Rick, John W.

Scheffer, T. H.

Schiffer, Michael B.

Springett, J. A.

Stahl, Peter W.

Stein, Julie K.

Thomas, David H.

Thorj., J.

Wood, W. Raymond, and Donald L. Johnson

**MORPHOLOGICAL PROJECTILE POINT TYPOLOGY:
REPLICATION EXPERIMENTATION AND TECHNOLOGICAL ANALYSIS**

J. Jeffrey Flenniken and Anan W. Raymond

*Morphological typologies of projectile points in North America have often been employed as time-sensitive prehistoric cultural markers. This article demonstrates that the contingencies of point manufacture, hafting, use, and rejuvenation create morphological changes that may render questionable use of these morphological typologies as prehistoric cultural markers. Thirty projectile points were replicated according to the attributes of a commonly employed typological scheme for the Great Basin. Experiments with hafting, impact, and rejuvenation demonstrate that a single point-type may manifest more than one “time-sensitive” shape within its normal use-life.*

Viable, systematic methods of flaked stone tool classification have concerned archaeologists since the late 1800s (e.g., Wilson 1899). By the 1960s, most of these methods of classification either became extinct (e.g., McKern 1939) or culminated in techniques to delimit patterns of morphological attributes, i.e., “types,” of stone tools that temporally assume prehistoric manufacture and use (cf. Deetz 1967; Ford 1954; Kreiger 1944; Rouse 1960; Spaulding 1953). Kreiger (1944:272), a pioneer who set the stage for a long debate concerning morphological typology, was concerned with types that would have “demonstrable historical meaning” and “represent a unit of cultural practice.” Spaulding (1953) advocated the use of statistical procedures to discover clusters of attributes that define an artifact type. The artifact type reflects conscious preferences and norms on the part of the prehistoric people making and using the artifacts. Ford (1954) maintained that an artifact type may have historical meaning but it is an arbitrary device that serves to chronicle cultures over

---

*J. Jeffrey Flenniken and Anan W. Raymond, Laboratory of Lithic Technology, Washington State University, Pullman, WA 99164-4910*


*Copyright © 1986 by the Society for American Archaeology*
time. From the distribution of variation that composes a cultural trait, the archaeologist abstracts a mean or central theme embodied in a group of artifacts (Ford 1954:42). This central theme becomes the artifact type.

In an attempt to clarify some of these problems, Rouse (1960) defined seven objectives of artifact classification. However, these seven objectives demand that the archaeologist have an intimate understanding of flaked stone tool manufacture and use as well as inherent knowledge of a specific "cultural type." Rouse (1960:318) defines "two kinds of modes: (1) conceptual modes, consisting of ideas and standards that the artisans expressed in the artifacts; and (2) procedural modes, consisting of customs followed by the artisans in making and using the artifacts." We contend that typologies based upon morphological attributes of end products, especially projectile points, do not adequately reflect the "conceptual modes" and the "procedural modes" that contributed to the prehistoric production and use of archaeologically recovered artifacts. A morphological typology of projectile points is based primarily upon the last "mode" or activity to which the artifacts comprising any given type were subjected.

In particular, our experiments suggest that the shape of a projectile point does not always disclose the numerous modes of manufacture and use that occurred in the prehistoric context before deposition and recovery in the archaeological context. Therefore, what archaeologists perceive as a pattern of similarity in morphology, i.e., a temporal type, may have little reality in the prehistoric context. In spite of this, many archaeologists use the shape of projectile points to determine the presence, distribution, and demise of prehistoric cultures. Our experiments indicate that morphological projectile point typologies are not consistently reliable temporal or cultural markers.

EXPERIMENTATION

The design of this experiment developed from an earlier one that addressed, from a general perspective, morphological change in projectile points used in a simulated prehistoric hunting situation (Flenniken 1985). This present experiment addresses morphological change within a single projectile point type as a result of hafting, use, breakage, and rejuvenation during simulated use-life.

After studying the various projectile point typologies employed in American archaeology, we followed Thomas's (1981, 1983) typology because it provides a straightforward dichotomous key to aid in sorting projectile points into specific time categories with objective morphological definitions. After reviewing the possible projectile point types available in Thomas's key we selected the type "Elko corner-notched" as our model or temporal type. We selected this point type because of its distinctive shape among Great Basin projectile points and its apparent temporal significance. Using Thomas's (1981, 1983) key (base width > 1 cm; proximal shoulder angle 110°-150°) as our guide, we fabricated 30 Elko corner-notched projectile points, using replication as an analytical method (Flenniken 1978, 1981; Figures 1 and 2 here). Fifteen points were replicated by each author creating two different populations of the same morphological type. Our purpose for producing two populations of the same projectile point type was to provide a data base that is more representative of a sample recovered archaeologically and used to create a typology than a single population would be. Population A, Figure 1, was manufactured from flakes derived from a single nodule of Glass Butte, Oregon, obsidian. Population B, Figure 2, was manufactured from flakes derived from seven different nodules of Glass Butte, Oregon, obsidian. Both populations were produced by the same flintknapping techniques applied in the same reduction sequence. Slight variations in morphology between the populations of Elko corner-notched points resulted from different skill levels or intra-quarry lithic material variation.

Manufacturing errors did occur and usually resulted in the production of functional projectile points that varied greatly in shape. These points might be assigned by archaeologists to different morphological types representing different temporal types. However, for purposes of control in this experiment, we rejected these points (6 out of 36 attempts, 16.6%) from our experimental populations.

The 30 experimental points were weighed, measured, photographed, and typed according to
Thomas's (1981) guide to Monitor Valley, Nevada, projectile points (Table 1). All 30 points fit comfortably into the Elko corner-notched type. All 30 points were then hafted using elk sinew (Cervus canadensis) and pine pitch (Pinus sp.) into willow (Salix sp.) foreshafts. The materials, dimensions, and hafting methods of our replicated foreshafts were similar to foreshafts recovered archaeologically in the Great Basin and the American Southwest (Aikens 1970:159; Cosgrove 1947:50–58; Guernsey 1931:73; Guernsey and Kidder 1921:83–87; Hattori 1982:113–118; Martin et al. 1952:376–382; Tuohy 1982:100). Our foreshafts measured 20 cm in length and 8 mm to 10 mm in diameter (Figure 3).

During the hafting process, 73.3% (22 of 30) of the points required some alteration in the basal
area to tailor them to the specific foreshaft notch (Figures 4 and 5). Five (16.6%) points changed sub-types from Elko corner-notched to Elko eared. Based upon our experimentation, we suggest that Thomas's (1981:21, 1983:180) morphological distinction between the two "Elko" varieties resulted from the prehistoric hafting process. During projectile point manufacture, final preparation of the base is not completed until a straight alignment between the point, haft notch, and foreshaft is achieved. It requires less time and energy to alter the point by removing several pressure flakes from the base than it does to alter the foreshaft notch. Examples of this manufacturing behavior are present in both the archaeological (e.g., Minor and Toepel 1982:vi, 44-47) and the experimental (e.g., Spencer 1974:49) literature.

The 30 foreshafts, hafted with Elko corner-notched and Elko eared projectile points, were set into dart mainshafts. The experimental darts were replicated from descriptions of dart fragments recovered archaeologically in western North America (Cosgrove 1947:50–58; Hattori 1982:113–118;
Heizer 1938:69–71; Martin et al. 1952:376–382). The dart mainshafts, measuring 1.5 m long and 10–15 mm in diameter, were constructed from cane. The darts tapered toward the proximal end, where feathers were attached with sinew to stabilize the weapon in flight. The proximal (non-hafted) ends of the foreshafts were tapered to fit snugly into the socketed distal ends of the dart mainshafts. The darts were designed for and thrown with a replicated western North American atlatl (e.g., Dalley and Peterson 1970:283; Guernsey 1931:71–72; Hester et al. 1974). At this time all 30 experimental tools were ready for use as hunting weapons.

Due to public pressure and misunderstanding, our simulated prehistoric hunting situation did not include the actual dispatching of live animals as in previous experiments (Flenniken 1985). However, three situations that might have occurred had the prehistoric hunter missed the prey were simulated. The darts were propelled by the atlatl into trees, soft loamy soil, and thick underbrush, each target 12 meters away.

During the use of these 30 projectile points, we documented by notes and photos specific data concerning impact and damage (Table 2; Figures 4–6). Once the 30 points had been subjected to our experimental hunting situation and used until noticeable damage occurred, they were collected and returned to the laboratory for analysis and rejuvenation. It is interesting to note, contrary to Thomas (1981:15), that 70% of our projectile points sustained impact damage in the base or haft area (Figure 6C–E) while only 43.3% sustained some tip damage (Figure 6A, B). After each point was analyzed and photographed, the salvageable point fragments (24 or 80%) were rejuvenated into functional projectile points (Figures 4 and 5).
Rejuvenation of broken projectile points occurred prehistorically (cf. Frison et al. 1976:28–57; Goodyear 1974:28–32; Miller 1980:107–111). Based upon our experimental data, we believe rejuvenation of projectile point fragments to have been an economical measure. A mean time of 40 minutes was employed to manufacture one Elko corner-notched point while a mean time of only three minutes was needed to rework a broken Elko point into a functional tool. Each salvageable point fragment was reworked by pressure flaking employing the same flintknapping technique as originally used to produce both populations of Elko points. A point fragment was deemed “salvageable” if enough mass remained intact to support a potentially new, but slightly smaller, Elko corner-notched point. Every attempt was made to reproduce the same morphological type (Elko) while exerting the least amount of energy to produce a functional point. As a result, 8 of the 24 (33.3%) salvageable projectile point fragments changed morphological (temporal) types (Table 2; Figures 4 and 5). Most morphological variation occurred while reworking the damaged bases (70%) of the broken points.

**DISCUSSION AND CONCLUSIONS**

This experiment has demonstrated a simple concept often ignored by advocates of morphological projectile point typologies as temporal or cultural markers. Frequently, prehistoric projectile points...
employed as hunting tools broke, and when rejuvenated may have changed morphological (temporal) types. Specifically, when an Elko corner-notched point broke due to impact, it may have been rejuvenated into an Elko, Gatecliff, or Rosegate temporal type, or an “anomalous type” rejected by Thomas’s (1981, 1983) key. Although in this experiment we were concerned with a single point type in a single typology, we believe our results and conclusions are generally applicable to chronological projectile point typologies.

Archaeologists cannot assume that patterns of morphological attributes have clear-cut chronological significance when simple alteration of shape during use-life may change the temporal assignment of that point by thousands of years. Therefore, in prehistory, projectile point shape may have resulted from technological and economical constraints rather than stylistic reasons, and may not represent accurate temporal types, particularly when found in archaeological situations such as surface lithic scatters, single component sites, or potential multicomponent sites with no stratigraphic

Figure 4. Outline drawings of Population A before use and after rejuvenation. BLACK—material lost through hafting, use-damage, and rejuvenation. WHITE—artifact re-entering systemic context, or entering archaeological context. C—“changed point type;” X—not reusable due to damage. All points 70% actual size.
control. However, stratigraphic control does not always alleviate the problem of transforming morphological types into true temporal or culturally relevant point types.

For example, Thomas's (1981, 1983) morphological projectile point typology seems to function extremely well as a temporal marker for the Elko projectile point series horizons (3–9) at Gatecliff Shelter in Nevada. He maintains, based upon basal width measurements, that there is less than “3% overlap” between the Elko series and the younger Rosegate series projectile points (Thomas 1983:180). Thomas, however, uses the stratigraphic interpretation at Gatecliff Shelter to “type” his 408 “typable” points as opposed to employing his own metric system; 29.3% of his Elko series points and 22.2% of his Rosegate series points are, in fact, not typable because they are too fragmentary (Thomas 1983:197–208; note estimated basal widths). Nonetheless, Thomas types these points on the basis of “dotted lines” and stratigraphic levels, not strict morphology. These same points, found in other archaeological situations, would either not be typed or would be typed as something different from Elko or Rosegate points. Unfortunately, many archaeologists do not have the luxury of close stratigraphic control to take care of their morphological problems. Therefore, Thomas's (1981:24) statement that his temporal (morphological) typology “... adequately discriminates over 95% of the points” seems a bit misleading, at least for the Elko and Rosegate point series.

The process of typing projectile points and fragments recovered from surface lithic scatters, single component sites, or non-stratified, multi-component sites on the basis of morphology is dangerous. The archaeologist has little or no information as to whether or not the pattern of morphological attributes forming his or her temporal type is one of valid prehistoric attributes or represents...
### Table 2. Metric data for experimental projectile points after use and rejuvenation.

<table>
<thead>
<tr>
<th>Population Number</th>
<th>Length (cm)</th>
<th>Base (cm)</th>
<th>Thickness (cm)</th>
<th>PSA (^a)</th>
<th>N O (^b)</th>
<th>Use</th>
<th>Damage</th>
<th>Point Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2</td>
<td>4.1</td>
<td>.50 126*</td>
<td>24*</td>
<td>4.8</td>
<td>TREE</td>
<td>TIP</td>
<td>Not Rejuvenated</td>
</tr>
<tr>
<td>A</td>
<td>3</td>
<td>4.5</td>
<td>.50 136*</td>
<td>17*</td>
<td>5.0</td>
<td>TREE</td>
<td>TIP</td>
<td>Elko</td>
</tr>
<tr>
<td>A</td>
<td>4</td>
<td>2.1</td>
<td>.40 108*</td>
<td>85*</td>
<td>1.2</td>
<td>0.9</td>
<td>TREE</td>
<td>Anomalous Type (^c)</td>
</tr>
<tr>
<td>A</td>
<td>5</td>
<td>2.9</td>
<td>.45 127*</td>
<td>30*</td>
<td>1.4</td>
<td>2.5</td>
<td>TREE</td>
<td>Elko</td>
</tr>
<tr>
<td>A</td>
<td>6</td>
<td>4.4</td>
<td>.45 117*</td>
<td>39*</td>
<td>1.4</td>
<td>2.0</td>
<td>GROUND</td>
<td>Gatecliff</td>
</tr>
<tr>
<td>A</td>
<td>7</td>
<td>3.3</td>
<td>.45 117*</td>
<td>39*</td>
<td>1.4</td>
<td>2.0</td>
<td>GROUND</td>
<td>Elko</td>
</tr>
<tr>
<td>A</td>
<td>8</td>
<td>5.0</td>
<td>.50 116*</td>
<td>89*</td>
<td>0.85</td>
<td>5.0</td>
<td>GROUND</td>
<td>Gatecliff</td>
</tr>
<tr>
<td>A</td>
<td>9</td>
<td>4.5</td>
<td>.50 124*</td>
<td>14*</td>
<td>1.8</td>
<td>4.3</td>
<td>GROUND</td>
<td>Elko</td>
</tr>
<tr>
<td>A</td>
<td>10</td>
<td>4.5</td>
<td>.50 124*</td>
<td>14*</td>
<td>1.8</td>
<td>4.3</td>
<td>GROUND</td>
<td>Not Rejuvenated</td>
</tr>
<tr>
<td>A</td>
<td>11</td>
<td>4.4</td>
<td>.55 135*</td>
<td>23*</td>
<td>2.3</td>
<td>4.8</td>
<td>TREE</td>
<td>Elko</td>
</tr>
<tr>
<td>A</td>
<td>12</td>
<td>4.4</td>
<td>.55 135*</td>
<td>23*</td>
<td>2.3</td>
<td>4.8</td>
<td>TREE</td>
<td>Elko</td>
</tr>
<tr>
<td>A</td>
<td>13</td>
<td>2.9</td>
<td>.45 105*</td>
<td>54*</td>
<td>.95</td>
<td>1.9</td>
<td>BRUSH</td>
<td>Rosegate</td>
</tr>
<tr>
<td>A</td>
<td>14</td>
<td>4.2</td>
<td>.60 83*</td>
<td>64*</td>
<td>.7</td>
<td>4.2</td>
<td>BRUSH</td>
<td>Gatecliff</td>
</tr>
<tr>
<td>A</td>
<td>15</td>
<td>3.1</td>
<td>.50 113*</td>
<td>44*</td>
<td>1.9</td>
<td>2.5</td>
<td>TREE</td>
<td>Elko</td>
</tr>
<tr>
<td>B</td>
<td>2</td>
<td>3.4</td>
<td>.45 117*</td>
<td>39*</td>
<td>1.1</td>
<td>2.9</td>
<td>GROUND</td>
<td>Elko</td>
</tr>
<tr>
<td>B</td>
<td>3</td>
<td>3.7</td>
<td>.50 131*</td>
<td>54*</td>
<td>1.6</td>
<td>3.0</td>
<td>GROUND</td>
<td>Elko</td>
</tr>
<tr>
<td>B</td>
<td>4</td>
<td>4.0</td>
<td>.50 115*</td>
<td>24*</td>
<td>2.0</td>
<td>4.9</td>
<td>TREE</td>
<td>Elko</td>
</tr>
<tr>
<td>B</td>
<td>5</td>
<td>5.0</td>
<td>.50 111*</td>
<td>69*</td>
<td>1.8</td>
<td>6.2</td>
<td>TREE</td>
<td>Elko</td>
</tr>
<tr>
<td>B</td>
<td>6</td>
<td>4.3</td>
<td>.50 131*</td>
<td>89*</td>
<td>1.7</td>
<td>3.3</td>
<td>GROUND</td>
<td>Elko</td>
</tr>
<tr>
<td>B</td>
<td>7</td>
<td>5.3</td>
<td>.50 81*</td>
<td>52*</td>
<td>.9</td>
<td>5.5</td>
<td>GROUND</td>
<td>Gatecliff</td>
</tr>
<tr>
<td>B</td>
<td>8</td>
<td>3.8</td>
<td>.50 109*</td>
<td>25*</td>
<td>1.7</td>
<td>3.9</td>
<td>TREE</td>
<td>Elko</td>
</tr>
<tr>
<td>B</td>
<td>9</td>
<td>3.7</td>
<td>.55 120*</td>
<td>30*</td>
<td>2.1</td>
<td>3.9</td>
<td>BRUSH</td>
<td>Elko</td>
</tr>
<tr>
<td>B</td>
<td>10</td>
<td>2.6</td>
<td>.50 120*</td>
<td>39*</td>
<td>1.4</td>
<td>1.9</td>
<td>BRUSH</td>
<td>Elko</td>
</tr>
<tr>
<td>B</td>
<td>11</td>
<td>3.7</td>
<td>.45 119*</td>
<td>78*</td>
<td>.7</td>
<td>2.5</td>
<td>TREE</td>
<td>Rosegate</td>
</tr>
<tr>
<td>B</td>
<td>12</td>
<td>3.1</td>
<td>.50 118*</td>
<td>84*</td>
<td>.85</td>
<td>2.0</td>
<td>GROUND</td>
<td>Rosegate</td>
</tr>
<tr>
<td>B</td>
<td>13</td>
<td>3.1</td>
<td>.50 124*</td>
<td>42*</td>
<td>1.6</td>
<td>3.1</td>
<td>GROUND</td>
<td>Elko</td>
</tr>
</tbody>
</table>

\(^a\) PSA—proximal shoulder angle (Thomas 1981:11).
\(^b\) N O—notch opening index (Thomas 1981:14).
\(^c\) Anomalous Type—morphological projectile point types “judged to be out of the Monitor Valley, Nevada Key” (Thomas 1981:24).

alterations that occurred prior to deposition. Thus, it is often the case that morphological typologies do not accurately reflect prehistoric technology, or other relevant behavior, and the site formation processes that actually influenced the final shapes of chipped stone tools. Like a single frame among the thousand of frames in a movie, projectile points provide only a fractional glimpse of the whole story. The remainder of the movie—raw material acquisition, stone reduction, tool manufacture, hafting, use, reuse, and discard—must be investigated through debitage analysis; and all the processes listed certainly influenced the shapes of projectile points we study today.

We do not advocate totally abandoning morphological typologies, but rather we stress systematic collection and technological analysis of the entire lithic reduction and projectile point manufacturing sequence. Projectile points represent a single stage in a reduction sequence of material selection, reduction, use, and reuse. This sequence, including the debitage, has more cultural and temporal significance than projectile point morphology alone. As this experiment has demonstrated, use of morphology as the single criterion may not adequately or precisely mark time. If archaeologists want to construct cultural chronologies based upon flaked stone artifacts, perhaps it would be more accurate to record the entire reduction sequence, which is bound unaltered in time (Flenniken and Stanfill 1980:23–30). For example, aside from variation due to different skill levels and material quality (both of which are definable), the technological attributes of the reduction sequence employed
prehistorically to produce the Elko point may have been diagnostically different from the technological attributes of the Rosegate reduction sequence.

Thomas (1983) does not discuss the debitage from Gatecliff Shelter and, therefore, potentially diagnostic technological differences between the Elko reduction sequence(s) and the Rosegate reduction sequence(s) cannot, at this time, be discerned. Although the flaked stone reduction technology from the bottom to the top of Gatecliff Shelter may form a technological continuum, specific diagnostic differences may occur. These specific technological differences may include larger Elko flake cores and differing platform preparation techniques such as faceting and abrasion; larger Elko flake-blanks for point production; increased counts of direct free-hand percussion thinning debitage from the production of an Elko preform from a flake-blank; increase in platform preparation in the Elko sequence; more massive pressure flakes derived from the production of the Elko point; larger,
less controlled, Elko "notch" flakes; different flake removal sequences; and an overall increase in Elko debitage counts. Concerning "stage" analysis, for the Rosegate sequence, pressure flaking may have occurred directly after flake-blank production, totally omitting the direct, free-hand percussion, thinning "stage" of the flake-blank in the Elko sequence. In addition, higher frequencies of bipolar reduction may occur in the Rosegate sequence.

These technological attribute differences between the Elko and Rosegate reduction sequence are speculations, but quite plausible ones, and there may be other diagnostic attributes as well. If the diagnostic technological attributes of the two reduction sequences could be identified, they would be more adequate to separate Elko from Rosegate than mere morphology of a potentially altered projectile point.

In conclusion, we note that, according to this experiment, potentially one out of every three (33.3%) aboriginal projectile points changed "temporal types" (morphological types) while still in their prehistoric context due to damage sustained during use as hunting tools. In this experiment we controlled for (but were not concerned with) morphological variation created by different flintknapping skill levels or raw material types. Furthermore, each projectile point was removed from experimental use upon the first evidence of damage regardless of the minimal extent of that damage. We maintain that if varying levels of flintknapping skill, variation in quality of raw material, and extended duration of use were tested, morphological variability would be increased.

Acknowledgments. We would like to thank Robert Elston of Intermountain Research for "typing" our experimental projectile points before use and after rejuvenation.

REFERENCES CITED

Aikens, C. M.
Cosgrove, C. B.
Dalley, F., and K. L. Peterson
Deetz, J.
1967 Invitation to Archaeology. The Natural History Press, Garden City, New York.
Flenniken, J. J.
Flenniken, J. J., and A. Stanfill
Ford, J. A.
Frisen, G. C., M. Wilson, and D. J. Wilson
Goodyear, A.
Guernsey, S. J.
Guernsey, S. J., and A. V. Kidder
Hattori, M.

Heizer, R. F.


Kreiger, A. D.


McKern, W. C.

Miller, P. A.

Minor, R., and K. A. Toepel

Rouse, I.

Spaulding, A. C.

Spencer, L.

Thomas, D. H.


Tuohy, D. R.

Wilson, T.