It is currently unknown why Great Basin Stemmed (GBS) points exhibit considerable morphological variation. We report on an actualistic experiment in which 18 replicated GBS points were used as projectiles and knives to butcher a deer carcass. The resulting use-wear was compared to use-wear on 59 GBS points from archaeological contexts. This allowed us to evaluate two alternative possibilities: (1) GBS points were used for the same tasks, and therefore their morphological variability may reflect other factors (e.g., stylistic traditions); and (2) GBS points were used for distinct tasks and represent components of the same toolkit. Because most GBS points in our sample exhibit use-wear consistent with a use as both projectiles and knives, the second possibility is rejected. Although the first possibility is tentatively accepted, it represents only the starting point for further research on GBS point variability.

Great Basin archaeologists have long recognized the substantial morphological variability exhibited by Great Basin Stemmed (GBS) points, which are indicative of terminal Pleistocene/early Holocene (Paleoindian) occupations in the American West, and co-occur with crescents, bifaces, and formal unifaces (Beck and Jones 1997, 2009a, 2010). The history of the study of GBS point types and similar forms in other parts of the American West has been complex and has varied by researcher and study area (see Butler 1965; Daugherty 1956; Harrington 1948, Layton 1970; Rice 1965; Tuohy and Layton 1977). Types have been proposed on an ad hoc basis without the use of objective metric attributes (e.g., Thomas 1981) like those used to classify Archaic projectile points (but see Beck and Jones [2009a] for a recent effort). Instead, different GBS point types have generally been described as idealized forms by the authors who created the types (e.g., Layton 1970) rather than being formulated using a rigorous typology in which all types were clearly defined.
in which archaeologists should combine all types into a single series—the Great Basin Stemmed Series. Despite this call for a shift in terminology, most researchers have continued to classify specimens using poorly-defined regional types based on descriptions of a few idealized forms—a practice that has only added to the confusion over GBS point terminology and the relationships between different types.

The fact that researchers’ perceptions of GBS point types are far from standardized is more than simply an example of the “splitter-lumper” distinction often referred to by archaeologists; it reflects an inability to move beyond basic questions about culture history. For example, what does the morphological variation among GBS points represent, and was it meaningful to Paleoindians? There are at least four potential sources of such variation, sources which are not necessarily mutually exclusive: (1) temporal differences; (2) point resharpening/reworking; (3) stylistic differences; and (4) functional differences. Until we resolve this question, our ability to tackle more complex issues (e.g., technological organization, demography, or population migration) remains hampered.

If different GBS point types had distinct or only slightly overlapping dates, it might be reasonable to suggest that (as in the case of Archaic points) morphological types equate to temporal types—that is, that GBS point types of different ages could represent the product of technological, stylistic, and/or functional changes. While GBS point types are not as well dated as later point types, a cursory review of published radiocarbon dates associated with GBS points indicates that there are approximately 100 such dates. Their distribution does not suggest discrete or even slightly overlapping ranges for different GBS point types. Rather, each type appears to span the period ~11,000–7,000 14C B.P. (see Table III in Beck and Jones [1997]). Therefore, temporal differences alone do not appear to be a major source of morphological variation in GBS points (but see Duke [2011] for a recent attempt at separating types by time at a local scale).

Resharpening is another possible source of variability. Frison (1968) demonstrated long ago that stone tools change shape as they are used and refurbished. Recently, Beck and Jones (2009a:183) have considered the question of whether GBS point variability could be a function of resharpening/rejuvenation, much as Flenniken and Raymond (1986) argued is the case for Archaic points. While they concluded that one form might occasionally result from the resharpening of another, they found no support for the possibility that the GBS point types in their eastern Nevada sample represented a resharpening continuum. Buvit and Goebel (1997), working with GBS points from the Mount Hebron site, showed that while blade length is correlated with distance from toolstone sources (presumably due to resharpening), base length is not. This may be due to the fact that GBS point stems were apparently enclosed within a foreshaft/shaft and were rarely reworked on their proximal ends (Beck and Jones 2009a). Therefore, resharpening alone is likely not a major contributor to morphological variability in GBS points.

If temporal differences and resharpening cannot fully account for GBS point variability, at least two possibilities remain: the variability is due to (1) stylistic differences, with different groups using morphologically distinct points; or (2) functional differences, with GBS point types representing different components (e.g., projectiles, knives) of the same toolkit (Beck and Jones 2009a). To the best of our knowledge, no studies have explored the first possibility. With regard to the latter possibility, Beck and Jones (2009a), in their study of GBS points from eastern Nevada, relied primarily on macroscopic evidence (e.g., general morphology, breakage types, use-wear, resharpening) to argue that while some types (Parman, Cougar Mountain) likely served multiple purposes, others (Lake Mohave and Silver Lake) probably had specific functions. We do not disagree with many of Beck and Jones’ (2009a) suggestions, but recognize two ways to strengthen their arguments. First, the GBS points in their study come mostly from surface contexts. Replicative studies (e.g., McBrearty et al. 1998; Pargeter 2011) have shown that artifacts from surface contexts may be damaged by human and/or animal trampling, potentially confounding interpretations of function based on macroscopic use-wear. We suggest that artifacts from buried contexts might be better suited for analysis.

Second, because of the large size of their sample, Beck and Jones (2009a) did not conduct the kind of extensive or consistent microscopic analysis that can be useful in identifying the function of lithic artifacts (Odell
2004) on every specimen (Charlotte Beck, personal communication 2012). In this paper, we supplement their work by reporting on an actualistic study that employed both macro- and microscopic approaches to explore the function of GBS points and provide additional insight into factors that may have contributed to their morphological variation. While actualistic studies like ours cannot conclusively demonstrate how artifacts were used in the past, they can tell us how they may have been used, and therefore we hope add to our collective understanding of GBS points.

MATERIALS AND METHODS
Patterns of use-wear on stone tools must be identified to determine their function(s). As Bamforth (2010:95) asserts, this can only be done by comparing them to tools with known use histories (i.e., replicated tools used in actualistic experiments). Additionally, it is important that stone tools be replicated so that different hafting techniques, flaking patterns, and causes of breakage can be identified (Collins 1993; Crabtree 1975; Kay 1996; Keeley 1980; Odell 1980; Pendleton 1979; Vaughan 1985). Here, we outline the types of attributes we considered diagnostic of points used as projectiles and as knives, describe the materials and methods used in our actualistic experiment, and summarize the sample of GBS points analyzed in this study.

Analytical Protocol
Both macroscopic and microscopic use-wear studies have proven effective in inferring how lithic tools were used. Those attributes generated on tools used as projectile points versus those generated on tools used as knives are of particular concern to this study. Dockall’s (1997) summary of use-wear studies provides a concise overview of researchers’ opinions on the utility of various attributes in inferring particular uses. Most researchers agree that three attributes—longitudinal fracturing, lateral macrofracturing, and distal crushing—are reliable indicators of tools used as projectiles. Longitudinal macrofractures are characterized by “the failure of the distal part of the point through cone- or bending-initiation with propagation along one surface,” and include stepped or hinged flake terminations on the distal ends of specimens (often referred to as impact fractures), as well as step/hinge, snap-to-step, and bending fractures (Dockall 1997:325). Lateral macrofractures are characterized by macroscopic flake scars that spread along the lateral edge of an artifact and include burin scars. Distal crushing—formed by a series of very small step fractures clustered at the point of impact—is also diagnostic of tools used as projectiles. Based on the results of our experiment (see below), we add flake spalling (also known as “spin offs”), in which tiny flakes occur on a break when there is vibration between the point fragments (Fischer et al. 1984), overall breakage frequency, macroscopic stepped flakes on locations other than point tips or lateral margins, and other crushing (e.g., on shoulders or bases) to our list of diagnostic projectile attributes.

Although less numerous than those diagnostic of projectiles, two attributes are diagnostic of artifacts used for cutting. Many researchers (Ahler 1971; Ahler and McMillan 1976; Hurcombe 1992; Kononenko 2011; Odell 1980) have demonstrated that surface- and edge-dulling, which is microscopic smoothing of arrises along the surfaces and edges of tools, is linked to tools used for cutting. In some cases, wear is generated when artifacts move around in their hafting while being used (Keeley 1980, 1982; Kononenko 2011; Odell 1981; Shea 1991), wear that increases as tools are handled for longer periods (Shea 1988, 1992; Shea et al. 2001). Given that obsidian projectile points have relatively short use-lives because they often break after one or two throws (Cheshire and Kelly 2006; Lafayette 2006; Woods 1987), moderate to heavy surface- and edge-dulling is probably indicative of tools that were handheld rather than thrown. Conversely, no or light dulling is not especially informative. Based on the results of our experiment, we add feathered flake terminations on the distal ends of points to our list of attributes diagnostic of tools used as knives. Although our experiment showed that striations are common on GBS point replicas (hereafter simply referred to as “replicas”) used as knives and are uncommon on replicas used as projectiles, when we examined the GBS points from archaeological contexts (hereafter referred to as “GBS points”), the overwhelming number and random orientation of striations on those tools, likely generated through a combination of use and post-depositional processes, made it impossible to use striations as a diagnostic attribute in our study—a problem recognized
Table 1
SUMMARY OF USE-WEAR ATTRIBUTES SCORED IN THIS STUDY

<table>
<thead>
<tr>
<th>Use-wear Attribute</th>
<th>Scale</th>
<th>Categories</th>
<th>Definition</th>
<th>Suggested Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface- and Edge-Dulling</td>
<td>Ordinal</td>
<td>None (N)</td>
<td>Not present</td>
<td>Equivocal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Light (L)</td>
<td>Present only on high points of margin</td>
<td>Equivocal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Medium (M)</td>
<td>Present on high and low points of margin</td>
<td>Knife</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Heavy (H)</td>
<td>High and low points indistinguishable</td>
<td>Knife</td>
</tr>
<tr>
<td>Feathered Flake Terminations on Tip</td>
<td>Nominal</td>
<td>Present/Absent</td>
<td>Smooth distal termination of negative flake scar</td>
<td>Knife</td>
</tr>
<tr>
<td>Striations</td>
<td>Nominal</td>
<td>Present/Absent</td>
<td>Lines etched into surface of points</td>
<td>Knife</td>
</tr>
<tr>
<td>Overall Breakage Frequency</td>
<td>Nominal</td>
<td>Present/Absent</td>
<td>Point breakage</td>
<td>Projectile</td>
</tr>
<tr>
<td>Stopped Flake Terminations on Tip</td>
<td>Nominal</td>
<td>Present/Absent</td>
<td>Abrupt (90°) distal termination of negative flake scar</td>
<td>Projectile</td>
</tr>
<tr>
<td>Hinged Flake Terminations on Tip</td>
<td>Nominal</td>
<td>Present/Absent</td>
<td>Rounded or blunt distal termination of negative flake scar</td>
<td>Projectile</td>
</tr>
<tr>
<td>Burin Scars</td>
<td>Nominal</td>
<td>Present/Absent</td>
<td>Breaks that travel along a lateral margin parallel to point's long axis</td>
<td>Projectile</td>
</tr>
<tr>
<td>Flake Spalling</td>
<td>Nominal</td>
<td>Present/Absent</td>
<td>Small flakes on breaks produced when point fragments vibrate together</td>
<td>Projectile</td>
</tr>
<tr>
<td>Stopped Flake Terminations</td>
<td>Nominal</td>
<td>Present/Absent</td>
<td>Flakes with stopped terminations on the lateral margins or base</td>
<td>Projectile</td>
</tr>
<tr>
<td>Elsewhere Besides Lateral Margins</td>
<td>Nominal</td>
<td>Present/Absent</td>
<td>Multiple stepped flake scars on point tip visible under magnification;</td>
<td>Projectile</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>appears crystal-like macroscopically</td>
<td></td>
</tr>
<tr>
<td>Distal Crushing</td>
<td>Nominal</td>
<td>Present/Absent</td>
<td>Multiple stepped flake scars in other locations (shoulders, bases, breaks)</td>
<td>Projectile</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>visible under magnification; appears crystal-like macroscopically</td>
<td></td>
</tr>
</tbody>
</table>

by others (Hurcombe 1992; Kononenko 2011). Thus, while we recorded striations on both replicas and GBS points and present those data here, they did not factor into our interpretations of GBS point function. We used the attributes outlined above to distinguish points used as projectiles, points used as knives, and points used in both capacities. Table 1 summarizes the attributes that we considered in this study.

The Actualistic Experiment
Because few use-wear studies pertaining to GBS points have been conducted (but see Beck and Jones 1993, 2009a), an actualistic study offered an opportunity to discover potential sources of morphological variability. To determine if GBS points were used as projectiles, knives, or a combination thereof, we focused on four point types found in the northern Great Basin: (1) Cougar Mountain; (2) Haskett; (3) Parman; and (4) Windust (Fig. 1). Eighteen replicas (six Parman, six Haskett, and six Windust) were manufactured from obsidian by expert flintknapper Jim Woods (Fig. 2). The size, shape, and flake scar patterns of the replicas were consistent with the ranges of those attributes found on GBS points. Due to time constraints, Cougar Mountain points were not replicated, but because they do not differ significantly in many regards (e.g., blade length, maximum width, basal width, neck width [Beck and Jones 2009a:185]) from Parman points, and because Beck and Jones (2009a:192) recently concluded that both types may have served
Figure 2. Replicas used in our study: (top row left to right) Parman replicas #1-6; (middle row left to right) Windust replicas #11–16; and (bottom row left to right) Haskett replicas #20-25. Replicas manufactured by Jim Woods.
as generalized tools, we assumed that they may have performed similarly. The replicas provided a sample of tools used for known purposes with which GBS points could be compared. They were examined under a 10x hand lens prior to use to note any pre-existing marks that might mimic use-wear.

We used half of the replicas (three of each type) as projectiles and half as knives. All the replicas were hafted in either short foreshaft-like “knife handles” or long “spear shafts.” Animal-hide glue and sinew were used to haft the replicas to milled pine dowels. Hafting methods followed Musil’s (1988:374) inferred techniques for Parman and Windust points—Parman replicas were set in socketed hafts and Windust replicas were inset in split-shaft hafts (Fig. 3). We drilled an oblong hole to create socketed hafts for the Parman replicas and removed the midsection from the dowels’ ends to create split-shaft hafts for the Windust replicas. We then filed the dowel ends so that they were tapered. Spear shafts were cut to 1.5 m. in length and knife handles were cut to 20 cm.; dowel diameters ranged between 3 and 4 cm. We hafted the Haskett replicas in split-shaft hafts following Frison’s (1974:194) hafting method for Hell Gap points (see Fig. 3), a form found on the Great Plains but similar in size and shape to the Haskett points of the northern Great Basin. The recent recovery of a bone/antler split-shaft foreshaft with Haskett points at the Sentinel Gap site on the Columbia Plateau (Galm and Gough 2008) suggests that at least some Haskett points were probably hafted that way. After hafting the replicas, we wiped additional glue over the sinew to keep the points in place, and added a layer of paste wax to prevent moisture from penetrating the glue (which was water soluble) and loosening its hold. Prehistorically, pine tar, pitch, or another natural mastic may have been used in a similar capacity. Figure 4 shows examples of hafted replicas.

We obtained a freshly-killed mule deer carcass from Reno Animal Control Services for use as a target for replicated projectiles and for subsequent butchering using replicated knives. We suspended it upright with rope from a wooden crossbeam in order to imitate
its natural posture. Experiments involving thrusting/throwing may be problematic because it is impossible to know the velocity and accuracy of projectiles thrown by prehistoric hunters. A force plate, which measures the velocity of projectiles and helps to ensure consistent velocity between throws, was unavailable; however, we do not believe this affected the outcome or interpretations of our results, because previous researchers (e.g., Dockall 1997; Musil 1988; Schmitt and Churchill 2003) have noted that there is no clear relationship between use-wear/breakage and velocity. To attempt to control variation in velocity and accuracy, only one of us (Lafayette) threw the spears into the body of the carcass while standing approximately 2 m. from the target. To the best of our knowledge, none of the points hit bone, but instead primarily became embedded in the animal’s abdomen. After half of the replicas had been driven into the carcass, Lafayette used the other half to butcher it.

There are many ways to conduct butchering in a use-wear experiment. For example, Richards (1988) advocated recording butchering activities by counting the number of cutting strokes. Hurcombe (1992) argued that this method is imprecise because different individuals apply different amounts of cutting force. We chose to time the butchering actions using a stopwatch. Since we had three replicas of each point type (for a total of nine) to use as knives, Lafayette used one of each type for 5, 10, and 15 minutes, respectively. We recognize the possibility that more prolonged intervals might either enhance or obscure use-wear signatures; however, because we only had one carcass, use time had to be limited. Lafayette used each replica to both cut (unidirectional) and saw (bidirectional) through hair and skin, separate skin from meat, and cut tendons. These actions involved multiple motions and directions and took place on a dirt surface, because debris can create striations and use-wear traces, and likely best recreates those conditions under which game was traditionally butchered (Bamforth 2010). Using a standardized form, we noted (1) the type and identifying number of each replica; (2) how long we used it (for projectiles we recorded the number of throws, while for knives we recorded the duration of use in minutes); (3) if the replica broke; (4) when and where it broke; and (5) any other relevant observations.

Following use, the replicas were soaked in hot water to melt the paste wax and facilitate their removal from the hafting. Once released from the hafting, the replicas were again soaked in hot, soapy water to remove any remaining glue. Each replica was microscopically examined and documented using an Olympus Zoom Stereo Microscope (6x-120x), a digital Canon 300D Rebel camera, camera-to-microscope attachments, and a light guide with bifurcated fiber optics. Surface- and edge-dulling, breaks, and other attributes related to use were recorded and photographed.

The GBS Point Sample
The context from which lithic artifacts have been recovered is of primary concern to use-wear analysts. Artifacts found on the ground surface may be more weathered (which can conceal use-wear) or impacted by natural processes (e.g., livestock trampling) that mimic use-wear, than artifacts from buried contexts, including caves and rockshelters. This could lead to biased analyses (Jensen 1988; Keeley 1980; Pendleton 1979). Therefore, we initially focused on GBS points recovered from caves and rockshelters for our analysis, but later augmented our sample with specimens recovered from buried contexts at the open-air Bone Springs (Fagan 1974) and Paulina Lake (Connolly 1999) sites. The GBS points included in this study met three additional criteria: (1) they were sufficiently complete to be assigned to one of the four GBS point types prevalent in the northern Great Basin (Cougar Mountain, Haskett, Parman, and Windust); (2) they had at least one lateral edge that permitted use-wear analysis; and (3) they were available for study. Fifty-nine points from seven sites in the northern Great Basin, most of which are made of obsidian, met these criteria (Table 2).

Odell and Odell-Vereeeken’s (1980) approach to use-wear analysis, which demonstrated the benefits and accuracy of low-powered (≤200x) microscopy, was well-suited to our needs because it is low-cost and time-efficient. The low-powered approach does not require the cleaning of artifacts prior to analysis, a practice which has been questioned because it may 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). Additionally, if the GBS points had to be cleaned before analysis, they would also need to be analyzed for residues, and such an analysis was beyond the scope of our project. Finally,
Table 2
GBS POINTS FROM ARCHAEOLOGICAL CONTEXTS USED IN THIS STUDY

<table>
<thead>
<tr>
<th>Archaeological Site</th>
<th>Cougar Mountain</th>
<th>Parman</th>
<th>Windust</th>
<th>Haskett</th>
<th>Total</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cougar Mountain Cave, Ore.</td>
<td>2</td>
<td>10</td>
<td>5</td>
<td>12</td>
<td>29</td>
<td>Cowles (1960)</td>
</tr>
<tr>
<td>Dirty Shame Rockshelter, Ore.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>—</td>
<td>6</td>
<td>Hanes (1980)</td>
</tr>
<tr>
<td>Fort Rock Cave, Ore.</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>—</td>
<td>7</td>
<td>Bedwell (1973)</td>
</tr>
<tr>
<td>Hanging Rock Shelter, Nev.</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>—</td>
<td>4</td>
<td>Layton (1970)</td>
</tr>
<tr>
<td>Last Supper Cave, Nev.</td>
<td>—</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>Layton and Davis (1978)</td>
</tr>
<tr>
<td>Paulina Lake, Ore.</td>
<td>—</td>
<td>—</td>
<td>7</td>
<td>—</td>
<td>7</td>
<td>Connolly (1999)</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>5</strong></td>
<td><strong>20</strong></td>
<td><strong>21</strong></td>
<td><strong>13</strong></td>
<td><strong>59</strong></td>
<td></td>
</tr>
</tbody>
</table>

while high-powered (>200x) microscopy is suitable for identifying specific materials that may have been worked (Odell and Odell-Vereecken 1980), our study was not aimed at discerning that aspect of use. Instead, we simply wanted to determine if GBS points had diagnostic traces from being used as projectiles, knives, or both.

The GBS points and replicas were analyzed as follows: (1) they were examined macroscopically and any damage (e.g., breaks, crushing) was noted; (2) they were examined microscopically for striations, surface- and edge-dulling, and crushing; and (3) they were mounted in a stand so that their lateral edges could be viewed and any stepped faking, surface- or edge-dulling, and crushing noted. A magnification of 30x was most commonly employed to initially examine the GBS points; up to 120x was used when additional magnification was required.

As stated earlier, we have proposed two possibilities regarding the morphological variability present in GBS points: (1) it is due to functional differences; and (2) it is due to stylistic differences. We evaluate these possibilities below.

### RESULTS

Certain replica types were more useful than others for performing particular tasks during our experiment (Table 3). Spears tipped with Parman replicas consistently penetrated the carcass and broke at the haft after the first throw, leaving their distal ends embedded in the target. Parman replicas also worked efficiently as knives for butchering the carcass.

Spears tipped with Windust replicas consistently fell out of their hafts after the first throw; however, their tips remained embedded in the carcass. As knives, Windust replicas became loose or fell out of their hafts during butchering. Although the Windust replicas, like Windust points, generally have shorter stems than other GBS point types, their failure to remain attached to the spear shafts likely says more about our hafting technique than being an issue of point morphology. Obviously, hafting separation did not happen prehistorically or people would not have continued to make those points.

As projectiles, Haskett replicas consistently penetrated the target but failed to remain embedded. None broke on their distal ends, but one broke on its proximal end while in the haft. At face value, the failure of the Haskett replicas to remain embedded suggests that Haskett points made poor spear tips; however, perhaps Frison’s (1974) proposed hafting technique for Hell Gap points—morphologically similar to Haskett points—did not leave a sufficiently long blade for them to remain lodged in carcasses. Hell Gap points have been found associated with large prey (Frison 1974), indicating that prehistoric groups clearly knew how to haft and use them; thus, the failure of our morphologically similar Haskett replicas to perform well as projectiles is

Table 3
SUMMARY OF EFFECTIVENESS OF GBS REPLICAS IN THE EXPERIMENT

<table>
<thead>
<tr>
<th>Experimental Function</th>
<th>Point Type</th>
<th>Projectile</th>
<th>Knife</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Parman</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Windust</td>
<td>+</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Haskett</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

...
likely related to our hafting method. We recognize that employing different hafting methods in future studies, perhaps using a smaller split-shaft haft similar to the one found with Haskett points (Galm and Gough 2008), might produce different results. The Haskett replicas also proved inefficient as knives, perhaps because they lacked sufficiently long blades for cutting as they were hafted. Frison (2004:199) has suggested that long-stemmed points may have served most efficiently as knives when unhafted and used without handles, and this may very well have been the case.

Use-Wear Attributes of Replicas
To infer what GBS points were used for, we relied on attributes (e.g., longitudinal and lateral fractures, distal crushing, moderate to heavy surface- and edge dulling) previously noted by other researchers involved in replicative experiments (see Dockall [1997] for a summary), as well as on additional attributes that were generated during our own spearing and cutting experiment. Use-wear attributes generated during our experiment included longitudinal and lateral fractures (Figs. 5 and 6), degree of surface- and edge-dulling (Fig. 7), flake spalling (Fig. 8), stepped flake terminations on tips (Fig. 9A), distal crushing (Fig. 9B), burin scars (Fig. 9C), stepped flakes on locations other than lateral margins (Fig. 10), striations (Fig. 11), hinged flake terminations on tips (Fig. 12); and feathered flake terminations on tips (Fig. 13) (see Table 1 for definitions of these attributes).
Figure 6. Break located on Parman Replica #2 used as a projectile (30x magnification).

Figure 7. Degrees of dulling on GBS points: (A) no dulling, 60x magnification (Cougar Mountain Cave Parman point 25–146); (B) light dulling, 75x magnification (Last Supper Cave Windust point 31–1280); (C) moderate dulling, 75x magnification (Hanging Rock Shelter Parman point 103–1225); and (D) heavy dulling, 75x magnification (Hanging Rock Shelter Parman point 103–2853).

Figure 8. Flake spalling on a break on Hanging Rockshelter Windust point 103-3240 (30x magnification).

Figure 9. Examples of: (A) stepped flakes; (B) crushing; and (C) a burin scar on the break of Haskett Replica #25.
Replicas Used as Projectiles. Experimental use, and an analysis of the resulting breakage and wear, identified attributes diagnostic of use as a projectile, including overall breakage frequencies, distal crushing, other crushing, hinged and stepped flakes on tips, burin scars, and flake spalling (Table 4). Replicas broke 55 percent of the time, crushing on the tip occurred 44 percent of the time, and crushing in other places occurred 33 percent of the time. Stepped flakes at locations other than on lateral margins occurred 44 percent of the time. Flake spalling occurred every time a break occurred. Large burin scars occurred infrequently, but were exclusively produced through use as projectiles (see Figs. 5B and 5E). Tuohy (1969) posited that the large burin scars commonly found on Lake Mohave points were purposefully produced, but our results show that this is not necessarily the case. He also suggested that points with both distal and proximal breaks could not result from impact fracturing or lateral stress breakage alone, and instead attributed the combination of breaks to intentional recycling efforts. During our experiment, one of our Haskett replicas broke on both its proximal and distal ends after a single throw (see Fig. 5E), demonstrating that such breaks can result from impact (it is worth noting that Tuohy [1969:138] himself indicated that actualistic studies were needed to evaluate his statements on GBS point breakage-patterns).

Replicas Used as Knives. Experimental use, and an analysis of the resulting wear, also produced attributes indicative of use as a knife, including flakes with feathered terminations and small burin scars on the point tips, no incidences of breakage, and greater numbers of striations relative to those replicas used as projectiles (Table 5). Additionally, the small burin scars found on the tip of Windust Replica #14 (Fig. 14), and the feather-terminated flake on Parman Replica #6, were produced during use as a knife. Small burin breaks can produce points with distal ends similar to the “chisel tips” that both Tuohy (1969:139) and Beck and Jones (2009a:192) have suggested may have been produced intentionally.

Use-Wear Attributes of GBS Points
The results of our experiment with the replicas were used to identify use-wear on, and interpret the function of, GBS points (Table 6). Attributes resulting from a use as projectiles (flake spalling, large burins, crushing, hinged
Table 4
SUMMARY OF USE-WEAR ATTRIBUTES FOUND ON GBS REPLICA USED AS PROJECTILES

<table>
<thead>
<tr>
<th>Replica Number</th>
<th>Replica Type</th>
<th>Replicas Type Broken</th>
<th>Stepped Flakes on Tip</th>
<th>Hinged Flakes on Tip</th>
<th>Feathered Flakes on Tip</th>
<th>Distal Burins</th>
<th>Proximal Burins</th>
<th>Distal Crushing</th>
<th>Other Crushing</th>
<th>Striations</th>
<th>Striations Distal Flakes Elsewhere</th>
<th>Flakes Spalling</th>
<th>Dulling</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Parman</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>L</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Parman</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>L</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Parman</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
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<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>L</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Windust</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>L</td>
<td>L</td>
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</tr>
<tr>
<td>12</td>
<td>Windust</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
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<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>L</td>
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<td>15</td>
<td>Windust</td>
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<td>L</td>
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<td>L</td>
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<td>L</td>
<td>L</td>
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<td></td>
</tr>
<tr>
<td>22</td>
<td>Haskett</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>L</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Haskett</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
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<td>+</td>
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</tr>
<tr>
<td>25</td>
<td>Haskett</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
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<td>+</td>
<td>L</td>
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</tr>
</tbody>
</table>

L = light

Table 5
SUMMARY OF USE-WEAR FOUND ON GBS REPLICA USED AS KNIVES

<table>
<thead>
<tr>
<th>Replica Number</th>
<th>Replica Type</th>
<th>Duration of Use</th>
<th>Broken</th>
<th>Stepped Flakes on Tip</th>
<th>Hinged Flakes on Tip</th>
<th>Feathered Flakes on Tip</th>
<th>Distal Burins</th>
<th>Proximal Burins</th>
<th>Distal Crushing</th>
<th>Other Crushing</th>
<th>Striations</th>
<th>Striations Distal Flakes Elsewhere</th>
<th>Flakes Spalling</th>
<th>Dulling</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Parman</td>
<td>5 min</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
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<tr>
<td>5</td>
<td>Parman</td>
<td>15 min</td>
<td>+</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td>L</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Parman</td>
<td>10 min</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Windust</td>
<td>5 min</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td>L</td>
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<tr>
<td>13</td>
<td>Windust</td>
<td>10 min</td>
<td>+</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Windust</td>
<td>15 min</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
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<td>20</td>
<td>Haskett</td>
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</tr>
<tr>
<td>21</td>
<td>Haskett</td>
<td>15 min</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>L</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Haskett</td>
<td>10 min</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>L</td>
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</tr>
</tbody>
</table>

L = light

and stepped flake terminations on tips, high breakage rates) and as knives (moderate to heavy surface- and edge-dulling, feathered flake terminations on tips) were especially informative. There were, however, some clear differences between the replicas and artifacts. Striations on the GBS points are common, are found all over the specimens, and do not follow any particular direction. Conversely, striations on the replicas are uncommon and run parallel to their lateral margins. This result is not unexpected and supports assertions made by Bamforth (1988) and Moss (1983) that use-wear occurs only at nominal levels on tools—especially on those made of obsidian—used for short periods of time, like our replicas (Hurcombe 1992; Lewenstein 1981). Similarly, surface- and edge-dulling is more prevalent on GBS points from...
Table 6

USE-WEAR ON GBS POINTS FROM ARCHAEOLOGICAL CONTEXTS

<table>
<thead>
<tr>
<th>Site and Specimen Number</th>
<th>Point Type</th>
<th>Raw Material</th>
<th>Inferred Function</th>
<th>Use-Wear Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Projectile Knife Broken</td>
<td>Stepped Flakes on Tip</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
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<td></td>
</tr>
</tbody>
</table>

(Continued on following page)
archaeological contexts than on the replicas. Finally, the lack of use-wear on the replicas used as knives either indicates that the high degree of use-wear found on the artifacts could only have resulted from a far longer period of use than the maximum of 15 minutes that we employed, or that the points were used differently than the replicas.

While the experimental use-wear did not precisely match that found on the artifacts, our results nevertheless have provided us with a useful comparative sample, and we have drawn some conclusions about how different GBS point types may have been used (Table 7). First, the twenty Parman points in our sample were likely used primarily as knives, with some additional use as projectiles. We base this conclusion on high frequencies of moderate and high degrees of surface- and edge-dulling, low frequencies of hinged and stepped flake terminations on tips, low frequencies of stepped flakes on locations other than the lateral margins, and the presence of a few specimens with feathered fake terminations on their tips. Evidence that some of the Parman points were used as projectiles includes high frequencies of crushing and flake spalls. Our conclusion that Parman points were primarily used as knives is in line with Beck and Jones’ (2009a:192) recent interpretations of Parman point function.

Second, all five Cougar Mountain points appear to have been used primarily as projectiles, with a secondary use as knives. We base this conclusion on high breakage rates, common flake spalling, and high frequencies of stepped flakes on locations other than the lateral margins. Evidence that Cougar Mountain points were also used as knives includes some specimens with moderate to heavy surface- and edge-dulling, an absence of burin scars, and low frequencies of crushing. Although our sample is admittedly small, our results generally support Beck and Jones’ (2009a:192) conclusion that Cougar Mountain points were used for multiple purposes, including tipping spears.

Third, the thirteen Haskett points appear to have been used more often as knives than projectiles. Evidence for use as knives includes high incidences of moderate and heavy edge-dulling, low breakage rates,
Table 7

SUMMARY OF USE-WEAR FOUND ON GBS POINTS FROM ARCHAEOLOGICAL CONTEXTS AND THEIR INFERRED FUNCTION(S)

<table>
<thead>
<tr>
<th>Use-Wear Attribute</th>
<th>Cougar Mountain (n = 5)</th>
<th>Parman (n = 20)</th>
<th>Windust (n = 21)</th>
<th>Haskett (n = 13)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Crushing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distal</td>
<td>0/1 (0.0)</td>
<td>2/16 (12.5)</td>
<td>0/12 (0.0)</td>
<td>0/12 (0.0)</td>
</tr>
<tr>
<td>Other</td>
<td>1/5 (20.0)</td>
<td>6/20 (30.0)</td>
<td>2/21 (9.5)</td>
<td>3/13 (23.1)</td>
</tr>
<tr>
<td>Flakes Spalls</td>
<td>4/5 (80.0)</td>
<td>7/17 (100.0)</td>
<td>5/11 (45.4)</td>
<td>2/4 (50.0)</td>
</tr>
<tr>
<td>Stiations</td>
<td>2/5 (40.0)</td>
<td>16/20 (80.0)</td>
<td>3/21 (14.3)</td>
<td>9/13 (69.2)</td>
</tr>
<tr>
<td>Hinged Terminations on Tip</td>
<td>0/1 (0.0)</td>
<td>0/16 (0.0)</td>
<td>2/12 (16.7)</td>
<td>0/12 (0.0)</td>
</tr>
<tr>
<td>Stepped Terminations on Tip</td>
<td>0/1 (0.0)</td>
<td>1/16 (6.3)</td>
<td>2/12 (16.7)</td>
<td>0/12 (0.0)</td>
</tr>
<tr>
<td>Feathered Termination on Tip</td>
<td>0/1 (0.0)</td>
<td>2/16 (12.5)</td>
<td>0/12 (0.0)</td>
<td>1/12 (8.3)</td>
</tr>
<tr>
<td>Stepped Flake Terminations Elsewhere</td>
<td>3/5 (60.0)</td>
<td>5/20 (25.0)</td>
<td>7/21 (33.3)</td>
<td>0/13 (0)</td>
</tr>
<tr>
<td>Broken</td>
<td>5/5 (100.0)</td>
<td>7/20 (35.0)</td>
<td>11/21 (52.4)</td>
<td>3/13 (23.1)</td>
</tr>
<tr>
<td><strong>Burin Scars</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proximal</td>
<td>0/5 (0.0)</td>
<td>0/20 (0.0)</td>
<td>1/21 (4.8)</td>
<td>1/13 (7.7)</td>
</tr>
<tr>
<td>Distal</td>
<td>0/5 (0.0)</td>
<td>0/20 (0.0)</td>
<td>3/21 (14.3)</td>
<td>2/13 (15.4)</td>
</tr>
<tr>
<td><strong>Degree of Dulling</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>1 (20.0)</td>
<td>1/20 (5.0)</td>
<td>5/21 (23.8)</td>
<td>0/13 (0.0)</td>
</tr>
<tr>
<td>Little</td>
<td>1 (20.0)</td>
<td>3/20 (15.0)</td>
<td>2/21 (9.5)</td>
<td>4/13 (30.8)</td>
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<tr>
<td>Moderate</td>
<td>1 (20.0)</td>
<td>10/20 (50.0)</td>
<td>8/21 (38.1)</td>
<td>7/13 (53.8)</td>
</tr>
<tr>
<td>Heavy</td>
<td>2 (40.0)</td>
<td>6/20 (30.0)</td>
<td>6/21 (28.6)</td>
<td>2/13 (15.4)</td>
</tr>
<tr>
<td><strong>Inferred Use</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knife</td>
<td>0 (0.0)</td>
<td>10/20 (50.0)</td>
<td>6/21 (28.6)</td>
<td>7/13 (53.8)</td>
</tr>
<tr>
<td>Projectile</td>
<td>2 (40.0)</td>
<td>2/20 (10.0)</td>
<td>4/21 (19.0)</td>
<td>1/13 (7.7)</td>
</tr>
<tr>
<td>Both</td>
<td>3 (60.0)</td>
<td>6/20 (30.0)</td>
<td>8/21 (38.1)</td>
<td>2/13 (15.4)</td>
</tr>
<tr>
<td>None</td>
<td>0 (0.0)</td>
<td>2/20 (10.0)</td>
<td>3/21 (14.3)</td>
<td>3/13 (23.1)</td>
</tr>
</tbody>
</table>

*Numbers in parentheses represent percentages.*

no stepped flake at locations other than lateral margins, and no stepped or hinged flake terminations on point tips. Conversely, crushing is relatively common in the Haskett sample, and a few specimens possess burin scars, suggesting that they may have been used as projectiles. Although there were no Haskett points in their eastern Nevada sample, Beck and Jones (2009a:235) pointed out that such points generally meet Musil’s (1988) criteria for effective projectiles and may have been suitable for use as such. We found only limited evidence that the Haskett points in our sample were actually used as projectiles; therefore, our findings correspond more closely to those of Galm and Gough (2008) from the Sentinel Gap site, where many of the Haskett points exhibit damage and wear consistent with a use as knives.

Finally, the twenty-one Windust points appear to have been used almost equally as knives and projectiles. Evidence that Windust points were used as projectiles includes a high rate of breakage, flake spalling, stepped flake terminations elsewhere than lateral margins, hinged and stepped flake terminations on tips, and burin scars. Evidence that Windust points were used as knives includes high frequencies of moderate and heavy surface- and edge-dulling and low frequencies of crushing. Based on their eastern Nevada sample, Beck and Jones (2009a) concluded that Windust points probably served as projectile points, and—given our results—we cannot discount that possibility.

In summary, we found evidence that all four GBS point types exhibit evidence of use as both projectiles and knives, although some types seem to have been more commonly used in one capacity than another. When the point types are compared for evidence of use in each capacity (Table 8), a chi-square test cannot be performed
### Table 8

**COMPARISON OF INFERRED FUNCTIONS BY GBS POINT TYPE**

<table>
<thead>
<tr>
<th>Function</th>
<th>Cougar Mountain</th>
<th>Parman</th>
<th>Windust</th>
<th>Haskett</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knife</td>
<td>3</td>
<td>16</td>
<td>14</td>
<td>9</td>
<td>42</td>
</tr>
<tr>
<td>Projectile</td>
<td>5</td>
<td>8</td>
<td>12</td>
<td>3</td>
<td>28</td>
</tr>
</tbody>
</table>

$\chi^2 = 1.81, \ df = 2, \ p = 0.405$ (Cougar Mountain points excluded from comparison)

 Counts differ from those presented at the bottom of Table 7. There, we scored points as having evidence of use as knives, projectiles, both, or no evidence. Here, if a point exhibited evidence for use as both a knife and projectile, it was counted once for each function.

Due to the low number of Cougar Mountain points. When the Cougar Mountain points are eliminated, a chi-square test shows that there are no significant differences in the way that each point type was used ($\chi^2 = 1.81, \ df = 2, p = 0.405$).

### DISCUSSION

At the outset of this paper, we proposed two possibilities that could account for the morphological variability exhibited by GBS points: (1) the stylistic traditions of different groups inhabiting the same or overlapping geographic areas resulted in distinct point forms being produced; and (2) GBS point types had different forms because they were used for different functions. With regard to the first possibility, perhaps such traditions reflected the cumulative effects of stylistic drift, where the technologies of relatively isolated geographic groups diverged from a common form. Morrow and Morrow (1999) have made such an argument for fluted points in the New World. Beck and Jones (2009a:237) posit that this may also have been the case for the different GBS point types, which they see evolving across time and space from Lind Coulee and possibly Haskett antecedents on the Columbia Plateau. If stylistic differences were a major influence on GBS form, then different GBS point types should exhibit evidence of being used for the same function(s). Because the Cougar Mountain, Parman, and Windust points in our sample generally all exhibit evidence of use as both projectiles and knives—that is, they each may have been multipurpose tools—we cannot currently reject that possibility. Beck and Jones (1997) cursorily mention the fact that different GBS point forms occur in varying frequencies in different parts of the Great Basin (e.g., Haskett points are limited to the northern and parts of the eastern Great Basin [see Beck and Jones 2009b for a report on the recent discovery of the latter], and Lake Mohave and Silver Lake points are most common in the southern Great Basin, etc.); however, to our knowledge, only Duke (2011) has started to evaluate this possibility. Future studies should be directed at compiling a comprehensive list of GBS points, using a replicable approach like that developed by Beck and Jones (2009a:145–148), to determine if their general impressions hold true. If this does prove to be the case, then the possibility that GBS point forms represent different stylistic traditions may find additional support.

On the other hand, if different functional requirements were responsible for morphological variability in GBS points, they should exhibit different use-wear attributes. This is not the case—the Cougar Mountain, Parman, and Windust points in our sample all exhibit evidence of use as projectiles as well as for other purposes. Although much work remains to be done to tease out the different sources of variability in GBS point form, we find little support for the possibility that different GBS point types were specialized implements present in the same toolkit. The possibility that GBS points were used for multiple purposes is in line with the commonly invoked argument that Paleoindian lithic technology was centered on a narrow range of flexible tools (Beck and Jones 1997; Smith 2006).

Our findings, based on an actualistic study, comparison, and micro- and macroscopic analyses of use-wear on both replicas and GBS points, generally support those of Beck and Jones (2009a), who examined a large sample of GBS points from eastern Nevada for macroscopic use-wear and concluded that most GBS point types were probably multifunctional tools. One difference in our respective conclusions is that we found minimal evidence that the Haskett points in our sample were used as projectiles, whereas Beck and Jones (2009a:237) hypothesized that such points were part of the initial projectile technology employed by Paleoindians as they entered the Great Basin from the north. Additional experiments and expanded studies of microscopic use-wear on Haskett points from buried contexts may help to resolve this discrepancy.
CONCLUSIONS

Although they cannot definitively demonstrate how lithic artifacts at archaeological sites were used, actualistic experiments provide one of the best means of identifying how stone tools may have been used. Without comparing artifacts to replicated stone tools with known use histories, we run the risk of misinterpreting how tools were used in the past. In this paper, we have described an experiment employing GBS replicas as both projectiles and knives, an experiment in which we recorded the types of macro- and microscopic use-wear produced, and compared those results to GBS points recovered archaeologically. We found that most GBS points in our sample were likely to have been used for multiple purposes, a suggestion that Beck and Jones (2009a) made without support from actualistic studies. With regard to our two possibilities—stylistic versus functional differences—our results do not support the latter, but more work must be done to evaluate the former.

Determining that GBS points were used as projectiles, knives, or for multiple purposes is only the first step in learning more about Paleoindian lifeways in the Great Basin. Bamforth (2010:97) distinguished between tasks (specific things stone tools were used for), and activities (larger and more culturally meaningful sets of tasks). Macro- and microscopic studies like the one presented here can identify tasks, but not activities—knowing how a tool was used does not tell us what it was used for. Our results suggest that most GBS points were likely multifunctional tools, but the scarcity of subsistence residues dated to the terminal Pleistocene/early Holocene leaves us to largely speculate about the resources that early groups exploited.

NOTES

1To the best of our knowledge, the most recent compilation of radiocarbon dates associated with GBS points is found in Beck and Jones (1997). Their Table III shows that at that time, 79 dates were associated with particular GBS point types. Since 1997, additional dates associated with particular GBS point types have come from Bonneville Estates Rockshelter (Graf 2007), Last Supper Cave (Grant 2008; Smith 2008), Cooper’s Ferry (Davis and Schweger 2004), and likely other sites as well. Our estimate of 100 dates is just that—an estimate; we did not undertake an exhaustive search of the literature.

2This paper is a condensed version of Lafayette’s (2006) master’s thesis, which includes more detailed information on the macro- and microscopic use-wear present on the replicas.

3We direct readers interested in individual researchers’ conclusions concerning the utility of various use-wear attributes to Table 1 in Dockall (1997), which lists nineteen use-wear studies and their respective conclusions regarding different variables.

4Beck and Jones’ (2009a) suggestion that Haskett points may represent the initial technology employed by Paleoindians as they entered the Great Basin is conjectural; there are no Haskett points in their sample from eastern Nevada.

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