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# Toward a Definition of Pinto Points

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**I**NCONSISTENCIES in the identification of Pinto projectile point types, as used in Great Basin and Mojave Desert archaeology, have created chronological as well as typological problems (Warren 1980). Thomas' (1981:22) attempt to "clarify the situation" by assigning the type name "Gatecliff Split-stem" to the class of points that formerly had been included under the Pinto rubric in the western and central Great Basin, reflects the need for an adequate definition of Pinto points. We have assumed that the Pinto designation should be retained in the Mojave Desert where it was first used (Amsden 1935), unless it can be shown no longer to have a viable application. The viable application of any type is in part dependent upon its intended analytical function. The Pinto point type traditionally has been used primarily as a temporal type, or time marker. The Pinto point type, as defined here, is assumed to be a temporal type and the purpose of this paper is to take the initial step in testing the validity of that assumption. The validity of a temporal type is dependent upon two criteria: 1) a definable temporal distribution of the type; and 2) the consistent occurrence of a set or sets of physical attributes. In this paper we address only the second criterion: the physical attributes of the Pinto points in the Mojave Desert.

The longstanding argument regarding whether archaeologists discover their types in the data or impose their types on the data (Ford 1952, 1954a, 1954b, 1954c; Spaulding 1953a, 1953b, 1954a, 1954b) is irrelevant to the definition of temporal types, or time markers. The necessary quality for a temporal type is the correlation of

physical attribute(s) with a unit of time. It matters not if the attribute(s) results from a change of cultural preference or a change in the availability of a lithic source. We need not know whether the forms we observe result from patterned resharpening of reoccurring fractures patterned by use, from the intractability of the preferred raw material, or from the "mental template" of the prehistoric craftsman. The only necessary qualities are reoccurring attribute(s) that are restricted to a definable period of time. The temporal type is the archaeologist's tool for constructing chronological units, not cultural units. It need reflect the cultural behavior of the prehistoric people no more than does the charcoal used in radiocarbon dating.

Our ultimate goal is to identify a time-sensitive artifact type known as the Pinto point. Our immediate goal is to identify attributes that set the Pinto point apart from other morphologically similar temporal types found in the Mojave Desert (e.g., Thomas 1981). The problems associated with this task are many. The traditional "intuitive taxonomy" of the Mojave Desert and Great Basin has resulted in definitions of Pinto points that vary so greatly in morphology, technology, and chronological placement that the Pinto point, so defined, can no longer function as a temporal type. This may indicate that either the "Pinto point type," regardless of how it is defined, is not a temporal type (and perhaps not a type of any sort); or that the Pinto point type is a temporal type but has been grossly misused and incorrectly identified by archaeologists attempting to develop chronologies in the

Great Basin and Mojave Desert. This paper is written on the assumption that the latter is closer to the truth.

The projectile points described here are called Pinto points because they exhibit the characteristics attributed to Pinto points by Amsden (1935), Rogers (1939), and Harrington (1957) in their intuitive definitions of the Pinto point types. These characteristics are reviewed below. When intuitive types are redefined by a more objective taxonomic system (e.g., Thomas 1981), we believe that it is important that they be made to duplicate, insofar as possible, the intuitive types that in the past have appeared to be time markers. It would be more desirable to use the Pinto Basin (Amsden 1935), Little Lake (Harrington 1957), and the various collections of Rogers (1939) for defining the Pinto type. This, however, would require more resources than we have available.

Taking measurements of Pinto points from photographs of these collections was considered, but the number of projectile points in available photographs is small and the range of variation is probably biased because the points were selected to illustrate idealized intuitive types. Furthermore, some important attributes, such as thickness, cannot be measured from a photograph.

The analysis of the small collection from the Awl site illustrates morphological and/or technological differences between the Awl site Pinto points and: (1) the "Pinto points" from the western Great Basin (now called Gatecliff Split-stem by Thomas [1981, 1983]); (2) the "Pinto points" described by Green (1975); and (3) Elko series points as defined by Thomas (1981, 1983). These morphological differences may correlate with differences in chronological and/or geographical distribution. If so, the Pinto point, as defined here, may be a temporal type, useful in establishing the chronological order of archaeological assemblages in the Mojave

Desert. The test of the validity of the Pinto point as a time marker, which will come only with independent dating of these points, is beyond the scope of this paper. This paper represents only a trial run on a small sample, but we believe the methods and results are worth reporting.

#### A REVIEW OF THE PINTO POINT CONCEPT

The Pinto point was first described by Amsden (1935) as a part of the artifact descriptions in the Pinto Basin report (Campbell and Campbell 1935). Amsden's (1935:44) description was short but he noted that

[Pinto points] vary somewhat in detail of form, but through them all one sees the intent . . . to produce a projectile point with a definite although narrow shoulder and usually an incurving base. . . . The points are thickish, well rounded on each face, as if made from a thick flake . . . .

M. J. Rogers (1939:54) "refined" this classification by describing and numbering five morphological types of Pinto points.

Type 1 has a concave base and sometimes a faintly shouldered effect. . . . Type 2 is broad stemmed with weakly developed shoulders. . . . Type 3 has both the base as well as the sides notched. . . . Type 4 points have straight bases and are side-notched. . . . Type 5 is a small, slender, leaf-shaped point. . . .

Rogers' *Early Lithic Industries* (1939) was out of print for many years and his typology was never widely used.

M. R. Harrington's (1957) typology, based on the series of points from the Stahl (Little Lake) site, became the Pinto point definitions most commonly cited. Harrington named and described five subtypes within the Pinto type: shoulderless, sloping shoulders, square shoulders, barbed shoulders, and one shoulder (Harrington 1957:50-53). Amsden

(1935), Rogers (1939), and Harrington (1957) all characterized the flaking of Pinto points as crude, resulting in thick cross sections. However, Harrington noted that most of his "square shoulders" and some of his "barbed shoulders" Pinto points are thin in cross section due to pressure flaking across the midline of the blade face.

Lanning's (1963) analysis of the Rose Spring material included a description of seven Pinto points, most of which are leaf-shaped. He reported them as large, crude, obsidian points made by percussion flaking with occasional pressure retouch. Lanning (1963:250) placed the "Rose Spring Pinto" and the Stahl site Pinto points into a single category and designated them the Little Lake series. Later, Bettinger and Taylor (1974) argued that the Little Lake series and the Pinto points are significantly different in that the Pinto points are thick and percussion flaked, whereas the points of the Little Lake series are long and thin and exhibit extensive pressure flaking as the finishing manufacturing technique (Bettinger and Taylor 1974:13). They also suggested that the Pinto point may be confined to the Colorado and the eastern Mojave deserts. This seems unlikely given the descriptions of Pinto points cited above (Harrington 1957; Lanning 1963).

In a review of the Pinto problem, Warren (1980:73) wrote:

The problem of defining Pinto points objectively remains with us and a detailed analysis of the original Pinto collections made by the Campbells, Rogers and Harrington is badly needed. This analysis should be innovative, but objective, using the principles of Thomas' (1971) taxonomy in conjunction with analysis of the technology of flintknapping of the points based on principles developed by Don Crabtree and his students.

Pat Green, a student of Don Crabtree, stated (1975:166-167) that on Pinto or Little

Lake series points the flake scar pattern on finished pieces is parallel oblique, which requires a pressure-thinning technique. A parallel oblique pattern is produced by the removal of narrow flakes which usually begin at the upper left of the point face and are overlapped by narrow flake scars coming from the lower right. This gives the impression of a continuous flake scar extending diagonally across the face of the point. Negative bulbs of pressure are shallow. When viewed on edge, the bulbar scar on one face will align with a ridge between two bulbar scars on the opposite face. To facilitate hafting, the lateral edges of the stem are crushed or ground. Basal thinning is a final step in the production of the point and is accomplished by removal of a number of small flakes or a single longitudinal flake from one or both faces. There is no grinding of the basal concavity. Cross sections are usually lenticular to plano-convex.

One major flaw exists in the analysis made by Green: the points analyzed were primarily from Great Basin sites; the Pinto points collected by Rogers and the Campbells were not examined by Green. Other archaeologists have noted what appear to be significant morphological differences between Great Basin and Mojave Desert "Pinto points" (Layton 1970; O'Connell 1971; Bettinger and Taylor 1974). Green's description of the flake scar pattern may apply to points from the Great Basin, but not to the Pinto points originally described in the Mojave Desert (Amsden 1935; Rogers 1939; Harrington 1957).

#### PINTO POINT MANUFACTURE AT THE AWL SITE

Tool types characteristic of the Pinto Period (5000-2000 B.C.) include Pinto point types, large leaf-shaped knives (bifaces) with rounded or bluntpointed extremities, domed and keeled unifaces, and thin, flat milling

slabs. The bifaces (including the projectile points) and the domed or keeled unifaces are common tool types at the Awl site. In the manufacture of each of these tool types, there appears to have been a preference for certain raw material types. Approximately 75% of the unifaces were made from cherts and chalcedonies; 63% of the bifaces were made from rhyolites, fine-grained basalts, andesites, and other fine-grained volcanic materials. The following discussion of the fine-grained volcanic biface production system at the Awl site focuses on the technological aspects of the flaking on the fine-grained volcanic knives and Pinto points from the site.

Two of the morphological variants of the bifaces from the Awl site were examined: parallel-edged specimens and ovate-shaped specimens. Parallel-edged specimens exhibit the following features, presented in order of technological occurrence.

1. Flake blank platforms are sometimes in evidence. This indicates that the original tool blank was a flake and not a core. These platforms usually occur near or at the rounded base of the tool.

2. The initial flaking is a flat percussion removal, bifacially executed, with expanding scars that reach to or approach the tool midline. No midline ridge was created by the removal of the initial flake series, and the resultant cross section is lenticular. In addition, the blank platform area was bifacially thinned in this initial flaking.

3. Removal of a series of nonpatterned percussion flakes that carry to approximately halfway between the lateral edge and the midline was the next step. This series is not patterned in the sense that it does not consist of continuous and overlapping, unifacial, alternate unifacial, or bifacial scars. Since the removal of these flakes affects only the shape of the edge, they are referred to as *edging flakes* or *initial edging*.

4. The final flake removal series produced a grouping of small, steep-angled scars located at the extreme margins of the tool. The flakes are usually neither continuous along an entire edge nor restricted to one tool face. In fact, they often occur bifacially at the same edge. The term *beveling flakes* is used for these scars because they were generally removed from the more convex tool face and they create a steep incline at the tool perimeter. Replication of these scar types shows that beveling may be accomplished by allowing the hammerstone to graze the tool margin.

Although skeptics may claim such flake scars could result from tool use, there are at least three reasons why these bevelled scars probably were not caused by use. First, the bevelled scar groupings have a limited rather than continuous distribution along the edge. If the patterned beveling scars were the result of use, one would expect an attrition pattern that involves most of the margin of the lateral edge. Second, such uniform unifacial scars that laterally overlap and encroach the same distance onto the tool face would not be expected. Third, the beveling scars are often found on areas usually thought of as nonfunctional sections of the tools: near or along the rounded basal extremities. These beveling features seem to be the final edging technique in the sequence of biface manufacture. They create a uniform edge in plan view and, when viewed edge-on, they give the margin an even, horizontal plane.

The second morphological variant examined is the ovate-shaped knife (biface). The range of flaking patterns on these knives (bifaces) is similar to that on the parallel-edged specimens. There are at least two series of percussion flaking.

1. The initial flake scars extend to or across the midline and are broad and expanding with shallow, negative bulbar scars.



2. The edging scars reach to about half-way between the edge and the midline of the tool and are ovate in shape and generally terminate as rounded hinge fractures or feathered ends.

3. Finally, bevelling scars appear along the lateral margins of all the specimens except one biface. On this specimen, bevelling is limited to the formation of the rounded basal edge. On all specimens, bevelling serves to regularize the tool perimeter and gives the tool its final shape.

The flaking of the Pinto points from the Awl site can be compared with that of the larger bifaces just described. The general flaking techniques are similar in a number of ways.

1. Many of the Pinto points show remnants of the initial flake scars in the central and midsection areas and therefore, like the larger bifaces, they were produced from flakes rather than cores.

2. The initial flaking, or at least the earliest scars that can be detected, are broad expanding flakes that extend to the midline or cross over it slightly. Therefore, like the bifaces, there is no evidence of a midline ridge on either tool face.

3. The Pinto points receive their general shape and uniform edge outline with the final series of flake removals. The technology for producing the shape and edge of the Pinto points is different from that of the larger knives (bifaces). The percussion edging scars, seen on the larger bifaces as sporadic occurrences, are displayed as continuous series along the lateral edges of the Pinto points. However, they are not always a bifacial feature. Pressure flaking was also used as the final edging and shaping mechanism for many of the Pinto points. Where applied, the pressure scars are either unifacial and have been removed from the more massive tool face, or they are bifacial and the final series was removed from the more

massive face. The pressure scars vary in shape, length, and orientation depending on the massiveness of the tool face, but the final bevelling that is characteristic of the larger bifaces does not occur on the Pinto points. The Pinto points that are biconvex in cross section show pressure removals which are short and scaled with stepped terminations. These pressure flakes were removed perpendicular to the tool edge and they laterally overlap in sequence.

For the thinner Pinto points, the pressure scars carry almost to the midline. They are linear in appearance with laterally overlapping parallel edges. The pressure scars are oriented at an oblique angle to the base, and they have feathered terminations.

The final differences between the large bifaces and the Pinto points are the shoulder and base features which are the distinctive characteristics of the Pinto series. The notching process, which creates the shoulder and the basal concavity, is a part of the final edging stage. Where pressure flaking was applied to the lateral edges, it continues along the edge as the technique for the creation of the shoulders, ears, and concave base. On Pinto points whose lateral edges received percussion trimming as the final edging process, pressure flaking was still used to create the distinctive proximal features (e.g., Fig. 1m, t). On all the Pinto points, the thickest area in cross section is within the proximal one-third of the specimen. As a result, pressure scars on the proximal one-third are short in length, steep in angle, expanding in shape, and stepped in termination.

The major differences in the flaking characteristics of the large bifaces and the Pinto points appear as a result of the final edging process. Edging by the bevelling technique is not used for Pinto point manufacture, but is present on all the large bifaces examined. Conversely, pressure edging

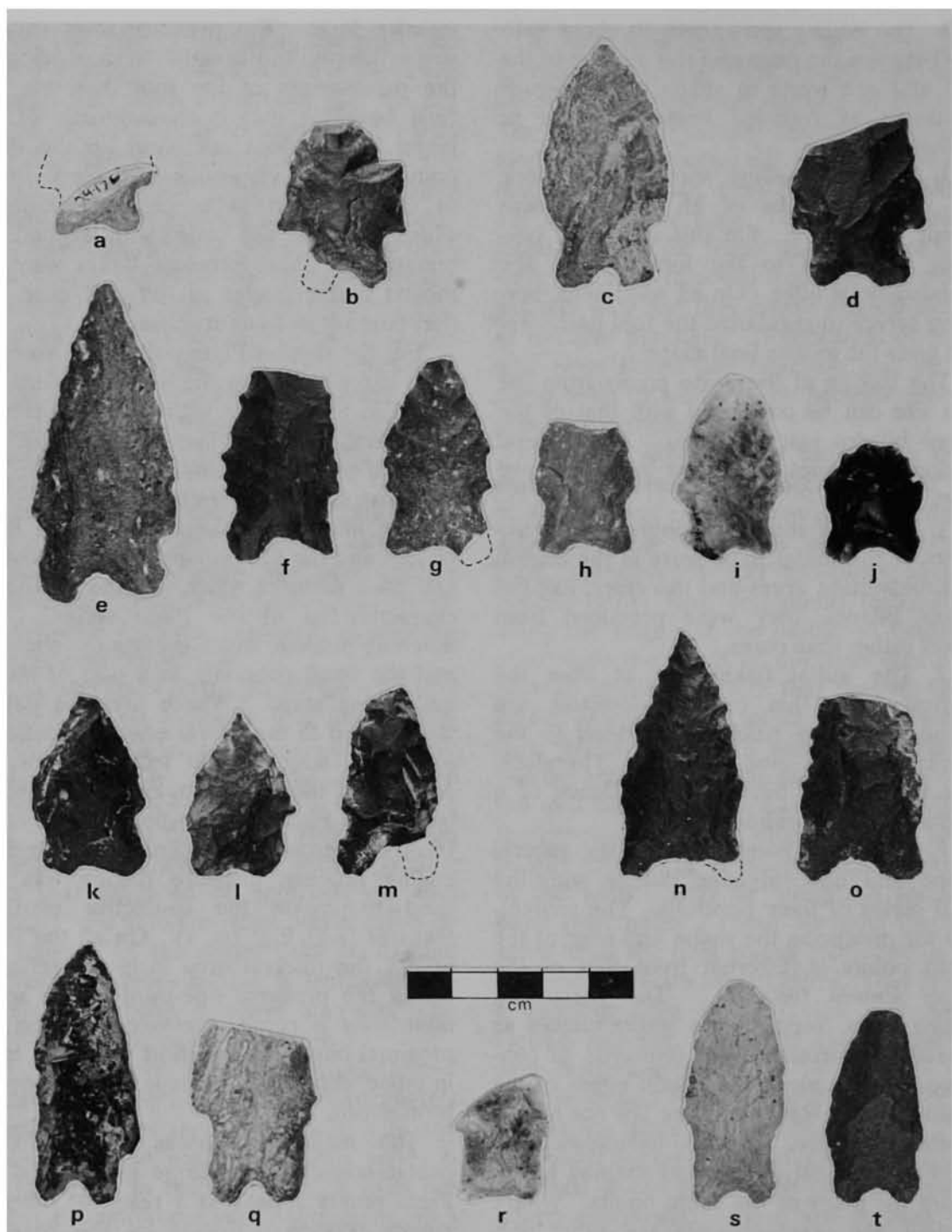


Fig. 1. Pinto points from the Awl site: a-d, Group Ia; e-m, Group Ib; n-o, Group Ic; p-q, Group IIa; r, Group IIb; s-t, Group III. (See Table 1 for catalog numbers.)

was used to give the Pinto points their final shape and margin features, but was not part of the manufacturing sequence for the larger bifaces.

### A TAXONOMIC KEY FOR PINTO POINTS: TOWARD A DEFINITION

The taxonomic system utilized here was borrowed directly from Thomas' Monitor Valley Projectile Point Key (Thomas 1981:25). Because we are concerned with only Pinto points we have not reproduced the whole of Thomas' key. The following illustrates the steps added to the Monitor Valley Projectile Point Key in order to incorporate the Pinto points from the Mojave Desert.

The definitions of attributes are provided below. Most were taken directly from Thomas (1981) and were illustrated by Thomas (1981:14, Fig. 3). The remaining attributes have been shown to be important in distinguishing points of the Lake Mojave and Pinto series in the Mojave Desert (Warren et al. 1987).

1. Distal Shoulder Angle (DSA) (Fig. 2). The distal shoulder angle is that angle formed between line (A) defined by the shoulder at the distal point of juncture and line (B) drawn perpendicular to the longitudinal axis (C) at the intersection of A and C. DSA ranges between 90 and 270 degrees. If points are asymmetrical, the smaller value of DSA is measured. DSA is recorded to the nearest 5 degrees (Thomas 1981:11).

2. Proximal Shoulder Angle (PSA) (Fig. 2). The proximal shoulder angle is that angle formed between line (D) defined by the proximal point of juncture and line (B) plotted perpendicular to the longitudinal axis at the intersection of C and D. PSA ranges between 0 degrees and 270 degrees. If points are asymmetrical, the larger value of PSA is measured. PSA is recorded to the nearest 5 degrees (Thomas 1981:11). For asymmetrical points, Thomas measured the smaller value. However, by measuring the smaller value the possibility of recording use-life modification is increased.

3. Basal Width (WB) (Fig. 2). The width at the widest portion of the base (Thomas 1981:13).

4. Basal Indentation Ratio (BIR) (Fig. 2). The length measured along the longitudinal axis (C) divided by the maximum length measured parallel to the longitudinal

axis (C), i.e.,  $BIR = LA/LT$ . The basal indentation ratio ranges between 0.0 and about 0.90 (Thomas 1981:11).

5. Neck Width (WN) (Fig. 2). The width of the stem at intersection with shoulders.

6. Maximum Width at Shoulder (MWSH) (Fig. 2). Width of blade at intersection of blade edge and shoulder.

7. Shoulder Width (WSh). Sum of the width of the two shoulders. Calculated by subtracting neck width from maximum width at shoulder ( $WSh = MWSH - WN$ ).

8. Shoulder Width-Maximum Width at Shoulder Index (WSh/MWSH). The WSh/MWSH Index is calculated by dividing the WSh by the MWSH and multiplying by 100 ( $WSh/MWSH \times 100$ ).

### The Key

1. Point is unshouldered . . . . . out of key
- 1a. Point is shouldered . . . . . (2)
2. Point is side-notched . . . . . out of key
- 2a. Point is stemmed . . . . . (3)
3. Point is small. Neck width < 10.00 mm. . . . . out of key
- 3a. Point has neck width > 10.00 mm. . . . . (4)
4. Point has basal width < 10.00 mm. . . . . out of key
- 4a. Point has basal width  $\geq$  10.00 mm. . . . . (5)
5. Point has  $BIR \geq 0.98$ . . . . . out of key
- 5a. Point has  $BIR < 0.98$ . . . . . (6)
6. Point has thickness < 6.4 mm. . . . . Elko and Gatecliff series
- 6a. Point has thickness  $\geq$  6.4 mm. and  $WSh < 12.75$  mm. . . . . go to 7
- 6b. Point has thickness  $\leq$  7.4 mm. and  $WSh > 12.75$  mm. . . . . Elko and Gatecliff series
7. Point has  $WSh/MWSH$  Index < 15 . . . . . Group Ic
- 7a. Point has  $WSh/MWSH$  Index > 15 and < 30 . . . . . go to 8
- 7b. Point has  $WSh/MWSH$  Index > 30 . . . . . go to 9
8. Point has  $PSA \leq 100^\circ$ . . . . . Group IIx
- 8a. Point has  $PSA > 100^\circ$  and <  $110^\circ$  . . . . . Group III
- 8b. Point has  $PSA \geq 110^\circ$ . . . . . Group Ib
9. Point has  $PSA \leq 100^\circ$ . . . . . Group IIa
- 9a. Point has  $PSA > 100^\circ$ . . . . . Group Ia

### PINTO POINT MORPHOLOGY AT THE AWL SITE

The morphological analysis of the Pinto points from the Awl site is based on Thomas' (1981) taxonomic system for Monitor Valley. Our use of the Monitor Valley taxonomic system, however, is not an at-



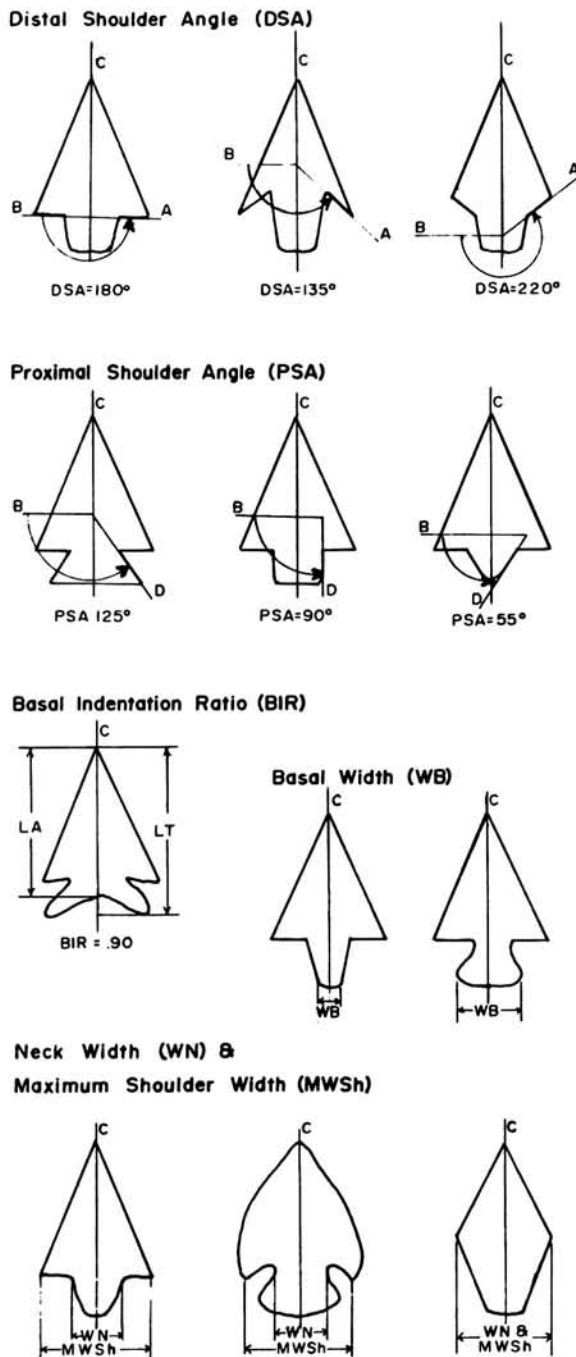


Fig. 2. Attribute illustrations.

tempt to force the Awl site Pinto points into the types defined for the Monitor Valley and the western Great Basin. On the contrary, we follow the taxonomic procedure set forth by Thomas (1981) in order to illustrate the differences as well as the similarities between the Pinto points from the Awl site and those from Gatecliff Shelter.

We are of the opinion that the Pinto points of the Mojave Desert belong to a different stylistic and technological tradition from those of the central and western Great Basin (e.g., Gatecliff Split-stem). The degree to which Mojave Desert Pinto points differ from those from Gatecliff Shelter is perhaps best illustrated by the fact that 15 (Group I, see Fig. 1) of the 21 Pinto points from the Awl site key out as Elko series points on the Monitor Valley projectile point key. Four of the remaining points (all of Group II and one in Group I [Fig. 1n]) key out as Gatecliff Split-stem and two (Group III) do not exhibit key attributes for any of the Monitor Valley types (Table I).

Thomas (1981:20) noted that the basal width alone separates the Elko series from the Rosegate series with an accuracy of better than 95%. The Elko series consists of large corner-notched projectile points with a basal width greater than 10 mm. and a proximal shoulder angle of 110 to 150 degrees. Fifteen of the Pinto points from the Awl site meet these criteria (Group I, Table 1), with proximal shoulder angles between 110 and 130 degrees. Furthermore, 13 of these 15 points have basal indentation ratios of less than 0.94, which would place them in the Elko Eared type. The two exceptions are too fragmentary to allow measurement of the basal indentation ratios.

Although the Awl site Pinto points key out as Elko Eared and Gatecliff Split-stem, even a cursory examination of these points reveals morphological differences between Gatecliff and Awl site points. The morpho-

**Table 1**  
**METRIC ATTRIBUTES OF THE AWL SITE PROJECTILE POINTS**

Cat. No.	Length	BIR	MWSh	WN	WSh	WB	Th	DSA	PSA	WSh/MWSh <sup>a</sup>
<b>Group Ia</b>										
24-18	(57.0) <sup>b</sup>	(0.93)	28.9	18.7	10.2	21.9	6.8	180	130	.35
24-176	—	—	(24.3)	(16.5)	(7.8)	18.9	(8.0)	200	120	(.32)
24-1076	54.0	0.92	25.7	17.6	8.1	21.9	7.6	200	110	.32
24-1614	(58.0)	(0.92)	28.3	15.6	12.7	(17.0)	8.0	185	120	.45
Mean	56.3	0.92	26.8	17.1	9.7	19.9	7.6	191.3	120	.36
SD	2.08	0.006	2.17	1.34	2.27	2.41	0.57	10.31	8.16	.0616
Sample size	3	3	4	4	4	4	4	4	4	4
<b>Group Ib</b>										
24-2	(41.0)	(0.93)	22.0	17.8	4.2	20.9	7.0	225	110	.19
24-4	(58.0)	(0.92)	26.0	20.1	5.9	23.9	7.8	200	120	.23
24-20	70.0	0.92	32.0	24.1	7.9	27.8	10.9	210	120	.25
24-21	37.0	0.92	(24.0)	20.0	4.0	20.3	8.0	200	110	(.17)
24-22	41.0	0.92	24.5	19.2	5.3	22.4	8.2	200	120	.22
24-930	(29.0)	(0.90)	22.0	18.2	3.8	21.0	8.1	230	120	.17
24-1068	(46.0)	(0.86)	21.8	17.2	4.6	22.5	7.0	220	130	.21
24-1070	(41.5)	(0.93)	24.0	17.0	7.0	20.0	9.0	220	130	.29
24-1158	(43.5)	—	26.2	19.9	6.7	[>20.5]	7.5	240	110	.26
24-1666	(45.0)	0.93	24.0	18.4	5.6	(23.8)	9.1	210	110	.23
Mean	45.2	0.91	24.65	19.19	5.5	22.51	8.26	215.5	118	.222
SD	11.36	0.022	3.01	2.07	1.39	2.44	1.17	13.83	7.89	.0388
Sample size	10	9	10	10	10	9	10	10	10	10
<b>Group Ic</b>										
24-1665	(60.0)	0.92	27.0	24.8	2.2	28.0	10.0	250	110	.11
24-19	53.2	0.92	27.0	24.0	3.0	(27.0)	10.5	250	105	.11
<b>Group IIa</b>										
24-5	(64.0)	(0.92)	(30.0)	20.1	9.9	19.0	7.9	185	95	(.33)
24-1336	56.0	0.91	(26.5)	17.2	(9.3)	13.1	8.1	200	90	(.35)
<b>Group IIx</b>										
24-1066	—	—	21.0	16.5	4.5	17.1	8.7	205	95	.21
<b>Group III</b>										
24-13	(51.0)	0.91	22.2	16.7	5.5	17.0	8.4	240	105	.25
24-23	(48.0)	0.91	22.0	18.2	3.8	18.5	7.4	240	105	.17
<b>Summary</b>										
Mean	50.17	0.916	25.21	18.94	6.29	21.1	8.29	213.81	112.6	.247
SD	10.18	0.016	2.98	2.59	2.69	3.83	1.10	21.44	11.36	.085
Sample size	19	21	21	21	21	21	21	21	21	21

<sup>a</sup> All measurements are in millimeters. Abbreviations are as follows:

- BIR = Basal indentation ratio
- MWSh = Maximum width at shoulder
- WSh = Shoulder width
- WB = Basal width
- Th = Thickness
- DSA = Distal shoulder angle
- PSA = Proximal shoulder angle

<sup>b</sup> Numbers in parenthesis are reconstructed from incomplete artifacts.

logical attributes that most obviously differ between "Pinto points" of the Awl site and those of the Elko Eared and Gatecliff Split-stem types (Thomas 1983:180-186) are thickness, shoulder width, and distal shoulder angle.

The shoulder width measurement is larger for the points from Gatecliff Shelter than the Awl site points. The shoulder width-maximum width at shoulder index ( $WSh/MWSh \times 100$ ) indicates that the shoulder width is not a reflection of differences in absolute size (width) between the Gatecliff Shelter and Awl site points. In both shoulder width and  $WSh/MWSh$  index, the mean of the measurements on points from the Awl site is only slightly more than 50% of the mean of the measurements on points from Gatecliff Shelter. Considerable variability exists in these populations, especially in the Awl site sample, which suggests that the sample could be subdivided on the bases of these attributes.

Thickness is the single attribute that best separates these assemblages. The points from the Awl site are significantly thicker than those from Gatecliff. The Gatecliff Shelter mean thickness is beyond two standard deviations of the Awl site mean thickness. The Awl site mean thickness is beyond three standard deviations of the Gatecliff Shelter mean thickness.

The distal shoulder angle (DSA) is larger on the Awl site points than on the points from Gatecliff Shelter. The mean of the DSA for the Awl site points is just outside two standard deviations of the mean of the DSA for the Gatecliff Split-stem points.

The Student's *t*-test calculations for the thickness, shoulder width,  $WSh/MWSh$  index, and the distal shoulder angle (DSA) for Awl site Pinto points and Gatecliff Split-stem points clearly demonstrate that the two groups of points are from different populations (Table 2). The null hypothesis is that

the mean of the attribute for Gatecliff Split-stem points is equal to that of the Awl site Pinto points [ $H_0: M_{SS} = M_{PP}$ ]. All of the *t*-scores indicate that there are significant differences in the means of the two samples and that they are from different populations. The conclusion is simple and straightforward: Gatecliff Split-stem and the Awl site Pinto points are not the same morphological type. The differences between the Awl site Pinto points and Gatecliff Split-stem points are: (1) Awl site points are thick and tend to have narrow sloping shoulders; (2) Gatecliff Split-stem points are thin and tend to have squared, wide shoulders.

The Awl site Pinto points exhibit variations in form, some of which were described by Rogers (1939) and Harrington (1957). These variations probably indicate that the so called "Pinto type" is really a series consisting of several types. The Awl site Pinto points display attributes which may cause them to be confused with the Elko and Gatecliff series. The Awl site Pinto points have been divided into three groups: Group I (Fig. 1a-o), most like the Elko Eared points from Gatecliff Shelter; Group II (Fig. 1p-r), most like the Gatecliff Split-stem; and Group III (Fig. 1s, t), miscellaneous points. Two of these groups are further subdivided on the basis of differences in shoulder width, DSA, and thickness (Table 1).

Group I was subdivided into three groups; Ia (Fig. 1a-d), Ib (Fig. 1e-m), and Ic (Fig. 1n-o) on the basis of the  $WSh/MWSh$  index: Group Ia > 30; Ib > 15; Ic < 15. Group II was subdivided into Group IIa (Fig. 1p, q), containing two similar points, and Group IIx (Fig. 1r) containing one unique point. This division is also made on the basis of shoulder width index: Group IIa > 30; IIx < 30. The small size of most of these groups prevents statistical testing of the validity of the divisions.

Groups Ia and Ib are, however, those

**Table 2**  
**t-TEST RESULTS FOR GATECLIFF SPLIT-STEM**  
**AND AWL SITE PINTO POINTS<sup>a</sup>**

Attribute	df	t-Score	t at 0.05	Result
Thickness	41	ts = 10.09	> t = 2.020	H <sub>0</sub> rejected
WSh	[21,19]	t's = 5.05	> t = 2.090	H <sub>0</sub> rejected
Wsh/MWSh Index	40	ts = 7.816	> t = 2.021	H <sub>0</sub> rejected
DSA	41	ts = 5.662	> t = 2.020	H <sub>0</sub> rejected

<sup>a</sup> H<sub>0</sub>: Mean<sub>SS</sub> = Mean<sub>PP</sub>  
 SS = Gatecliff Split Stem  
 PP = Awl Site Pinto Points

**Table 3**  
**t-TEST RESULTS FOR FOUR ATTRIBUTES AMONG THREE POINT GROUPS<sup>a</sup>**

Attribute	H <sub>0</sub> :	df	t-Score	t at 0.05	Results
Thickness	Mean <sub>EE</sub> = Mean <sub>Ia</sub>	61	ts = 5.942	> t = 2.020	Reject H <sub>0</sub>
	Mean <sub>EE</sub> = Mean <sub>Ib</sub>	67	ts = 10.478	> t = 1.998	Reject H <sub>0</sub>
	Mean <sub>Ia</sub> = Mean <sub>Ib</sub>	12	ts = 1.062	< t = 2.179	Not reject H <sub>0</sub>
WSh	Mean <sub>EE</sub> = Mean <sub>Ia</sub>	49	ts = 0.746	< t = 2.012	Not reject H <sub>0</sub>
	Mean <sub>EE</sub> = Mean <sub>Ib</sub>	[47, 9]	t's = 8.494	> t = 2.133	Reject H <sub>0</sub>
	Mean <sub>Ia</sub> = Mean <sub>Ib</sub>	12	ts = 4.299	> t = 2.179	Reject H <sub>0</sub>
WSh/MWSh Index	Mean <sub>EE</sub> = Mean <sub>Ia</sub>	50	ts = 2.082	> t = 2.011	Reject H <sub>0</sub>
	Mean <sub>EE</sub> = Mean <sub>Ib</sub>	[46, 9]	t's = 13.16	> t' = 2.136	Reject H <sub>0</sub>
	Mean <sub>Ia</sub> = Mean <sub>Ib</sub>	12	ts = 5.115	> t = 2.179	Reject H <sub>0</sub>
DSA	Mean <sub>EE</sub> = Mean <sub>Ia</sub>	44	ts = 8.707	> t = 2.017	Reject H <sub>0</sub>
	Mean <sub>EE</sub> = Mean <sub>Ib</sub>	50	ts = 7.891	> t = 2.011	Reject H <sub>0</sub>
	Mean <sub>Ia</sub> = Mean <sub>Ib</sub>	12	ts = 3.144	> t = 2.179	Reject H <sub>0</sub>

<sup>a</sup> EE = Elko Eared as defined by the Monitor Valley typology.  
 Ia = Awl Site Pinto Points Group Ia  
 Ib = Awl Site Pinto Points Group Ib

most similar to Elko Eared, with Group Ia appearing to be intermediate between Group Ib and Elko Eared points from Gatecliff Shelter. In order to test this relationship, Student's t-tests were used to determine if the means of any two of these three groups (Group Ia, Ib, Elko Eared points from Gatecliff Shelter) were statistically the same for each of four attributes: thickness, DSA, shoulder width, and WSh/MWSh index. The null hypotheses state that the mean for the measurements on the Elko Eared points from Gatecliff Shelter is equal to the means of the same measurements on the Awl site

Pinto points, and that the means of the measurements for the two groups from the Awl site are equal (mean of Group Ia = mean of Elko Eared; mean of Group Ib = mean of Elko Eared; mean of Group Ia = mean of Group Ib). The results are shown in Table 3. The only two null hypotheses not rejected were: (1) the mean of the shoulder width of Elko Eared and Group Ia points are equal, and (2) the mean of the thickness for Group Ia and Ib are equal. It seems reasonable to conclude that: (1) the Awl site Pinto points and the Elko Eared points from Gatecliff Shelter are from different popula-



tions and are therefore not the same type and, (2) the variation within the Awl site Pinto point population suggests that the traditional "Pinto type" is best considered a series and that Group Ia and Group Ib may represent types within that series.

Finally, another variable that must be considered is the material used in the production of the Pinto points. Seventeen of the points discussed here are fine-grained volcanics (including basalt, andesite, dacite, rhyolite, etc.). The remaining four specimens (see Table 1) are jasper (24-1614), obsidian (24-930) and chert/chalcedony (24-1066, 24-1070). It may be argued that fine-grained volcanics may be so tough as to limit pressure flaking to the final treatment of the edge, making it impossible to make well-formed and deep notches, thus limiting such characteristics as the shoulder width (WSh). Thinning may also have been out of the question, so the points end up being thick. In other words the tough material may lead to Pinto and not Elko points, regardless how hard one tries to make the latter.

If the lithic material is a prohibiting factor in the making of Elko points (or some other more refined point type) then there should be significant differences between the 17 fine-grained volcanic points and the remaining four cryptocrystalline and obsidian points from the Awl site. Furthermore, there should be strong similarities between the cryptocrystalline/obsidian points from the Awl site and Elko Eared points from Gatecliff Shelter. Elko Eared points from Gatecliff Shelter are all "chert" (Thomas 1983:206-207). In order to test these hypothetical relationships, Student's t-tests were run to determine if the means of the four attributes used to distinguish the Awl site Pinto points from Elko Eared points from Gatecliff Shelter were statistically the same for each of the three lithic material groups: cryptocrystalline/obsidian points from the

Awl site, the fine-grained volcanic points from the Awl site, and the "chert" Elko Eared points from Gatecliff Shelter (Tables 4, 5, and 6).

The Student's t-test indicated that the means for all four attributes are statistically the same for the fine-grained volcanic Pinto points and the cryptocrystalline/obsidian Pinto points from the Awl site (Table 4). This supports the hypothesis that the material does not significantly influence these attributes. On the other hand, the Student's t-test (Tables 5 and 6) indicates that the Awl site cryptocrystalline/obsidian Pinto points and the Elko points from Gatecliff Shelter do have equal means in the shoulder width (WSh) and in the WSh/MWSh index, but not in attributes of thickness and distal shoulder angle (DSA), and that the Awl site fine-grained volcanic Pinto points and the Elko Eared points from Gatecliff Shelter did not have equal means for any of the attributes examined. This suggests that at the Awl site the material from which the points are made may affect the shoulder width, but probably not the other attributes examined.

The sample of cryptocrystalline/obsidian Pinto points from the Awl site is so small that the merit of these tests can be questioned. However, on the basis of the data we have, the differences in material cannot be said to result in significant differences in the attributes used here to differentiate the Awl site Pinto points from other projectile point types of similar form.

It may be argued that it is the fine-grained volcanic material, from which most of the Pinto points at the Awl site were made, that results in the narrow shoulder width. However, it may also be postulated that the material from which the points are made is a time-sensitive attribute of the Pinto points in the Mojave Desert. In recent years, Pinto points have been reported in quantity at a number of sites on Fort

**Table 4**  
**t-TEST RESULTS FOR FINE GRAINED VOLCANIC POINTS**  
**AND CRYPTOCRYSTALLINE/OBSIDIAN POINTS**  
**FROM THE AWL SITE<sup>a</sup>**

Attribute	df	t-Score	t at 0.05	Result
Thickness	19	ts = 0.499	< t = 2.093	H <sub>0</sub> not rejected
WSh	19	ts = 0.330	< t = 2.093	H <sub>0</sub> not rejected
Wsh/MWSh Index	19	ts = 0.810	< t = 2.093	H <sub>0</sub> not rejected
DSA	19	ts = 0.386	< t = 2.093	H <sub>0</sub> not rejected

<sup>a</sup> H<sub>0</sub>: Mean<sub>FGVP</sub> = Mean<sub>C/OP</sub>  
 FGVP = Fine grained volcanic points;  
 C/OP = Cryptocrystalline/obsidian points.

**Table 5**  
**t-TEST RESULTS FOR CRYPTOCRYSTALLINE/OBSIDIAN**  
**POINTS: AWL SITE PINTO POINTS AND**  
**ELKO POINTS FROM GATECLIFF SHELTER<sup>a</sup>**

Attribute	df	t-Score	t at 0.05	Result
Thickness	3	ts = 15.639	> t = 3.182	H <sub>0</sub> rejected
WSh	3	ts = 1.955	< t = 3.182	H <sub>0</sub> not rejected
Wsh/MWSh Index	3	ts = 2.880	< t = 3.182	H <sub>0</sub> not rejected
DSA	3	ts = 4.609	> t = 3.182	H <sub>0</sub> rejected

<sup>a</sup> H<sub>0</sub>: Mean<sub>PP</sub> = Mean<sub>EP</sub>  
 PP = Awl Site Pinto Points  
 EP = Elko Points from Gatecliff Shelter.

**Table 6**  
**t-TEST RESULTS FOR FINE GRAINED VOLCANIC**  
**POINTS: AWL SITE PINTO POINTS AND**  
**ELKO EARED POINTS FROM GATECLIFF SHELTER<sup>a</sup>**

Attribute	df	t-Score	t at 0.05	Result
Thickness	16	ts = 13.121	< t = 2.120	H <sub>0</sub> rejected
WSh	16	ts = 7.641	< t = 2.120	H <sub>0</sub> rejected
Wsh/MWSh Index	16	ts = 11.511	< t = 2.120	H <sub>0</sub> rejected
DSA	16	ts = 9.203	< t = 2.120	H <sub>0</sub> rejected

<sup>a</sup> H<sub>0</sub>: Mean<sub>PP</sub> = Mean<sub>EP</sub>  
 PP = Awl Site Pinto Points  
 EP = Elko Points from Gatecliff Shelter.

Irwin (and elsewhere) and in each case the dominant material from which all bifaces were made (including Pinto points) was fine-grained volcanic, whereas the dominant material for uniface tools was chert, chalcedony, and other cryptocrystalline materials.

On Fort Irwin, the sources for these materials are within 20 km. of the sites, and in some instances the sites are less than a kilometer from a source area. The major source of basalt on Fort Irwin, the Ridge site (CA-SBR-4977), also contains plentiful quantities of chert and chalcedony (Robarchek et al. 1984:86-98). The fact that both fine-grained volcanic and cryptocrystalline materials are easily available in the area, and that both occur as tools and detritus on sites containing relatively large numbers of Pinto points, seems to indicate that cryptocrystalline materials were readily available to the makers of the Pinto points. If the raw material affects the shoulder width, and the desired end product was an Elko Eared point with deep notches and broad shoulders, it seems highly unlikely that the fine-grained volcanics would have been used almost to the exclusion of the relatively plentiful chert and chalcedony.

This dominance of basalt and other fine-grained volcanics in the biface tool assemblage does not appear to be characteristic of later sites in the area, further supporting the postulate that cryptocrystalline materials were available during the Pinto Period, but not preferred for the production of bifaces. The heavy use of fine-grained volcanics in the production of biface tools may, in itself, prove to be a time marker characteristic of the Pinto Period and earlier occupations in the central Mojave Desert.

### CONCLUSIONS

A comparison of published data on the "Pinto" technology and morphology from the western and central Great Basin with data

derived from the Awl site Pinto points demonstrates significant differences in both technology and morphology of the two samples. The analysis of the Pinto points from the Awl site demonstrates that the flake scar pattern described by Green (1975) for the Great Basin "Pinto" points does not apply to the Pinto points from the Awl site. The analysis of the morphological attributes indicates that there are significant differences between the Awl site Pinto points on one hand and the Gatecliff Split-stem and the Elko Eared points from Gatecliff Shelter on the other. These data support the interpretation that the Pinto points from the Mojave Desert and the "Pinto" points from the western and central Great Basin exhibit differences in technology and morphology that preclude them from being classed in a single "Pinto type" (or Pinto series).

This analysis of the Awl site Pinto points indicates that the application of the principles of Thomas' (1981) taxonomic system, in conjunction with analysis of the lithic technology, has the potential of clarifying the massive confusion that surrounds Pinto point typology. The analysis presented here is only a beginning and we believe that a similar analysis of the assemblages of "Pinto points" described by Amsden (1935), Rogers (1939), and Harrington (1957), would be the strongest test of the validity of the "Pinto series" in the Mojave Desert.

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