Use-Wear Analysis of Great Basin Stemmed Points

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Arts in Anthropology

by

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ABSTRACT

Stemmed points have long been used as time markers of the Terminal Pleistocene/Early Holocene (TP/EH) in the Great Basin. Much less is known, however, about the lifeways of the people who made stemmed points. Some researchers suggest that learning the function of a lithic tool helps to define it in addition to gaining knowledge about the people who used it. The goal of my research is to determine whether the stemmed point types Cougar Mountain, Haskett, Parman, and Windust were used as projectiles, for other purposes, or for a combination of both. In order to accomplish this, I conducted use-wear experiments with replicas of the above stemmed point types. The wear that accrued on the replicas was compared with prehistoric stemmed points with the goal of determining their functions. This thesis reviews the results from the experiment and the use-wear analysis of the replica and prehistoric stemmed points.
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CHAPTER 1

INTRODUCTION

Great Basin archaeology is at the critical stage of reevaluating the evidence of lifeways of Terminal Pleistocene/Early Holocene (TP/EH) people. Recently, attention has been called to the inability to date many sites, the uncertainty about the use of stone tools, and the inability of archaeologists to construct supportable models of adaptation (Beck and Jones 1997; Jones and Beck 1999). These issues are interrelated and the continued study of one can ultimately lead to better explanations of another.

Culture-historical studies in the Great Basin have lagged behind those in other parts of the country primarily because of reduced sedimentary deposition in the dry desert environment. Deposition is important for the establishment of chronological controls because relationships among cultural horizons outside of caves and rockshelters are difficult to reconstruct and diet choices remain unknown. Virtually all that is left in open-air sites are lithic remains.

An analysis of stone tool use-wear can facilitate an understanding of lithic artifacts that date to the TP/EH in the Great Basin. Thomas (1981) has stated the importance of knowing the use of a tool in order to classify it properly; therefore, additional clarity regarding stemmed point classification could be gained if the uses of various stemmed point types associated with the TP/EH were known.
My research is a comparative analysis of use-wear on freshly manufactured stemmed points and prehistoric stemmed points to interpret their functions. Six replicas each of each Haskett, Parman, and Windust point types were crafted and experimentally used in predetermined activities likely to have occurred during the TP/EH. After examination of them under a low-powered microscope, prehistoric Great Basin stemmed points from the buried archaeological sites of Bone Springs, Cougar Mountain Cave, Dirty Shame Rockshelter, Fort Rock Cave, Hanging Rock Shelter, Last Supper Cave, and Paulina Lake were examined in the same fashion to search for similar wear patterns, hence allowing a more reliable interpretation of their use.

In the remainder of this chapter, I review past and current discussions and hypotheses related to the study of stemmed point types from the Great Basin during the TP/EH. Then I review current methods of research related to furthering studies of stemmed point typology. In Chapter 2 I discuss the history and issues regarding the study of use-wear. In Chapter 3 I describe the materials used in the experiment and analysis, and in Chapter 4 I explain the methods used. In Chapter 5 I provide detailed descriptions of the experimental results and analysis. The final chapter is a discussion of the interpretations and conclusions made from the experiments and results.

**Background**

In this section, I review the history of archaeological methods and theories pertaining to stemmed points in the Great Basin. Previous typological studies of stemmed points can help explain the current typology used by the region’s
archaeologists. Then I review current studies and how they attempt to improve upon earlier concepts relating to stemmed point typologies within the Great Basin.

The History of Terminal Pleistocene/Early Holocene Point Classification

The classification of artifacts is a method employed since the beginning of archaeological studies. In North America, however, classification studies were put on hold until unequivocal proof of the presence of people in North America during the TP/EH could be shown. Once the discovery of a Folsom point in direct connection with an extinct species of bison was made in 1927, studies then turned back to the culture-historical approach of defining culture complexes and constructing chronologies (Daugherty 1956a). The goal of the culture-history concept was to determine when people arrived in an area and how long they stayed. From 1940-1960 research shifted to cultural context and artifact function, with an aim of answering questions regarding how people lived. Since the 1960s, research has been concerned with why people chose certain environments and why their lifeway may have changed (Thomas 1979). These research trends can be found in regards to studies of stemmed points of the Great Basin.

One of the earliest discussions concerned with points from the TP/EH in the Great Basin dates to 1935, a typological study of the Pinto Basin site located in southeastern California (Campbell and Campbell 1935). Campbell and Campbell (1935) concluded that the site was of great antiquity because of its location on an ancient shoreline. A geologist of the time believed the shoreline to have formed during the last glacial stage, dating from 15,000-20,000 B.P. Campbell and Campbell also concluded that a large
number of people inhabited the area because of similarities between lithic tool types. In their opinion if there were small groups visiting Pinto Basin, over time the tool types would have changed (Campbell and Campbell 1935).

Amsden (1935) analyzed the bifacial points from the Pinto Basin site, and although he stated that quantities of types could not be given because forms graded from one to another, he nonetheless named the points with a narrow shoulder, an incurring base, and a thick cross-section the Pinto type. Amsden posited that the Pinto type varied in form because of hasty workmanship and the use of poor quality raw material. Amsden found that seven other sites contained Pinto type points as well, although not as abundantly, and postulated that they probably represented a single cultural complex (Amsden 1935). Interpretations such as these would be made for years to come.

At Lake Mohave in 1937 Campbell and Campbell found two additional forms of stemmed points lying on an ancient lake margin near Pinto Basin. They named them the Lake Mohave and Silver Lake types. Amsden (1937) defined the Lake Mohave types as being “. . . characterized by a long, tapering stem, produced by shouldering the point (usually very slightly), just below the center of its vertical axis. This results in a generally diamond-shape form, with more shoulder than blade” (Amsden 1937:80). He defined the Silver Lake type as having “. . . more definition of shoulder and less basal taper than the Lake Mohave type. The base comprises never more than half the whole length, usually about a third. It is always somewhat rounded at the butt” (Amsden 1937:84). Thus began the trend of naming projectile point types after named geographic features when the tool tradition was not clearly associated with any known living tribe or culture.
The next major study relevant to the history of stemmed point classification in the Great Basin was performed by Harrington (1948). Harrington discovered Folsom points at Borax Lake located in northern California on the surface and in buried deposits. Some of these points certainly appeared to be similar to Folsom types found on the plains but others he termed “Folsom-like” or a “crude form of Folsom”. Today these would be termed Black Rock Concave Base (Clelowlow 1968) or Clovis. I refer to them here simply as concave based points. Also identified at Borax Lake was the Borax Lake point, characterized as having:

“... a relatively long, broad straight stem, medium to broad shoulders (often barbed), and a rather short blade with straight or slightly convex sides. One or both sides of the stem may show thinning flakes, and the base, usually square, may be concave. Occasionally the edges of the stem are ground smooth, Folsom-wise. The chipping is often of percussion type similar to that seen on Pinto Basin points” (Harrington 1948:81).

From these characteristics, Harrington posited that the Borax Lake point was a kind of hybrid of Silver Lake points from southern California and Folsom points from the Great Plains region, and that Borax Lake points were transitional between concave-based points and stemmed point forms or the result of the Folsom users influencing Silver Lake users. In the end, Harrington concluded that there are great similarities between the Borax Lake and Silver Lake points and that concave based points mark the last remnants of the Folsom culture (Harrington 1948). Daugherty (1956a) did not agree with Harrington’s
interpretations because of problems with stratigraphy at the site. Nevertheless, Harrington's study marks the beginning of research in the Great Basin regarding the relationship between concave based points and stemmed points.

In 1956, Daugherty discovered stemmed points he named Lind Coulee in south-central Washington. He divided Lind Coulee points into two styles. Style 1 was described as having “. . . a tapered stem, rounded shoulders, and convex base . . . The sharp edges of the stem of the fragmentary point have been ground smooth, but no indications of this can be found on the complete specimen” (Daugherty 1956b:246). Style 2 was described as having “. . . sharp lateral shoulders . . . long and slender in shape . . . asymmetry of the shoulders. On each point, one shoulder is sharp and the other is rounded” (Daugherty 1956b:246).

In response to the growing numbers of stemmed points dating to the TP/EH and the difficulties in distinguishing unique culture complexes, Daugherty (1956a) defined a set of terms and a method in which to better analyze them. “Form” represented a single occurrence, “style” represented a group of similar forms, and “type” represented temporal, spatial, and relational similarities of a style. According to Daugherty, a type can be flexible so that the range of variation caused by individuality can be included. In addition, Daugherty (1956a) speculated that there was a generalized Basin and Range culture with localized variations during the TP/EH. These variations made it difficult to designate specific resemblances between sites based on artifact types except in regard to the highly distinctive Folsom type.

Jennings (1953) also did not consider the Great Basin to possess separate culture areas. According to Jennings, naming new cultures as each site was excavated was
unfounded. He suggested instead that all Great Basin remains be lumped together into the “Desert Culture”. Jennings (1953) imagined a culture that began during the TP/EH and changed little throughout the next 10,000 years.

In 1962, Daugherty again addressed the problem of variation among stemmed points in the Great Basin by defining a tradition called the Intermontane Western tradition. This tradition was proposed to extend between the Rockies and the Sierras and from southern British Columbia to northern Mexico. The Intermontane Western tradition was broken up into periods, but the period concerning my study he termed the Early Period, dating from 11,000-8000 B.P. Daugherty (1962) characterized peoples of the Early Period as having a diverse economy that included hunting and food gathering. Fishing was also included but only in the north. Early Period societies consisted of small nomadic bands composed of several nuclear families living in temporary houses or caves and rockshelters when available. The end of the Early Period was marked by more arid conditions that changed the types of available food (Daugherty 1962).

In 1965, Rice excavated the Windust Caves in eastern Washington, finding specimens similar to those from the Lind Coulee site; however, the Lind Coulee points were generally larger and exhibited better workmanship than the Windust Cave Specimens (Rice 1965). These “Tradition 1” Windust points were described as having:

“lanceolate blade shapes and are quite thin in relation to their width.

These points appear to have been manufactured by a technique which produced broad, shallow flake scars. These flake scars are usually
collateral or transverse, but some oblique scars also occur” (Rice 1965:35).

“Tradition 2” Windust points were described as:

“generally thicker in proportion to their width than those of the preceding tradition. This thickness is especially pronounced in the earlier specimens of this tradition. The flake scars have a more random placement and a narrower appearance than those on points of the preceding tradition” (Rice 1965:37).

Also in 1965, Butler found two forms of Haskett stemmed points in southern Idaho. Type 1 was described as:

"... broadest and thickest near the tip end and have a long, edge-ground basal section that tapers into a narrow, relatively thin (0.4cms. thick), some-what rounded butt. The basal section accounts for approximately 60 percent of the length of the point" (Butler 1965:6).

Type 2 differed from Type 1 because they were larger, thicker, and the widest part is midway between the base and the tip (Butler 1965).

Lithic materials from the Sadmat site located in west-central Nevada were examined by Warren and Ranere (1968). They found similarities between the stemmed
points from Sadmat and sites in south-central Oregon and southern Idaho. Specifically, Warren and Ranere (1968) found that Sadmat’s stemmed lanceolate points most closely resembled those from the Cougar Mountain Cave and Haskett sites. They even proposed calling the type the Hascomat. Warren and Ranere also studied the relationship between fluted concave based and stemmed points because fluted points were typically found as isolates or in questionable associations with stemmed points (Warren and Ranere 1968).

In addition, Warren and Ranere (1968) disputed Jennings’ idea of a Desert Culture. They argued that from 9,000 to 11,000 years ago, the Great Basin was much wetter than later periods and probably did not resemble a desert. Furthermore, stemmed points were typically located around pluvial lake margin features and lacked grinding stones, which were seen as a characteristic of the Desert Culture (Warren and Ranere 1968). Finally, Warren (1968) defined a cultural tradition as being comprised of historically related phases or cultural patterns reflected by similarities in artifact types and assemblages. Accordingly, cultural tradition has nothing to do with ecology; therefore, a single cultural tradition can be adapted to several different environments through time or space. Culture and environment should be distinguished so one can study their relationship.

Davis et al. (1969) proposed the term Western Lithic Co-Tradition because both Lake Mohave and Silver Lake points were found in the same deposit in the Panamint Valley, eastern California. The Western Lithic Co-Tradition was based on the similarity of toolkits found near pluvial lakeshores. Davis et al. (1969) described the early people of the deserts of California and Nevada, into the Plateau, and down into Baja California, as thinly scattered hunter-collectors. The Western Lithic Co-Tradition is made up of
many sub-cultures who may have spoken many different languages. Davis et al. speculated that the co-tradition dated from 10,000-8000 B.P (Davis et al. 1969).

Bedwell (1973) studied caves in the Fort Rock Basin located in the northwestern region of the Great Basin. From the analysis of geologic deposits, he found that from 11,000-8,000 B.P. the Great Basin was made up of pluvial lake systems. From these data he posited that the lifeways of the time were focused on lakes, marshes, and grassland environments. This model is referred to as the Western Pluvial Lakes Tradition. Additionally, Bedwell posited that the similarity of tool assemblages over such a large area could be explained by the fact that the pluvial lakes covering the region were similar enough to allow specific groups to travel long distances without coming across unfamiliar flora and fauna. The beginning of the Archaic period around 8000 B.P. is explained by increased aridity and drying of once fertile shallow lakes (Bedwell 1973).

Layton (1972) analyzed stemmed points collected from Cougar Mountain Cave located in central-southern Oregon. From this cave, he defined another stemmed point variant he called Cougar Mountain. Layton described the Cougar Mountain point as “lanceolate in form with prominent sloping shoulders. The stem contracts with straight sides to a convex base. The edges of the stem are heavily ground or blunted for their entire length; however, the base is not ground” (Layton 1972:2).

Another stemmed point type defined by Layton is Parman. Layton found Parman points in northwestern Nevada along a TP/EH lakeshore margin, in Last Supper Cave, and in Hanging Rock Shelter. Layton (1970:257) defined the Parman point as having “... a square or tongue-shaped stem, the edges of which are blunted by edge-grinding, crushing, or steep peripheral retouch.” Later, Layton (1979:48) added that Parman points
have “broad blades and square to sloping shoulders. A few are single-shouldered. Flaking is irregular. Stems are generally proportionally shorter than blades . . .”

After examining stemmed points along an extinct shoreline and noting the lack of grinding stones, Layton (1970) determined that Bedwell’s Western Pluvial Lakes Tradition applied to the western Great Basin and that it is archaeologically manifested in the “Stemmed Projectile Point Tradition”. At this time, however, Layton did not place Haskett points into the Stemmed Projectile Point Tradition but into the Lanceolate Projectile Point Tradition. Layton proposed that the Western Pluvial Lakes Tradition could extend from the western Great Basin from Fort Rock Valley down to the Lake Mohave/Silver Lake area in southern California, based on the finding of a Lake Mohave type point in Fort Rock Cave (Layton 1970).

Layton (1970) argued that a valid chronology was required in the Great Basin before more sophisticated studies of hunter-gatherer ecology could be accomplished. Using stratigraphic control and obsidian hydration, Layton determined that there were changes in stemmed point shapes through time, including a change from tongue-shaped bases to square bases and from basal grinding to no basal grinding. Further, obsidian hydration analysis on Hanging Rock Shelter specimens suggested that concave based points are the oldest point types in the cave, and at Cougar Mountain Cave he found that Cougar Mountain points were the first to be used, followed by Parman points (Layton 1972).

In a paper describing the projectile points of Parman Lake, northwestern Nevada, Layton (1979) observed that there were at least eight distinctive variants of stemmed points: Lake Mohave, Silver Lake, Cougar Mountain, Parman, Long-stemmed, Haskett
type 1, Lind Coulee, and Windust points. Although recognizing so many types, Layton (1979:47) proposed the term “Great Basin Stemmed Series” to group them all. This typology allowed a flexible terminology which could group related forms but still distinguish variants.

Pendleton (1979) agreed with Layton on the need for a chronology of stemmed points, arguing that chronology is the basis for all other explanatory studies. By analyzing a large collection of early-period points from the Tonopah area, Pendleton hoped to clearly define the difference between concave based points and stemmed points. Recognizing that both forms overlapped in time and that in some buried sites they occurred together, she pondered whether the differences were functional, temporal, spatial, or a combination of all three. To explore this question, Pendleton (1979) decided to study use-wear on stemmed points and concave based points. Unfortunately, her replicative study of edge damage could not reliably distinguish between use-wear from cutting or scraping of wood or bone and edge abrasion from platform preparation or edge grinding. This made the assignment of a tool to a utilized category quite problematic. Furthermore, she found it difficult to identify use-wear on the points in her sample because they were from surface contexts. In the end, Pendleton (1979) stated that until a buried single-component Concave Base Series site was found with dates, associated implements, and manufacturing stages, typology and chronology would be arbitrary.

Bryan (1980) pointed out that the purpose of assigning a type is to “. . . identify and define a product made by a particular cultural group along with an estimate of its time range” (Bryan 1980:77). A tradition may possess typological similarities of multiple cultural groups and it may persist throughout a long period of time. In order to
define a tradition, one must classify types from a site and then define and trace spatial and temporal distributions of manufacturing techniques, tool forms, and tool styles. Technological traditions that can be identified are flaking methods such as pressure or percussion, grinding or pecking, and the shape of the tool, most specifically in regard to its haft. In Bryan’s (1980) opinion, researchers too commonly postulate that regional cultural traditions represent continent-wide economic organization. In addition, researchers may infer too much about cultural traditions instead of testing hypotheses (Bryan 1980).

In a review of the attempts to characterize points of the western United States, Bryan (1980) argued that the traditions defined by Daugherty (1956a) and Jennings (1953) were much too general to be useful. In contrast, the tradition suggested by Bedwell (1973) assumed too close a relationship between tool traditions, the environment, and culture. Davis et al.’s (1969) tradition lumped too many shouldered points together. Bryan (1980) concluded that the Stemmed Point Tradition first proposed by Layton (1970) was the most accurate reflection of stemmed point variability.

Bryan (1980) further identified two contrasting explanations of the relationship between stemmed points of the Great Basin and concave based points of the Great Plains. The first explanation is that the two traditions developed simultaneously to differing environments, while the second is that users of concave based points hunted big-game in the Great Basin before stemmed point users appeared. Based on radiocarbon ages for the two types in the two regions, Bryan (1980) developed a multilinear evolutionary model of parallel socioeconomic adaptations to different environmental regions. He wondered how a broad and thin-based lanceolate point could evolve into a narrow thick-based type.
Holmer (1986) argued that in order to have a morphological point typology with spatio-temporal meaning, points with identical shapes but different age or geographic ranges should be classified as different types, while points with identical shapes and ages all should be given the most common name used. His review focused on Archaic points and did not cover stemmed point typology except to clarify that the place of Pinto type points was not among the TP/EH Great Basin stemmed points. Holmer (1986) theorized that perhaps changes in stemmed point form were due to migration or diffusion.

Another view that developed was that the users of stemmed points in the Great Basin were neither big-game hunters nor Western Pluvial Lake Tradition foragers (Willig 1988; Willig and Aikens 1988). Mehringer (1986) found geological data revealing that TP/EH lakes in the Great Basin were not stable, but rather always underwent rapid change. Therefore, the concept of a consistently wet Great Basin filled with pluvial lakes throughout the TP/EH was no longer accurate. In addition, because of the rapidly changing environment, peoples of the Great Basin could not have had lives similar to the big-game hunters of the Great Plains. Willig and Aikens (1988) further argued that the basic “Desert Culture” concept of a broad spectrum and flexible lifeway could be used to describe peoples of the TP/EH time period with foundations dating back to 11,500 B.P. From these data, Willig and Aikens (1988) termed groups living in the Great Basin during the TP/EH the Western Stemmed tradition. Accordingly, people of the Western Stemmed tradition had “a generalized adaptation to a wide variety of mesic habitats offering critical food and water supplies” (Willig 1988:478).

Beck (1999) agreed with Willig and Aikens’ concept of the Western Stemmed tradition and posited that it is not a problem if one sees the time period from 11,500-7500
B.P. as a continuum of changing adaptations related to technology, subsistence, environments utilized, and mobility patterns.

These studies of stemmed points from the Great Basin have evolved over time; however, researchers are still debating the relationships between the various types identified. It seems that researchers still do not fully understand the meaning of stemmed point variability. The result of an unclear nomenclature is that researchers often designate stemmed point types based on opinion, rather than on agreed-upon designations. Further research regarding why variation in stemmed point form exists in the Great Basin is warranted, and recent studies of this topic are reviewed below. Understanding the relationship between concave based and stemmed points may aid in determining whether stemmed points spread through diffusion or migration.

*Explanations of Stemmed Point Variability*

Developing a definitive typology for stemmed points in the Great Basin has been difficult because there may be different factors behind the variability. Among these factors are temporal change, stylistic differences, functional differences, and degrees of resharpening. Each of these factors is discussed briefly below.

Point variability may be a factor of change through time. Temporal change can be measured by establishing the chronological order of point types. It is a useful indication of which, if any, differences reflect change through time rather than change that might be functional or stylistic. Layton (1972) argued that stemmed point variability was related to temporal change based on obsidian hydration. Unfortunately, since these
hydration studies were performed, criticisms of their validity have been made because hydration rates for different materials vary and Layton did not source any of the obsidian. Also, hydration rates can be affected by temperature and humidity (Beck 1999).

Current chronologies, however, indicate that all different types of stemmed points span the 4000 year time period referred to as the TP/EH, making their chronological order very unclear (Table 1.1) (Beck and Jones 1997; Bedwell 1973; Connolly 1999; Fagan 1974; Goebel et al. 2003; Hanes 1988; Layton 1970; Layton and Davis, n.d.; Pitblado 2003; Rice 1965; Willig and Aikens 1988). It should be noted, however, that over 70% of the dates are concentrated between 10,000 and 7500 B.P., that some samples are small, and that some of the specimens are fragments which could be identified with several different types (Beck and Jones 1997). Thus, dating various stemmed point types has not led to progress in solving questions about stemmed point typology.

Table 1.1 Ranges of Radiocarbon Dates for Paleoarchaic Projectile Point Types (after Beck and Jones 1997: Table III).

<table>
<thead>
<tr>
<th>Type</th>
<th>Age Range (Radiocarbon Years Before Present)</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haskett</td>
<td>7,240-11,200</td>
<td>12</td>
</tr>
<tr>
<td>Windust</td>
<td>7,080-10,740</td>
<td>22</td>
</tr>
<tr>
<td>Cougar Mountain</td>
<td>7,080-9,920</td>
<td>20</td>
</tr>
<tr>
<td>Parman</td>
<td>8,260-10,200</td>
<td>6</td>
</tr>
<tr>
<td>Lake Mohave</td>
<td>7,815-11,140</td>
<td>18</td>
</tr>
<tr>
<td>Silver Lake</td>
<td>7,140</td>
<td>1</td>
</tr>
</tbody>
</table>
Stylistic preference may explain some variation found in stemmed points in the Great Basin. Wiessner (1983) and Sackett (1982) have defined three different categories that make up style: (1) emblemic; (2) assertive; and (3) isochrestic.

Emblemic style is often used to represent group norms, values, perceived attributes, and boundaries. Flags and emblems are good examples of emblemic style. A limitation of items which represent this style is that they do not carry information about interaction between or across boundaries (Wiessner 1983).

Assertive style carries information about individual identity such as age, sex, social class, and group membership. Examples that illustrate an assertive style of identity are wedding rings or beaded necklaces worn in a certain way. Assertive style can be conscious or unconscious and is subject to enculturation and acculturation. As a result, it can provide evidence of contact between groups (Wiessner 1983).

Isochrestic variation reflects the everyday choices we make unconsciously resulting from enculturation. This kind of style is hard to identify and requires detailed dissections of adaptive responses. It is hard to identify because items that represent isochrestic style are typically not seen as having great importance by the people who use them. Choices about how to make isochrestic items are automatic or subconscious. As a result, isochrestic variation cannot be used as an ethnic indicator because the maker did not make a conscious decision to reflect their culture (Sackett 1982).

Therefore, style can represent the self-identification of an individual, a group, or a culture; however, style can be unconscious. Bordes (1971) noted that there are different ways of performing the same tasks using different toolkits. Thus, different stemmed points found in the same region could represent use of an area by more than one culture.
as Campbell and Campbell (1937), Harrington (1948), Daugherty (1956a), Warren and Ranere (1969), Davis et al. (1969), Bedwell (1973), and Holmer (1986) proposed. Binford (1973) disputed the possibility of this occurring, however, and believed that if an artifact contains an attribute that is cultural as opposed to functionally or temporally significant, it would be immediately perceived.

Assigning function to stemmed points has also been problematic but projectile points in general are known to be multifunctional (Beck and Jones 1997; Jones and Beck 1999; Nelson 1997). This is especially the case for stemmed points, which have been thought to represent multifunctional tools because of their lack of symmetry, rounded points, and presence of extensive use-wear and resharpening (Beck and Jones 1993, 1997; Jones and Beck 1999). Evidence to support this possibility is the extreme wear on the base of the stem of some points. Heavy abrasion could be due to hard usage while set in a socketed-shaft during activities such as cutting or sawing in addition to use as a spear tip (Beck and Jones 1993). Many of the differences between stemmed point size and shape could affect overall performance and quality of projectile points, making some qualities more desirable than others for specific tasks. These differences may provide another possible explanation for the concurrent existence of multiple stemmed point types because different types may have served different functions within the same toolkit.

Resharpening may be an explanation for stemmed point variants that were present over similar time periods (Beck and Jones 1997; Musil 1988). Evidence of resharpening could demonstrate a more diverse set of roles for stemmed points supporting the idea of a mobile lifestyle (Beck and Jones 1990; Binford 1973; Kuhn 1995). Support for the possibility of extensive reworking of stemmed points comes from raw material choice. A
large majority of stemmed points are either obsidian or basalt, both of which yield sharp edges that dull quickly and would have required resharpening frequently (Amick 1995). Significantly, studies by Beck and Jones (1997) indicate that although stemmed points vary greatly in size and shoulder angle, these variances can be attributed to resharpening.

Raw material availability, however, could be an alternative explanation for the appearance of heavy resharpening. A lack of raw material might mean that differences between stemmed point types were caused by resharpening in order to repeat the same functions. Perhaps peoples of the TP/EH were not resharpening stemmed points to perform different uses, but resharpening them because suitable materials were not readily available to replace worn tools (Andrefsky 1994).

Thus, as can be seen, past studies of organizing stemmed points from the Great Basin have not led to progress in explaining archaeological variability. Presently, many issues that need to be resolved require additional research in dating, further studies of the cultural implications of style change, and new approaches in the determination of function. It is likely that stemmed point variability can be explained best by several combined factors. The tasks at hand are to distinguish which approach works best with which stemmed point type, and to distinguish the important features of each type. Further research will aid in the overall understanding of the lifeways of the Great Basin's TP/EH peoples. In this thesis, I report studies of use-wear to determine function of stemmed points from the Great Basin in an attempt to better explain the variation in form seen among them.
Research Goals

The ultimate research objective of this project has been to determine if stemmed points were used as projectiles, for other purposes, or for a combination of both. Corollary questions addressed include:

- Can use-wear analysis be used to determine the function of stemmed points?
- Were different stemmed point types used for different functions?
- Can increased knowledge of stemmed point function lead to an improved typology?

Learning more about stemmed points would contribute to our body of knowledge about the living patterns and habits of the TP/EH peoples that inhabited the Great Basin. As a result, a more thorough understanding of the first inhabitants of this region can be obtained.

The stemmed point types used in my study included Cougar Mountain, Haskett, Parman, and Windust points. These types were chosen because my study focuses on stemmed points from the northwestern Great Basin, and those listed above are the type names used in this region. They can, however, be related to other variants throughout the Great Basin. For example, Amsden (1937) noted that Silver Lake and Lake Mohave points share many similarities. Layton (1970) noted that the Lind Coulee point is similar in shape but smaller than Cougar Mountain points but are smaller and that the Lind Coulee Style is Parman but Parman points are less delicately flaked. Bryan (1980) noted that Parman points look like both Lake Mohave and Lind Coulee points and that Windust
points are similar to Lind Coulee points. Harrington (1948) noted that there are similarities between Borax Lake and Silver Lake points. Beck and Jones (1997) and Pitblado (2003) single out Windust points from the rest of the stemmed points because of their short stem lengths and concave bases (Beck and Jones 1997; Pitblado 2003). These examples clearly indicate that the current stemmed point typology is not standard and that the Cougar Mountain, Haskett, Parman, and Windust types found in the northern Great Basin can, to some degree, represent stemmed point types identified in other regions.
CHAPTER 2

USE-WEAR ANALYSIS:

BACKGROUND AND REVIEW OF PREVIOUS STUDIES

Over the past forty years, experimental archaeology has become an increasingly popular approach to understanding archaeological assemblages. One area of experimental archaeology that researchers have found particularly useful is use-wear analysis of stone tools. Use-wear analysis, including the study of breakage patterns, has provided a great deal of information about lithic artifacts and prehistoric activities. Despite experimental results supporting the value of use-wear analysis, it must be remembered that experimental archaeology assumes that present observations and interpretations of modern processes also must represent processes of the past. This chapter reviews arguments regarding the relevance of experimental archaeology, past experimental use-wear research performed, methodology including the pros and cons of low-power and high-power microscopy and macroscopy, and applications of use-wear studies in prehistoric archaeological investigations.
Relevance of Experimental Archaeology

Middle-Range Theory

Experimental archaeology has demonstrated the value of lithic use-wear studies. The relevance of experimental archaeology itself, however, has been a subject of much debate. The debate centers on the validity of Binford’s middle-range theory, a central theme in experimental archaeology. Binford’s definition of middle-range theory is: “a) how we get from contemporary facts to statements about the past, and b) how we convert the observationally static facts of the archaeological record to statements of dynamics” (Binford 1977:6). Middle-range theory attempts to link artifacts to past processes. Two methods that employ middle-range theory are experimental archaeology and ethnoarchaeology (Johnson 1999). Experimental archaeology attempts to recreate the past while ethnoarchaeology is the study of material items from people in the present in order to understand materials of the past.

Criticisms of Middle-Range Theory

Johnson (1999) warned that interpretations of artifacts based on experiments and ethnoarchaeology are based on mere analogies. Analogies make the assumption that if some things in the past behaved as they do today, then others also did so. No matter how obvious an analogy may be, it should be tested. Binford (1977) stated that testing must assume conditions of the past were similar to conditions of the present. It is not difficult
to make this assumption when referring to conditions regarding physical phenomena; however, making assumptions about human behavior is much more problematical. Thus, the use of middle-range theory in archaeology can be more aptly applied to issues that concern physical properties. An example that connects physical properties to human behavior is the preparation of grain for human consumption: physics determines that it can only be processed in a certain way (Johnson 1999).

Another downside to middle-range theory is that it does not facilitate the testing of alternative theories. Furthermore, if a theory is proven possible, the evidence can always be interpreted in another way. One must eliminate other processes that may have the same results. A proven theory gains strength depending on the amount of data that support it. Storage pits can be used as an example to illustrate this point. Questions that pertain to storage pits include: (1) are the pits similar to those used by modern groups; (2) are modern groups seen as being descendents of the group studied that used similar pits; and (3) are the pits the same size? Positive answers to the questions listed above add strength to an interpretation based on analogue (Johnson 1999). Likewise, experimental archaeology attempts to add strength to the argument that use-wear patterns seen today result from the same processes that were in operation in the past.

One problem with archaeological interpretation is that it is based on what some consider soft science. Hard sciences, such as chemistry or physics, can be furthered in controlled environments where repetition of the same experiments will yield the same results. It is difficult to do this in archaeology. Actions that produced prehistoric artifacts are largely unknown, and possibly unique to particular times and places. To further complicate matters, human beings today and in the past act in unpredictable ways
in response to external stimuli. Therefore, whether an experiment rejects or confirms a hypothesis, it is always under probabilistic terms (Stiles 1979).

Relevance of Use-Wear Studies

Like the preparation of grain, use-wear on stone tools depends on various physical phenomena, such as amount and direction of force applied, making it a good candidate for experimental studies. The physical properties of target objects and materials such as animal bone, wood, and plants that tools contact today in modern experiments or in contemporary hunter/gatherer societies, are assumed to be similar to those in prehistory. In addition, ethnographic data confirm that hunter/gatherers of the recent past used stone tools for the same kinds of purposes as contemporary people. The shared characteristics of past and present stone, animals, and plants, and the documented activities of hunter/gatherer groups help to add reliability to use-wear studies.

While it may be true that findings from experimental archaeology offer only one of many possible explanations to a study’s outcome, I am certain that acknowledging this fact and going ahead with hypotheses and theories is a better alternative than ceasing all experimental work. I argue that studies of use-wear in conjunction with breakage patterns can help to build a better case for determining the use of a prehistoric stone tool.
Why Perform Experimental Archaeology?

Experimental archaeology can be used to learn more about the behavior of prehistoric peoples. Stone tools are often the only things left to examine archaeologically, encouraging the need for as much in-depth study as possible. Because of developments in experimental use-wear analysis, it is now possible to determine the duration of a particular use, the contact material on which it was used, and the direction of movement employed. This knowledge makes it possible to theorize about site contexts and technical developments (Vaughan 1985).

Furthermore, researchers are able to infer past decision-making based on use-wear analyses (Hayden and Kamminga 1979). For example, differences between material properties may influence which raw materials a group chooses to manufacture their tools (Greiser and Sheets 1979). Collins (1993:92) further illustrated the need for use-wear analysis by stating “Continued emphasis on gaining ethnoarchaeological, ethnohistorical, and experimental insights are crucial to building better theory and designing more productive research.” Another example illustrating the advantages of use-wear analysis is seen by Ahler (1971). The collection of artifacts he analyzed from Rodgers Shelter were classed as projectile points; however, through use-wear experiments, he was able to determine that, in fact, only a small portion were actually used as projectiles. The rest were assigned to activities such as heavy-duty cutting, light cutting, and sawing.

Experimental archaeology is informative when used in conjunction with ethnographic data and necessary without it (Collins 1993; Richards 1988; Vaughan 1985). Generally, though, when dealing with artifacts from prehistoric peoples,
ethnographic data are not available. Therefore, it is accepted that use-wear analysis cannot begin until experimentation has been accomplished because one cannot look at artifacts and determine function without comparative data (Plew and Woods 1985; Vaughan 1985). Commonly, when conducting an experiment, only one or a few aspects of use-wear are studied, depending on the goal of the experiment. Some experiments involve only one tool type and contact material, while others use a variety of both. As a consequence, there is a wide variety of methods and results (Vaughan 1985). Attempts to standardize use-wear experiments have been made since the mid-1970s; however, there seem to be too many variables and differing goals to achieve this, making it necessary for researchers to perform their own experiments rather than relying on others’ data (Ahler 1979; Gonzalez-Urquijo and Ibanez-Estevez 2003; Lewenstein 1981; Young and Bamforth 1990).

Richards (1988) outlines several reasons why previous experimental research typically cannot be applied to answer each subsequent set of research questions. First, texture of materials affects wear patterns. Second, researchers use different magnifications that can determine which kind of use-wear that can be observed. Third, experiments employ different tool types, contact materials, and actions. These reasons make it necessary to conduct one’s own experiment with materials and goals specific to a particular problem.
Background to Use-Wear Studies

History

In the 19th century, the function of stone tools was theorized based on comparisons between tools of their time and tools used by preindustrial societies. Some of the first scientific use-wear studies were performed by Spurrell (1892). He attempted to determine which materials formed a polish on bladelets from Neolithic sites. Later, Curwen (1930) began research of the mechanics of the formation of sickle polish, rather than the identification of contact materials. In addition, archaeologists of the 1930s laid the framework for the development of experimental archaeology; however, their studies were limited in scope, did not follow stringent techniques, and results were not published in an academic form (Vaughan 1985). It was not until the early 1960s that Sonnenfeld (1962) conducted microscopic analysis in conjunction with use-wear studies.

Previous Experimental Research

Systemic Versus Analytical Approaches

Experiments generally follow one of two approaches. The first is systemic, which attempts to emulate aboriginal conditions of use. The second is analytic, which attempts to control variables. Experiments do not have to be performed in the exact manner as
artifacts were used; there are substitutes that can be used with simulations of actions being usually sufficient (Richards 1988).

A systemic example is illustrated by Barton and Bergman (1982), who recreated a Mesolithic Holmegaard bow because the tool they were testing was theorized to be an arrow tip from such a bow. For creating wear on this projectile, Barton and Bergman (1982) suspended a deer carcass by its hind legs from a tree. To catch any small pieces of material that could have broken off of the implement during testing, they placed a plastic sheet underneath the target. Next, they shot their arrow from a bow at a distance of 4 m and 8 m, noting the angle and depth of penetration as well as any damage to the projectile. For a systemic use-wear analysis pertaining to butchering, the gutting and skinning of a deer or buffalo in the appropriate manner is sufficient. It generally takes as little as 20 minutes for one user to skin a deer with one tool (Ahler 1971; Frison 1979; Richards 1988).

Bergman and Newcomer (1983) exemplify an analytic procedure. They used a Mesolithic Holmegaard bow, too, but used a side of beef 15 cm thick backed by the scapula of an ox instead of a deer. The side of beef was encapsulated in a cardboard box to catch any fallen tool fragments. The experiment was set up this way in order to facilitate the retrieval of flint fragments from the beef and to increase consistency, since each shot at a carcass may often differ because its bone is not uniformly shaped. Similarly, Shea et al. (2001) controlled the speed of an arrow with a calibrated crossbow as well as use of a force plate to accurately record the velocity of the projectile.

The amount of pressure to exert on a tool while cutting has been a subject of debate. Vaughan (1985) suggested a systemic approach using only the amount of
pressure needed for efficiency. For this tactic, it is necessary to be consistent and hold tools in the same manner with each stroke as much as possible. For an analytical approach, Lawrence (1979) used an Instrom Machine to exert pressure. With this machine, it was possible to set a constant force similar to that applied by hand. For example, Lawrence (1979) mounted a flake and set the Instrom Machine so that it oscillated vertically for 100 strokes at a uniform pressure against a chosen material.

Richards (1988) advised using prepared forms for the recordation of variables such as tool edge used, the direction and extent of motion, how the tool was held, and other specific details. If the goal of the experiment is to record the different stages of use-wear or use duration, arbitrary observation points are necessary, such as after 50, 200, 800, and 1600 strokes. In addition, the duration of time between each point should be documented with a stopwatch (Vaughan 1985). When the goal of the experiment does not involve wear duration, projectiles or scrapers can be used or projected until broken (Bergman and Newcomer 1983).

Regardless of the method employed, it is necessary to report where the experiment took place, such as on a cement barn floor, in a field, in sand, or on a cutting board (Richards 1988). At the end of the experiment, each tool should be wrapped in tissue, stored in a labeled bag, and taken out only for cleaning and examination. This is so damage does not occur to the replica that may obscure, confuse, or prevent later analysis (Richards 1988).
Previous Analytical Research

One necessary step to ensure a valid experiment is to replicate the tools that will be used for study. This is necessary because different shapes break differently, are hafted differently, and thus acquire wear differently. Once production has finished, the replica can be cleaned, labeled, and examined microscopically for any accidental damage. In addition to examination, tools to be used in the experiment should be measured and described in detail including material, length, width, and thickness (Richards 1988). After this has been accomplished, the replica can be placed into a plastic bag for later use in the experiment (Vaughan 1985).

Variance in experimentation also relates to the hafting procedure. Choice of procedure is directly related to the goals of the researcher. Some researchers are concerned with authenticity while others are concerned with the practicality of making sure the tool will stay in its haft. Barton and Bergman (1982) used pine resin mixed with beeswax on animal sinew because tree resin and sinew have been found on prehistoric artifacts. Odell and Cowan (1986) hafted projectiles using hemp and water-soluble white glue. Shea et al. (2001) used a synthetic paving tar because it possessed similar properties to mastic in use in Syria. Ahler (1971) applied an epoxy resin compound to the haft and bound the tool with rubber bands and nylon thread.

Examples of wood for arrow shafts that have been replicated for experimentation are Port Orford cedar (Barton and Bergman 1982), birch (Bergman and Newcomer 1983), willow, chokecherry, and skunk brush (Frison 1989). Frison (1989) determined that willow works very well for smaller mammals, but a stronger material such as
chokecherry was needed for the penetration of elephant hide. Frison (1989) chose skunk brush for his atlatl replica because this material was used on Archaic period atlatls preserved in caves.

Contact materials used to simulate wear on artifacts include stone, bone, antler, wood, reeds, plants, meat, carcasses, hide, grit, and soil. To simulate butchering, ribs, vertebrae, lower legs of cows, or rabbits can be used. Jerky can stand in to simulate the cutting of dried beef. Commercially tanned hides and leather of deer, rabbits, and cattle can be used when simulating hide cutting (Vaughan 1985). For the simulation of wear inflicted on thrusting spears and projectiles, animal carcasses such as deer, sheep, cattle, and elephants have been employed (Ahler 1971; Frison 1989; Richards 1988; Shea et al. 2001; Vaughan 1985).

It should be stressed that noting just the contact materials is insufficient. It is also important to note the condition of the materials used, including freshness and degree of dryness (Vaughan 1985). For example, Beggarly (1976) observed that aged wood was easier to scrape than green wood. This attribute would affect the wear on the tools; thus, experimenters must be aware that such features might be useful to others who will review the data (Richards 1988).

Cleaning Methods

As with other factors, the cleaning of artifacts and experimental tools can vary greatly, depending on the goal of the researcher. Cleaning is necessary for both artifacts and replicas because under close examination other materials or residues can obscure
traces of wear. Options for cleaning range from using a soft brush and soapy water to a variety of different chemicals and concoctions. Vaughan (1985) recommended using HCl and NaOH for cleaning experimental tools. At observation points, he used warm soapy water, acetone, or 15% dilute HCl. After the experiment, he suggested washing the replica gently with a soft brush in warm soapy water. Beggarly (1976) recommended a stiff brush for removal of wood material.

Kardulias and Yerkes (1996) employed a method of cleaning requiring three successive baths. The first was an ammonia-based cleaner, the second a 10-percent solution of HCl, and the third was 10-percent KOH. Artifacts and replicas were immersed in each bath for ten minutes and rinsed with water before the next bath. To remove dirt and other materials without abrading the surface, the artifacts were placed in plastic containers with the solutions placed inside an ultrasonic cleaner. Fischer et al. (1984) used the same solutions.

Another alternative to brushing comes from Neumann and Sanford (1998) who used sodium (hexa) metaphosphate [(NaPO₃)₁₃], also known as Calgon. They found Calgon highly effective and undamaging if the item was soaked for 12 hours. When handling artifacts after the experiment, finger grease can be removed with acetone (Hurcombe 1992; Richards 1988; Vaughan 1985).

Hurcombe (1992) disagreed with some of the methods employed by other researchers. He viewed the cleaning of artifacts as quite damaging. Damage from cleaning techniques can result from using a toothbrush or strong solutions such as alkalis.

Once the item is clean and air dried, it should then be placed in a plastic bag until further examination is needed (Richards 1988; Vaughan 1985). Because cleaning can
remove diagnostic residues used for residue analysis on prehistoric artifacts, Hardy and Garufi (1998), Hurcombe (1992), and Keeley (1982) advised performing microscopic residue analysis prior to cleaning for use-wear analysis.

**Previous Analytical Methods**

*Microscopy*

Nearly all of the methods for examining use-wear involve a microscope; however, the kind of microscope and magnification used varies between researchers. Varieties of microscopes and magnifications used include stereoscopic, compound, scanning electron microscope (SEM), low-powered or below 100x, high-powered or 200x-2000x, or a combination of all magnifications and microscopes (Richards 1988). A stereoscopic microscope is generally used for finding edge scarring and polishes. Unfortunately, it is largely unusable for magnifications of over 100x. If a magnification of over 100x is required, a compound or binocular microscope with a light transmitted through the lens and onto the tool surface should be used (Vaughan 1985). A magnification of 600x is the upper limit of most of these microscopes. Because of the limits of the stereoscopic and the glare from compound microscopes, some wear traces are only observable using a Scanning Electron Microscope (SEM), which often requires casting the original material and reducing its size to fit the stage (Richards 1988).

Categories of use-wear that can be found microscopically on experimental tools include microchipping, striations, rounding, and micropolishes. Alternate terms for
microchipping are microflaking, edge scarring, utilization damage, and edge damage (Vaughan 1985). Microchipping can result from post-depositional factors including impacts from a plow or trampling. This can be deciphered using low magnification from 10x to 100x on a stereoscope; however, 40x is recommended by Richards (1988) as ideal for recording descriptions. Striations have been called scratches, grooved scratches, furrows, linear depressions, sleeks, and abrasion tracks. Light parallel striations have been termed chattermarks and abraded lines. Striations do not always exist on an artifact and require a high-powered microscope such as a compound at 280x or a SEM to be observed. Striations are useful for determining the motions of a stone tool. Rounding is caused by the contact material smoothing edges and ridges, and can also indicate motion depending on the location of the rounding. These can be viewed with a stereoscope and a magnification from 10x to 100x. Micropolishes have been a good indicator of whether a tool has been used but not the manner in which the wear was acquired. Micropolishes can be viewed at 100x for recognition and at 200x for analysis using a compound microscope (Vaughan 1985). For the recognition of the contact material, Keeley and Newcomer (1977) recommend a compound microscope with an incident light attachment at a magnification of 200x. For documentation, a 35mm camera with fine-grained black and white film with a speed of 125 or color slide film with a speed of 100 can be attached with a microscope adaptor to take micrographs (Richards 1988; Vaughan 1985).

There are researchers who use alternative microscopic methods to those listed above. Del Bene (1979) argued that a compound microscope with an attached light has poor depth of field and hazy images. This can result in the illusion of striations when there really are none. A metal coating can reduce haziness but nothing can be done about
the lack of depth of field. Since SEM does not use light, but instead relies on electrons, there is no problem with reflectivity. In addition, there is a significant increase in depth of field making striations accurately visible. Even when striations are present, however, they are hard to find. This can be solved by utilizing derivative amplification of the SEM image, enhancing edges and flattening out surfaces so that striations are easier to view.

Another option to solve the depth of field problem with light microscopes and impracticality of the SEM is to form a cast of the object to be studied. Ilkjaer (1979) believes this to be an easy and accurate way of performing use-wear analysis. Ilkjaer supports this method because it is no longer necessary to coat the artifact or replica with a translucent material. The cast can be unfolded and flattened, thus eliminating the need for depth of field. This adds the ability to observe the edge and the surface at the same time. In addition, photographed areas can be marked directly on the cast. In my research I have found no additional information pertaining to this method in recent years, calling into question its use in modern use-wear studies, possibly because of extra costs and technical training needed.

Odell and Odell-Vereecken (1980) claim that high-powered magnifications are not needed for the identification of use-wear. They performed a use-wear study with magnifications of below 100x using a stereomicroscope with a reflecting lamp attached. Using a blind test, Odell identified the used part, activity, and worked material as accurately as in a study performed by Keeley and Newcomer (1977), who used a high-powered binocular microscope with an incident-light attachment, a stereomicroscope, and a high-powered microscope for awkward pieces that would not fit in the other types of microscopes. Odell and Odell-Vereecken (1980) suggest that the benefits of using one
low-powered microscope are that it is much cheaper, much less time-consuming, and there is no need to clean the artifact. It is stressed, however, that the researcher must have experience performing use-wear analysis before using the low-powered approach. An SEM appears to be the best instrument to use for identifying specific use-wear; however, it can be expensive and time-consuming.

**Macroscopy**

In addition to microscopic analysis of edge-wear to determine function, there is macroscopic analysis in the form of the study of impact fracture or breakage patterns (Collins 1993; Dockall 1997; Epstein 1963; Fischer et al. 1984; Geneste and Plisson 1993; Knecht 1997; Odell 1981; Shott 1995; Sollberger 1986; Titmus and Woods 1986; Whittaker 1994; Woods 1987). Prior to the development of experimental archaeology, most archaeologists based their studies on morphological attributes of projectile points. Such studies assumed that tools classified as projectile points functioned primarily as projectiles, and that projectile points were the primary tools used as spear or arrow tips (Odell 1988). Ahler (1971) employed experimental archaeology to study use-wear and suggested that this is not the case. He found that the function of projectile points varies greatly. In addition, other artifacts previously not identified as projectiles have been shown to have been used as such. This suggests that projectile point variability may be due to multiple uses within the same toolkit, not from spatial or temporal differences. Since the study by Ahler (1971), further experimental use-wear studies have been performed to continue to increase archaeological understanding of prehistory.
Experimental flint-knapping and use are attempts to define the mechanisms that created fractures on artifacts. These experiments have led Geneste and Plisson (1993) to state that identifying the type of break on a stone tool is the most significant way to determine if the artifact was used as a projectile point. In light of their recommendations, I review fractures and the actions that produce them.

The most common types of breakage are bending fractures. Bending fractures are described as being right-angled on both sides, or with one side having a slight lip (Whittaker 1994). Fischer et al. (1984) found that bending fractures occur when the force is applied over a large area of the tool resulting in a large break that may not be near the contact area. Bending fractures can occur from manufacturing failure or from impact (Fischer et al. 1984).

Bending fractures often occur on the distal end of a stone tool. They are described as being flat, untwisted, unlipped and result from forces acting against the blade in opposing directions (Dockall 1997). Experimental studies have shown that distal bending fractures can be the result of impact, uses other than as a projectile, plow damage, manufacture, or trampling. Ahler (1971) states that distal bending fractures that are accompanied by use-wear, such as edge-rounding and smoothing, were likely used as scraping or cutting implements. Dockall (1997) has found, however, that contact between the target and lateral margins of the artifact can produce forces similar to those of cutting. Therefore, distal bending fractures by themselves should not be used for identification of impact damage or scraping and cutting.

Impact fluting is a kind of bending fracture that occurs when a projectile strikes a hard surface, such as bone, and a flake is detached from the tip that extends down
towards the base (Whittaker 1994). Lieberman and Shea (1994) posit that “macrofracturing,” or impact fluting, is the most indicative breakage characteristic that shows evidence of a tool having been used as a projectile. They state that small distal fractures on a tool can indicate other tool uses or trampling, but that flutes three to five millimeters in length hinder performance as a projectile and only result from use as a projectile. In addition, Frison et al. (1976) found that impact flutes usually only extend down one face of the tool.

Another fracture type is impact burination, where a flake runs along a distal margin (Whittaker 1994). Burins on the distal end occur on breaks and can be single, double, or multiple (Dockall 1997). Titmus and Woods (1986) found that “shearing,” or burination, occurred as a result of hitting targets that were somewhat yielding like wood. They posit that burination is different from bending fractures because the force is directed towards the margin instead of the tip and because hinges rarely appear.

In his study of burins on Paleoindian point types from Texas, Epstein (1963) found that burins on the proximal end or base could be intentional or from use. Two burin characteristics that he identified were those with a broken edge and those with a faceted edge. Broken edges have a slightly rolled surface with a lip or depression. Burin facets have sharp edges, concave surfaces, and negative bulbs of percussion. Epstein (1963) posited that burin facets on proximal ends were produced intentionally during manufacture for five reasons: (1) multiple and patterned facets with negative bulbs of percussion are unlikely to occur by chance; (2) some of the burins recorded could not be the result of a single blow; (3) had the burins been removed from impact there would be no negative bulb of percussion; (4) such burins are similar to others from points made by
groups known to produce burins intentionally; and (5) none of them have been retouched. It is hypothesized that the purpose of intentional burins on the proximal ends of projectile points is for securing them onto the haft. None of the hypotheses from Epstein's (1963) article has been experimentally tested however.

Dockall (1997) referred to the arguments regarding whether or not proximal burins are intentional. He found that experimental tests using Clovis points as thrusting spears resulted in basal burins being commonly associated with the crushing of the ears on the point bases. Because there have been similar results from experiments with other lanceolate points, Dockall (1997) posited that these characteristics may be used to identify the use of lanceolate points as spear tips.

In many cases, crushing on the tip of a projectile may be the only observable impact damage (Whittaker 1994). Crushing occurs primarily on the distal end of the projectile point and leaves step fractures on the area of impact. Titmus and Woods (1986) found that impact with hard materials such as boulders or tree stumps resulted in crushing. In addition, Dockall (1997) found that crushing or multiple step fractures can result from use in cutting, scraping, and piercing. Crushing is also found together with striations, edge abrasion, or spall removals, and these may help to determine the tool’s use. Regardless of the multiple actions that result in crushing and step fractures, it is certain that a force parallel to the long axis of the distal end of the tool occurred (Dockall 1997).

Geneste and Plisson (1993) conducted experiments and found that 80 percent of the breaks from shouldered points were hinge fractures. The height of the hinge usually measured to greater than 2 mm on projectiles only. This hinge height does not occur
through manufacturing failure, trampling, or sediment movement. In a study by Titmus and Woods (1986), it was found that hinge fractures may result from impact with soft materials such as sod, but are common with harder materials such as loose gravel as well. In addition, the fractures were most commonly located on the neck of the projectile (Titmus and Woods 1986).

Cone fractures are fractures that result from force applied to a small area. Such fractures are located near the contact area. Spall removals are a kind of cone fracture. In a study by Fischer et al. (1984), it was found that spall removals occurred in 30 percent of experiments and that they indicated evidence of impact. Dockall (1997) describes “spin-off fractures,” or spall removals, as small features that remove portions of the surface of the projectile point. Their size and location vary depending on the force of the bending fracture that caused them. Experimental studies have shown that spall removals on one surface of the bending fracture are the result of forces that were perpendicular to the projectile point face. If spalling is located on both surfaces of the bending fracture it could be the result of the two fragments vibrating against each other while in the target. Spall removals have not been found to result from manufacturing failure (Dockall 1997; Geneste and Plisson 1993).

There are other breakage patterns that can give information not related to the size and shape of a break. Titmus and Woods (1986) found that the largest difference between impact and manufacturing related breakages was the location of the break. Most of the manufacturing breaks occurred near notches of notched points. In addition, the remaining fragments of a tool alone can be an indication of projectile use. Medial fragments are rarely the result of accidental breakage (Geneste and Plisson 1993).
Another kind of break whose origin cannot be distinguished between impact, manufacturing, or post-depositional processes are *outre-passé* breaks. *Outre-passé* breaks occur when a flake travels to the opposite lateral margin and takes off all or part of it. It is a kind of break that occurs on projectile points when a platform is made too strong or too close to the center-plane of the tool (Whittaker 1994).

An action that may cause projectile points to break is heat-treatment or burning. This action creates potlids, crazing, or irregular pitted scars. Whittaker (1994) suggested that heat-treated specimens are more likely to fracture; however, Odell and Cowan (1986) posited that there is no difference in breakage patterns as a result of heat-treating.

**Breakage Pattern Studies**

Breakage pattern analysis is a practical way to help determine the use of a stone tool because no other use-wear studies are associated with projectiles alone (Lieberman and Shea 1994). Other benefits of the study of breakage patterns are that they can be observed macroscopically and on incomplete implements. This is significant since many tools found in sites are fragmentary. Thus, added interpretation can be made where otherwise there would be none (Titmus and Woods 1986). The information gained from the study of breaks can be helpful for determining the function of single artifacts, and groups of similar artifacts as well as identification of patterns within assemblages (Collins 1993). Another benefit of the study of breakage patterns is that there are few kinds of breakage because of the physical properties of stone (Dockall 1997). Collins (1993:90) states that “the location of the breaks and the stress causing them reflect use
angles, extent and position of hafts, force directions, relative force, and other details reflecting function.”

Collins (1993) pointed out that the study of breakage patterns and reworking should be conducted together. Many tools that break are reworked into different forms. He discovered that a tool in Texas called the Pedernale point had two patterns of breakage and reworking. As it turned out, one function of this tool form was as a projectile point and the other function was as a knife. This difference was discerned by breakage patterns. In addition, Collins (1993) observed that both types of patterns occurred together at the same site, although at some sites one use was more frequent than the other.

Breakage patterns can also provide clues about the nature of the haft (Collins 1993; Geneste and Plisson 1993; Titmus and Woods 1986). Geneste and Plisson (1993) found that hafting with glue alone results in shaft breakage. Hafting with glue in addition to binding results in a projectile fracturing into many pieces at the base. Titmus and Woods (1986) found that adding adhesive to the haft reduces the amount of neck breaks. As a result of the study of breakage patterns and their relation to hafting techniques, Collins (1993) deduced that Paleoindian Angostura lanceolates were hafted in shallow sockets. The multitude of Angostura bases only 2 cm in length found with bending fractures was an indication of this. Another indication was that many of the complete Angostura points found showed basal reworking. These two indications suggest that the points had broken at the terminus of the shallow shaft (Collins 1993).

Studies of breakage patterns have been used to reconstruct subsistence behaviors, associated patterns of weapons use and discard, and hominid evolution (Dockall 1997).
For example, Odell (1988) performed a study to show how lithic analysis can illuminate prehistoric hunting practices. Ethnoarchaeology has shown that aboriginal peoples employ a wide variety of materials and tool forms to use as projectiles. Therefore, Odell (1988) decided to test if debitage had been used as projectiles at a site in Illinois. He found that typical breakage patternsindicative of use as a projectile existed on debitage from the site. Furthermore, the characteristics and location of the breaks on the projected debitage provided clues about the nature of the haft. This information led to the conclusion that there had been a change in hunting techniques.

Another example of the use of breakage pattern analysis is found in a study by Lieberman and Shea (1994), who hypothesized that there were behavioral differences between archaic and modern humans in the Levantine Mousterian. To support their hypothesis, they analyzed lithic hunting technologies to show that archaic peoples hunted more frequently than modern humans. They observed the presence of impact-damaged projectile points, and from this evidence, concluded that hominids were making significant efforts to design their hunting equipment. In addition, a significantly higher degree of projectiles with impact fractures were found in the materials made by Archaic hominids. From this evidence, Lieberman and Shea (1994) were able to support their argument for a shift in behavior between the two groups.

The above evidence illustrating the relevance of breakage patterns in the archaeological record supports the need for its inclusion in future studies. One group of materials that would benefit from breakage pattern experiments are stemmed points of the Great Basin. It is currently hypothesized that stemmed points from the region were multi-purpose tools; however, few experiments have been conducted to test this
hypothesis (Beck and Jones 1993; Pendleton 1979). Lack of breakage indicating use as a projectile may indicate that this hypothesis is incorrect, while evidence of impact breakage may indicate the use of these tools as projectiles.

Use-wear analysis has come a long way since its inception in the 19th century. Once the magnitude of its usefulness was realized, methods of experimentation and analysis vastly improved. It appears, however, that the perfection and standardization of use-wear experimentation is still in the process of being explored and developed. As a result, there are a multitude of ways in which to experiment and perform use-wear analysis involving variations in raw material, contact material, setting, and analysis.

Dockall (1997) has created a table to easily view and access previous studies (Table 2.1). This table neatly summarizes how different use-wear studies indicate different results concerning projectile impact. It also illustrates how, in general, a majority of the studies do find the same information. Among other things, the table shows that of the diagnostics listed, distal breaks are the most debatable feature thought to diagnostically reflect projectile impact.

Perhaps the most important factors to consider when planning use-wear experiment are time, money, materials available, and research questions. Other decisions must also be made such as the kind of experiment desired, whether systemic or analytic, and the kind of microscope or microscopes to be used. While there are many opinions on how best to perform use-wear experiments, the important thing is to test specific goals and describe the project as accurately and in as much detail as possible.
Table 2.1. Summary of Previous Use-Wear Studies of Diagnostic Projectile Impact (After Dockall 1997).

<table>
<thead>
<tr>
<th>Source</th>
<th>Linear Polish</th>
<th>Linear Striae</th>
<th>Edge Rounding</th>
<th>Longit. Macro.</th>
<th>Lateral Macro.</th>
<th>Distal Break</th>
<th>Distal Crushing</th>
<th>spin-offs</th>
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<tr>
<td>Shea 1988</td>
<td>0</td>
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<td>3</td>
<td>1</td>
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<tr>
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<td>Beyries 1998</td>
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<tr>
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Notes: Use-wear studies and the inferred utility of these traces as diagnostic of projectile impact. In some instances the inferred utility of these traces is based upon their identification in text description or photographs within the article. Otherwise, the wear type was considered as not discussed. 0 = Not discussed; 1 = Diagnostic; 2 = Equivocal; 3 = Non-diagnostic.
CHAPTER 3

MATERIALS

The first issue to consider when embarking on use-wear analysis is the scope of the project. For example, is the goal to decipher the material affected by tools or to determine the function of an artifact? There can be many varying goals, each with its own methodology and accompanying experiments. In this study, my goal is to determine whether the function of stemmed points from the Great Basin were used as projectile tips, for other purposes, or in combination of both. Chapters 3 and 4 discuss the materials and methodological options involved in research regarding the function of stemmed points from the northwestern Great Basin. Learning how to identify use-wear is critical to determining the function of stemmed points. Because there are no use-wear experiments pertaining to stemmed points, an experimental study is required (Collins 1993; Crabtree 1975; Kay 1996; Keeley 1980; Odell 1980; Pendleton 1979; Vaughan 1985).

Stemmed Points Analyzed

The provenience of the stemmed point should be a detail of concern. Stemmed points that have been found on the surface of the ground have experienced different degrees of weathering that could conceal or create subtle evidence of edge-wear leading to a biased analysis (Jensen 1988; Keeley 1980; Pendleton 1979). Therefore, stemmed
points recovered from buried contexts are a better choice for the study of use-wear.

Stemmed points that qualified for use in this study met four criteria: (1) they were from a buried context; (2) they were sufficiently complete in form to be assigned to one of the types of stemmed points (e.g., Cougar Mountain, Haskett, Parman, or Windust); (3) they had at least one lateral edge to make a use-wear study possible; and (4) they were available for study. Buried deposits that have yielded stemmed points meeting the above criteria include Bone Springs (Fagan 1974), Cougar Mountain Cave (Cowles 1960; Layton 1972), Dirty Shame Rockshelter (Hanes 1988), Fort Rock Cave (Bedwell 1973), Hanging Rock Shelter (Layton 1970), Last Supper Cave (Layton and Davis, n.d.), and Paulina Lake (Connolly 1999). The total number of stemmed points meeting the above criteria that are included in the current use-wear study is 59. Figure 3.1 shows the locations of these sites. Each site is described briefly below.

Bone Springs (35ML34) is located in south-central Oregon. It was excavated in 1970 by John Fagan. The collection now resides at the Oregon State Museum of Anthropology. Stemmed points that fit the above criteria for the current use-wear study include two Parman points (Fagan 1974) (Figure 3.2).

Cougar Mountain Cave is located in the Fort Rock Basin in south-central Oregon. It was excavated by John Cowles in 1958. Although an amateur archaeologist, Cowles excavated carefully, noted stratigraphy, and kept the collection intact in the Favell Museum in Klamath Falls, Oregon (Cowles 1960). This collection was the most extensive available for study and includes two Cougar Mountain, ten Parman, five Windust, and twelve Haskett type points (Figures 3.3-3.8). Cougar Mountain Cave is the type site for the Cougar Mountain type point (Layton 1972).
Dirty Shame Rockshelter (35ML65) is located in southeastern Oregon in the Owyhee Uplands. It was excavated in 1973 by C. Melvin Aikens and David L. Cole. The collection now resides at the Oregon State Museum of Anthropology. Stemmed points which fall under the above criteria for the current use-wear study include three Windust, two Parman, and one Cougar Mountain point (Hanes 1988) (Figure 3.9).
Fort Rock Cave (35LK1) is located in the Fort Rock Basin in south-central Oregon. It was first excavated in 1938 and 1966 by Luther Cressman and in 1967 by Stephen Bedwell, under the supervision of Cressman. By 1967, the only areas left to excavate were under large boulders that were removed with dynamite and a bulldozer. Stemmed points that fit the above criteria for the current use-wear study include three Windust, three Parman, and one Cougar Mountain point (Figure 3.10). The collection is curated at the Oregon State Museum of Anthropology (Bedwell 1973).

Hanging Rock Shelter (26WA1502) is located in northwestern Nevada near Last Supper Cave. Layton (1970) excavated the rock shelter in 1967 and 1968 and recovered a total of 24 stemmed points. Stemmed points that fit under the above criteria for the current use-wear study include one Windust, two Parman, and one Cougar Mountain point (Figure 3.11). They are curated at the Nevada State Museum.

Last Supper Cave (26Hu102) is located in northwestern Nevada (Layton and Davis, n.d.). It was excavated by Thomas Layton periodically from 1964 to 1974. Stemmed points that fit the above criteria for the current use-wear study include two Windust, one Parman, and one Haskett point (Figure 3.12). They are curated at the Nevada State Museum. Unfortunately, the majority of the points from the Last Supper Cave collection were not available for study.

Paulina Lake (35DS34) is located in central Oregon inside the caldera of Newberry Volcano (Connolly 1999). It was excavated from 1990-1992 by Thomas Connolly, and the collection is stored at the Oregon State Museum of Anthropology. Stemmed points that fit the above criteria for the current use-wear study include seven Windust points (Figure 3.13).
Figure 3.2. Bone Springs Parman stemmed points analyzed in this study (A, 79-8; B, 79-1).

Figure 3.3. Cougar Mountain Cave Cougar Mountain stemmed points analyzed in this study (A, 25-34; B, 25-416).
Figure 3.4. Cougar Mountain Cave Haskett stemmed points analyzed in this study (A, 25-50; B, 25-163; C, 25-49; D, 25-45; E, 25-54; F, 25-57).

Figure 3.5. Cougar Mountain Cave Haskett stemmed points analyzed in this study (A, 25-56; B, 25-58; C, 25-59; D, 25-74; E, 25-46; F, 25-110).
Figure 3.6. Cougar Mountain Cave Parman stemmed points analyzed in this study (A, 25-152; B, 25-264; C, 25-42; D, 25-36; E, 25-122).

Figure 3.7. Cougar Mountain Cave Parman stemmed points analyzed in this study (A, 25-37; B, 25-41; C, 25-8; D, 25-9; E, 25-146).
Figure 3.8. Cougar Mountain Cave Windust stemmed points analyzed in this study (A, 25-40; B, 25-7; C, 25-39; D, 25-38; E, 25-122).

Figure 3.9. Dirty Shame Rockshelter stemmed points analyzed in current use-wear study (Windust: A, A3-7/1B-24; B, B4-10/2 A-1; D, C36/1 I-3; Cougar Mountain: C, C3-12/2-1; Parman: E, C4-10/1-8; F, C4-11/1-4).
Figure 3.10. Fort Rock Cave stemmed points analyzed in this study (Parman: A, 1-10-9/2; B, 11-10/2-1; C, 10-8/2-18; Cougar Mountain: D FRC-66-118; Windust: E, FRC-66-123; F, FRC-66/164; G, FRC-66/203).
Figure 3.11. Hanging Rock Shelter stemmed points analyzed in this study (Windust: A, 103-3240; Parman: B, 103-1225; D, 103-2853; Cougar Mountain: C, 103-2138).

Figure 3.12. Last Supper Cave stemmed points analyzed in this study (Windust: A, 31-1280; B, 31-1856; Haskett: C, 31-1303; Parman: D, 31-1612).
Figure 3.13. Paulina Lake Windust stemmed points analyzed in this study (A, 821-34-BBB-4/3-9; B, 821-34-CCB-3/3-1; C, 821-34-EEB-3/3-2; D, 821-34-KKA-11/3-9; E, 821-34-LLA-8-3-9; F, 821-34-LLD-7/3-9; G, T4, 743-34-P10M-H/32).
Stemmed Point Replicas

Differing lithic materials respond uniquely to the same use-events. In order to avoid performing experiments on an infinite number of lithic sources one should group flints or cryptocrystalline silicates (CCS) into categories of grain-size. Categorizing lithic sources is important because tool type and contact material can determine how long a tool can be used. Many materials have been used in experiments, and they include chert, chalcedony, obsidian, basalt, quartzite, quartz, volcanic tuff, and rhyolite, all of which have differing properties. As a result, there have been use-wear experiments for the sole purpose of comparing materials and determining how they differ. The results indicate that there are indeed variations of resistance to edge-wear, depending on the material used (Greiser and Sheets 1979; Richards 1988; Vaughan 1985).

According to Jones and Beck (1999), stemmed points in the Great Basin are typically made from basalt, obsidian, and CCS. It is to the current study’s benefit that a majority of the stemmed points from the northwestern Great Basin are made from obsidian. Thus, the material used in my experiments was chosen to be similar to the prehistoric artifacts being studied. For the experiment described in Chapter 4, there were six Parman, six Haskett, and six Windust points, all made from obsidian and replicated by James C. Woods (Figures 3.14-3.16). Woods painstakingly replicated these stemmed points so that the most accurate information could be gained from their use. No Cougar Mountain points were replicated because of time constraints.
Figure 3.14. Parman stemmed point replicas used in experiment (A, replica 1; B, replica 2; C, replica 3; D, replica 4; E, replica 5; F, replica 6).

Figure 3.15. Windust stemmed point replicas used in experiment (A, replica 11; B, replica 12; C, replica 13; D, replica 14; E, replica 15; F, replica 16).
Figure 3.16. Haskett stemmed point replicas used in experiment (A, replica 20; B, replica 21; C, replica 22; D, replica 23; E, replica 24; F, replica 25).

Other Materials

Material used to haft the replicas included 12 wooden pine dowels, two pounds of animal hide glue, Johnson’s paste wax, and eighteen 45-cm long rawhide hafting strips. Also used in the experiment was the carcass of a mule deer buck, six 2-m long 2x4 pieces of lumber, 30 m of rope, a stopwatch, a camera, three rolls of black-and-white 400-speed film, and four volunteers. Materials used for analysis included an Olympus Zoom Stereo Microscope with microscopic capabilities of 6x-120x, a digital Canon 300D Rebel camera, camera-to-microscope attachments, and a light guide with bifurcated fiber optics.
In summary, the materials used in this experiment include prehistoric stemmed points, replica stemmed points, supplies used to haft the replica stemmed points, supplies used to implement the experiment, and equipment for microscopic analysis of both the replica and prehistoric stemmed points. These materials were the best suited for my experiment. Factors that influenced their use in this study are availability, time, and money.
CHAPTER 4

METHODS

The goal of this chapter is to describe the methods used in the current experiment and subsequent use-wear analysis, as well as give explanations as to why certain choices regarding methods were made. Previous research was consulted before making decisions concerning how to proceed. Also taken into consideration were the materials available to use as well as time and money constraints.

Methods of Experiment

My experiment was systemic, an experiment that attempts to emulate aboriginal conditions. Reasons for this are that I did not have the money or connections to obtain machines such as an Instrom Machine, calibrated crossbow, or force plate. I was also unsure that an analytical approach would accurately replicate actions that have happened in the past. For example, the Instrom Machine may be very precise and accurate (Lawrence 1979), but I do not believe that a prehistoric person would use a tool exactly the same way with exactly the same force every time. Likewise, a target such as an ox scapula wrapped in 15 cm of beef may create a standard target object (Bergman and Newcomer 1983), but I do not believe that it replicates a real animal target with bones of various shapes and angles. Thus, in my experiments, stemmed points were used to skin
and butcher an animal carcass by hand in a manner likely similar to how it was done in the past.

As noted above in Chapter 3, replicas of the stemmed points used for study were produced experimentally by James Woods. Replication is important because different shapes require different hafting, break differently, and, as a result, have wear on different portions of their body. In this case, method of hafting should be as authentic as possible because use-wear on the hafted element may reveal a tool’s use as well as determine where the tool breaks (Holdaway 1989). The goal of my experiments was to determine if stemmed points were used as projectiles or as knives, creating two functions in need of experimentation. Beck and Jones (1993) have argued that heavy wear on the hafted element could indicate use as a knife. If hafted with Elmer’s glue, there may not be enough movement in the haft to create wear; therefore, I employed animal hide glue and animal sinew in my experiments (Figure 4.1).

Hafting method followed Musil’s (1988) interpretation of hafting styles for the Parman and Windust type points. That is, Parman points were set in socket-hafts and Windust points in split shafted handles (Figure 4.2a, b). Because of time constraints, I did not procure spear handles likely used prehistorically. This would have required going into the forest in the appropriate season and selecting the appropriate tree and branch. Since I did not think the type of spear handle was significant, I used pine dowels purchased from a home improvement store. I then drilled an oblong hole to replicate a socket-haft for the Parman point, and I sawed the midsection out of the end to replicate a split shaft for the Windust. After this, I filed the dowel ends so that they would be tapered. I did this for both the knives and the spears. The spears were cut to 1.5 m long,
and the knife handles were cut to 20 cm long. The width of the dowel was the minimum necessary to fit each individual point. I did not haft the Haskett point in a socket-haft after Musil (1988) because I did not own a drill bit long enough to make the hole required for the length of Haskett stems. In addition, the width of the dowel would have been unacceptably wide in order to fit a Haskett. Therefore, I hafted the Haskett points according to Frison (1974:194) (Figure 4.2c). Frison (1974) illustrated a Hell Gap point in a haft with a split shaft. Hell Gap points are found on the Plains but are of similar size and shape to the Haskett points of the Great Basin.

![The author wrapping animal sinew around a socket-haft.](image)

After producing the spears and knife handles I used animal hide glue to secure the points into them. The split shaft style still had the rawhide hafting strips to secure them, but the socket-haft style had nothing to keep them inside without some kind of mastic. I
added mastic on the points that were hafted into the split shafts for extra strength, so that the points would not become loosened. Next, I wiped glue over the top of the rawhide hafting strips to keep them in place. In the case of the socket-haft, the rawhide hafting strips were necessary to keep the wood near the point from splintering due to impact or pressure. After hafting the replicated stemmed points with glue and hafting strips I added a layer of paste wax because the glue is water-soluble. The paste wax prevented moisture from penetrating into the glue and loosening its fix (Figure 4.3).

Figure 4.2. Methods used to haft stemmed points to spear shafts (A, split-shaft used for experimental Windust points [after Musil 1988: figure 1b]; B, Socket-haft used for experimental Parman points [after Musil 1988: figure 1c]; C, Split-shaft used for experimental Haskett points [after Frison 1974: figure 5.2a]).
I obtained a mule deer carcass from the Reno Animal Control Services for use as a target and for butchering. I decided that the deer should be upright as if it were still alive so I suspended it with rope from a wooden crossbeam that volunteers and I constructed in my back yard.

Experimenting with thrusting/throwing is difficult because it is hard to replicate the velocity and accuracy that a prehistoric hunter possessed. In this experiment, however, the replicated stemmed points were too large to be used with a calibrated crossbow, and a force plate was not available. It has been noted by previous researchers, however, that it is not possible to distinguish between wear patterns on projectiles thrust, thrown, projected from an atlatl, or projected from an arrow (Dockall 1997; Musil 1988). Schmitt and Churchill (2003) provided data from use of a force plate illustrating that there is no difference in wear and breakage regarding velocity. Furthermore, their experiment found no differences in use-wear created by men or women. This evidence
led me to believe that velocity would not determine the outcome of the experiment alone so I felt confident that a spear thrown by myself at variable velocities would not invalidate the results of the experiment. Therefore, I alone threw the spears while standing approximately two meters from the deer carcass (Figure 4.4).

As stated above, some researchers have chosen to record butchering by counting the number of cutting strokes. Hurcombe (1992) suggested, however, that this method is irrelevant because each person who conducts research applies a different force. Therefore, I chose to time my butchering actions with a stopwatch. Since I had three specimens of each point type for use as knives, I chose to use one of each for the times of

![Figure 4.4. The author throwing replica 23 at deer carcass.](image)
five minutes, ten minutes, and fifteen minutes. Other experimenters suggest stopping use at a predetermined time or stroke, cleaning and examining the specimen, and then continuing use; however, I decided that this method was awkward and impractical. I hypothesized that using each type specimen for a different amount of time would still allow me to view the different levels of butchering wear later in a laboratory. Had I an unlimited number of mammal carcasses to butcher, I would have chosen longer use durations but since I only had one mule deer carcass I needed to limit the times of use.

Butchering took place over a dirt surface because dirt and debris can create striations and more wear than a sterile environment (Figure 4.5). I do not think a sterile environment is one that existed for prehistoric peoples; therefore, I did not conduct my experiment in one. It should be noted that the deer had been frozen prior to the experiment and that it had not completely thawed at the time of experimentation. However, it was sufficiently thawed so that a small knife could penetrate it easily.

Each stemmed point replica had an associated paper form that was filled out as the experiment was ongoing. On each form was noted the date, replica number, type of stemmed point, action performed, how many times it was projected if used as a projectile or how long it was used as a knife, where the projectile hit the target or where the knife butchered the carcass, whether or not it broke, when it broke, where it broke, and any other relevant information.
Methods of Analysis

The benefits of a low-powered approach (200x or lower) outlined by Odell and Odell-Vereecken (1980) matched my research needs. I needed a low-cost and fast approach to use-wear in order to conduct my study on stemmed points from the northwestern Great Basin. In addition, the low-powered approach did not require cleaning the artifacts. Currently, cleaning methods are debated because some chemicals can erase evidence of use-wear (Beggarly 1976; Fischer et al. 1984; Hurcombe 1992; Kardulias and Yerkes 1996; Neuman and Sanford 1998; Richards 1988; Vaughn 1985). If I had chosen to clean the artifacts, I would also have needed to have the artifacts analyzed for residue so that I would not erase other important data from them. In
addition, I would have had to gain permission from the organizations responsible for the collections before I conducted any potentially damaging tests on them. It also seems that high-powered use-wear analysis (200x or more) is more concerned with identifying contact materials and specific use-actions, whereas my study did not aim to discern those aspects of use. Instead I aimed to determine whether stemmed points were used for purposes other than as projectiles. All of the above considerations led me to conclude that a low-powered stereo microscope was the most suitable tool for examination of microscopic use-wear on stemmed points. Before the experiment, all of the replica stemmed points were examined under a 10x hand lens and all marks were noted. This was done so that I did not confuse wear from use with wear that may have accrued before the experiment.

After the experiment, the replicas were soaked in hot water to melt the paste wax applied to them so that they could be removed from the hafts. After the paste wax had been removed, they were soaked again so that the animal hide glue would loosen its grip and release the replicas. Once they were released they were again soaked in hot, soapy water and gently rubbed with my fingers to remove any remaining animal hide glue from their surfaces.

After the replicas were washed, they were examined microscopically, before I examined any of the prehistoric artifacts. I recorded and photographed striations, breaks, and other markings that may have indicated use. This initial study also helped me to become familiar with what obsidian looks like under a microscope. I learned that some of the natural properties of obsidian can at first appear similar to use-wear. For example, translucent obsidian has lines or fissures within the material that appear similar to
striations from use (Figure 4.6). I am confident, however, that I learned to distinguish accurately between them. Once I became familiar with the replicated stemmed points and their attributes I began to study the prehistoric stemmed point artifacts.

![Figure 4.6](image)

Figure 4.6. Lateral margin of replica 5 showing natural properties of obsidian (identified by arrows) that are similar to striations caused by use.

Several steps of analysis were conducted during microscopic examination of each stemmed point artifact. First, the point was examined macroscopically and breakage types were noted. Second, each face was examined microscopically to determine if there were any striations on the surface or wear on the arrises. Third, each point was temporarily mounted in a stand so that the lateral edges could be seen, and any basal grinding, stepped flaking, dulling, or crushing were noted. Finally, an overall degree of dulling on the lateral margins was assessed and noted (assessment described in Chapter 5). A power of 30x was most commonly employed to initially examine the points and if
anything needed more examination, a power of up to 120x was used. Certain attributes of wear were photographed and the location of the wear was noted on a photograph of the point being examined.

Previous use-wear studies have been very useful to my study. They illustrated the many different ways to conduct experiments and use-wear analysis, and they showed that many of the methods and materials used are dependent on the goal of the study and the materials available. This helped me to design my own use-wear study. The result of my use-wear study has potential to unveil meaning related to the Great Basin’s poorly understood stemmed point forms. Patterns related to tool use can aid in determining if different stemmed point types were used for different functions. In addition, the attributes relating to function can then be labeled properly, and a more definitive method of explaining stemmed point variability from the Great Basin can be developed. New information about the kinds of activities in which stemmed points were used will increase our understanding of peoples during the TP/EH and their adaptations in the Great Basin.
CHAPTER 5

RESULTS

The goal of this chapter is to describe the results of the spear-throwing and butchering experiments, the resulting use-wear on the experimental points, and results of use-wear analysis on the stemmed point artifacts. From the experiments, I found that some point types were more useful than others for different tasks. In addition, I was able to discern macroscopic and microscopic characteristics that are indicative of particular kinds of use such as crushing, degree of dulling, flake spalling, stepped flakes, striations, and arris wear. There were some use-wear characteristics described by previous researchers that I was not able to identify, supporting the advisability of conducting one's own experiments.

Experimental Results

Experimental Spearing

A total of nine spears were produced and tipped with Parman, Windust, and Haskett point forms and thrown at a deer carcass to observe how they perform and what kind of use-wear would result. In this section I review what occurred with these spears on the day of the experiment.
Replica 1 is a Parman point that was thrown once into the animal target and it struck the upper hindquarters. Immediately following impact the point broke just above the haft. The base of the point bounced out of the target and onto the ground, leaving the tip embedded in the target.

Replica 2 is a Parman point that was thrown once into the animal target striking the upper ribcage. The replica fragmented immediately upon impact. The base remained in the haft, the tip remained in the target, and the midsection broke into two pieces that fell to the ground.

Replica 4 is a Parman point that was thrust once into the animal target and struck in the ribcage. The replica broke into two pieces immediately upon impact. The base remained in the haft, while the distal end remained embedded in the target.

Replica 11 is a Windust point that was thrown once into the target, striking the middle of the rib cage. The replica came out of the haft, the haft fell away, and the replica remained embedded in the target to about one-third of its length. The point was removed from the target, and upon closer examination was found to have an impact burin scar on the distal end (Figure 5.1).

Replica 12 is a Windust point that was thrown once into the target, and striking it in the hindquarters. The replica came out of the haft, the haft fell away, and the replica remained embedded in the target.

Replica 15 is a Windust point that was thrown once into the target and struck 10 cm behind the shoulder. Like the other two Windust type points, it fell out of its haft. While the haft fell away, the replica remained embedded in the target.
Replica 22 is a Haskett point that was thrown four times at the target. The first strike hit above the target’s flank, the second strike hit the middle of the shoulder, the third strike hit on the top of the front shoulder, and the fourth strike hit above the rear leg. After each throw, the spear and hafted replica penetrated but bounced out of the target, and after the fourth throw, the replica sustained a small impact flake on the tip.

Replica 23 is a Haskett point that was thrown ten times at the target. The first throw hit the target’s lower neck, the second hit on the lower neck, the third hit the front of the ribcage, the fourth hit the upper portion of the middle of the ribcage, the fifth hit the middle of the side of the hindquarters, the sixth hit the upper part of the front ribcage, the seventh hit the middle of the shoulder, the eighth hit the top of the shoulder, the ninth hit the upper front leg, and the tenth struck the chest. No breaks were discovered on this point. The spear and hafted replica penetrated but bounced out of the target after each throw.
Replica 25 is a Haskett point that was thrown ten times. The first strike hit on the middle of the shoulder, the second on the upper hindquarter, the third on the rear right side, the fourth on the rear of the shoulder, the fifth on the upper portion of the middle ribcage, the sixth on the rear right side, the seventh on the front lower stomach, the eighth on the back of the shoulder, the ninth on the middle of the stomach, and the tenth on top of the shoulder. After the third throw, a flake was removed from one side of the tip, and after the eighth throw crushing was found on the opposite side of the point tip. Upon closer examination, it was noticed that the point was broken inside of the haft. After each throw, the spear penetrated but bounced out of the target.

*Experimental Butchering*

A total of nine knives were produced and tipped with Parman, Windust, and Haskett point forms. Each point was used for butchering activities such as skinning, meat cutting, and the disarticulation of bones. In this section I review happened to each knife on the day of the experiment.

Replica 3 is a Parman point used as a knife for a duration of five minutes. The replica was used to skin the animal for one minute and 34 seconds and to cut meat for three minutes and 26 seconds. Occasionally bone was scraped.

Replica 5 is a Parman point used as a knife for a duration of fifteen minutes. The replica was used to cut meat from the dismembered front leg and to disarticulate the humerus from the ulna and radius. There was contact with bone as well as some gouging, skinning, and scraping.
Replica 6 is a Parman point used as a knife for a duration of ten minutes. The replica was used to skin around the shoulder for 43 seconds. At this time, the point came out of the haft and use continued without the haft. At two minutes and seven seconds skinning stopped and the cutting of meat began in the shoulder region, disarticulating the front leg. The remaining eight minutes were spent cutting and skinning the leg. My hand quickly tired while holding the point without a haft.

Replica 13 is a Windust point used as a knife for a duration of ten minutes. The replica was first used to slice over the ribcage and into the ribs in order to expose them, second to dig into the partially frozen stomach contents to remove the tip of another point which broke during the throwing portion of the experiment, and third to slice into the back, coming into contact with the ribs. At three minutes and 55 seconds the point became loose in the haft but was still useable. At five minutes and 40 seconds the replica was used to skin the hindquarter. At eight minutes it was used to cut the meat from the hindquarter.

Replica 14 is a Windust point used as a knife for a duration of fifteen minutes. The replica was used to skin the hindquarter for one minute and 30 seconds, then to slice meat from the hindquarter until five minutes. Next the deer was turned over and the point was used to skin for three minutes and five seconds around the forelimb, then it was used to cut into the forelimb and around the elbow joint to disarticulate the radius and ulna from the humerus while frequently coming into contact with bone, and finally it was used to slice meat around the tibia and fibula. The point became loose in the haft at thirteen minutes and five seconds but remained functional.
Replica 16 is a Windust point used as a knife for a duration of five minutes. The replica was used to slice and gouge meat from the scapula and ribs, frequently coming into contact with bone.

Replica 20 is a Haskett point used as a knife for a duration of five minutes. The replica was used to slice meat from the radius and ulna two minutes and 45 seconds. For the remaining amount of time the point was used to pierce skin on the hind limb.

Replica 21 is a Haskett point used as a knife for a duration of fifteen minutes. The replica was used to skin the tibia and fibula for one minute and 42 seconds. Next the Achilles tendon was cut and the femur was disarticulated from the pelvis until three minutes and 34 seconds. Then meat was cut from the femur with no bone contact, but there was a lot of dirt and debris present in the tissue. From 12 minutes to 12 minutes and 30 seconds the point was used to cut tendons, often coming into contact with the tibia bone. For the rest of the time, the tool was used to cut meat from the femur.

Replica 24 is a Haskett point used as a knife for a duration of ten minutes. The replica was used to skin until five minutes and 19 seconds. Next it cut meat over the tibia and fibula while coming into contact with bone and tendons until eight minutes and 20 seconds. For the remainder of time, the point sliced meat and had no contact with bone.

*Resulting General Patterns of Experiment*

While conducting the experiment I noticed a few general patterns regarding how each stemmed point type performed (Table 5.1). All of the spears tipped with Parman points broke at the haft after the first throw, leaving the point embedded in the target.
Perhaps this would not have happened if I had attached the points to a foreshaft that could separate from the weight of the main part of the heavy spear. The Parman points also worked very efficiently as knives while butchering.

All of the spears tipped with Windust points fell out of their hafts after the first throw; however, all of their tips remained embedded in the target. In addition, all of the Windust points became loose or fell out of their hafts while butchering. Windust points have a much shorter stem than the Parman points and this may have led to their inability to remain inside of the haft. In addition, my hafting method probably was not the method employed by TP/EH peoples. Narrower hafts permitting the base to extend outside of the haft may have produced a more effective projectile. This way, animal hide hafting strips could be bound more tightly around the point, anchoring it more firmly to the haft. As a spear, the Windust points effectively penetrated the target efficiently. As a knife, the point itself worked efficiently because the lateral margins were long and very sharp. Overall, however, the point was ineffective because it was unable to stay securely in the haft making butchering problematic.

All of the Haskett points penetrated the target but bounced out after every throw. None of them broke on the distal end but one did break on the proximal end. This leads me to conclude that Haskett points would have made a very inefficient spear tip. Furthermore, Frison's (1974) proposed hafting technique for Hell Gap points did not leave a sufficiently long blade protruding out of the haft. Again, I may not have hafted these points as peoples of the TP/EH would have. All of the Haskett points proved very inefficient as knives, perhaps because they lacked long blades.
Table 5.1. Summary of Effectiveness of Each Point Type.

<table>
<thead>
<tr>
<th>Type</th>
<th>Effective as Projectile</th>
<th>Effective as Knife</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parman</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Windust</td>
<td>X</td>
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<tr>
<td>Haskett</td>
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Resulting Wear on Experimental and Prehistoric Points

Definitions of Observed Use-Wear

Use-wear noted on the experimental and prehistoric points includes degree of dulling on the lateral margins (Figure 5.2), breaks (Figure 5.3), hinged breaks (Figure 5.4), flake spalling (Figure 5.5), stepped flakes (Figure 5.6), stepped flakes on lateral margins (Figure 5.7), hinged termination flakes (Figure 5.8), feathered termination flakes (Figure 5.9), arris wear (Figure 5.10), striations (Figure 5.11), burin scars (Figure 5.6), basal grinding (5.12), and crushing (Figure 5.6). The different degrees of dulling are: (1) no dulling; (2) light, if there is dulling only on the high points of the margin; (3) medium, if dulling extends into the low points of the margin; and (4) heavy, if the high and low points are no longer distinguishable on the margin. When breaks have occurred, a description of their location is included. Hinged breaks are noted if the break extends down one side. Flake spalls are tiny flakes that appear on a break when there is vibration between the two fragments and their presence was also noted. Stepped flakes on the margins are flakes with stepped terminations on the lateral margins of the body of the
point, and the locations of stepped flakes elsewhere were noted. Hinged termination
flakes are flakes that terminate in a hinge, which is less abrupt than a stepped termination
but more abrupt than a feathered termination. Arris wear is wear that occurs on the
ridges separating flake scars, and its presence and location are noted. Striations appeared
as lines on the surface of the point and their presence and locations were noted. Burin
scars are flakes that travel along the lateral margin of a point, their location is noted.
Basal grinding was recorded in three different stages: (1) no basal grinding is when there
is no basal grinding present; (2) slight basal grinding is when there are spots of basal
grinding; and (3) complete basal grinding is when basal grinding is constantly present
throughout the length of the point’s base. Under a microscope crushing appears like
multiple stepped flakes located one on top of the other, giving a crystal-like appearance.
When crushing was present its location was noted.

*Descriptions of Resulting Wear on Replicas*

Replica 1 is a Parman point thrown as a spear once. Use-wear features present are
a break where the base meets the body (Figure 5.3a); on the lateral margins there are
stepped fractures and light dulling as well as some areas with no dulling (Figure 5.13); on
the proximal end of the tip fragment there is a hinged break and flake spalling; on the
distal end of the tip fragment there are stepped flakes and crushing; on the distal end of
the base there is flake spalling and a hinge; and there are a few worn arrises on the middle
and lower body of the point.
Figure 5.2. Examples of degrees of dulling (A, example of no dulling, 60x [Cougar Mountain Cave point 25-146]; B, example of light dulling, 75x [Last Supper Cave point 31-1280]; C, example of moderate dulling, 75x [Hanging Rock Shelter point 103-1225]; D, example of heavy dulling, 75x [Hanging Rock Shelter 103-2853]).
Figure 5.3. Breaks resulting from experiment (A, Replica 1; B, Replica 2; C, Replica 4; D, Replica 25).

Figure 5.4. Example of a hinge on a break (denoted by arrow) located on Replica 2, 30x.
Figure 5.5. Example of flake spalling on a break (denoted by arrows) of Hanging Rockshelter point 103-3240, 30x.

Figure 5.6. Example of crushing (denoted by arrow B), stepped flakes (denoted by arrow A), and a burin scar (denoted by arrow C) on the break of replica 25.
Figure 5.7. Example of stepped flakes (denoted by arrows) on the lateral margin of replica 3, 75x.

Figure 5.8. Example of a hinged termination flake (denoted by arrow) on Cougar Mountain Cave point 25-40.
Figure 5.9. Example of a feathered termination flake (denoted by arrow) on tip of replica 6, 20x.

Figure 5.10. Example of arris wear (denoted by arrow) on replica 2, 90x.
Figure 5.11. Example of striations (denoted by arrow) on replica 3, 75x.

Figure 5.12. Example of basal grinding (denoted by arrow) on Cougar Mountain Cave point 25-58, 75x.
Figure 5.13. Area of no dulling on the lateral margin of replica 1, 75x.

Replica number 2 is a Parman point thrown once as a spear. This point broke into four fragments (Figure 5.3b). One fragment remained in the haft, one fragment is relatively small and broke from the proximal end of the midsection, one fragment is the midsection and one fragment is the tip. Use-wear features present on the base include a hinged break (Figure 5.4), crushing on the lateral margin, and flake spalling on the break; on the small fragment there is a hinge on the distal break, crushing on the proximal and distal breaks, and flake spalling on the proximal end; on the midsection there is flake spalling and a burin scar on the proximal end break and hinges, stepped flakes, and crushing on the proximal and distal end breaks; on the tip fragment there is a hinge, stepped flakes, flake spalling, and a burin scar on the break; on the lateral margins there
are stepped flakes and light dulling; and on the body of the point there is one worn arris (Figure 5.10).

Replica number 3 is a Parman point used as a knife for five minutes. Use-wear features present on the lateral margins include light dulling and stepped flakes (Figure 5.7) and on the base there are striations (Figure 5.11).

Replica number 4 is a Parman point thrown as a spear. Use-wear features present are a break where the base meets the body (Figure 5.3c); the tip fragment includes a break with a negative hinge and flake spalling; on the base fragment there is a hinge and flake spalling on the break (Figure 5.14); on one lateral margin there is crushing near the break; and on both lateral margins there is light dulling and stepped flakes.

Figure 5.14. Flake spalling (denoted by arrow) located on a break of replica 4, 30x.

Replica number 5 is a Parman point used as a knife for fifteen minutes. Use-wear features present on the lateral margins include stepped flakes and light dulling.
Replica number 6 is a Parman point used as a knife for ten minutes. Use-wear present on the body is one worn arris; on the lateral margins there is light dulling and stepped flakes; and on the tip there is a flake with a feathered termination (Figure 5.9).

Replica number 11 is a Windust point thrown as a spear once. Use-wear features present on the tip include a burin scar which travels down one lateral edge (Figure 5.15), stepped flakes, and flake spalling. On the lateral margins there is light dulling and stepped flaking.

![Figure 5.15. Large burin (denoted by arrow) on replica 11.](image)

Replica number 12 is a Windust point thrown as a spear once. Use-wear features on the lateral margins are light dulling and stepped flakes, and on the base there are striations.
Replica number 13 is a Windust point used as a knife for ten minutes. Use-wear features on the lateral margins include light dulling and stepped flakes, and on the lateral margins, body, and base there are striations.

Replica number 14 is a Windust point used as a knife for fifteen minutes. Use-wear features on one lateral margin near the shoulder are striations; on both lateral margins there are stepped flakes and light dulling (Figure 5.16); and on the lateral margins of the tip there is a burin scar on each side (Figure 5.17).

Figure 5.16. Light dulling on a lateral margin of replica 14, 75x.
Figure 5.17. Small burin scars (denoted by arrows) on each side of the distal lateral margins on replica 14.

Replica number 15 is a Windust point thrown as a spear once. Use-wear features on the lateral margins include a few stepped flakes and light dulling.

Replica number 16 is a Windust point used as a knife for five minutes. Use-wear on the lateral margins includes light dulling, stepped flakes, and striations (Figure 5.18).

Replica number 20 is a Haskett point used as a knife for five minutes. Use-wear features on the lateral margins include stepped flakes and light dulling, and on the body and the base there are striations.

Replica number 21 is a Haskett point used as a knife for fifteen minutes. Use-wear features on the lateral margins include light dulling, and stepped flakes and there are striations on the lateral margins of the base.

Replica number 22 is a Haskett point thrown as a spear four times. Use-wear features on the lateral margins include light dulling, and stepped flakes and on the tip there is crushing and a flake with a stepped termination (Figure 5.19).
Figure 5.18. Striation (denoted by arrow) on replica 16, 60x.

Figure 5.19. Crushing (denoted by arrow A) and stepped flakes (denoted by arrow B) on replica 22, 6x.

Replica number 23 is a Haskett point thrown as a spear ten times. Use-wear features on the lateral margins include light dulling and stepped flakes, and on the tip there is crushing.
Replica number 24 is a Haskett point used as a knife for ten minutes. Use-wear features on the lateral margins include one striation, light dulling, and stepped flakes.

Replica number 25 is a Haskett point thrown as a spear ten times. Use-wear features present include a break on the base (Figure 5.3d), on the lateral margins there is light dulling and stepped flakes; on the tip there is crushing (Figure 5.20); on the tip fragment’s break there is a burin scar, crushing, flake spalling, and stepped flakes; and on the base fragment’s break there is a burin scar that travels down the lateral margin, crushing, and stepped flakes (Figure 5.6).

![Figure 5.20. Crushing (denoted by arrow) on the tip of replica 25, 20x.](image)

*Distinguishing Projectiles from Knives*

From the experiments and the analysis of resulting use-wear, I found use-wear attributes indicative of use as a projectile (Table 5.2). These attributes include breakage,
hinged breaks, crushing on the tip, crushing elsewhere, stepped flakes elsewhere, burin scars, and flake spalling. These projectiles broke 55% of the time, and of those that broke, 60% have a hinged break. Crushing on the tip occurred 44% of the time, and crushing in other places occurred 33% of the time. Stepped flakes in locations other than on lateral margins occurred 44% of the time. Flake spalling occurred every time a break occurred. Burin scars on the tip and burin scars in other places did not occur frequently, but since large burin scars likely would not occur from any other use they are still considered indicative of use as a projectile. Other use-wear features that did not appear indicative of use as a projectile were striations and arris wear as well as light dulling and stepped flaking on the lateral margins, which are always present.

From the experiments and the analysis of the resulting use-wear, I found use-wear attributes indicative of use as a knife (Table 5.3). These attributes include flakes with feathered terminations and small burin scars on the tips of the points, a lack of breaks, and striations which appear 77% of the time. The small burin scars found on the tip of replica 14 and the feather-terminated flake on replica 6 do not seem likely to appear from use as a projectile; therefore, they are considered indicative of use from a knife. Other use-wear features that did not appear indicative of use as a projectile were arris wear as well as light dulling and stepped flaking on the lateral margins, which are always present.

From the experiment, I found that there were no differences in lateral margin wear between the spears and the knives. It appears that I am unable to distinguish between light dulling and stepped flakes occurring from use and light dulling and stepped flakes which result from manufacture. This same conclusion was made in use-wear studies
Table 5.2. Summary of Use-Wear Found on Experimental Projectiles.

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Table 5.3. Summary of Use-Wear Found on Experimental Knives.

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by Pendleton (1979) and Plew and Woods (1985). Arris wear was not a common feature on any of the points. Two distal burin scars occurred, one on a knife and one on a projectile. The burin scar that occurred on the projectile was much larger than the scars found on the knife tip. Burin scars located on other areas of the points resulted only from spearing and are located on breaks. Distal crushing and crushing on other areas of the point only occurred on replicas used as projectiles. Therefore, crushing, stepped flakes other than those on the lateral margins, and breaks only occurred on the projectiles. Striations occurred on a majority of knives and rarely on spears.

*Descriptions of Use-Wear Seen on Artifacts*

The results obtained from the use-wear experiment on replicated stemmed points have been beneficial in identifying use-wear and interpreting function on prehistoric stemmed points. Only if lateral margin dulling is moderate or heavy can I conclude that a point has been used for purposes other than as a projectile. Features indicative of use as a projectile are breaks, crushing on the tip, crushing elsewhere, hinged breaks, and flake spalling. Striations found on the artifacts greatly differ from those found on the experimental replicas. Striations on the prehistoric artifacts are frequent, found all over the specimen, and do not follow any particular direction, whereas striations on the experimental replicas do not number more than five on a side and they run parallel to the lateral margin. Likewise, arris wear is much more prevalent on the artifacts than on the replicas and I could not interpret any pattern associated with their presence or location. Therefore, striations and arris wear may not be usable use-wear features in my study. I
noted the material because different materials possess different qualities. For example, I found that arris wear and striations are not as visible on CCS and basalt as they are on obsidian. Also, I am not as familiar with these other materials as I am with obsidian, and activities that produced crushing or stepped flakes on obsidian may not produce crushing or stepped flakes on basalt and CCS because they are stronger materials. Basal grinding was noted because it is unclear whether grinding on stemmed points is from manufacture or from intense use (Beck and Jones 1993).

The following section describes in detail the stemmed points from the Bone Springs, Cougar Mountain Cave, Dirty Shame Rockshelter, Fort Rock Cave, Hanging Rock Shelter, Last Supper Cave, and Paulina Lake sites. A total of 59 stemmed points was examined.

**Bone Springs Results.** Bone Springs point 79-8 is a broken Parman point manufactured on obsidian. Use-wear features on this point indicative of use as a projectile include crushing on the stepped termination of a flake on the break and crushing (Figure 5.21) and flake spalling on the break. Use-wear indicative of use for other purposes is moderate lateral wear. Features that may or may not be related to use-wear are crushing on the bottom of the base, slight basal grinding, striations, and arris wear. These features suggest use as a projectile and also for other purposes.

Bone Springs point 79-1 is a broken Parman point manufactured on CCS. Use-wear features indicative of use as a projectile include a hinge and flake spalls on the break. A feature not indicative of use is lack of dulling on the lateral margins. Another feature that may or may not be related to use-wear is arris wear. These features suggest use as a projectile and do not suggest use for other purposes.
Cougar Mountain Cave Results. Cougar Mountain Cave point 25-6 is a near-complete Windust point manufactured on obsidian. Use-wear features indicative of use for other purposes are heavy dulling on the lateral margins and on the break (Figure 5.21). A feature that may or may not be indicative of use is slight basal grinding. These features do not suggest use as a projectile and do suggest use for other purposes.

Cougar Mountain Cave point 25-7 is a complete Windust point manufactured on rhyolite. Use-wear features indicative of use as a projectile are two hinged-termination flakes on the tip (Figure 5.22). Features not indicative of use are lack of dulling on the lateral margins and reworking on the tip, which appears to have occurred prior to the break. A feature that may or may not indicate use is slight basal grinding. These features suggest use as a projectile and do not suggest use for other purposes.

Cougar Mountain Cave point 25-8 is a broken Parman point manufactured on obsidian. Use-wear features indicative of use are crushing and flake spalling on the
break. Features not indicative of use are light dulling on the lateral margins and partial reworking on the break. Features that may or may not be indicative of use are arris wear and complete basal grinding. These features suggest use as a projectile and do not suggest use for other purposes.

Figure 5.2. Heavy dulling (denoted by arrow) on the distal break of Cougar Mountain Cave point 25-6, 30x.

Cougar Mountain Cave point 25-9 is a complete Parman point manufactured on obsidian. A use-wear feature indicative of use for other purposes is moderate dulling on the lateral margins. Features that may or may not be indicative of use are arris wear, striations, and slight basal grinding. These features do not suggest use as a projectile and do suggest use for other purposes.

Cougar Mountain Cave point 25-34 is a broken Cougar Mountain point manufactured on obsidian. Use-wear features indicative of use as a projectile are flake spalling and crushing on the break (Figure 5.24). A feature not indicative of use is light dulling on the lateral margins. Features that may or may not be indicative of use are arris
wear and complete basal grinding. These features suggest use as a projectile and do not suggest use for other purposes.

Figure 5.23. Hinge-terminated flakes (denoted by arrow) on the tip of Cougar Mountain Cave point 25-7.

Cougar Mountain Cave point 25-36 is a complete Parman point manufactured on obsidian. Use-wear features indicative of use for other purposes are moderate dulling and crushing on the lateral margins. Features that may or may not be indicative of use include crushing on the lateral margin of the base, striations, and worn arrises. A feature not indicative of use is a reworked tip. These features do not suggest use as a projectile and do suggest use for other purposes.

Cougar Mountain Cave point 25-37 is a complete Parman point manufactured on rhyolite. Use-wear features indicative of use for other purposes include moderate dulling on the lateral margins and a small flake with a feathered termination on the tip. Features
that may or may not be indicative of use are arris wear and slight basal grinding. These features do not suggest use as a projectile and do suggest use for other purposes.

![Figure 5.24. Flake spalling on break (denoted by arrow) of Cougar Mountain Cave point 25-34, 30x.](image)

Cougar Mountain Cave point 25-38 is a complete Windust point manufactured on quartzite. A use-wear feature indicative of use for other purposes is moderate dulling on the lateral margins. Features that may or may not be indicative of use are arris wear and complete basal grinding. These features do not suggest use as a projectile and do suggest use for other purposes.

Cougar Mountain Cave point 25-39 is a complete Windust point manufactured on CCS. Use-wear features indicative of use for other purposes include heavy dulling on the lateral margins and the tip. Features that may or may not be indicative of use are arris wear and slight basal grinding. These features do not suggest use as a projectile and do suggest use for other purposes.
Cougar Mountain Cave point 25-40 is a complete Windust point manufactured on rhyolite. Use-wear features indicative of use as a projectile are two flakes with hinged termination on the tip (Figure 5.8). Features not indicative of use are light dulling on the lateral margins and reworking on the tip, which appears to have been done prior to the break. Features that may or may not represent use are arris wear and slight basal grinding. These features suggest use as a projectile and do not suggest use for other purposes.

Cougar Mountain Cave point 25-41 is a complete Parman point manufactured on obsidian. A use-wear feature indicative of use for other purposes is moderate dulling on the lateral margins. Features that may or may not be indicative of use are arris wear, striations, and slight basal grinding. These features do not suggest use as a projectile and do suggest use for other purposes.

Cougar Mountain Cave point 25-42 is a complete Parman point manufactured on obsidian. A feature that is not indicative of use for other purposes is light dulling on the lateral margins (Figure 5.25). Features that may or may not be indicative of use are worn arrises, striations, and complete basal grinding. These features do not suggest use as a projectile or use for other purposes.

Cougar Mountain Cave point 25-45 is a complete Haskett point manufactured on obsidian. A use-wear feature indicative of use for other purposes is moderate dulling on the lateral margins. Features that may or may not be indicative of use are small burin scars on both lateral margins of the base (Figure 5.26), arris wear, striations, and complete basal grinding. These features do not suggest use as a projectile and do suggest use for other purposes.
Figure 5.25. Light dulling on the lateral margin (denoted by arrow) of Cougar Mountain Cave point 25-42, 30x.

Figure 5.26. Burin scar on the bottom of the base (denoted by arrow) of Cougar Mountain Cave point 25-45, 30x.

Cougar Mountain Cave point 25-46 is a broken Haskett point manufactured on obsidian. Use-wear features indicative of use as a projectile are crushing and flake
spalling on the break. A use-wear feature indicative of use for other purposes is heavy dulling on the lateral margins. Features that may or may not be indicative of use are arris wear and striations. A feature not indicative of use is reworking on the tip. These features suggest use as a projectile and use for other purposes.

Cougar Mountain Cave point 25-49 is a complete Haskett point manufactured on CCS. Use-wear features not indicative of use are light dulling on the lateral margins and reworking on the tip. A feature that may or may not be indicative of use is slight basal grinding. These features do not suggest use as a projectile or use for other purposes.

Cougar Mountain Cave point 25-50 is a complete Haskett point manufactured on obsidian. Features indicative of use for other purposes are moderate dulling on the lateral margins, a flake with a feathered termination, and dulling on the tip. Features that may or may not be indicative of use are arris wear, striations, and complete basal grinding. A feature not indicative of use is a very thin cross-section indicating manufacture on a flake. These features do not suggest use as a projectile and do suggest use for other purposes.

Cougar Mountain Cave point 25-54 is a complete Haskett point manufactured on obsidian. A use-wear feature indicative of use for other purposes is moderate dulling on the lateral margins. Features that may or may not be indicative of use are worn arrises and striations. A feature not indicative of use is reworking on the tip. These features do not suggest use as a projectile and do suggest use for other purposes.

Cougar Mountain Cave point 25-56 is a complete Haskett point manufactured on basalt. A feature not indicative of use is light dulling on the lateral margins. A feature
that may or may not be indicative of use is slight basal grinding. These features do not suggest use as a projectile or use for other purposes.

Cougar Mountain Cave point 25-57 is a complete Haskett point manufactured on obsidian. Use-wear features indicative of use for other purposes are moderate dulling on the lateral margins and dulling on the tip. Features that may or may not be indicative of use are heavy arris wear (Figure 5.27), striations, and basal grinding. These features do not suggest use as a projectile and do suggest use for other purposes.

Figure 5.27. Heavy arris wear (denoted by arrow) on Cougar Mountain Cave point 25-57, 30x.

Cougar Mountain Cave point 25-58 is a complete Haskett point manufactured on obsidian. Use-wear features indicative of use for other purposes are crushing and moderate dulling on the lateral margins and a small break on the tip. Features that may or may not be indicative of use are striations, worn arrises, and complete basal grinding
(Figure 5.12). These features do not suggest use as a projectile and do suggest use for other purposes.

Cougar Mountain Cave point 25-59 is a complete Haskett point manufactured on obsidian. A use-wear feature not indicative of use is light dulling on the lateral margins. Features that may or may not be indicative of use are worn arrises, complete basal grinding, and crushing just above the basal grinding. These features do not suggest use as a projectile or for other purposes.

Cougar Mountain Cave point 25-74 is a complete Haskett point manufactured on obsidian. Use-wear features indicative of use for other purposes are multiple burin scars on the tip resulting in the appearance of a perforator (Figure 5.28). On the end of the perforator-like tip is heavy dulling. Despite the multiple burin scars on the distal end, I do not think they indicate use as a projectile. These burins appear to have been produced intentionally in order to use the point for a purpose other than as a projectile, such as for perforation. A feature that may or may not be indicative of use is complete basal grinding.

Cougar Mountain Cave point 25-110 is a broken Haskett point manufactured on obsidian. Use-wear features indicative of use as a projectile include a burin scar, crushing, and a negative hinge on the break (Figure 5.29). A use-wear feature indicative of use for other purposes is moderate dulling on the lateral margin. Features that may or may not be indicative of use are complete basal grinding, crushing just above the basal grinding, and striations. A feature not indicative of use is reworking on the tip, which appears to have been done prior to the break. These features suggest use as a projectile and use for other purposes.
Cougar Mountain Cave point 25-122 is a broken Parman point manufactured on obsidian. Use-wear features indicative of use as a projectile are crushing and flake spalling on the break. Use-wear features indicative of use for other purposes include crushing and moderate dulling on the lateral margins. Features that may or may not be
indicative of use are striations and worn arrises. These features suggest use as a projectile and use for other purposes.

Cougar Mountain Cave point 25-146 is a complete Parman point manufactured on obsidian. Features that are not indicative of use are light dulling on the lateral margins (Figure 5.2a) and reworking on the tip. Use-wear features that may or may not be indicative of use are striations and complete basal grinding. These features do not suggest use as a projectile or use for other features.

Cougar Mountain Cave point 25-152 is a complete Parman point manufactured on obsidian. A use-wear feature indicative of use for other purposes is moderate dulling on the lateral margins. Features that may or may not be indicative of use are striations, crushing on the lateral margin near the shoulder, and crushing and stepped flakes on the bottom of the base (Figure 5.30). These features do not suggest use a projectile and do suggest use for other purposes.

Figure 5.30. Stepped flakes (denoted by arrow) on the bottom of the base of Cougar Mountain Cave point 25-152, 6x.
Cougar Mountain Cave point 25-163 is a complete Haskett point manufactured on obsidian. Use-wear features indicative of use for other purposes are crushing and moderate dulling on the lateral margins. Features that may or may not be indicative of use are striations, complete basal grinding, crushing on the base, and crushing on one side above the basal grinding. These features do not suggest use as a projectile and do suggest use for other purposes.

Cougar Mountain Cave point 25-264 is a complete Parman point manufactured on obsidian. Use-wear features indicative of use are crushing and heavy dulling on the lateral margins. Features that may or may not be indicative of use are worn arrises, striations, crushing and stepped flakes (Figure 5.31) on the bottom of the base, crushing on one shoulder, and slight basal grinding. These features do not suggest use as a projectile and do suggest use for other purposes.

Figure 5.31. Stepped flakes (denoted by arrow) on the bottom of the base of Cougar Mountain point 25-264, 30x.
Cougar Mountain Cave point 25-416 is a broken Cougar Mountain point manufactured on obsidian. Use-wear features indicative of use as a projectile include a hinge and stepped flaking on the proximal break and flake spalling on the distal break. A use-wear feature indicative of use for other purposes is heavy dulling on the lateral margins. Features that may or may not be indicative of use are heavily worn arrises, striations, stepped flaking on the proximal and distal break, and complete basal grinding. These features suggest use as a projectile and use for other purposes.

Dirty Shame Rockshelter Results. Dirty Shame Rockshelter point A3-7/1B-24 is a broken Windust point manufactured on obsidian. Use-wear features indicative of use as a projectile are a hinge and flake spalling on the break. A use-wear feature indicative of use for other purposes is heavy wear on the lateral margins. A feature that may or may not be indicative of use is crushing on the bottom of the base. These features suggest use as a projectile and use for other purposes.

Dirty Shame Rockshelter point B4-10/2 A-1 is a broken Windust point manufactured on CCS. Use-wear features indicative of use as a projectile are a hinge and flake spalling on the break (Figure 5.32). A use-wear feature indicative of use for other purposes is moderate dulling on the lateral margins. A feature that may or may not be indicative of use is slight basal grinding. These features suggest use as a projectile and use for other purposes.

Dirty Shame Rockshelter point C3-12/2-1 is a broken Cougar Mountain point manufactured on CCS. Use-wear features indicative of use as a projectile are a stepped flake on the tip (Figure 5.33) and flake spalling on the distal break. A feature indicative of use for other purposes is moderate dulling on the lateral margins. Other features not
indicative of use are reworking on the distal and proximal breaks (Figure 5.34). These features suggest use as a projectile and for other purposes.

Figure 5.32. Flake spalling (denoted by arrows) on the distal break of Dirty Shame Rockshelter point B4-10/2 A-1, 30x.

Figure 5.33. Stepped flake (denoted by arrow) on the tip of Dirty Shame Rockshelter point C3-12/2-1, 30x.
Dirty Shame Rockshelter point C36/1 I-3 is a complete Windust point manufactured on obsidian. A use-wear feature indicative of use as a projectile is a stepped flake on the tip (Figure 5.35). A use-wear feature indicative of use for other purposes is heavy dulling on the lateral margins. Features that may or may not be indicative of use are arris wear, striations, and slight basal grinding. A feature not indicative of use is reworking on the tip. These features suggest use as a projectile and for other purposes.

Dirty Shame Rockshelter point C4-10/1-8 is a complete Parman point manufactured on obsidian. Use-wear features indicative of use for other purposes are moderate wear on the lateral margins and a flake with a feathered termination on the tip. Features that may or may not be indicative of use are arris wear, striations, and slight basal grinding. These features do not suggest use as a projectile and do suggest use for other purposes.
Dirty Shame Rockshelter point C4-11/1-4 is a complete Parman point manufactured on obsidian. Use-wear features indicative of use for other purposes are moderate dulling on the lateral margins and the tip. Features that may or may not be indicative of use are arris wear, striations, and complete basal grinding. These features do not suggest evidence of use as a projectile and do suggest evidence of use for other purposes.

Fort Rock Cave Results. Fort Rock Cave point 10-9/2 is a broken Parman point manufactured on obsidian. Use-wear features indicative of use as a projectile are crushing and flake spalling on the break. A use-wear feature indicative of use for other purposes is heavy dulling on the lateral margins (Figure 5.36). Features that may or may not be indicative of use are crushing near the shoulder and slight basal grinding. These features suggest use as a projectile and use for other purposes.

Fort Rock Cave point 11-10/2-1 is a complete Parman point manufactured on obsidian. A use-wear feature indicative of use for other purposes is heavy dulling on the
lateral margins. Features that may or may not be indicative of use are arris wear and striations. A feature that is not indicative of use is reworking on the tip. These features do not suggest use as a projectile and do suggest use for other purposes.

Figure 5.36. Heavy dulling on the lateral margin (denoted by arrow) of Fort Rock Cave point 10-9/2, 75x.

Fort Rock Cave point 10-8/2-18 is a broken Parman point manufactured on obsidian. Use-wear features indicative of use as a projectile are a hinge, crushing, and flake spalling on the break. A use-wear feature indicative of use for other purposes is heavy dulling on the lateral margins. Features that may or may not be indicative of use are arris wear, striations, and slight basal grinding. These features suggest use as a projectile and use for other purposes.

Fort Rock Cave point FRC-66/118 is a broken Cougar Mountain point manufactured on obsidian. A feature indicative of use as a projectile is a hinge on the distal break. A feature that is not indicative of use is a lack of dulling on the lateral
margins. These features suggest use as a projectile and do not suggest use for other purposes.

Fort Rock Cave point FRC-66/123 is a complete Windust point manufactured on obsidian. A use-wear feature indicative of use for other purposes is moderate dulling on the lateral margins. A feature that may or may not be indicative of use is complete basal grinding. These features do not suggest use as a projectile and do suggest use for other purposes.

Fort Rock Cave point FRC-66/164 is a broken Windust point manufactured on obsidian. A use-wear feature indicative of use is a burin scar on the break (Figure 5.37). A use-wear feature indicative of use for other purposes is heavy dulling on the lateral margins. Features that may or may not be indicative of use are arris wear and crushing on the base. These features suggest evidence of use as a projectile and of use for other purposes.

Figure 5.37. Burin scar on the break (denoted by arrow) of Fort Rock Cave point FRC-66/164, 6x.
Fort Rock Cave point FRC-66/203 is a broken Windust point manufactured on CCS. A use-wear feature indicative of use as a projectile is flake spalling on the break. A use-wear feature indicative of use for other purposes is moderate wear on the lateral margins. Features that may or may not be indicative of use are dulling on the lateral margins of the base (Figure 5.38) and arris wear. These features suggest use as a projectile and use for other purposes.

![Figure 5.38](image)

_Hanging Rock Shelter Results._ Hanging Rock Shelter point 103-1225 is a complete Parman point manufactured on basalt. Use-wear features indicative of use for other purposes are moderate dulling on the lateral margins (Figure 5.2c) and small flakes and moderate dulling on the tip. A feature that may or may not be indicative of use is slight basal grinding. These features do not suggest use as a projectile and do suggest use for other purposes.
Hanging Rock Shelter point 103-2138 is a broken Cougar Mountain point manufactured on obsidian. Use-wear features indicative of use as a projectile include flake spalling and crushing on the distal break. Use-wear features indicative of use for other purposes are feathered terminations on the proximal break, and heavy dulling and crushing on the lateral margins. Features that may or may not be indicative of use are heavily worn arrises (Figure 5.39), striations, crushing on the lateral margins near the shoulder, and slight basal grinding. The wear is so heavy on the distal break it appears as though it was used after the break occurred. These features suggest use as a projectile and use for other purposes.

![Figure 5.39. Heavily worn arrises (denoted by arrow) on Hanging Rock Shelter point 103-2138, 30x.](image)

Hanging Rock Shelter point 103-2853 is a complete Parman point manufactured on obsidian. Use-wear features indicative of use as a projectile are crushing and stepped flakes on the tip. A use-wear feature indicative of use for other purposes is heavy dulling
on the lateral margins (Figure 5.2d). Features that may or may not be indicative of use are arris wear, striations, and slight basal grinding. These features suggest use as a projectile and use for other purposes.

Hanging Rock Shelter point 103-3240 is a broken Windust point manufactured on obsidian. Use-wear features indicative of use as a projectile are a burin scar that runs along the entire length of the point, flakes with stepped terminations on the tip, and flake spalling (Figure 5.5) and crushing on the break. A use-wear feature indicative of use for other purposes is heavy dulling on the lateral margins. Features that may or may not be indicative of use are arris wear, striations, and slight basal grinding. These features suggest use as a projectile and use for other purposes.

*Last Supper Cave Results.* Last Supper Cave point 31-1280 is a complete Windust point manufactured on obsidian. A use-wear feature not indicative of use is light dulling on the lateral margins (Figure 5.2b). This feature does not suggest use as a projectile or of use for other purposes.

Last Supper Cave point 31-1303 is a broken Haskett point manufactured on obsidian. Use-wear features indicative of use as a projectile are flake spalling and a hinge on the break. Use-wear features not indicative of use are light dulling on the lateral margins and reworking on the tip. Features that may or may not be indicative of use are worn arrises and striations. These features suggest use as a projectile and do not suggest use for other purposes.

Last Supper Cave point 31-1612 is a broken Parman point manufactured on obsidian. Use-wear features indicative of use as a projectile are flake spalling and crushing on the break. A use-wear feature indicative of use for other purposes is heavy
dulling on the lateral margins. Features that may or may not be indicative of use are striations, arris wear, and slight basal grinding. These features suggest use as a projectile and use for other purposes.

Last Supper Cave point 31-1856 is a complete Windust point manufactured on CCS. Use-wear features indicative of use for other purposes are moderate wear on the lateral margins and the distal end. A feature not indicative of use is reworking on the tip. These features do not suggest use as a projectile and do suggest use for other purposes.

**Paulina Lake Results.** Paulina Lake point 821-34-BBB-4/3-9 is a complete Windust point manufactured on obsidian. A use-wear feature indicative of use for other purposes is moderate lateral wear. Features that may or may not be indicative of use are heavy arris wear, a burin scar on the lateral margin of the base, and complete basal grinding. These features do not suggest use as a projectile and do suggest use for other purposes.

Paulina Lake point 821-34-CCB-3/3-1 is a broken Windust point manufactured on obsidian. Use-wear features indicative of use as a projectile are a hinge, flake spalling, and a burin on the break (Figure 5.40). A feature that may or may not be indicative of use is complete basal grinding. A feature that is not indicative of use is lack of dulling on the lateral margins. These features suggest use as a projectile and do not suggest use for other purposes.

Paulina Lake point 821-34-EEB-3/3-2 is a complete Windust point manufactured on obsidian. Use-wear features that are not indicative of use are a lack of dulling on the lateral margins, manufacture from a flake, and a reworked tip. These features do not suggest use as a projectile or use for other purposes.
Paulina Lake point 821-34-KKA-11/3-9 is a broken Windust point manufactured on obsidian. Use-wear features indicative of use as a projectile are flakes with stepped terminations and crushing on the break. A use-wear feature indicative of use for other purposes is moderate wear on the lateral margins. Features that may or may not be indicative of use are striations and complete basal grinding. These features suggest use as a projectile and use for other purposes.

Paulina Lake point 821-34-LLA-8/3-9 is a broken Windust point manufactured on obsidian. Use-wear features indicative of use as a projectile are crushing and a stepped flake on the break. A use-wear feature indicative of use for other purposes is moderate wear on the lateral margins. A feature that may or may not be indicative of use is complete basal grinding. These features suggest use as a projectile and use for other purposes.
Paulina Lake point 821-34-LLD-7/3-9 is a broken Windust point manufactured on obsidian. A use-wear feature indicative of use is a stepped flake on the break (Figure 5.41). A feature that may or may not be indicative of use is basal grinding. A feature that is not indicative of use is a lack of dulling on the lateral margins. These features suggest use as a projectile and do not suggest use for other purposes.

![Figure 5.41. Hinged-termination flake on distal break (denoted by arrow) of Paulina Lake point 821-34-LLD-7/3-9.](image)

Paulina Lake point T4, 743-34-P10M-H/32 is a broken Windust point manufactured on CCS. A feature that may or may not be indicative of use is complete basal grinding. Features that are not indicative of use are a lack of dulling on the lateral margins and reworking on the distal break and proximal end. These features do not suggest use as a projectile or use for other purposes.
Discussion

The remainder of the chapter summarizes the results presented (Table 5.4) and addresses the specific research questions presented in Chapter 1 (Tables 5.5-5.20). My analysis focuses on specific features that were found in the use-wear study to be diagnostic of specific functions, and compares them with three factors that may influence their appearance. These three factors are stemmed point type, the sites that were examined in the study, and the inferred use of each stemmed point. These comparisons attempt to discover meaning in the data recovered.

The first feature compared is degree of dulling (Tables 5.5 and 5.6). I measured the degree of dulling in four categories; none, light, moderate, and heavy. The primary question related to this feature is, does the specific degree of dulling relate to stemmed point type or site? A table comparing dulling with use was not made because dulling was used to define use. The Haskett and Parman points appear to trend toward a moderate level of dulling, the Cougar Mountain points are more often heavily dullled, and the Windust points are not associated with any particular level of dulling but they have a higher percentage of no dulling that the other point types (Table 5.5). Predominant dulling trends relating to sites are no dulling at the Paulina Lake site, light dulling at Last Supper Cave, moderate dulling at the Cougar Mountain Cave and Dirty Shame Rockshelters, and heavy dulling at Fort Rock Cave and Hanging Rock Shelter (Table 5.6). Bone Springs does not have a sufficient sample to indicate specific preferences for degree of dulling; however, it appears not to have heavily dulled point.
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<td>X</td>
<td>X</td>
<td>X</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>
Table 5.4 (cont). Summary of Use-Wear Results on Archaeological Artifacts.

<table>
<thead>
<tr>
<th>site and artifact #</th>
<th>type</th>
<th>material</th>
<th>other use use as projectile</th>
<th>degree of dulling</th>
<th>tip crushing</th>
<th>basal crushing</th>
<th>shoulder crushing</th>
<th>break crushing</th>
<th>hinge</th>
<th>flake spalls</th>
<th>aris wear</th>
<th>striations</th>
<th>stepped flakes</th>
<th>broken</th>
<th>basal grinding</th>
<th>reworked tip</th>
<th>other rework</th>
<th>proximal burin</th>
<th>distal burin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paulina Lake 821-34-BBB-4/3-9</td>
<td>Windust</td>
<td>obsidian</td>
<td>X</td>
<td>moderate</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>X</td>
<td>complete</td>
<td>NA</td>
<td>X</td>
<td>complete</td>
<td>X</td>
<td>complete</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>821-34-CCB-3/3-1</td>
<td>Windust</td>
<td>obsidian</td>
<td>X</td>
<td>none</td>
<td>NA</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>complete</td>
<td>NA</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>complete</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>821-34-EEB-3/3-2</td>
<td>Windust</td>
<td>obsidian</td>
<td>none</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>absent</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>complete</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>821-34-KKA-11/3-9</td>
<td>Windust</td>
<td>obsidian</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>complete</td>
<td>NA</td>
<td>X</td>
<td></td>
<td></td>
<td>complete</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>821-34-LLA-8/3-9</td>
<td>Windust</td>
<td>obsidian</td>
<td>X</td>
<td>moderate</td>
<td>NA</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>complete</td>
<td>NA</td>
<td>X</td>
<td></td>
<td></td>
<td>complete</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>821-34-LLD-7/3-9</td>
<td>Windust</td>
<td>obsidian</td>
<td>X</td>
<td>none</td>
<td>NA</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>complete</td>
<td>NA</td>
<td>X</td>
<td></td>
<td></td>
<td>complete</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T4, 743-34-P10M-H/32</td>
<td>Windust</td>
<td>CCS</td>
<td>none</td>
<td></td>
<td>X</td>
<td>complete</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>complete</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Degree of basal grinding is another feature compared with stemmed point type, site, and use. Complete basal grinding appears to dominate Cougar Mountain and Haskett points. While there is no overwhelming trend concerning basal grinding on Windust points, complete basal grinding made up the highest percentage. Slight basal grinding appears to be most characteristic of Parman points (Table 5.7). When compared between sites (Table 5.8), complete basal grinding is found on almost all of the points from Cougar Mountain Cave and Paulina Lake. Dirty Shame Rockshelter and Hanging Rock Shelter have slight basal grinding as the most common type of grinding, and at Last Supper Cave no basal grinding is predominant. There is no trend for basal grinding at Fort Rock Cave, and there is an absence of complete basal grinding at Bone Springs. Use as a projectile only is the predominant use for complete basal grinding. Use for other purposes and as both is most commonly associated with slight basal grinding. No basal
grinding is predominant on points with no observed purpose, but complete basal grinding has the same percentage (Table 5.9).

Table 5.7. Degree of Basal Grinding According to Stemmed Point Type.

<table>
<thead>
<tr>
<th>Type</th>
<th>Absent n</th>
<th>Slight n</th>
<th>Complete n</th>
<th>Total n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cougar Mountain</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Haskett</td>
<td>1</td>
<td>9</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Parman</td>
<td>6</td>
<td>30</td>
<td>11</td>
<td>20</td>
</tr>
<tr>
<td>Windust</td>
<td>5</td>
<td>24</td>
<td>7</td>
<td>21</td>
</tr>
</tbody>
</table>

Table 5.8. Degree of Basal Grinding According to Site.

<table>
<thead>
<tr>
<th>Site</th>
<th>Absent n</th>
<th>Slight n</th>
<th>Complete n</th>
<th>Total n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bone Springs</td>
<td>1</td>
<td>50</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Cougar Mountain Cave</td>
<td>5</td>
<td>18</td>
<td>10</td>
<td>28</td>
</tr>
<tr>
<td>Dirty Shame Rockshelter</td>
<td>2</td>
<td>33</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Fort Rock Cave</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Hanging Rock Shelter</td>
<td>2</td>
<td>67</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Last Supper Cave</td>
<td>1</td>
<td>14</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Paulina Lake</td>
<td>1</td>
<td>14</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 5.9. Degree of Basal Grinding According to Inferred Use.

<table>
<thead>
<tr>
<th>Inferred Use</th>
<th>Absent n</th>
<th>Slight n</th>
<th>Complete n</th>
<th>Total n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other Use Only</td>
<td>5</td>
<td>22</td>
<td>10</td>
<td>23</td>
</tr>
<tr>
<td>Use as a Projectile Only</td>
<td>1</td>
<td>14</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Use as Both</td>
<td>3</td>
<td>18</td>
<td>6</td>
<td>17</td>
</tr>
<tr>
<td>None Observed</td>
<td>3</td>
<td>38</td>
<td>3</td>
<td>8</td>
</tr>
</tbody>
</table>

While examining the prehistoric artifacts, I discovered recurring features that were not features on the experimental stemmed point replicas (Tables 5.10-5.12). These features include areas of crushing on the base, crushing in the shoulder region, increased amounts of arris wear, striations with no particular concentration or direction, and small burins on the lateral margins on the bottom of the base. Comparing these features with
the other variables may reveal whether they are relevant to use-wear analyses. Basal crushing appears commonly on Parman points but is absent or rare on other types. Crushing on the shoulder appears rarely on all point forms but Windust points. Arris wear is surprisingly common on Parman, Cougar Mountain, and Haskett points, and absent on Windust points. There were not many basal burins found, and, according to the data, they are not related to any particular stemmed point type (Table 5.10).

Excluding Bone Springs, basal crushing is absent or appears at low percentages in all site assemblages. Similarly, shoulder crushing and basal burins are rare or in low percentages at all sites. Arris wear and striations are common among all sites except for Paulina Lake, likely because only Windust points occur in the latter site (Table 5.11).

When compared with inferred use (Table 5.12), basal crushing appears most on points used as both projectiles and for other purposes and never appears on points used as projectiles only. Shoulder crushing appears infrequently with all inferred uses except for use as a projectile only. Arris wear and striations are common on all inferred uses except on those used as a projectile only and points with no observed use. Basal burination appears to only be associated with use for other purposes only.

Therefore, basal and shoulder crushing appear to be more related to use for other purposes than to stemmed point type or site. Arris wear and striations are not common on Windust points and are predominant on Parman points and they appear to be related to use for other purposes. Basal burination could be associated with other purposes, but their sample is not great enough to move beyond speculation.
Table 5.10. Wear that May or May not be Indicative of Use by Type.

<table>
<thead>
<tr>
<th>Type</th>
<th>Basal Crushing</th>
<th>Shoulder Crushing</th>
<th>Arris Wear</th>
<th>Striations</th>
<th>Basal Burination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cougar Mountain</td>
<td>0/1 (0%)</td>
<td>1/5 (20%)</td>
<td>3/5 (60%)</td>
<td>2/5 (40%)</td>
<td>0/1 (0%)</td>
</tr>
<tr>
<td>Haskett</td>
<td>2/11 (18%)</td>
<td>2/13 (15%)</td>
<td>8/13 (62%)</td>
<td>9/13 (69%)</td>
<td>1/11 (9%)</td>
</tr>
<tr>
<td>Parman</td>
<td>6/20 (30%)</td>
<td>3/20 (15%)</td>
<td>17/20 (85%)</td>
<td>16/20 (80%)</td>
<td>0/20 (0%)</td>
</tr>
<tr>
<td>Windust</td>
<td>2/21 (10%)</td>
<td>0/21 (0%)</td>
<td>8/21 (38%)</td>
<td>3/20 (15%)</td>
<td>1/21 (5%)</td>
</tr>
</tbody>
</table>

Table 5.11. Wear that May or May not be Indicative of Use by Site.

<table>
<thead>
<tr>
<th>Site</th>
<th>Basal Crushing</th>
<th>Shoulder Crushing</th>
<th>Arris Wear</th>
<th>Striations</th>
<th>Basal Burination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bone Springs</td>
<td>1/2 (50%)</td>
<td>1/2 (50%)</td>
<td>2/2 (100%)</td>
<td>1/2 (50%)</td>
<td>0/2 (0%)</td>
</tr>
<tr>
<td>Cougar Mountain Cave</td>
<td>5/27 (19%)</td>
<td>4/28 (14%)</td>
<td>19/28 (68%)</td>
<td>17/28 (61%)</td>
<td>1/21 (5%)</td>
</tr>
<tr>
<td>Dirty Shame Rockshelter</td>
<td>1/5 (20%)</td>
<td>0/6 (0%)</td>
<td>4/6 (67%)</td>
<td>3/6 (50%)</td>
<td>0/6 (0%)</td>
</tr>
<tr>
<td>Fort Rock Cave</td>
<td>2/6 (33%)</td>
<td>1/7 (14%)</td>
<td>5/7 (71%)</td>
<td>3/7 (43%)</td>
<td>0/7 (0%)</td>
</tr>
<tr>
<td>Hanging Rock Shelter</td>
<td>1/3 (33%)</td>
<td>1/4 (14%)</td>
<td>3/4 (71%)</td>
<td>3/4 (43%)</td>
<td>0/4 (0%)</td>
</tr>
<tr>
<td>Last Supper Cave</td>
<td>0/3 (0%)</td>
<td>0/4 (0%)</td>
<td>2/4 (50%)</td>
<td>2/4 (50%)</td>
<td>0/4 (0%)</td>
</tr>
<tr>
<td>Paulina Lake</td>
<td>0/7 (0%)</td>
<td>0/7 (0%)</td>
<td>1/7 (14%)</td>
<td>1/7 (14%)</td>
<td>0/7 (0%)</td>
</tr>
</tbody>
</table>

Table 5.12. Wear that May or May not be Indicative of Use Compared with Inferred Use.

<table>
<thead>
<tr>
<th>Inferred Use</th>
<th>Basal Crushing</th>
<th>Shoulder Crushing</th>
<th>Arris Wear</th>
<th>Striations</th>
<th>Basal Burination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other Use Only</td>
<td>4/23 (17%)</td>
<td>3/23 (13%)</td>
<td>15/23 (65%)</td>
<td>14/23 (61%)</td>
<td>2/23 (9%)</td>
</tr>
<tr>
<td>Use as a Projectile Only</td>
<td>0/7 (0%)</td>
<td>0/9 (0%)</td>
<td>5/9 (56%)</td>
<td>1/9 (11%)</td>
<td>0/7 (0%)</td>
</tr>
<tr>
<td>Use as Both</td>
<td>6/15 (17%)</td>
<td>2/19 (11%)</td>
<td>14/19 (74%)</td>
<td>13/19 (68%)</td>
<td>0/15 (0%)</td>
</tr>
<tr>
<td>None observed</td>
<td>0/8 (0%)</td>
<td>1/8 (13%)</td>
<td>2/8 (25%)</td>
<td>2/8 (25%)</td>
<td>0/8 (0%)</td>
</tr>
</tbody>
</table>
Material is another important feature to examine because certain materials may be preferred for particular uses; depending on their abundance they may be related to site, or they could be related to a particular type of stemmed point (Tables 5.13-5.15). When considered by stemmed point type (Table 5.13), obsidian predominates for Haskett and Parman points but not for Cougar Mountain and Windust points. CCS is the next most common material and it is used most frequently among Cougar Mountain points. Included among the fine-grained volcanic rock (FGVR) category are rhyolite and basalt. FGVR is not very common among these stemmed points but Cougar Mountain points have the highest percentage. Quartzite is only present among Windust points. Therefore, Haskett and Parman points are most commonly found on obsidian while the Cougar Mountain and Windust types are generally made on a wider variety of materials. Obsidian is the predominant material found at all of the sites (Table 5.14).

Obsidian is predominant for all inferred uses except for use as a projectile only where there are more varied material preferences (Table 5.15). CCS is the next most preferred material and occurs in low frequencies in all inferred categories followed by FGVR and quartzite respectively.

<table>
<thead>
<tr>
<th>Type</th>
<th>Obsidian</th>
<th>CCS</th>
<th>FGVR</th>
<th>Quartzite</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Cougar Mountain</td>
<td>2</td>
<td>40</td>
<td>2</td>
<td>40</td>
<td>1</td>
</tr>
<tr>
<td>Haskett</td>
<td>11</td>
<td>85</td>
<td>1</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Parman</td>
<td>18</td>
<td>90</td>
<td>1</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Windust</td>
<td>13</td>
<td>62</td>
<td>5</td>
<td>24</td>
<td>2</td>
</tr>
</tbody>
</table>
Table 5.14. Comparison of Materials with Sites.

<table>
<thead>
<tr>
<th>Site</th>
<th>Obsidian</th>
<th>CCS</th>
<th>FGVR</th>
<th>Quartzite</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Bone Springs</td>
<td>1</td>
<td>50</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cougar Mountain Cave</td>
<td>21</td>
<td>72</td>
<td>2</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Dirty Shame Rockshelter</td>
<td>4</td>
<td>66</td>
<td>3</td>
<td>33</td>
<td>0</td>
</tr>
<tr>
<td>Fort Rock Cave</td>
<td>5</td>
<td>71</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hanging Rock Shelter</td>
<td>3</td>
<td>75</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Last Supper Cave</td>
<td>3</td>
<td>75</td>
<td>1</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>Paulina Lake</td>
<td>6</td>
<td>86</td>
<td>1</td>
<td>14</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 5.15. Comparison of Materials with Inferred Uses.

<table>
<thead>
<tr>
<th>Inferred Use</th>
<th>Obsidian</th>
<th>CCS</th>
<th>FGVR</th>
<th>Quartzite</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Other Use Only</td>
<td>18</td>
<td>78</td>
<td>2</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>Use as a Projectile Only</td>
<td>4</td>
<td>44</td>
<td>2</td>
<td>22</td>
<td>3</td>
</tr>
<tr>
<td>Use as Both</td>
<td>16</td>
<td>84</td>
<td>3</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>None Observed</td>
<td>5</td>
<td>63</td>
<td>2</td>
<td>23</td>
<td>1</td>
</tr>
</tbody>
</table>

Stemmed point completeness and reworking are characteristics that can indicate degree of use and/or recycling. Again, these characteristics may be influenced by stemmed point type, site function, or use (Tables 5.16-5.18). Among differing stemmed point types, Haskett and Parman points are frequently complete, while Windust points are more frequently broken (Table 5.16).

Among sites, Cougar Mountain Cave has the highest incident of complete points, while the rest of the sites have lots of broken points (Table 5.17). There are no sites with high percentages of reworked tips, but Last Supper Cave and Fort Rock Cave have the highest percentage, but both are very small samples. Reworking on other areas excluding tips is not very common but occurs at Cougar Mountain Cave, Dirty Shame Rockshelter, and Paulina Lake.
Comparing completeness and reworking with inferred use may not applicable because breakage is usually an indication of use as a projectile and a reworked tip may veil previous use as a projectile (Table 5.18). Thus, it is not a surprise that complete points are substantially representative of use for other purposes and for points with no use identified. Reworked tips are most frequent among points having no observed use and points used as both projectiles only and for other purposes only. Reworking done on other areas is most common on points used as projectiles only.

Table 5.16. Comparison of Stemmed Point Types with Point Completeness and Reworking.

<table>
<thead>
<tr>
<th>Type</th>
<th>Complete</th>
<th>Broken</th>
<th>Reworked Tip</th>
<th>Other Reworking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cougar Mountain</td>
<td>0/5</td>
<td>5/5</td>
<td>NA</td>
<td>1/5</td>
</tr>
<tr>
<td></td>
<td>(0%)</td>
<td>(100%)</td>
<td>(20%)</td>
<td></td>
</tr>
<tr>
<td>Haskett</td>
<td>10/13</td>
<td>3/13</td>
<td>4/12</td>
<td>0/12</td>
</tr>
<tr>
<td></td>
<td>(77%)</td>
<td>(23%)</td>
<td>(33%)</td>
<td>(0%)</td>
</tr>
<tr>
<td>Parman</td>
<td>13/20</td>
<td>7/20</td>
<td>3/17</td>
<td>1/20</td>
</tr>
<tr>
<td></td>
<td>(65%)</td>
<td>(35%)</td>
<td>(18%)</td>
<td>(5%)</td>
</tr>
<tr>
<td>Windust</td>
<td>10/21</td>
<td>11/21</td>
<td>3/12</td>
<td>3/21</td>
</tr>
<tr>
<td></td>
<td>(48%)</td>
<td>(52%)</td>
<td>(25%)</td>
<td>(14%)</td>
</tr>
</tbody>
</table>

Table 5.17. Comparison of Sites with Point Completeness and Reworking.

<table>
<thead>
<tr>
<th>Site</th>
<th>Complete</th>
<th>Broken</th>
<th>Reworked Tip</th>
<th>Other Reworking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bone Springs</td>
<td>0/2</td>
<td>2/2</td>
<td>NA</td>
<td>0/2</td>
</tr>
<tr>
<td></td>
<td>(0%)</td>
<td>(100%)</td>
<td>(0%)</td>
<td></td>
</tr>
<tr>
<td>Cougar Mountain Cave</td>
<td>22/29</td>
<td>7/29</td>
<td>5/24</td>
<td>3/29</td>
</tr>
<tr>
<td></td>
<td>(76%)</td>
<td>(24%)</td>
<td>(21%)</td>
<td>(10%)</td>
</tr>
<tr>
<td>Dirty Shame Rockshelter</td>
<td>3/6</td>
<td>3/6</td>
<td>1/3</td>
<td>1/6</td>
</tr>
<tr>
<td></td>
<td>(50%)</td>
<td>(50%)</td>
<td>(33%)</td>
<td>(17%)</td>
</tr>
<tr>
<td>Fort Rock Cave</td>
<td>2/7</td>
<td>5/7</td>
<td>1/2</td>
<td>0/7</td>
</tr>
<tr>
<td></td>
<td>(29%)</td>
<td>(71%)</td>
<td>(50%)</td>
<td>(0%)</td>
</tr>
<tr>
<td>Hanging Rock Shelter</td>
<td>2/4</td>
<td>2/4</td>
<td>0/3</td>
<td>0/4</td>
</tr>
<tr>
<td></td>
<td>(50%)</td>
<td>(50%)</td>
<td>(0%)</td>
<td>(0%)</td>
</tr>
<tr>
<td>Last Supper Cave</td>
<td>2/7</td>
<td>5/7</td>
<td>1/3</td>
<td>1/7</td>
</tr>
<tr>
<td></td>
<td>(50%)</td>
<td>(50%)</td>
<td>(50%)</td>
<td>(0%)</td>
</tr>
<tr>
<td>Paulina Lake Site</td>
<td>2/7</td>
<td>5/7</td>
<td>1/3</td>
<td>1/7</td>
</tr>
<tr>
<td></td>
<td>(29%)</td>
<td>(71%)</td>
<td>(33%)</td>
<td>(14%)</td>
</tr>
</tbody>
</table>
Table 5.18. Comparison of Inferred Uses with Point Completeness and Reworking.

<table>
<thead>
<tr>
<th>Inferred Use</th>
<th>Complete</th>
<th>Broken</th>
<th>Reworked Tip</th>
<th>Other Reworking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other Use Only</td>
<td>22/23</td>
<td>1/23</td>
<td>4/22</td>
<td>0/23</td>
</tr>
<tr>
<td></td>
<td>(96%)</td>
<td>(4%)</td>
<td>(18%)</td>
<td>(0%)</td>
</tr>
<tr>
<td>Use as a Projectile Only</td>
<td>2/9</td>
<td>7/9</td>
<td>1/5</td>
<td>3/9</td>
</tr>
<tr>
<td></td>
<td>(22%)</td>
<td>(78%)</td>
<td>(20%)</td>
<td>(33%)</td>
</tr>
<tr>
<td>Use as Both</td>
<td>4/22</td>
<td>1/8</td>
<td>3/8</td>
<td>1/8</td>
</tr>
<tr>
<td></td>
<td>(18%)</td>
<td>(13%)</td>
<td>(38%)</td>
<td>(13%)</td>
</tr>
<tr>
<td>Neither</td>
<td>0/23</td>
<td>0/23</td>
<td>0/23</td>
<td>0/23</td>
</tr>
</tbody>
</table>

Finally, to determine whether the differences between stemmed point types are dependent on use, a comparison between them and inferred use must be made (Table 5.19). What is found is that all of the stemmed points were used frequently for both other purposes and for use as a projectile. Specifically, though, Haskett and Parman points were commonly used for other purposes only, while Cougar Mountain points were commonly used as projectiles only. Cougar Mountain points have the highest percentage of being used as a projectile only, and they have the highest percentage of being used as both projectiles and for other purposes. There is a low frequency of stemmed points with no indications of wear.

Table 5.19. Comparison of Inferred Uses with Stemmed Points.

<table>
<thead>
<tr>
<th>Type</th>
<th>Other Use Only</th>
<th>Use as a Projectile Only</th>
<th>Use as Both</th>
<th>None Observed</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Cougar Mountain</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>40</td>
<td>3</td>
</tr>
<tr>
<td>Haskett</td>
<td>7</td>
<td>54</td>
<td>1</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Parman</td>
<td>10</td>
<td>50</td>
<td>2</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Windust</td>
<td>6</td>
<td>29</td>
<td>4</td>
<td>19</td>
<td>8</td>
</tr>
</tbody>
</table>
While comparing the inferred uses with the sites, one finds that use for other purposes and use as a projectile are common at all sites (Table 5.20). Use for other purposes only and use as a projectile only is common at Cougar Mountain Cave. Use as both projectiles and for other purposes is not common at Cougar Mountain Cave, Last Supper Cave, and Paulina Lake. Finding no observed use on stemmed points from these sites is not common.

Table 5.20. Comparison of Inferred Use with Sites.

<table>
<thead>
<tr>
<th>Site</th>
<th>Other Use Only</th>
<th>Use as a Projectile Only</th>
<th>Use as Both</th>
<th>None Observed</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Bone Springs</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>50</td>
<td>1</td>
</tr>
<tr>
<td>Cougar Mountain Cave</td>
<td>16</td>
<td>55</td>
<td>4</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td>Dirty Shame Rockshelter</td>
<td>2</td>
<td>33</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Fort Rock Cave</td>
<td>2</td>
<td>29</td>
<td>1</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td>Hanging Rock Shelter</td>
<td>1</td>
<td>25</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Last Supper Cave</td>
<td>1</td>
<td>25</td>
<td>1</td>
<td>25</td>
<td>1</td>
</tr>
<tr>
<td>Paulina Lake</td>
<td>1</td>
<td>14</td>
<td>2</td>
<td>29</td>
<td>2</td>
</tr>
</tbody>
</table>

While the experimental use-wear results did not match precisely what was found on the artifacts, they did provide useful examples. For instance, lack of wear found on the experimental knives shows that the high degree of wear found on the artifacts could only be from more extensive use than the replicas. Classic characteristics of use-wear resulting from use as a projectile such as flake spalls and hinges on breaks were also of great help in this study. Using key use-wear features such as these, I have found a few patterns regarding stemmed point type and stemmed point use. These findings and their implications are discussed next in Chapter 6.
CHAPTER 6

DISCUSSION AND CONCLUSIONS

In Chapter 1, I reviewed the history of stemmed point research in the Great Basin and the methods used to study them. When Campbell and Campbell (1935) first collected stemmed points from the Pinto Basin, they immediately attempted to classify them through typology. Amsden (1935) examined the points and defined the first stemmed point type, but he stated that there were many variations and posited that they were related to differential raw material quality and individual craftsmanship.

The study of artifact form and function in the Great Basin has not changed much since Campbell and Campbell’s work in the 1930s except the addition of some new type designations describing variability in point forms. Throughout this time, there have been attempts to characterize stemmed points. Some of the names for stemmed point types used today are Lake Mohave (Campbell and Campbell 1937), Silver Lake (Campbell and Campbell 1937), Borax Lake (Harrington 1948), Lind Coulee (Daugherty 1956b), Windust (Rice 1965), Haskett (Butler 1965), Parman (Layton 1970), Cougar Mountain (Layton 1972); however, some researchers combine or exclude stemmed point types (Beck and Jones 1997; Bryan 1980; Layton 1970).

While typologies have not changed dramatically, hypotheses concerning the lifeways of the people who used stemmed points have evolved through time. The Western Pluvial Lakes Tradition model purports that stemmed points were made by
peoples who were dependent on lake environments. In this tradition, peoples could have been highly mobile because at the time of the TP/EH, lakes covered a large portion of the Great Basin and people would not have had to adapt to new surroundings whenever they traveled (Bedwell 1973). There is also the Western Stemmed tradition model, which purports that environments during the TP/EH were always changing. Therefore, peoples from this time period had to have a technology that would allow them to be flexible and subsist on a broad spectrum of resources, not just lakes and marshes (Willig and Aikens 1988).

The traditions defined by researchers have improved our understanding of what life may have been like for peoples living during the TP/EH, but researchers of the Great Basin still do not fully understand variability in stemmed point forms. Different stemmed point forms could be the result of temporal differences, stylistic preferences, functional differences, resharpening, or a combination of these factors. Currently, temporal differences cannot be determined because all of the different stemmed point types appear to date from around 7000 to 11,200 B.P. (Beck and Jones 1997; Pitblado 2003). This limits explanations of stemmed point variability to three possibilities: (1) style, where stemmed point variability is due to different individuals, groups, or cultures with different styles inhabiting the same areas; (2) function, where stemmed point variety is due to each type having a different function and possibly being a part of the same toolkit of a uniform culture; and (3) resharpening, where stemmed point variability is due to similarly used points being discarded at different stages of reduction. I have chosen to explore the functions of stemmed points in an attempt to better explain variability in the context of these three factors.
In order to determine function, I performed use-wear analysis on four of the stemmed point types present in the Great Basin, Cougar Mountain, Haskett, Parman, and Windust. Studies involving lithic analysis have been performed for nearly a century and it has been proven that specific characteristics of prehistoric stone tools can be recreated and their causes recognized (Odell and Odell-Vereecken 1980).

To perform my use-wear study, I performed my own experiments to develop a reference collection for comparison with prehistoric stemmed points. My experiment involved replicas of Parman, Windust, and Haskett points, produced by Jim Woods and used by me as spear tips or knives in a controlled experiment. Next, the replicas were examined under a stereoscopic microscope with a power of 6x-120x and compared with prehistoric stemmed points.

In Chapter 5, I described the results of the experiment, the use-wear analysis of the experimental stemmed points, and the use-wear analysis of the prehistoric stemmed points. The remainder of this chapter presents interpretations of these findings followed by conclusions, findings, and further research.

**Interpretations**

The goal of exploring these data according to stemmed point type is to determine if some use-wear characteristics and features are related to a particular stemmed point type. If the use-wear characteristics and features are not affected by stemmed point type, perhaps stemmed point types are not tied to different functions. Which of these outcomes occurred, and their implications, are discussed in this section.
From the 20 Parman points available for study, I found that they were used primarily for other purposes with additional use as projectiles. Other features associated with the Parman point are: (1) a moderate degree of dulling; (2) a high frequency of slight basal grinding with some instances of complete grinding and no grinding; (3) manufactured on obsidian with one instance of both CCS and FGVR; (4) a relatively low rate of breakage; (5) infrequent reworking on the tip; and (6) one instance of reworking in other areas. Experimentally, the Parman points performed very well as both a projectiles and knives.

From the five Cougar Mountain points available for study, I found that they were used primarily as projectiles with secondary use for other purposes. In addition, I found that: (1) when Cougar Mountain points were used for other purposes, they were not used heavily; (2) a high frequency of them had complete basal grinding; (3) they were made on a variety of materials such as obsidian, CCS, and FGVR; (4) they have a 100% rate of breakage; and (5) they possess evidence of reworking on areas other than the tip. Cougar Mountain point replicas were not available to use experimentally, but based on the remaining prehistoric artifacts, I propose that this point type probably would act similarly to the Parman point and break where the base meets the body.

From the 13 Haskett points available for study, I found that they were primarily used for other purposes and rarely used as projectiles. Other features associated with Haskett points are: (1) a moderate degree of dulling; (2) a high frequency of complete basal grinding; (3) manufactured on obsidian with limited use of CCS and FGVR; (4) a relatively low rate of breakage; and (5) a relatively high percentage of reworking on the tip. It is possible that reworking on the tip obscured evidence of use as a projectile;
however, there is only one instance of use as a projectile only. Experimentally, the Haskett points were not very efficient either as projectiles or knives. Therefore, I conclude Haskett points may have been used primarily for a purpose not recreated during the experiment.

From the 21 Windust points available for study, I found that they were nearly equally used for both other purposes and as projectiles. Windust points may have been primarily used as projectiles, though, because they do not possess crushing on the shoulder and rarely on the base, have relatively low frequencies of arris wear and striations, and have a high rate of breakage. Other features associated with the Windust points are: (1) relatively similar degrees of dulling; (2) the presence of all levels of basal grinding with a slightly higher association with complete basal grinding; (3) manufactured predominantly on obsidian with lesser amounts on CCS, FGVR, and quartzite; (4) a high rate of breakage; and (5) some instances of reworking on the tip as well as other areas. Experimentally, the Windust points did well as projectiles and not very well as knives because they commonly came loose in the haft. Since they appear to have been used as a knives prehistorically, a different hafting technique from that used in my experiment was probably employed.

Possibilities

In the following section, I discuss different possibilities to explain stemmed point variation. These possibilities are style, function, and/or resharpening.
Possibility One

The first possibility attributes stemmed point variability to individuals, groups, or cultures with differing stylistic preferences living within the Great Basin during the same time period. Varying styles could still be a part of a Great Basin TP/EH tradition, but if the stylistic preferences were conscious, stemmed points might have been used to distinguish groups or cultures from each other (Wiessner 1983). In this case, different types of stemmed points defined by researchers are meaningful and a culture-historical study can be used to represent similar time periods and movements of self-identified individuals, groups, or cultures.

In this possibility, two or more stemmed point types would need to have evidence of being used for the same function, and no more than two types could be the result of a resharpener continuum. If these requirements are found, it would indicate that the only difference between all or some stemmed points is due to style. This could mean, for example, that two stemmed point types represent part of a toolkit of one individual, group, or culture, while another stemmed point type represents part of a toolkit of another individual, group, or culture.

Possibility Two

The second possibility attributes stemmed point variability to functional differences. Functional differences between stemmed point types would mean that some
or all of the types represent different components of the same toolkit (Beck and Jones 1997).

This possibility requires finding different functions for some or all of the stemmed point types discussed. I have categorized functions in my study into use as a projectile and use for other purposes. Use for other purposes is admittedly vague and could indicate use for any number of activities such as butchering, cutting grass, or carving wood. For stemmed point variability to represent function, use for other purposes must encompass specific tasks such as those listed above.

Possibility Three

Possibility three attributes stemmed point variability to resharpening. Variability due to resharpening implies that all or some of the stemmed point types in the Great Basin are the result of a resharpening continuum of tools used for the same function (Beck and Jones 1997). In addition, possibility three suggests that all or some of the different names assigned to stemmed point types are irrelevant.

Possibility three is similar to possibility one because it requires evidence that some or all of the stemmed points functioned in the same way. The distinction is that differences among stemmed points are a result of resharpening, not stylistic preference.
Discussion of Possibilities

Possibility One

Since the Cougar Mountain, Parman, and Windust points all indicate use as projectiles and use for other purposes, these three types could represent different styles. Haskett points, however, appear to have been predominantly used for other purposes; therefore, they could be another component of the Cougar Mountain, Parman, or Windust point toolkits. I pair Haskett points with Cougar Mountain points because Cougar Mountain points appear to have been used primarily as projectiles, making the addition of the Haskett point feasible because it was primarily used for other purposes. In addition, they both possess long stems with heavy basal grinding, features that could be identified as stylistic similarities.

Recognizing three styles within the tradition of stemmed points does not necessarily imply that makers of stemmed points did not share similar lifeways such as Bedwell’s (1973) Western Pluvial Lakes Tradition or Willig and Aikens’ (1988) Western Stemmed Tradition. All of the stemmed point types suggest use as multipurpose tools which are associated with mobility. One can only carry so many items; therefore, the cost of transport and need are constantly weighed in a mobile society. The result is a toolkit that is multifunctional with tools that have been reused in a variety of ways (Kuhn 1995).
Possibility Two

While my study could not determine the other purposes for which stemmed points were used, assigning different functions to all or some of the stemmed point types and making them all components of the same toolkit indicates a relatively sedentary lifestyle (Kuhn 1995). It seems that if a tradition is made up of groups who are not very mobile, there would not be as much contact between groups or widespread travel by the same group. This possibility does not explain the widespread distribution of similar stemmed point types found in the Great Basin today. In addition, Andrefsky (2004) posits that sedentary groups use expedient and informal tools for specific tasks. Stemmed points are formal tools that this study has found to be, to different degrees, multifunctional. Because stemmed points are formal and the study area possesses abundant lithic raw material, it is unlikely that different types of stemmed points would be due to use for specific purposes. The recent discovery of a Haskett point cache (Davis and Schweger 2004) and a Parman point cache (Amick 2004) further support the hypothesis that the makers of stemmed points possibly led a mobile lifestyle. Meltzer (2002) suggests that caches of lithic tools may have been used to resupply mobile groups so they would not need to locate a new toolstone source or return to a known toolstone source.

Possibility Three

Possibility three attributes stemmed point variability to a resharpening continuum. The current use-wear results that all stemmed points were, to differing degrees,
multifunctional, are the results that would be expected for a resharpening continuum. There is, however, other evidence that discourages me from reaching this conclusion.

Windust points cannot be included in the resharpening continuum described above because they have significantly different bases than Cougar Mountain, Haskett, and Parman points. Windust points possess parallel-sided straight or concave bases, while Cougar Mountain, Haskett, and Parman points possess contracting and convex bases. Musil (1988) posited that these differences in bases are a result of differing hafting technology. Buvit and Goebel (1997) found that reduction in blade length correlated to distance from raw material source. They did not, however, find a correlation between distance to raw material source and the size of a stemmed point’s base. Thus, differences between stemmed points caused by resharpening cannot be associated with Windust points, whose bases are unique.

Buvit and Goebel (1997) also found that as a point’s blade is reduced (i.e., resharpened) in length and width, a removal of the shoulder can result. This suggests that Haskett points could be resharpened Cougar Mountain points that have lost their shoulders and some of the smaller Haskett points could be the result of resharpened Parman points.

Evidence that hinders the conclusion that any stemmed point types are the result of resharpening, however, is the recent discovery of a Haskett point cache (Davis and Schweger 2004) and a Parman point cache (Amick 2004). Points found in caches are generally seen to represent idealized forms of their types (Amick 2004; Davis and Schweger 2004). It seems unlikely that prehistoric peoples would store or ritualize points that had been previously used and/or resharpened. Furthermore, the cache of Parman
points came with a reduction sequence of bifaces that led up to nearly finished Parman points indicating that Parman points are not the result of resharpening themselves. This evidence leads me to conclude that stemmed point variability is not due to resharpening.

I find that the most likely explanation for the variability found between Cougar Mountain, Haskett, Parman, and Windust stemmed points is a combination of possibilities one and two. Variability between Cougar Mountain, Parman, and Windust points may be due to stylistic differences between individuals, groups, or cultures while Haskett points may represent a functional difference from the others.

**Summary of Findings**

In Chapter 1, I outlined research goals to be addressed in this study. The main goal of this thesis has been to determine if stemmed points were used as projectiles, for other purposes, or for a combination of both. I found that stemmed points were used in varying degrees as both projectiles and use for other purposes.

The first corollary question to be answered is “Can use-wear analysis be used to determine the function of stemmed points?” The answer to this question is yes, use-wear analysis can be used to determine functions of stemmed points, but in this study only approximately, not specifically.

The second corollary question to be answered is “Were different stemmed point types used for different functions?” The answer to this question is not clear. This use-wear study was not able to determine what the other purposes of use might be; however, all of the stemmed point types demonstrated evidence of use as both projectiles and for
other purposes indicating that they were all, to different degrees, multipurpose tools. Haskett points were used relatively infrequently as projectiles, singling them out from the other stemmed points.

The third corollary question to be answered is “Can increased knowledge of stemmed point function lead to an improved typology?” I think that once a typology is proposed, use-wear analysis to determine function can be performed to test it. My study suggests that there is very little functional difference between Cougar Mountain, Parman, and Windust points. Haskett points on the other hand, may represent a tool that should not be equated with the other three stemmed point types.

My study has led me to conclude that: (1) it is possible that Cougar Mountain and Haskett points, Parman points, and Windust points represent three different styles operating within the Great Basin during the TP/EH; (2) the Haskett point is the only point with an apparent functional difference; (3) the unique base of the Windust point and the recently discovered Parman point cache (Amick 2004) and Haskett point cache (Davis and Schweger 2004) make resharpening as an explanation for all of the variability in size and shape unlikely; and (4) the above evidence shows that stemmed points are multifunctional, supporting the idea that peoples inhabiting the Great Basin during the TP/EH may have led a mobile lifestyle (Kuhn 1995).

In summary, I think the most likely possibility is stylistic differences between Cougar Mountain, Parman, and Windust points, with the Haskett representing a functional difference. These stylistic differences may represent emblemic, assertive, or isochrestic views of an individual, group, or culture (Sackett 1982; Wiessner 1983).
Future improvements in dating stemmed points, however, may reveal these differences to be temporal.

\textit{Other Findings}

Some findings in my study can be related to other areas of research regarding stemmed points of the Great Basin. Beck and Jones (1993) posit that heavy edge grinding found on some bases of stemmed points is an indication of heavy use from activities such as cutting or sawing. I have found no patterns indicating that basal grinding results from heavy use (Table 5.9). To the contrary, I found that basal grinding is much more closely related to stemmed point type: Cougar Mountain and Haskett points often possess complete basal grinding, Parman points possess slight basal grinding, and Windust points show no trend in basal grinding (Table 5.7). In addition, Beck and Jones (1993) state that haft damage could be related to the abrasive contact of the stem base with the walls of a socketed haft. I found complete basal grinding on nine of the 21 prehistoric Windust points, which are theoretically set into split shafts. I did find that spots of crushing on the bottom of the base, just above the shoulder of shouldered points, and on the widest point on Haskett points to be related to use for other purposes (Table 5.12). Crushing and grinding are distinguishable under a microscope.

Tuohy (1969) posited that the numerous flakes and burin scars found on stemmed points were purposeful. He wondered whether these characteristics were site specific or part of a larger trend pertaining to all stemmed points. In my experimental study, I found that burin scars on breaks and large burins on the tips of points can be formed from use as
a projectile. In addition, I found that small burin scars and flakes with feathered terminations are characteristics of points used as knives. Tuohy (1969) also stated that specimens with a distal and proximal break could not result from impact fracturing or from lateral stress breakage. He attributed the combination of these two breaks to the reuse of stem fragments. I obtained a break on the proximal and distal ends of a point after a single throw. Some of the features noted by Tuohy (1969) could be from intentional manufacture or from reuse; however, it is possible that some of them could be from use.

Further Research

While working on my project, I found there to be a few topics requiring further research beyond the scope of my project that would also benefit the understanding of stemmed points. These topics include blood residue analysis, residue analysis, and geochemical sourcing.

While I was analyzing the prehistoric stemmed points under the microscope, I noticed that the surfaces of some had spots of a reddish-brown residue that could represent dried blood (Figure 6.1a). Some researchers suggest that protein analysis of blood residues can be used to identify species of mammals (Kooymans et al. 1992). Analysis of blood residues has also been employed on ancient stone tools such as Clovis points to identify animals that the tool had come into contact with during its time of use (Kooymans et al. 2001). Other kinds of residues can also be identified such as plant residues, plant fibers, parenchymous tissue, vessels of poplar and hazelnut origin,
tracheids of pine and spruce, and fragments of reeds (Hardy and Garufi 1998). Another residue that I observed on the prehistoric points in my study appeared granular and pinkish under the microscope (Figure 6.1b). Amick observed a, “reddish-brown mineral film, perhaps red ochre, often associated with ritual internments” (Amick 2004:139) on Parman points found in a cache.

Figure 6.1. Residues present on Prehistoric Stemmed Points, (A, possible blood residue [denoted by arrow], 45x [Cougar Mountain Cave point 25-122]; B, pinkish granular residue [denoted by arrow], 90x [Cougar Mountain Cave point 25-416]).

Identifying animals that stemmed points had come into contact with would definitely increase our knowledge about how peoples of the TP/EH lived and how they used their tools. Other residues could be useful in determining if stemmed points were used for tasks other than projecting and butchering animals. Residue analysis could also answer questions such as how stemmed points were hafted by identifying what kinds of
materials were used as mastic, as binding, and as a foreshaft. I suggest that it is possible that many of the stemmed points in current collections could also have these residues on them even if they have been washed in the past, because I found spots of blood on the experimental tools used in the experiment even after I washed them twice.

Geochemical sourcing would also help further understanding of stemmed points and the lifeways of the people who made them. Geochemical sourcing is commonly used to determine distances of tools from their lithic source; thereby finding the range people traveled to or from a particular spot (Amick 1997; Connolly 1999; Graf 2001, 2002; Jones et al. 2003; Smith 2004, 2005). Geochemical sourcing of the artifacts examined would be useful in addition to my study because it would be interesting to know if heavy dulling was a characteristic of a stemmed point type or a feature associated with a tool’s distance from its raw material source.
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