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Parallel-oblique flaked projectile points| Angostura, Lusk, Frederick, James Allen?

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PARALLEL-OBLIQUE FLAKED PROJECTILE POINTS: ANGOSTURA, LUSK, FREDERICK, JAMES ALLEN?

by
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Director: Dr. Dee C. Taylor

Archaeologists from the University of North Dakota research station in Belfield conducted limited excavation at 32SL100 in July of 1986. Several parallel oblique flaked point fragments were recovered during the effort. The initial goal was to identify these points as belonging within a named projectile point type. Research of current literature revealed seven named parallel oblique flaked projectile point types: Angostura, Frederick, Lusk, James Allen, Browns Valley, Lovell Constricted and Pryor Stemmed. The latter three appeared to have different shapes that distinguished them from the other four as well as the points collected from 32SL100a. Research was then focused on distinguishing between the Angostura, Frederick, Lusk and James Allen point types. After looking at drawings and photos of points and reading descriptions of each type's attributes there appeared to be as much variation within the named types as between them. Upon completion of initial research it was hypothesized that Angostura, Frederick, Lusk and James Allen points should be placed within the same type and called by a single term.

Due to difficulties in locating various projectile point collections, photographs and artifact sketches were used for analysis. This analysis consisted of using the polar grid measurement method, compiling measurement data, and running factor and cluster analyses on the measurements. A total of 18 distal and 43 proximal point fragments from nine sites in the Northern Plains were used in the analysis. the majority of these had been called Angostura, Lusk, Frederick or Allen points; others had not been formally associated with a named type.

Conclusions from the analysis are: 1) the points from the Pretty Butte site, the two points from the Pretty Creek site, and points from the Mummy Cave site, Layers 27 and 29-31, are Angostura points, 2) that the term Lusk should be dropped because it only confuses the issue, 3) that at least Frederick and Angostura points should be placed in the same type, and 4) that James Allen points may or may not warrant classification into a separate type.

Acknowledgements.

There are many people I want to thank for their assistance with this project. One person through the years has been relentless in his support for my education and career goals. This thesis is the result of his perseverance in promoting post graduate education. Thanks Larry (Dr. Loendorf). I would also like to thank Drs. Taylor and Foor for their guidance and good humor throughout my graduate studies and seemingly endless thesis process. Additionally, I need to thank Drs. Frison and Hannus. Dr. Frison took the time to visit with me over the telephone regarding my thesis and sent me a copy of Irwin's dissertation. Dr. Hannus also provided background for me on my thesis topic and sent me Wheeler's 1957 manuscript on the Ray Long Site. Thanks!

People at the UNDAR-West Office were very supportive also during my graduate studies and thesis preparation period. I want to thank Dave Kuehn for his support in allowing time from work to complete this process. I want to thank the crew that worked on the test excavation at 32SL100 (Dr. Loendorf, Dave Kuehn, Audrey Porsche, Lowell Blikre, and Deb Smith). Thanks to Jackie Foster for fixing some of the figures. And last, but not least, thanks to Michele Hoff for her spirit and friendship.

I couldn't have completed my graduate studies without the help and support of my family (my husband Tony Knopik, and my son, Jacob). I love you.

I know, this sounds like one of those Academy Award acceptance speeches..."and I want to thank my mother for having bore me, my father for having supported me, and my dog for just being there." But I am truly indebted to those mentioned above and genuinely grateful and tickled that the end of this memorable experience is in sight.

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Statement of Problem

Archaeologists from the University of North Dakota research station in Belfield conducted limited excavation at 32SL100 in July of 1986. Several parallel oblique flaked point fragments were recovered during the effort. Initially I tried to identify these points as belonging within a named projectile point type. My research of the current literature revealed seven named parallel oblique flaked projectile point types: Angostura, Frederick, Lusk, James Allen, Browns Valley, Lovell Constricted and Pryor Stemmed. The latter three appeared to have different shapes that distinguished them from the other four as well as from the points collected from 32SL100. Browns Valley, Lovell Constricted and Pryor Stemmed points also appeared to be restricted to smaller geographical areas than the other named point types. I focused my research on distinguishing between the Angostura, Frederick, Lusk and James Allen point types. After looking at drawings and photos of points and reading descriptions of each type's primary attributes I believe that there is as much variation within the named types as between them. Upon completion of my initial research I hypothesized that Angostura, Frederick, Lusk and James Allen points should be placed within the same type and named by a single term. I then proceeded to devise a method for testing this proposition. In the following pages I report my initial research of parallel oblique flaked points, my methods used in testing the stated hypothesis, the subsequent results of my analysis, and my conclusions.

32SL100

The Pretty Butte Site, 32SL100, is situated on the north end of an eroded remnant terrace in a heavily dissected area between Pretty Butte and the Little Missouri River in southwestern North Dakota (Figure 1). The site, on United States Forest Service, Little Missouri Grasslands, was originally located by Lawrence L. Loendorf. He noted cultural material eroding out of a cutbank on the north end of the terrace. During another visit in the summer of 1986, we recorded the site and collected tools from the surface of the slope below the cutbank.

These tools included four parallel oblique flaked projectile point fragments (Figure 2). Three of these were distal (tip) fragments and one was a proximal (basal) fragment. While all of the points were fragments, a general description is possible. These points are lanceolate in shape, the edges expand or gently curve from the tip to become nearly parallel at the center, then taper to a narrow base. The one proximal fragment had a slightly concave, irregular base. Basal thinning was evident and was attained by the removal of vertical flakes. On all four specimens parallel oblique flaking was confined to one side. The

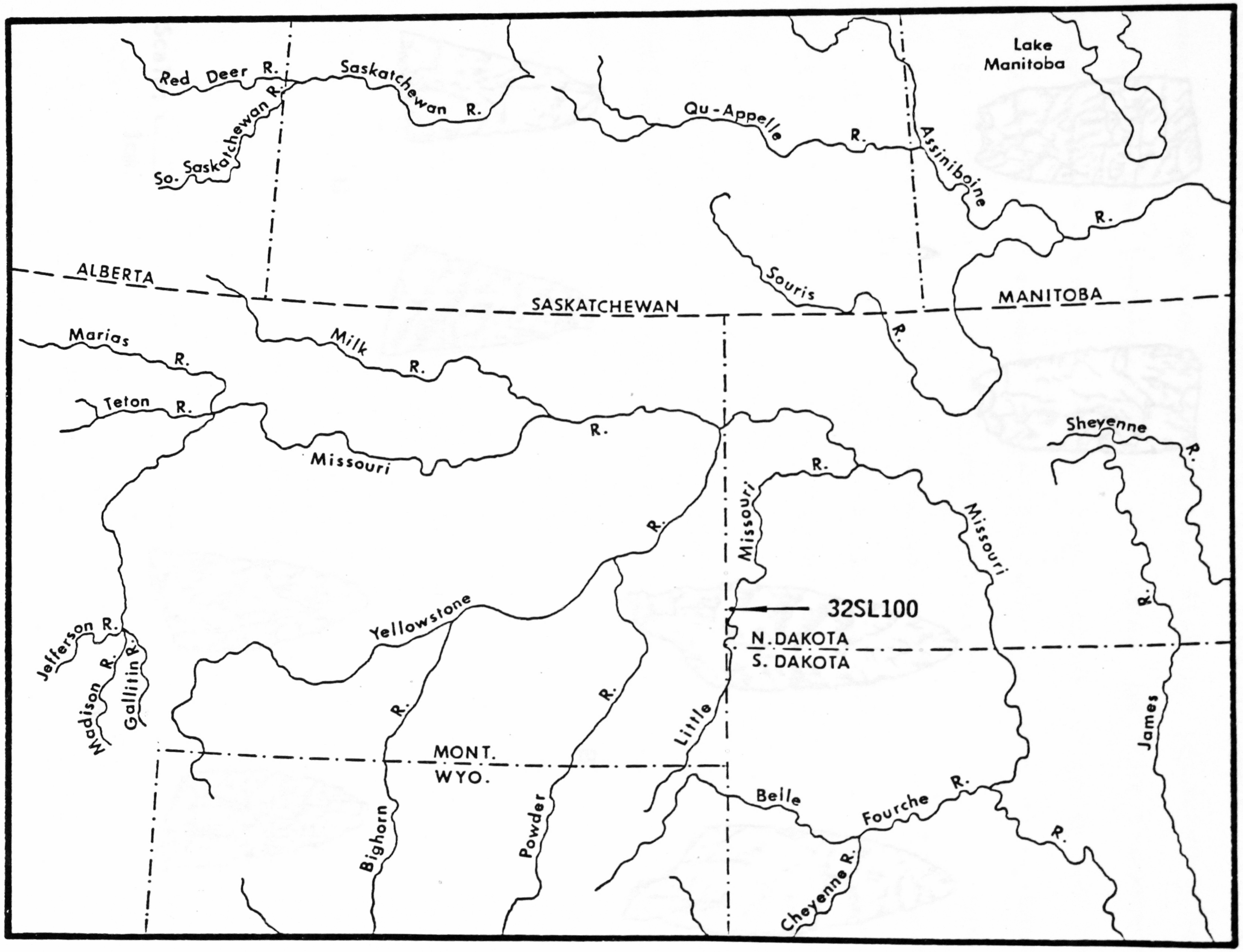

Figure 1. Map of the region showing the location of 32SL100.

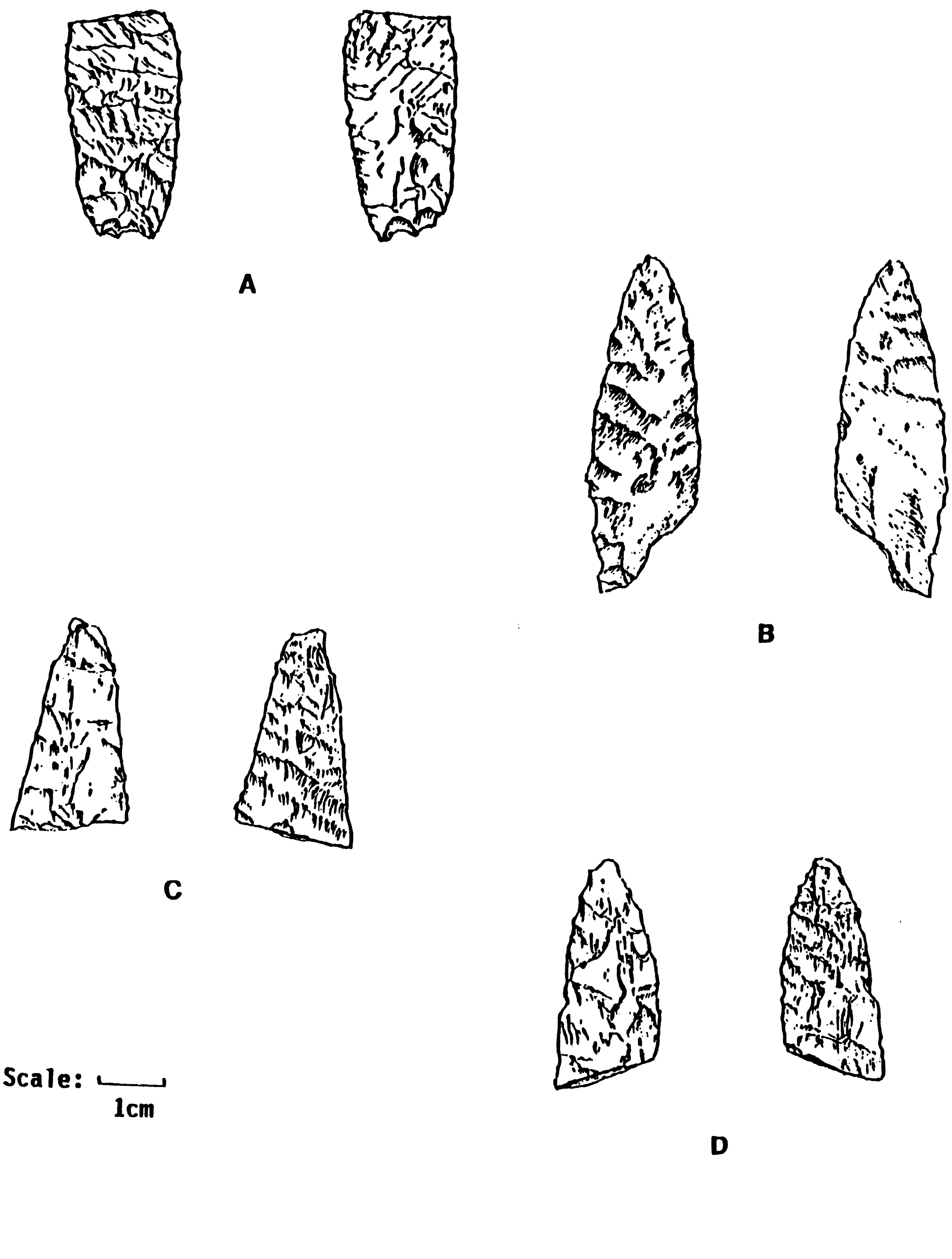

Figure 2. Drawings of points from 32SL100.

parallel oblique flake scars run from the upper left to lower right. Horizontal parallel flaking produced wider scars on the reverse sides of three of the fragments (Figures 2a, b, and c). On the fourth (Figure 2d) it appeared that the maker began by removing parallel oblique flakes from upper left to lower right extending past center and in some cases to the right margin. However, this was crossed by a wider oblique flake scar running from upper right to lower left. The quality of the flaking varied. On two of the point fragments the parallel oblique flaking was relatively uniform while on the remaining two points the flaking appeared almost haphazard. All four specimens were lenticular in cross section.

Testing activities at 32SL100 (The Pretty Butte Site) took place on July 16-18, 1986, under a United States Forest Service permit. The work was done by Jeani Borchert, Lawrence L. Loendorf, David D. Kuehn, Audrey Porsche, Lowell Blikre and Deb Smith, personnel from the University of North Dakota Archaeological Research-West center. The intent of the work was to discover if intact deposits remained at the site, to define site boundaries, and to expose deposits along the existing cutbank for the purpose of examining cultural and natural stratigraphy and to help us better understand the site content.

Detailed information on excavation techniques and results are presented in the site report (Borchert:in progress).

Only data that I feel is relevant to the current discussion is presented here.

The cultural level was approximately 5 cm in width and appeared to vary in depth from 80 cm to 100 cm below surface (b.s.) (Figure 3). Stratigraphic layers above this depth were culturally sterile. Cultural material recovered from 32SL100 appeared to come from a single component.

The crew encountered a hearth feature during excavation along the cutbank face. This feature was an amorphous stain which extended from 92 cm to 105 cm b.s. and gradually tapered inward from top to bottom. The hearth consisted of primarily stained soil; we recovered only .3 gm. of charcoal. Some fire-cracked rock (FCR) and flaking debris was also recovered from the feature. We sent three samples from the feature to laboratories for radiocarbon (C14) dating. The charcoal was sent to the University of Arizona Radiocarbon Dating Laboratory for an accelerator date. Samples of stained soil were sent to the Radiocarbon Laboratory at Southern Methodist University and to Beta Analytic, Incorporated.

The dates from the hearth feature were quite surprising, as they were more recent than I had expected. The Southern Methodist University radiocarbon age was 5300 + 60 years: 3350 B.C. (SMU 1842). The Beta Analytic radiocarbon age was 5570 + 110 years: 3620 B.C. (Beta-1720s). The charcoal

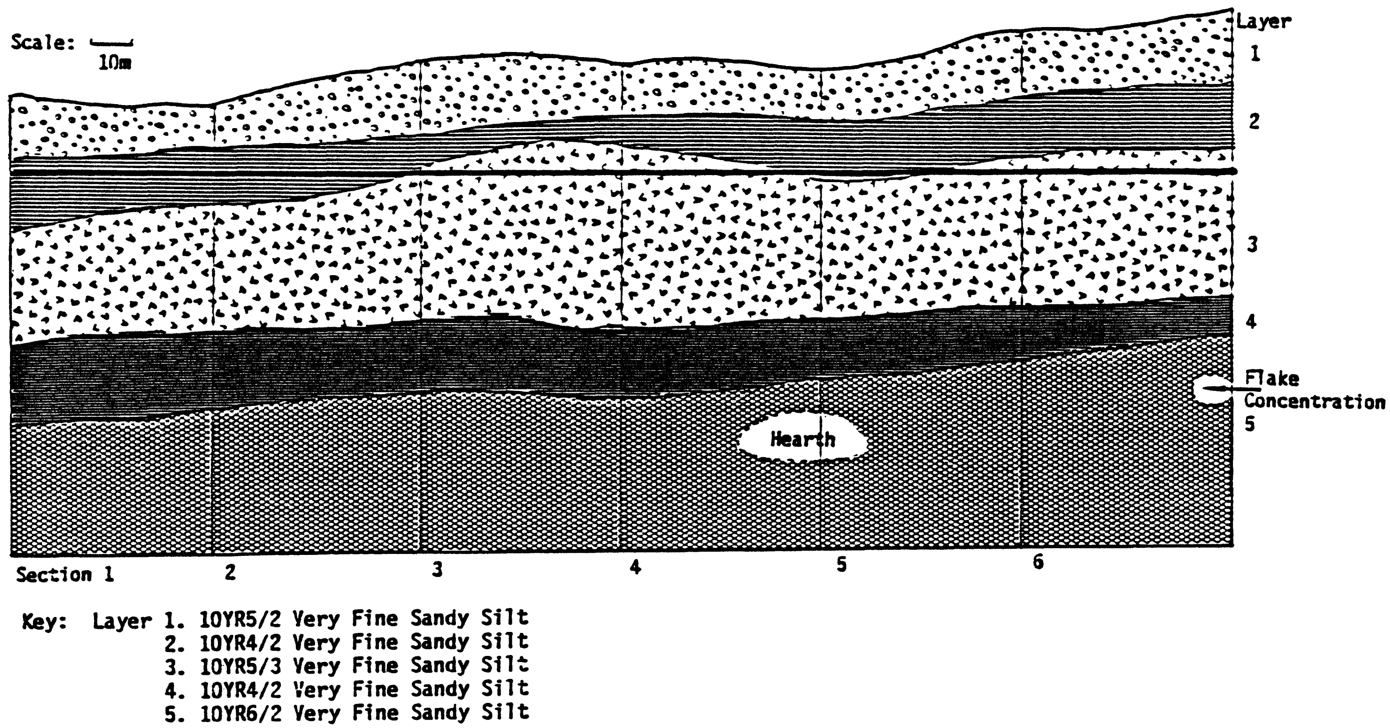

Figure 3. Stratigraphy of cutbank profile at 32SL100.

sample sent to the University of Arizona was misplaced in their offices and has not yet been located.

There are two possible explanations for this recent date. First, it is possible that the hearth feature at 32SL100 had been contaminated. While the feature was buried over 90 cm deep it was only about 25 cm back from the cutbank. Second, it is also possible that the parallel oblique flaked point tradition extended later in time in this area. Currently, the most recent date for parallel oblique flaked points came from material at the Betty Greene Site, a radiocarbon age of 6750 + 800 years: 4800 B.C. (Monseth-Greene:1968-70). Others ranged from 9230 + 150 years: 7280 B.C. (Husted 1978:84) at Mummy Cave, Layer 35, to possibly 7073 + 300 years: 5123 B.C. (Wheeler 1957:556) at the Ray Long Site. I don't feel that any of these dates are extremely reliable, rather they establish a general time range. According to radiocarbon dates from the Betty Greene Site and 32SL100, there could be as little as 270 years separating these occupations. Clarification of the age of the parallel oblique flaked point tradition is needed. It seems likely that additional excavation at 32SL100 would expose other hearth features for further radiocarbon dating. Such data would be a great help in answering questions about the temporal placement of 32SL100 relative to other Late Paleo-Indian period sites.

In summary, at 32SL100, a single component site located in southwestern North Dakota, we found four parallel oblique flaked point fragments. In addition, our excavations located a hearth feature at the site. Two radiocarbon dates were received on stained soil samples from the feature: 3620 B.C. and 3350 B.C. Two possibilities to explain these recent dates are: 1) contamination, and 2) a possibility that the parallel oblique flaked point tradition continued up to more recent times in this area. Additional work at 32SL100 and other sites yielding these points could clarify the current confusion over the age of the Parallel Oblique Flaked Point Tradition.

Parallel Oblique Flaked Points

These artifact types have been discussed in the literature at least since the early 1940s. Wormington (1957:103-107) reviewed the history of the typological grouping and naming of these points. Originally all well-flaked, unfluted lanceolate projectile points were called Yuma points (Wormington 1957:103). A problem with lumping all these points under one name was that often it seemed that students assumed there was one complex, which was not the case. Wormington and Holmes subsequently studied 500 points and devised a classification system (Wormington 1957:105). Over half of the points were placed in two groups named Oblique Yuma and Collateral Yuma. The former consisted of unstemmed, parallel-sided points exhibiting parallel oblique flaking. These usually had concave bases. The latter were points, exhibiting horizontal parallel flaking, were often stemmed with straight bases. The remainder of the collection did not fit into either of the two categories. Rather they exhibited both horizontal and oblique parallel flaking which was more shallow and less regular. Some of these had shapes reminiscent of fluted points but lacked the fluting. These points were termed Indeterminate Yumas.

These classification problems were discussed at the Conference on Terminology and Typology at Santa Fe in 1941 (Wormington 1957:106). Conference members decided to retain the term Oblique Yuma and to rename Collateral Yumas after two type stations. The result was the terms "Eden Yuma" and "Scottsbluff Yuma." In addition they agreed that Indeterminate Yumas would be left unnamed until type stations were found, because all currently known points in that category had been found on the surface. An overall designation of parallel flaked points was to be used.

In 1948, Wormington (1957:106) proposed dropping the term Yuma, and most western archaeologists agreed. Thus Eden Yumas and Scottsbluff Yumas came to be known only as Eden and Scottsbluff points. Also until type stations were found Oblique Yumas would be referred to as points with oblique parallel flaking. And the Indeterminate Yumas were simply referred to as parallel flaked points.

Today there are two broad categories of parallel flaked points (Wormington 1957:107). These are horizontal and oblique. Horizontal flaking can be further subdivided into collateral and transverse. Collateral flaking results from the removal of broad conchoidal spalls beginning from either edge and extending to the midsection leaving a dorsal ridge. While transverse flaking results when narrow flakes, beginning at either edge, were removed to leave a single flake scar. These flake scars lay at right angles to the long axis of the point and resulted in the point appearing lenticular cross-section. Oblique flaking resulted in a similar cross-section (lenticular), however the flake scars were diagonal across the blade, usually from upper left to lower right (Wormington 1957:107).

The first parallel oblique flaked point type to be named was the Long point identified from the Ray Long site in South Dakota. This name was subsequently changed to Angostura as the name "Long" caused some confusion when many students assumed the term referred to the size of the point (Wheeler 1957:537). The Ray Long site is located 13 miles south of Hot Springs, South Dakota. The site was originally investigated as part of the Missouri Basin Project before waters were impounded in the Angostura Reservoir (Wormington 1957:138). The investigation was begun in 1948 by Jack T. Hughes and was continued by Richard P. Wheeler. Wheeler (1957:537-538) described the Angostura point as:

"a large slender lanceolate point, the symmetrical sides of which curve to the tip and taper to the narrow base forward from the base about two-fifths to one-half of the total distance from base to tip. The base is either shallowly concave or irregularly straight. Each face bears parallel diagonal ripple flake scars, i.e. long, narrow extremely shallow flake scars, running from upper left (tip) to lower right (base) and generally extending in from each lateral edge but sometimes reaching completely across the face. A few specimens also show horizontal ripple flake scars. Ripple flake scars may occur over the entire surface except at the extreme tip and near the base where small and minute scars occurring in a row or crescent-shaped area mark the removal of longitudinal flakes for the purpose of thinning the blade at the base. Usually, diagonal ripple flake scars of about equal length extend from each lateral edge to or just beyond the midline; the faces are smoothly convex from side to side and the points are lenticular in cross section.

Occasionally, however, ripple flake scars of unequal length -- shorter on one side than on the other -- occur on one or both faces and produce one or two low longitudinal ridges. In the first case, one face is smoothly convex and the other is asymmetrically ridged. In the other case both faces are asymmetrically ridged and the specimen has a rhomboidal cross section. The lateral edges are commonly smoothed by grinding forward from the base for a distance of one-fourth to two-fifths of the total length of the point. The thinned concave or straight basal edge is unsmoothed. As to the ranges of size, proportions, and weight of Angostura points: no complete specimens in pristine condition were recovered from the Ray Long type site, but five complete or nearly complete examples obtained at find-spots in Sioux and Dawes Counties, Nebraska, in the northwestern corner of the Nebraska Panhandle some 40 to 50 miles south of the Angostura Reservoir area, provide the following data: length -- 66 to 83 mm.; maximum breadth-- 21 to 27.5 mm.; breadth across the base -- 13 to 18.8 mm.; thickness -- 6 to 13.25 mm.; proportion (length to breadth) -- 2.5 : 1 to 3.5 : 1; weight-- 13.5 to 15.6 gm.

Wheeler pointed out that, although Angostura points were similar in outline and edge-smoothing to Agate Basin points, they had a different flaking pattern and usually a different cross section (1957:540).

One resharpened, two proximal fragments and two unfinished points identified as Angostura were recovered from excavations in Area B of the Ray Long Site. Two radiocarbon dates were given from Area B samples. One was from a 0.3 foot-thick lens of charcoal and stained earth and the other from a heavily fired hearth. These dated to 7715 + 740 B.P. and 7073 + 300 B.P. respectively (Wheeler 1957:556).

At Area A at the Ray Long Site, nine Angostura point fragments were recovered during investigations. Two of these were collected from the surface when the site was first found and seven were found during excavation (Wheeler 1957:563). A radiocarbon date of 9380 + 500 B.P. was returned for Area A (Wheeler 1957:588). However, as Wormington (1957:140) has pointed out, the date from Area A was obtained from hundreds of tiny pieces of charcoal recovered from various features within the same zone as Angostura. Whereas the more recent dates from Area B were from individual features not directly in association with Angostura points, they were derived from materials at comparable vertical levels in the same general area. Neither of these situations are ideal, but I feel more confident about the more recent dates than the earlier date. The date of 9380 + 500 B.P. seems to me to be the result of averaging an average. That is, the date resulted from a collection of charcoal from numerous features within an entire zone, averaging the possible individual variations from the features. And as the radiocarbon dating method involves averaging counts, we have arrived at an end resulting from averaging averages. In addition, I question whether there was good association between the charcoal, used for the date, and the points.

The James Allen site located near Laramie, Wyoming is the type site for Allen points. Mulloy (1959:114) described Allen points as:

> "The shape is lanceolate without notches. The edges incurve to a rather rounded point, tend to be parallel at the midsection, and very slightly incurve toward the base, sometimes expanding to a suggestion of a fishtail base. This occasionally produces a scarcely perceptible constriction of the proximal third of the point which is frequently slightly more apparent on one side than the other. This constriction seems to be more a function of the smooth grinding of the proximal third of the edges than of a contour deliberately produced by pressure flaking.
>
> Bases have rounded corners and are indented to a distance usually about one-quarter of the basal width. Central thinning of the base was accomplished by the removal of one or more longitudinal flakes and usually extended about one-half the width of the base. The basal concavity was ground smooth. Cross sections are uniformly lenticular with thin, sharp, and regular edges. There is a tendency for small chips to break off the edges on the distal third of the point,...
>
> The most distinctive feature of these points is the excellent oblique, parallel flaking. The uniformity of flaking and the length of the flakes both reflect a skill in pressure flaking far out of the ordinary. The flake scars cross the surface of the blade at an angle which varies from transverse to about 60% with the longitudinal. Apparently the technique was to drive from one edge a flake which usually extended about two-thirds of the distance across the point. Then the point was reversed and

> a flake was driven from the proper place on the opposite edge (such) that the resulting scar would be continuous with the longer one. The successful result gives the appearance of a single, continuous flake scar extending from one edge of the point to the other, although close examination usually reveals the juncture..."

Thirty fragmentary Allen points were recovered from the James Allen site. These ranged from extremely small fragments to nearly complete specimens (Mulloy 1959:114). Eight of these were proximal fragments and seven were distal fragments. The remaining 15 fragments were midsections. These points ranged from 4.5 inches long and 1.1 inches wide to 3.25 inches long and 1.01 inches wide, when Mulloy estimated their complete length. However, one specimen was estimated to be only 1.6 inches long and 0.6 inch wide. This smaller point lay outside of the usual range but resembled the other points in all other features (1959:114).

Mulloy (1959:113) suggested that there might be a connection between the Long point (Angostura) and Allen points, nevertheless he contended that Angostura points were more similar to Agate Basin points. He made this suggestion based on his erroneous impression that parallel oblique flaking was present on only a few specimens from the Ray Long site, However, Wheeler (1957:537-538) stated that parallel oblique flaking was the norm and that only a few specimens exhibited horizontal flake scars.

Frederick points were first defined by Irwin (1968:99) from materials at the Hell Gap site in southwestern Wyoming.

As with the previous two point types, Frederick points have parallel oblique flaking. These points measured 3 to 4 inches in length and 3/4 to 1.5 inches in width. The points were generally quite thin, about 1/8 of an inch thick (Irwin 1968:214-215). He further described them as:

> "...lanceolate in outline with a lightly to markedly concave base. They are very close in type to points found at the Jimmy Allen site (Mulloy 1959). There are noticeable differences in width/length ratio and in the more pronounced basal concavity of Jimmy Allen types, however. This may be chronologic or regional. The differences might result from the points at Jimmy Allen being made for the most part by one group and thus more homogeneous (Mulloy, 1959)." (Irwin 1968:215).

Irwin (1968:100-101) suggested that Allen points were part of the Frederick Complex.

Irwin (1968:105, 215) used the term "Lusk" to replace, in part, the Angostura point type. His stated reasons for doing this were that the description of Angostura points, in his opinion, could apply to both Agate Basin and Lusk points. In addition he felt that the term Angostura had been abused in the literature. He suggested that only points from spatially and temporally defined sites should be included within a type (1968:105). Following that idea, he added the term Lusk. Lusk points were originally identified at the Hell Gap site and the Betty Greene site. Irwin (1968:215-216) described Lusk points as:

> "...elongate lanceolate in form; frequently, there is a constriction of the lower third. They are invariably concave based -- which is one good way to separate them from Agate Basin. They are made from blanks probably made from blades or flakes

> because frequently they are plano convex in cross section. ...finishing flaking, usually oblique and similar in excavation to that on Frederick points, was applied. However, it is rarely as neat, and on some examples it is poor and haphazard on one or both faces. Further, there is a lack of effort to make the points of careful symmetric outline. The points are usually basally ground. They are about 3 to 6 inches in length and are always of a lower width/length ratio than Frederick points."

Only a few of these points were recovered from excavation at Hell Gap, and dated to at least 5920 + 230 B.P. (Irwin 1968:106).

Monseth-Greene (1968:22) reported that "four complete and fifteen fragmentary projectile points" were recovered from the Betty Greene site near Lusk, Wyoming. She described these points as:

> "...elongate lanceolate in form, with a constriction of the lower third. The bases are always concave,and the points are basally thinned on both faces by a series of small longitudinal removals. The lower portion of the lateral edges, from 1/4 - 1/3 the length of the point, is generally smoothed by grinding. Sometimes the points were made from blanks made on flakes or blades and they are plano-convex in cross-section. At other times the cross-section is lenticular. Flaking is often, tho not always, parallel-oblique. On some specimens it seems poor and haphazard on one or both faces. Oblique flake scars run from upper left to lower right and often extend across the midline, sometimes running from one edge to the other. Complete specimens range from 63-79mm in length, 21-16mm in width, and 6-8mm in thickness." (1968:22).

These points dated to 6750 + 800 B.P. (1968:69).

While Irwin (1968) and Monseth-Greene (1968) included in their descriptions of the Lusk point type such statements as "they are sometimes plano-convex in cross-section" and that the flaking is "poor or haphazard" on some examples, I believe they've overlooked use-phase. That is, whether or not the artifacts were finished products. The sketches of points from the Betty Greene site suggest the possibility that the manufacturing process had not been completed on many of the examples. Frison (personal communication, 1987) has examined the points from the Betty Greene site; it seemed to him that only in a few instances were they completed.

There are other named types of parallel oblique flaked points, but their basic shape varies enough from that of Angostura, James Allen, Frederick and Lusk to be considered distinct. These include Pryor Stemmed, Lovell Constricted, and Browns Valley. Pryor Stemmed points were described by Husted (1969:51-52) as:

> "Medium to large stemmed projectile points with alternately beveled edges. Lateral edges vary from parallel to convex and are alternately beveled with the bevel on the right (tip up). Beveling extends at least from the tip to the shoulder, and on some specimens extends the full length of the stem. Serration of lateral edges ranges from fine and even through rough and irregular to nearly nonexistant. Serrations were made on the beveled edge; the amount of beveling and the quality of the material used determined the fineness of the serrations.
>
> Stems vary in length from one-fifth to one-third the total length of the points. Edges range from concave through parallel to contracting, and bases are shallowly concave. The lateral and basal edges are gound smooth.
>
> Shoulders range from straight and prominent through sloping to nearly lacking. In the latter instance, shoulders are represented by a slight angle betweent he stem and the blade portion.

> Chipping varies from crude parallel-oblique to random, and the quality of the flaking is fair to good. Edges are retouched only on the beveled edge. Basal edges are thinned but wedge-like in appearance. Specimens with slight to moderate beveling are lenticular in cross section. Those with pronounced beveling are rhomboidal.

These points have been reported from a number of sites including Schiffer Cave, Bottleneck Cave, the Sorenson site, the Medicine Lodge Creek site, and the Paint Rock V site. Radiocarbon dates for Pryor Stemmed levels at these sites ranged from 8500 + 160 B.P. at Schiffer cave to 7560 + 250 B.P. at the Sorenson site (Frison 1978:23-26, 34-37).

Frison (1978:37) described the Lovell Constricted point type as: "Lanceolate points with crude parallel-oblique flaking, slightly restricted blade edges giving a vaguely stemmed appearance, and concave bases." At Bottleneck Cave in Wyoming these were associated with materials dated at 8270 + 180 B.P. (Frison 1978:26). At the Sorenson site in the Bighorn Canyon of Montana a date was given for deposits which contained Lovell Constricted of 7800 + 250 B.P. (Frison 1978:26).

Browns Valley points were originally reported by Jenks to have been found in association with human bones in a gravel pit near Browns Valley, Minnesota. Wormington (1957:143) described these points as:

> "...lanceolate forms, slightly more than three inches long, with a maximum width at the mid-section of about one and a quarter inches. They are characterized by fine parallel flakes directed obliquely across the face of the point. Bases are concave and cross-sections are lenticular. There

> is some basal thinning produced by the removal of small vertical flakes, and some grinding of the basal edges."

Illustrations of Browns Valley points (Powell 1957:299) show them to be almost biconvex shape, excluding the base. Powell (1957:298-300) stated that these are very similar in shape to Milnesand points.

Angostura points have been reported from a number of sites in North America, primarily from sites concentrated in the Plains. Wheeler (1957:539) reported numerous Angostura points from Sioux, Dawes and Morril Counties in Nebraska. Additionally these have been reported at the Mule Creek Rockshelter, Keyhole Reservoir, Wyoming; the Little Missouri River in Wyoming; the Lewis Ranch near Glendive, Montana; Yuma County, Colorado; Blackwater Locality No. 1, Roosevelt County, New Mexico; Boysen Reservoir in west-central Wyoming; Glenns Ferry, Elmore County, Idaho; Johnson Park Reservoir, Washington County, Idaho; Regina Saskatchewan; Great Bear River site in the Northwest Territories; Kotzebue, Alaska; and Abilene, Texas (1957:539-545).

Wormington (1957:212) reported Angostura points from the Trail Creek site on the Seward Peninsula. The bottom deposits in this cave were dated at 6000 B.P. While this point type was not associated with the dated level, it was encountered in the excavation above it and thus would date more recent than 6000 B.P. Angostura points from Great Bear Lake have been radiocarbon dated to 4600 + 230 B.P.

(1957:141). An Angostura point was also reported at Iyatayet at Cape Denbigh in Norton Sound (1957:210).

Irwin (1968:78) reported "Frederick complex" points from the Jimmy Allen site, the Lime Creek site, the Scottsbluff site and the Fondis site. He said that all of these had been occupied after 8500 B.P. In the "Lusk Complex" Irwin (1968:78) included levels from the Mangus site, the Green Site, the Hell Gap site, the Blackwater Draw site, and Angostura (I suspect he was referring to the Ray Long site).

Husted (1978:144) reported that Layer 31 at Mummy Cave produced points similar to the Angostura, Allen and Frederick types but his conclusions were only tentative. Because of a basic similarity between points from Layers 27, 29, 30 and 31 at Mummy Cave, I suggest that they are all comparable to Angostura, Allen, Frederick and what has been called Lusk. These levels dated between 8100 B.P. and 8750 B.P.

Hlady (1970:273-274) reported Angostura points at the Jessica Exit site in Manitoba, and Schneider (1982:17) found an Angostura-Frederick-Lusk type point at the Moe site in northwestern North Dakota.

Loendorf et al. (1981) reported the location of five parallel oblique flaked points from Zones 6 and 7 at the Pretty Creek site. These dated to about 6000 B.C. The authors suggested that in shape and flaking technique these points were similar to those recovered from Mummy Cave, Layers 27-31 (1981:109-110). They suggested that the points should be included within a named type such as James Allen, Frederick, Lusk, or Angostura, but the authors refrained from naming these points because of their confusion over distinctions between the types(1981:105).

Ahler et al. (1977:72-77) reported his recovery of numerous Angostura or Lusk complex projectile points at the Travis 2 site in South Dakota. He stated that these points were very similar to Agate Basin except they had parallel oblique flaking, concave bases and exhibited flaking patterns and technology which were generally less well executed (1977:77).

I have made several references to the Agate Basin point type and see the need to describe them here for clarity. These points were first described by Roberts (1951) and later, further illustrated by him (1961). Frison (1974:81) described Agate Basin points as:

> "...The original projectile point configuration usually included a rounded base...The quality of the original workmanship varies, but the flaking is usually well executed, with flake scars at right angles to the longitudinal axis of the projectile point. Departure from this pattern is rare...Flake scars usually cover both faces and leave no evidence of original dorsal or ventral flake surfaces, with few execptions...Transverse cross-sections are usually smoothly lenticular, a fine retouch having been applied to the blade edges to ensure smooth margins...Longitudinal cross-sections were carefully controlled also, and taper evenly to both the tip and the base. Grinding of the blade edges usually extended from just around the basal corners up to or nearly to the point of greatest width. On specimens with narrow, rounded bases...the grinding may be continuous around the

> base, but it is invariably lighter on the basal extremity than on the edges. However, in most cases the bases are not ground.
>
> Another noticeable feature of the Agate Basin projectile points is the lack of a twist longitudinally, a feature common to the Hell Gap projectile points from the Casper site. Consequently, blade edges, almost without exception, are straight from base to tip. A suggestion of a stem and shoulders reminiscent of those on Hell Gap projectile points appears on a few specimens..."

After Irwin's discussion of Frederick and Lusk point types (1968) there has been some confusion as to distinctions between types. Some students have questioned the validity of the "Lusk Complex." There is also some hesitation at replacing the term Angostura with Lusk. In addition, the attributes distinguishing Frederick from Lusk or Angostura point types are not clearly defined. Allen points don't seem to be at the center of the confusion, but their similarity to the other types is clear.

Methods of Analysis

I originally intended to look at a representative sample of parallel oblique flaked projectile points, decide upon their primary attributes, take appropriate measurements and make a statistical comparison. I envisioned this as a way of formalizing similarities and differences and assessing inter and intra collection variability. I began by making telephone calls to archaeologists, museums and universities in an attempt to locate collections from the Ray Long site, the Hell Gap site, The Betty Greene site and the James Allen site. I soon discovered that the task was frought with difficulties. The collection from the Ray Long site has been stored at the Smithsonian Institution. The projectile points were used as part of a display in the past and have since been misplaced (Adrianne Hannus: personal communication, 1987). Had I chosen to do so I could have gone to the Smithsonian and attempted to locate the points, but I was told this would be an enormous undertaking. I then talked with Dr. George Frison, University of Wyoming, and he told me that the bulk of the Betty Greene site collection was in the hands of the landowner. While it was possible that I could view the collection, the current interpersonal relations between professional archaeologists and the landowner were poor. The prospect for my examining those materials appeared doubtful at best. Frison (personal communication, 1987) also informed me that the majority of the Allen points had been "lifted" some years ago and that he retained only a few of them. The Frederick points are currently stored with the Hell Gap collection at the Peabody Museum. I was told by Frison that it would be possible to go and examine the collection there, but it would have been an extremely expensive trip. I finally decided that it would be futile for me to attempt working directly with the points from the appropriate type site collections.

Because of that fact I had to devise an alternate method of study. The nearest thing to a collection that I had to work with were those photos and sketches of parallel oblique flaked points that were available in articles, books and unpublished manuscripts. Some of these lacked an appropriate scale, and this problem further reduced the size of my data base. Then there still remained the question as to what I could do with photos and sketches - what kinds of comparisons could be made?

Anna Montet-White (1973:61) described her use of the polar grid in artifact analysis:

> "From a central point on the graph paper radiates a series of lines, the polar axes, spaced at five degree intervals. One of these axes, usually the 0/360 degree lines, constitutes the arbitrary axis of origin of the polar coordinate system. Angles are read from the axis of origin and distances are measured along the polar axis from the centroid. Data recording starts when a planar projection of the artifact to be studied is placed at the center of the polar grid. Then a series of points are marked at the intersection of polar axes with the artifact perimeter. Descriptive points are defined by a linear and an angular measurement. The angle is measured between the axis of origin and the polar axis on which the point is located. The distance is a straight line between the centroid and the point. Effectiveness of the analysis hinges on: (1) the consistent definition of the artifact centroid, (2) selection of the artifact orientation and (3) the number and placement of points."

For me to design an effective analysis of the parallel oblique flaked points through use of the polar grid method required that I address two primary questions. First and foremost, how should one place the points on the grid and how to orientate them. Most of the points illustrated were incomplete. If a proximal (basal) or distal (tip) fragment were centered on the polar grid paper, then the primary variance would be in the lengths of the fragments. This would be the case even if proximal and distal fragments were isolated in the analysis. I chose to standardize the length of the fragment and approach comparison based on width and shape. This was accomplished by taking the shortest proximal and distal fragments and establishing a set point. The shortest proximal fragment was set below the 90/270 degree axis and the set point was marked at the base of the point. This was done based on an imaginary line from one edge of the base to the other. In that way, the incurvate base center would be above the set point and the excurvate base center would be below the set point. The shortest distal fragment was set above the 90/270 degree axis with the set point marked at the tip of the point. All points measured were placed according to the appropriate set point and centered on the 0/360 degree axis (Figures 4 and 5). Measurements were taken above the 90/270 degree axis for distal fragments and below it for proximal fragments, thereby excluding broken length of fragments as a factor.

The second consideration was the placement of measurement points. With placement of projectile points on the polar grid as described above, a consistent angle interval between measurement points would place undue emphasis on the width of the projectile point nearest the 90/270 degree axis (Figure 6). Because of that fact, irregular angle intervals were chosen to equalize linear distance between measurement

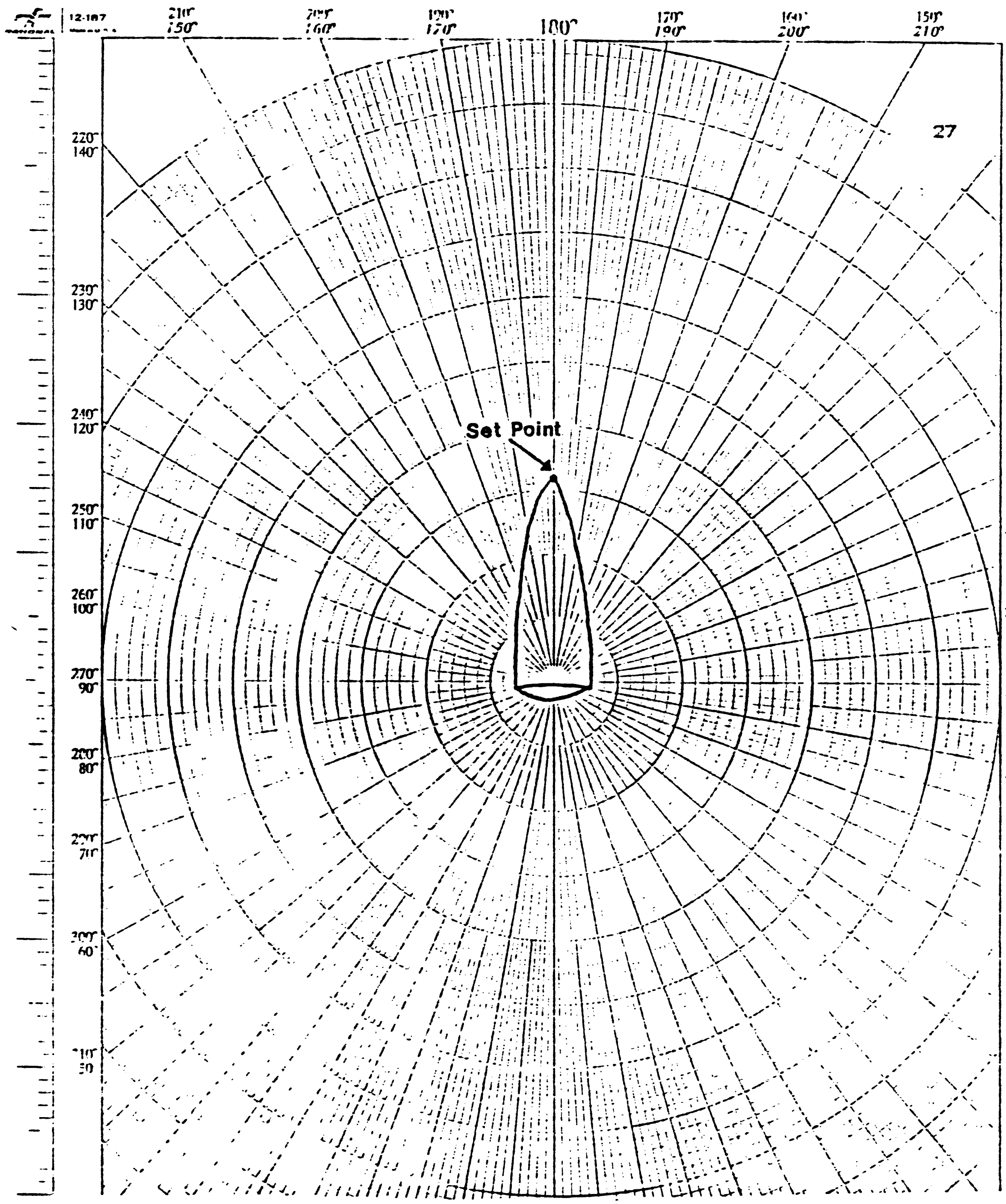

Figure 4. Proximal fragment placement on the polar grid.

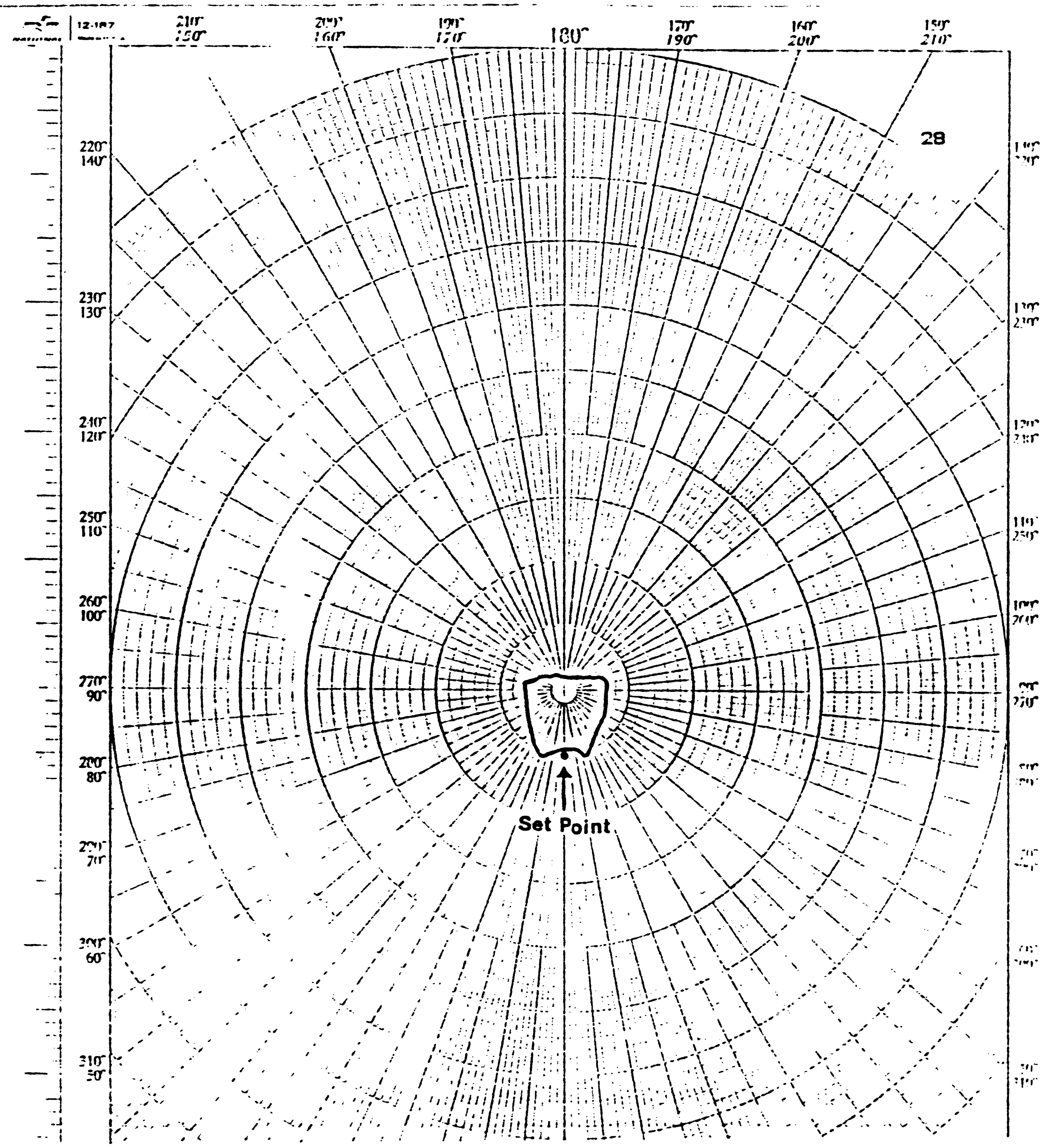

Figure 5. Distal fragment placement on the polar grid.

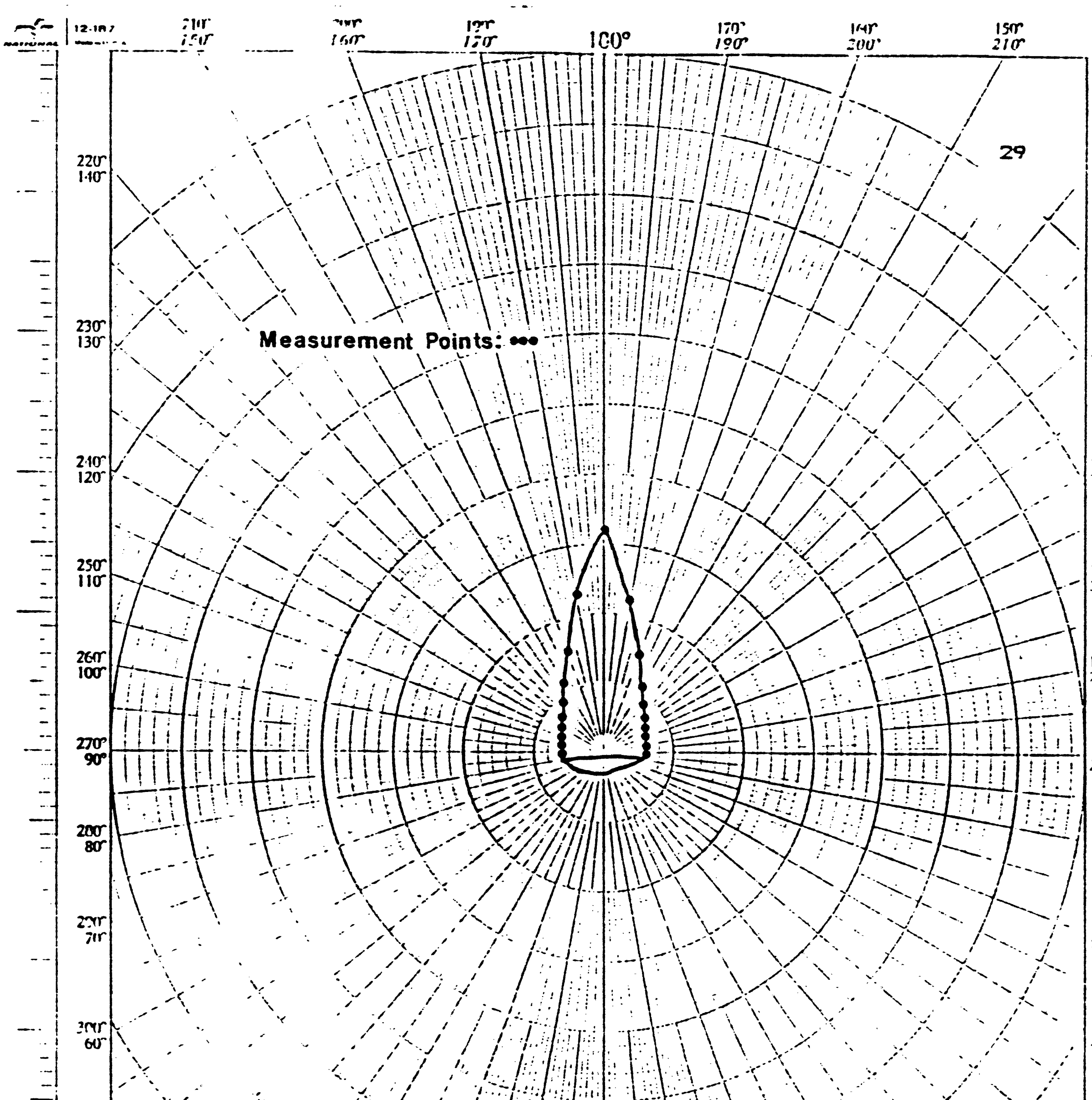

Figure 6. Measurement points if equal angle intervals are used.

points on the artifacts. These were consistent for each projectile point measured.

Illustrations of projectile points from the literature were brought to actual size according to scales provided with the original illustrations. I then traced the outlines of each. Projectile point drawings were then placed on the polar grid paper as described above. At the chosen intervals, I measured the distance from the central point on the polar grid to the edge of the artifact.

The measurements were then used for factor and cluster analyses. I used the SPSSx (SPSS, Inc. 1986b) computer program for these analyses. I used factor analysis to identify relationships between measurements which would account for the most variance. Principal component extraction was used in the factor analysis. The factor matrix was rotated, using the varimax method, to aid in interpretation.

I used cluster analysis to identify homogenous groups of projectile points within the sample. I chose squared euclidian distance to measure how dissimilar any two points were. This method of computing a distance measure is commonly used. As all measurements used in the analysis were in millimeters, a consistent scale, I had no problem in different scales contributing to weighting variables. I chose to use agglomerative hierarchical clustering in the analysis. My method for joining clusters was the average linkage between groups method. In this method the distance between two clusters is defined as "the average of the distances between all pairs of cases in which one member of the pair is from each of the clusters." (SPSS, Inc. 1986a:B-83). This method is usually preferred above single or complete linkage (SPSS, Inc. 1986a:B-83).

RESULTS

Analysis

Projectile points chosen for the analysis included illustrated examples of parallel oblique flaked points from several archaeological reports. The majority of these had been called Angostura, Lusk, Frederick or Allen points. Some of the points that I used were unnamed in the reports but appeared to be similar to the named types. Three distal fragments and seven proximal fragments were included from the Ray Long site (Figure 7) (Wheeler 1957:536). I also considered three distal fragments and one proximal fragment from the Pretty Butte site (Figure 2). The remaining points used in my analysis include two base fragments from the Pretty Creek site (Figure 8) (Loendorf et al. 1981:100), three complete and 11 proximal fragments from Mummy Cave (Figure 8) (Husted 1978:128), one complete and one proximal fragment from the James Allen site (Figure 9) (Frison 1978:36), four complete and four proximal fragments from the Betty Greene site (Figure 9) (Greene 1968:27; Irwin 1968:Figure 45), one complete and four proximal fragments from the Hell Gap and Patten Creek sites identified as Lusk points (Figure 10) (Irwin 1968:Figure 45), one complete, one distal and one proximal fragment from the Hell Gap site identified as Frederick points (Figure 10) (Irwin 1968:Figure 44), and one nearly complete point, identified as Angostura, from an illustration in Wormington (1957:139)

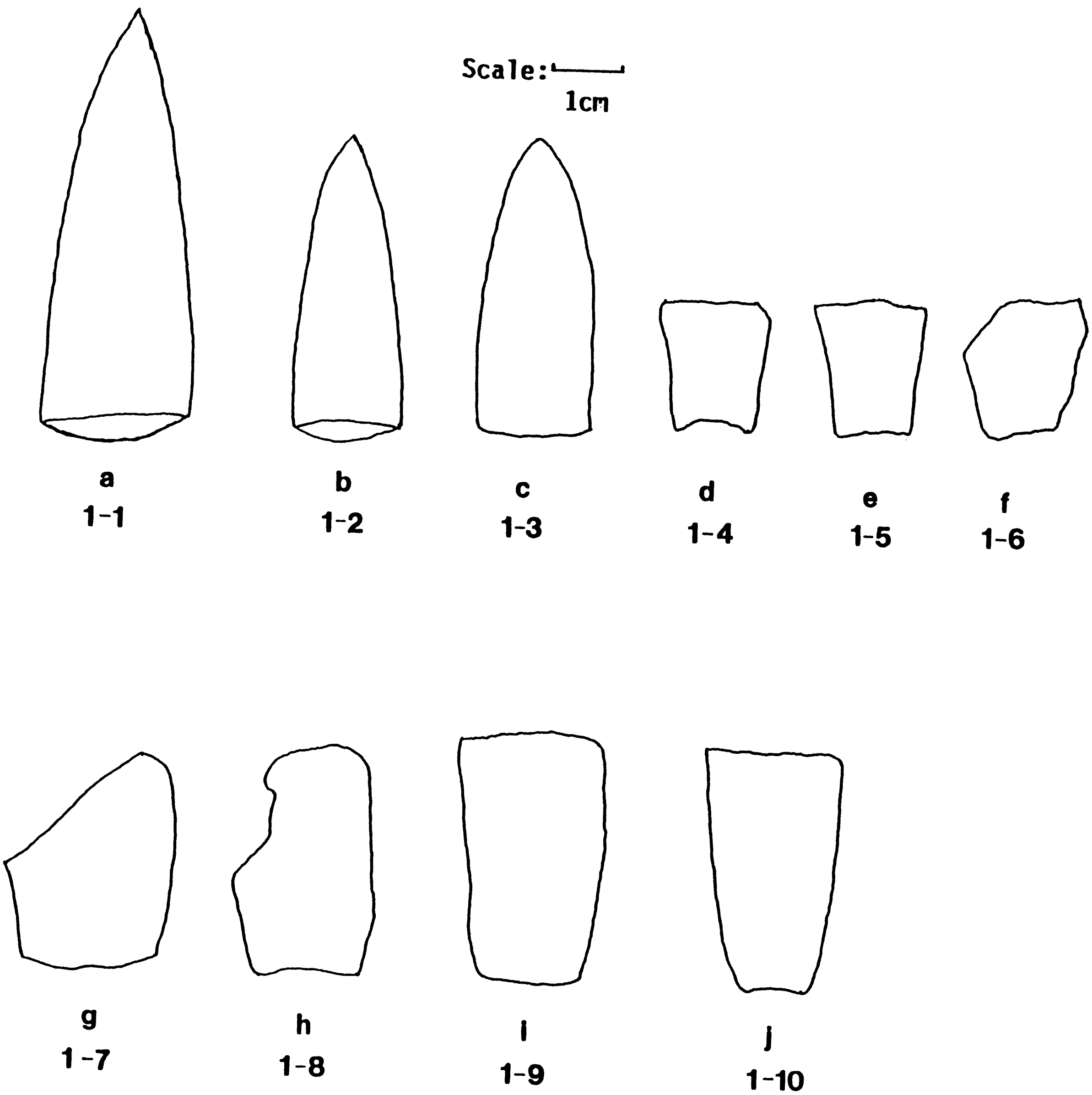

Figure 7. Outlines of projectile points from the Ray Long site.

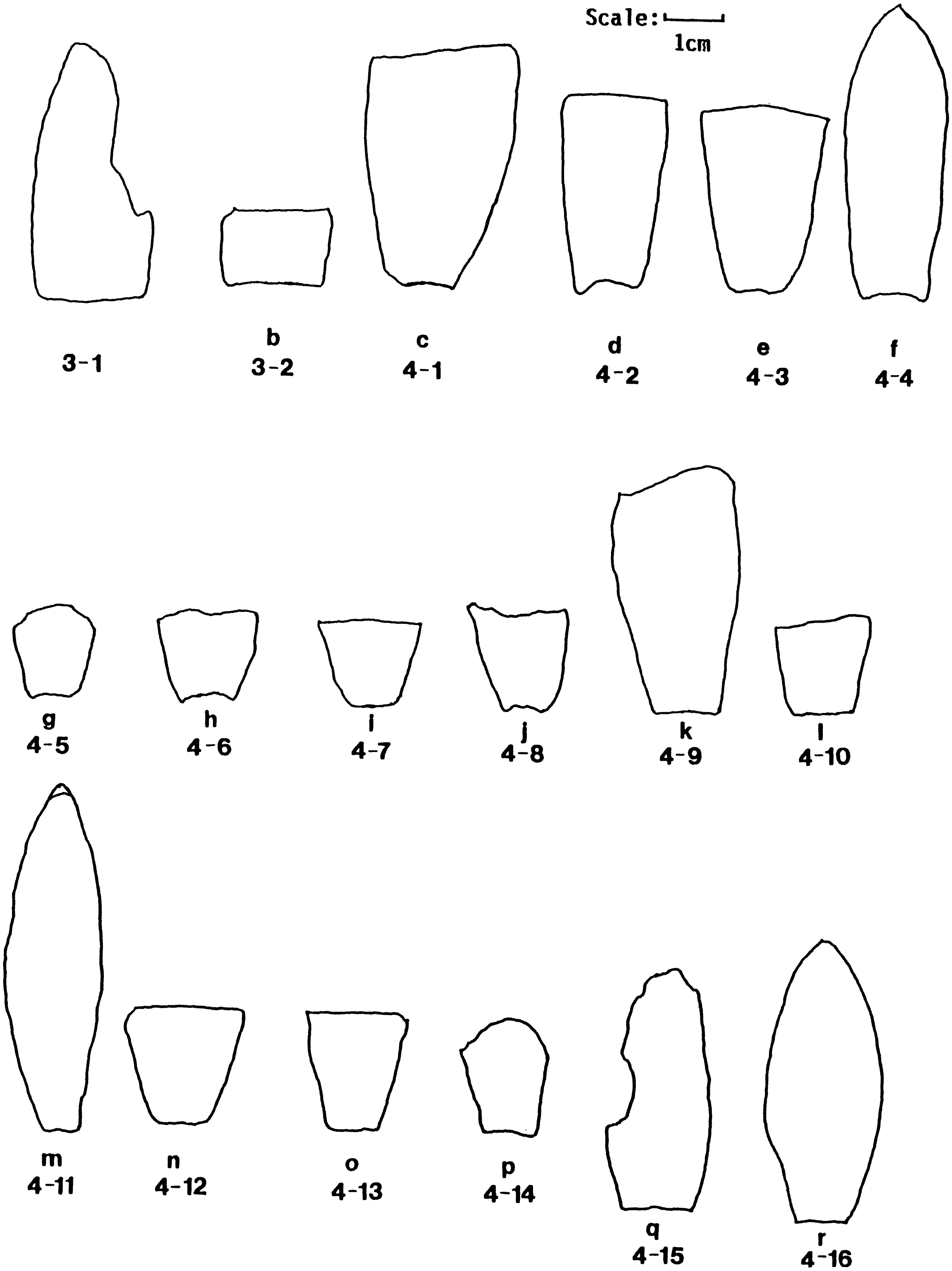

Figure 8. Outlines of projectile points from the Pretty Creek and Mummy Cave sites.

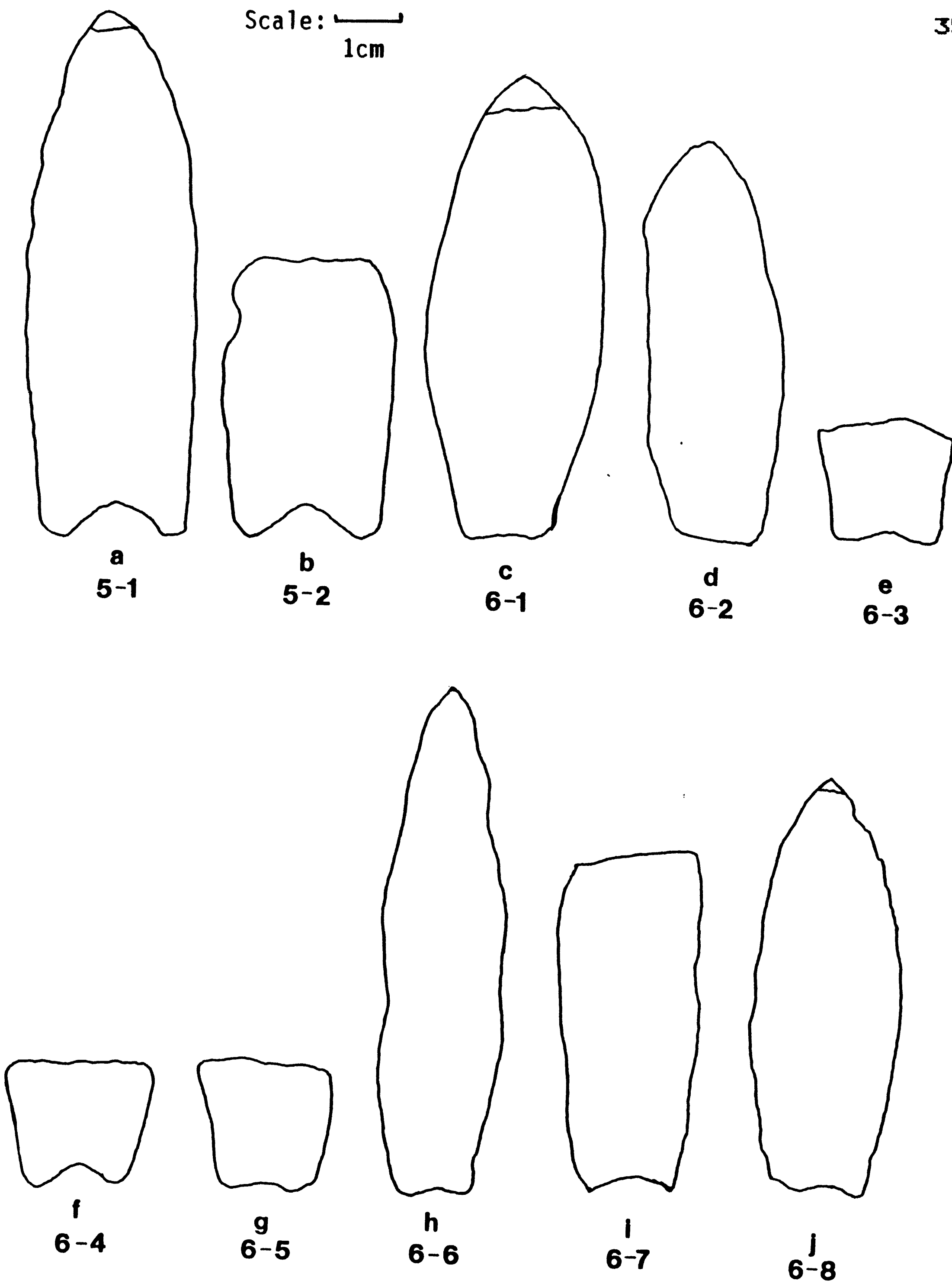

Figure 9. Outlines of projectile points from the James Allen and Betty Greene sites.

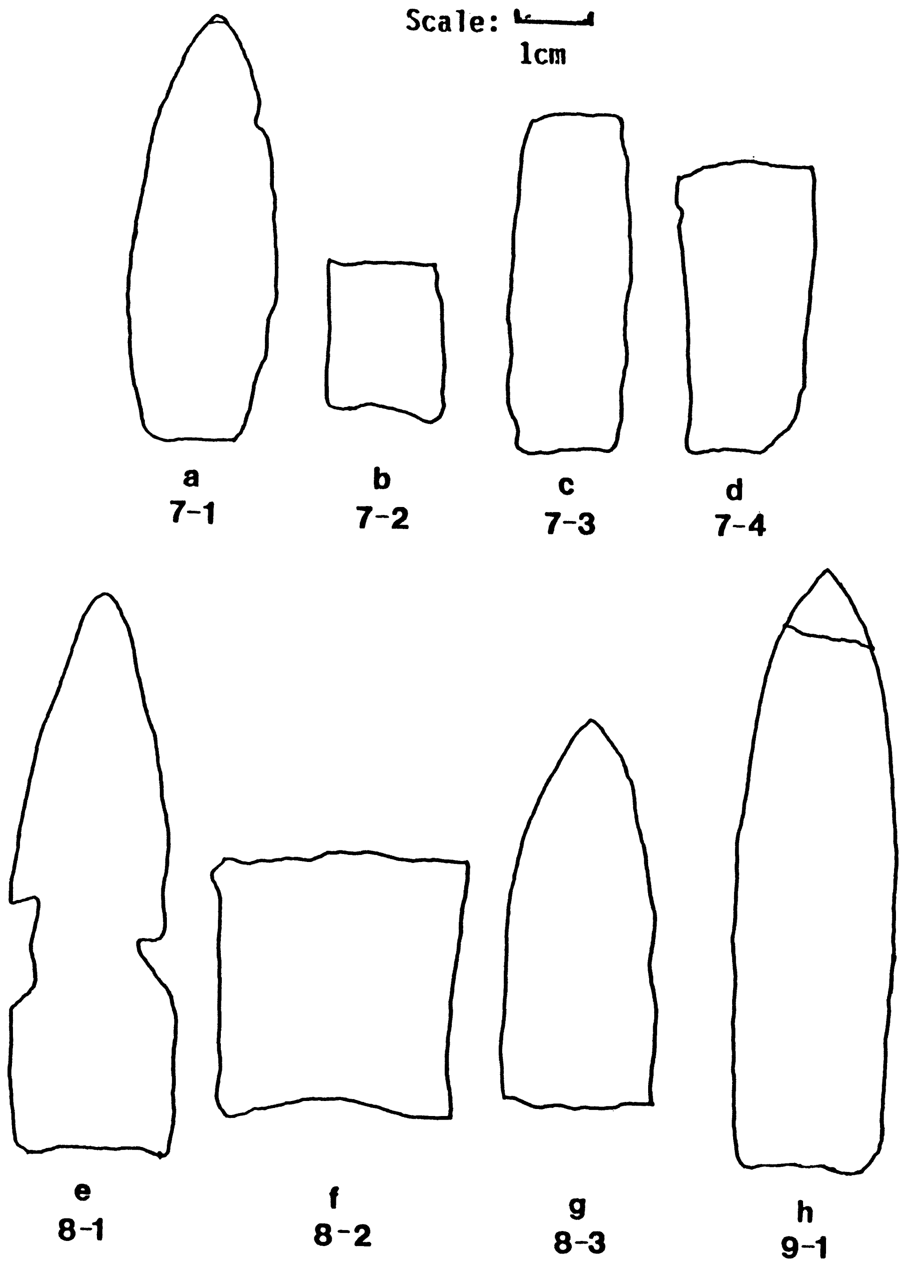

Figure 10. Outlines of projectile points from the Hell Gap and Patten Creek sites, and a surface find from Nebraska.

(Figure 10). I measured the complete specimens as consisting of both distal and proximal fragments. In total 18 distal fragments and 43 proximal fragments made up the sample for analysis.

I chose measurement points on the polar grid at irregular angle intervals to equalize the linear distances between 270, 240, 220, 210, 200, 195, 190, 185, 180, 175, 170, 165, 160, 150, 140, 120, and 90 degrees (Figure 11). Axes chosen for proximal measurements were 90, 70, 50, 40, 30, 20, 10, 0, 350, 340, 330, 320, 310, 290, and 270 degrees (Figure 12). Tables 1 and 2 present measurements for each of the points used in the analysis. There were 17 measurements taken for distal fragments; the first measurement was taken on the 270 degree mark and the last on the 90 degree mark. There were 15 measurements taken for proximal fragments with the first measurement being taken on the 90 degree mark and the last on the 270 degree mark.

Distal Fragments. Factor analysis of distal fragment measurements produced two factors which account for 78% of the variability. Factor 1 accounts for 62.5% of the variability. The rotated factor matrix is reproduced in Table 3. Factor 1 is related to width of the point fragments, where most of the variability is seen. Factor 2 is related to variability in shape on either side of the center of the point tip. Factor scores for each specimen are given in Table 4.

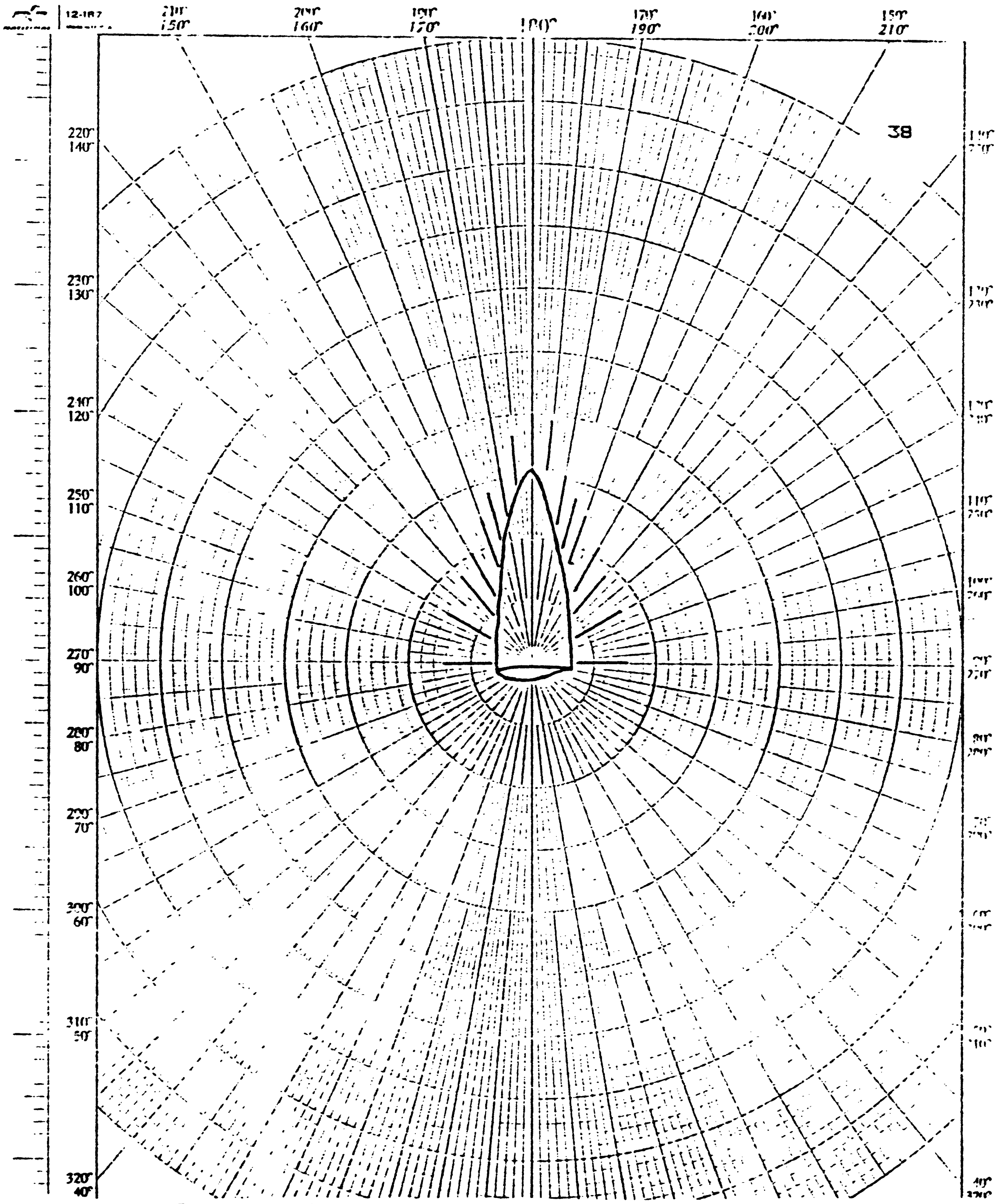

Figure 11. Measurement points used for distal fragments.

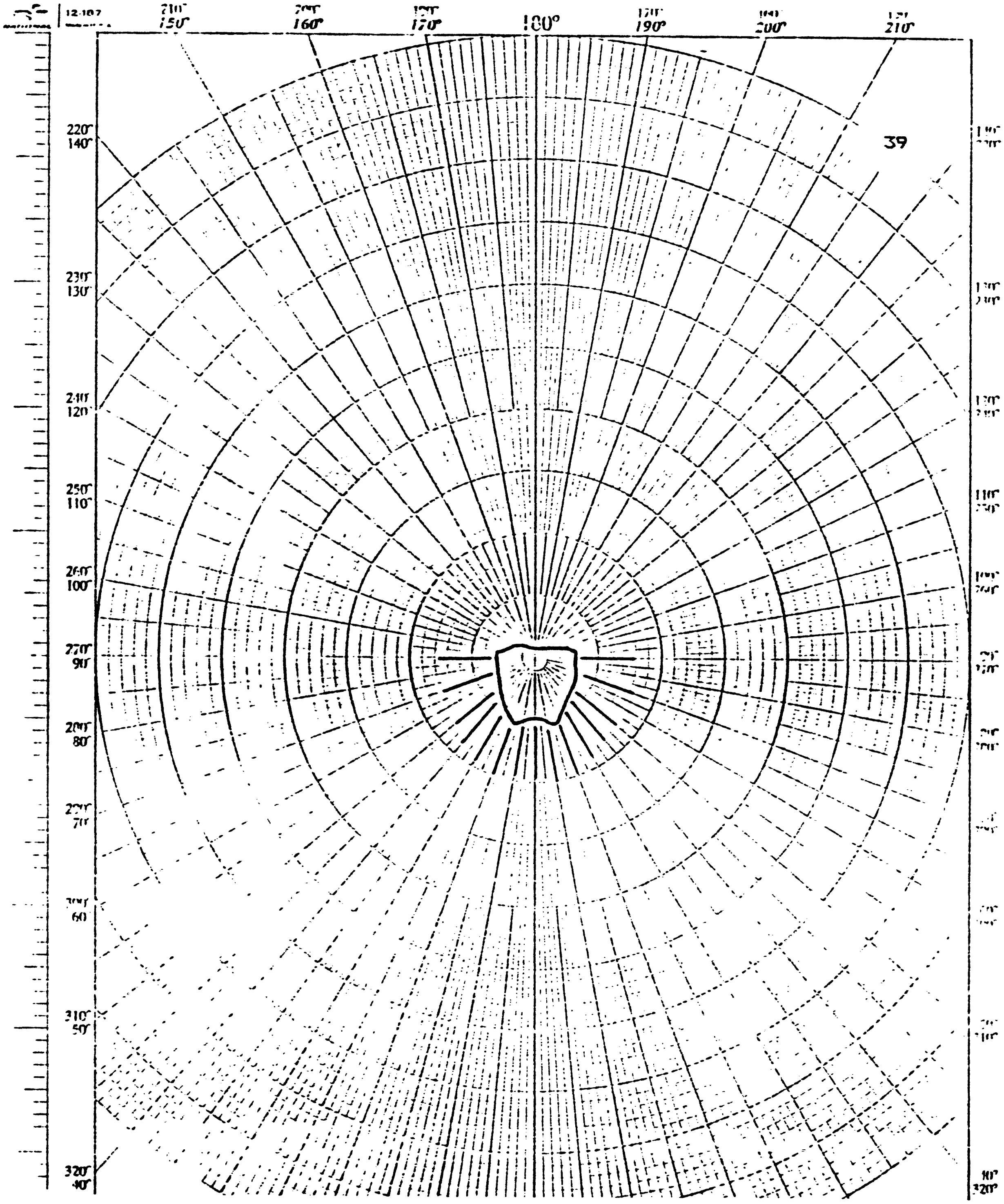

Figure 12. Measurement points used for proximal fragments.

Table 1. Distal Fragment Measurements.

Number	Site	Figure	Reference	Measurements (mm) at stated axes: 270	240	220	210	200	195	190	185	180	175	170	165	160	150	140	120	90
1-1,1.	Ray Long	55a	Wheeler 1957	10	11	14	17	22	25	30	35	40	33	27	23	20	15	13	10	10
1-2,2.	Ray Long	55b	Wheeler 1957	8	9	11	15	20	24	30	36	40	35	27	23	19	14	12	10	8
1-3,3.	Ray Long	55c	Wheeler 1957	8	10	12	16	21	24	31	36	40	37	31	26	24	18	13	9	8
2-1,4.	Pretty Butte	2a	Text	8	10	12	15	20	25	29	35	40	39	32	29	24	17	13	10	8
2-2,5.	Pretty Butte	2b	Text	9	11	13	15	20	24	31	37	40	36	31	26	21	16	13	11	9
2-3,6.	Pretty Butte	2c	Text	8	8	11	14	18	23	31	35	40	38	32	28	24	18	13	9	8
4-4,7.	Mummy Cave	61f	Husted 1978	7	10	12	17	24	29	33	38	40	37	34	30	25	17	12	9	7
4-11,8.	Mummy Cave	61v	Husted 1978	7	9	12	16	21	25	30	34	40	36	30	27	23	16	13	10	8
4-16,9.	Mummy Cave	61x	Husted 1978	6	10	15	19	24	29	33	37	40	38	34	29	26	20	15	10	7
5-1,10.	James Allen	pp36e	Frison 1978	12	14	21	25	27	29	33	37	40	38	35	31	27	22	19	13	12
6-1,11.	Betty Green	pp27b	Greene 1968	13	15	18	21	26	29	33	36	40	39	36	33	30	25	21	15	13
6-2,12.	Betty Green	pp27c	Greene 1968	10	12	16	20	29	33	35	37	40	39	36	31	25	19	16	12	10
6-6,13.	Betty Green	45TL	Irwin 1968	8	10	14	16	20	24	29	35	40	36	30	25	20	16	13	11	9
6-8,14.	Betty Green	45TR	Irwin 1968	11	12	16	19	24	28	32	36	40	37	33	29	27	21	18	14	11
7-1,15.	Hell Gap	45TCL	Irwin 1968	9	10	14	17	23	27	32	36	40	37	31	26	24	19	15	11	9
8-1,16.	Hell Gap	44BL	Irwin 1968	10	11	14	16	21	24	30	35	40	36	30	26	23	19	15	12	10
8-2,17.	Hell Gap	44BRC	Irwin 1968	10	11	15	19	24	27	32	36	40	37	32	28	24	19	14	11	10
9-1,18.	Unknown	pp139	Wormington 1957	10	11	14	17	22	27	32	37	40	37	32	29	25	20	16	12	11

Table 2. Proximal fragment measurements.

Number	Site	Figure	Reference	Measurements (mm) at stated axes														
				90	70	50	40	30	20	10	0	350	340	330	320	310	290	270
1-4,1.	Ray Long	55f	Wheeler 1957	8	8	10	11	14	15	14	13	13	16	12	9	8	7	7
1-5,2.	Ray Long	55g	Wheeler 1957	7	8	9	10	13	14	13	14	14	14	12	9	8	8	8
1-6,3.	Ray Long	55h	Wheeler 1957	9	9	10	11	13	13	12	13	14	14	12	10	9	9	9
1-7,4.	Ray Long	55i	Wheeler 1957	11	11	13	14	15	14	13	13	14	14	15	15	13	12	12
1-8,5.	Ray Long	55j	Wheeler 1957	9	11	12	14	15	14	13	12	13	14	15	13	11	10	10
1-9,6.	Ray Long	55k	Wheeler 1957	10	10	12	12	13	14	13	13	13	12	13	13	11	9	9
1-10,7.	Ray Long	55l	Wheeler 1957	8	8	9	11	12	14	13	13	13	14	12	11	10	8	8
2-4,8.	Pretty Butte	2d	Text	8	9	11	11	12	13	13	13	13	15	12	10	9	8	8
3-1,9.	Pretty Creek	25g	Loendorf et al. 1981	10	11	14	15	14	14	13	14	14	15	16	13	11	11	10
3-2,10.	Pretty Creek	25i	Loendorf et al. 1981	9	10	12	14	14	13	13	12	13	14	15	13	11	10	9
4-1,11.	Mummy Cave	61c	Husted 1978	9	9	10	10	12	13	12	12	13	14	13	13	11	10	11
4-2,12.	Mummy Cave	61d	Husted 1978	8	9	9	10	13	13	11	11	12	15	12	10	9	8	8
4-3,13.	Mummy Cave	61e	Husted 1978	8	9	10	11	12	14	14	13	14	14	12	10	10	9	9
4-4,14.	Mummy Cave	61f	Husted 1978	8	8	9	10	13	14	12	12	12	14	12	10	9	8	8
4-5,15.	Mummy Cave	61g	Husted 1978	7	7	8	10	11	13	14	12	13	13	10	10	9	8	7
4-6,16.	Mummy Cave	61h	Husted 1978	8	9	11	11	12	14	12	12	14	15	12	11	10	9	9
4-7,17.	Mummy Cave	61j	Husted 1978	8	8	8	9	10	13	13	13	13	12	11	10	9	8	8
4-8,18.	Mummy Cave	61k	Husted 1978	8	8	9	10	11	12	14	12	12	13	11	10	9	8	8
4-9,19.	Mummy Cave	61l	Husted 1978	8	8	10	11	12	14	14	13	13	13	12	10	10	8	8
4-10,20.	Mummy Cave	61n	Husted 1978	8	8	9	9	12	14	14	13	13	14	13	11	9	8	8
4-11,21.	Mummy Cave	61r	Husted 1978	6	7	7	8	9	13	13	13	12	10	8	7	6	6	6
4-12,22.	Mummy Cave	61s	Husted 1978	8	9	10	10	12	13	13	13	14	13	12	11	10	9	9

Table 2. Proximal fragment measurements, concluded.

Number	Site	Figure	Reference	90	70	50	40	30	20	10	0	350	340	330	320	310	290	270
				Measurements (mm) at stated axes														
4-13,23.	Mummy Cave	61u	Husted 1978	7	8	9	9	11	12	12	13	13	12	10	9	8	7	8
4-14,24.	Mummy Cave	61v	Husted 1978	7	7	7	9	10	13	12	11	12	13	12	10	9	8	9
4-15,25.	Mummy Cave	61w	Husted 1978	9	9	11	12	13	14	13	13	13	14	13	11	10	8	8
4-16,26.	Mummy Cave	61x	Husted 1978	8	8	10	11	12	13	13	13	13	13	12	10	9	8	9
5-1,27.	James Allen	pp36e	Frison 1978	11	12	14	17	14	14	8	8	9	11	15	15	13	12	11
5-2,28.	James Allen	pp36f	Frison 1978	12	12	15	15	15	11	8	8	8	10	14	15	14	13	12
6-1,29.	Betty Greene	pp27b	Greene 1968	10	10	11	12	13	14	13	13	14	14	14	12	11	10	10
6-2,30.	Betty Greene	pp27c	Greene 1968	10	10	11	12	14	14	14	13	13	13	12	11	10	9	10
6-3,31.	Betty Greene	pp27h	Greene 1968	10	10	13	13	15	14	11	10	12	15	15	13	11	10	10
6-4,32.	Betty Greene	pp27k	Greene 1968	10	10	11	15	15	14	12	11	12	14	14	13	11	10	10
6-5,33.	Betty Greene	pp27l	Greene 1968	10	10	11	14	14	14	13	12	14	15	14	12	10	9	10
6-6,34.	Betty Greene	45TL	Irwin 1968	8	8	9	10	14	13	13	13	13	13	12	10	8	8	8
6-7,35.	Betty Greene	45TR	Irwin 1968	9	10	11	12	15	12	11	11	12	14	13	12	11	9	9
6-8,36.	Betty Greene	45TCR	Irwin 1968	10	10	10	12	15	14	12	12	12	13	13	12	10	9	10
7-1,37.	Hell Gap, Lusk	45TCL	Irwin 1968	9	9	10	12	13	14	13	14	14	14	12	11	10	9	9
7-2,38.	Hell Gap, Lusk	45BL	Irwin 1968	7	8	11	13	16	14	12	11	12	13	14	12	10	8	7
7-3,39.	Hell Gap, Lusk	45BC	Irwin 1968	8	8	9	11	14	13	13	13	14	15	12	11	10	8	8
7-4,40.	Patten Creek, Lusk	45BR	Irwin 1968	8	9	9	11	12	13	13	13	13	15	15	12	10	8	8
8-1,41.	Hell Gap (Fred.)	44BL	Irwin 1968	10	11	14	16	15	13	13	13	14	14	15	15	13	11	10
8-2,42.	Hell Gap (Fred.)	44BLC	Irwin 1968	15	16	20	16	14	11	11	11	12	13	14	19	19	16	15
9-1,43.	NE, surface (Ang)	pp139	Wormington 1957	10	11	13	15	15	13	13	12	13	13	15	13	12	10	10

Table 3. Roatated factor matrix, distal fragments.

Measurement #	Factor 1	Factor 2
1.	.94731	.06103
2.	.88347	.35486
3.	.82859	.41679
4.	.68945	.55986
5.	.50803	.71013
6.	.31076	.82873
7.	.24074	.86190
8.	-.00435	.67428
9.	-.15444	-.37489
10.	.08734	.80002
11.	.28009	.92971
12.	.34080	.86227
13.	.45193	.77270
14.	.67583	.60842
15.	.85970	.43812
16.	.91438	.20481
17.	.97224	.06205

Table 4. Factor scores for distal specimens.

Specimen #	Factor 1	Factor 2
1-1	.51038	-1.75491
1-2	-.61882	-1.50214
1-3	-.77432	-.08045
2-1	-.76574	-.02630
2-2	-.27926	-.52288
2-3	-1.10176	-.06362
4-4	-1.55190	1.45787
4-11	-.64390	-.60760
4-16	-1.04382	1.45887
5-1	1.76492	.81950
6-1	2.20051	.81049
6-2	.08092	1.74644
6-6	-.09292	-1.12093
6-8	1.18222	.11562
7-1	-.10797	.03039
8-1	.61561	-1.03363
8-3	.24316	.11046
9-1	.38269	.16283

Cluster analysis of distal fragments was run on the measurements (Figure 13). Based on coefficient variation presented in the agglomeration schedule (Table 5) I chose to separate the collection into four clusters. Cluster 1 consisted of Specimen Nos. 16, 13, 5, 6, 4, 8, 3, 2, and 1. Cluster 2 consisted of Specimen Nos. 18, 17, 15, 14, 9 and 7. Cluster 3 consisted of Specimen Nos. 10 and 11. And, finally, Cluster 4 consisted of Specimen No. 12. Table 6 presents information on each specimen by number. Cluster 1 was comprised of projectile points from the Ray Long site, the Pretty Butte site, the Betty Greene site and Frederick from the Hell Gap site. Cluster 2 included projectile points from Mummy Cave, the Betty Greene site, Lusk and Frederick points from the Hell Gap site and a point identified as Angostura, pictured in Wormington (1957:139). Cluster 3 was made up of a single point from the Betty Greene site and a single point from the James Allen site. Cluster 4 consisted of a single point from the Betty Greene site.

The first three pairs of points to cluster were 1) a Frederick point from Hell Gap and a Lusk point from Hell Gap, 2) a point from the Betty Greene site and a point from the Pretty Butte site, and 3) a point from the Ray Long site and a point from Mummy Cave.

<u>Proximal Fragments.</u> Factor analysis of proximal fragment measurements produced two factors which, when combined,

Figure 13. Cluster analysis of distal fragments.

```
==============================================================
|         |                      SPECIMEN NUMBERS
|Number of|1  1  1  1  1  1  1        1  1
|Clusters |1  0  2  8  7  5  4  9  7  6  3  5  6  4  8  3  2  1
|---------|----------------------------------------------------
|       1 |XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
|       2 |XXXX  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
|       3 |XXXX  XXXXXXXXXXXXXXXXXXX  XXXXXXXXXXXXXXXXXXXXXXXXX
|       4 |XXXX  X  XXXXXXXXXXXXXXXX  XXXXXXXXXXXXXXXXXXXXXXXXX
|       5 |XXXX  X  XXXXXXXXXXXXXXXX  XXXXXXXXXXXXXXXXXXX  XXXX
|       6 |XXXX  X  XXXXXXXXXX  XXXX  XXXXXXXXXXXXXXXXXXX  XXXX
|       7 |X  X  X  XXXXXXXXXX  XXXX  XXXXXXXXXXXXXXXXXXX  XXXX
|       8 |X  X  X  XXXXXXX  X  XXXX  XXXXXXXXXXXXXXXXXXX  XXXX
|       9 |X  X  X  XXXXXXX  X  XXXX  XXXXXXX  XXXXXXXXXX  XXXX
|      10 |X  X  X  XXXXXXX  X  XXXX  XXXXXXX  XXXXXXXXXX  X  X
|      11 |X  X  X  XXXXXXX  X  X  X  XXXXXXX  XXXXXXXXXX  X  X
|      12 |X  X  X  XXXXXXX  X  X  X  X  XXXX  XXXXXXXXXX  X  X
|      13 |X  X  X  XXXXXXX  X  X  X  X  XXXX  XXXX  XXXX  X  X
|      14 |X  X  X  XXXXXXX  X  X  X  X  XXXX  X  X  XXXX  X  X
|      15 |X  X  X  X  XXXX  X  X  X  X  XXXX  X  X  XXXX  X  X
|      16 |X  X  X  X  XXXX  X  X  X  X  XXXX  X  X  X  X  X  X
|      17 |X  X  X  X  XXXX  X  X  X  X  X  X  X  X  X  X  X  X
```

Table 5. Agglomeration schedule, distal fragments.

Stage	Clusters Combined Cluster 1	Cluster 2	Coefficient	Stage Cluster 1st Appears Cluster 1	Cluster 2	Next Stage
1.	3	4	.003005	0	0	3
2.	17	18	.022213	0	0	6
3.	3	6	.110902	1	0	9
4.	5	8	.140138	0	0	9
5.	10	11	.189824	0	0	17
6.	15	17	.193996	0	2	11
7.	7	9	.258150	0	0	14
8.	2	13	.421891	0	0	12
9.	3	5	.494112	3	4	13
10.	1	16	.531310	0	0	12
11.	14	15	1.065073	0	6	13
12.	1	2	1.089457	10	8	15
13.	3	14	1.786837	9	11	15
14.	7	12	2.048551	7	0	16
15.	1	3	2.530239	12	13	16
16.	1	7	5.990288	15	14	17
17.	1	10	7.336323	16	5	0

Table 6. Distal fragment information.

Specimen Number	Site	Point Type	Figure In Text	Reference
(1-1) 1.	Ray Long	Angostura	8a	Wheeler 1957
(1-2) 2.	Ray Long	Angostura	8b	Wheeler 1957
(1-3) 3.	Ray Long	Angostura	8c	Wheeler 1957
(2-1) 4.	Pretty Butte	Parallel Oblique Flaked	2a	Text
(2-2) 5.	Pretty Butte	Parallel Oblique Flaked	2b	Text
(2-3) 6.	Pretty Butte	Parallel Oblique Flaked	2c	Text
(4-4) 7.	Mummy Cave	Parallel Oblique Flaked	9f	Husted 1978
(4-11) 8.	Mummy Cave	Parallel Oblique Flaked	9m	Husted 1978
(4-16) 9.	Mummy Cave	Parallel Oblique Flaked	9r	Husted 1978
(5-1) 10.	James Allen	James Allen	10a	Frison 1978
(6-1) 11.	Betty Green	Lusk	10c	Greene 1968
(6-2) 12.	Betty Green	Lusk	10d	Greene 1968
(6-6) 13.	Betty Green	Lusk	10h	Irwin 1968
(6-8) 14.	Betty Green	Lusk	10j	Irwin 1968
(7-1) 15.	Hell Gap	Lusk	11a	Irwin 1968
(8-1) 16.	Hell Gap	Frederick	11e	Irwin 1968
(8-2) 17.	Hell Gap	Frederick	11f	Irwin 1968
(9-1) 18.	Nebraska, surface	Angostura	11h	Wormington 1957

account for 70.6% of the variability. Factor 1 accounts for 54.7% of the variability. The rotated factor matrix is reproduced in Table 7. Factor 1 was related to width of the point fragment above the base. Factor 2 was related to variability in shape on either side of center at the edges of the base. Factor scores for each specimen are given in Table 8.

The cluster analysis of proximal fragment measurements produced results similar to those of the distal fragments (Figure 14). Based partially on the agglomeration schedule coefficient variability (Table 9) I chose to separate the collection into six clusters. In this separation of the collection, 37 of the 43 projectile point fragments fell into Cluster 1. Cluster 2 consisted of Specimen No. 21 and Cluster 3 of Specimen Nos. 27 and 28. Cluster 4 contained only Specimen No. 42. Cluster 5 consisted of Specimen No. 6. And, finally, Cluster 6 was made up of Specimen No. 4. Table 10 presents information on each specimen by number. In this case the two point fragments from the James Allen site clustered into a separate unit. Also, the unusually wide Frederick point from Hell Gap, two points from the Ray Long site and a point from Mummy Cave, Layer 31 clustered into separate units. The two specimens from Ray Long which fell into separate and individual clusters (Nos. 4 and 6) must, however, be disregarded. This was due to an error in my entering the measurement data. One measurement for each

Table 7. Rotated factor matrix, proximal fragments.

Measurement #	Factor 1	Factor 2
1.	.91467	-.17942
2.	.93043	-.19513
3.	.93096	-.16254
4.	.90934	-.10171
5.	.73706	.03328
6.	-.06593	.61120
7.	-.37213	.81729
8.	-.33918	.84358
9.	-.14194	.89437
10.	.10320	.21874
11.	.83336	.08793
12.	.94828	-.18116
13.	.91691	-.21702
14.	.91607	-.24454
15.	.38710	.28063

Table 8. Factor scores for proximal specimens.

Specimen #	Factor 1	Factor 2
1-4	-.56809	.92070
1-5	-.75883	.84049
1-6	-.31579	.16042
1-7	2.02747	1.97670
1-8	.85686	.52906
1-9	.61438	1.11637
1-10	-.52619	.31716
2-4	-.51250	.06132
3-1	1.25751	1.31871
3-2	.65642	.19314
4-1	-.06014	-.32635
4-2	-.71237	-1.09714
4-3	-.32934	.81745
4-4	-.70676	-.38148
4-5	-1.19984	-.20136
4-6	-.25645	.16973
4-7	-1.08936	-.17936
4-8	-1.06724	-.66189
4-9	-.52226	.53202
4-10	-.60688	.56710
4-11	-2.28100	-.76275
4-12	-.39392	.30441
4-13	-1.36871	-.68485
4-14	-1.29854	-1.07150
4-15	-.06090	.47325
4-16	-.63853	.04768
5-1	1.33850	-2.57236
5-2	1.26552	-3.72638
6-1	.47404	.82764
6-2	.16370	.68627
6-3	.75091	-.64588
6-4	.70724	-.24773
6-5	.52185	.69921
6-6	-.67119	.11198
6-7	.13124	-1.15029
6-8	.23251	-.14597
7-1	-.05998	.90643
7-2	.02140	-.27750
7-3	-.38818	.41976
7-4	-.20078	.25129
8-1	1.46700	.81509
8-2	3.05926	-1.20730
9-1	1.04796	.27679

Figure 14. Cluster analysis of proximal fragments.

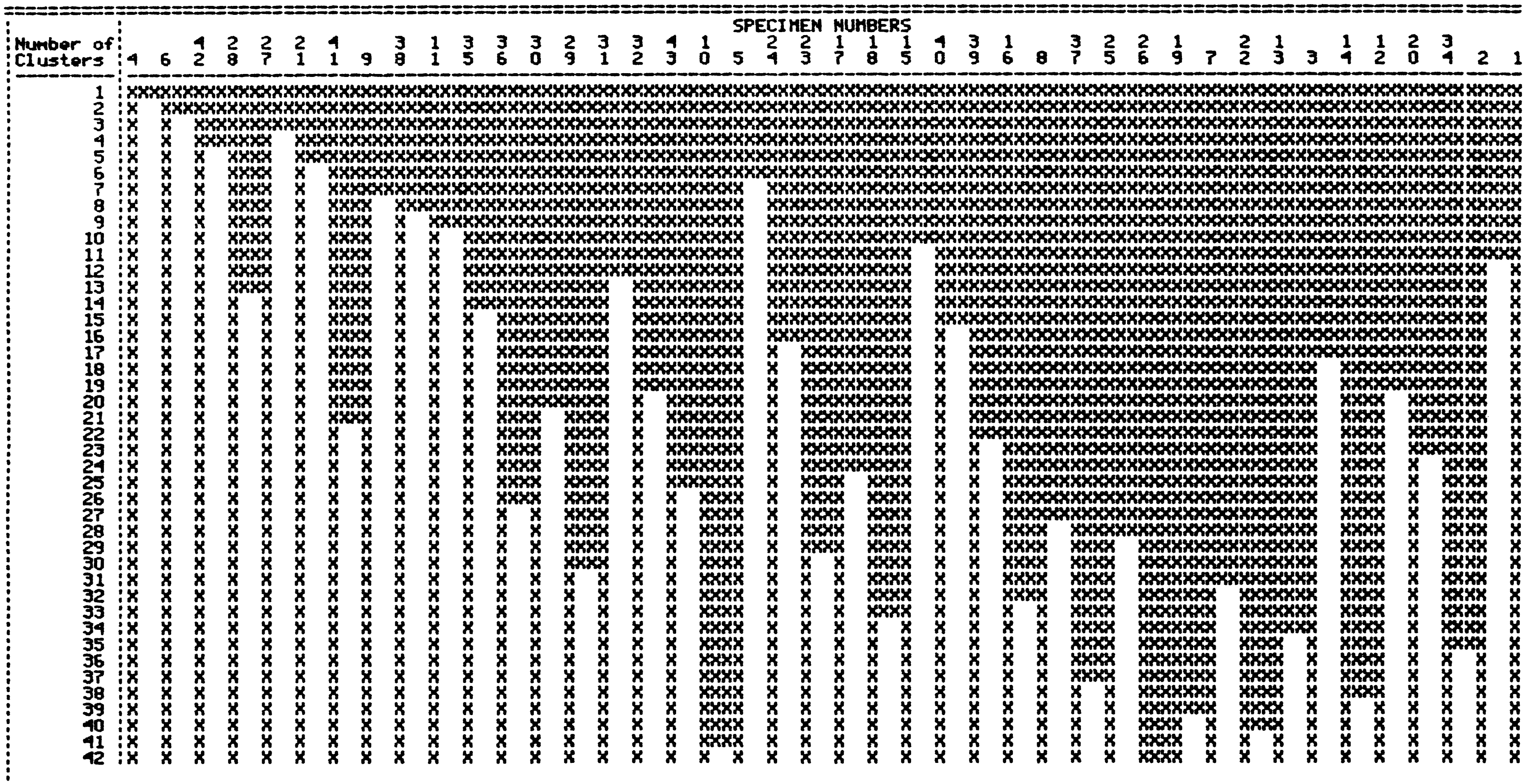

Table 9. Agglomeration schedule, proximal fragments.

	Clusters Combined			Stage Cluster 1st Appears		Next
Stage	Cluster 1	Cluster 2	Coefficient	Cluster 1	Cluster 2	Stage
1.	19	26	4.000000	0	0	4
2.	5	10	4.000000	0	0	7
3.	13	22	5.000000	0	0	9
4.	7	19	5.000000	0	1	12
5.	12	14	5.000000	0	0	24
6.	25	37	6.000000	0	0	15
7.	5	43	7.000000	2	0	18
8.	2	34	7.000000	0	0	20
9.	3	13	7.000000	0	3	12
10.	15	18	8.000000	0	0	19
11.	8	16	8.000000	0	0	16
12.	3	7	8.000000	9	4	15
13.	29	33	9.000000	0	0	23
14.	17	23	9.000000	0	0	19
15.	3	25	9.500000	12	6	16
16.	3	8	9.750000	15	11	21
17.	30	36	10.000000	0	0	23
18.	5	32	10.000000	7	0	25
19.	15	17	11.000000	10	14	27
20.	2	20	11.500000	8	0	24
21.	3	39	11.600000	16	0	26

Table 9. Agglomeration schedule, proximal fragments, concluded.

Stage	Clusters Combined Cluster 1	Cluster 2	Coefficient	Stage Cluster 1st Appears Cluster 1	Cluster 2	Next Stage
22.	9	41	14.000000	0	0	36
23.	29	30	14.500000	13	17	29
24.	2	12	14.833333	20	5	26
25.	5	31	15.500000	18	0	31
26.	2	3	15.672728	24	21	28
27.	15	24	16.750000	19	0	33
28.	2	40	20.125000	26	0	32
29.	29	35	20.750000	23	0	31
30.	27	28	22.000000	0	0	39
31.	5	29	22.719999	25	29	34
32.	1	2	23.764706	0	28	33
33.	1	15	29.355556	32	27	37
34.	5	11	33.400002	31	0	35
35.	5	38	38.727272	34	0	36
36.	5	9	43.833332	35	22	37
37.	1	5	66.472054	33	36	38
38.	1	21	157.972977	37	0	40
39.	27	42	174.000000	30	0	40
40.	1	27	311.254395	38	39	41
41.	1	6	12022.170898	40	0	42
42.	1	4	12927.213867	41	0	0

Table 10. Proximal fragment information.

Specimen Number	Site	Point Type	Figure In Text	Reference
(1-4) 1.	Ray Long	Angostura	8d	Wheeler 1957
(1-5) 2.	Ray Long	Angostura	8e	Wheeler 1957
(1-6) 3.	Ray Long	Angostura	8f	Wheeler 1957
(1-7) 4.	Ray Long	Angostura	8g	Wheeler 1957
(1-8) 5.	Ray Long	Angostura	8h	Wheeler 1957
(1-9) 6.	Ray Long	Angostura	8i	Wheeler 1957
(1-10) 7.	Ray Long	Angostura	8j	Wheeler 1957
(2-4) 8.	Pretty Butte	Parallel Oblique Flaked	2d	Text
(3-1) 9.	Pretty Creek	Parallel Oblique Flaked	9a	Loendorf et al. 1981
(3-2) 10.	Pretty Creek	Parallel Oblique Flaked	9b	Loendorf et al. 1981
(4-1) 11.	Mummy Cave	Parallel Oblique Flaked	9c	Husted 1978
(4-2) 12.	Mummy Cave	Parallel Oblique Flaked	9d	Husted 1978
(4-3) 13.	Mummy Cave	Parallel Oblique Flaked	9e	Husted 1978
(4-4) 14.	Mummy Cave	Parallel Oblique Flaked	9f	Husted 1978
(4-5) 15.	Mummy Cave	Parallel Oblique Flaked	9g	Husted 1978
(4-6) 16.	Mummy Cave	Parallel Oblique Flaked	9h	Husted 1978
(4-7) 17.	Mummy Cave	Parallel Oblique Flaked	9i	Husted 1978
(4-8) 18.	Mummy Cave	Parallel Oblique Flaked	9j	Husted 1978
(4-9) 19.	Mummy Cave	Parallel Oblique Flaked	9k	Husted 1978
(4-10) 20.	Mummy Cave	Parallel Oblique Flaked	9l	Husted 1978
(4-11) 21.	Mummy Cave	Parallel Oblique Flaked	9m	Husted 1978
(4-12) 22.	Mummy Cave	Parallel Oblique Flaked	9n	Husted 1978

Table 10. Proximal fragment information, concluded.

Specimen Number	Site	Point Type	Figure In Text	Reference
(4-13) 23.	Mummy Cave	Parallel Oblique Flaked	9o	Husted 1978
(4-14) 24.	Mummy Cave	Parallel Oblique Flaked	9p	Husted 1978
(4-15) 25.	Mummy Cave	Parallel Oblique Flaked	9q	Husted 1978
(4-16) 26.	Mummy Cave	Parallel Oblique Flaked	9r	Husted 1978
(5-1) 27.	James Allen	James Allen	10a	Frison 1978
(5-2) 28.	James Allen	James Allen	10b	Frison 1978
(6-1) 29.	Betty Greene	Lusk	10c	Greene 1978
(6-2) 30.	Betty Greene	Lusk	10d	Greene 1968
(6-3) 31.	Betty Greene	Lusk	10e	Greene 1968
(6-4) 32.	Betty Greene	Lusk	10f	Greene 1968
(6-5) 33.	Betty Greene	Lusk	10g	Greene 1968
(6-6) 34.	Betty Greene	Lusk	10h	Irwin 1968
(6-7) 35.	Betty Greene	Lusk	10i	Irwin 1968
(6-8) 36.	Betty Greene	Lusk	10j	Irwin 1968
(7-1) 37.	Hell Gap	Lusk	11a	Irwin 1968
(7-2) 38.	Hell Gap	Lusk	11b	Irwin 1968
(7-3) 39.	Hell Gap	Lusk	11c	Irwin 1968
(7-4) 40.	Patten Creek	Lusk	11d	Irwin 1968
(8-1) 41.	Hell Gap	Frederick	11e	Irwin 1968
(8-2) 42.	Hell Gap	Frederick	11f	Irwin 1968
(9-1) 43.	Nebraska, surface	Angostura	11h	Wormington 1957

was entered incorrectly. In the remainder of the discussions I have excluded these two points. The large cluster consisted of points from the Ray Long site, the Pretty Butte site, the Pretty Creek site, Mummy Cave, Hell Gap Frederick and Lusk, Patten Creek Lusk, the Betty Greene Site and the point pictured in Wormington (1957:139).

The first three pairs of points to cluster from the analysis by measurements were 1) a point from the Ray Long site and a point from Mummy Cave, Layer 30, 2) a point from the Ray Long site and a point from the Pretty Creek site, and 3) two points from Mummy Cave, one each from Layers 29 and 31.

Interpretation

In the following I discuss my interpretation of the factor and cluster analyses. In addition a cross classification of the data is presented.

It seems apparent to me that there is as much variability in shape within the point collection from one site as between sites, possibly excluding the two Allen points. In my view, the cluster analyses of distal and proximal point fragments illustrates this in the following ways. In the analysis of distal fragments Clusters 1 and 2 contained over 83% of the complete point collection. Points from Ray Long, Pretty Butte, Mummy Cave, Betty Green, and Hell Gap (Frederick) were in Cluster 1. And points from Mummy Cave, Betty Green, Hell Gap (Lusk and Frederick), and the

Angostura point pictured in Wormington (1957:139) were in Cluster 2. Clusters 3 and 4 combined contained three points, two from Betty Green and one from James Allen. Points from Betty Green were in all four clusters and points from Mummy Cave and Hell Gap were in two of the four clusters. Frison (personal communication 1987) suggested that many of the points from the Betty Green site were of incomplete manufacture. While only those points which appeared (from sketches) to be finished products were used in my analysis, incomplete manufacture, rather than different ideas as to final projectile point form, may account for some of the variability.

The factor analysis for both distal and proximal fragments suggested that two interpretable factors were operative. Within distal fragments the greatest amount of variability accounted for by Factor 1 was in width near the midpoint; this was followed by Factor 2 which was interpreted as lateral width near the point. I constructed a scattergram to better illustrate the distribution of points on these factors (Figure 15). As the illustration indicates, most of the points clustered toward the center of mid-width and leaned toward a narrow lateral width. Two of the three distal fragments from Mummy Cave (one from Layer 29 and one from Layer 31) tended to have a narrower mid-width and wider lateral width than other points in the collection. This suggested a somewhat straight sided point form, but it is

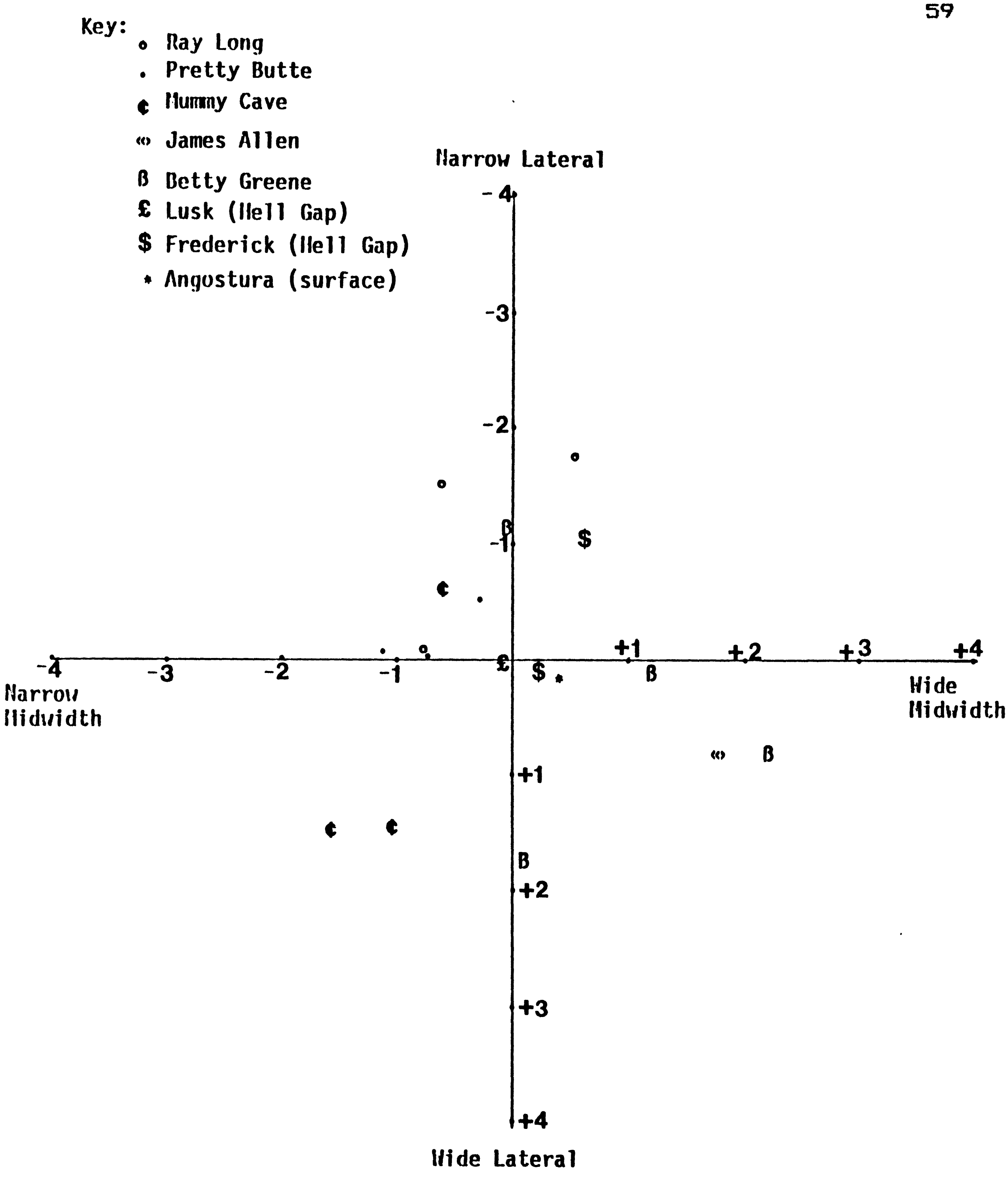

Figure 15. Distribution of distal fragments by factor analysis variations.

necessary to remember that the length of the fragments to be measured was standardized to be relatively short and did not represent, for example, the upper half of every point. Considering this, a more gradual narrowing toward the point tip, rather than straight sides, was indicated. Two of the points from Betty Green and the one from James Allen also fit this interpretation, except they tend to be wider at mid-width than the rest of the collection.

My idea that there was variation within assemblages from individual sites is further supported by the cluster analysis of proximal fragments. In this case one of 16 points from Mummy Cave, one of three Frederick points from Hell Gap, and both points from James Allen were in separate clusters. The remaining cluster contained points from all the sites except for James Allen. However, only two points from the James Allen site were used in the analysis. Published description of the entire point collection at the James Allen site indicated that there was one point much smaller than the others although comparable in shape and manufacture techniques (Mulloy 1959:114). In addition, Irwin (1968:215) stated that he believed the James Allen points belonged to the Frederick complex, were comparable to Frederick points recovered from Hell Gap, and that variation between the two collections was due to the great homogeneity of the James Allen points. He further suggested that this stylistic regularity possibly had resulted from their production by a single group of people. The question is whether the variation is significant enough to warrant a separate projectile point type name. It is possible that the James Allen point type is only a minor, and individualistic, variation on the Angostura style, which provided the basic model for shape and manufacturing technique.

Factor analysis of proximal fragments also showed two primary factors of variation. These were mid-width variation (Factor 1) and variation in base shape (Factor 2). The latter primarily indicated an incurvate to excurvate shape but also appeared to be related to the width across the base. As with distal fragments, I constructed a scattergram for proximal fragments to illustrate their distribution on these two factors (Figure 16). The majority of proximal fragments (n=38) clustered around the center, suggesting very little variation in shape. Sixteen of the fragments clustered very tightly near the center within the lower left-hand quadrant. These point fragments tended toward being comparatively narrow in width with slightly incurvate to straight bases. Points in this grouping came from Ray Long, Pretty Butte, Mummy Cave (Layers 29-31), Betty Green, Hell Gap (Lusk) and Patten Creek (Lusk). An additional seven points clustered by common possession of a slightly incurvate to straight base area but were relatively wider. These included points from Ray Long, Pretty Creek,

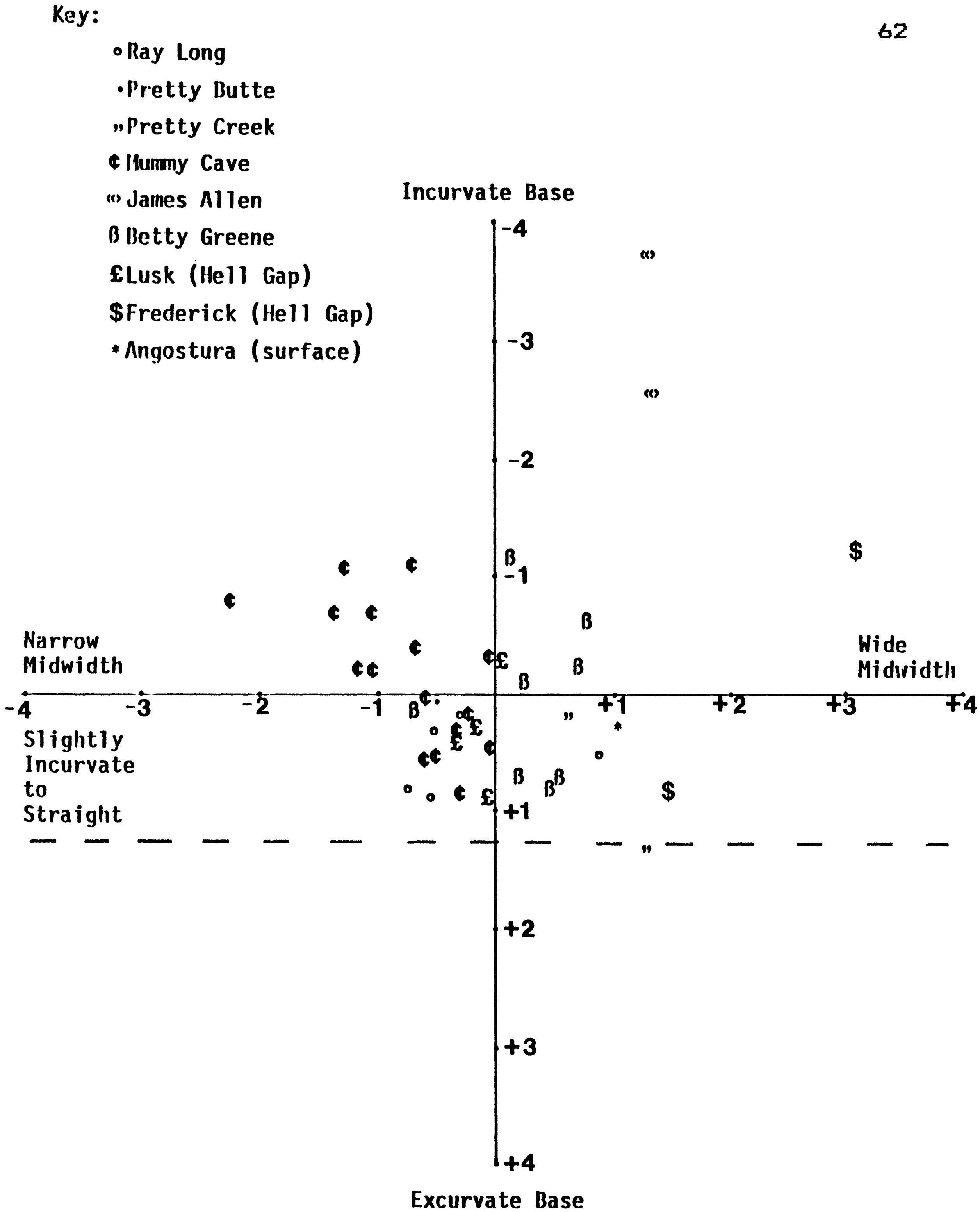

Figure 16. Distribution of proximal fragments by factor analysis variations.

Betty Green, Hell Gap (Frederick), and the Angostura point pictured in Wormington (1957:139). One point had a slightly excurvate base and was wider than most others in the collection. This point was from the Pretty Creek site. Fifteen points in the collection exhibited incurvate bases, with nine of these falling into the established narrower width category, five with a slightly wider width, and one which was the widest point in the collection. The nine were all from Mummy Cave (Layers 27 and 29-31). The five were from Betty Green and Hell Gap (Lusk). The widest point was a Frederick point from Hell Gap. The remaining two points from James Allen had extremely incurvate bases and were relatively wide.

I measured nine of the points in the collection both as distal and proximal fragments, as they were complete or nearly so. Correlations between various point attributes, combining distal and proximal, were considered (Table 11). Obviously the small size of the collection precludes my establishing predictability. The data is presented to illustrate shape variations within the collection.

To reiterate, it seems evident to me that my analysis at least partly supported a contention that there is as much shape variation within named types (ie. Angostura, Lusk, Frederick) as between them. The analysis did not suggest that this is the case with James Allen points, but small sample size and stylistic regularity (possibly due to

Table 11. Distal and proximal measurement correlation, by specimen number.

		DISTAL			
		Wide Midwidth		Narrow Midwidth	
PROXIMAL		Wide Lateral	Narrow Lateral	Wide Lateral	Narrow Lateral
Slightly Incurvate To Straight Base	Narrow			7-1	6-6
	Wide	9-1	8-1		
Excurvate Base	Narrow				
	Wide				
Incurvate Base	Narrow			4-4, 4-16	4-11
	Wide	6-8			
Extremely Incurvate Base	Narrow				
	Wide	5-1			

manufacture by a single group and/or the small sample size) may be the cause of the variation between James Allen points and the rest of the collection. So we have the same form occurring at relatively different times at different sites within the Northwestern Plains. This projectile point style combines the technological tradition of parallel oblique flaking with a particular, and relatively consistent, shape.

Sources of Error

The probable sources of error in this analysis are the method of measurement, the small collection size, and the cluster analysis itself. Anna Montet-White's polar grid method was developed for comparing shapes of flake tools (Montet-White 1973:61). Because my projectile point collection was primarily made up of distal and proximal fragments it was necessary to modify Montet-White's method. First, for measurement of comparable shape I standardized the length of the fragments. And second, I did not use equal intervals of degrees on the grid because this would have put undue emphasis on discrete portions of the point. Rather intervals, while consistent on all specimens, were varied in order to place measurements at relatively more even spacing along the tool margin. I believe these modifications were amply justified and necessary for any viable comparison. The placement of measurement points at varied intervals did introduce a subjective element.

In addition, one should consider the accuracy with which the measurement technique reflects critical attributes. Certainly I would rather have had the points in hand and used more traditional methods of measurement and comparison. Given the difficulties I encountered in my attempts to study the points themselves, the alternative devised appeared enticing. I considered what I would have studied if I had the artifacts themselves rather than only photographs and drawings. I believe that traditionally we look at manufacturing techniques, basal form, length, width, and basic shape when classifying projectile points. In my analysis the manufacturing technique was established as comparable through published descriptions of the collections. Basal form, width and basic shape were consistently measured in the same way in my analysis. While I standardized the data for point length, thus precluding its inclusion in analysis, the very nature of fragments precludes accurate measurement of point length. I am convinced that my basic analytical method was adequate.

While my analysis does not contradict any assertion that Frederick should be included into the same typological unit as Angostura and Lusk, neither does it overwhelmingly support this. One problem was sample size. Only three Frederick points from the Hell Gap site were used in the analysis. Initially I did not see this as a major problem. Upon reflection, I believe a much larger sample size is needed for any conclusive statements. The same situation was true for the James Allen points. Only two of these were used in the analysis. The difference is Frederick points did cluster with Angostura and Lusk, while James Allen points did not. A final consideration is the validity of cluster analysis itself. Primary problems are 1) that we seldom meet the requirements and theoretical assumptions of the technique, 2) cluster techniques can generate different solutions to the same data sets when different techniques and measures are used, and 3) the structure that is produced can be interpreted in more than one way. So, while cluster analysis is an accepted method of analysis, one should remember that the interpretive solutions it allows are not without question.

CONCLUSIONS

The problem I attempted to solve was what was the relationship of the points from 32SL100 to established types of parallel oblique flaked points. My conclusions are: 1) the points from the Pretty Butte site, the two points from the Pretty Creek site and points from the Mummy Cave site, Layers 27 and 29-31, are Angostura points, 2) that the term Lusk should be dropped because it only confuses the issue, 3) that at least Frederick and Angostura points should be placed in the same type, and 4) that James Allen points may or may not warrant classification into a separate type. In the following, I will discuss each of these conclusions and the subsequent consequences.

First, to reiterate briefly, within the Parallel Oblique Flaked Point Tradition there are, at present, seven identified projectile point types. These are Angostura, Frederick, Lusk, James Allen, Browns Valley, Lovell Constricted and Pryor Stemmed. The latter three vary enough in the attribute of shape to distinguish each from the other and from the other four named point types. Within Angostura, Lusk, Frederick and James Allen types distinguishing variations in shape, if present, have not been easy to determine from descriptions in archaeological reports. Irwin (1968:105) stated that he assigned the term "Lusk", at least in part because he felt that the term Angostura had been abused in the literature. "Lusk" could be used in place of "Angostura." The confusion over terminology and stylistic variation became apparent to me as I began trying to determine the types of projectile points recovered from the Pretty Butte site. I have already discussed the methods for comparison of various projectile points within these four named types, the results of analysis, interpretation of the data, and briefly defined conclusions.

The results of my analysis suggested to me that the lanceolate points from Ray Long, Pretty Butte, Pretty Creek and Mummy Cave (Layers 27 and 29-31), could all be considered as the same point type. Points from the Ray Long site were previously called Angostura, but the latter three have not been named.

The Pretty Butte site is located in southwestern North Dakota on an eroded remnant terrace in a heavily dissected area between Pretty Butte and the Little Missouri River. We found four parallel oblique flaked projectile point fragments within the single component site. Analysis conducted on the measurements from these points, when compared with measurements of various other parallel oblique flaked points illustrates that the points from Pretty Butte are similar to the Angostura points from the Ray Long site in southwestern South Dakota and also to other parallel-oblique flaked points. Two charcoal stained soil samples from a hearth feature at the site were sent to separate laboratories for radiocarbon dating. Dates of 3350 B.C. and 3620 B.C. were returned on the samples.

The Pretty Creek site, located in southcentral Montana (Carbon County), lay along either side of a stream, sometimes called Pretty Creek (Loendorf et al. 1981:1-5). Five parallel oblique flaked projectile points were recovered from Zones 6 and 7 at the site. I used two of the points from Zone 6 in my analysis. Measurements of these two proximal point fragments fell into the same cluster as points from Ray Long, Pretty Butte, Mummy Cave, Hell Gap (Frederick and Lusk), Patten Creek (Lusk), and Betty Greene. Zones 6 and 7 at the site dated to ca. 6000 B.C.

"Mummy Cave is situated on the North Fork of Shoshone River in the Absaroka Mountains of northwestern Wyoming." (Wedel 1978:21). Several parallel oblique flaked projectile points were recovered from Layers 27 and 29-31 at the site. Husted (1978:144) suggested that points from Layer 31 were similar to Angostura, Allen, and Frederick. When I read descriptions of the points recovered from Layers 27 and 29-31, I saw little difference between points from the various layers. For that reason, I included points from all four layers in my analysis. Measurements on points from all four layers clustered well with measurements on various Angostura, Lusk and Frederick points. Layers 27-31 date between 6150 - 6800 B.C.

The points called Lusk from Hell Gap, Betty Greene and Patten Creek also belong to the Angostura projectile point type. I disagree with Irwin (1968:105), and believe that his addition of the term Lusk only confuses the issue. He suggested 1) that the description of Angostura points could describe both Lusk and Agate Basin points, and 2) that the term Angostura had been abused in the literature.

To address the first of these, that the description of Angostura points would include both Lusk and Agate Basin points, I refer to Wheeler's (1957:537-538) description of Angostura points on pages 11 and 12 of this text, and give a brief description of Agate Basin points below.

> "General characteristics of the Agate Basin site projectile points include a lenticular cross-section with a delicate final retouch, giving almost perfectly straight blade edges, and eliminating ridges between flake scars. Blade edges are straight and in no case was a twist observed from one end to the other. The final pressure retouch was well executed, was at right angles to the blade edges, and extended beyond the center leaving no central ridge. The archetype, as a result, is long, narrow, and lenticular in transverse cross-section; there is, however, a wide variation in thickness (Figure 5.6a, b; Figure 5.7a-c). In outline, the base is rounded and achieved by an ever-increasing inward taper that usually begins about one-third of the distance from base to tip. Moderate to heavy grinding is present this entire distance. Longitudinal cross-section taper evenly from the base to the widest part of the point and taper evenly again to the tip."
>
> "Variations are usually the result of reworking broken specimens..." (Frison 1978:159).

In comparison, both point types are lenticular in cross-section and exhibit grinding of the lateral edges from the base to about 1/3 the length of the point. Where they constrast markedly is in final pressure flaking scars and their basal form. Agate Basin points are described as having horizontal parallel flaking, while Angostura points are described as having parallel oblique flaking. Angostura point bases are shallowly concave or irregularly straight, while Agate Basin point bases are rounded. I believe these latter two characteristic differences would be enough to distinguish between the two types. While I support the assertion qf two projectile point styles (Angostura and Agate Basin) I am not denying any association. Pettipas (1977:15) suggests that the Agate Basin and Angostura point types are very close.

> "...there is no obvious dividing line, morphologically or temporally, between the two, each being variations on a basic "leaf-shaped point" theme that has cultural and chronological continuity. In other words, the Agate Basin-Angostura weapon point combination represents a tradition or continuum which appears to have involved, over time, increasing emphasis upon the application of parallel-oblique flaking in the finishing of individual specimens." (Pettipas 1977 :15).

Pettipas (1977:11-15) bases his contention on Robert's (1961) "observations and opinions.", and on definitions of Angostura and Agate Basin points produced during a symposium at the 1964 Annual Meeting of the American Anthropological Association (Agogino et al. 1964:1351-1352).

While my study was not designed to address the Agate Basin-Angostura question, and I concede that some of the points from both types may appear similar in shape and manufacturing technique, I believe that for most of the collections Agate Basin and Angostura points are distinguishable primarily by flake scars and secondarily by base form. This does not preclude a developmental connection between Angostura and Agate Basin, as suggested by Pettipas (1982). In this Pettipas (1982:55) suggested that "Lusk" (Angostura) developed from the Agate Basin form, "...with parallel oblique flaking replacing the more irregular collateral mode typical of the Agate Basin type."

As to Irwin's (1968:105) contention that the term Angostura has been abused in the literature, I suggest it has not. He suggested that we "...return to a definition encompassing only sites of known areal and chronological connection." If I understand this correctly, Irwin did not believe that a separate projectile point type (Angostura) should have been named based on the attributes of artifacts found at the Ray Long site. Irwin stated that artifacts presented by Hughes (no reference given) in a preliminary article were from the surface and eroding from cutbanks at the Ray Long site. He further stated (1968:105) that from Wheeler's excavations, in one locality :

> "...only Agate Basin points and artifacts were found. It was C14 dated at 7430+500 B.C. (M-370), not too far from Agate Basin dates. In the second location, no points were found but some tools and both handstones and netherstones were discovered. It dated 5764+740 and 5123+330 B.C. (C-454), locating it definitely post Frederick. Now in Hughs' collections there are types conforming to what we call Lusk. It is just possible that they

> came from a level corresponding to the second location,..."

Irwin's contention that no Angostura points were recovered from excavations is not true. It is possible that Irwin did not have access to Wheeler's manuscript at the time of his writing. Wheeler (1957:528,560) clearly stated that Angostura point fragments were found in controlled excavations in Areas A and B (of A, B and C) at the Ray Long site. These correspond with Components C and B, respectively. Dates from Component B were 7715+740 B.P. (5766 B.C.) and 7073+300 B.P. (5123 B.C) (Wheeler 1957:556). While an Angostura point was recovered in Area A stratigraphically between two hearths (Wheeler 1957:560) and another was found in burned earth adjacent to a hearth (Wheeler 1957:563), I found no discussion relating to radiocarbon dating of these particular features. However a C14 date for Component C was given at 9380+500 B.P. (7430 B.C.) (Wheeler 1957:588). Wormington (1957:140) stated that the latter date was derived from hundreds of tiny pieces of charcoal recovered from various features within the same zone.

I find Wheeler's discussions on the location of the Angostura points to be clear, but the dates of Angostura at the Ray Long site are questionable. The same is true for Irwin's "Lusk" point type which he gave only as "at least 5920+230 B.P. (Irwin 1968:106). Wheeler's definition of the Angostura point type was devised from his examination of points recovered from the Ray Long site and excluded some measurement data taken from surface finds of Angostura points in Nebraska. Considering these facts, I find it difficult to understand Irwin's objection to the definition of Angostura points.

There have been many reports of Angostura points from Alaska to Texas, but the described points are primarily from the Plains. It isn't clear to me whether this accurately reflects distribution of parallel oblique flaked points of Angostura form or simply indicates a general lack of use of the term outside of the plains. I do not take exception with the use of the term "Angostura" to describe parallel oblique flaked projectile points of a comparable form, regardless of their geographical location.

Bryan (1980:77) attempted to restrict the definition of a "type" by defining a type as being limited to a specific group and time and a technological tradition as spanning cultural groups and time. As I see the Angostura point type, it conforms better to his definition of "tradition" than to "type." If we were to use Bryan's definitions, I believe we would be imposing restrictions on studying the reality of trade, migration of human populations, and the transmission of ideas through space and time. To be specific, the Angostura point type is part of the Parallel Oblique Flaked Projectile Point Tradition, as are the Browns Valley, Lovell Constricted and Pryor Stemmed point types.

Browns Valley, Lovell Constricted and Pryor Stemmed fit fairly well with Bryan's definition of a "type." I do not believe this is the situation with Angostura. In using the terms Angostura, Lusk, Frederick, and James Allen, distinguishing between the types is difficult as artifact attributes do not vary considerably. I have therefore suggested that at least Lusk and Frederick point types be subsumed under the Angostura point type. Angostura points range in age from ca. 8100 B.P. at Mummy Cave to ca 5500 B.P. at Pretty Butte. The reliability of the Pretty Butte date and many others associated with Angostura have been questioned. As things currently stand, the projectile point type appears to span about a 2500 year period. Obviously, in that time span we are not talking about a specific group of people. Therefore "Angostura point type" by Bryan's definition does not describe the reality of the situation. I believe definition of a "type" should be based on artifact attributes alone. With such a definition, a type's distribution in space and time could be more easily studied to interpret cultural processes. Sackett (1982:72-73), in his article on style, defines isochrestic form as:

> "the seemingly equally valid and feasible options we may regard as functional equivalents with respect to a given end constitute a spectrum of what I choose to term isochrestic form"

He further stated (1982:73) that:

> "given the large number of options that are at least potentially available, chance alone dictates that any single one is unlikely to be chosen by two

> societies which are not ethnically related in some fashion; and chance would appear to exclude altogether the possibility that the same combination of several such choices in different spectra of isochrestic form could be made by two unrelated societies."

The validity of these statements, to me, rests with the definition of ethnicity and the variety of variation viewed as optional. Sackett (1982:105) believes that style in artifact typology should not be bound, simply, to things such as "shaping" but isochrestic variation of all kinds should be considered. In this he includes:

> "choice of raw materials, knapping techniques for reducing cores and producing tool blanks, alternative types of marginal retouch and burin spalling, and varying edge angles and wear patterns. It may be reflected in the distinctive ways in which tools are used and rejuvenated before being discarded. It may exhibit itself in the extent and manner in which unstandardized 'ad hoc' tools are employed, or the degree to which the standardized ones are reproduced within narrow margins of tolerance. This last is an aspect of variation which seldom finds its way into formal systematics but which nonetheless can vary markedly between assemblages that are otherwise quite similar in their artifactual makeup and even type frequencies. None of these factors is typological in the conventional sense, but they can combine in distinctive fashions to lend a congruence or "family air" to artifact assemblages that is surely suggestive of ethnically meaningful style.

Here we come to the difference between lumpers and splitters. Sackett, I believe, is a "splitter." I see major problems with the practical applicability of his approach. The perception of such isochrestic variation from one researcher to another would only serve to introduce confusion rather than clarity. What would be similar? Is a single flintknapper, at any time, able to replicate, with machine accuracy, a previously produced tool? I doubt it. Where does isochrestic variation stop and individual variation began? What, in actuality, would be significant isochrestic variation and how would we interpret that variation?

To return to Irwin's introduction of the term Lusk because he perceived abuse of the term Angostura, I do not feel that he has proven that the term has lost its usefullness. Perhaps the perceived abuse was the result of poorly defined categories in the classification system rather than misidentification of projectile point type.

The question of whether or not the Frederick points actually should be classed with the Angostura point type was not conclusively demonstrated in my analysis. This was primarily due to the small sample of Frederick points (n=3). My analysis does suggest that the three Frederick points do not consistently vary in shape from Angostura points. Two of the three Frederick points fell into clusters with the analyzed Angostura points. This was not the case with James Allen points, but again the sample size (n=2) was too small for me to make conclusive statements. (Pettipas 1982:55-57) suggested that Frederick and Lusk belong to separate "Co-Traditions." Based on my demonstration of similarity of some attributes of the Frederick points and Lusk (Angostura) I believe that Pettipas' developmental sequence is in error.

As it currently stands, the situation requires that additional stylistic comparisons be made between collections of Frederick and James Allen points and Angostura points. As I previously pointed out there are difficulties in this task because the specimens are in widely dispersed, and occasionally unknown, locations. Ideally, the development of a single center to house significant collections from the region would be remarkably helpful to future research. This is likely an unrealistic dream, because it would require adequate funding sources as well as cooperation between researchers and Government Agencies.

As to the persistence of the Angostura point type in time and the diversity of the type in space, future research at sites bearing similar points, within and beyond this region, would greatly augment the current data base and likely clarify the questions raised here. The prospects of being able to date reliably the Angostura point type at the Pretty Butte site is good. Future research at the site should be considered. Our pursuing this line of inquiry could have great benefit for our understanding of stylistic variation in projectile points, the ethnic significance of such variation, and the transmission of technological traditions through time and space.

The intent of my research was not to define cultural complexes, but to compare similar, diversely named projectile point types within the Parallel Oblique Flaked

Projectile Point Tradition. I undertook this in an attempt to clarify suggested stylistic variability and elucidate order. The validity of my methods of comparison remains to be seen and more questions than answers resulted. At least for me, this was a necessary step toward understanding elusive relationships between various methods of classification and interpretation of the past.

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