially used to assess the age and cultural affiliations of sites of the Woodland and later Pre-Contact periods, projectile points are often our only means of determining where Paleoindian and Archaic sites fit in time. In many senses, projectile points are to archaeologists as index fossils are to geologists. Many projectile point types have been found in stratigraphically ordered sites—places where progressively younger layers of occupation are stacked atop older layers—and this allows for a reconstruction of their relative ages. Many projectile point types are associated with radiocarbon and/or thermoluminescence dates, so their approximate absolute ages are known. Unfortunately, the earlier one goes back in time, the scarcer and more dispersed these tidbits of chronological data become. The ages of most Paleoindian and Archaic point types in Minnesota must, out of necessity, be inferred from archaeological sites excavated in other parts of the United States and Canada.

As a functional class, projectile points are bilaterally symmetrical and exhibit a point at one end and a basal portion for hafting on the opposite end. Most chipped stone points are bifacial. Beyond this, projectile points come in an almost bewildering variety (Figure 5.1). They range from over 20 cm (7.9 inches) to less than 1 cm (0.4 inches) in length. Some are long and slender; others are shorter and squat. The bases are often specifically modified for hafting; variations include side, corner, and basal

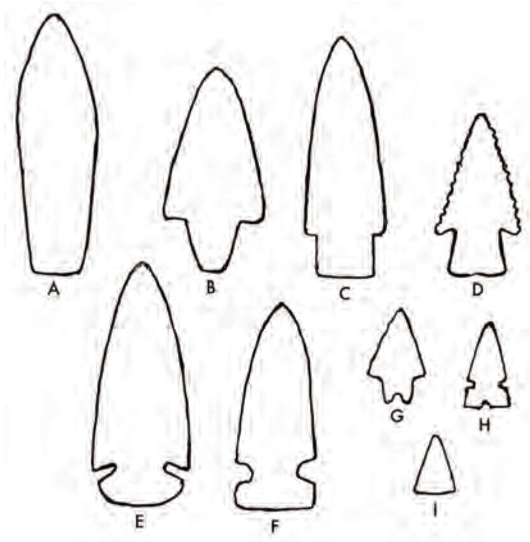


Figure 5.1. Various projectile point shapes. (A) Lanceolate; (B) contracting stem; (C) straight stem; (D) expanding stem; (E) corner-notched; (F) side-notched; (G) bifurcated base; (H) multi-notch; and (I) triangular.

notching and expanding, straight, or contraction stems. Leaf-shaped (lanceolate) and triangular points without stems or notches are also common. Some have beveled blade edges, others have serrated edges, and still others have both. On some, the sharp edges of basal hafting portions have been ground dull. Other points lack this haft grinding. The care and attention lavished in making some projectile points renders them true works of art. In comparison, some points appear crude and clumsy. Proof of their past use on projectiles is often recorded in the form of impact fractures which may remove an elongated flake form the tip or an abrupt "burinated" facet along the tip's edge (Figure 5.2). Such breaks were often repaired but in same cases traces of them can still be seen.

Projectile point types are typically named for a type site or for a region where they are first defined. Clovis points are named for the Blackwater Draw Site near Clovis, New Mexico; Agate Basin points are named for the Agate Basin Site in eastern Wyoming; Alberta points are named for the Province of Alberta, Canada, etc. These named types can and usually do occur beyond the locales where they were first identified, sometimes being found over vast geographic areas. These style distributions, along with lithic raw material identifications, inform us about regional and interregional level interactions and connections.

Figure 5.2. Impact fracture on a Paleoindian point. (SNF Artifact: 512; Keokuk Chert; unknown provenience.)

On Types and Typology

There is an unfortunate trend in projectile point identification—and this applies for both professional archaeologists and amateur collectors—of taking a rather cavalier attitude toward the process. Many projectile point types have been reimagined and reinterpreted in a manner that is far removed from their original form and intent. Some type names in particular have been very much abused. One of these is Agate Basin. As viewed from the original type site (Frison and Stanford 1982), Agate Basin points are relatively narrow, somewhat thick, elongated lanceolate points with a faintly tapering proximal portion, a convex to straight basal edge, heavily ground lateral margins of the proximal haft portion, and a flaking pattern that ranges from collateral pressure and horizontal pressure to somewhat less organized but still very well- and evenly executed pressure flaking. That is a lot to remember, so people have gotten into the habit of calling pretty much any long, well-made lanceolate point with a narrow base an Agate Basin (Figure 5.3). Hardin points are another example of a frequently misused type name. Hardin points, like most of the point types of the earlier periods are actually very stylistically specific and easy to identify. Unfortunately, the name Hardin has been applied to such a

Figure 5.3. So-called "Agate Basin" point. (MHS Artifact: A754; Burlington Chert; Sauk Co. WI.) This point is analogous to an oversized Rice Lanceolate point.

wide variety of stemmed points with barbed shoulders that it is quite likely that some may no longer recognize the type as it was originally defined. Tell people that a crude, barbed, and stemmed Late Archaic point with no basal grinding is a Hardin point often enough, and they will start to believe it. One could make similar critiques of the irresponsible uses of the Scottsbluff, Eden, and Kirk Corner-Notched type designations. Casual, dumbed-down typology does no one any good and only serves to muddle and confuse the archaeological literature.

Identifying projectile point types is not a simple matter of matching outline shapes to pictures in a book. Such a simplistic morphological approach to the task is bound to result in unintended but serious errors (Figures 5.4 and 5.5). This "Cookie Cutter" approach groups points together based on their proportions and gross morphology. This way of sorting projectile points not only assumes that all projectile points of the same type will have the same general proportions, it pretty much overlooks the potential complexities of shape configurations that will result from point maintenance (see Flenniken 1985; Flenniken and Raymond 1986; Thomas 1986; Flenniken and Wilke 1989). There is a real danger of misidentifying multiple distinct point types that merely represent different use-life stages in a single point style (e.g., see Hoffman 1985). Plainview points are often thought of as a common and widespread lanceolate point type, but it seems likely that in the case of the Midwest, many of these so-called Plainview points are actually first-stage Dalton points that have not yet been resharpened. Along a similar line of thought, Meserve points on the Great Plains are often considered to be resharpened Plainview points (e.g., Goodyear 1982), but Meyers and Lambert (1983) argue that Meserve points are a western extension of the Dalton Horizon.

Figure 5.4. Both of these points were originally typed as Snyders points. On the left is a Snyders point (Middle Woodland), on the right, a Thebes knife (Early Archaic). ([Left] MHS Artifact: 1984.77.50.1; Burlington Chert; unknown provenience; [right] MHS Artifact: 1988.120.35.7; Burlington Chert; IL.)

Among all stone artifacts, projectile points, especially larger and multipurpose ones, had long and complex use lives. Projectile points, by virtue of their primary function, suffered various forms of impact damage and breakage that could often be repaired, shortening the point and sometimes even giving it a brand new base. The lateral edges of points that were used as knives had to be periodically resharpened, narrowing and shortening the blade portion. Some points were repurposed into other tool forms like hafted scrapers, drills, and gravers (Figure 5.6).

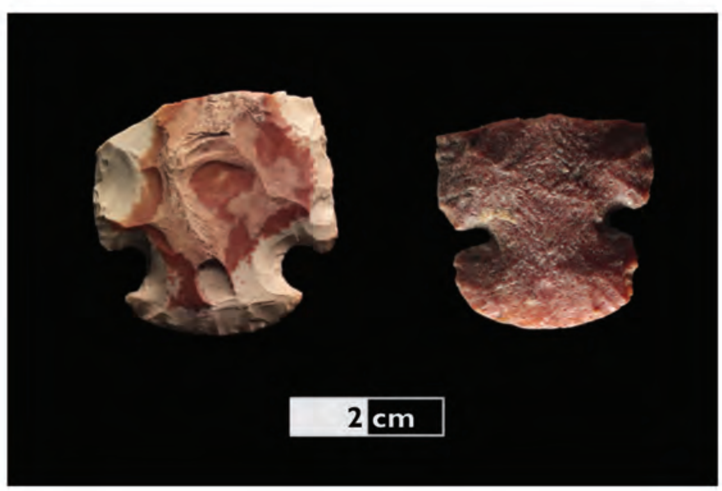


Figure 5.5. Both of these broken point bases were originally typed as St. Charles points. On the left is a Gibson point (Middle Woodland), on the right, a St. Charles point (Early Archaic). ([Left] MBISP Artifact: 19513; heat-treated Croton Tabular Chert; Douglas Co., MN; [right] MBISP Artifact: 10348; burned Shakopee Chert; Blue Earth Co., MN.)

An overly simplistic approach to point typology also ignores the various attributes that are not related to simple outline shape that can be (and often are) far more important and diagnostic. In 1956, J. A. Eichenberger, an amateur archaeologist

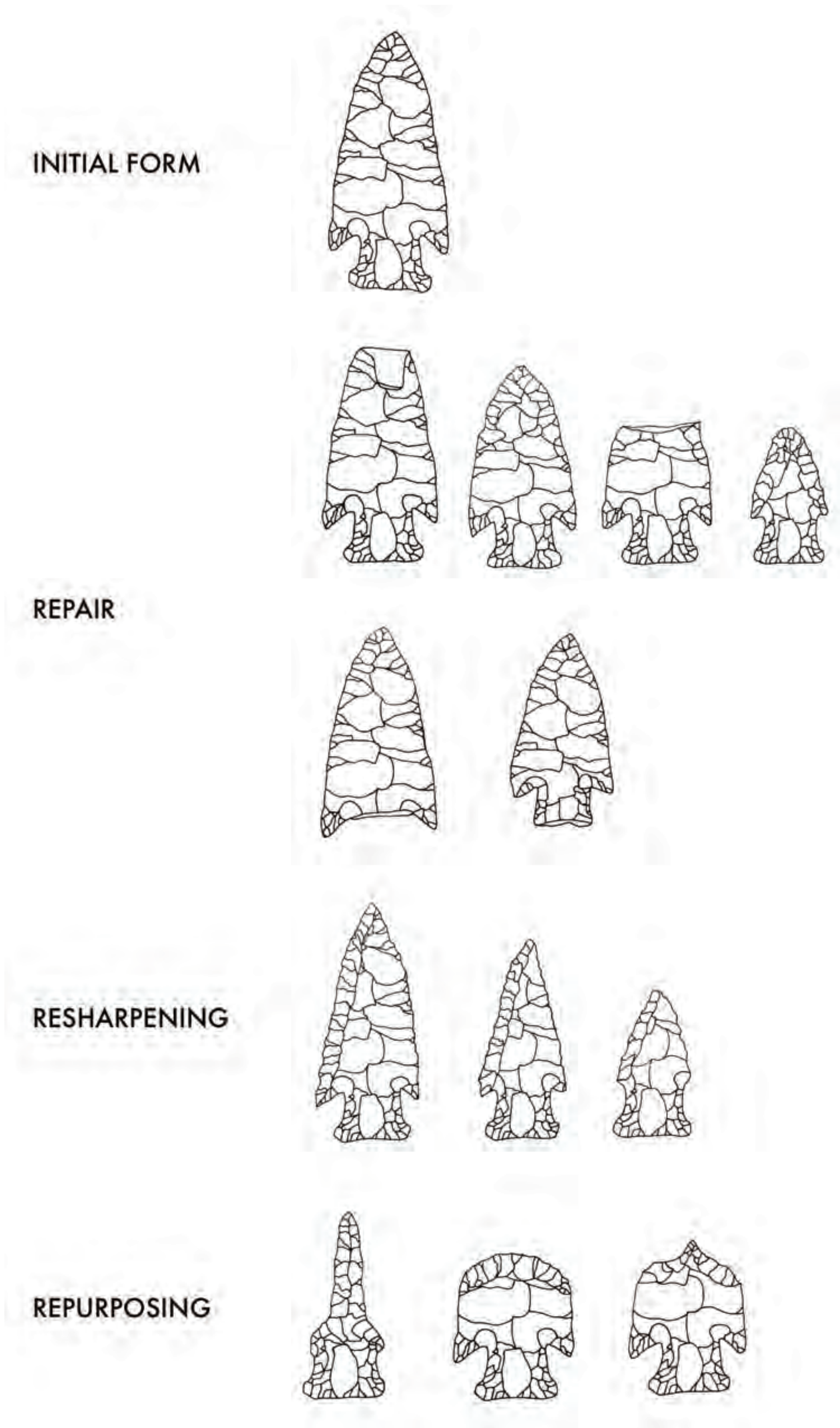


Figure 5.6. Various use-life trajectories for a large projectile point/knife, in this case a Hardin point.

from Hannibal, Missouri, best known for the casts he made of diagnostic projectile points from many classic western Paleoindian sites, published an article in the *Missouri Archaeologist* entitled "The Hannibal Complex" (Eichenberger 1956). In spite of their widely divergent morphologies, he correctly grouped what we now know as Dalton, Hardin, St. Charles, and Searcy/Rice Lanceolate points into one class, arguing that these were the earlier points. Types that today we would call Etley, Sedalia, Raddatz/Osceola, and Adena/Waubesa points were put into another class that Eichenberger assigned to a later interval of time. Keep in mind that this was before many of these point types were even named and certainly long before most of them were associated with any reliable radiocarbon dates. Clearly, Eichenberger was seeing something beyond outline shapes.

The time and care that went into making a projectile point varies from time period to time period. It is a surprising fact to many that it is the earlier, rather than the later points, that tend to exhibit the most refined workmanship. Various explanations for this have been offered, such as Torrence's (1989) concept of time stress, wherein she essentially argues that as plant foods and/or agriculture became more prevalent and big game hunting was less critical to survival, people directed their time and effort to things other than preparing for the hunt. Parry and Kelly (1987) propose that the general decline in the sophistication of chipped stone tool technology resulted from the ability of more sedentary populations to stockpile raw material, arguing that later, more settled people could afford to squander their stone rather than having to tightly conserve it. In actuality, the precise opposite of Parry and Kelly's (1987) thesis might be the culprit. In Minnesota, as in many parts of the rest of the midcontinent, the decline in chipped stone tool technology corresponds to a reduction in mobility and *declining access* to sometimes distant high-quality raw material sources, forcing populations to turn more heavily toward lower-quality raw materials that were available locally. In other words, the shift to smaller, more crudely made tools was due to desperation, not abundance.

Doubtless, one of the things that Eichenberger (1956) was seeing in those projectile points from northeast Missouri was variation in workmanship. Paleoindian projectile points, as a general category, are renown for their exquisite flaking. The remarkably thin, fluted Folsom points and unfluted Midland points commonly have blade edges retouched with exceptionally fine, narrow pressure flakes. Agate Basin, Scottsbluff, and Eden points typically exhibit regularly patterned pressure flaking with parallel scars running horizontal across the body of the point, meeting at or near the point midline. Parallel-oblique flaked points of the very late part of the Paleoindian era have elegant parallel ribbon-like pressure flake scars traversing their blades at an angle. These various elaborate flaking patterns are the result of considerable planning, preparation, time, and effort, not just inherent skill, on the part of the point makers. Even the generally less uniformly flaked Paleoindian types like Clovis, Gainey, Hell Gap, and Alberta tend to exhibit smoothly finished surfaces and even cross-sectional and longitudinal symmetry. Moderate to heavy haft grinding is a universal characteristic of these Paleoindian points.

The Early Archaic types of the Upper Mississippi Valley are directly contemporaneous with the unfluted, Late Paleoindian point types just discussed, and like them, also exhibit generally good overall workmanship. In the case of most Early Archaic types like Dalton, Hardin, and St. Charles this relied more on even percussion work and selective pressure flaking to trim and smooth surfaces. When viewed as three-dimensional objects rather than static outline shapes, most Early Archaic projectile points have a balance and symmetry to them that was seldom matched by later point styles. Special edge treatments like blade edge serration and alternate bevel resharpening were typical. Kirk Corner-

Notched and related point/knife forms like Stilwell and Neuberger were also resharpened by beveling, but the flaking shifted orientation from left beveling to right beveling and back with each sequential resharpening. As with Paleoindian points, moderate to heavy haft grinding was the norm on all of these Early Archaic styles. People often lament that one cannot type a point if its base is broken off, but it is definitely possible to determine that a distal fragment is from an Early Archaic point and in some cases identify the specific type. The same might be said of many Paleoindian points.

Sometime between 9,000 and 8,000 years ago, the refinement and workmanship that went into manufacturing chipped stone projectile points essentially vanished. Points became generally smaller, rougher, cruder, and less remarkable. Cross sections became often less symmetrical, and errors in workmanship like step or hinge fractures were commonly tolerated. Flaking was unpatterned with selective, often discontinuous use of pressure flaking over random percussion. In some types, pressure flaking was minimal while in others it was limited to abrupt retouch along the edges of the point. For the first time, heat treatment of chert became common and widespread. Haft grinding was not the prerequisite it once was but shows up sporadically and is prevalent on some later Archaic point types. Most Woodland point styles exhibit little, if any, haft abrasion; however, Middle Woodland contemporary Besant points are exceptions to this. The mediocre quality of workmanship generally prevailed for several thousand years. There were occasional points of above-average workmanship—some Early and Middle Woodland points are quite well made—but even these tend not exhibit the fine attention to detail that the earlier styles show.

This somewhat generic technology based around medium sized bifaces finally shifted gears around 500 C.E. when light, thin projectile points started to dominate. These later smaller points are generally under 3 to 4 cm (1.2 to 1.6 inches) in length and usually less than 4 to 5 mm (0.16 to 0.20 inches) thick. Most of these were made on flakes, and some exhibit unworked areas displaying the original surfaces of the selected piece. Others are more fully flaked, some of them displaying considerable refinement. These diminutive projectile points are thought by many to signify the arrival of the bow and arrow.

Spear, Dart, or Arrow?

There is a traditional model for the development of prehistoric weaponry that begins with thrusting and hand-thrown spears, followed by the use of the spear and spear thrower (atlatl and dart), and ends with the bow and arrow (see Hughes 1998). Christenson (1986a, b) and Hughes (1998) have both discussed projectile point variability from a largely theoretical/engineering standpoint. They quite logically reason that stone points attached to thrusting spears can be large and heavy and that stone points attached to arrows will be small and light. Points for atlatl darts are envisioned as falling somewhere in between.

Large, lanceolate Paleoindian projectile points have been interpreted by some as tips of thrusting or jabbing spears (e.g., Vickers 1986:53; Osborn 2011). This idea seems based on the assumption that leaf-shaped points without barbs were specifically designed for repeatedly stabbing the prey. In perhaps the only study of its kind, Hutchings (2015) examined the characteristics of impact fractures on obsidian Paleoindian points from northwestern North America and determined that Paleoindian spears were most likely propelled with an atlatl.

Notched projectile points are believed by some to indicate the appearance of the atlatl (e.g., Vickers 1986:53). Perhaps the co-occurrence of bannerstones and side-notched Middle Archaic projectile points perpetuates this idea. There is no reason at all to draw any causal relationship between point notching and spear throwers; lanceolate, triangular, and stemmed points were all used on atlatl darts. Further, recall from the previous paragraph that atlatls were apparently in use long before side- or corner-notched points were being made.

The popular view in North American archaeology is that bow and arrow technology developed in the far north and spread southward (Blitz 1988). This weaponry system first appears in the Arctic, spreading from west to east between 3000 and 800 B.C.E. Light, thin Avonlea points appear in the Northern Plains of Manitoba and Saskatchewan by 200 C.E., and these are thought by many to signify the arrival of the bow and arrow (Kehoe 1966). Notched Klunk and Koster points are believed to represent the earliest arrow points in Illinois and date between 600 and 700 C.E. (Fowler and Hall 1978). The earliest arrow points over much of the southeastern United States appear to date around 700 and 800 C.E. (see Blitz 1988). In most parts of the country, it appears that the bow and arrow completely replaced the atlatl and dart, though the latter may have lingered on in a few areas. Outside of Mexico and Alaska, precious few Native American people were still using the atlatl and dart in historic times. This is the traditional understanding of the development and spread of the bow and arrow in North America. However, there have been challenges to this view.

It has been suggested that small, notched, and stemmed Archaic points in mid-continental and eastern North America were used on arrows (Byers 1959; Bradbury 1997; Snarey and Ellis 2010), and some argue that the bow and arrow appeared, disappeared, and reappeared at various points in time. These interpretations are based on the known or assumed size differences between atlatl dart points and arrow points. Thomas (1978) examined 132 stone-tipped arrows and 10 stone-tipped atlatl darts in the American Museum of Natural History collections in order to devise a means of distinguishing between arrow and dart points from the archaeological record. Using measurements of point length, width, neck width, thickness, and weight, his resulting equation correctly classified 86 percent of the arrow points and 70 percent of the dart points. Recognizing the small number of atlatl darts in Thomas' study, Shott (1997) added 29 stone-tipped dart points from other institutional collections to the sample and reexamined the database. In particular, Shott's reanalysis isolated shoulder width as the most useful discriminating attribute, and his revised equation correctly classified 89 percent of the arrow points.

On the one hand, the use of actual hafted stone points to distinguish arrow and dart points is a brilliant idea, and it does allow for an objective way of classifying archaeological points. On the other, the results are not infallible—notice that while the majority of the hafted points were correctly categorized, there was a sizable minority that were not. The inconvenient fact is atlatl dart points and arrow points overlap somewhat in size. For this simple reason, demonstrating that a prehistoric projectile point is small enough to be an arrow point does not prove that it was an arrow point. So the suggestions that some Early Archaic and Late Archaic point types served as arrowheads can be viewed with some due skepticism. On a related note, Hildebrandt and King (2012) recently offered an alternative dart/arrow index utilizing neck width and maximum thickness to distinguish between the two. They reevaluated the proposition that several early point types in the in the northwestern United States were also used to tip arrows (Ames et al. 2010), and concluded that they were most likely dart points.

One of the critical things that many of these projectile point morphology studies overlook is the built-in multi-functionality of some designs. This is a hallmark of Midwestern Early Archaic hafted biface technology but could probably also apply to most medium to large projectile points of other periods. Dalton, St. Charles, and Hardin points frequently exhibit impact fractures, and their lateral blade edges were routinely resharpened by alternate beveling. These types were intended to be dual-purpose tools. Hafted on detachable foreshafts, these tools could freely shift from projectile to knife functions (Figure 5.7). St. Charles and Hardin points are among the first notched and stemmed projectile point forms to appear in the Upper Midwest. In contrast to Musil's (1988) argument regarding notching points to make broken points more easily repaired, perhaps the notching was of benefit in the alternate use of these points as hafted cutting and sawing tools. Notches and stems allow a wider blade to be securely hafted to a smaller diameter shaft. That wider blade can endure more resharpenings than a narrower one and therefore make a longer-lasting, more versatile tool.

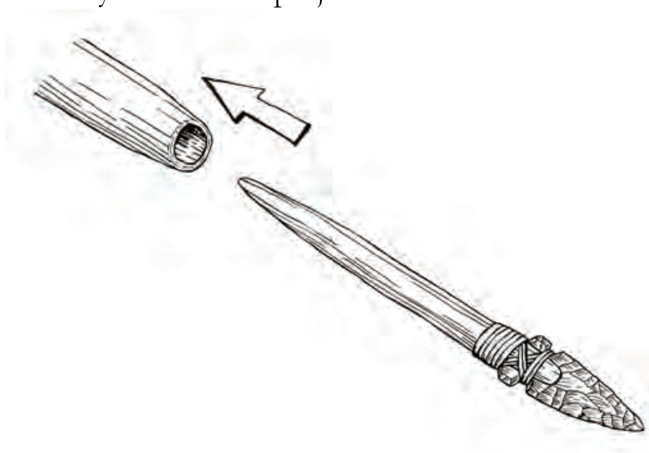


Figure 5.7. Reconstruction of a detachable foreshaft.

CHRONOLOGY AND POINT CLUSTERS

Archaeologists traditionally divide prehistory into blocks of time called periods. These divisions are based on broad themes and general trends that characterize particular lifeways. In eastern and central North America these periods are Paleoindian, Archaic, Woodland, and Late Prehistoric. Paleoindian represents the earliest people in the continent who made lanceolate, or leaf-shaped, projectile points and lived by hunting and gathering with a presumed emphasis on big game hunting. This is followed by the Archaic period, a time when people made and used new and different tool technologies and broadened their economies to include a wider variety of wild plant and animal foods. Woodland is a period largely defined by the introduction of clay pottery technology, the domestication of certain plant foods, and mound building. The last period, Late Prehistoric, includes groups of people who aggregated into large villages, made an expanded array of pottery, and relied substantially on domesticated plant foods, especially corn. Each of these four major periods can also be further subdivided, for example, into Early Archaic, Middle Archaic, and Late Archaic. This is how archaeologists organize their sites and data. Archaeologists studying in particular regions have worked out specific sequences of periods and sub-periods for their respective locale.

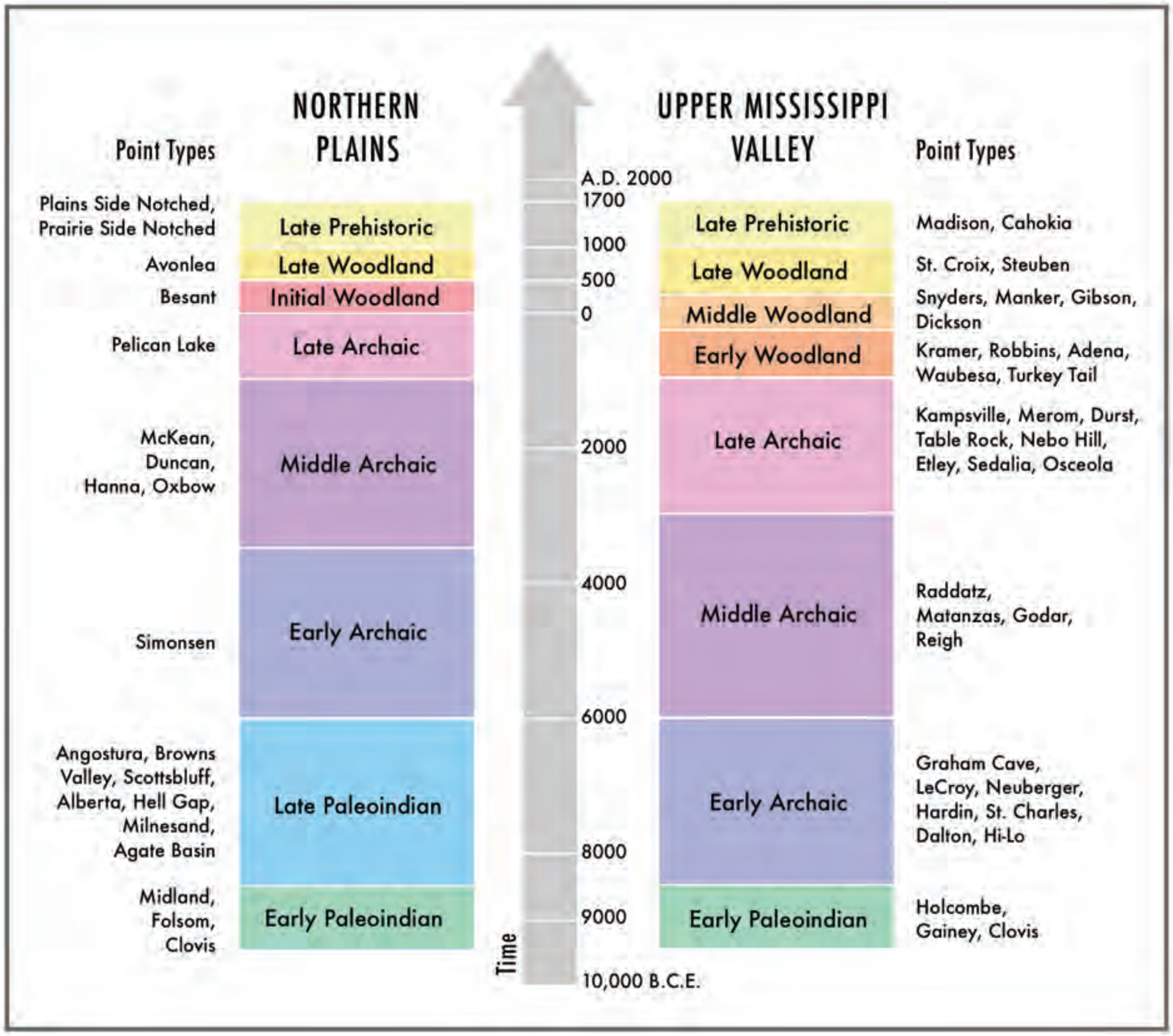


Figure 5.8. Chart showing chronological differences of cultural periods and associated projectile point types in the Northern Plains and Upper Mississippi Valley.

But things did not happen simultaneously across an area as vast as North America. For example, pottery making developed early in some areas and spread into neighboring areas over time, and some native plant species were domesticated at different times in different places. Mounds were being built in the Deep South during Archaic times, thousands of years before the period we traditionally call Woodland. Problems inevitably arise when trying to apply fixed beginning and ending dates to the various periods and sub-periods over large and varied geographic areas. Early Archaic in Saskatchewan does not mean the same thing as Early Archaic in Illinois; they are referring to very different blocks of time. This issue is especially acute in states that straddle the boundary between the Great Plains and the Eastern Woodlands, places like Minnesota. Throughout prehistory, Minnesota was a melting pot of people and ideas derived from the Northern Plains to the north and west, the Great Lakes to the east, and the Mississippi River Valley to the south and east. This resulted in geographically and temporally complex patterns of prehistoric cultures across the state.

To help clarify this situation, the accompanying chart (Figure 5.8) presents the prehistoric cultural sequences of the Northern Plains and the Upper Mississippi River Valley. While both sequences begin at essentially the same time for Early Paleoindian, from there on they diverge. Note that Late Paleoindian on the Northern Plains occupies much the same block of time as does Early Archaic to the southeast. Minnesota reflects both of these contemporaneous regional traditions, and they overlap considerably in space. Characteristic Late Paleoindian projectile point styles related to those to the north and west are found throughout the state and point and knife types of the eastern Early Archaic occur over a large part of southern and eastern Minnesota. A similar situation is represented during the subsequent Early Plains Archaic and the eastern Middle Archaic periods just as it is during the Late Plains Archaic and the eastern Late Archaic. Developed early on to the southeast, pottery technology arrived nearly one thousand years later on the Northern Plains. There essentially is no "Early Woodland" on the Northern Plains or in northern Minnesota for that matter.

Projectile point types that are related in time and space can conveniently be grouped to together in clusters (e.g., Justice 1987). The following type clusters are represented in Minnesota.

Fluted Point Cluster: The Fluted Point cluster is composed of unstemmed lanceolate points with a characteristic flute or channel scar removed from their bases, usually on both sides of the point. These distinctive artifacts are the earliest projectile points known in Minnesota, dating from about 9350 to 8200 B.C.E. This timeframe extends back to the late Pleistocene or Ice Age, and these fluted points have been found in association with long extinct megafauna like mammoth, mastodon, and larger, extinct forms of bison. In Minnesota, this cluster includes Clovis, Gainey, Folsom, and Holcombe points. Though they are unfluted, Midland points are also included here because of their obvious association with and affinity to Folsom points. Several studies have focused on documenting these rare and early points in Minnesota including Shane (n.d.), Higginbottom (1996), and Buhta et al. (2011).

Early Plano Lanceolate Cluster: This cluster consists of medium- to large-sized points with a characteristic lanceolate shape, lack fluting, and date from roughly 8500 to 7500 B.C.E. Distributions of classic forms are concentrated in the Great Plains, where they are associated with the big-game-hunting tradition, especially the hunting of bison. This cluster includes Agate Basin, Milnesand, and Hell Gap points. Frank Florin (1996) has compiled a comprehensive survey of Late Paleoindian projectile points in Minnesota.

Dalton Cluster: This group is composed of often heavily reworked lanceolate points with a concave base, pronounced basal ears, and fluting or thinning on some specimens. These points developed directly out of previous fluted lanceolate points. Some researchers prefer to call Dalton and related points Paleoindian because of their lanceolate shape. Others see Dalton as transitional between Paleoindian and Archaic traditions. The tool technology associated with Dalton and related points includes alternate bevel resharpening, blade edge serration, and chipped stone adzes. In general, the infrequent occurrence of exotic raw materials in most Dalton assemblages suggests a sharp restriction in mobility and range size when compared to most Paleoindian traditions (Koldehoff and Loebel 2009). For a variety of reasons, it may be better to think of Dalton as representing the earliest part of the Early Archaic period (see Koldehoff and Walthall 2009 for discussion). Regardless of the label one prefers, the Dalton point cluster dates from roughly 8500 to 7500 B.C.E. There are a tremendous number of localized Dalton point varieties across the eastern and central United States. In Minnesota, Dalton and Hi-Lo points are representative of this cluster.

Plano Stemmed Lanceolate Cluster: Projectile points in the Plano Stemmed Lanceolate cluster are lanceolate points that have stems and distinct shoulders. On the Great Plains this cluster includes Alberta, Scottsbluff, and Eden points. In Minnesota, true Eden points, as they are known from the High Plains, do not appear to be present, but Alberta and Scottsbluff points are certainly found in the state. Minnesota is on the western side of the distinctive eared variety of Cody points that are largely limited to the Western Great Lakes region. These stemmed Lanceolate points date from around 7500 to 6600 B.C.E. Frank Florin (1996) has compiled a comprehensive survey of Late Paleoindian projectile points in Minnesota.

Thebes Cluster: The Thebes cluster is composed of well-made, medium to large points and knives with deep corner or diagonal side notches. These distinctive Early Archaic artifacts often exhibit alternate beveling and edge serration. The Thebes cluster dates from about 7500 to 6700 B.C.E., and includes St. Charles points and Thebes knives. In western Illinois, Wiant et al. (2009:242) place the similarly alternately beveled but stemmed Hardin point form in the Twin Ditch phase which includes the Thebes cluster.

Parallel-Oblique Lanceolate Cluster: This grouping is intended to draw together that group of Late Paleoindian points that correspond to the very late, or terminal Paleoindian period on the Great Plains. These points vary in outline shape, but all share the same trait of being composed of medium- to large-sized points that have a characteristic lanceolate shape, fine transverse to parallel-oblique pressure flaking on the faces, and moderate to heavy grinding around the lower edges of the point. They date from roughly 7000 to 5500 B.C.E., placing them into a timeframe that embraces the early part of the Middle Archaic period in Midwestern archaeology. These are the last of the Paleoindian lanceolate points made. Frank Florin (1996) has compiled a comprehensive survey of Late Paleoindian projectile points in Minnesota.

Kirk Corner-Notched Cluster: This cluster is composed of a varied assortment of medium to large corner-notched points dating to the Early Archaic period. These points generally share a roughly triangular to elongated blade shape, bifacially beveled and serrated blade edges, and moderate to heavy haft grinding. Because of their easily recognizable form, Kirk cluster points are good common-horizon markers for the Early Archaic in the mid-portion of the eastern United States. In general, corner-notched forms like Kirk Corner-Notched, Charleston, Palmer, and Pine Tree appear to circa 7900 to 6900 B.C.E. Though very common in the east, these points are less so in the Midwest, and they may or may not occur in Minnesota. Neuberger points are described and illustrated here since they comprise the Kirk Corner-Notched variety that is among the most common in neighboring states.

Early Archaic Bifurcated Base Cluster: Projectile points with a deep notch (bifurcation) on the center of the base are the latest Early Archaic point types in the eastern United States. They range in age from about 7000 to 5800 B.C.E. in age and immediately follow the Kirk Corner-Notched Cluster. Bifurcated base points are widely distributed from northern Tennessee to the lower Great Lakes and from eastern Missouri into New England. Among the more common bifurcate base types are

MacCorkle, Rice Lobed, St. Albans, LeCroy, Lake Erie Kanawha, and Fox Valley Bifurcated Base. Of these, LeCroy points occur in small numbers in southeastern Minnesota.

Archaic Side-Notched Cluster: This is probably the most nebulous of the point type clusters included here. Side-notched point forms are among the most common and long-lived projectile point designs. The earliest forms appear around 6500 B.C.E., and the latest last until nearly 1000 B.C.E. There is tremendous variation within the relatively generic Archaic Side-Notched pattern over time, but unfortunately, due to typically mediocre craftsmanship there is also plenty of variation within contemporary groups of points. Even the side-notched points excavated from single component contexts may seem to contain several different "types" that may in reality represent the typical range of variation within a single type. The types illustrated here are the best known and most easily recognized. These include Graham Cave, Simonsen, Raddatz, Godar, Reigh, Osceola, Matanzas, and Oxbow. However, keep in mind that for every side-notched Archaic point that fits a type designation perfectly, there's another that straddles the line between two or three different types.

McKean Cluster: The McKean cluster contains stemmed and lanceolate points that date from the Middle and Late Plains Archaic periods (ca. 3000 to 500 B.C.E.; Kornfeld 1998; Roll 1998). They are widely distributed throughout the Northern Plains, where they are an early manifestation of the small point tradition. Although the exact relationships between types in the cluster are unknown, they are generally considered to represent a somewhat overlapping temporal sequence within the long lived McKean complex (ca. 3000 to 500 B.C.E.). McKean (ca. 3000/2500 to 1500 B.C.E.) and Duncan (ca. 2000 to 1500 B.C.E.) points are associated with the earlier portion of the McKean era, while Hanna (ca. 1500 to 1000 B.C.E.) was the predominant point type in the complex between circa 1500 and 1000 B.C.E. The Yonkee point marks the terminal phase of the McKean complex between about 1000 and 500 B.C.E. Hanna and Yonkee are Late Plains Archaic point types. McKean complex people were most likely composed of linguistically and biologically diverse groups of bison hunters. Types in the cluster include McKean, Mallory, Duncan, Yonkee, and Hanna. Of these only McKean, Duncan, and Hanna have been noted in Minnesota.

Sedalia/Nebo Hill Cluster: The Late Archaic Sedalia/Nebo Hill cluster included point types associated with the Titterington Phase of Illinois, the Sedalia Complex of central and eastern Missouri, and the Nebo Hill Phase of northwestern Missouri. Sedalia points and Nebo Hill points are both elongated lanceolate points. However, this cluster also includes stemmed points such as Etley and Stone Square-Stemmed. The large bifaces of the Titterington Phase and the Sedalia Complex share a common work style of bold random percussion flaking. This cluster dates from roughly 2500 to 1500 B.C.E. and includes Etley, Nebo Hill, Sedalia, Smith, Stone Square-Stemmed, and Wadlow points/knives. These are sparsely represented in Minnesota, but Sedalia, Nebo Hill, and Etley points are described here.

Late Archaic Stemmed Cluster: The Late Archaic Stemmed Cluster includes small and medium point types with straight or expanding stems that date between 3000 and 1000 B.C.E. The types in this cluster include Table Rock, Durst, Merom, and Kampsville.

Large Plains Notched Cluster: The Large Plains Notched cluster included side notched and corner notched point made during the Late Plains Archaic period dating from roughly 1000 B.C.E. to 500 C.E. This group includes Pelican Lake and Besant points.

Turkey Tail Cluster: The Turkey Tail cluster includes varieties of generally large, thin, and distinctive bifaces that were made between 1200 and 500 B.C.E. These are diagnostic artifacts that occupy the terminal Late Archaic and Early Woodland interval. These exotic artifacts were routinely made of high-quality gray and blue gray cherts from southern Indiana, southern Illinois, and Kentucky sources. Though widely distributed in the states of Ohio, Indiana, Kentucky, Michigan, Illinois, and Wisconsin, these are sparsely represented in Minnesota.

Early Woodland Stemmed Cluster: This Early Woodland Stemmed cluster is composed of medium to large points that have a straight or contracting stem. Although they are considered a diagnostic of the Early Woodland period (ca. 1000 to 500 B.C.E.), some types extend into the later Middle Woodland period (perhaps to 200 C.E. or later). The types in this cluster include Kramer, Robbins, Adena, Waubesa, and Dickson. A form named Fox Valley Stemmed in Wisconsin may simply represent crude versions of these points.

Hopewell Cluster: The Hopewell cluster includes a range of notched and stemmed projectile point types. These share a common manufacturing style of percussion flaking with marginal pressure retouch, deep, open notches and the common use of heat-treated and exotic raw materials. These styles date from roughly 200 B.C.E. to 200 C.E. The types in this cluster include Snyders, Manker, Gibson. Steuben points, which persist into the subsequent Late Woodland period, are also included in this group due to their similar work style and historical relationship to the Hopewell cluster point types.

Early Arrow Point Cluster: The Early Arrow Point cluster includes light, thin points made between circa 500 and 1000 C.E. These are believed to represent the introduction of the bow and arrow. Types in Minnesota include Avonlea and St. Croix.

Late Arrow Point Cluster: The Late Arrow Point cluster includes light, thin points made between circa 1000 and 1700 C.E. These are the projectile points of the late Prehistoric era. In Minnesota this included Cahokia, Madison, Prairie Side-Notched and Plains Side-Notched.

Introduction to Type Descriptions

Much has been written about the various projectile point shapes and what they mean. Some focus on the potential functional and performance variables that differences in point shape conveyed (e.g., Musil 1988; O'Brien and Lyman 2002; Darwent and O'Brien 2006). Others emphasize style as a means of communicating identity and group membership (e.g., Wiessner 1983; Rick 1996). These ideas will be touched upon in the concluding chapter of this book. For now, let us simply remember that these artifacts were a practical part of people's everyday lives. Projectile point designs were forged in tradition, historically linked to previous designs, inspired from time to time by novel innovations, and on very rare occasions, adapted to changes in weaponry systems. The various configurations of projectile points can be thought of as multiple working solutions to the need for a pointed, sharp edge on the end of a projectile.

The following descriptions of Minnesota projectile point types are organized chronologically, beginning with the Early Paleoindian period around 11,000 years ago. Where appropriate, closely related types are presented together and grouped into clusters in the fashion used by Justice (1987). Basic information from many older, previously published projectile point guides (e.g., Bell 1958, 1960; Perino 1968, 1971; Morrow 1984; Goldstein and Osborn 1988) is used, but the broad temporal ranges provided in these references have been updated to more closely reflect current knowledge.

When using this guide, consider the pertinent details in the written descriptions regarding haft grinding, flaking patterns/styles, trends in raw material use and heat treatment, and do not just rely on the pictures. This will help greatly in correctly identifying the types and ages of projectile points. Keep in mind that each projectile point is somewhat unique, and not all of them will fit into the classifications given here. One may be able to narrow down a particular specimen to a general time period based on its technological affinities but not be able to give it a specific type name. Some points may be so aberrant in form or so drastically damaged and/or reworked that they defy classification.

CLOVIS

Clovis points are named for specimens found in the Blackwater Draw locality near Clovis, New Mexico.

Description: A broad, thin, fairly well made lanceolate point with a concave base and basal flutes that extend one-half to one-fifth the length of the point on both faces (Howard 1990). Occasional points have flutes that extend almost the full length of the point, but many of these are probably the result of reworking and repair. The flutes, or channel flakes, were usually made by removing a single flake, although more than one channel flake was occasionally struck off each face. Some channel flakes terminated in a step or hinge fracture either intentionally or accidentally (Romano 1997, personal communication 2015), but most have this feature removed by subsequent lateral flaking. The flutes were struck off using a simpler technique, possibly direct soft hammer percussion, than that used on Gainey and Folsom points. The isolated striking platforms prepared for flute removal are also slightly different (Morrow and Morrow 2002a). Blade edges are generally parallel and gently convex, ending in a fairly narrow and pointed tip. The widest section of the blade is commonly below the midpoint and closer to the base. Fine pressure flaking was used to trim or dress the edges, but most thinning and reduction was carried out by percussion flaking. Cross sections tend to be symmetrical and flattened to lenticular. Basal ears are slightly rounded and downward projecting. The sides of the haft area and the basal edge typically exhibit moderate to heavy grinding. Clovis points vary widely in length (ca. 3.5 to 15.4 cm or 1.4 to 6 inches), but average length ranges between 6.4 and 10.2 cm (2.5 and 4 inches). Heat treatment is exceedingly rare, or absent entirely, in Clovis points.

Distribution: Clovis points and their close variants are the earliest and perhaps the most widely distributed point type in North America (Bonnichsen and Turnmire 1991; Tankersley 1998). They have been found from coast to coast and from northern Mexico in the south to Canada and Alaska in the north. They are rare in Minnesota but a few have been documented as isolated surface finds (Jenks 1937:42–43; Steinbring 1974; Shane 1989). True Clovis points are well represented in Wisconsin, where 22 of 65 fluted points examined in a 1969 study were classified as Clovis (Stoltman 1991a). A few sites in Wisconsin have produced several fluted points such as Aebischer, Gail Stone, Morrow-Hensel, and Withington (Hensel et al. 1999; Loebel 2009). As discussed by Stoltman (1991a), many of these Wisconsin points may be Gainey rather than Clovis.

Age and Associations: Fluted Clovis points have been recovered from several excavated sites in the Great Plains and Southwest where they date between 9350 and 8650 B.C.E. They are diagnostic of the Early Paleoindian period. In the western United States, Clovis points have been found in association with the remains of mammoth and other now-extinct species of large animals. Since the vast majority of known points in the Eastern Woodlands are surface finds, their associations remain a subject of speculation.

Similar and Identical Types: Clovis points are similar to Gainey fluted points in overall size and outline. There are differing opinions about the nature of larger fluted points found east of the Great Plains. Some researchers consider Clovis and Gainey to be distinct types with their own particular temporal and geographic ranges (e.g., Morrow and Morrow 2002a). Pristine, freshly manufactured points are fairly easy to distinguish but with pervasive point maintenance, the two end up looking alike and are sometimes essentially impossible to separate. Some Paleoindian researchers use a combined designation Clovis/Gainey for these points (e.g., Loebel 2009). Others reject the designation Gainey altogether and consider all medium to large partially fluted points to be part of the variation within the Clovis type (see Miller et al. 2013:209). It would appear that most of the non-Folsom fluted points in Minnesota are more like Gainey points rather than western Clovis points.

Figure 5.9. Clovis points. ([A] Gregg Nelson Collection; unheated Cedar Valley Chert; Blue Earth Co., MN; [B] Gregg Nelson Collection; Tongue River Silica; Blue Earth Co., MN; [C] Harris Darling Collection; unidentified chert or chalcedony; Murray Co., MN.)

GAINEY

This is a predominantly eastern fluted point type that resembles the classic Clovis type of the Great Plains in size and general shape. The type is named after the type site in Genesee County, southeastern Michigan (Simons 1980, 1998).

Description: Gainey fluted points have a lanceolate outline, deep and rounded basal concavities, and well-defined primary flutes (Simons et al. 1984; Deller and Ellis 1988). These points have the size range and general outline shape of western Clovis points. However, Gainey points tend to have much deeper basal concavities and are proportionately thinner between the flutes (Morrow and Morrow 2002b). The isolated striking platforms created for flute removal are more like Folsom fluting platforms. Given the depth of the basal concavity, fluting was probably accomplished with indirect percussion. On freshly made Gainey points the flutes extend one-fourth to half the length of the point, but this proportion is greatly altered by point resharpening and repair. Heavily resharpened Gainey points can sometimes be mistaken for Folsom points or even Cumberland points (e.g., Morrow 1984:14). Single or multiple flutes were removed from both faces. Pristine points that have not been resharpened are usually widest closer to the midline, but this changes with point reworking. The basal areas are ground as in Clovis points. Gainey points typically range from 5.0 to 12.7 cm (2 to 5 inches) in length. Heat treatment is extremely rare.

Distribution: Southern Michigan and Ontario is the core area of Gainey point distribution. Many Gainey or Gainey-like points have also been found in Wisconsin.

Age and Associations: Gainey is the point type of the Gainey complex, which is thought to be the earliest complex in the Gainey/Parkhill/Crowfield sequence. All contain fluted points with a Clovis-like form and a Folsom-like fluting technology. Since Clovis and Folsom points are apparently absent in the southern Michigan/Ontario core area of the sequence, the initial inhabitants of the region could have made Gainey points. This interpretation is supported by the technological, overall size, and shape similarities between Clovis and Gainey points, which indicates that they probably date to roughly the same period. However, the Folsom-like fluting technology suggests that Gainey points are somewhat more recent. They could date to the same period as Folsom points or, as Stoltman (1991a:260) suggests, they could be a transitional form between Clovis and Folsom. According to the latter interpretation, a Clovis/Gainey/Folsom sequence in the western Great Lakes west of Lake Superior overlaps the Gainey/Parkhill/Crowfield sequence of southern Michigan/Ontario, with Folsom being contemporary with the Parkhill complex. However, a date range of about 9000 to 8500 B.C.E. seems most likely (see Morrow and Morrow 2002a), making Gainey points partially contemporaneous with Folsom points on the Great Plains.

Comments: Gainey points have probably been thought to be Clovis points in Minnesota for many years, as they are well represented in Wisconsin (Stoltman 1991a:259). They could, therefore, be present in the state. Examples of these Gainey points are illustrated by Stoltman (1991a) from the Aebischer Site just east of Lake Winnebago in Calumet County. In western Wisconsin, Gainey points have been found with a mastodon at the Boaz mastodon site in Richland County and at the Withington Site in Grant County in the Driftless area (Loebel 2009). The Withington Site is a small seasonal camp on a ridge overlooking the Platte River. Seven Gainey points in the Steele collection from Silver Mound in Jackson County in the northern part of the Driftless area have also been described. Most Wisconsin Gainey points are made of high quality Hixton Silicified Sandstone. The Withington Site assemblage is dominated by Hixton Silicified Sandstone with other exotic materials like Cobden Chert, Cochran Chert and possibly Gunflint Silica (Loebel 2009). The Aebischer Site in eastern Wisconsin is dominated by Moline Chert from western Illinois (Koldehoff and Loebel 2009).

Similar and Identical Types: The same discussion of fluted point variability given in the Clovis description above applies to Gainey points. Bull Brook fluted points in the northeastern United States are generally identical to Gainey points.

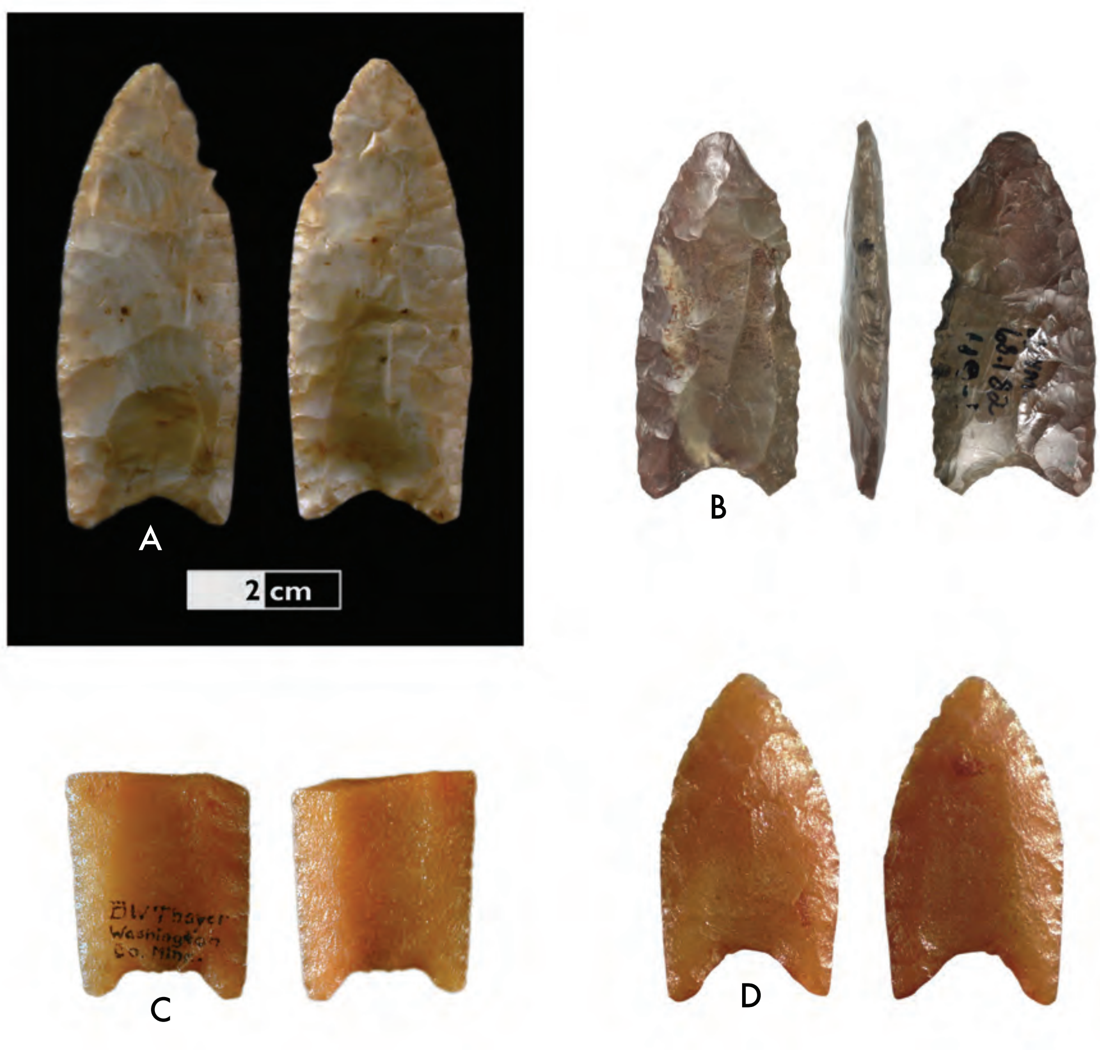


Figure 5.10. Gainey points. ([A] SMM Artifact: A94:4; unheated Grand Meadow Chert; southeastern MN; [B](MHS Artifact: 68.182; Cochrane Chert; Yellow Medicine Co., MN; [C] SMM Artifact, on loan from Monroe Killy; Hixton Silicified Sandstone; Washington Co., MN; [D] Joseph Neubauer, Sr. Collection; Hixton Silicified Sandstone; Pine City area, MN.)

FOLSOM

This Early Paleoindian point type is named for the Folsom Site in New Mexico (Wormington 1957).

Description: A thin, finely-made, medium-sized fluted lanceolate point with a flattened to bi-concave cross section, parallel to convex sides, and broad flutes that typically cover at least 60 percent of each face. Fluting involved careful preparation of an isolated platform in the center of the base from which flutes were removed. The flutes extend at least three-fifths of the total point length from the base and often go up to the tip of the point. Bases are concave, have pronounced ears, and are fairly heavily ground. The widest part of the point is usually just above the midsection. Folsom points range from about 4 to 8 cm (1.5 to 3 inches) in length and 1.9 to 2.2 cm (0.75 to 0.88 inches) in width. Well-made points can be as thin as 0.15 cm (1/16 inch) between flutes. This point type is usually made of high-quality cherts and other materials. Heat treatment is typically absent.

Distribution: A somewhat rare type, Folsom points are present in densest numbers in the Southwest and on the High Plains. Scattered specimens have been found as far east as Wisconsin and Illinois in the Upper Midwest. Their distribution is confused somewhat in the east by the more common and widespread distribution of the Folsom fluting technique. Some archaeologists consider these latter points "Folsom-like," but they lack many of the attributes of classic Folsom points. They are well represented in Wisconsin, with 7 of 65 fluted points examined in a 1969 study classified as Folsom (Stoltman 1991a). Folsom points are rare in Minnesota, but a few have been documented as isolated surface finds (Shane 1989; Johnson and Higginbottom 1994:3.23–3.24; Higginbottom 1996; Anfinson 1997:Figure 10; Myre–Big Island State Park n.d.).

Age and Associations: On the Plains, Folsom points have been found in contexts associated with the procurement and processing of large, now-extinct forms of bison such as *Bison antiquus* and with smaller game. In these contexts, the point type is radiocarbon dated to circa 8800 to 8200 B.C.E. (Hofman 1998a). They are thought to date to the same time period in southern Wisconsin (Stoltman 1991a).

Comments: Folsom was the first point type found in association with the bones of now-extinct species of mammals. A small number of points have fluting on only one face. Care must be taken in identifying Folsom points, for other types of fluted points whose blade has been greatly reduced by reworking can be mistaken for a Folsom point. Fluting on these forms appears (misleadingly) to extend up the length of the blade, which is a typical characteristic of Folsom points. Folsom points are generally distinguishable by their extreme thinness and fine pressure retouch.

Similar and identical Types: Midland points are usually considered unfluted Folsom points that date to the same general time period (Hofman 1998a; Taylor 2006). Heavily resharpened and shortened Clovis and Gainey points can superficially resemble Folsom points.

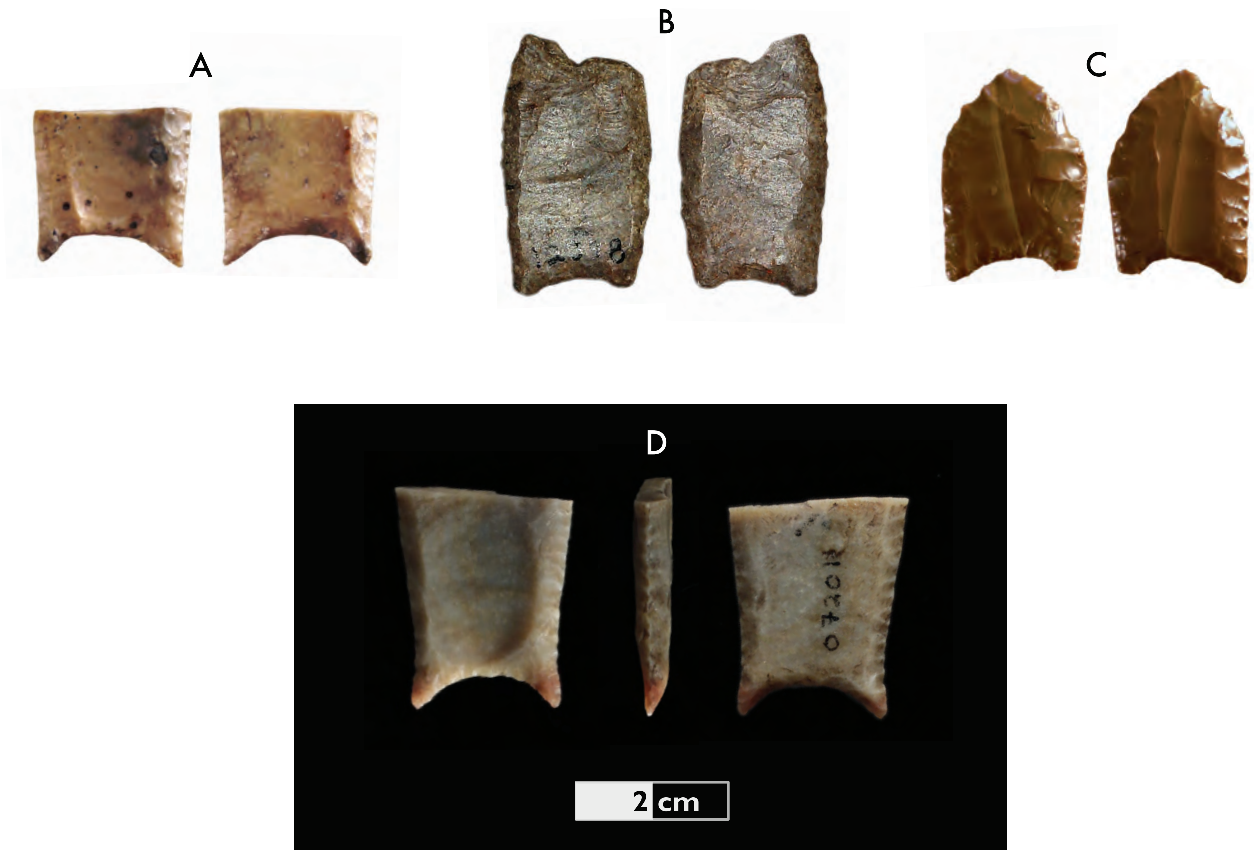


Figure 5.11. Folsom points. ([A] Joseph Neubauer, Sr. Collection; unidentified chert; Pine City area, MN; [B] MBISP Artifact: 12428; unidentified chert; Faribault Co., MN; [C] Joseph Neubauer, Sr. Collection; unheated Cochrane Chert; Pine City area, MN; [D] MBISP Artifact: 07201; unidentified chert; Faribault Co., MN.)

MIDLAND

Midland is an Early Paleoindian Lanceolate point type named after points found at the Scharbauer Site near Midland, Texas. These points are frequently called "unfluted Folsom" points, because they resemble Folsom points without flutes. They are included here in the Early Paleoindian Fluted Point cluster because of this highly likely association.

Description: These very thin (ca. 3 to 5 mm or 1/8 inch) points are similar in shape to Folsom points but lack the flutes diagnostic of that type. Some archaeologists believe that Midland points are a separate type of point made on thin and flat flakes rather than a Folsom point that was not fluted, which would make them a subcategory of Folsom point. They are almost flat in cross section and have only light or no smoothing across the basal concavity. Grinding extends up the edges to at least the point of maximum width. Occasionally, carefully prepared nipple platforms are found centrally located at the base edge. These do not appear to be functional and may simply be homage to the closely related Folsom type. Bases were thinned by the removal of three to four short flakes on one face. Point length ranges from about 3 to 7 cm (1.2 to 2.8 inches), with most points being somewhat less than 5 cm (1.2 to 2.8 inches) in length. Severely resharpened examples have a short, stubby appearance. Fine, steep retouch similar to that found on Folsom points occurs along the edges of some of these points. Like Folsom points, Midland points are usually made from high-quality, non-local stone.

Distribution: The core distribution of Midland points is in the Southwest and High Plains. This point type is somewhat rare in Minnesota, where they are concentrated in the southern part of the state (Faribault, Fillmore, Freeborn, and Olmsted Counties) as well as Anoka and Pine Counties.

Age and Associations: These points are thought to date to the same time span as Folsom points, that is, about 8800 to 8200 B.C.E. (Hofman 1998b). They are considered by many to be unfluted Folsoms and appear to have been made on thin, flat flakes. In their core area, they have been found both alone and apparently in association with Folsom points. Some archaeologists believe that Midland points are a transitional form to simpler types from the technologically more complex Folsom point. Other aspects of their tool technologies are essentially identical. Like Folsom points, Midland points are associated with the Great Plains bison big-game-hunting tradition. At present, the relationship between Midland, Folsom, and other contemporary point types in the Great Plains remains unresolved.

Similar and Identical Types: Midland points are identical to Folsom points in general appearance but lack fluting. Some are somewhat similar to Milnesand points, which are generally longer and thicker than Midland points. Goshen points may be closely related or even the same type (Taylor 2006:154–159). They also resemble Plainview points, a very problematical point type outside of their type region in the southern Plains (Taylor 2006:151–153).

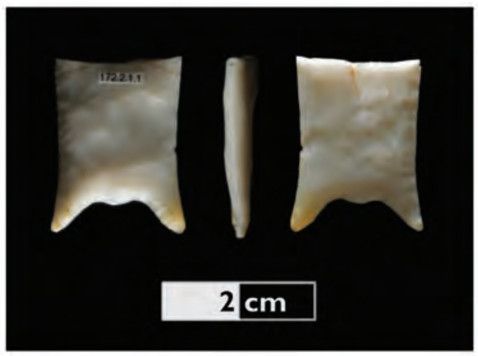


Figure 5.12. Midland point. (MHS Artifact: 172.2.1.1; unidentified chert; Fillmore Co., MN.)

Holcombe

Holcombe is a small, thin fluted point named by Fitting, DeVisscher, and Wahla (1966) after specimens from the Holcombe Beach Site in Macomb County, southeastern Michigan.

Description: Holcombe points are small, thin lanceolate points with shallow basal concavities (Wahla and DeVisscher 1969; Justice 1987:24; Deller and Ellis 1989). With their broadly convex sides and high midpoint above the center, they are thought to resemble a pumpkin seed in outline. As a result, some collectors called them "pumpkin seed" fluted points (DeRegnaucourt 1991:9). Holcombe points range from 3.5 to 7.0 cm (1.4 to 2.7 inches) and are thin (about 3.5 to 6 mm or 0.1 to 0.2 inches) fluted points with a shallow basal concavity measuring 5 mm or less than 0.2 inches. Blade width was 16 to 28 mm (0.6 to 1.1 inches) in a sample of points from the Holcombe Beach in southeastern Michigan (Justice 1987:242). The bases are typically narrower, ranging from 13 to 27 mm (0.5 to 1 inch), caused by a sharp contraction toward the base that distinguishes them from other types in the cluster. They also have sharp, usually thin, basal ears that often have been delicately chipped, a well-ground basal concavity and lateral edges, and a biconvex cross section or, more usually, a cross section that is convex on one face and almost flat on the other. About half of all specimens are fluted. Most of these have a flute on only one face, which was made by detaching multiple channel flakes. Flute length is usually about equal to the width of the base 13 to 27 mm (0.5 to 1 inch). Fluting seems to have been omitted where the base was already sufficiently thin to allow hafting. Primary flaking seems fairly random, while secondary flaking can be neatly patterned.

Distribution: Most Holcombe points have been found in Michigan and southern Ontario. Smaller numbers of Holcombe or Holcombe-like points have been reported from northern Indiana, Ohio, Wisconsin, and New Jersey. At least 15 Holcombe-like points have been found in Minnesota (2 in Cook County, 5 in Koochiching County, 1 in Roseau County, 1 in Houston County, 2 in Pine County, and 4 in Freeborn County; Florin 1996:Figure 62; Higginbottom 1996:Figures 35 and 38). However, extensively reworked Clovis and Gainey points, especially points fashioned out of broken point tips, can superficially resemble Holcombe points.

Age and Associations: Because of their technological features and a radiocarbon date of 9000 B.C.E. obtained from a hearth at the Holcombe Beach Site, these points are thought to date to the Late Paleoindian period. In addition, since some have been found on the lakebed of Glacial Lake Algonquin, which drained around 8500 B.C.E., at least some Holcombe points are thought to be more recent than this date. For this reason, they are also thought to be more recent than Clovis, Barnes, Gainey, and other fluted point types in the region that have not been found on the lakebed.

Comments: The single Holcombe point reported from a Minnesota site was recovered by Forest Service archaeologists from the Superior National Forest during archaeological testing of the Bearskin Point Site (21CK18), which is located on the north shore of East Bearskin Lake in Cook County. It was first reported in a Forest Service annual report by Gordon Peters (1990) but has since been briefly discussed by Florin (1996) and by Dobbs and Anfinson (1993).

Similar and Identical Types: The Holcombe fluted points are generally similar to Crowfield points, which have more extensive fluting (Deller and Ellis 1988).

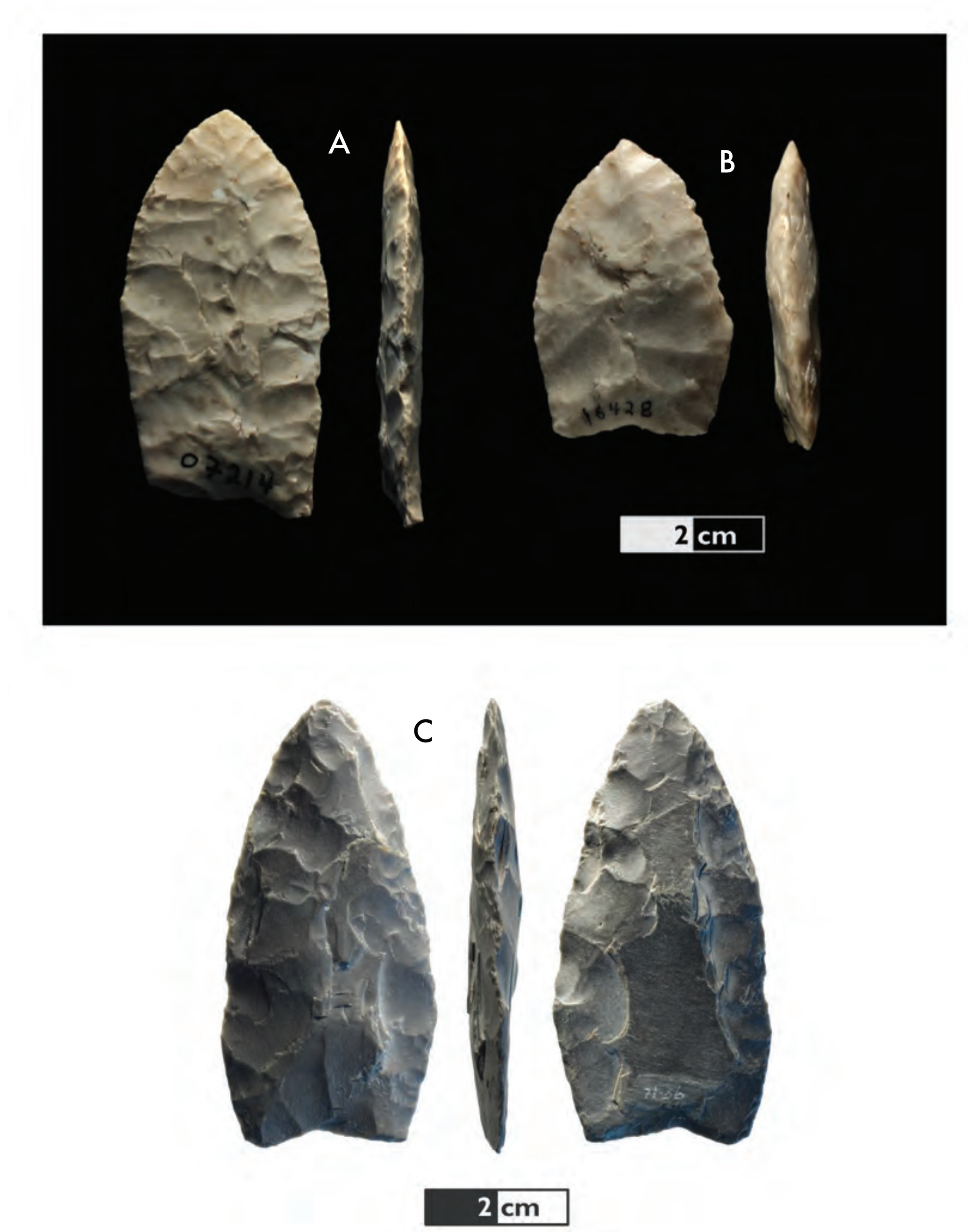


Figure 5.13. Holcombe points. ([A] MBISP Artifact: 07214; unidentified chert; Freeborn Co., MN; [B] MBISP Artifact: 16428; heat-treated Prairie du Chien Chert; Freeborn Co., MN; [C] DAC Artifact: 4.24.95; Knife Lake Siltstone; 21SL314, St. Louis Co., MN.)

Agate Basin

These are lanceolate points first reported by Frank H. H. Roberts Jr. from a site in the Agate Basin of Wyoming (Wormington 1957; Perino 1968).

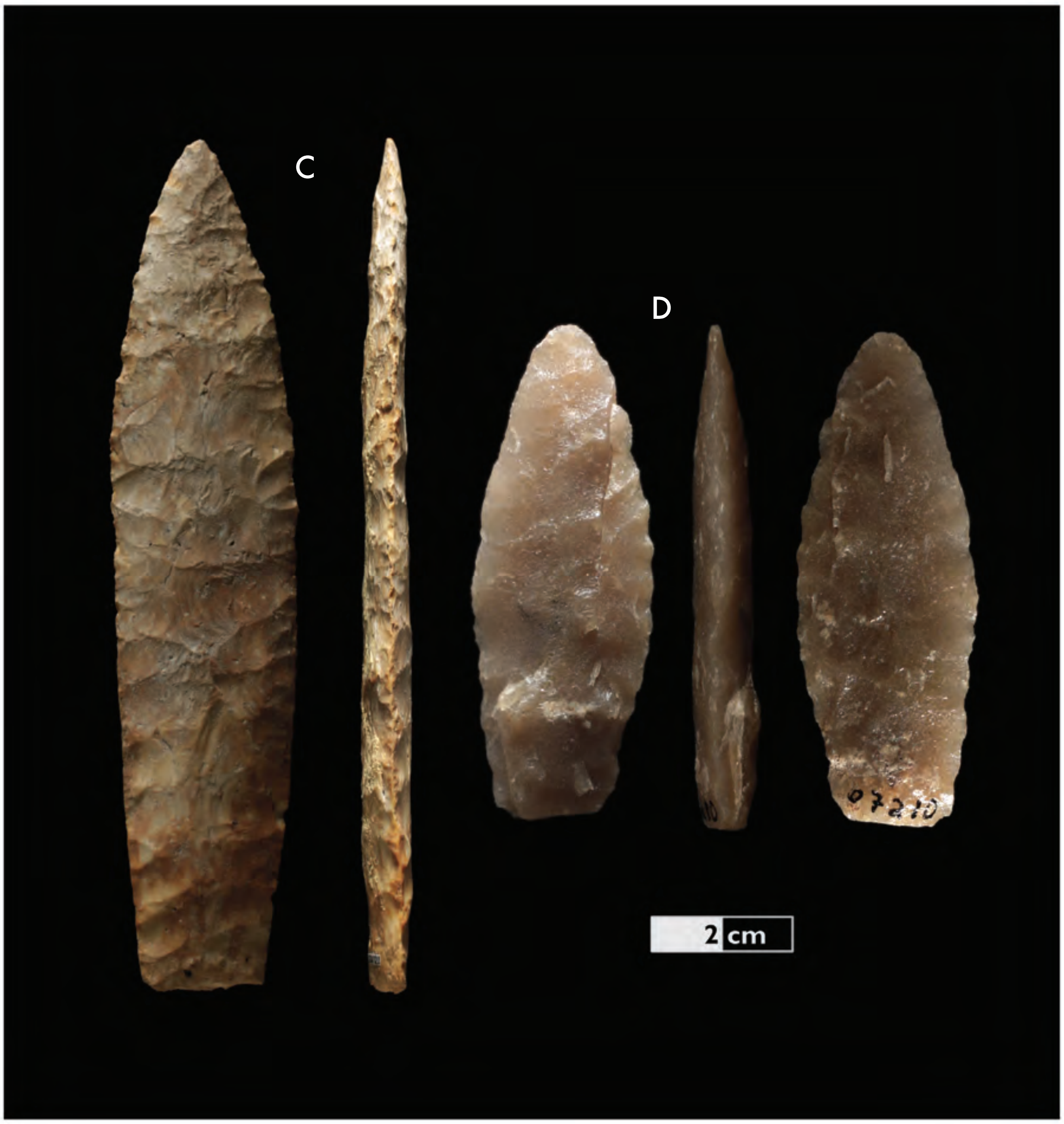
Description: Agate Basin points are narrow lanceolate points with collateral to horizontal pressure with flake scars meeting at or near the midline. Though well made, Agate Basin points tend to be somewhat thick with width-thickness ratios averaging between 2:1 and 3:1. In general, the blade is widest at the middle or about two-thirds up from the base. Heavily resharpened points can appear somewhat stubby. The elongated haft tapers very gently from the point of maximum width to a slightly narrower base. Heavy haft grinding is present on the along the lateral sides from the base to near the point of maximum width, which can be a distance of over 5 cm (2 inches). On classic specimens from the Wyoming type site, the very basal edge is usually not ground. The base is commonly straight or convex and is virtually never concave, an important characteristic to consider when identifying lanceolate Paleoindian points. The length range in Goldstein and Osborn's (1988:20) description is 7.0 to 14.7 cm (2.7 to 5.7 inches), the width range 1.8 to 3.9 cm (0.7 to 1.5 inches), and the thickness range 0.5 to 0.9 cm (0.2 to 0.4 inches). Agate Basin points are usually made of high-quality, often exotic material such as Burlington Chert, Hixton Silicified Sandstone, and Knife River Flint. They typically do not exhibit heat treatment.

Distribution: Agate Basin is a common point type in the Great Plains and Upper Midwest and is widely distributed throughout the midcontinent. Similar points have been found within the Ohio River Valley in Ohio and Indiana, which is considered near the extreme eastern range of the type (DeRegnaucourt 1991:17). Agate Basin is the most common Late Paleoindian point type found in Minnesota (Johnson 1994:3.23; Michlovic and Johnson 1995:20; Magner 1994; Florin 1996:Figure 50). The majority of points of this type in Minnesota have been found in the Twin Cities area. This pattern most likely reflects the distribution of collectors who report their discoveries, for similar points have been found in intensively surveyed and well-reported out-state areas, such as the Reservoir Lakes area northwest of Duluth (Harrison et al. 1995). A large number of Agate Basin points, most made of Hixton Silicified Sandstone, are present in several surface collections from Site 21RW13 in Redwood County, Minnesota.

Age and Associations: Agate Basin is a Late Paleoindian point type thought to date within 8550 to 8050 B.C.E., although some radiocarbon dates are as recent as circa 7500 B.C.E. (Frison 1998a). Since most eastern points of this type are surface finds, the age of the type in the western Great Lakes remains unclear. In the Great Plains, Agate Basin points are often associated with bison kills. In northern Wisconsin, Agate Basin points are generally considered part of the Flambeau Phase (Salzer 1974).

Similar or Identical Types: As discussed in the introduction to this chapter, Agate Basin is a highly abused type designation. O'Brien and Wood (1998:119) discuss the typological confusion between Searcy/Rice Lanceolate points, in Missouri, many of which have been called Agate Basin. Browns Valley points may have a vaguely similar outline shape but are generally wider and thinner and often exhibit parallel-oblique pressure flaking, a trait not seen on Agate Basin points. Poorly made lanceolate points with a general Agate Basin outline are most likely not true Agate Basin points. Even when made of a substandard piece of material, for example, the flawed Hixton Silicified Sandstone (D) in the accompanying illustrations, Agate Basin points maintain a standard of evenness and workmanship. Taylor (2006:195) considers Milnesand points to be essentially equivalent to Agate Basin.

Figure 5.14. Agate Basin points. ([A] MHS Artifact: 170.52.1.1; Knife River Flint; 21DL54, Douglas Co., MN; [B] MHS Artifact: 28.26; Biwabik Silica; Mille Lacs Co., MN; [C, following page] MHS Artifact: 2007.52.2; unheated Burlington Chert, patinated; Fillmore Co., MN; [D, following page] MBISP Artifact: 07210; Hixton Silicified Sandstone; Freeborn Co., MN.)


C
D
2 cm

MILNESAND

Milnesand points are medium-sized lanceolate points named after specimens found at the Milnesand locality in New Mexico (Sellards 1955).

Description: Milnesand points are similar in appearance to Midland points, except they are longer and thicker than Midland points (Wormington 1957; Bell 1958). They range in length from about 3.8 to 8.9 cm (1.5 to 3.5 inches), although most are about 6.4 cm (2.5 inches) long. Their width-thickness ratio is about 3:1 (Waldorf and Waldorf 1987:37). Milnesand points tend to have parallel sides, a straight to slightly convex base, and a lenticular cross section with a slight median ridge. Fine pressure flaking has produced a generally horizontal to transverse-parallel flake scar pattern. The base has usually been thinned and tapered by the removal of several small flakes. This gives the point base a characteristic chisel-like edge. Grinding is often present along the basal edge and halfway up the edges of the blade.

Distribution: The core area of Milnesand point distribution is the southern Great Plains and the High Plains. They occur in small numbers further east, including Minnesota, where a Milnesand-like point was recovered from excavations at the Cedar Creek Site (21AK58) in Aitkin County (Allen 1993:Figure 14f).

Age and Associations: Although there are no associated radiocarbon dates for Milnesand, this point type is thought to date to between 7000 and 5000 B.C.E. On the Great Plains, the type is associated with the bison big-game-hunting tradition.

Similar and Identical Types: Milnesand is similar in appearance to other Late Paleoindian Lanceolate points. Taylor (2006:195) considers Milnesand points to be essentially equivalent to Agate Basin.

Figure 5.15. Milnesand point. (UMn Artifact: 615 89; Knife Lake Siltstone; 21PN11, Pine Co., MN.)

HELL GAP

Hell Gap is a rather large, lanceolate point named after Hell Gap Valley in east-central Wyoming (Agogino 1961; Perino 1971).

Description: Hell Gap points are rather medium to large lanceolate points with characteristic weak shoulders and a long, tapered haft element. The flaking is well done but not nearly so meticulous as that commonly seen on Paleoindian projectile points. The points are widest just above the shoulders, which are located one-fourth to one-half the point length from the base, but this ratio varies with point repair and resharpening. Most have heavily ground stems but the very basal edges are commonly not ground. Bases can be straight or slightly convex. Morrow's (1984:31) Iowa samples range in length from 5.1 to 12.7 cm (2 to 5 inches). Bradford (1989:33) reports a size range of 6.0 to 8.9 cm (2.5 to 3.5 inches). In Minnesota, many points of this type have been so extensively resharpened that they are smaller than their classic Plains counterparts. In some cases, their stems tend to be longer than their blades (Bonney 1965:18; Anfinson 1997:Figure 14, lower left). Made from a variety of materials, Hell Gap points are one of the earliest Paleoindian types to exhibit frequent heat treatment.

Distribution: Generally considered a common High Plains point type, Hell Gap points occur in collections throughout Minnesota. They appear to be slightly more common in the northern part of the state. Hell Gap or Hell Gap-like points have been found in Anoka, Benton, Chisago, Freeborn, Koochiching, Lake of the Woods, Lincoln, Marshall, Roseau, Stearns, St. Louis, Waseca, and Wright Counties (Johnson and Higginbottom 1994:4.83; Magner 1994; Florin 1996:Figure 53; Anfinson 1997:Figure 10). This is perhaps the best-represented Paleoindian point type in the state. Hell Gap points are distributed across most of Iowa and into Wisconsin.

Age and Associations: George Frison (1998b:356–357) a time range of 8050 to 7550 B.C.E. for Hell Gap points on the High Plains. According to Agogino (1985), Hell Gap postdates Agate Basin and represents a transitional form between Paleoindian lanceolate blade and stemmed hafting technologies.

Similar or Identical Types: Hell Gap points with very weak shoulders closely resemble Agate Basin points and the two can seem to grade into each other. Heavily reworked Early Woodland stemmed points can sometimes resemble Hell Gap points so some caution should be exercised in applying the Hell Gap designation.

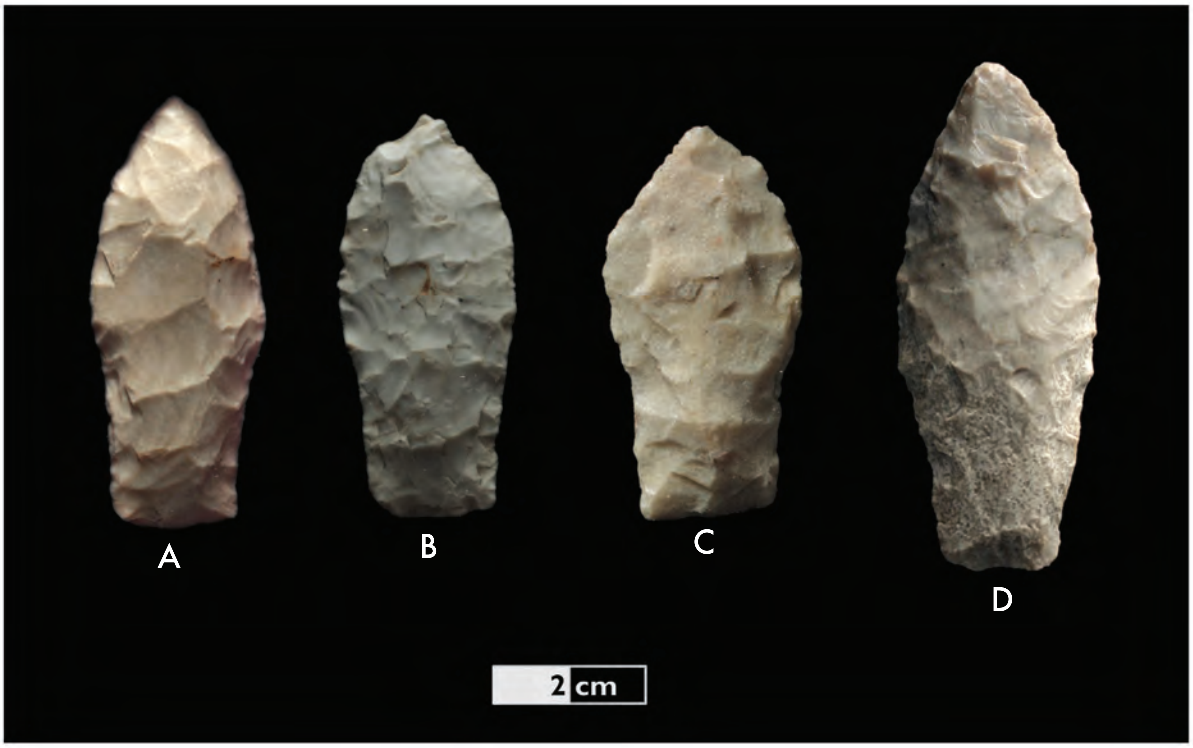


Figure 5.16. Hell Gap points. ([A] Glynn Collection: heat-treated Maynes Creek Cream Chert; Rice Co., MN; [B] Glynn Collection: unheated Burlington Chert; Rice Co., MN; [C] Glynn Collection: heat-treated Prairie Du Chien Chert; Rice Co., MN; [D] MBISP Artifact: 12613; unidentified chert; Pickeral Lake, Freeborn Co. MN.)

DALTON

Carl Chapman (1948) named Dalton points for Judge S. P. Dalton of Missouri, who discovered points of this type in Cole County, Missouri (Bell 1958).

Description: Dalton is a distinctive early point with a lanceolate to triangular blade and a concave base. The haft element ranges from parallel sided to incurvate, often with flaring basal ears. Some Dalton points exhibit a distinct shoulder, but this feature is commonly removed by resharpening. Bases are usually moderately to markedly concave. The bases on most examples have multiple long pressure thinning flakes. A minority of them exhibits true fluting on one or both faces, a trait retained from the earlier fluted points from which they developed. The sides and base edges are usually moderately to heavily ground. These points generally exhibit careful workmanship with most having a combination of even percussion and selective pressure trimming to smooth blade surfaces. Resharpening was most commonly done by alternate beveling, giving the blades a rhomboidal cross section. This beveling is visible on either the left or right side when the tip is oriented upward. Left- and right-beveled examples of Dalton points occur in nearly equal frequencies, unlike later alternately beveled Early Archaic forms like St. Charles and Hardin points and Thebes and Bass knives, which are almost always beveled on the left. Blade edges are also commonly serrated. Blade morphology changes considerably through point resharpening from initially convex-sided lanceolate to steeple-shaped triangle to blades with an incurvate, drill-like appearance. Dalton points vary from about 5 to 18 cm (2 to 7 inches) in length with most being in the smaller end of that size range. Many Dalton points found in Minnesota and Wisconsin are made of Burlington Chert, but in general, exotic raw materials are rare. In their core area of distribution to the south Dalton points are routinely made of mostly locally available materials. Heat treatment was frequently applied, but only to those raw material varieties that benefit the most from it, such as Galena Chert and the Maynes Creek Chert varieties.

Distribution: Dalton points are widespread throughout the Eastern Woodlands, with a particular concentration in the Central Mississippi River Valley. While present northward in Minnesota and Wisconsin, they are most frequent in Arkansas, Missouri, western Illinois, and eastern Iowa. Nonetheless, Dalton points are fairly common and widespread in Minnesota. From one to six points have been found in Aitkin, Anoka, Brown, Clearwater, Freeborn, Fillmore, Goodhue, Hennepin, Houston, Itasca, Koochiching, Lac qui Parle, Meeker, Morrison, Ramsey, Rice, Roseau, and Wabasha Counties (Florin 1996:Figure 60).

Age and Associations: Dalton is considered a transitional Late Paleoindian–Early Archaic point type that dates between about 8750 and 8250 B.C.E., and possibly more recently (Morse 1998:195). Radiocarbon dates of Dalton components have been attained at Rodgers Rock Shelter, Arnold Research Cave, and Graham Cave in Missouri, among other sites. Goodyear (1974) suggested a temporal span of 8500 to 7900 B.C.E. This timeframe should probably be extended to approximately 7500 B.C.E., when notched and stemmed Early Archaic forms become common in the Upper Mississippi River Valley.

Comments: Dalton points exhibit extensive degrees of blade edge resharpening, a result of their being used as hafted knives and saws. They also frequently show impact fractures demonstrating their use as projectile tips. Daltons are among the earliest hafted bifaces to be intended for the dual purpose of being a knife and a projectile point, a pattern that continues into the subsequent points of the Early Archaic period.

Similar and Identical Types: Dalton points are similar to Meserve points on the Great Plains and Hi-Lo points in the northern Great Lakes. Unresharpened Dalton points can resemble Plainview, Quad, Golondrina, and even Scottsbluff points. Some varieties of Dalton have been proposed that may, alternatively, represent stages of reworking and resharpening (Goodyear 1974). Holland points for example, are first-stage Dalton points that retain a slight shoulder above the haft area (Holland 1971; Perino 1971).

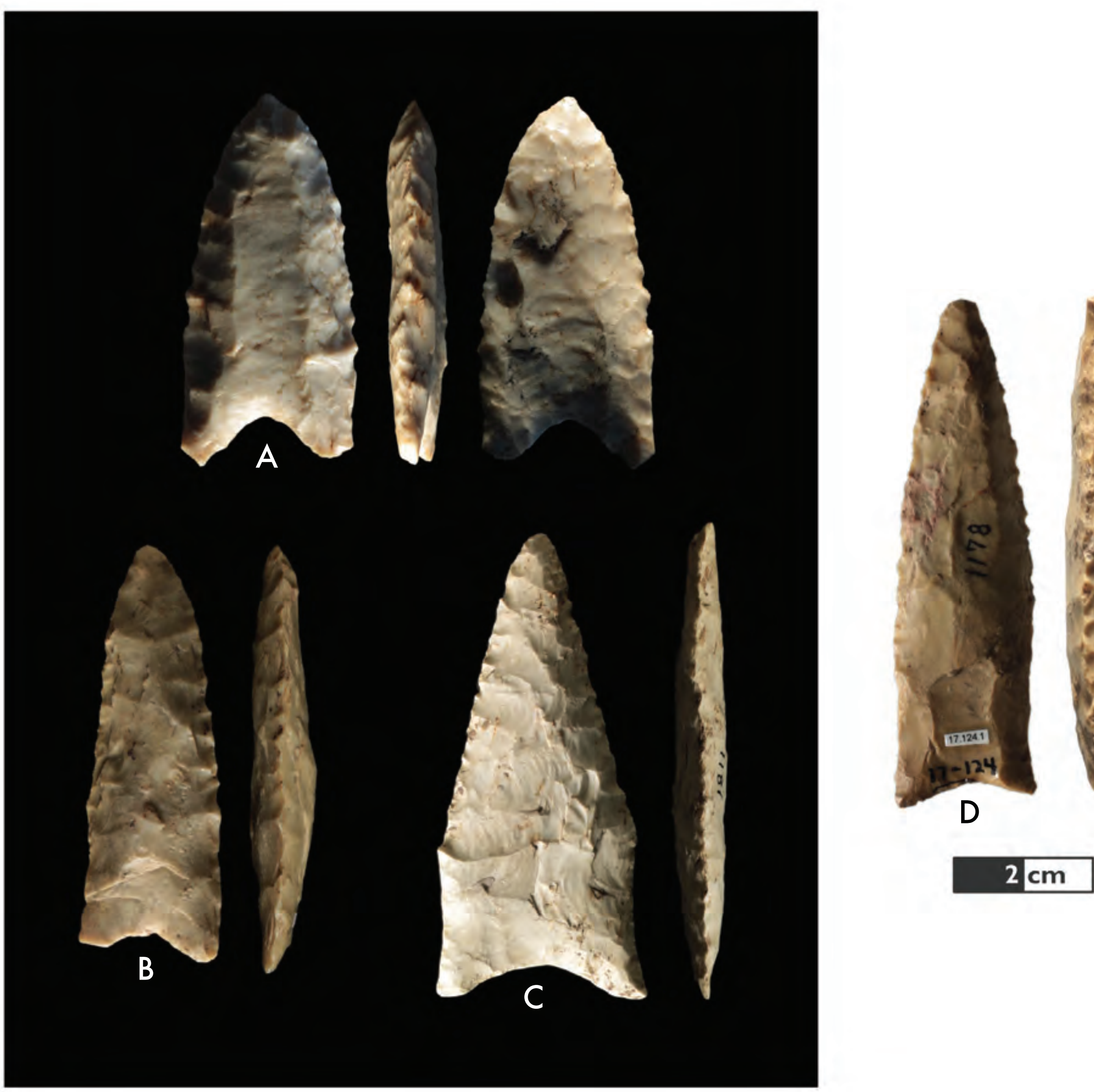


Figure 5.17. Dalton points. ([A] DAC Artifact: unheated Burlington Chert; Fish Lake Reservoir, St. Louis Co., MN; [B] MHS Artifact: 20.12.1; unheated Prairie du Chien Chert; Houston Co., MN; [C] MHS Artifact: 45.22; unheated Burlington Chert; Wabasha Co., MN; [D] MHS Artifact: 17.124.1; unidentified chert; Goodhue Co., MN.)

Hi-Lo

Hi-Lo is a Late Paleoindian to Early Archaic point type named after the Hi-Lo Gun Club Site in Ionia County, Michigan (Fitting 1963).

Description: Hi-Lo points are lanceolate in outline and usually heavily ground around the edges of the base and stem (Justice 1987:44–46; DeRegnaucourt 1991:12–16). The concave base is usually thinned or even fluted, and many bases flare out into ears that give the point a fishtail appearance. Most bases have weak stems or even weakly developed side notches, which gives these points a slightly shouldered appearance. Cross sections tend to be somewhat flat on one side and convex on the other. Length ranges from about 34 to 65 mm (1.3 to 2.5 inches), width from 19 to 35 mm (0.7 to 1.4 inches), and thickness from 6 to 8 mm (0.2 to 0.3 inches). Unlike many early points, Hi-Lo points are often made of locally available, and sometimes less desirable raw material.

Hi-Lo points were most likely multipurpose implements that were used as knives and butchering tools, as well as spearheads, as indicated by edge beveling and heavy resharpening. Long-term maintenance often dramatically changed the appearance of the point, leaving it short, asymmetrical, and stubby at the time of discard. The slight stem and shoulders of newly made points were soon reduced or even occasionally removed through resharpening.

Distribution: Hi-Lo points are found throughout the Great Lakes region and adjacent areas, although Hi-Lo or Hi-Lo-like points are rare in Minnesota. Single specimens are known from Houston, Koochiching, Olmsted, and Roseau counties (Magner 1994:34; Florin 1996:Figure 62).

Age and Associations: Although not securely dated, this point type is thought to date to the Late Paleoindian/Early Archaic period in the Great Lakes area. Several lines of evidence support this temporal placement. First, Hi-Lo points are generally considered related to Dalton points, which are more firmly dated. Second, the presence of heavy basal and lateral grinding and occasional fluting suggests an early Archaic date (Ellis and Deller 1982; Deller and Ellis 1989). And third, an apparent correlation of these points in some areas with glacial beach ridges suggests great age. Some archaeologists regard Hi-Lo points as a transitional form between Late Paleoindian and Early Archaic point types.

Similar and Identical Types: Hi-Lo points resemble Dalton points and are probably a northern equivalent (DeRegnaucourt 1991:29).

Figure 5.18. Hi-Lo points. ([A] MHS Artifact: 20.11.3; unidentified chert; Houston Co., MN; [B] MHS Artifact: 37.17.1; unidentified chert; Ramsey Co., MN.)

ALBERTA

Alberta is a Late Paleoindian projectile point type named by H. Marie Wormington (1957) after the Canadian Province of Alberta, where this type is particularly common.

Description: Alberta points have a lanceolate blade, distinct shoulders and an elongated stem. The stems are generally slightly longer than they are wide, a characteristic that is useful in distinguishing them from most Scottsbluff points. The stem is typically about one-fifth to one-half the total length of the point. The stems are generally parallel sided, but in some examples they may flare or taper slightly. The basal edge is straight to slightly convex or slightly concave. The entire stem including the sides and base are ground smooth. The flaking on Alberta points commonly consists of even percussion work smoothed over with selective long pressure flakes. These are often fairly heavy points with an even, but relatively thick cross section. Point length ranges from about 5 to 13 cm (2 to 5 inches) with an average maximum width of about 2.5 to 3.2 cm (1 to 1.2 inches). Alberta points seem to be made out of a wide range of materials including some high-quality exotic stone like Knife River Flint. Heat treatment appears to be rare or absent entirely.

Distribution: Alberta points are common throughout the Canadian prairies, especially in parts of southern Alberta and Saskatchewan, and they are found into the High Plains region of the United States. A well-known Alberta site is Hudson-Meng, a bison kill located in western Nebraska (Agenbroad 1978). Alberta and Alberta-like points occur in small numbers across central and northern Minnesota. They have been found in Anoka (1), Benton (1), Blue Earth (1), Freeborn (3), Houston (1), Kittson (1), Koochiching (1), Le Sueur (1), Meeker (3), Mille Lacs (1), Morrison (2), Pine (1), Roseau (2), Stearns (1), St. Louis (2), Sherburne (1), and Washington (1) Counties, where the number in parentheses represents the number of Alberta points known from that county (Johnson 1994:3.23; Johnson and Higginbottom 1994:4.81; Magner 1994; Florin 1996:Figure 54; Romano 1997). Alberta points are also found into Wisconsin but are rare in Iowa.

Age and Associations: Alberta is a Late Paleoindian point type that dates between 7850 and 6650 B.C.E. in the Northern Plains (Gibbon 1998a). It may be related to the Scottsbluff type for the reasons mentioned above and because the two types are commonly found on the same sites. The Alberta point found in situ at the Bradbury Brook Site, a siltstone lithic workshop in Mille Lacs County, Minnesota, has been radiocarbon dated to circa 7200 B.C.E. (Malik and Bakken 1999). Another Alberta point was found in an undisturbed deposit at the East Terrace Site in Benton County, Minnesota (Johnson and Higginbottom 1994).

Similar and Identical Types: Alberta points are similar to Scottsbluff points but tend to have less refined pressure flaking have proportionately longer stems and are commonly heftier and thicker. Interestingly, Alberta points exhibit a design that is intermediate between Hell Gap and Scottsbluff points.

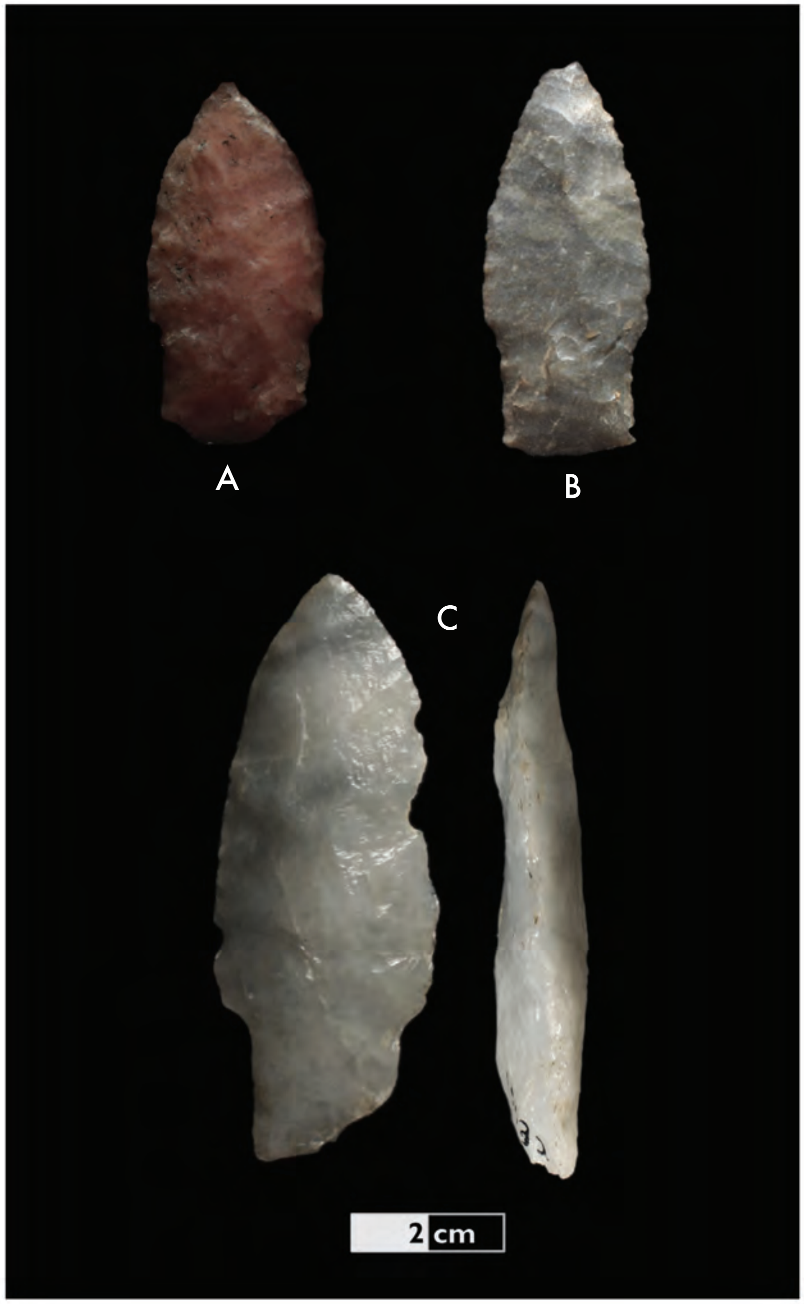


Figure 5.19. Alberta points. ([A] Glynn Collection: heat-treated Swan River Chert; Rice Co., MN; [B] Glynn Collection: unidentified chert; Rice Co., MN; [C] MBISP Artifact: 14632; quartz; Freeborn Co., MN.)

SCOTTSBLUFF

Scottsbluff points are named for the Scottsbluff bison quarry near Scottsbluff, Nebraska (Barbour and Schultz 1932).

Description: Scottsbluff is a well-made, medium to large, stemmed lanceolate point. They are generally thinner than most Alberta points and exhibit horizontal medial to transverse pressure flaking. Stems are straight to slightly expanding, and the stem is usually about the same length as its width. The base edge is typically straight or very slightly convex. Base and stem side edges are ground. Shoulders may be pronounced and rarely barbed but on most specimens, the shoulders are at right angles and subtle. Scottsbluff points range from 5 to 15 cm (2 to 6 inches) in length; the majority of Scottsbluff points are between 7.6 and 10.2 cm (3 and 4 inches) in length. Goldstein and Osborn's (1988:18) point sample ranges from 2.2 to 3.9 cm (0.8 to 1.5 inches) in width and from 0.6 to 1.3 cm (0.2 to 0.5 inches) in thickness. On the Plains, Scottsbluff points have been divided into two subtypes, with Type II having a more triangular blade, more prominent shoulders, and a shorter, wider stem than Type I. The narrower Type I points have a thicker, biconvex cross section and look much more like the exquisitely flaked, bayonet-like Eden points with diamond-shaped cross sections. Many Minnesota Scottsbluff points more closely resemble the Type II variety that Taylor (2006:217) refers to as Johnston points. True Eden points probably do not occur in Minnesota. A distinctive Cody Eared variety of Scottslbuff point is common in Minnesota and adjacent Wisconsin with a few being found in northern Iowa. These points have a straight or slightly tapering stem with knobs or projecting ears on the basal corners. Some Cody Eared points have concave bases as well. In Minnesota, eared and uneared Scottsbluff points were commonly made of Hixton Silicified Sandstone, Prairie du Chien Chert, and Jasper Taconite. Examples of the uneared, typical Plains variety are also occasionally made of Knife River Flint. Heat treatment is very uncommon.

Distribution: Scottsbluff points are widely distributed throughout the Great Plains and bordering areas. Gregg and Davidson (1985:93) mention the following states and provinces in their discussion of the distribution of this point type: Saskatchewan, Alberta, British Columbia, Washington, Wyoming, Montana, the Dakotas, Colorado, New Mexico, Nebraska, Texas, Oklahoma, Arkansas, Louisiana, Manitoba, Minnesota, and Wisconsin. In Minnesota, Scottsbluff-like points are common throughout the state (Caine 1974:Figure 2.3; Johnson and Higginbottom 1994:4.84; Magner 1994; Harrison et al. 1995; Florin 1996:Figure 57). The distinctive Cody knives are also occasionally found in Minnesota and Wisconsin.

Age and Associations: Scottsbluff points are considered part of the Cody complex, which was originally defined by Jepson (1953) to include Scottsbluff and Eden points in association with Cody knives. This complex dates to between 7500 and 6600 B.C.E. (Taylor 2006) in the High Plains. Alberta points are also now considered by many to be part of the Cody complex. Salzer (1974) places the Cody complex in northern Wisconsin into the Minocqua Phase. There are three Scottsbluff cremation sites known in the western Great Lakes. These are the Pope Site (Ritzenthaler 1971) and the Renier Site (Mason and Irwin 1960), both in western Wisconsin, and the Gorto Site in northern Michigan (Buckmaster and Paquette 1988).

Similar or Identical Types: Similar appearing but more roughly made stemmed lanceolate points are widely distributed throughout parts of the Eastern Woodlands. In contrast to the fine horizontal flaking of the classic western points, these cruder eastern points display a combination of percussion and pressure flaking (Waldorf and Waldorf 1987:56). The age of these eastern stemmed lanceolate points and their relationship to the Cody complex is not well known.

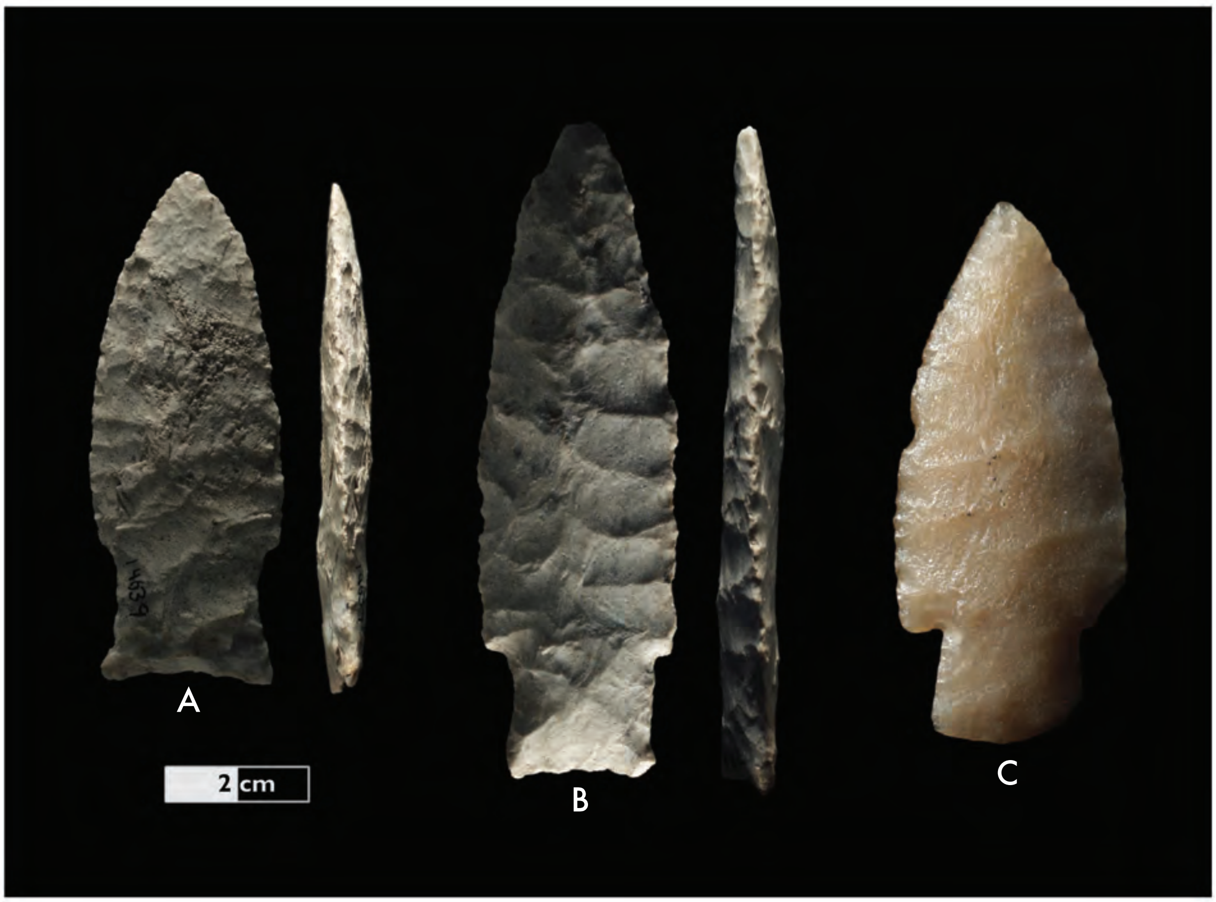


Figure 5.20. Scottsbluff points. ([A] MBISP Artifact: 14639; unheated Prairie du Chien Chert; Freeborn Co., MN; [B] MBISP Artifact: 5735; unheated Prairie du Chien Chert; Freeborn Co, MN; [C] Glynn Collection: Hixton Silicified Sandstone; Rice Co., MN.)

ST. CHARLES

St. Charles points are named for St. Charles County, Missouri (Scully 1951; Edler 1990). Collectors call them "dovetail" points because of their shape.

Description: St. Charles is a medium to large, well-made, corner-notched point with a leaf-shaped blade and a rounded, fan-shaped base (Chapman 1975:148). The flaking pattern consists of even percussion work with selective pressure trimming to smooth blade surfaces, giving them a smooth lenticular cross section when freshly made. This flaking pattern is useful in distinguishing them from the sometimes similar but flatter and more randomly flaked Thebes knives. Many specimens were used as knives in addition to being projectile points and these were resharpened by left alternate beveling, giving them a more rhomboidal cross section. The blade edges are also occasionally serrated. Corner notches tend to be well made, deep, and narrow. Some St. Charles points have more open V-shaped notches, and these tend to grade into convex-based Hardin points. The broad, rounded base is often heavily ground, as is the very interior edge of each notch. Goldstein and Osborn's (1988:26) Wisconsin sample ranges in length from 6.5 to 10.2 cm (2.5 to 4 inches), in width from 2.9 to 4.0 cm (1.1 to 1.6 inches), and in relative thickness from 0.7 to 0.9 cm (0.3 to 0.4 inches). St. Charles points are typically made of high-quality raw materials such as Burlington Chert and Hixton Silicified Sandstone. Heat treatment is so rare it can be considered nonexistent.

Distribution: St. Charles points are found over a large part of the Midwest, ranging from southern Wisconsin and eastern Iowa to Missouri, Kentucky, and Ohio and up to southern Michigan and extreme southern Ontario. They are relatively uncommon in Minnesota. A few are in collections from Freeborn, Lincoln, Martin, and Wabasha Counties.

Age and Associations: Many older references give St. Charles points an age range of around 8000 to 6000 B.C.E. (e.g., Luchterhand 1970; Chapman 1975; Morrow 1984). Thebes knives have been securely radiocarbon dated from a sealed site context to 7500 to 6700 B.C.E. at the Twin Ditch Site in west-central Illinois (Morrow 1996b). At Twin Ditch, multiple Thebes knives were found in association with several St. Charles points and chipped stone "Dalton" adzes.

Comments: St. Charles points were a combination projectile point and hafted knife, like many Midwestern Early Archaic styles.

Similar or Identical Types: St. Charles points are similar or identical to what are called Plevna points in the Deep South. If flaking patterns are considered, they generally cannot be confused with the associated Thebes knives (described and discussed in the Chipped Stone Tools chapter of this book). Some specimens intermediate to St. Charles and Hardin points are called "Hardoves" by collectors.

Figure 5.21. St. Charles points. ([A] Ulch collection, Calkins Nature Center*; unheated Burlington Chert (patinated); Marshall Co., IA; [B] MBISP Artifact; 10348; burned Prairie du Chien Chert; Freeborn Co., MN.)*

HARDIN

Hardin points are named for Hardin County in west-central Illinois.

Description: Hardin points are large to medium-sized stemmed points with characteristically barbed shoulders. Like many Early Archaic types, they exhibit refined workmanship consisting of even percussion flaking with selective pressure trimming. Blades are initially somewhat lanceolate with convex sides but become more triangular with repeated resharpening. Resharpening was typically done by left alternate beveling, giving well-used points a rhomboidal cross section. A well-made stemmed point that often has pronounced shoulders or barbs. Stems are typically slightly expanding, but on some Hardins the stem is nearly straight sided. Many examples of Hardin points found in the northern part of their distributional range exhibit small knobs or ears on their basal corners (Behm 1985). The basal edge may be slightly convex, straight, slightly concave or somewhat recurved. Bases are evenly tapered in side view and often exhibit pronounced basal thinning pressure flakes. The sides of the stem and the basal edge are typically moderately to heavily ground. A distinctive feature that helps distinguish Hardin points from superficially similar barbed and stemmed points is the sharp V-shaped angle commonly formed at the shoulder/stem intersection, often accompanied by a distinctive semicircular flake scar. Because of extensive resharpening, points of this type vary widely in length. Goldstein and Osborn's (1988:22) Wisconsin sample ranges from 4.7 to 13.5 cm (1.8 to 5.3 inches) in length, from 2.0 to 4.5 cm (0.8 to 1.6 inches) in width, and from 0.6 to 1.1 cm (0.2 to 0.4 inches) in thickness. Very heavily resharpened points can be even smaller and only a hint of the former barbs may be visible. Hardin points were made from a variety of Midwestern raw materials including Burlington Chert, Galena Chert, Prairie du Chien Chert, and Hixton Silicified Sandstone. Heat treatment is so rare it can be considered nonexistent.

Distribution: Hardin points are common throughout the Midwest. DeRegnaucourt (1991:74) suggests that Luchterhand's (1970) distributional study of this point type demonstrates an association with the Prairie Peninsula, which extended from the Plains into west-central Ohio. However, Hardin points have been found as well in Mississippi, Louisiana, Oklahoma, Missouri, Arkansas, Kentucky, and Tennessee. In Minnesota, they appear to be limited to the southeastern quarter of the state. A particularly important Hardin site is the Bass Site in Grant County, southwestern Wisconsin (Stoltman et al. 1984) where Hardin points were found with Bass knives and chipped stone adzes.

Age and Associations: Though Hardin points are commonly compared to Scottsbluff points, their historical and technological affinities are clearly with the preceding Thebes Cluster. Hardin points almost certainly developed directly out of the earlier St. Charles points, and there are many examples of hybrid points collectors call Hardoves. Thebes knives, associated with St. Charles points, were replaced by unnotched Bass knives as a part of the tool kit associated with Hardin points. Hardin points were found stratigraphically above Thebes and St. Charles at Twin Ditch (7500 to 6700 B.C.E.) and are absent from Horizon 11 at Koster (circa 6400 B.C.E.). A date range of around 7000 to 6500 B.C.E. seems most likely for Hardin points. Hardin points were contemporary with Scottsbluff points to the west and the later varieties of Kirk Corner-Notched and the earlier Early Archaic bifurcate point varieties to the southeast. In the Upper Midwest and Western Great Lakes region Hardin points and Cody complex points have somewhat opposite and complimentary distributions. These probably represent two neighboring but distinct populations who occasionally interacted. Cody Eared points made of Burlington Chert are commonly found in Wisconsin and Hardin points made of Hixton Silicified Sandstone are widespread in Iowa and Illinois.

Comments: Hardin points were a combination projectile point and hafted knife, like many Midwestern Early Archaic styles.

Similar or Identical Types: Scottsbluff points have a vaguely similar outline shape and many exhibit eared bases like Hardin points do. Barbed shoulders are occasionally seen on Scottsbluff points but when present they are minor compared to typical Hardin barbs. Scottsbluff points exhibit a flaking pattern of horizontal pressure flaking while Hardin points show a mix of even percussion and selective pressure work. More crudely made barbed and stemmed points of the Late Archaic period are all too often mistyped as Hardin points.

Figure 5.22. Hardin points. ([A] MHS Artifact: 38.6; unidentified chert; Rice Co., MN; [B, following page] MHS Artifact: 25.20.3; unidentified chert; Le Sueur Co., MN; [C, following page] MHS Artifact: 37.12.3; unheated Burlington Chert; Ramsey Co., MN; [D, following page] MHS Artifact: 25.21.2; unheated Blanding Chert; Le Sueur Co., MN; [E, following page] MHS Artifact: 570.A85.1; unidentified chert; Le Sueur Co., MN.)


B
C
D
E
2 cm

NEUBERGER

Neuberger points were named by Larry Conrad (1980) for specimens found in west-central Illinois.

Description: Neuberger points are fairly distinctive thin, medium-sized, corner-notched points. They exhibit a somewhat random flaking pattern of percussion and pressure work but are routinely quite thin for their breadth. Width-thickness ratios are typically between 6:1 and 10:1. They usually have a somewhat flattened lenticular cross section. These are proportionately broad points ranging from 4 to 6.5 cm (1.5 to 2.5 inches) long and 2.5 to 4 cm (1 to 1.5 inches) wide. Blades have an overall triangular outline with somewhat recurved lateral edges. They are widest at or very near the shoulders. Neuberger points have small, deep corner notches. Blade edges were resharpened in the Kirk style, which involves beveling but reversing from left to right beveling with each successive resharpening episode. This gives the points an asymmetrical edge configuration that somewhat resembles conventional alternate beveling, but the beveling is bifacial. Blade edges are commonly serrated. Bases are sometime slightly convex or straight but are most typically concave. A variety of raw materials appear to have been used to make these points including Burlington Chert, Maynes Creek Chert, and Galena Chert. So far as is known, they are never heat treated.

Distribution: Neuberger points are relatively common across Illinois, and they are found from eastern to central Iowa and extend into southern Wisconsin. No examples of this type with a sound Minnesota provenience were seen during the collections search conducted for this project, but it is highly likely that Neuberger points occur at least in southeastern Minnesota.

Age and Associations: The age of Neuberger points is largely conjectural, but they share so many characteristics with the larger Kirk Corner-Notched cluster that they are probably of a similar age. It is tentatively suggested here that Neuberger points date somewhere between 7500 and 6500 B.C.E.

Similar or Identical Types: Neuberger points share a general morphology with Kirk Corner-Notched, Pine Tree, and Charleston points from the eastern United States.

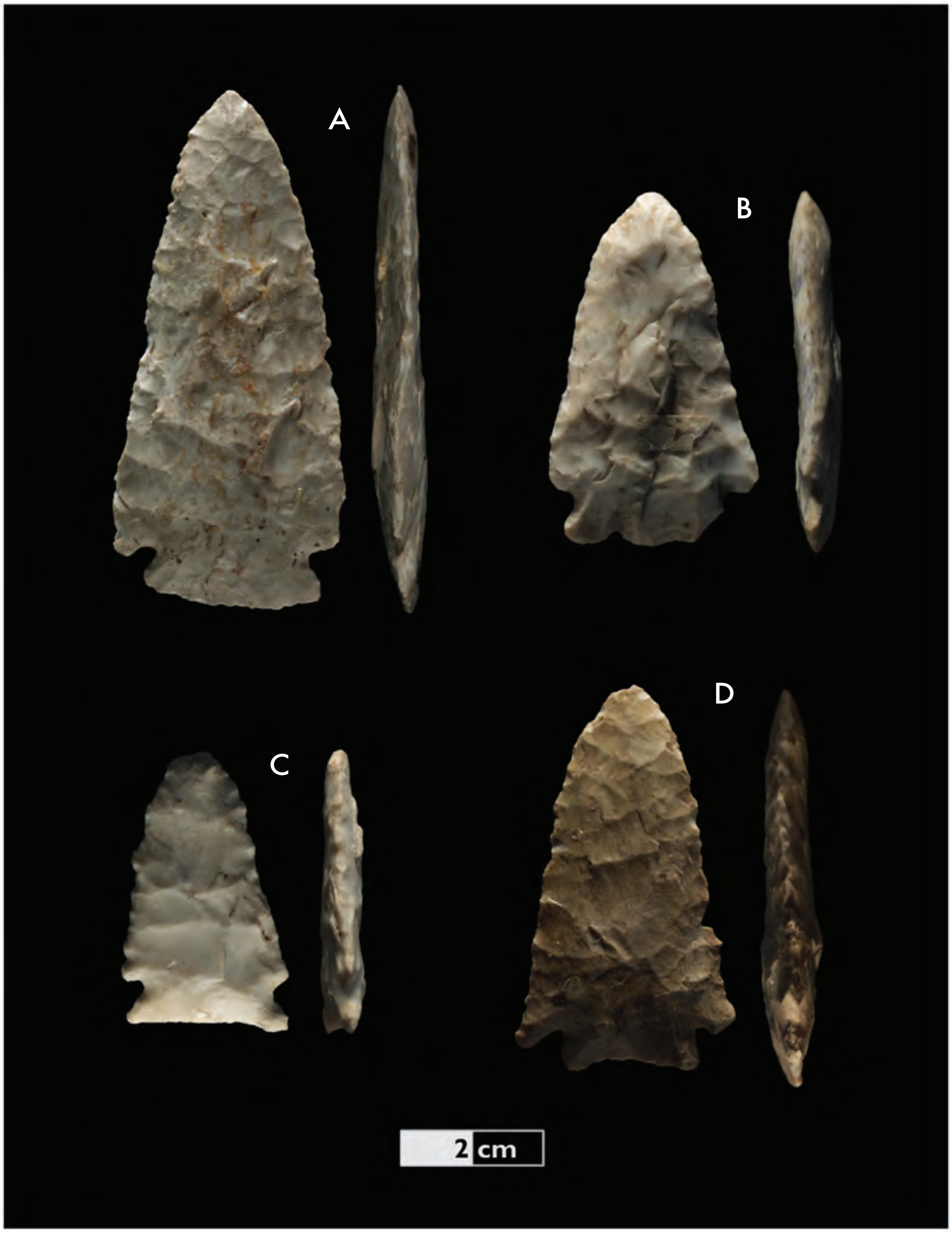


Figure 5.23. Neuberger points. ([A] MHS Artifact: 56.11; unheated Galena Chert; unknown provenience; [B] MBISP Artifact: SP89163; unheated Burlington Chert; Illinois; [C] MBISP Artifact: SP891114; unheated Burlington Chert; unknown provenience; [D] MBISP Artifact: SP89187; unheated Galena Chert; Wisconsin.)

ANGOSTURA

Angostura is a Late Paleoindian point type named by R. P. Wheeler (1957) after examples found at the Ray Long Site in the Angostura Reservoir near Hot Springs, South Dakota. The site is now under reservoir waters.

Description: These are medium to large, leaf-shaped lanceolate points with a thin, lenticular cross section. Blade edges tend to be almost parallel along the bottom half to two-thirds and to curve inward near the tip. Bases are generally concave but can be approximately straight, and they are usually thinned by the removal of vertical pressure flakes. The base edge and sides of the haft area are ground. A distinctive pattern of long, ribbon-like pressure flake scars run diagonally across the faces of classic specimens. The flaking is virtually flawless on many points but grades toward being somewhat more random on others. Morrow's (1984:17) Iowa samples range from 6.4 to 9 cm (2.5 to 3.5 inches) in length and are about 2.5 cm (1 inch) wide. Like all parallel-oblique flaked points, they are generally made of high-quality raw materials. Examples made of Maynes Creek Chert from central Iowa are usually heat treated. Specimens made of Burlington Chert and Knife River Flint are not heat treated. In northern Minnesota, Jasper Taconite appears to have been a favored raw material.

Distribution: Angostura points are found most widely throughout the Great Plains. Parallel-oblique flaked points that are analogous to Angostura points are widely distributed in the Upper Mississippi River Valley and are found throughout Iowa and into western Illinois and western Wisconsin. Angostura-like points are widespread (Freeborn, Fillmore, Itasca, Koochiching, Morrison, Otter Tail, and Roseau Counties) but fairly rare in Minnesota (Florin 1996:Figure 59).

Age and Associations: Radiocarbon dates suggest a date of 7000 B.C.E. or slightly earlier for Angostura points (Hannus 1998). Morrow also suggests an age of around 7000 B.C.E. Points of this type may extend well into the Archaic period in extreme northern Minnesota and adjacent parts of southern Canada. The parallel-oblique flaked family of Late/Terminal Paleoindian points, to which Angostura belongs, was manufactured up to circa 5550 B.C.E. (see Taylor 2006).

Comments: Originally named "Long Points" for the Ray Long Site, they were renamed to avoid confusion.

Similar and Identical Types: There are a wide number of names for Late/Terminal Paleoindian lanceolate point with parallel-oblique pressure flaking including Angostura, Frederick, Allen, Lusk, Browns Valley, Yuma, and Anderson. This may be a case where archaeologists simply have too many type names at their disposal. Angostura and Lusk points typically have a more lenticular outline shape while Frederick and Allen points are more triangular and widest near the base. There are even occasional fishtail-shaped lanceolate points with the distinctive parallel-oblique flaking pattern. Technically, the points illustrated here from Minnesota could be argued to be more like Frederick or Allen than the type site Angostura points.

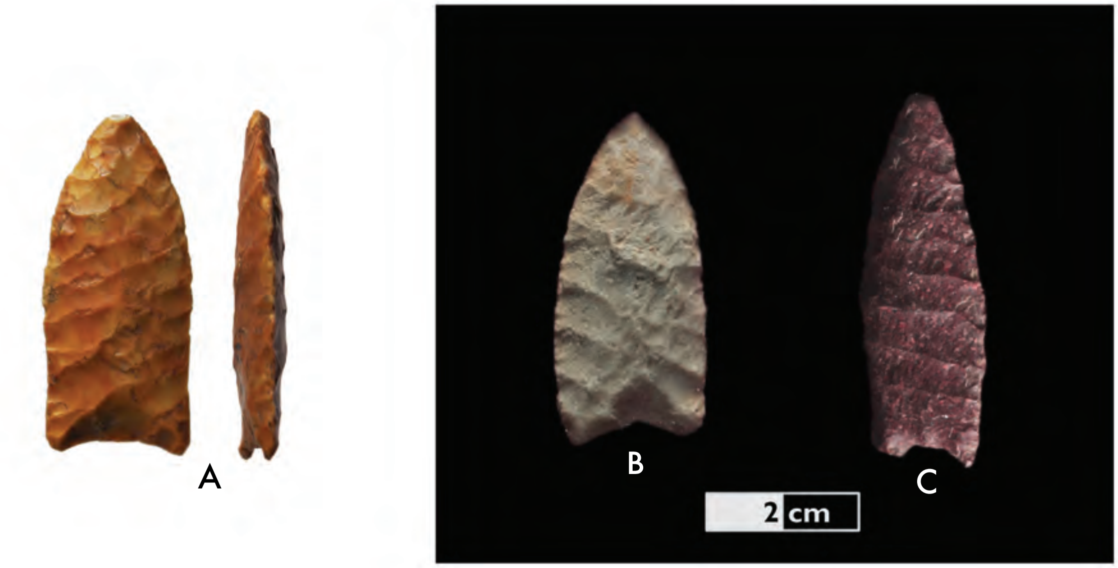


Figure 5.24. Angostura points. ([A] UMn Artifact: 39.11; unidentified chert; 21PN11, Pine Co., MN; [B] Glynn Collection; heat-treated Prairie du Chien Chert; Rice Co., MN; [C] Glynn Collection: Jasper Taconite; northern MN.)

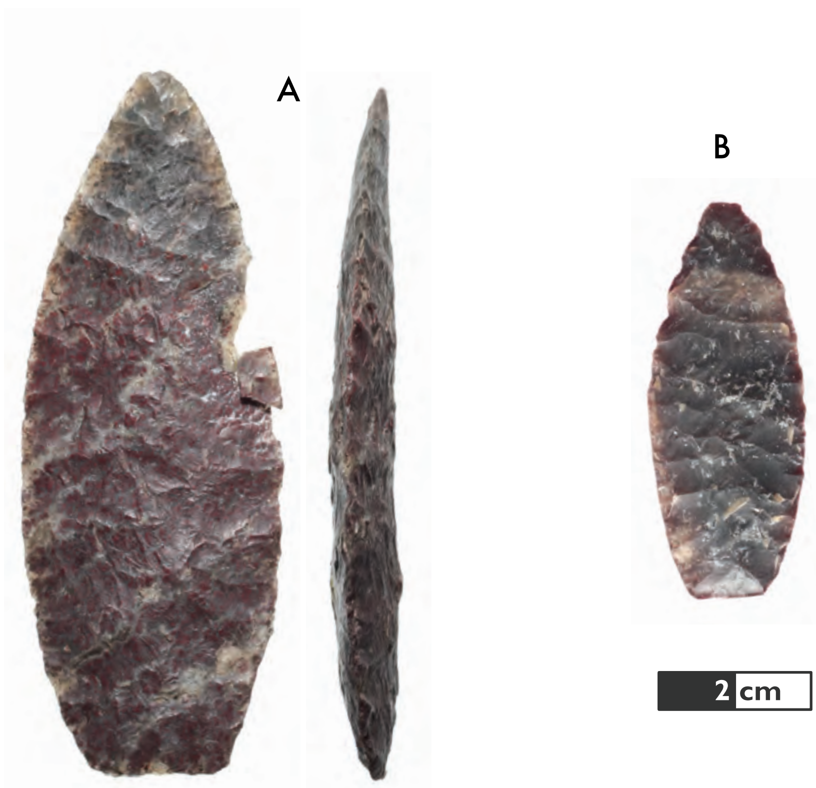


Figure 5.25. Browns Valley points. ([A] UMn Artifact: 615.50; Jasper Taconite; 21PN11, Pine Co., MN; [B] Glynn Collection: Knife River Flint; Rice Co., MN.)

BROWNS VALLEY

Browns Valley points were named by A. E. Jenks (1937) after the site (21TR5) of that name in Browns Valley, Minnesota. Browns Valley is in Traverse County just south of the juncture of the Red and Bois de Sioux Rivers.

Description: Browns Valley is a broad but thin lanceolate-shaped point with very convex edges and a straight to slightly concave base that is usually heavily ground (Wormington 1957; Anfinson 1997:Figure 8). The points tend to be widest at mid-blade. Bases are occasionally thinned by the removal of three or more vertical flakes on each face. The surfaces of the blade generally display fine horizontal or parallel-oblique flaking. The flaking on some specimens grades toward random pressure flaking, but the points are still generally well made. These medium to large points range in length from about 7.6 to 11.4 cm (3 to 4.5 inches); most are about 7 to 8 cm (2.7 to 3.1 inches) long. The three specimens from the type site are made of Knife River Flint. Similar points in Iowa called Burroughs points (Morrow 1984:21) are commonly made out of Maynes Creek Chert and Croton Tabular Chert, both of which were heat treated.

Distribution: The center of distribution of these fairly rare points is the eastern grasslands just west of the Mississippi River Valley, from Minnesota down to Mississippi. In Minnesota, the majority of Browns Valley points (6) come from the type site area in Traverse County. Caine (1974:Figure 2.2) illustrates an example from Pine County in east-central Minnesota. Other examples have been found in a surface collection from Murray County and in excavations at the Cedar Creek Site (21AK58) in Aitkin County (Allen 1993:Figure 14c). Ritzenthaler (1966) illustrates three specimens from the Kouba Site in Wisconsin.

Age and Associations: This is a Late Paleoindian point type that is thought to date between 8000 and 6000 B.C.E. (Shane 1991; Anfinson 1997:30–32). A recent radiocarbon date from associated human skeletal remains at the Browns Valley Site is about 7000 B.C.E. The six points and a human skeleton were recovered out of context in a gravel pit at the site by Jenks, who thought they might be associated with a nearby burial pit feature.

Similar and Identical Types: The two larger lanceolate points recovered from Horizon III of the Cherokee Sewer Site in northwestern Iowa have long been compared to Agate Basin points (Anderson 1980). Considering their technological appearance and relative breadth, they may actually be more like Browns Valley points. This makes more sense, considering that the circa 6400 B.C.E. radiocarbon dates from Cherokee Horizon III are far too recent for Agate Basin. Burroughs points in eastern Iowa (Morrow 1984:21) are probably a local equivalent of Browns Valley.

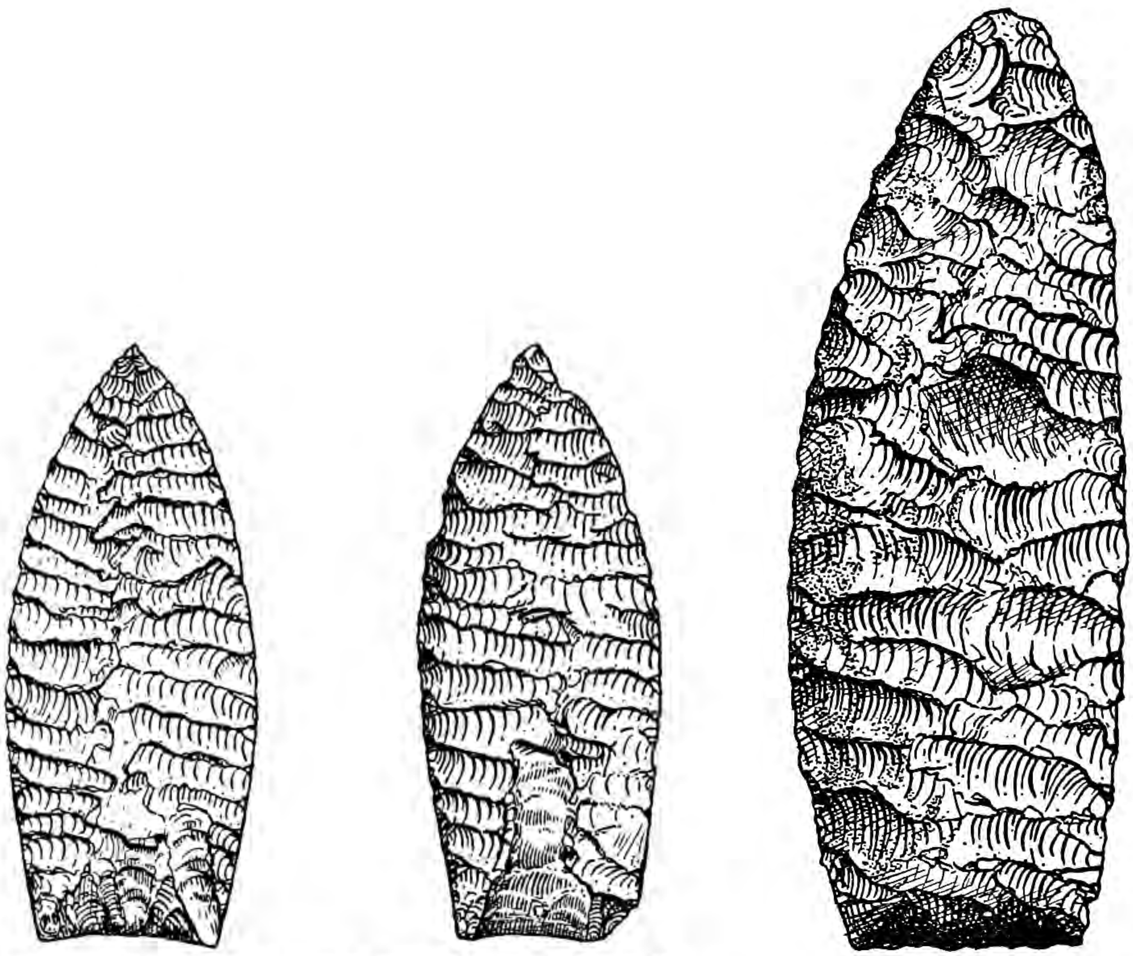


Figure 5.26. Browns Valley points from the type site, 21TR5, Traverse Co., MN. Drawings from Jenks (1937).

LECROY

LeCroy points are named after specimens found at the A. L. LeCroy Site in Hamilton County, Tennessee (Lewis and Kneberg 1955; Kneberg 1956:27–28).

Description: LeCroy points are small, thin, broad, points with a straight to slightly contracting stem and a notched or bifurcated base (Justice 1987:91–92; Waldorf and Waldorf 1987:99–103; DeRegnaucourt 1991:99–103). Flaking is random pressure over percussion. Blades on LeCroy points are generally triangular, with the blade being about twice as long as it is wide. But these can also be squat points with stubby triangular blades. Blade edges may be serrated. Basal ears may be pointed, but most are rounded. There may be light basal grinding on the stem. The bifurcating basal notch can be relatively shallow but is often half the length of the total stem. Most points are between 2.5 to 3.2 cm (1 and 1.2 inches) in length, 1.2 to 3.2 cm (0.5 to 1.2 inches) in width, and 0.4 to 0.6 cm (0.1 to 0.2 inches) in thickness. Some have been heat treated. These points are so scarce in the Upper Mississippi River Valley that it is difficult to draw any conclusion about raw material use and heat treatment.

Distribution: LeCroy points are widely distributed in the eastern United States, from northern Georgia and Tennessee to Missouri, Wisconsin, and Michigan into Massachusetts and the Northeast. A few have been found in eastern Iowa. In Minnesota, they are probably relatively rare. If present, they should be concentrated in the southeastern corner of the state and possibly along the Lake Superior shoreline.

Age and Associations: LeCroy points are a widely distributed and well-dated Early Archaic point type in the eastern and Midwestern United States. They have been securely dated to circa 6450 to 6300 B.C.E. at widely separated sites such as Koster in western Illinois (Wiant et al. 2009) and St. Albans in West Virginia (Broyles 1971).

Similar and Identical Types: LeCroy points are similar or identical to a Great Lakes types called Lake Erie points. They share a historical and developmental relationship with St. Albans, Kanawha, and Stanley points in the southeast.

Figure 5.27. LeCroy points. ([A] MHS Artifact: 1988.120.38.101; unheated Maynes Creek Cream Chert, unknown provenience; [B] MBISP Artifact: 6587; unidentified chert; Freeborn Co., MN.)

GRAHAM CAVE

Graham Cave Side-Notched is a large, side-notched Archaic point named after specimens found in Graham Cave, Montgomery County, Missouri (Logan 1952).

Description: These are long, generally narrow, side-notched points with a markedly concave base (Logan 1952:30; Justice 1987:62–66). The flaking on most specimens consists of broad to random percussion flaking, some invasive pressure trimming to smooth the surfaces of the blade, and short marginal pressure retouch along the blade edges. The side notches a moderately deep and located close to the base. Basal ears range from rounded to barbed in shape; the base is usually ground. The basal concavity is forms smooth, rounded arc. Many Graham Cave points are extensively resharpened and exhibit a somewhat recurved blade planview. Some examples have serrated blade edges. They range in length from 6.3 to 5.2 cm (2.5 to 6 inches) with a maximum width between 2 to 3 cm (0.8 and 1.2 inches). They are commonly made of Burlington Chert, but other materials were also used. Heat treatment is rare.

Distribution: This point type is largely confined to the Midwest, with a core distribution in Missouri and Illinois. Smaller numbers of similar appearing points have been found in Indiana, Wisconsin, Iowa, and Oklahoma. They are very rare in Minnesota.

Age and Associations: Graham Cave points are a late Early Archaic period type that may continue slightly into the following early Middle Archaic period. Several examples were recovered from Horizon 11 at the Koster Site in western Illinois where they are dated to circa 6450 B.C.E.

Similar and Identical Types: These points are fairly distinctive but can be mistaken for the similarly large and side-notched Osceola type. Osceola points generally have less refined workmanship and exhibit a straight to slightly concave base with the notches usually located higher up the sides than is typical of Grahama Cave. The two Graham Cave points illustrated here are cruder than typical Graham Cave points from their core area of distribution, but they do show the characteristic base style.

Figure 5.28. Graham Cave points. ([A] MHS Artifact: 13.12.2; unheated Prairie du Chien Chert; Dakota Co., MN; [B] MHS Artifact: 19.111; unheated Burlington Chert; Hennepin Co., MN.)

SIMONSEN

Simonsen is an Early Plains Archaic (equivalent in time to the Middle Archaic of the Mississippi River Valley) type named for the Simonsen Site along the Little Sioux River in northwestern Iowa (Agogino and Frankforter 1960).

Description: These are medium-sized, typically squat, side-notched dart points with a broad, often slightly concave base. These points have a distinctly triangular blade with straight to slightly convex blade edges. They are widest at the base or the shoulders. Workmanship ranges from fairly even to somewhat rough with a mix of random percussion and pressure flaking. They have a width-thickness ratio of around 3:1 or 4:1. The side notches on many points are about as wide as they are deep but may be much shallower in resharpened points. The basal corners are typically square and taper downward toward the base. Basal edges are usually somewhat concave but may be nearly straight. Bases were shaped by the removal of long pressure thinning flakes, but many exhibit short pressure retouch. Basal grinding is often present. Simonsen points range from 2 to 5 cm (0.8 to 2 inches) in length and are 1.9 to 3.2 cm (0.75 to 1.25 inches) wide (see Ahler 1995:Table 4.14). A wide variety of materials were used to make these points, and heat treatment is common among those made of locally available cherts.

Distribution: This widespread point type is found throughout the Northern Plains. Important excavated sites include the Simonsen Site (Agogino and Frankforter 1960) and Horizon II of the Cherokee Site in northwestern Iowa (Anderson 1980). Analogous points were recovered from the Itasca Bison Kill (21CE1) in Clearwater County, Minnesota (Shay 1971); the Granite Falls Bison Kill (21YM47) in southwestern Minnesota (Peterson 1996); and the Rustad Quarry Site (32RI775) in Richland County, North Dakota (Michlovic and Schmitz 1996:6–10). Similar points have also been reported from south-central South Dakota (Ahler 1995) and Wyoming (Frison et al. 1976; McCraken et al. 1978) as well as the Long Creek Site in Saskatchewan (Taylor 2006:314–315). They are contemporaneous with the Logan Creek complex in eastern Nebraska that also include side-notched end scrapers (Kivett 1959) and the Hill Site in southwestern Iowa (Frankforter 1959).

Age and Associations: Simonsen points date between 5500 and 4000 B.C.E. These are among the earliest notched points to occur on the Northern Plains. They are present in association with bison kills at the Simonsen Site, Cherokee Sewer Sites, the Itasca Site, and the Granite Falls Site.

Similar or Identical Types: Long Creek points described by Taylor (2006:314–315) are essentially identical to Simonsen points. Morrow (1984:61) called these points Little Sioux. Tama points (Morrow 1984:60) are very similar. In outline shape, Simonsen points may resemble the much later Avonlea type. Avonlea points are true arrow points and are characteristically smaller and much thinner than a typical Simonsen point.

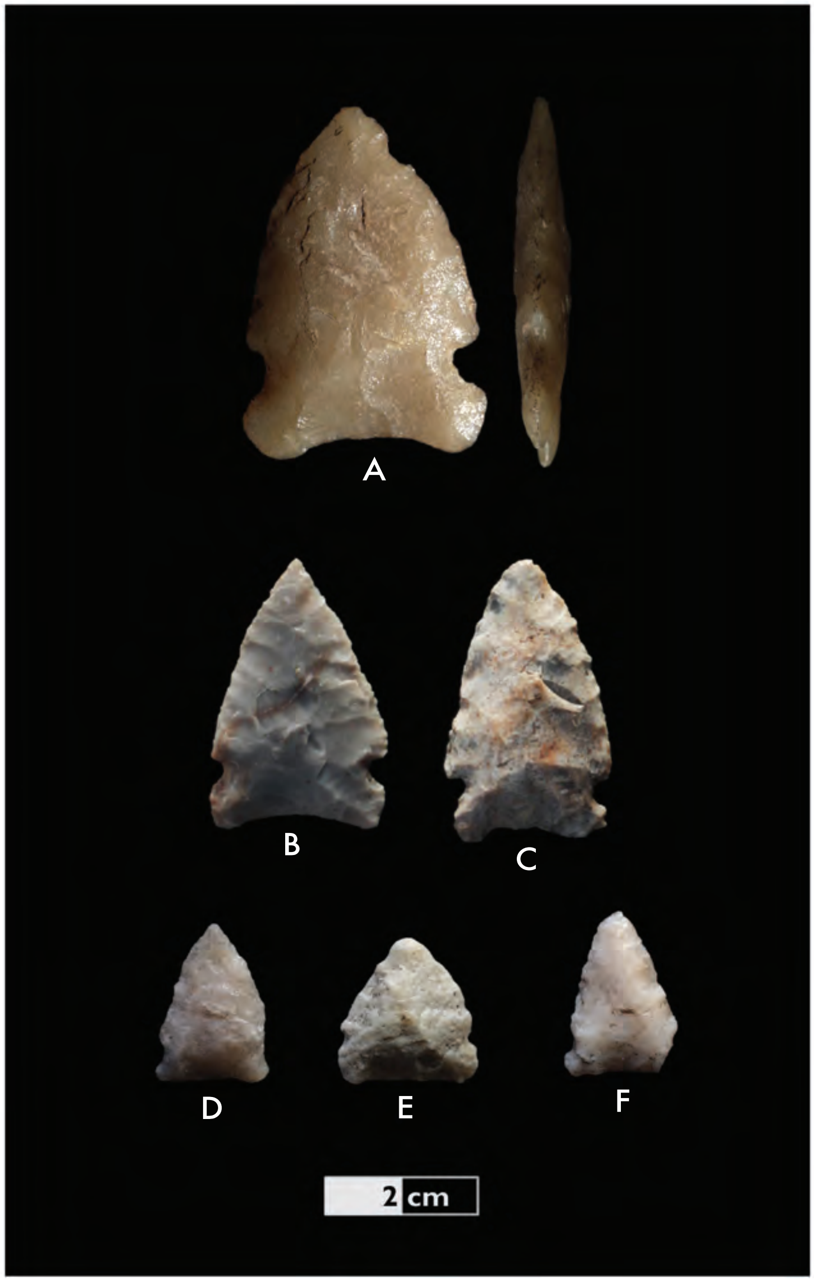


Figure 5.29. Simonsen points. ([A] MHS Artifact: 1988.120.14.4; Hixton Silicified Sandstone; Mille Lacs Co., MN; [B] MBISP Artifact: 6731; unheated Grand Meadow Chert; Freeborn Co., MN; [C] MBISP Artifact: 6740; heat-treated Prairie du Chien Chert; Freeborn Co., MN; [D] SCHM Artifact: 83.85.15; heat-treated Swan River Chert; Meeker Co., MN; [E] SCHM Artifact: 83.85.14; unheated Swan River Chert; Meeker Co., MN; [F] SCHM Artifact: 83.85.20; heat-treated Swan River Chert; Meeker Co., MN.)

RADDATZ

Raddatz is a common Midwestern point type named for the Raddatz Rockshelter in southern Wisconsin (Wittry 1959a).

Description: This is a medium-sized point with an elongated to triangular planview and moderately deep side notches an ovate to almost parallel-ovate blade shape. Flaking is typically random and consists of a mix of percussion a pressure retouch. The side notches tend to be U-shaped and are commonly about as deep as they are wide. The basal ears are commonly somewhat squared and are aligned with the sides of the shoulder above them. Bases are straight to slightly concave and are often thinned by the removal one or more long pressure flakes. Basal and notch grinding is common but not universal. This grinding is usually on the light to moderate side, rarely is it heavy grinding. Goldstein and Osborn's (1988:28) Wisconsin samples range in length from 3.8 to 9.2 cm (1.5 to 3.5 inches), in width from 1.6 to 3.4 cm (0.6 to 1.3 inches), and in thickness from 0.6 to 1.1 cm (0.2 to 0.4 inches). Raddatz points are generally made of local available chert varieties and heat treatment is common.

Distribution: Raddatz is a common point type that is widely distributed in one variant or another throughout the Midwest.

Age and Associations: Medium-sized, side-notched projectile points are ubiquitous across the Upper Midwest for most of the Middle Archaic period and persist into the early part of the Late Archaic period. These points have a range of variation that defies rigid typology, although at a site/assemblage level they can all be seen as variations of the same theme. There are several examples of Middle Archaic age sites that have been investigated across central Iowa. These include radiocarbon-dated assemblages from buried contexts at the Allen Fan Site, 13HA385, with Tama/Raddatz points dated to circa 5000 B.C.E. (Fishel et al. 2003); the Buchanan Site, 13SR153, with Jakie and Raddatz points dated to circa 2200 B.C.E. and several additional side-notched points from contexts dated between 3200 and 3500 B.C.E. (Hainlin 1992); and the side-notched points from the Palace Site, 13PK966, dating between 5300 and 6200 B.C.E. (Pope et al. 2014). Raddatz points are also similar to points found further west as the Hill Site in southwestern Iowa (Frankforter 1959), at Horizon I of the Cherokee Sewer Site in Northwestern Iowa (Anderson 1980) and the Logan Creek Site in eastern Nebraska (Kivett 1959). A date range of 6500 to 2000 B.C.E. is proposed for Raddatz and similar points.

Similar or Identical Types: Raddatz points freely intergrade with other Middle to Late Archaic side-notched points such as Matanzas, Osceola, Simonsen, Tama, and Godar.

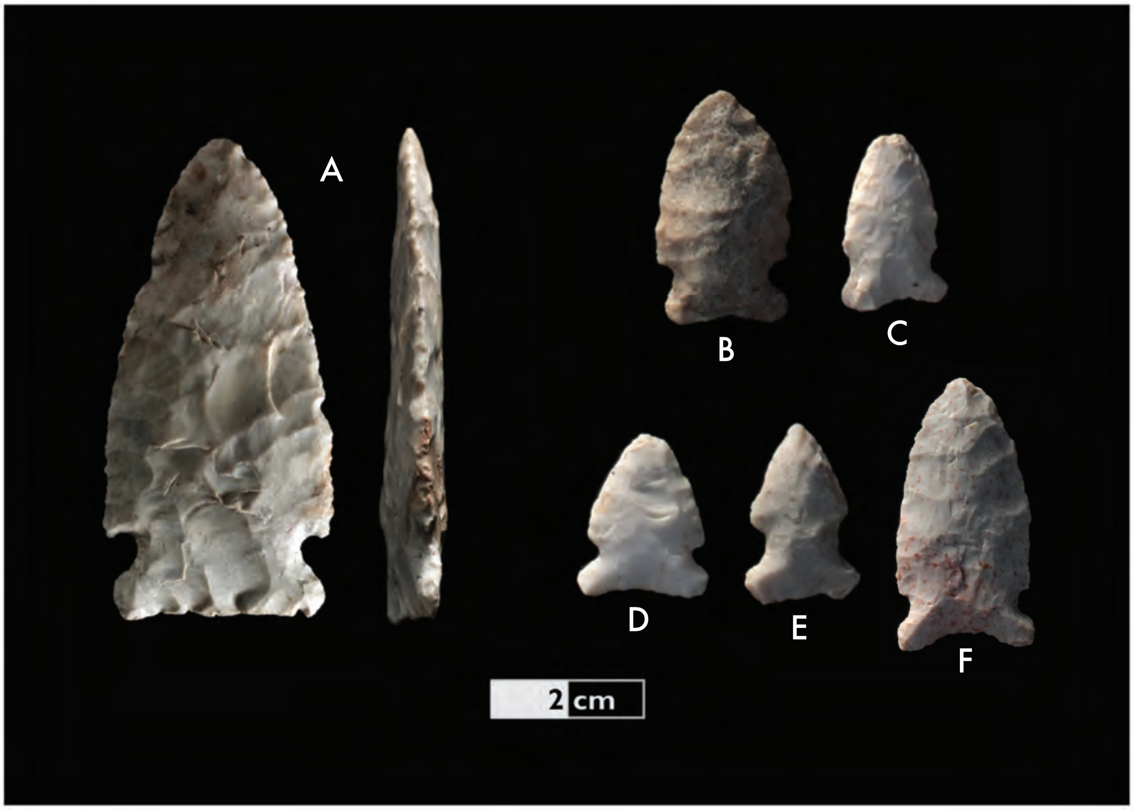


Figure 5.30. Raddatz points. ([A] MHS Artifact: 56.27; unheated Prairie du Chien Chert, unknown provenience; [B] MBISP Artifact: heat-treated Prairie du Chien Chert, Freeborn Co., MN; [C] MBISP Artifact: unheated Burlington Chert, Freeborn Co., MN; [D] MBISP Artifact: unheated Prairie du Chien Chert, Freeborn Co., MN; [E] MBISP Artifact: unheated Maynes Creek Fossiliferous Chert, Freeborn Co., MN; [F] MBISP Artifact: unidentified chert, Freeborn Co., MN.)

GODAR

Godar points are named for the Godar Site in western Illinois (Montet-White 1968; Perino 1971).

Description: This is a broad-bladed, medium-sized, side-notched point with a straight to slightly convex base. Workmanship is generally fairly good with even, but random, percussion flaking and pressure retouch. Blade edges are convex to parallel sided, with a gradual curve ending in a relatively broad tip. The moderately deep side notches tend to be as wide as they are deep, and the base as wide as the shoulders. Basal ears are generally quite square. Most examples show light to moderate haft grinding. Goldstein and Osborn's (1988:32) Wisconsin sample ranges from 5 to 10 cm (2 to 4 inches) in length, from 3.2 to 4.0 cm (1.2 to 1.6 inches) in width, and from 0.9 to 1.1 cm (0.3 to 0.4 inches) in thickness. A variety of local raw materials were used in making these points, and heat treatment occurs sporadically.

Distribution: The distribution of Godar points are concentrated in the Upper Mississippi River Valley, including Wisconsin, eastern Iowa, and southern Minnesota. In Minnesota, examples are present in the Owen Johnson collection from Freeborn County.

Age and Associations: Godar points are associated with the Middle Archaic Napoleon Phase (5300 to 4300 B.C.E.) and Helton Phase (4300 to 2400 B.C.E.) in western Illinois (Wiant et al. 2009). Late Archaic Hemphill points are somewhat similar, dating as late as 1500 B.C.E.

Similar or Identical Types: Godar points and Raddatz points freely intergrade in morphology. One might even conclude that the two type designation are provincial rather than typological with medium-sized, side-notched points in Illinois being called Godar and medium-sized, side-notched points in Wisconsin being called Raddatz. Like most Middle Archaic side-notched types, there are typical differences in shape, but the range of overlap between our defined types is enormous.

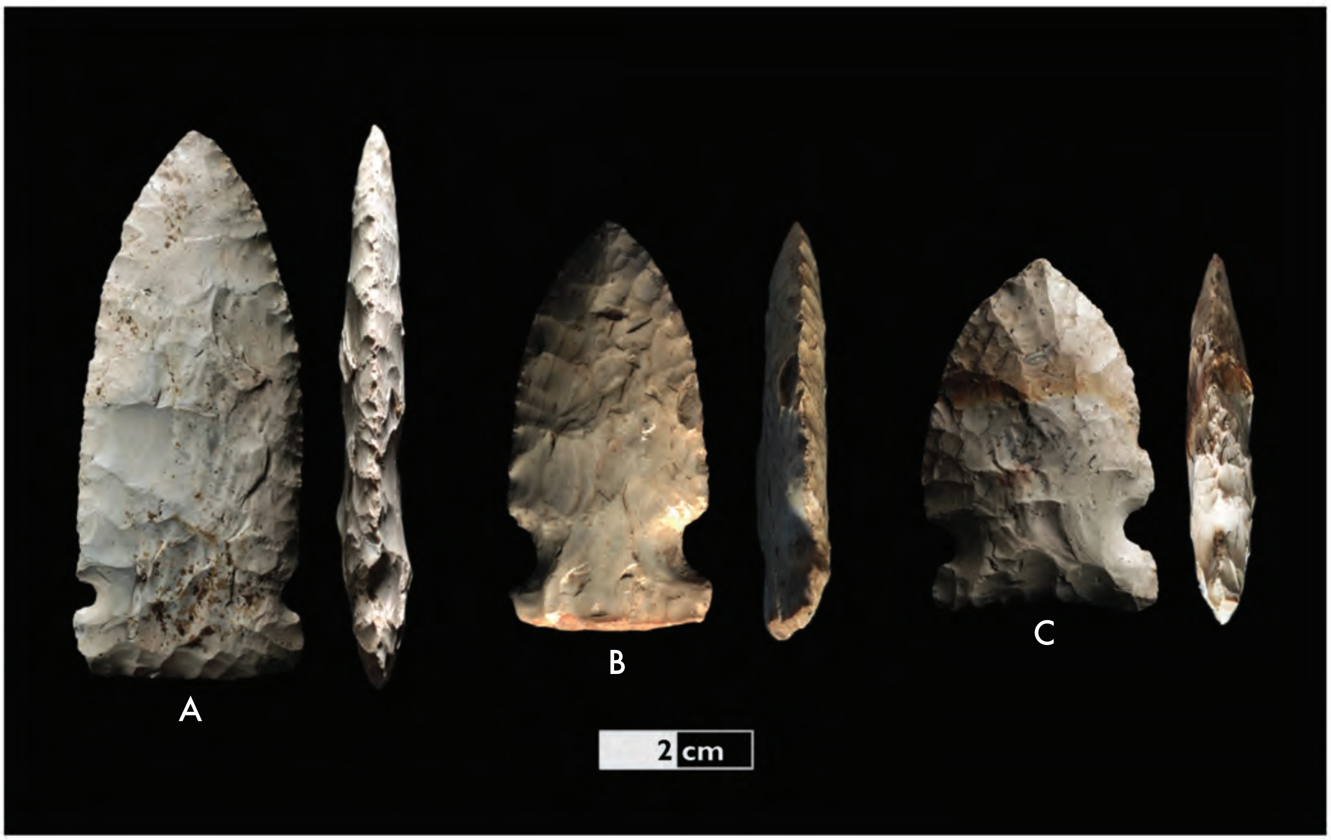


Figure 5.31. Godar points. ([A] MHS Artifact: 56.25; heat-treated Blanding Chert; unknown provenience; [B] MBISP Artifact: SP89106; unidentified chert; unknown provenience; [C] MHS Artifact: 56.14; heat-treated Blanding Chert, unknown provenience.)

MATANZAS

This point type is named after West Matanzas in Fulton County, Illinois, in the central Illinois River valley. Munson and Harn (1966:153–154) first assigned this name to surface finds in that area.

Description: These are small to medium points with shallow, wide side notches and a thick, biconvex or diamond-shaped cross section. Blades are usually long and fairly narrow with roughly parallel to convex sides. Irregular percussion and pressure flake scars generally cover both faces of the blade. Side notches form a relatively short stem with the notches placed very close to the basal corners or somewhat above them. The notches may be faint and shallow or relatively bold and moderately deep. The basal corners may be rounded or somewhat pointed. The basal edge is straight to convex and may exhibit light to medium grinding. Points average about 4 to 6 cm (1.5 to 2.5 inches) in length and 1.5 to 3 cm (0.6 to 1.2 inches) in width. A variety of local cherts were used in the manufacture of Matanzas points and heat treatment is common.

Distribution: Matanzas points are most common in the central Mississippi, lower Missouri, and Illinois River Valleys, and across central and southern Indiana and Ohio. They are also found in southern Wisconsin and are common in southeastern Minnesota with many examples present in the Owen Johnson collection.

Age and Associations: Matanzas points are representative points of the French Lick phase in southern Indiana (3300 to 2500 B.C.E.) and the Helton phase (4300 to 2300 B.C.E.) (Stafford and Cantin 2009; Wiant et al. 2009). This is a type that straddles the Middle Archaic and Late Archaic interface.

Similar and Identical Types: There is considerable variation in the Matanzas type. Cook (1976) divided the Matanzas points from the Koster Site in Illinois into several sub-varieties based on notching and haft shape. At their morphological extremes, Matanzas points can resemble Raddatz points, Durst points, and even Besant points.

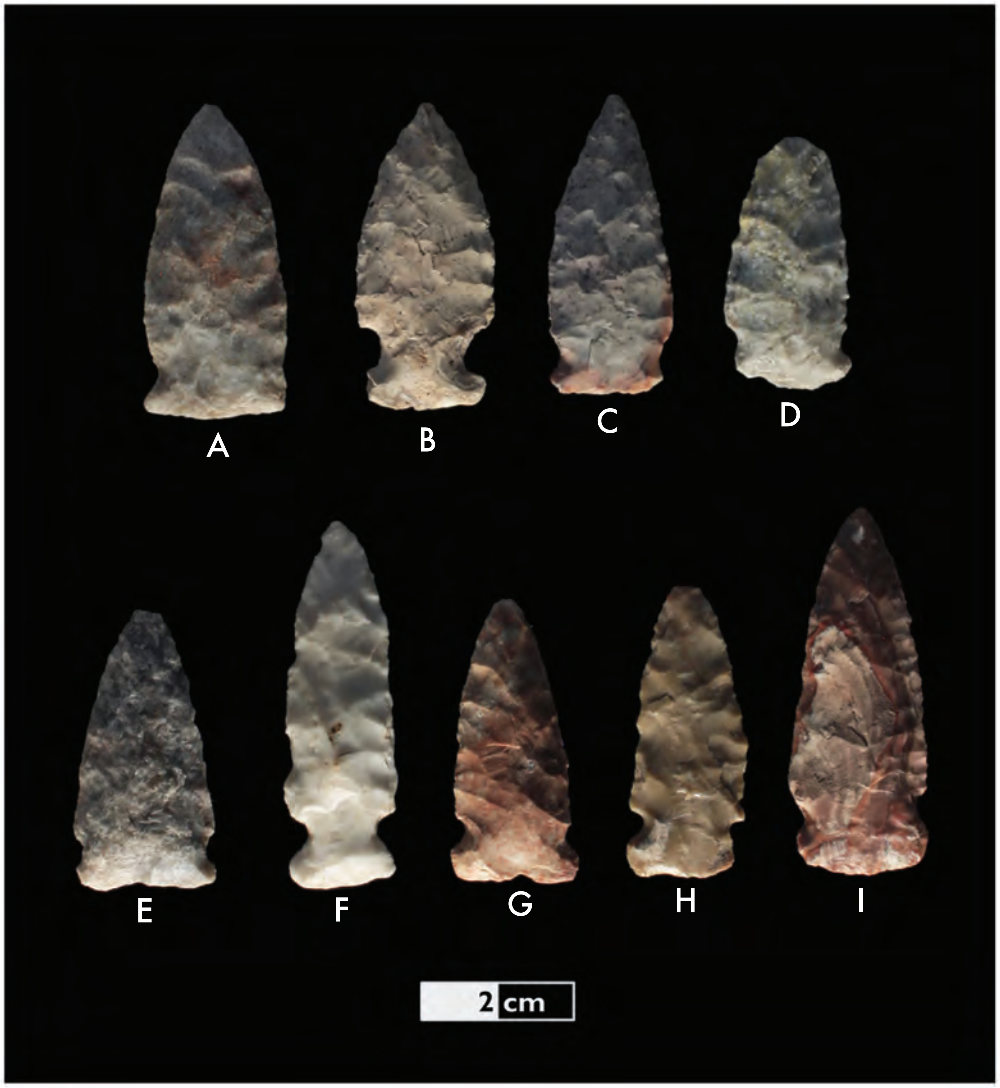


Figure 5.32. Matanzas points. ([A] MBISP Artifact: 6705; heat-treated Prairie du Chien Chert; Freeborn Co., MN; [B] MBISP Artifact: 6777; heat-treated Galena Chert; Freeborn Co., MN; [C] MBISP Artifact: 6769; heat-treated Maynes Creek Cream Chert; Freeborn Co., MN; [D] MBISP Artifact: 6900; unheated Prairie du Chien Chert; Freeborn Co., MN; [E] MBISP Artifact: 6857; heat-treated Prairie du Chien Chert; Freeborn Co., MN; [F] MBISP Artifact: 6743; unheated Burlington Chert; Freeborn Co., MN; [G] MBISP Artifact: 6790; heat-treated Galena Chert; Freeborn Co., MN; [H] MBISP Artifact: 6901; unidentified chert; Freeborn Co., MN; [I] MBISP Artifact: 6787; heat-treated Maynes Creek Speckled Chert; Freeborn Co., MN.)

REIGH

Reigh points are named for specimens found at the Reigh and Oconto sites in eastern Wisconsin (Ritzenthaler 1957).

Description: These are rather crudely made, relatively thick, medium-sized, side-notched points with a wide base and a roughly triangular blade shape. Blade edges are usually convex. Side notches are characteristically small and set close to the base. Flaking is irregular with random percussion flaking and marginal pressure retouch. Basal grinding appears to be absent from the majority of Reigh points. These rather squat points ranging from 4 to 9 cm (1.5 to 3.5 inches) in length and 3.2 to 5 cm (1.25 to 2.0 inches) in width. Reigh points appear to be made from a variety of local cherts and heat treatment was common.

Distribution: Reigh points are present throughout central, western, and southern Wisconsin, as well in northern Illinois and parts of eastern Minnesota.

Age and Associations: In Wisconsin, Reigh points are dated to 4000 to 3000 B.C.E. at the Oconto Site, and a date of circa 1700 B.C.E. is available from the Reigh Site (Pleger and Stoltman 2009). These points are associated with the Middle to Late Archaic Old Copper culture (4000 to 1000 B.C.E.).

Similar or Identical Types: Reigh points are quite similar to points described as Madison Side-Notched (Rittzenthaler 1967; Goldstein and Osborne 1988) and should probably be considered the same type. The designation Madison has been dropped here to avoid the potential confusion between Madison Side-Notched and Madison Triangular that are completely different and unrelated point types.

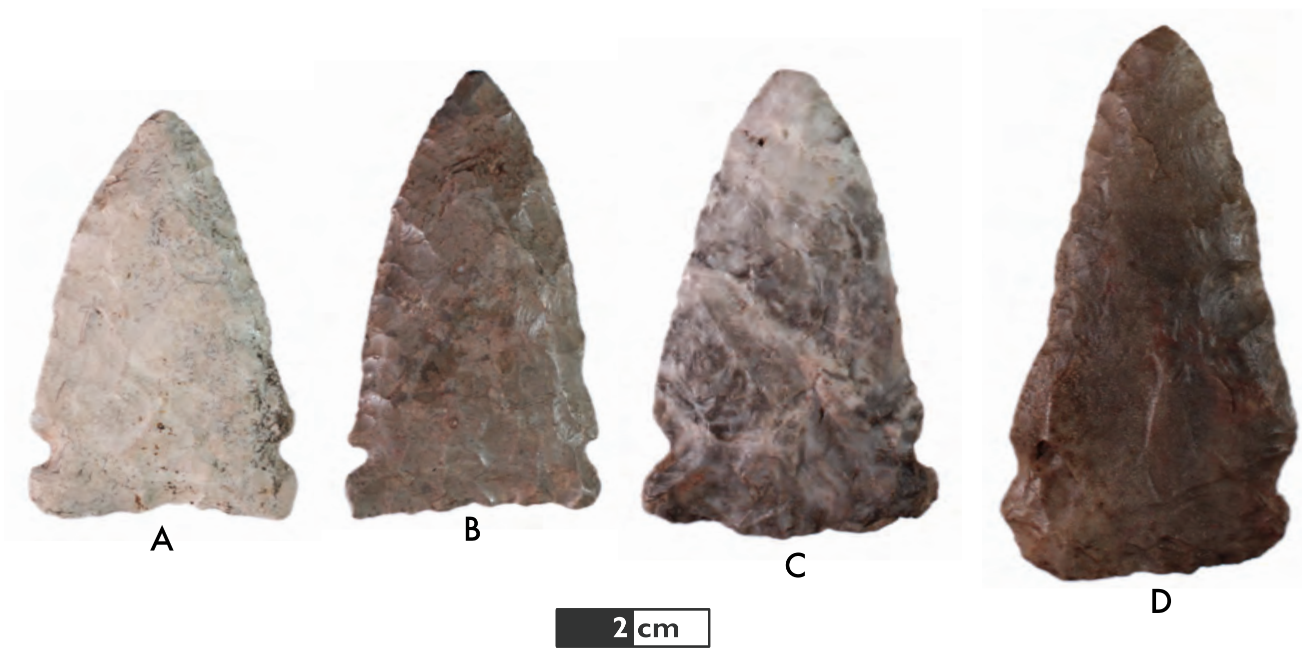


Figure 5.33. Reigh points. ([A.] MHS Artifact: 56; unheated Blanding Chert; Winona Co., MN; [B] MHS Artifact: 56-7; heat-treated Galena Chert; unknown provenience; [C] MHS Artifact: 84.77.36; heat-treated Prairie du Chien Chert, unknown provenience; [D] MHS Artifact: 47-12 1806; heat-treated oolitic Prairie du Chien Chert; unknown provenience.)

Osceola

Osceola points are named for the Osceola Site in southwestern Wisconsin (Ritzenthaler 1946; Bell 1958).

Description: This is a medium to large, narrow, long, side-notched point. They are elongated with nearly parallel sides. Workmanship varies from fair to good with a mix of percussion flaking and marginal pressure retouch. The large and moderately deep side notches are characteristically placed higher up the sides of the base than is typical of other side notched Archaic points. The notches may appear relatively shallow on heavily reworked or resharpened points. Bases may be straight or moderately concave. Basal corners are blunt, not pointed. Basal grinding is rare and if present is usually rather light. Goldstein and Osborn (1988:30) report a range in length from 8 to 23 cm (3 to 9 inches), in width from 2.5 to 4.7 cm (1 to 1.8 inches), and in thickness from 1 to 1.3 cm (0.4 to 0.5 inches). Osceola points are made from a wide variety of raw materials and those made of chert are commonly heat treated.

Distribution: The core distribution of Osceola points is the Upper Mississippi River Valley, including southern Minnesota, Wisconsin, eastern Iowa, Illinois, and Missouri. Waldorf and Waldorf (1987:95) suggest that Osceola points are most common along the Mississippi, Illinois, and Missouri Rivers. Similar forms are present throughout the Eastern Woodlands.

Age and Associations: In Wisconsin, Osceola points are associated with Old Copper Culture that has traditionally been considered to be Middle Archaic in age (5000 to 3000 B.C.E.). However, recent research has demonstrated that Old Copper persists through the Late Archaic period as well. Goldstein and Osborn (1988) consider Osceola to be a Late Archaic form (3000 to 1000 B.C.E.) and also associate it with the Old Copper culture. Radiocarbon dates from the Osceola type site range from 2200 to 1250 B.C.E. (Pleger and Stoltman 2009).

Similar or Identical Types: Osceola points are virtually identical in outline to Hemphill points in Illinois, although they differ in workmanship and age. Hemphill points tend to be better made and are more recent (ca. 2500 to 1500 B.C.E.), if Osceola is a Middle Archaic point form. Goldstein and Osborn (1988) consider Osceola points similar to Raddatz, Hemphill, Black Sand, Graham Cave, and Madison Side-Notched points.

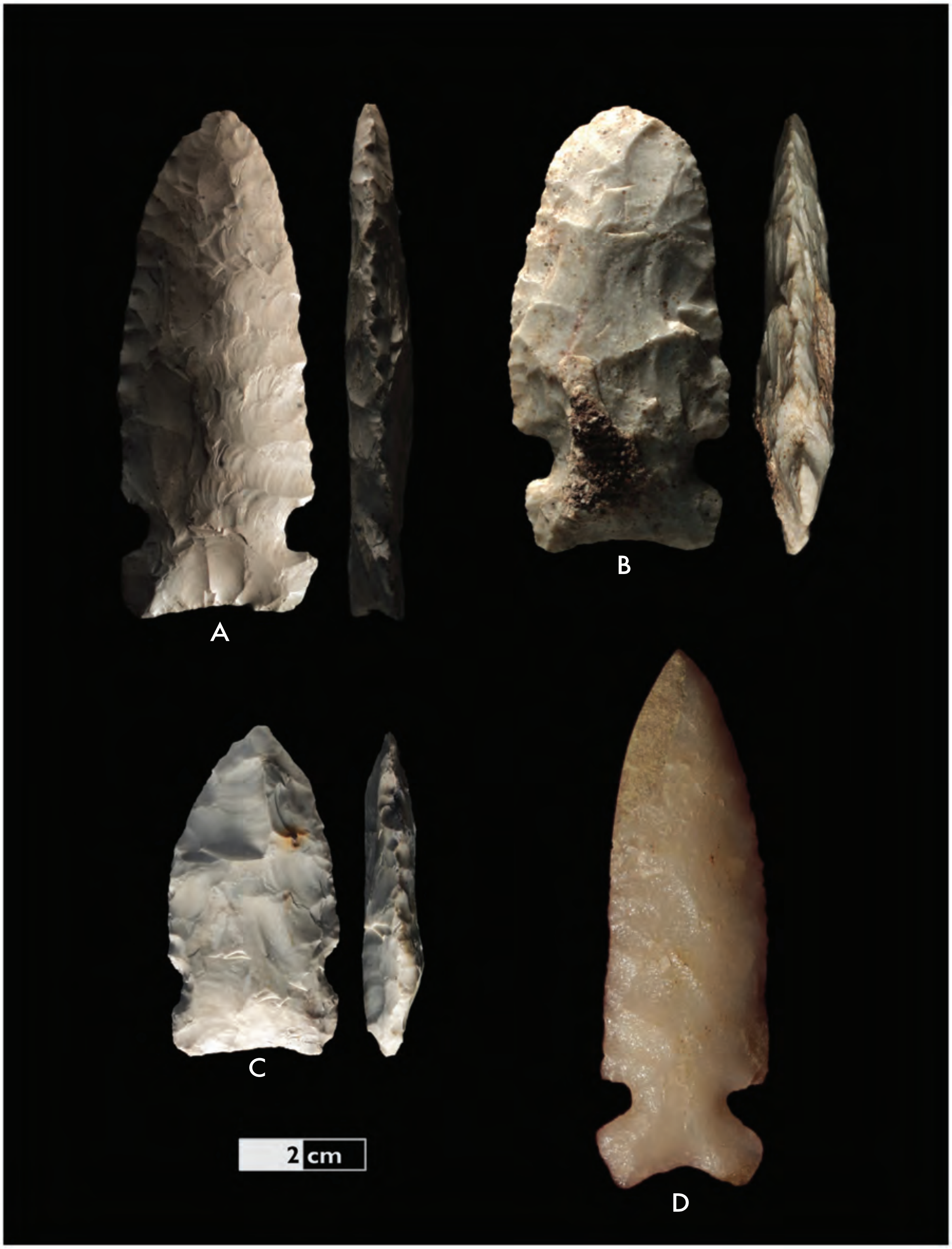


Figure 5.34. Osceola points. ([A] MBISP Artifact: 7205; heat-treated Maynes Creek Cream Chert; Freeborn Co., MN; [B] MBISP Artifact: 12611; heat-treated Prairie du Chien Chert; Freeborn Co., MN; [C] MBISP Artifact: 7205; heated/burned Burlington Chert; unknown provenience; [D] Glynn Collection: Hixton Silicified Sandstone; Rice Co., MN.)

OXBOW

Oxbow is a western point type named for the Oxbow Dam Site in Saskatchewan (Nero and McCorquodale 1958).

Description: Oxbow is a small to medium, side-notched point with pronounced concave to notched base (Dyck 1977:72–86). The blade is roughly triangular in shape with relatively straight to convex sides. Side notches may be moderately deep or shallow and almost indistinct. The base is sharply concave and sometimes appears almost notched or bifurcated. Bases are frequently ground. Length is typically between 2.5 to 5 cm (1 and 2 inches). Oxbow points in Minnesota appear to have been made of a variety of local raw materials, and many are heat treated.

Distribution: Oxbow is a widely distributed point type that is most common in the Northwestern Plains. Smaller numbers have been found in the boreal forest from eastern Manitoba across Saskatchewan into Alberta. Others have been found in western Nebraska and in North and South Dakota. In Minnesota, Oxbow points have been reported from the central part of the state and are present in many collections in Minnesota (e.g., Shay 1971; Allen 1993:45; Johnson 1994:3.30; Magner 1994:35; Anfinson 1997:Figure 14, second row).

Age and Associations: Radiocarbon dates from components in the Northwestern Plains fall for the most part between 2700 and 1000 B.C.E. (Brumley 1998; also see Gregg and Davidson 1985:105–108). Oxbow points are associated with the Oxbow complex in the Northwestern Plains. Oxbow points date to the Middle Plains Archaic period, a time that would be considered equivalent to the Late Archaic period in the east.

Similar and identical Types: During the 1970s and 1980s, Oxbow points found in Minnesota were commonly called Parkdale Eared (e.g., Caine 1974:Figure 2.7). Oxbow points can seem to grade into the similarly broad, concave-based Simonsen points of the Middle Archaic period.

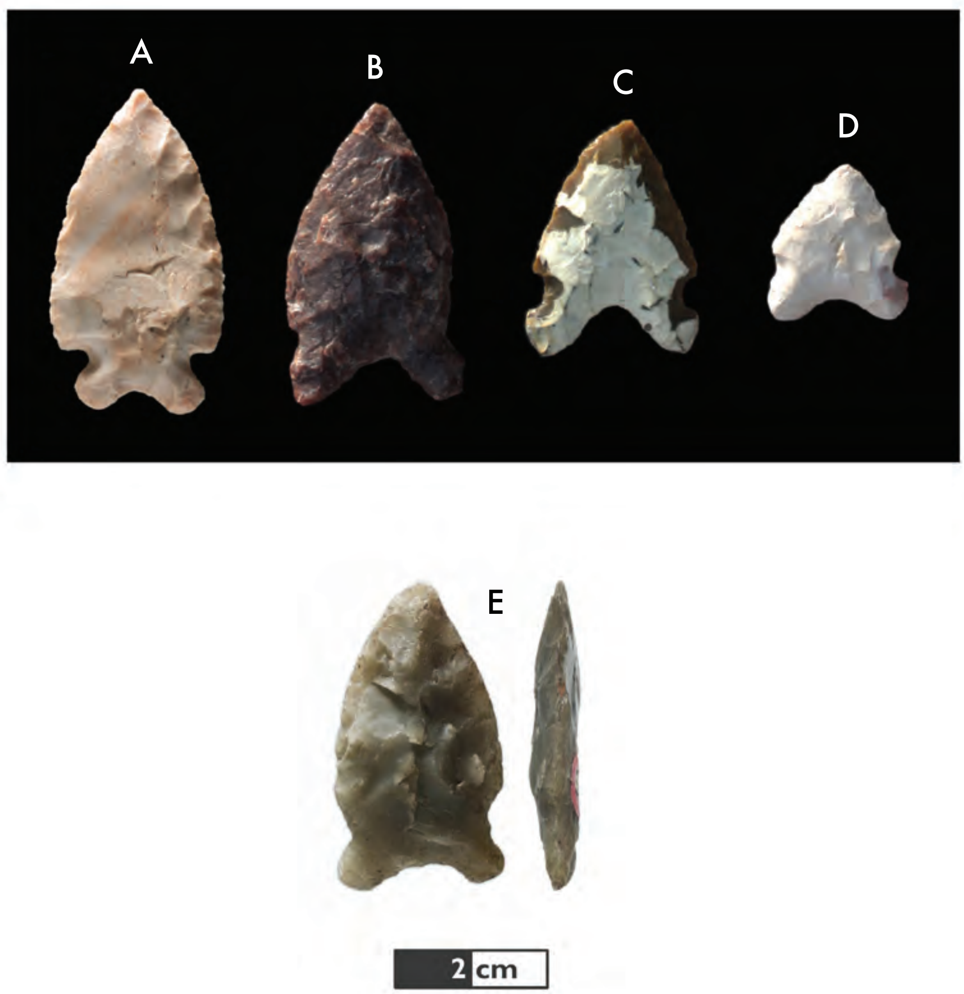


Figure 5.35. Oxbow points. ([A] MHS Artifact: 1988.120.15.34; heat-treated Prairie du Chien Chert; Mille Lacs Co., MN; [B] MBISP Artifact: 6825; unidentified chert; Freeborn Co., MN; [C] MBISP Artifact: 16930; patinated/reworked Hudson Bay Lowland Chert; Freeborn Co., MN; [D] MBISP Artifact: 6729; unidentified chert; Freeborn Co., MN; [E] MHS Artifact: 11.69.3; possibly Lake of the Woods Rhyolite; Clearwater Co., MN.)

MCKEAN

McKean is a Plains Middle Archaic point type originally named McKean Lanceolate by Richard Wheeler (1952).

Description: McKean is a lanceolate point with a deeply indented base and convex blade edges; it is usually made of local materials (Wheeler 1952; Syms 1969; Kornfeld 1998). The manufacturing technology is generally random percussion and pressure flaking. The widest part of the blade is toward its midsection. Point length is 2.5 to 5 cm (1 to 2 inches). McKean points in the northeastern sector of their distribution in southeastern Manitoba often appear in a "fish-shaped" variant (Buchner 1979:95).

Distribution: McKean points are distributed over a million square miles of central North America (Gregg and Davidson 1985:108–112). Although centered in the grasslands of the Northern Plains, they are also present in bordering aspen parklands, mountains, and boreal forests. In Minnesota, they are present in the central (Johnson and Higginbottom 1994:3.26) and extreme western parts of the state. This point type is rare in Minnesota.

Age and Associations: The appearance of the McKean and Duncan point types mark the beginning of the McKean complex in the Northern Plains, which is thought to date between about 3000 and 500 B.C.E. McKean points seem to be diagnostic of the McKean phase (ca. 3000 to 1500 B.C.E.) of the complex. This would place it within the Middle Archaic period, which is called the Middle Plains Archaic or Middle Prehistoric period on the Plains. Syms (1969:165) has suggested that there is a temporal slant in point age, with points as old as circa 3000 B.C.E. present in the mountain ranges in the northwest and others as recent as 1500 to 1200 B.C.E. present in Nebraska and other sections to the east and southeast. Syms (1970:131) has also suggested that the McKean complex itself persisted as late as 1000 to 600 B.C.E. in the very most northern part of the Northern Plains. A McKean point was associated with material dated to circa 2450 B.C.E. at the Sitting Crow Site near Fort Thompson in south-central South Dakota (Neuman 1964:477). The McKean phase is contemporary with the Old Copper complex in Minnesota and Wisconsin.

Similar and Identical Types: There is stylistic overlap between some McKean complex point types, which include McKean, Mallory, Duncan, Hanna, Yonkee, and several unnamed point varieties. McKean points may dominate early with a shift to Duncan points between circa 2000 and 1500 B.C.E.

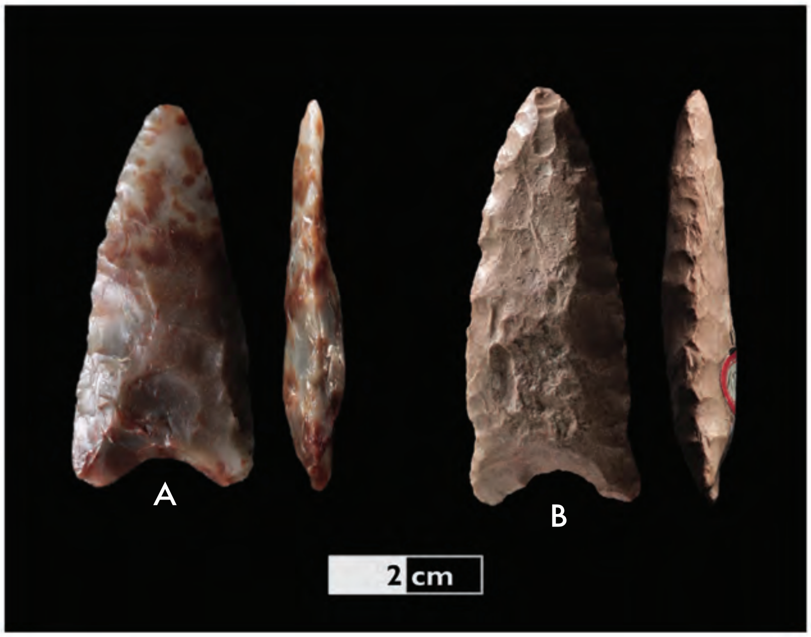


Figure 5.36. McKean points. ([A] MHS Artifact: 17.124.2; unidentified chert; Goodhue Co., MN; [B] MHS Artifact: 17.124.3, unidentified chert; Goodhue Co., MN.)

DUNCAN

Duncan is a western point type named by Richard Wheeler (1954) for specimens found in Wyoming.

Description: These are small to medium stemmed points with a lanceolate-shaped blade and a concave base. Stems are tapering to straight and the points have weak, sloping shoulders. The stems are often ground along the edges. Stems are generally one-fourth to one-third the total length of the point. Duncan points range in length from 3 to 6 cm (1.2 to 2.5 inches). Wheeler's type samples from the Plains are 3.2 cm (1.2 inches) or more in total length, 1.6 cm (0.6 inches) or more in maximum width, and 0.4 cm (0.2 inches) or more in maximum thickness; points in the sample ranged from 2.8 to 5.8 grams (0.10 to 0.20 ounces) in weight. Some Minnesota and Iowa examples are made of Knife River Flint.

Distribution: Duncan is a common point type in the Northern Plains that decreases rapidly in numbers eastward across Minnesota and Iowa. In Minnesota, Duncan points are present in the Owen Johnson collection, Blueberry Lake (Johnson and Buck 1995: Figure 64), and Shingabee Island (Hohman-Caine and Goltz 1999), among other sites.

Age and Associations: Duncan is considered Late Plains Archaic (ca. 2500 to 850 B.C.E.) point type in the Northern Plains (Perino 1971). The appearance of Duncan and McKean points mark the onset of the McKean phase (ca. 3000 to 1500 B.C.E.) and the beginning of the long presence of the McKean complex in that area (Gregg and Davidson 1985:108–112). A number of archaeologists have suggested that it was the predominant point type in the complex between circa 2000 and 1500 B.C.E. (e.g., Reeves 1970a:74; Brumley 1975:72–73). Three stratified Duncan components at Lightning Spring in extreme northwestern South Dakota are radiocarbon dated to around 1900 B.C.E. (Keyser 1982). Its appearance correlates with the onset of more modern Sub-Boreal climatic (cool, moist) conditions, and it is contemporaneous at least in part with the Old Copper complex in Minnesota.

Similar and Identical Types: There is stylistic overlap between some McKean complex point types, such as McKean, Duncan, Yonkee, Hanna, and several unnamed point varieties. Hanna is most easily confused with Yonkee points. Taylor (2006:322) refers to Duncan and Hanna points as McKean Shouldered points.

Figure 5.37. Duncan point. (MHS Artifact: 37.15.3; Knife River Flint; Ramsey Co., MN.)

Hanna

Hanna is a Plains Late Archaic point type that is associated with the widespread McKean complex.

Description: This is a long, stemmed, lanceolate point that is lenticular or plano-convex in cross section (Wheeler 1954; Syms 1969). Blade edges are convex. Shoulders are straight or slightly barbed. The expanding stem has a straight or slightly notched base that is thinned. Point length is 2.5 to 5 cm (1 to 2 inches), with the stem one-fifth to almost one-half the total length of the point. Blade width is about 1.4 cm (0.5 inches) or more, and maximum thickness is 0.4 cm (0.2 inches) or more. Stem edges are usually smoothed by grinding or retouch. A sample of points studied by Wheeler range in weight from 2.0 to 5.1 grams (0.07 to 0.18 ounces) (Wheeler 1954). Hanna points are usually made of local materials and exhibit moderate workmanship.

Distribution: McKean complex components are distributed over a million square miles of central North America. Although centered in the Northern Plains, they occur in adjacent areas, including the mountains to the west, aspen parklands to the north and east, and boreal forests in the far north. In Minnesota, Hanna points have been observed in amateur collections in Kandiyohi, Lincoln, and Norman Counties. A site in Minnesota with *in situ* Hanna points is Canning (21NR9) in Norman County (Michlovic 1986). Most points from this site have been so extensively resharpened that little remains of the blade element. They are also found in other locations along the Red River (Michlovic and Johnson 1995:Figure 3.2f–l).

Age and Associations: Hanna points are associated with the McKean complex, which has been dated within the 3000 to 500 B.C.E. period. Hanna may have been the predominant point type in the complex between ca. 1500 to 1000 B.C.E., which would place it within the Late Archaic period in Minnesota. Hanna and Duncan points have been found together with McKean points and in more recent components where McKean points are absent.

Similar and Identical Types: There is stylistic overlap between some McKean complex point types, such as McKean, Duncan, Yonkee, Hanna, and several unnamed point varieties. Hanna is most easily confused with Yonkee points. Taylor (2006:322) refers to Duncan and Hanna points as McKean Shouldered points.

Figure 5.38. Hanna points. ([A] MBISP Artifact: SP89144; patinated/reworked Burlington/Keokuk Chert; unknown provenience; [B] MHS Artifact: 6604.61.3; unheated Burlington Chert, Goodhue Co., MN.)

ETLEY

Etley points were named by Dr. P. F. Titterington for finds on the Oettle family farm in Calhoun County, Illinois. Scully (1951:2) appears to have been the first to publish the Anglicized spelling of the name.

Description: These are long points with elongated blades, short stems, and prominent barbed shoulders (Bell 1960; Perino 1968:98; Morrow 1984:47; Justice 1987:146–149). Like other bifaces in the Titterington Phase and Sedalia Complex, Etley points exhibit bold random percussion flaking with minimal pressure retouch. Blades range from parallel sided to somewhat recurved. The distinctive basally or laterally projecting barbs can be as long as 0.7 to 1 cm (0.3 to 0.4 inches). The widest part of the point is generally at barbed shoulders. Stems are somewhat contracting, straight or slightly expanding and relatively short. Bases are slightly convex or straight. Haft grinding is absent. Etley points range in length from about 8 to 23 cm (3 to almost 9 inches), making them one of the longest Archaic point types. The average point length is about 14 cm (5.5 inches). In their core area in western Illinois and east-central Missouri, Etley points are commonly made of raw (unheated) Burlington chert.

Distribution: Etley points relatively common in their core area of distribution in west-central Illinois and east-central Missouri. They are found in increasingly smaller numbers outside of that range and are very rare in Minnesota.

Age and Associations: This point type is diagnostic of the Late Archaic Titterington phase in the lower Illinois Valley, where these points are dated to 2200 to 1800 B.C.E. (Wiant et al. 2009). They are also characteristic of the Sedalia Complex in Missouri where they date from 2700 to 1900 B.C.E. (Harl 2009).

Similar and Identical Types: Etley points grade morphologically with the closely related Stone Square Stemmed and Smith Basal-Notched points. Wadlow bifaces are thought to be preforms for Etley points.

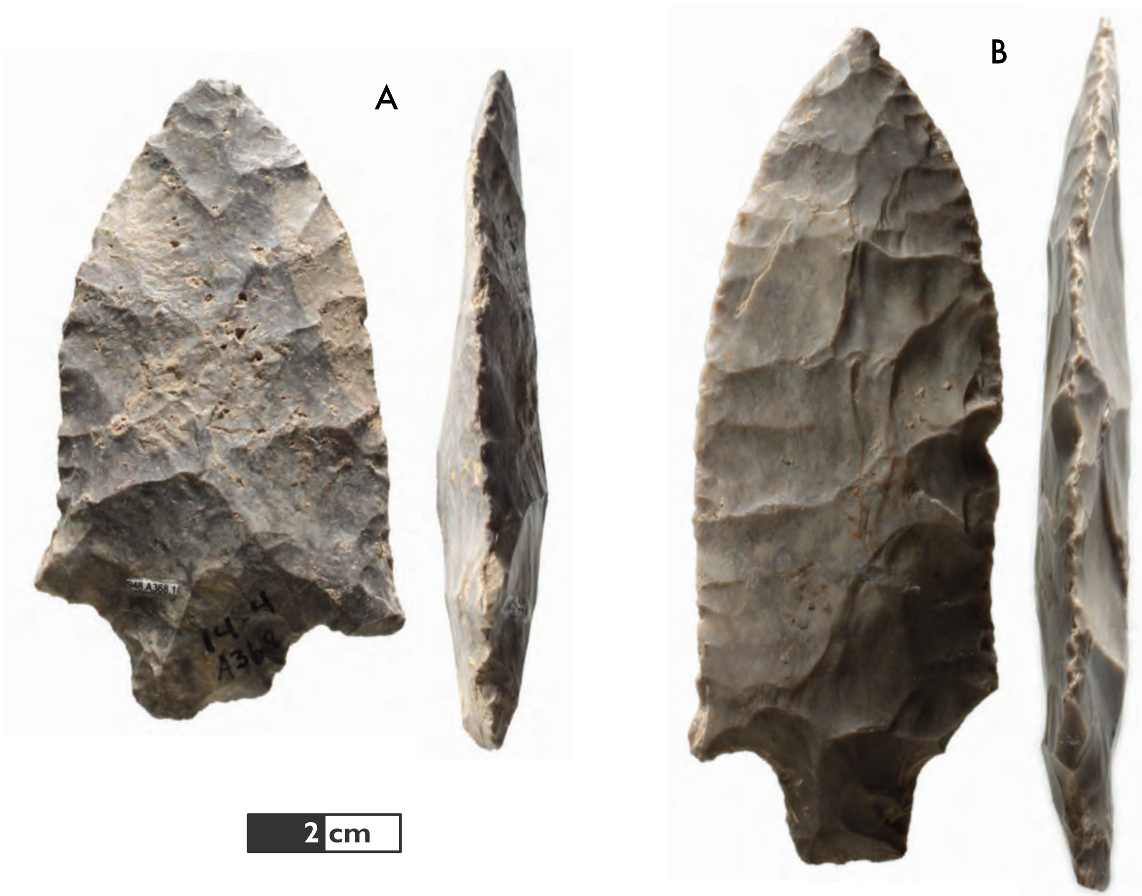


Figure 5.39. Etley points. ([A] MHS Artifact: 948.A368.1; possibly unheated Florence B Chert; Douglas Co. MN; [B] MHS Artifact: 858.A283.1; unheated Cobden Chert; Le Sueur Co., MN.)

SEDALIA

Sedalia points were named by Seelen (1961) for finds made around Sedalia in Pettis County, central Missouri.

Description: These are long lanceolate points (Perino 1968; Morrow 1984:19; Justice 1987:143). Like other bifaces in the Titterington Phase and Sedalia Complex, Sedalia points exhibit bold random percussion flaking with minimal pressure retouch. These points are often heavy and quite thick. Blades are typically excurvate and widest near the middle. Some Sedalia points exhibit a very subtle flaring toward the base. The base edge is usually straight or slightly convex but may be slightly concave. Haft grinding is usually absent, but a small number of Sedalia points do exhibit lateral grinding on the lower portions of the blade toward the base. Sedalia points range in length from about 8 to 20 cm (3 to 8 inches). In their core area in western Illinois and east-central Missouri, Sedalia points are commonly made of raw (unheated) Burlington chert.

Distribution: Sedalia points common in their core area of distribution in west-central Illinois and east-central Missouri. They are found into southern Iowa and are very rare in Minnesota.

Age and Associations: This point type is diagnostic of the Late Archaic Titterington phase in the lower Illinois Valley, where it they are dated to 2200 to 1800 B.C.E. (Wiant et al. 2009). They are also characteristic of the Sedalia Complex in Missouri where they date from 2700 to 1900 B.C.E. (Harl 2009).

Similar and Identical Types: Sedalia points are similar to Nebo Hill points in general shape and size. However, Nebo Hill points trend toward being somewhat smaller and narrower with more pressure retouch and a thick, almost diamond-shaped cross section.

Figure 5.40. Sedalia point (made into drill). (SCHM Artifact: 1960.7.1; unheated Burlington Chert; near Mankato, Blue Earth, or Le Sueur Co., MN.)

NEBO HILL

Nebo Hill points were named after the site of the same name in northwestern Missouri (Shippee 1948).

Description: These are long, narrow lanceolate points (Perino 1968; Morrow 1984:20; Justice 1987:139–142). These points exhibit a random flaking pattern with considerable pressure retouch. These points are typically thick and have a nearly diamond-shaped cross section. Blades are typically excurvate and widest near the middle. Some Nebo Hill points exhibit a very subtle flaring toward the base and some appear to be weakly stemmed. The base edge may be straight, slightly convex or slightly concave. Haft grinding is characteristically absent. Nebo Hill points range in range in length from about 5 to 13 cm (2 to 5 inches). Nebo Hill points were made of a variety of local cherts and some are heat treated.

Distribution: Nebo Hill points common in their core area of distribution in northwestern Missouri. They are uncommon outside of that range and are very rare in Minnesota.

Age and Associations: Nebo Hill points are dated to 1600 to 1000 B.C.E.

Similar and Identical Types: Nebo Hill points are similar to Sedalia points in general shape and size. However, Sedalia points trend toward being larger and wider and exhibit a flaking pattern of percussion flaking with minimal pressure retouch.

Figure 5.41. Nebo Hill points. ([A] MHS Artifact: 3497.A2578.1; unheated Burlington/Keokuk Chert; MN; [B] MHS Artifact: 56.2, heat-treated Galena Chert; MN.)

TABLE ROCK

Table Rock points are named for points from the Rice Site at the Table Rock Reservoir in Stone County, Missouri (Bray 1956:127).

Description: This is a generally well-made medium- to large-sized stemmed point (Justice 1987:124–125; DeRegnaucourt 1991:136–139; Morrow 1984:45; Waldorf and Waldorf 1987:168–169). Flaking pattern is typically random percussion with invasive pressure trimming and retouch. Blades are commonly convex sided. The shoulders are weak and sloping. The stem is relatively narrow and flares slightly at the base. The basal edge is typically straight to slightly convex. The stem form resembles the shape of an old-style stoppered bottle, hence the common name "bottleneck points." The entire stem is usually heavily ground, and this grinding continues up the shoulders. This characteristic can allow for the identification of a Table Rock point even when its stem is broken off. Point length ranges from about 2.5 to 10 cm (1 to 4 inches), width at the shoulder ranges from 1.5 to 3.5 cm (0.6 to 1.4 inches), and thickness ranges from 0.4 to 0.8 cm (0.1 to 0.3 inches). Many exhibit evidence of extensive resharpening, which reduced the width and length of the blade. Table Rock points were made from a variety of raw materials, and heat treatment is common. In Iowa there seems to have been a preference for heat-treated Maynes Creek Chert and heat-treated Prairie du Chien Chert.

Distribution: Table Rock points are common throughout the Midwest, with Missouri, northern Arkansas, eastern Kansas, and northeastern Oklahoma the area of greatest concentration. They are frequently found in eastern Iowa and have been reported from Wisconsin, southern Michigan, Ohio, Indiana, and Kentucky. Table Rock points commonly appear in collections from all over Minnesota (Johnson and Higginbottom 1994:3.31).

Age and Associations: Table Rock points have been recovered from dated contexts in a few sites in Iowa. They are dated to around 1800 B.C.E. at the Edgewater Park Site in Johnson County in southeastern Iowa (Whittaker et al. 2007). At the Allen Fan Site in Hardin County, central Iowa, they are associated with radiocarbon dates of 800 to 600 B.C.E.

Similar and Identical Types: Table Rock points are essentially synonymous with what are called Bottleneck points in Ohio (Waldorf and Waldorf 1987:168; DeRegnaucourt 1991:136). They are somewhat similar to Durst points, but Dursts are generally smaller and more poorly made and have less pronounced shoulders. Merom points can also sometimes resemble Table Rock points but are generally smaller and usually have barbed shoulders.

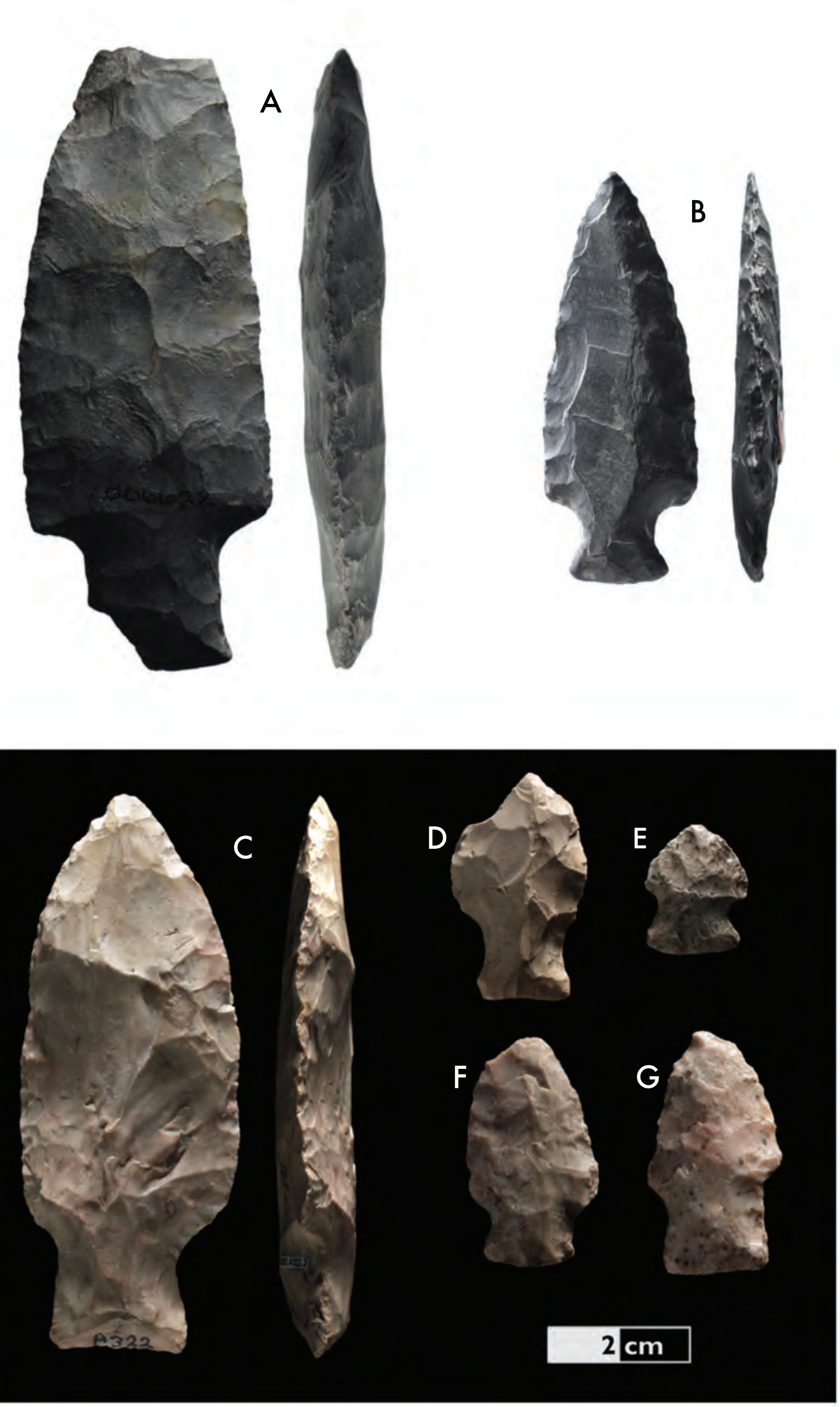


Figure 5.42. Table Rock points. ([A] MBISP Artifact: 6622; unheated Moline Chert; Freeborn Co., MN; [B] MHS Artifact: 21.9.1; Knife Lake Siltstone; MN; [C] MHS Artifact: 902.A322.2; heat-treated Galena Chert; Fillmore Co., MN; [D] SCHM Artifact: 83.85.140; unidentified chert; Meeker Co., MN; [E] SCHM Artifact: 83.85.103; heat-treated Prairie du Chien Chert; Meeker Co., MN; [F] SCHM Artifact: 83.85.135; heat-treated Maynes Creek Speckled Chert; Meeker Co., MN; [G] SCHM Artifact: 83.85.139; heat-treated Prairie du Chien Chert; Meeker Co., MN.)

DURST

Durst points are named for the Durst Rockshelter in south-central Wisconsin (Wittry 1959b).

Description: In general, this is a roughly flaked, small, thick, narrow point with very weak shoulders and an expanding stem. Flaking is characteristically a mix of random percussion and pressure, and these points are commonly thick for their size. The blade is excurvate, and the base usually convex. The stem, which is about one-third the length of the point, is often ground. Goldstein and Osborn's (1988:36) Wisconsin sample ranges in length from 2.1 to 7 cm (0.8 to 2.7 inches), in width from 1.3 to 2.9 cm (0.5 to 1.1 inches), and in thickness from 0.5 to 1 cm (0.2 to 0.4 inches). Durst points were made from a variety of local cherts, and heat treatment is common.

Distribution: This is a common point type in the western Great Lakes (i.e., Wisconsin, western Michigan, northern Illinois, and eastern Iowa). In Minnesota, Durst points occur in small numbers in the extreme eastern part of the state (Caine 1974:Figure 2.4; Gibbon 1975b: Plate 1c; Mather 1991:35).

Age and Associations: Durst Stemmed is a Late Archaic point type. Pleger and Stoltman (2009) give an age range of 1000 to 500 B.C.E. A Durst point is associated with a radiocarbon date of circa 800 to 600 B.C.E. at Site 13CT228 in Clayton County, northeast Iowa (Whittaker et al. 2007).

Similar and Identical Types: Lamoka points in the Northeast and Dustin points in Michigan very similar to Durst points (DeRegnaucourt 1991:150). Table Rock points are somewhat similar but are usually larger, wider, and better made, and they have somewhat more pronounced shoulders than Durst points.

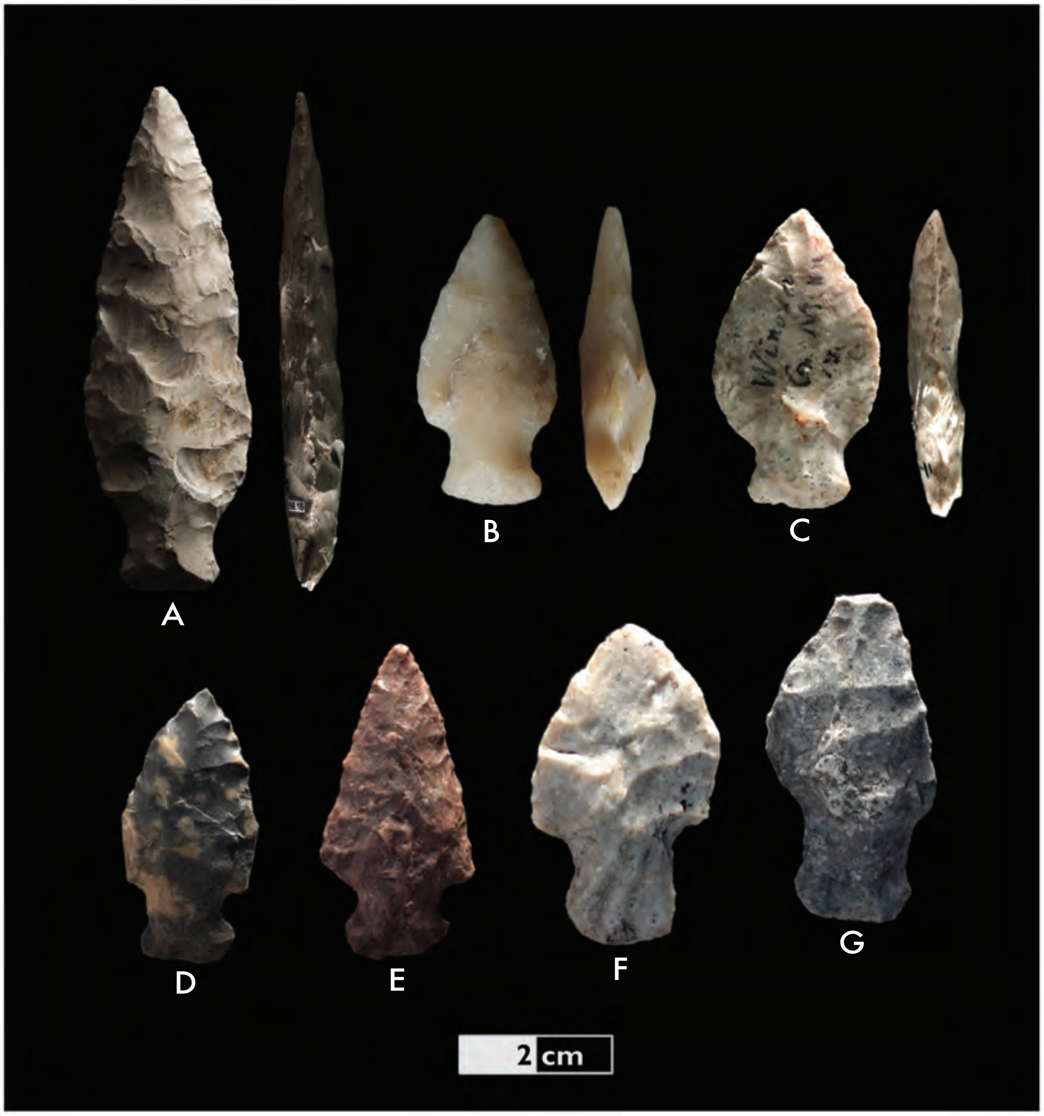


Figure 5.43. Durst points. ([A] MHS Artifact: 56.18; heat-treated Galena Chert; unknown provenience; [B] MHS Artifact: 67.188.A162; Hixton Silicified Sandstone; Washington Co., MN; [C] MHS Artifact: 20.11.4; unheated Prairie du Chien Chert; Houston or Winona Co., MN; [D] MBISP Artifact: 6850; unheated Stoner B Chert; Freeborn Co., MN; [E] MBISP Artifact: 6806; heat-treated Tongue River Silica; Freeborn Co., MN; [F] MBISP Artifact: 6645; heat-treated Prairie du Chien Chert; Freeborn Co., MN; [G] MBISP Artifact: 6663; burned Prairie du Chien Chert; Freeborn Co., MN.)

MEROM

Merom points were named by Howard Winters (1969) for examples found in southeastern Illinois.

Description: These are small, corner notched to expanding stem points (Justice 1987:130–132). They commonly exhibit mediocre workmanship with a combination of random percussion and pressure flaking. Side or corner notches are generally shallow, forming an expanding stem. Stems may be nearly as wide as the shoulders of the point or may be considerably narrower. The bases are straight to convex and basal corners are most commonly rounded. Basal grinding, sometimes heavy, is very typical. Winters (1969) reports that southern Illinois Merom points range from 1.9 to 3.6 cm (0.5 to 1.4 inches) in length, 1.1 to 2 cm (0.4 to 0.8 inches) in width, and 0.4 to 0.8 cm (0.2 to 0.4 inches) in thickness. Merom points were made from a variety of local cherts and heat treatment is common.

Distribution: Merom points are a common, rather generic notched point form throughout most of the Midwest. They are common in southern and eastern Minnesota.

Age and Associations: Merom, along with the closely related Trimble points, are diagnostic of Winter's (1969) Riverton Culture. These are a Late Archaic point variety. Stafford and Cantin (2009) give a date range of 1500 to 800 B.C.E. for the Riverton Culture. Pleger and Stoltman (2009) give a range of 1500 to 1000 B.C.E. for very similar, if not identical, Preston points in Wisconsin.

Similar and Identical Types: Merom points are sometimes mistaken for Late Woodland arrow points. For example, the Cedar Valley points and many of the Klunk and Koster points with basal grinding illustrated by Morrow (1984:44, 67, 78) probably belong in this group.

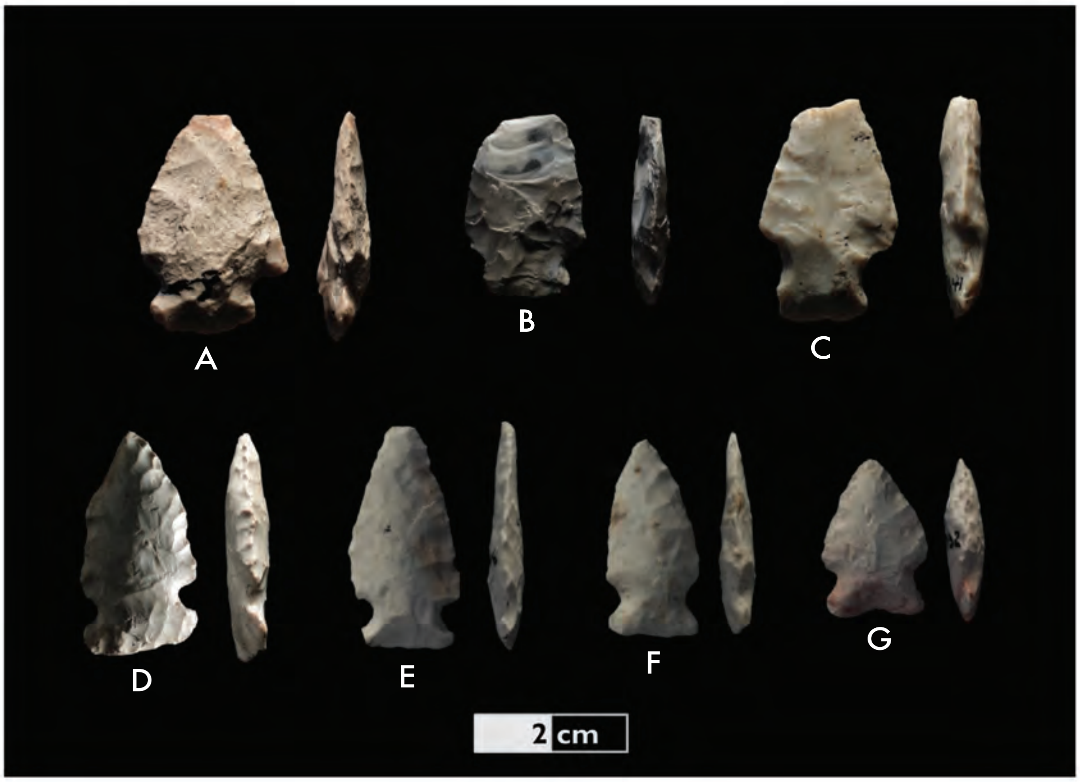


Figure 5.44. Merom points. ([A] SCHM Artifact: 83.85.137; heat-treated Maynes Creek Cream Chert; Meeker Co., MN; [B] SCHM Artifact: 83.85.124; unidentified chert; Meeker Co., MN; [C] SCHM Artifact: 83.85.141; unidentified chert; Meeker Co., MN; [D] MHS Artifact: 47.12.2; unidentified chert; Winona Co., MN; [E] MBISP Artifact: 6746; heat-treated Silurian Chert; Freeborn Co., MN; [F] MBISP Artifact: 6744; unheated Burlington Chert; Freeborn Co., MN; [G] MBISP Artifact: 6732; heat-treated Blanding Chert; Freeborn Co., MN.)

KAMPSVILLE

Kampsville points are named after the town of Kampsville in the Lower Illinois River Valley of west-central Illinois (Perino 1968).

Description: Kampsville points are medium-sized stemmed points with prominently barbed shoulders (Perino 1968). The blades are covered with random percussion scars with some pressure retouch. Blades are generally convex to straight sided and somewhat triangular in plan view. They are widest at the shoulders, which exhibit prominent downward-projecting barbs. The notching that creates the stem and barb juncture is rounded and often uneven. The stems are usually straight but sometimes expanding slightly. The basal corners may be rounded or sharp. The basal edge is slightly concave, slightly convex, or straight. Bases and stem are rarely ground. Kampsville points range in length from 4.1 to 10 cm (1.6 to 4 inches), in width from 1.7 to 3.8 cm (0.7 to 1.5 inches), and in thickness from 0.6 to 0.9 cm (0.2 to 0.5 inches). Kampsville points were made from a variety of local raw materials, and heat treatment is common.

Distribution: Kampsville and similar barbed Late Archaic points are common over much of the Midwest and eastern United States. They seem relatively uncommon in Minnesota.

Age and Associations: In their type area in the Lower Illinois River Valley, Kampsville points are diagnostic of the Kampsville Phase, a Late Archaic sub-period dating from 1250 to 500 B.C.E. (Wiant et al. 2009). They are very similar to the Terminal Archaic barbed points of the Prairie Lake Phase in the American Bottom dating to 1400 to 900 B.C.E. (McElrath et al. 2009).

Similar and Identical Types: Kampsville points should never be confused with Hardin points which are more refined and have sharply angled barbed shoulders, ground stems, and frequent alternate bevel resharpening and edge serration. The Springley, Dryoff, and Mo-Pac points of the Prairie Lake Phase are more or less equivalent. They are also quite similar to Delhi and Wade points of the American Southeast.

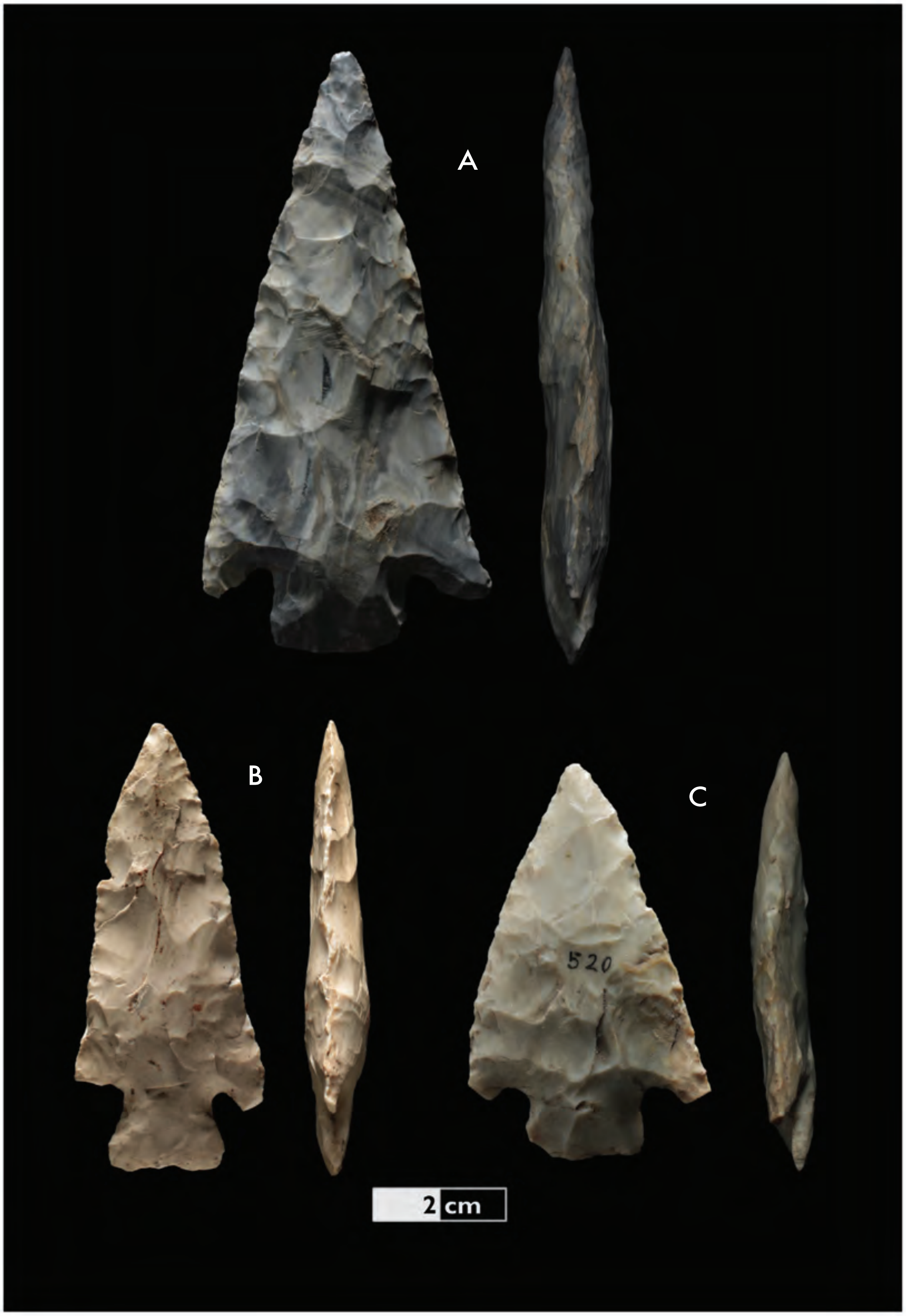


Figure 5.45. Kampsville points. ([A] MHS Artifact: 903.A323.6; unidentified chert; Morrison Co., MN; [B] MHS Artifact: 37.12.2; unidentified chert; Ramsey Co., MN; [C] MHS Artifact: 11.67.2, unidentified chert; Clearwater Co., MN.)

Pelican Lake

Pelican Lake is a projectile point type associated with the Pelican Lake culture first identified by Wettlaufer (1955) in lower cultural zones at the Mortlach Site in south-central Saskatchewan.

Description: This is a medium-sized, well-made point with pronounced corner notches and barbed shoulders (Reeves 1970b:45–47). Pelican Lake points exhibit pressure trimming and retouch over random percussion. The blade is generally triangular with straight to slightly convex edges. These points are typically widest at the shoulders. Stems are short and broad, with the majority at least two-thirds the width of the blade. Bases are straight or slightly convex and are sometimes ground. Since they are usually made of local cherts, Pelican Lake points are highly variable in quality of manufacture and vary widely in some regions in shape and size. Pelican Lake points range from 3 to 8 cm (1.2 to 3 inches) in length.

Distribution: Pelican Lake points are widely distributed throughout the Northern Plains and adjacent areas to the west, north, and south, including Minnesota, where they have been observed in considerable numbers in collections from the western and central part of the state (Bleed 1969:Plate 10 s–v; Johnson 1971:Figure 11a; Johnson 1994:3.30–3.31; Michlovic and Johnson 1995:Figure 3.3G–J; Anfinson 1997:Figure 32A). According to Gregg and Davidson (1985:113), the geographic distribution of Pelican Lake components includes (1) the plains, parklands, and fringes of the southern boreal forest of Alberta, Saskatchewan, and Manitoba, (2) the plains of Montana, the Dakotas, Wyoming, northern Colorado, and Nebraska, and (3) the eastern fringes of the Rocky Mountains of Alberta, Montana, and Wyoming.

Age and Associations: The Pelican Lake complex, with which the Pelican Lake point type is associated, is dated to about 1 to 700 C.E. (Frison 1992:101–111; Foor 1998). Dyck and Morlan (2001) provide a revised age of 1800 B.C.E. to 350 C.E. Syms (1980:364–365) separates corner-notched points dating within circa 1500 B.C.E. to 400 C.E. in southwestern Manitoba into larger, earlier "Archaic Barbed" points (1200 to 100 B.C.E.) and more recent, smaller "Plains Middle Woodland Pelican Lake" points (ca. 400 B.C.E. to 800 C.E.). The more recent points become smaller through time. In general, earlier Archaic varieties have shallower corner notches than Woodland forms have. Syms (1980) argues that the more recent components should be placed within the Plains Woodland tradition because later Pelican Lake populations were affected by Hopewellian contacts. Many Pelican Lake points from Minnesota are made from Knife River Flint, a material that is commonly associated with the Hopewellian Interaction Sphere.

Similar and Identical Types: Gregg and Davidson (1985) note that there "is considerable taxonomic confusion with the Pelican Lake point type and varieties," and cite Syms' distinction between "Archaic Barbed" and "Plains Middle Woodland Pelican Lake" mentioned above. Morrow (1984) mentions an overlap in size and shape between Pelican Lake and Koster points, and Keyser (1979:9) notes a similar overlap with Besant points.

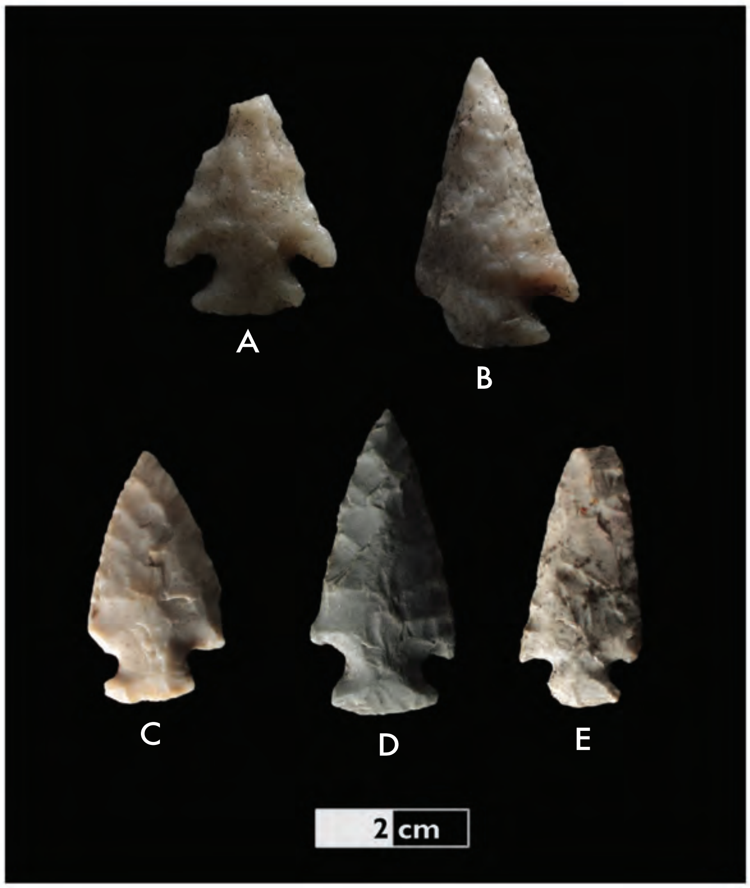


Figure 5.46. Pelican Lake points. ([A] SCHM Artifact: 83.85.149; Hixton Silicified Sandstone; Meeker Co., MN; [B] SCHM Artifact: 83.85.146; heat-treated Swan River Chert; Meeker Co., MN; [C] SCHM Artifact: 83.85.110; heat-treated Prairie du Chien Chert; Meeker Co., MN; [D] SCHM Artifact: 83.85.109; Knife Lake Siltstone; Meeker Co., MN; [E] SCHM Artifact: 83.85.102; heat-treated Maynes Creek Speckled Chert; Meeker Co., MN.)

BESANT

Besant points are named for the Besant phase or culture in Saskatchewan (Wettlaufer 1955; Frison 1978; Reeves 1983).

Description: Besant points are a small to medium, side-notched points. They exhibit random percussion flaking with pressure trimming and retouch. The blades are typically convex sided and widest at or near the shoulders. Shallow side notches create a short stem that is slightly narrower than the blade of the point. Basal corners are characteristically rounded, and the base edge is straight to slightly convex. The bases and stems are commonly ground. Besant points range in length from 2.5 to 6 cm (1 to 2.5 inches). A variety of raw materials were used to make Besant points, and some are heat treated. Many from the Dakotas and western Minnesota are made from Knife River Flint, which was a preferred material in the Middle Woodland period in the Mississippi and Ohio River Valleys.

Distribution: While most common on the High Plains of southern Canada and the northern United States, Besant points are also quite common in Minnesota (Johnson 1971:Figure 11e; Johnson 1973:Plate 22e; Anfinson et al. 1978:Figure 8f; Anfinson 1997:Figure 32C; Johnson 1994:3.48; Michlovic and Johnson 1995:Figures k–m).

Age and Associations: The Besant phase or culture, with which the point type is at least in part associated, is generally dated between about 1 and 700 C.E. (Gregg and Davidson 1985:118; Forbis 1998). Cloutier (2004:16–17) offers a revised age of 500 B.C.E. to 700 C.E. The Besant culture is associated with some of the earliest ceramics (including dentate stamp and punctate decoration) in central and western North Dakota and Samantha points. Samantha points are present in the Red River Valley (Michlovic and Johnson 1995:Figure3.3n–u). It is also a characteristic point type of the Sonota complex in the Dakotas (Neuman 1975). It may be associated with Brainerd ware in northern and central Minnesota.

Comments: The Besant culture subsistence base is thought to have ranged from nomadic bison hunting on the Northwestern Plains to incipient horticulture in the southeastern end of its range, although no domesticated plant foods have been found in Besant components. Partially contemporary with Avonlea, late Pelican Lake, and Laurel, the Besant phase in its eastern expression may have been strongly linked to the Hopewellian Interaction Sphere and to have been the main supplier of Knife River Flint to that exchange system (Clark 1984; Gregg and Davidson 1985:118–121). Many Besant points on the High Plains are made of this material.

Similar and Identical Types: Besant Side-Notched points are similar to Matanzas points, but they are wider and shorter than that point type (Morrow 1984). Samantha points are very similar but are said to be smaller and have corner/side notches rather than side notches. Samanthas are considered here to be within the range of variation for the Besant type.

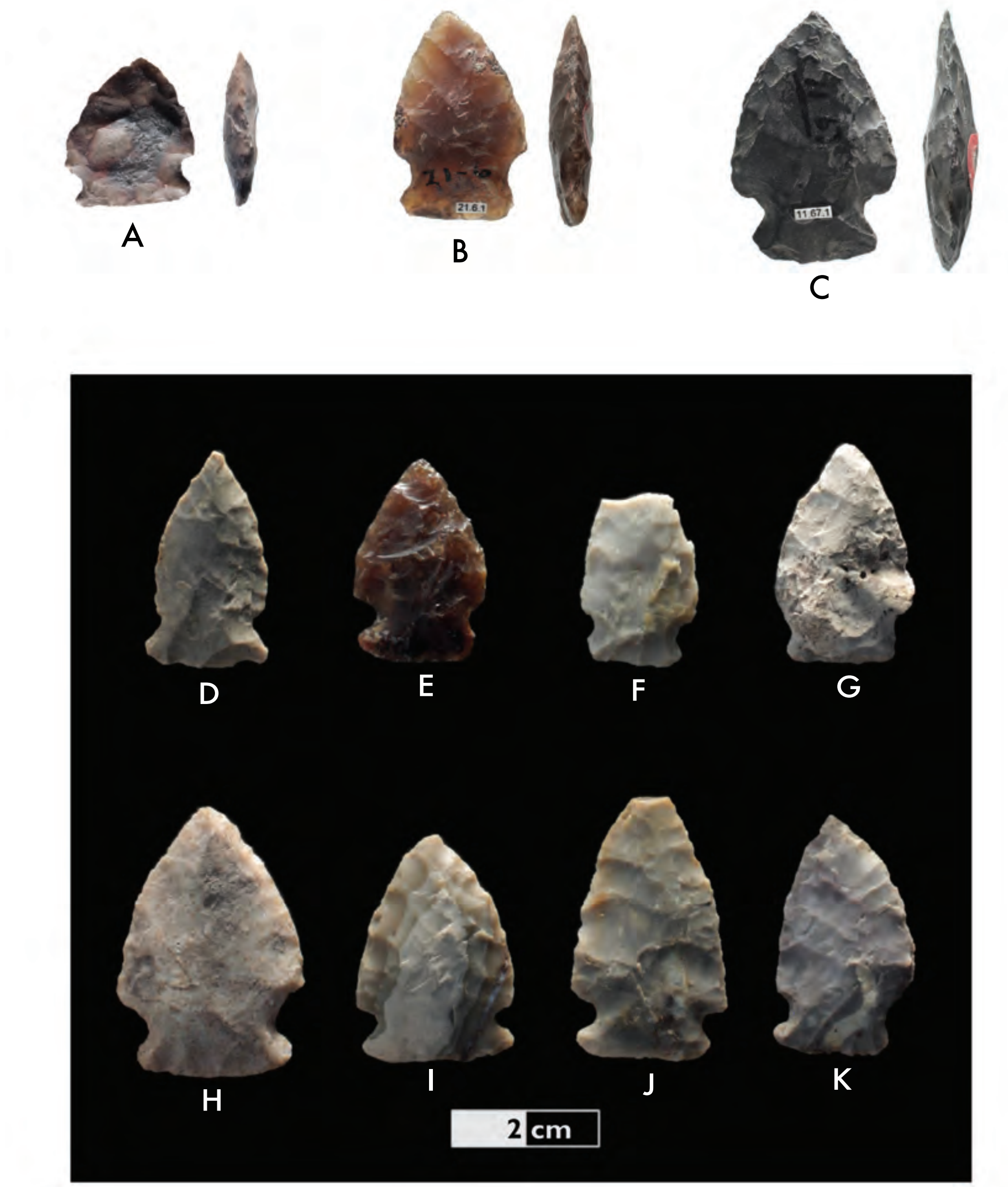


Figure 5.47. Besant points. ([A] SCHM Artifact: 83.85.66; unidentified chert; Meeker Co., MN; ([B] MHS Artifact: 21.6.1; Knife River Flint; Itasca Co., MN; ([C] MHS Artifact: 11.67.1; Knife Lake Siltstone; Clearwater Co., MN; [D] MBISP Artifact: 6789; Knife Lake Siltstone; Freeborn Co., MN; [D] MBISP Artifact: 6789; unheated Prairie du Chien Chert; Freeborn Co., MN; [E] MBISP Artifact: 6858; Knife River Flint; Freeborn Co., MN; [F] MBISP Artifact: 6807; unheated Grand Meadow Chert; Freeborn Co., MN; [G] MBISP Artifact: 6931; heat-treated Galena Chert; Freeborn Co., MN; [H] MBISP Artifact: 6682; heat-treated Prairie du Chien Chert; Freeborn Co., MN; [I] MBISP Artifact: 6692; unheated Grand Meadow Chert; Freeborn Co., MN; [J] MBISP Artifact: 6782; unheated Grand Meadow Chert; Freeborn Co., MN; [K] MBISP Artifact: 6739; unheated Grand Meadow Chert; Freeborn Co., MN.)

Turkey Tail

Turkey Tail points are so named because of the typical shape of their bases that resemble the tail of a dressed turkey.

Description: This is a thin, broad, well-made, medium to large point or, rather, a refined biface (Bell 1958:90; Justice 1987:173–178). They are often very thin for their size with width to thickness ratios approaching 10:1 or 12:1. Blades were thinned by intersecting percussion flake scars and finished with marginal pressure retouch. In side view, they often have a slightly curved or twisted appearance, but they are nonetheless remarkably thin. They have an overall leaf-shaped planview and are bi-pointed. There is frequently a small remnant of nodular cortex at one or both ends. A pair of small side notches is generally placed close to one of the pointed ends. Some examples have two pairs of notches. Another variation has wider indentations forming a tapering, pointed stem. In Goldstein and Osborn's (1988:34) Wisconsin sample, they range in length from 9.2 to 27.4 cm (3.6 to 10.7 inches), in width from 3.8 to 8.3 cm (1.5 to 3.2 inches), and in thickness from 0.4 to 0.7 cm (0.1 to 0.3 inches). Turkey Tail points are usually made of a high-quality gray chert commonly known Indiana Hornstone or Harrison County Flint (Wyandotte Chert) from southern Indiana, but Cobden Chert from southern Illinois and similar blue gray cherts from Kentucky were also used. Rarely, high-quality stone of other another color was used, but the vast majority of Turkey Tails are stereotypically gray to blue gray.

Distribution: Turkey Tail bifaces have been found most frequently in the Ohio River Valley and are present in very small numbers in other Midwestern states. In Minnesota, they are restricted with some exceptions (Stearns, Lyon, and Pine Counties) to the southeastern corner of the state. Morrow (1984) reports that those found in Iowa come from the eastern part of the state where they are also rare.

Age and Associations: Most site contexts indicate that Turkey Tail points date to the Late Archaic (2000/1500 to 500 B.C.E.) period (DeRegnaucourt 1991:213). In the Midwest, they are firmly associated in with the Red Ocher complex (Cole and Deuel 1937). This complex was long thought to be exclusively Late Archaic in age because Red Ocher burials lack pottery. It is now widely recognized that Red Ocher is a mortuary component of Early Woodland societies. Pleger and Stoltman (2009) give a date range of 1200 to 500 B.C.E. for the Red Ocher complex.

Comments: Turkey Tails are most frequently found in mortuary and cache contexts. They may have had somewhat of a more symbolic, ritual, or trade function. For reasons unknown, they are almost always made of gray to blue gray chert.

Similar or Identical Types: In their classic form, Turkey Tails are unmistakable. Caches of bi-pointed bifaces similar in every respect to Turkey Tails, except that they lack the notches or a stem, are also found in the Midwest. See Justice (1987) and Didier (1967) for detailed discussion of Turkey Tail varieties. The example shown here is small for a Turkey Tail; it was made on a thin flake and has a blunt rather than pointed end. Interestingly, it is made of gray Grand Meadow Chert.

Figure 5.48. Turkey Tail. (MBISP Artifact: unheated Grand Meadow Chert, Freeborn Co., MN.)

KRAMER

Kramer points are named for examples found in Illinois (Perino 1968).

Description: These are medium-sized, relatively narrow points with straight stems. The blades are covered with random percussion scars with some pressure work but can exhibit overall good workmanship. The blades are generally convex and elongated. The shoulders are weak to moderately pronounced. The straight-sided stems are generally longer than they are wide and have a straight or slightly convex basal edge. Basal corners may be sharp or rounded. A peculiar feature that seems to be isolated to Early Woodland stemmed points of the Upper Mississippi River Valley is the production of the stem by alternate unifacial retouch; that is, the stems were made in a fashion that they resemble the resharpened blades of Early Archaic points and knives and have a rhomboidal cross section. This feature is seen most frequently on Kramer points but also occurs on contracting stem Adena and Waubesa points. Basal grinding is present on a minority of Kramer points. Kramer points range in length from 4.1 to 10 cm (1.6 to 4 inches), in width from 1.7 to 3.4 cm (0.7 to 1.3 inches), and in thickness from 0.6 to 0.9 cm (0.2 to 0.5 inches). Kramer points were made from a variety of raw materials and cherts were commonly heat treated.

Distribution: Kramer points are common throughout the Midwest, including eastern Iowa and southeastern Minnesota.

Age and Associations: In Illinois, Kramer points are often found with Marion Thick Early Woodland pottery. Munson (1966, 1982) considers both artifact types part of the non-mortuary aspect of the Late Archaic Red Ocher complex. This, of course has lead to considerable confusion. For years, Red Ocher has been thought of as an exclusively Late Archaic phenomenon because Red Ocher burials lack pottery. It is now fairly well recognized that Red Ocher is the mortuary component of the earliest Early Woodland period in the upper Midwest. Kramer points date to circa 1000 to 500 B.C.E.

Similar and Identical Types: Kramer points are narrower than Robbins points. Caution should be exercised so that seemingly well-made Kramer points are not misidentified as Scottsbluff or Alberta points.

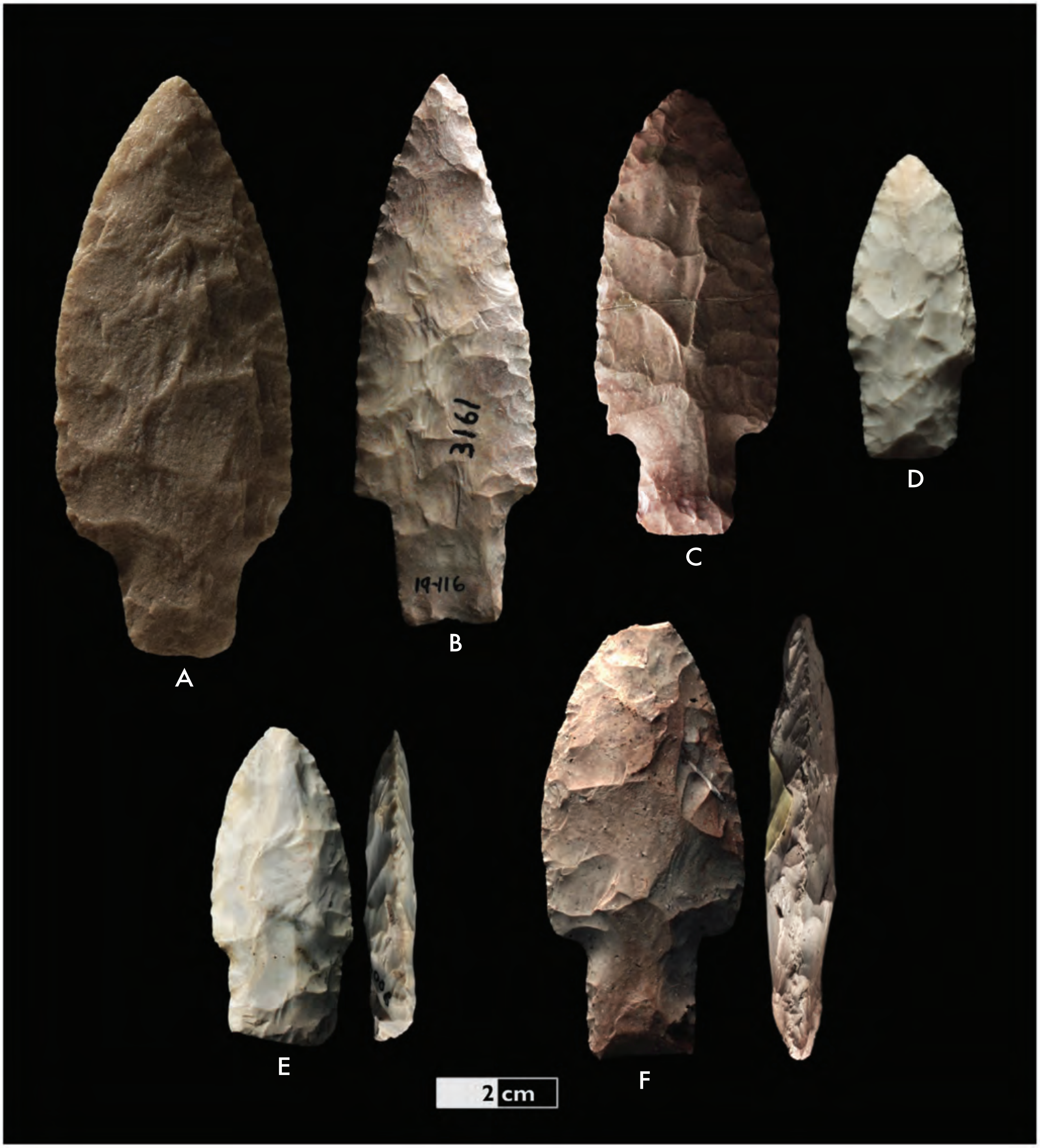


Figure 5.49. Kramer points. ([A] MHS Artifact: 37.13.3; silicified sandstone; Ramsey Co., MN; [B] MHS Artifact: 19.116 3161; unheated Burlington Chert, patinated; Hennepin Co., MN; [C] MHS Artifact 15.2.2; heat-treated Galena Chert; Fillmore Co., MN; [D] Glynn Collection: unheated Burlington Chert; Rice Co., MN; [E] MBISP Artifact: 24006; unheated Prairie du Chien Chert; Freeborn Co., MN; [F] MBISP Artifact: 7204; heat-treated Galena Chert; Freeborn Co., MN.)

ROBBINS

Robbins points are named for the Robbins Mound in Boone County, Kentucky.

Description: Robbins is a medium to large, broad-bladed point with pronounced shoulders and a generally straight stem (Perino 1971:82; Morrow 1984:48; Justice 1987:186–189). Workmanship is often fairly good but consists of a mix of random percussion with some pressure retouch and trimming. The maximum width is at or slightly above the shoulder. The blades are generally broad and convex. The shoulders are pronounced and are at right angles or nearly so. The stems are proportionately narrower and sometimes longer than they are wide, and they are parallel sided to slightly tapered. The basal edge is straight to convex. Basal grinding is usually absent but may be present on some specimens. Robbins points typically range in length from 5 to 10 cm (2 to 4 inches), in width from 2.5 to 5.5 cm (1 to 2 inches), and in thickness from 0.6 to 1.1 cm (0.2 to 0.4 inches). They are usually made of high-quality raw materials or alternatively on lower-quality, locally obtained cherts that were commonly heat treated.

Distribution: Robbins points are found throughout the Midwest, though they have a possible core area in Indiana, Ohio, Kentucky, and Pennsylvania. Their western distribution is not well known, but they are fairly common in eastern Iowa. They have also been found in the Northeast. In Minnesota, they have been found in sites across the southern part of the state.

Age and Associations: Robbins is an Early to Middle Woodland period point type with a probable age range somewhere between 500 B.C.E. and 200 C.E. (Justice 1987:188). They are diagnostic of the late Adena complex in Ohio and adjacent areas.

Comments: Robbins points are often considered a late Adena style. The gradual transition from Adena Stemmed to Robbins involved a shift from narrow ovate-based forms to wide-bladed, straight-stemmed forms. Earlier Robbins points have excurvate or ovate stem margins with slight indentations below the shoulders, as do earlier Adena Stemmed points. Robbins points on the more recent end of the scale have the sloping shoulder trait and straight or slightly expanding stems. They grade into Middle Woodland Synders points.

Similar and Identical Types: Robbins points are identical to Liverpool Stemmed in Illinois, and are similar to Adena points from which they developed.

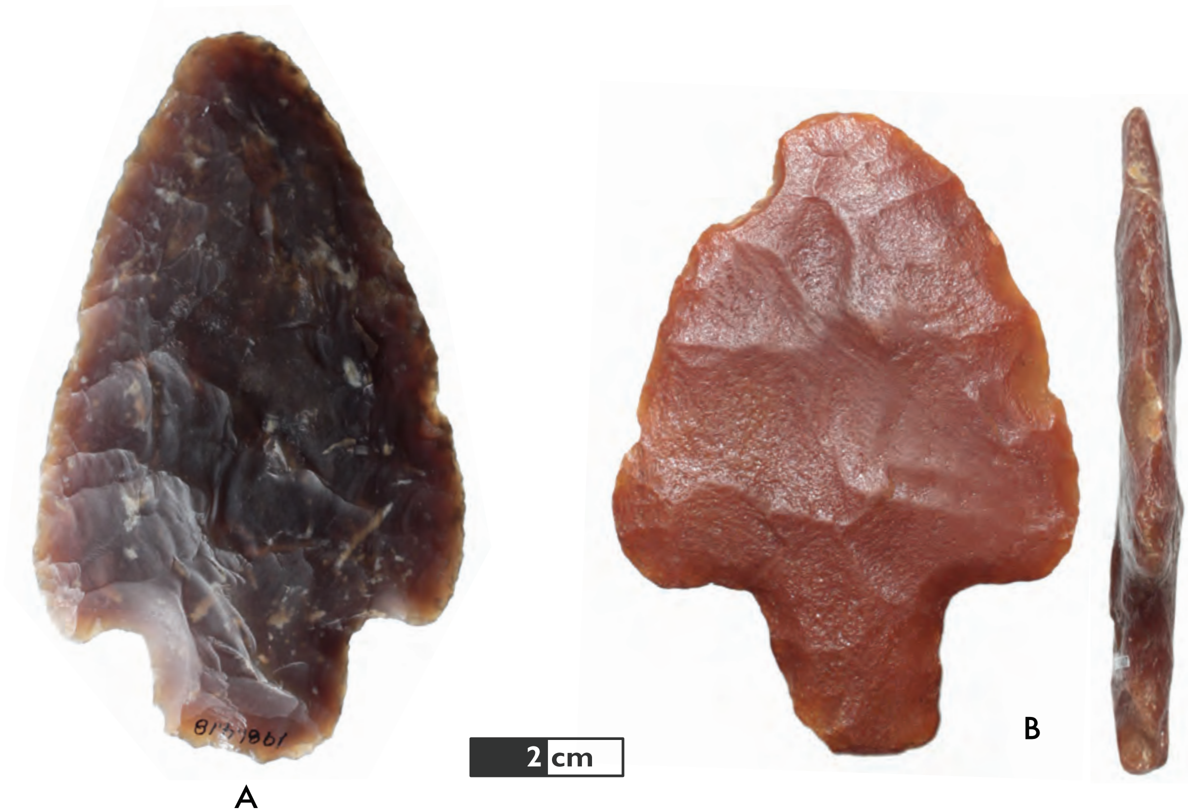


Figure 5.50. Robbins points. Note extensive surface abrasion on B. ([A] MHS Artifact: 1981.4.18; Knife River Flint; unknown provenience; [B] MHS Artifact: 2177.A1407; Hixton Silicified Sandstone; Ramsey Co., MN.)

ADENA

Adena points are named for their association with the Early Woodland Adena Culture (Bell 1958).

Description: Adena points are large to medium sized Contracting stem points. They have a flaking pattern of random percussion with pressure retouch but some are fairly well made. Blades are most typically excurvate and elongated with weak or near-ninety-degree shoulders. The stems are usually more than half as wide as the blade. Stereotypical Adena points have a stem that is somewhat parallel sided for part of its length then tapers abruptly to a rounded base. The base may be ground but often is not. In the western Great Lakes, length generally ranges between about 6.4 to 11.4 cm (2.5 and 4.5 inches), and width ranges between 2.5 to 5 cm (1 and 2 inches). Adena points were made from a variety of materials with some examples made of exotic Burlington Chert, Cobden Chert, Wyandotte Chert, or Hixton Silicified Sandstone. Those made of local cherts are often heat treated.

Distribution: This common point type is found throughout the Midwest and portions of the Southeast. In Minnesota, they appear to be most common in the southern and eastern part of the state.

Age and Associations: Adena points are found in Early Woodland Adena Culture contexts that date from 800 to 200 B.C.E. in Ohio, Indiana, Kentucky, and West Virginia (Justice 1987). In Tennessee the point type has apparently been found at Late Archaic sites (Kneberg 1956).

Comments: In general, Adena points are longer than Waubesa points, have a less distinct shoulder, and are widest just below the midpoint of the length of the blade rather than at the shoulder. They are also considered identical to Mason Contracting Stem in Illinois and Adena Narrow Stemmed in Alabama.

Similar or Identical Types: Adena points are very similar to Waubesa points (DeRegnaucourt 1991:217) or at least difficult to distinguish from them. Adena are also similar to Mason points in Illinois (Montet-White 1968) and Gary points in the southeastern United States (Bell 1958).

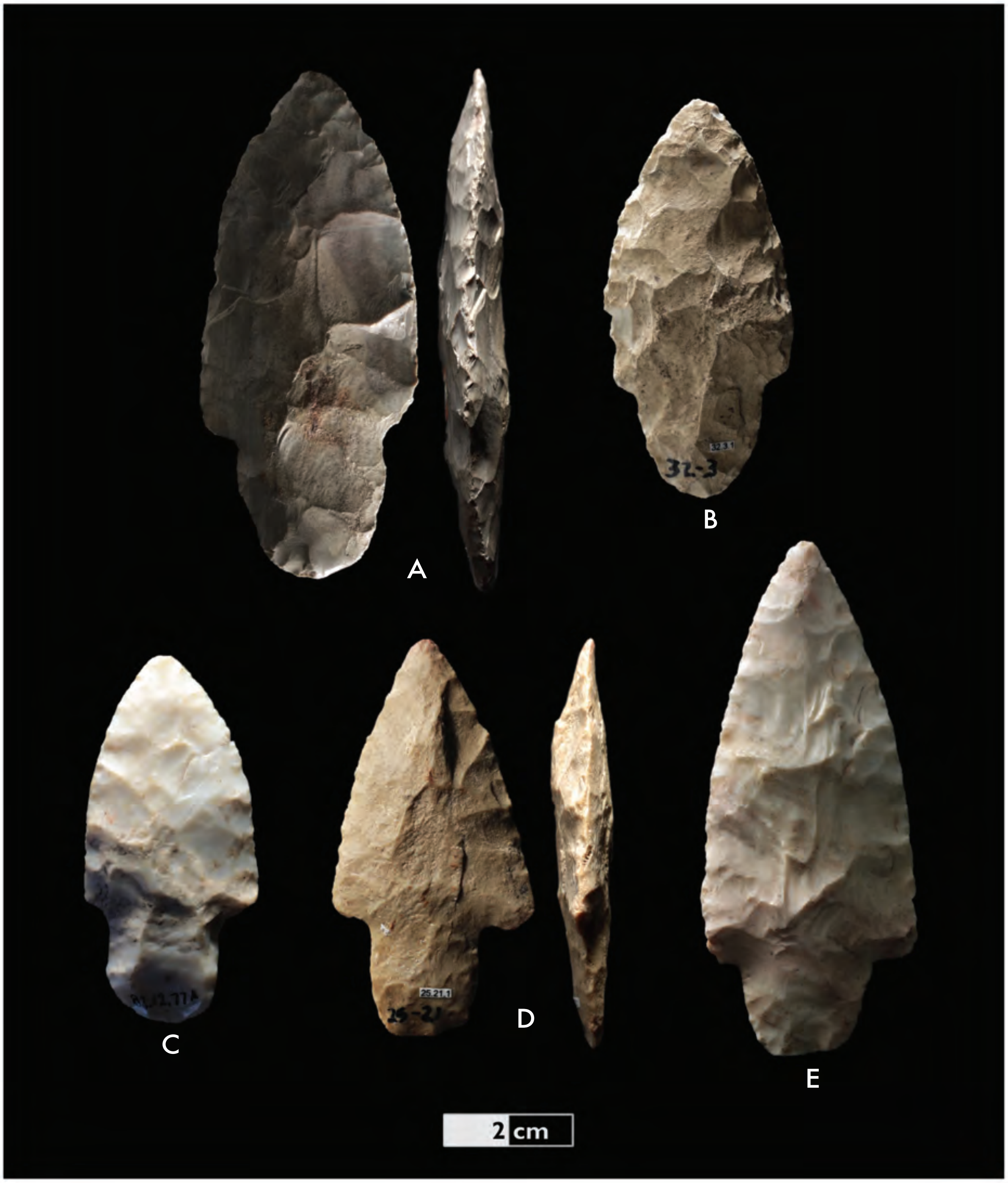


Figure 5.51. Adena points. ([A] MHS Artifact: 4626; unidentified chert; Kathio, Mille Lacs Co., MN; [B] MHS Artifact: 32.3.1; unheated Blanding Chert; Olmstead Co., MN; [C] SCHM Artifact: 82.12.77A; heat-treated Burlington Chert; Morrison Co., MN; [D] MHS Artifact: 25.21.1; unidentified chert; Le Sueur Co., MN; [E] MHS Artifact: 902.A22.3; heated Burlington Chert; Fillmore Co., MN.)

WAUBESA

Waubesa points are named for Lake Waubesa near Madison Wisconsin (Ritzenthaler 1967).

Description: Waubesa points are medium to large contracting-stem points. They exhibit random percussion flaking with some pressure retouch and trimming. Quality of workmanship varies widely. Blades are often elongated and can have convex or straight edges. Shoulders are usually sloping and weak but can range to being more barbed and prominent. The contracting stems taper evenly from the shoulder/stem juncture down to a rounded to nearly pointed base. Bases are only occasionally ground. Goldstein and Osborn's (1988:44) Wisconsin sample ranges from 5 to 10 cm (2 to 4 inches) in length, 2.5 to 4 cm (1 to 1.5 inches) in width, and 0.7 to 1.0 cm (0.3 to 0.4 inches) in thickness. Waubesa points were made from a wide range of raw materials and heat treatment was common.

Distribution: Waubesa points are a common type of point in Wisconsin, Iowa, and southern Minnesota. They are present in collections throughout southern Minnesota (Anoka, Brown, Cottonwood, Freeborn, Kandiyohi, Meeker, Morrison, Redwood, Stearns, and Wright Counties).

Age and Associations: Goldstein and Osborn (1988:44) consider Waubesa to be a Late Archaic through Middle Woodland point type in Wisconsin. Morrow (1984:53) confines the type more narrowly to Early and Middle Woodland times in Iowa (500 B.C.E. to 500 C.E.). While similar Gary points in the southeastern United States are often found in Late Archaic contexts, this does not seem likely for Waubesa points. A slightly more restricted timeframe of 500 B.C.E. to 300 C.E. is proposed here.

Similar or Identical Types: Similar or identical types include Adena Stemmed (Ohio-Kentucky area; Justice 1987), Mason Contracting Stem (Montet-White 1968), Adena Narrow-Stemmed (Cambron and Hulse 1964), Gary (Bell 1958), and Dickson (Montet-White 1968).

Figure 5.52. Waubesa points. ([A] MHS Artifact: 872.A297.2; heat-treated Burlington Chert; Winona Co., MN; [B] MHS Artifact: 48.6 3122; heat-treated Burlington/Keokuk Chert; Yellow Medicine Co., MN; [C] MHS Artifact: 902.A322.5; rhyolite; Fillmore Co., MN.)

DICKSON

This point type is named for examples found at the Dickson Site in Fulton County, Illinois.

Description: Dickson points are a medium to large point type with a wide, triangular blade, prominent shoulders, and a contracting stem (Montet-White 1968; Perino 1968). They commonly exhibit a flaking pattern of random percussion with marginal pressure retouch. Larger examples are relatively thin and have flattened cross sections. The blades are often very triangular in shape. Shoulders are wide and may be slightly sloping, straight or very slightly barbed. The stems are generally about half the width of the blade, but this can vary with point resharpening. Some Dickson points, especially the larger ones that were likely used as knives, exhibit alternate bevel resharpening analogous to that seen on Early Archaic point and knife types. Bases and stems are often moderately ground. Dickson points range in length from 5 to 15 cm (2 to over 6 inches) and in width from 4 to 8 cm (1.5 to 3 inches). These points are frequently made from raw or heat-treated Burlington Chert and Cobden Chert.

Distribution: The distribution of points of this type is concentrated in Illinois, but they are also present in Missouri, Michigan, Wisconsin, and the eastern third of Iowa. In Minnesota, they occur across the southern and central part of the state as far west as Kandiyohi and Redwood Counties (Gibbon 1975a:Plate 2a).

Age and Associations: Dickson points are an Early to Middle Woodland type that is thought to date between about 500 B.C.E. and 350 C.E. In Illinois at least, Dickson points are associated most frequently with Havana tradition assemblages.

Similar and Identical Types: Dickson points are usually wider than other contracting-stem points, but this can be considerably altered by point resharpening, in which case they can resemble both Adena and Waubesa points.

Figure 5.53. Dickson points. ([A] MHS Artifact: 1984.41.19.28; heat-treated Burlington Chert; Benton Co., MN; [B] MBISP Artifact: 6582; heat-treated Burlington Chert; Freeborn Co., MN; [C] MBISP Artifact: 6599; unheated Burlington Chert; Freeborn Co., MN.)

SNYDERS

Snyders points are named for the Snyders Site in Calhoun County, Illinois.

Description: These are a medium to large, broad-bladed, corner-notched point type with typically well-executed but random percussion flaking and marginal pressure retouch (Bell 1958; Montet-White 1968). The blades are distinctly convex and ovate. They are widest at or slightly above the barbed shoulders. The corner notches are wide and deep and somewhat rounded. The stem is generally one-half to one-third of the width of the entire point. Stems tend to be shorter than they are wide. The basal corners may have a slight flare or small projections. The basal edge is convex to straight. Basal grinding is characteristically absent. Snyders points are typically large points. They range from 5 to 15.2 cm (2 to 6 inches) in length, 5 to 10 cm (2 to 4 inches) in width, and 0.5 to 1.1 cm (0.2 to 0.4 inches) in thickness. Snyders points are sometimes made of locally available cherts but are more frequently made of exotic raw materials like raw or heat-treated Burlington Chert, Cobden Chert, Knife River Flint, and Hixton Silicified Sandstone.

Distribution: Snyders Corner-Notched points are common throughout the Midwest and in the eastern half of Iowa. Occasional examples are found more widely scattered throughout the Eastern Woodlands and along the eastern edge of the Plains. In Minnesota, they have been found in areas as far apart as Big Stone County on the state's western border, the Rainy River in the far north, and Freeborn County in the state's southeastern corner (Landon and Flaskerd 1945:Plate C9).

Age and Associations: Snyders points are an iconic artifact of the Middle Woodland Havana Hopewell tradition. This is commonly dated between about 200 B.C.E. and 200 C.E.

Comments: Many authorities consider Snyders points to be knives or scrapers because of their size and width. However, impact fractures are seen on a few classic examples, proving their use as projectile tips.

Similar and Identical Types: Snyders points are fairly distinctive, but other Hopewell cluster point types do grade into each other and into the Snyders form itself. Manker points are essentially smaller, cruder versions of Snyders points. With sufficient reworking and resharpening Snyders points can resemble Steuben points. Earlier Robbins points seem to have an evolutionary relationship to the Snyders form. North blades are usually thought of as preforms for Snyders points.

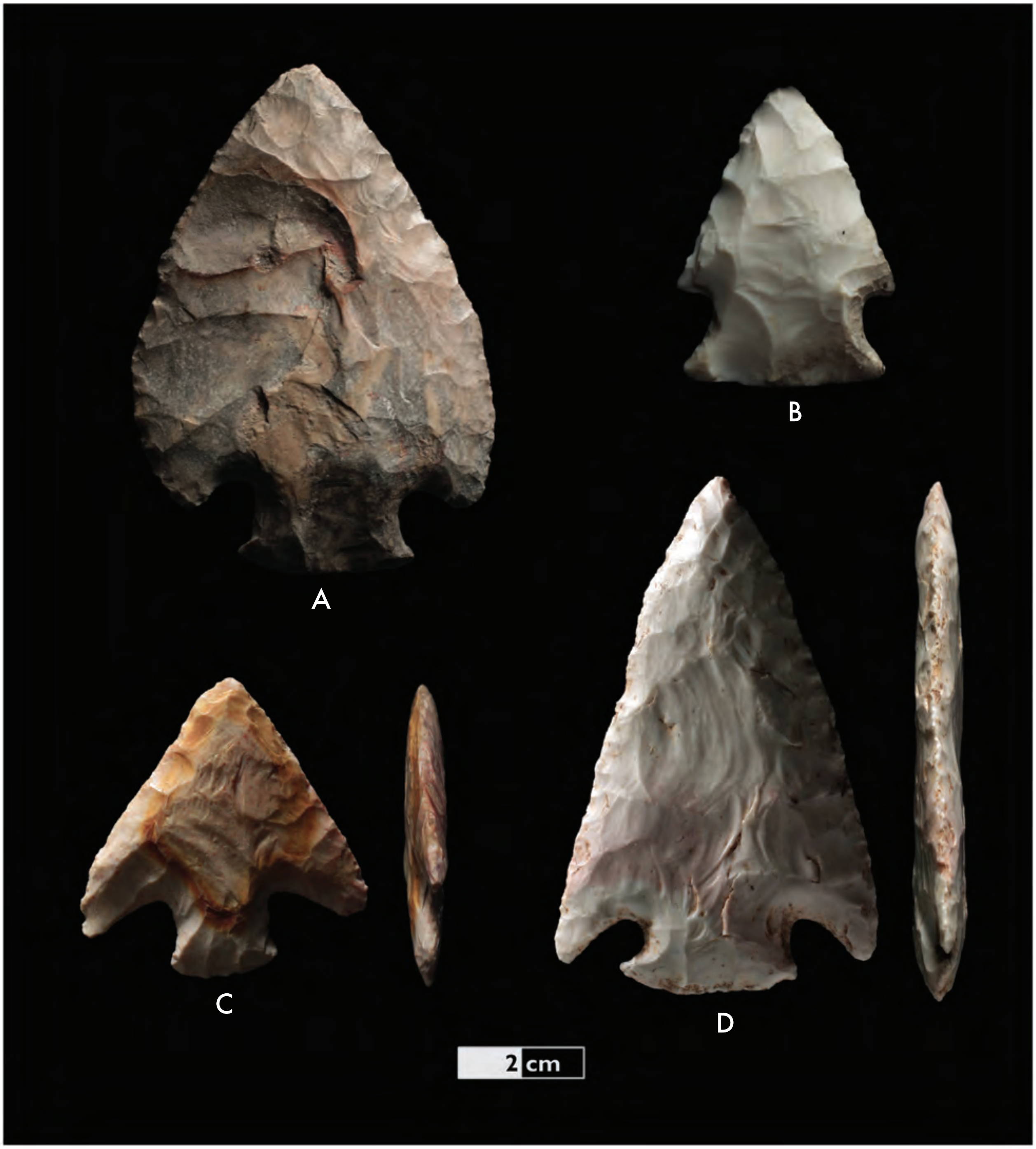


Figure 5.54. Snyders points. ([A] MHS Artifact: 4845.1; heat-treated Burlington/Keokuk Chert; Todd Co., MN; [B] Glynn Collection: unheated Burlington Chert; Rice Co., MN; [C] MHS Artifact: 19.86; heat-treated Burlington Chert; Hennepin Co., MN; [D] MHS Artifact: 2.3; heat-treated Burlington Chert; Anoka Co., MN.)

MANKER

Manker points were named by Montet-White (1968) after the Manker Site in Illinois.

Description: Manker is a medium-sized, corner-notched to stemmed point that looks like a smaller, thicker, less refined Snyders point (Montet-White 1968; Morrow 1984:73). Blade surfaces were roughly flaked by percussion with marginal pressure retouch. Blade and base edge are generally convex. They can be somewhat asymmetrical. Montet-White (1968) identified both corner-notched and expanding stemmed varieties. Like other Hopewell cluster types, the notches in Manker points tend to be broad and deep. Basal grinding is characteristically absent. The length of Manker points ranges from about 4 to 8 cm (1.5 to 3 inches), and width ranges from 2.5 to 5 cm (1 to 2 inches). In comparison, Snyders points range from about 5 to 15.2 cm (2 to 6 inches) in length and 5 to 10 cm (2 to 4 inches) in width. Manker points are made from the same range of local and exotic raw materials as Snyders points with locally available stone being more prevalent. Heat treatment of cherts is common.

Distribution: Manker points has been found in many areas of the Midwest, including the Ohio and Mississippi River Valleys, central and northern Illinois, southwest Michigan, eastern Iowa, and eastern Missouri. They are rare in southern Wisconsin.

Age and Associations: This is a Middle Woodland Hopewell type that dates between about 200 B.C.E. and 200 C.E. In Illinois Manker points are part of the Havana Hopewell tradition, and in Wisconsin it is associated with the Trempealeau Phase.

Similar and Identical Types: Manker points resemble smaller, cruder versions of Snyders points.

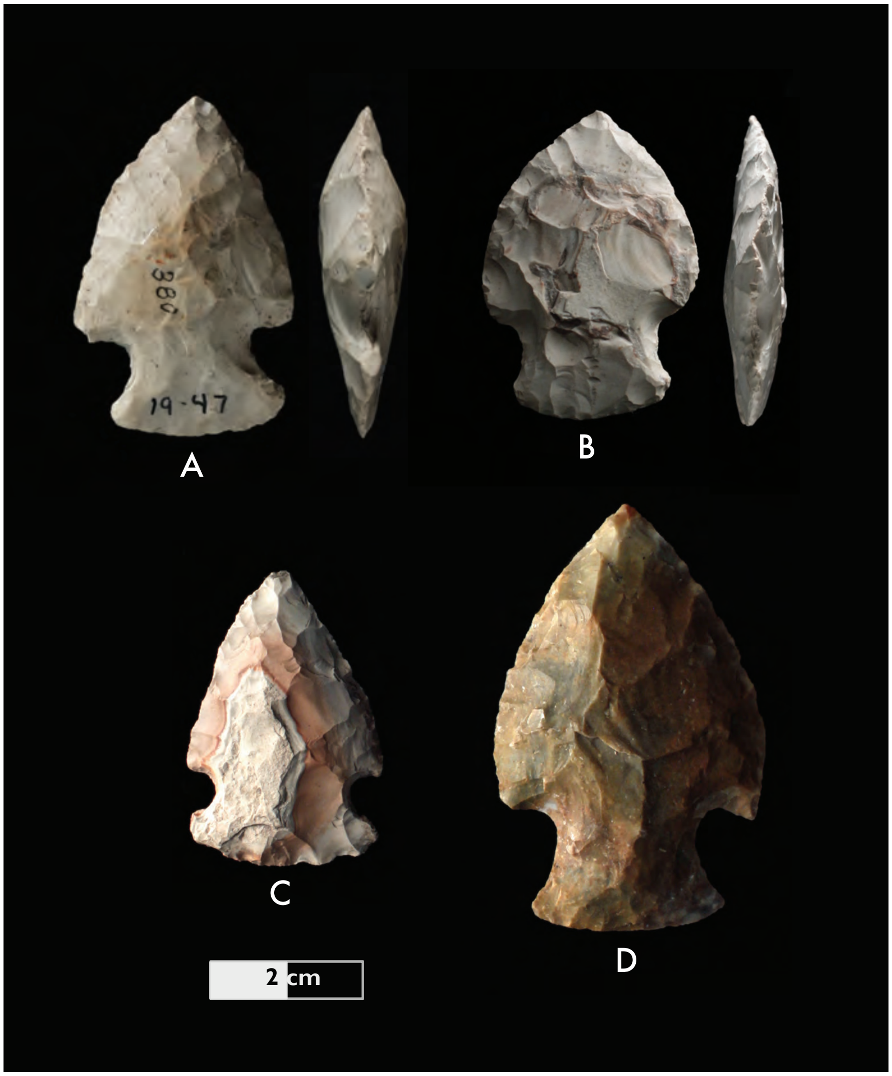


Figure 5.55. Manker points. ([A] MHS Artifact: 19.47; unidentified chert; Hennepin Co., MN; [B] MHS Artifact: 8738; heat-treated Croton Tabular Chert; Dodge Co., MN; [C] MBISP Artifact: 6828; heat-treated Croton Tabular Chert; Freeborn Co., MN; [D] MBISP Artifact: 6874; unidentified chert; Freeborn Co., MN.)

GIBSON

Gibson points are named for the Klunk-Gibson Mounds near Kampsville in Calhoun County, Illinois (Montet-White 1968; Perino 1968).

Description: Gibson points are medium-sized points with bold side notches and a convex base (Montet-White 1968; Perino 1968). They exhibit random percussion flaking with marginal pressure retouch. Their blades are often elongated and have convex edges. They are usually widest at the shoulders just above the notches. The side notches are deep and rounded. They create a wide stem with a markedly convex, almost rounded base. Basal grinding is characteristically absent. Gibson points range from 4 to 10 cm (1.5 to 4 inches) in length and 3 to 5 cm (1.2 to 2 inches) in width. Gibson points are made of a variety of materials, and many are heat treated. Examples made of exotic raw materials like heat-treated Croton Tabular Chert are known from Minnesota.

Distribution: This is a common point in Illinois, Missouri, the eastern third of Iowa, and southern Wisconsin. They are found in small numbers in southern Minnesota.

Age and Associations: In Illinois, these points are associated with the Middle Woodland Havana tradition and date to circa 200 B.C.E. to 200 C.E.

Similar and Identical Types: Gibson points blend morphologically into other Hopewell cluster point types such as Steuben points and Norton points.

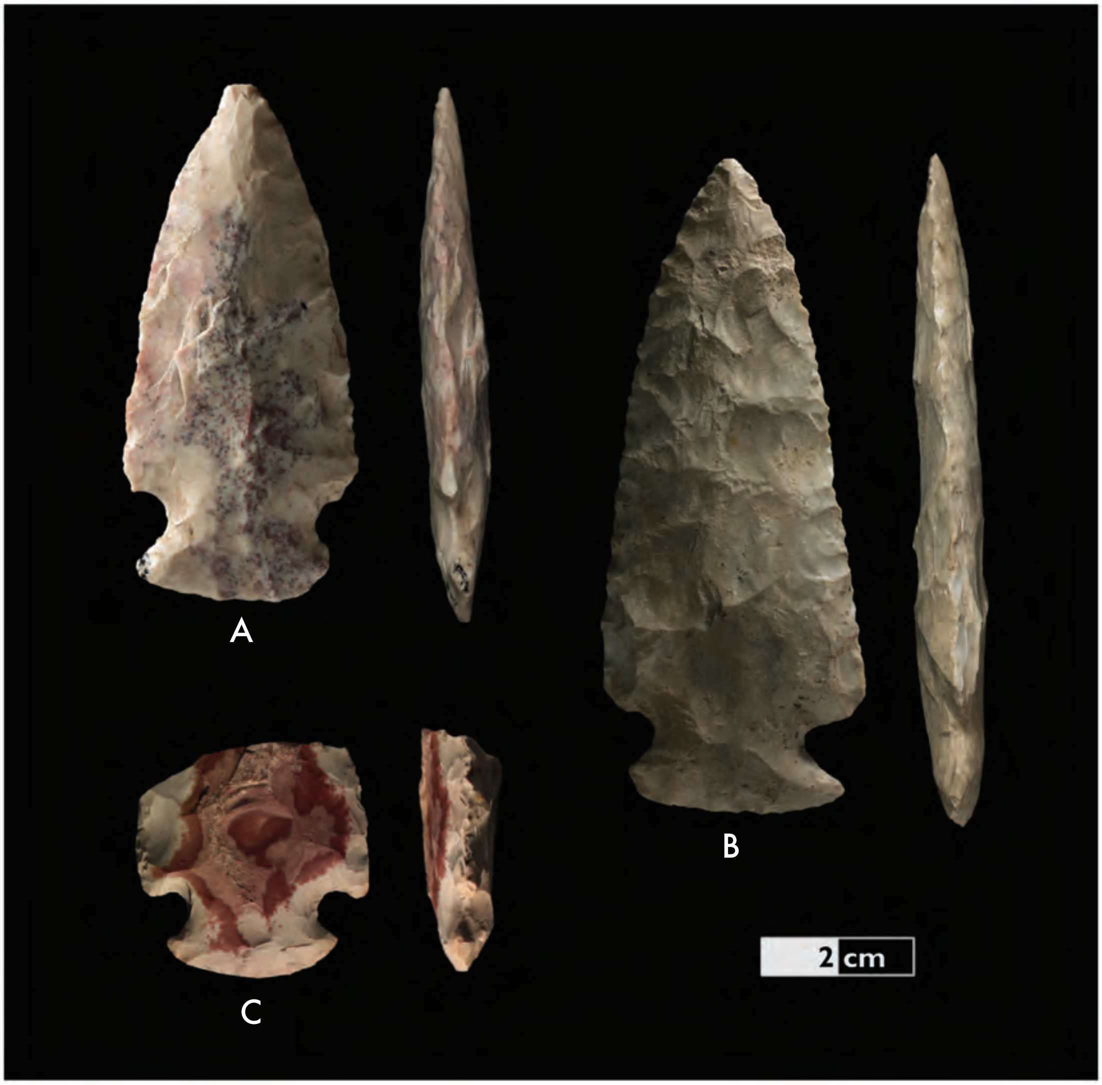


Figure 5.56. Gibson points. ([A] MHS Artifact: 67.188.A74.1; heat-treated Burlington Chert; unknown provenience; [B] MHS Artifact: 45.7 1802; unheated Galena Chert; Wabasha Co., MN; [C] MBISP Artifact: 19513; heat-treated Croton Tabular Chert; Freeborn Co., MN.)

STEUBEN

Steuben is named for the Steuben Site in Illinois (Morse 1963; Montet-White 1968; Perino 1968).

Description: This is a medium-sized point with an expanding stem (Montet-White 1968; Perino 1968). They exhibit random percussion flaking with marginal pressure retouch. Their blades are generally triangular to ovate and are widest at or near the shoulders. The shoulders are more or less perpendicular to the long axis of the points. The expanding or flaring stems are nearly as wide as the blade of the point. The basal edge is straight to convex, and basal grinding is characteristically absent. Steuben points range from 4 to 10 cm (1.5 to 4 inches) in length and 3 to 5 cm (1.2 to 2 inches) in width. Steuben points are often made of locally available cherts and may be heat treated, but some exotic materials such as raw and heat-treated Burlington Chert and heat-treated Croton Tabular Chert are represented.

Distribution: This is a common point in Illinois, Missouri, the eastern third of Iowa, and southern Wisconsin. Closely related varieties are present more widely eastward into the state of New York. In Minnesota, Steuben Expanded-Stemmed points appear in small numbers in collections from the southern part of the state.

Age and Associations: In Illinois, these points are associated with the Middle Woodland Havana tradition and dated to circa 100 to 500 C.E. Varieties such as Lowe Flared-Base are also considered late Middle Woodland in age (e.g., DeRegnaucourt 1991:239). In Wisconsin, they are associated with the Millville Phase and dated to about 300 to 500 C.E., which also falls within the late Middle Woodland or Middle/Late Woodland transitional period.

Similar and Identical Types: Steuben points are very similar or identical to Chesser Notched, Lowe Flared-Base, McCoy Corner-Notched, Bakers Creek, and Monona Stemmed (e.g., Hurley 1974; Justice 1987:208–214; Boszhardt 2003). Some of these names may simply be regional expressions for the same general type.

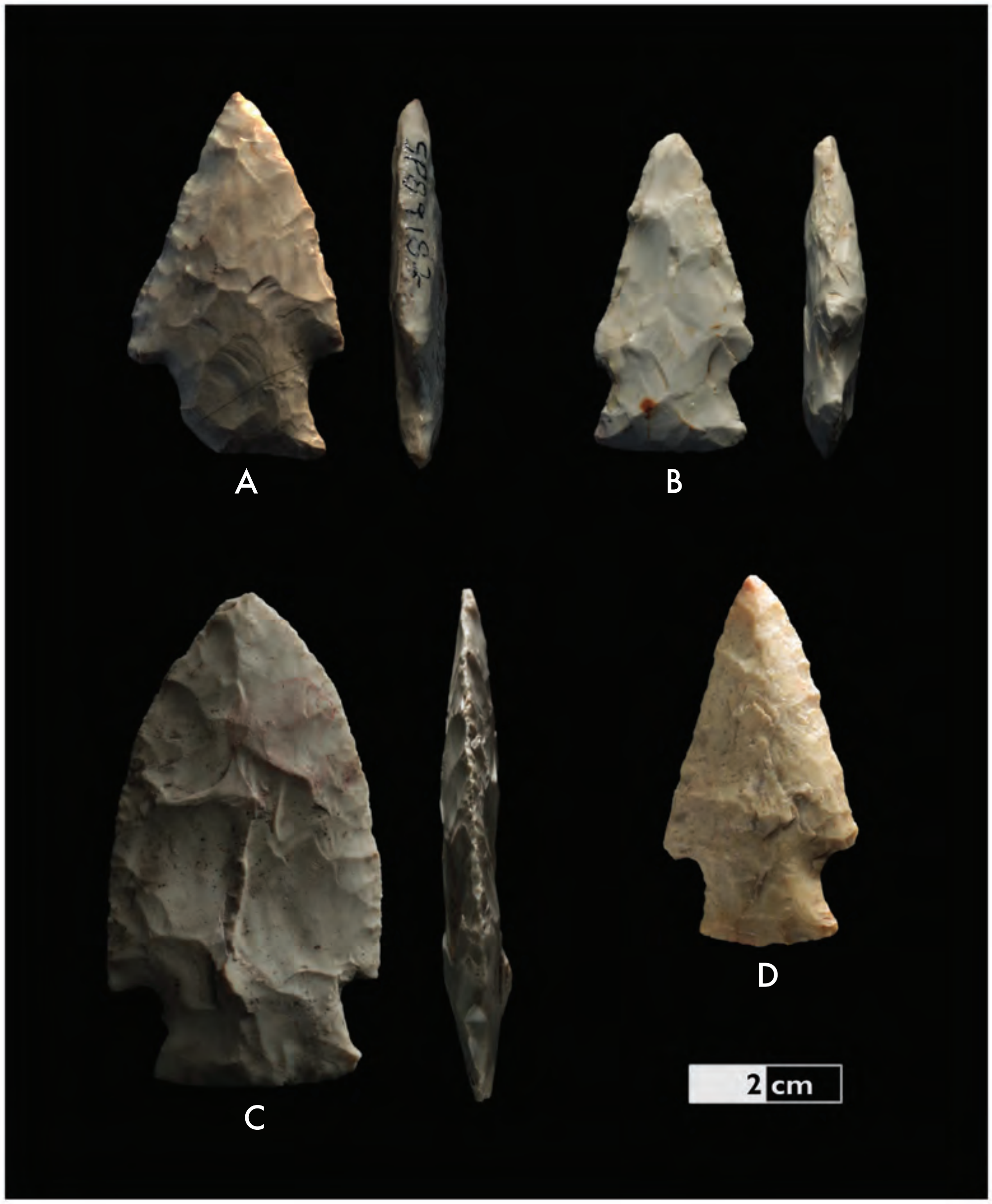


Figure 5.57. Steuben points. ([A] MBISP Artifact: SP89182; unheated Burlington Chert; MN; [B] MBISP Artifact: SP89111; unheated Burlington Chert; unknown provenience; [C] MHS Artifact: 37.12.8; unheated Burlington Chert; Ramsey Co., MN; [D] MHS Artifact: 11.68.1; unheated Prairie du Chien Chert; Mille Lacs Co., MN.)

AVONLEA

Avonlea is a Northern Plains early-middle Late Woodland period point type named for the Avonlea site in southwestern Saskatchewan (Kehoe and McCorquodale 1961).

Description: This is a small, thin, triangular projectile point with well-made side notches placed close to the base. Avonlea points often exhibit refined pressure flaking and are quite thin. These are elongated to squat triangular points that are widest at the base. Notches are small but distinct and often moderately deep. These notches are placed low on the sides and very near the basal corners. In fact, some Avonlea points grade into being corner notched. Reeves (1983) describes corner-notched Avonlea points as the "Head Smashed In" variety. The basal edge is usually slightly to moderately concave but may be nearly straight. A sample of 176 points from the Northwestern Plains ranged in length from 1.2 to 3.8 cm (0.5 to 1.5 inches), in width from 0.9 to 1.8 cm (0.4 to 0.7 inches), and in thickness from 0.2 to 0.4 cm (0.1 to 0.2 inches) (Kehoe and McCorquodale 1961:184). Avonlea points are made of a wide range of raw materials, including good-quality stone like Grand Meadow Chert and Knife River Flint and tougher materials like heat-treated Swan River Chert.

Distribution: Most Avonlea points are found in the Northwestern Plains (i.e., southwestern Saskatchewan, southeastern Alberta, and north-central Montana). However, smaller numbers are present across the Northern Plains into Northwestern Iowa and eastward as far as east-central Minnesota (Caine 1974:Figure 2.13; Mather 1991:35).

Age and Associations: Avonlea points are considered a horizon marker for the early Late Prehistoric period in the Canadian Plains. It dates from 100 to 1100 C.E. on the Northern Plains (Gregg and Davidson 1985:128; Johnson 1998:38). Cloutier (2004) gives a more restricted age of 500 to 1000 C.E. It is the earliest of the small, triangular, side-notched points on the High Plains (Kehoe 1966) and a marker for the beginning of the Late Prehistoric period in that region. These points are thought by some to be the earliest evidence for the bow and arrow on the Plains.

Similar and Identical Types: Avonlea points somewhat resemble Haskell points on the Southern Plains. Smaller-than-average Simonsen points can superficially resemble Avonlea points. These much earlier Archaic points are thicker and often exhibit haft grinding.

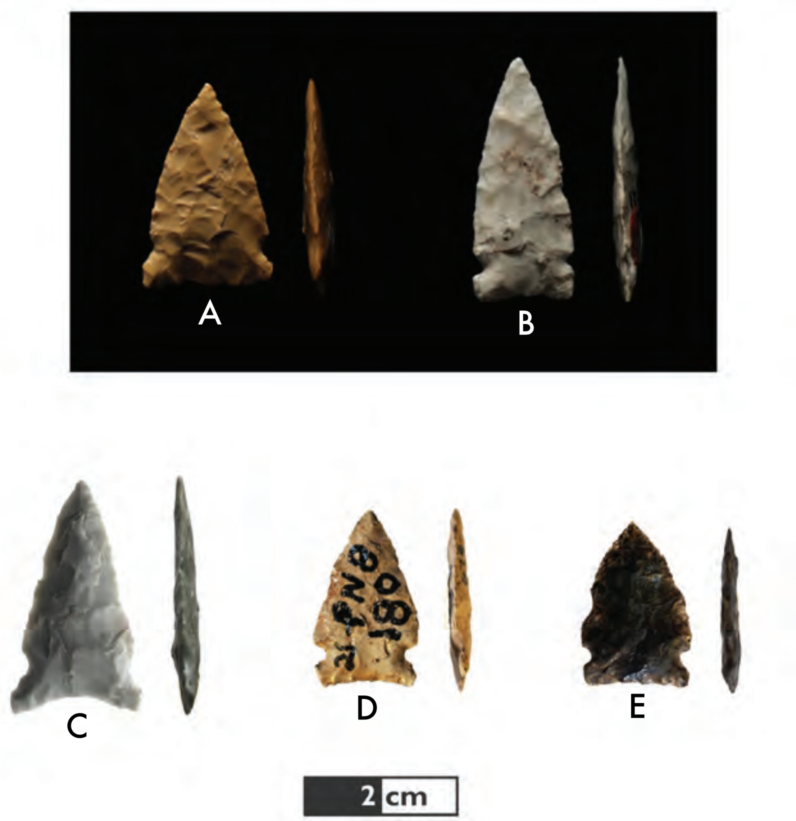


Figure 5.58. Avonlea points. ([A] MHS Artifact: 67.188.A36; unheated Cochrane Chert; unknown provenience; [B] MHS Artifact: 17.126.6 1583; unheated Burlington Chert; Goodhue Co., MN; [C] MHS Artifact: 1988.120.15.40; unidentified chert; Mille Lacs Co., MN; [D] MHS Artifact: 21PN8 180; unidentified chert; Pine Co., MN; [E] MHS Artifact: 21PN8 205; black chalcedony; Pine Co., MN.)

ST. CROIX

St. Croix is named for the St. Croix River region of eastern Minnesota (Caine 1974).

Description: St. Croix is a small point with a triangular blade, well-made corner notches, and a convex base (Caine 1974:Figure 2.14; Morrow 1984:79). The blade is usually thin, pressure flaked, and triangular with straight to convex edges. Notches are generally moderately deep and often well executed. The base ranges from being convex to nearly straight. St. Croix points range from 1.9 to 4 cm (0.75 to 1.5 inches) and about half that in width. They are made from a variety of raw materials that are sometimes heat treated.

Distribution: This point type is a western Great Lakes variant of the Late Woodland Stemmed/Corner-Notched cluster. It extends in small numbers down into the northern half of Iowa.

Age and Associations: St. Croix is an early Late Woodland point type that dates between about 600 and 900 C.E.

Similar and Identical Types: Small, thin corner notched arrow points of one form or another occur sporadically over a large part of eastern North America during the Late Woodland period. Caution should be exercised so as to not create a profusion of local and regional type names where they may not be necessary.

Figure 5.59. St. Croix points. ([A] MHS Artifact: 19.50; heat-treated Prairie du Chien Chert; Hennepin Co., MN; [B] Glynn Collection: heat-treated Prairie du Chien Chert, Rice Co., MN.)

CAHOKIA

This arrow point type is named for the Cahokia Site in Illinois (Scully 1951:14–15).

Description: Cahokia is a thin, well-made, side-notched triangular arrow point (Perino 1968:12, 1971:126–130; Justice 1987:232–235; Morrow 1984:86). These are generally very triangular points with typically straight blade edges aligned with the basal corners. There are many notching variations on Cahokia points. All varieties have a main pair of side notches set relatively high up on the sides of the point. Beyond this there are a tri-notched variety with an extra notch in the center of the base, a double-notched variety with an extra pair of smaller side notches below the main pair, and a multiple-notched form with the two extra side notches and one basal notch. Most Cahokia points measure between 1.9 and 3.8 cm (0.75 and 1.5 inches) long and just under 1.1 to 1.9 cm (0.5 to 0.75 inches). In Minnesota, Cahokia points appear to have been made out of a wide variety of mostly local raw materials.

Distribution: Cahokia points are wide spread throughout the mid-continent. In Minnesota, they are present in small numbers across the southern part of the state.

Age and Associations: Cahokia points are especially common at Cahokia-affiliated and Caddoan sites in the mid-continent, including Wisconsin, Illinois, and Iowa in the Upper Midwest. In Minnesota, they seem to be associated with the Silvernale and Cambria phases, which are Mississippian related. They are especially diagnostic of earlier Mississippian phases and date between about 900 and 1200 C.E. They are uncommon in their classic forms in most peripheral areas, such as Minnesota and Iowa. They seem to have been replaced by Madison points later in the Mississippian sequence.

Similar and Identical Types: Simple side-notched-variety Cahokia points may be difficult to distinguish from other side-notched arrow point forms, especially Plains Side-Notched. The more complexly notched varieties also have counterparts on the plains such as the tri-notched Harrell point and the double-notched or multiple-notched Huffaker points. If these point varieties are found outside of the confines of a village site with known Mississippian associations, it may be difficult or impossible to distinguish these Great Plains interlopers.

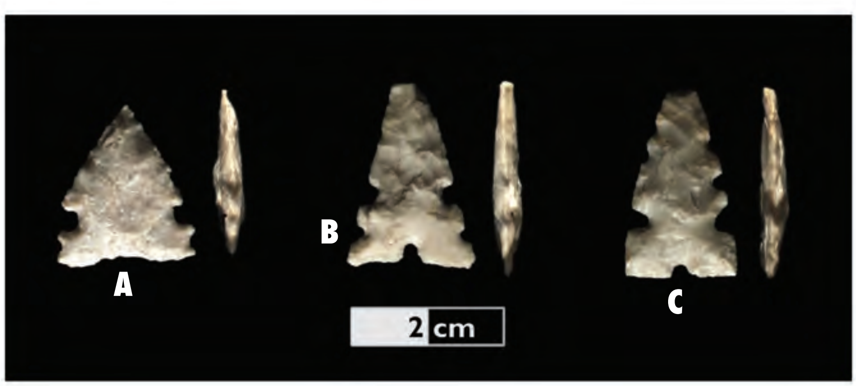


Figure 5.60. Cahokia points. ([A] MBISP Artifact: 6695; heat-treated Prairie du Chien Chert; Freeborn Co., MN; [B] MBISP Artifact: 6684; unheated Maynes Creek Cream Chert; Freeborn Co., MN; [C] MBISP Artifact: 6686; unidentified chert; Freeborn Co., MN.)

MADISON

Madison is a ubiquitous unnotched triangular arrow point throughout the eastern United States. It is named for Madison County, Illinois (Scully 1951:14).

Description: This is a small, thin, unnotched triangular point whose maximum width is always at the base (Perino 1968:52; Justice 1987:224–227; Morrow 1984:80; DeRegnaucourt 1991:249–253). Workmanship on Madison points varies widely. Many Madison points are made on a thin flake by pressure flaking and can be rather crude. Others are fully and elegantly flaked. In plan view shape, Madison points range from being an elongated isosceles triangle to a squat, nearly equilateral triangle. Blade edges may be slightly convex, straight, or slightly concave. Bases likewise can be convex, straight or concave. A small number of Madison points are serrated. Goldstein and Osborn's (1988:60) measurements for a sample of Madison triangular points in Wisconsin are 1.2 to 6.0 cm (0.5 to 2.3 inches) for length, 1.3 to 2.7 cm (0.5 to 1 inch) for width, and 0.2 to 0.5 cm (0.1 to 0.2 inches) for thickness. Madison points were made out of practically any available knappable material, and some cherts were heat treated.

Distribution: This is a very common point type across eastern North America. It occurs in large numbers throughout Minnesota (Bleed 1969:Plate 9; Wilford et al. 1969; Gibbon 1973:Plate 2, 1975b: Plate 1g–i, 1976:Plate 5a–f; Stoltman 1973:Plate 26a–j; Anfinson 1997:92–93, 100, 116).

Age and Associations: Once considered associated solely with Mississippian cultures, Madison points are known to be associated as well with Late Woodland cultural phases between about 800 or 900 C.E. to the historic period. In Minnesota, large numbers occur on Oneota-tradition sites.

Similar and Identical Types: Many researchers simply call Madison points "Triangular points." Morrow (1984:80–81) makes a distinction between larger more symmetrical Madison points and smaller, less symmetrical Fresno points. In reality this is probably just the variation within a single point type. Care should be taken not to mistake unfinished preforms for other small arrow points as finished Madison points. This can usually be done by carefully examining the degree of alignment or irregularity in the point's/preform's edges.

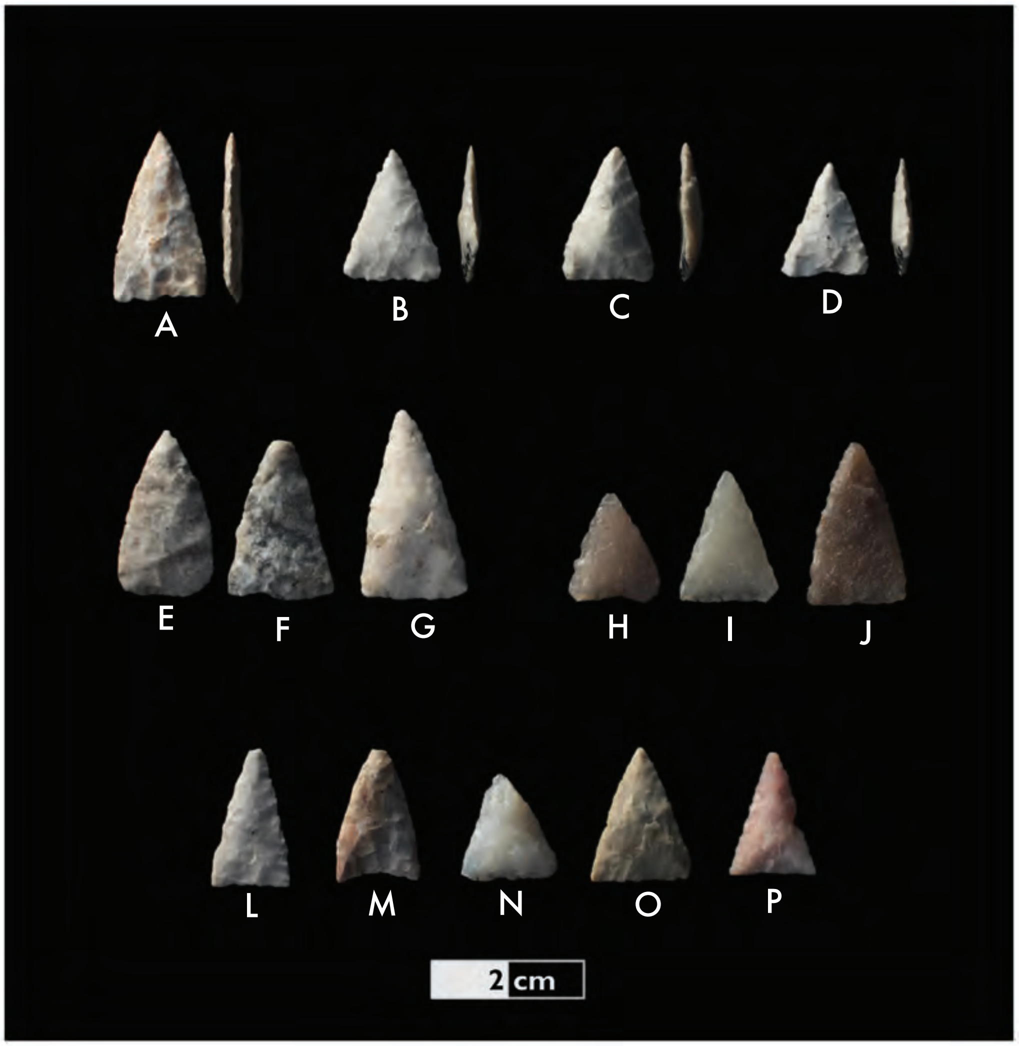


Figure 5.61. Madison points. ([A–D] MBISP Artifacts: 6517, 6440, 6463, 6446; unheated Prairie du Chien Chert, Freeborn Co., MN; [E–G] MBISP Artifacts: 6452, 6448, 6484; heat-treated Prairie du Chien Chert; Freeborn Co., MN; [H–J] MBISP Artifacts: 6485, 6494, 6411; Hixton Silicified Sandstone; Freeborn Co., MN; [L] MBISP Artifact: 6443; unidentified chert; Freeborn Co., MN; [M] MBISP Artifact: 6483; heat-treated Galena Chert, Freeborn Co., MN; [N] MBISP Artifact: 6457; quartz; Freeborn Co., MN; [O] MBISP Artifact: 6478; unheated Grand Meadow Chert; Freeborn Co., MN; [P] MBISP Artifact: 6453; heat-treated Swan River Chert; Freeborn Co., MN.)

Prairie Side-Notched

Prairie Side-Notched is a western side-notched arrow point type named by R. MacNeish (1954:40) in his study of the Stott mound and village near Brandon, Manitoba.

Description: Prairie Side-Notched is a small side-notched arrow point distinguished from Plains Side-Notched points largely by its less symmetrical shape and poorer workmanship (Kehoe 1966). These points have an overall triangular planview but generally lack crisp, straight sides. Side notches are highly variable and often not deeper than they are wide. Bases may be convex, straight, or concave. The base is often slightly narrower than maximum width. A sample from the Gull Lake Site in Saskatchewan ranges in length from 1.1 to 4.1 cm (0.4 to 1.6 inches), in width from 0.9 to 2.2 cm (0.4 to 0.9 inches), in thickness from 0.2 to 0.8 cm (0.1 to 0.3 inches), and in weight from 0.3 to 3.8 grams (0.01 to 0.13 ounces) (Kehoe 1973). Prairie Side-Notched points were made from a variety of raw materials, some of them heat treated.

Distribution: This point type is widely distributed across the Northern Plains. In Minnesota, they are present in the central and western parts of the state (Bleed 1969:Plate 10a–e; Johnson 1971:Figure 11f–g; Johnson 1973:Plate 22c; Caine 1974:Figure 2.12; Anfinson et al. 1978:19; Allen 1993:45; Anfinson 1997:92–93, 100).

Age and Associations: Prairie Side-Notched points appear about 700 C.E. and are thought to have been the dominant type in assemblages in the Northern Plains until about 1300 C.E., when they were replaced in popularity by the Plains Side-Notched type (Kehoe 1966, 1973:56–78). In some parts of the Northern Plains, such as southwest Manitoba, they are regarded as a trait of the Plains Late Woodland period because of their association with ceramics (Syms 1980:372). Contemporary complexes include Blackduck and Selkirk in the north and the Plains Village tradition to the south and southeast. In Alberta, they are associated with the Old Women's complex (Forbis 1962).

Similar and Identical Types: Prairie Side-Notched points are essentially identical to Reed points and Des Moines points (Morrow 1984:82–83). Kehoe (1966) identified seven varieties of Prairie Side-Notched points, with names like Swift Creek Fish-Tail and Nanton Wide Rounded Base. Some better made Prairie Side-Notched arrow points grade into the Plains Side-Notched type.

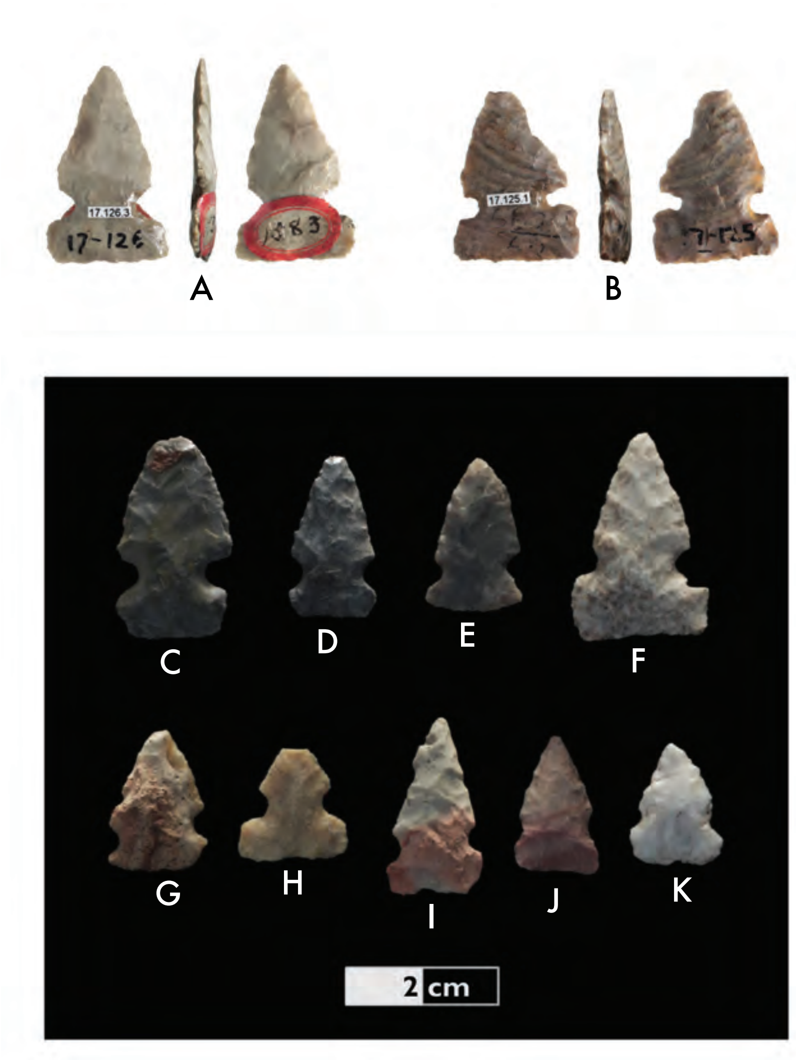


Figure 5.62. Prairie Side-Notched points. ([A] MHS Artifact: 17.126.3; unheated Galena Chert; Goodhue Co., MN; [B] MHS Artifact: 17.125.1; unidentified chert; Goodhue Co., MN; [C] MBISP Artifact: 6849; unidentified chert; Freeborn Co., MN; [D] MBISP Artifact: 6718; unheated Prairie du Chien Chert; Freeborn Co., MN; [E] MBISP Artifact: 6867; unheated Grand Meadow Chert; Freeborn Co., MN; [F] MBISP Artifact: 6886; heat-treated Prairie du Chien Chert; Freeborn Co., MN; [G] MBISP Artifact: 6910; heat-treated Maynes Creek Cream Chert; Freeborn Co., MN; [H] MBISP Artifact: 6861; heat-treated Prairie du Chien Chert; Freeborn Co., MN; [I] MBISP Artifact: 6926; heat-treated Maynes Creek Cream Chert; Freeborn Co., MN; [J] MBISP Artifact: 6758; unidentified chert; Freeborn Co., MN; [K] MBISP Artifact: 6866; unidentified chert; Freeborn Co., MN.)

PLAINS SIDE-NOTCHED

Plains Side-Notched is a Late Prehistoric arrow point on the Northern Plains named by MacNeish (1954:40) in his study of the Stott mound and village near Brandon, Manitoba.

Description: This is a symmetrical arrow point characterized by its well-defined outline and well-executed notches. Plains Side-Notched points are usually fully flaked by pressure and thin with an even, lenticular cross section. In plan view, they tend to be very triangular with straight sides and relatively sharp corners. The base is usually as wide as or wider than the blade and is straight or, in rare instances, concave. Notches in Plains Side-Notched points are generally placed at an intermediate position up the sides of the points; that is, midway between the typically high position of side notches on Cahokia points and the low position of side notches on Avonlea points. Plains Side-Notched points in one Northern Plains' sample range from 1 to 3.4 cm (0.4 to 1.3 inches) in length, from 0.9 to 1.8 cm (0.3 to 0.7 inches) in width, and from 0.2 to 0.7 cm (0.1 to 0.3 inches) in thickness, with weight between 0.3 and 2.0 grams (0.01 to 0.07 ounces).

Distribution: Plains Side-Notched points are present across the Northern Plains, especially in Plains Village–tradition sites (Anfinson 1997:92–93, 100). In Minnesota, Plains Side-Notched points have been found in Cambria phase assemblages along the upper Minnesota River and more widely in the Prairie Lakes region (Wilford et al. 1969:Plate 7a–b).

Age and Associations: Plains Side-Notched is the predominant arrow point type in assemblages on the Northern Plains between circa 1300 and 1500 C.E. (Kehoe 1966:832).

Comments: Kehoe (1966) suggests that the Plains Side-Notched point type derived from Mississippian culture influences to the southeast.

Similar and Identical Types: In his study of this point type, Kehoe (1966) divided the type into seven varieties with names like Emigrant Basal-Notched and Paskapoo Square-Ground base. Plains Side-Notched points of lesser workmanship can be difficult to distinguish from Prairie Side-Notched points. They can also be confused with Avonlea and simple side-notched Cahokia points, but notch position relative to the base should help in separating these.

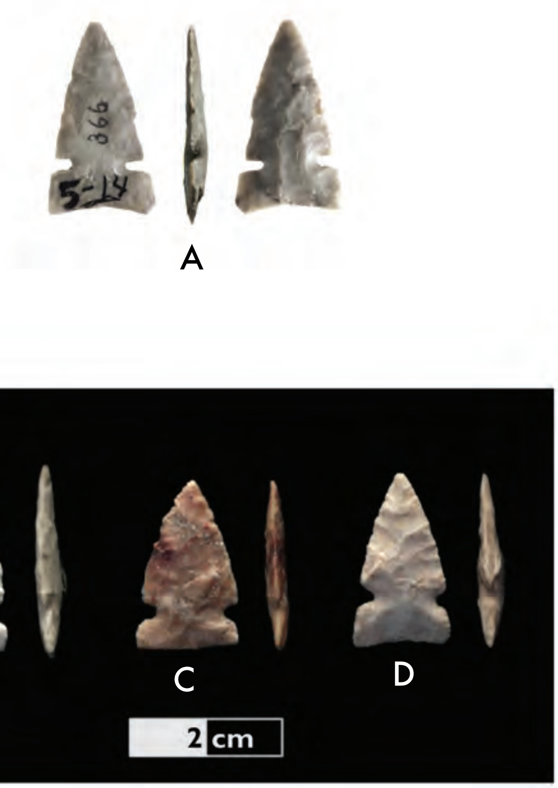


Figure 5.63. Plains Side-Notched points. ([A] MHS Artifact: 5.14; unheated Galena Chert; Beltrami Co., MN; [B] MBISP Artifact: 6689; unheated Prairie du Chien Chert; Freeborn Co., MN; [C] MBISP Artifact: 6693; heat-treated Prairie du Chien Chert; Freeborn Co., MN; [D] MBISP Artifact: 6698; unheated Burlington Chert; Freeborn Co., MN.)