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Surprise Valley Projectile Points and Their Chronological Implications

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Great Basin archaeologists continue to dispute important aspects of the regional projectile point sequence. Two alternative models are evaluated (the so-called "short" chronology originally developed by Heizer and others, and the "rejuvenation" model recently proposed by Flenniken and Wilke) in light of data from three sites in Surprise Valley, northeast California. All points in the sample were classified using a modified version of the Monitor Valley Key and their stratigraphic distributions assessed in light of predictions derived from the two models. Results support the "short" chronology; predictions derived from the Flenniken/Wilke model are rejected. Further tests involving obsidian hydration analysis are proposed. Implications for point typologies, stratigraphic interpretation, and regional sequences are discussed.

GREAT Basin archaeologists have a long-standing interest in the typology and chronology of local projectile points, primarily because of their potential utility as time markers in a region where other chronological indicators are few. Research on this topic has been aided by the development of taxonomic keys (Holmer 1978, 1986; Thomas 1981), but specialists continue to debate the definition of important types and their respective time ranges (e.g., Flenniken and Wilke 1989; Bettinger et al. 1991). Here we report the reanalysis of points from three stratified sites in Surprise Valley, northeastern California (Fig. 1). As originally presented, these data supported the so-called "short" chronology (O'Connell 1971, 1975) and are inconsistent with a recently proposed alternative, Flenniken and Wilke's (1989) "rejuvenation" model. Nevertheless, they are rejected by some analysts, partly because of uncertainty about the typological assignment of specimens, and partly because of ambiguities in their stratigraphic distribution (e.g., Aikens 1982). Our reanalysis clarifies taxonomic and stratigraphic issues, continues to support the short chronology over the time period represented by the Surprise Valley sites, and remains inconsistent with simple predictions based on the rejuvenation model. Problems with the short chronology persist both in other parts of the Basin and at earlier time periods in the vicinity of Surprise Valley. We outline research designed to solve these problems through obsidian hydration analysis, and discuss the implications of results achieved so far for current approaches to point taxonomy, stratigraphic interpretation, and the use of points as time markers.

TELLING TIME WITH PROJECTILE POINTS

The history of research on Great Basin point taxonomy and chronology has been reviewed many times (see Hester 1973; Heizer and Hester 1978; Holmer 1978, 1986; Thomas 1981; Beck 1984; Wilde 1985; Hughes 1986). The first systematic attempt to construct a regional point chronology was undertaken by Robert Heizer and his students beginning in the late 1950s (Baumhoff and Byrne 1959; Heizer and Baumhoff 1961; Lanning 1963; Clewlow 1967;

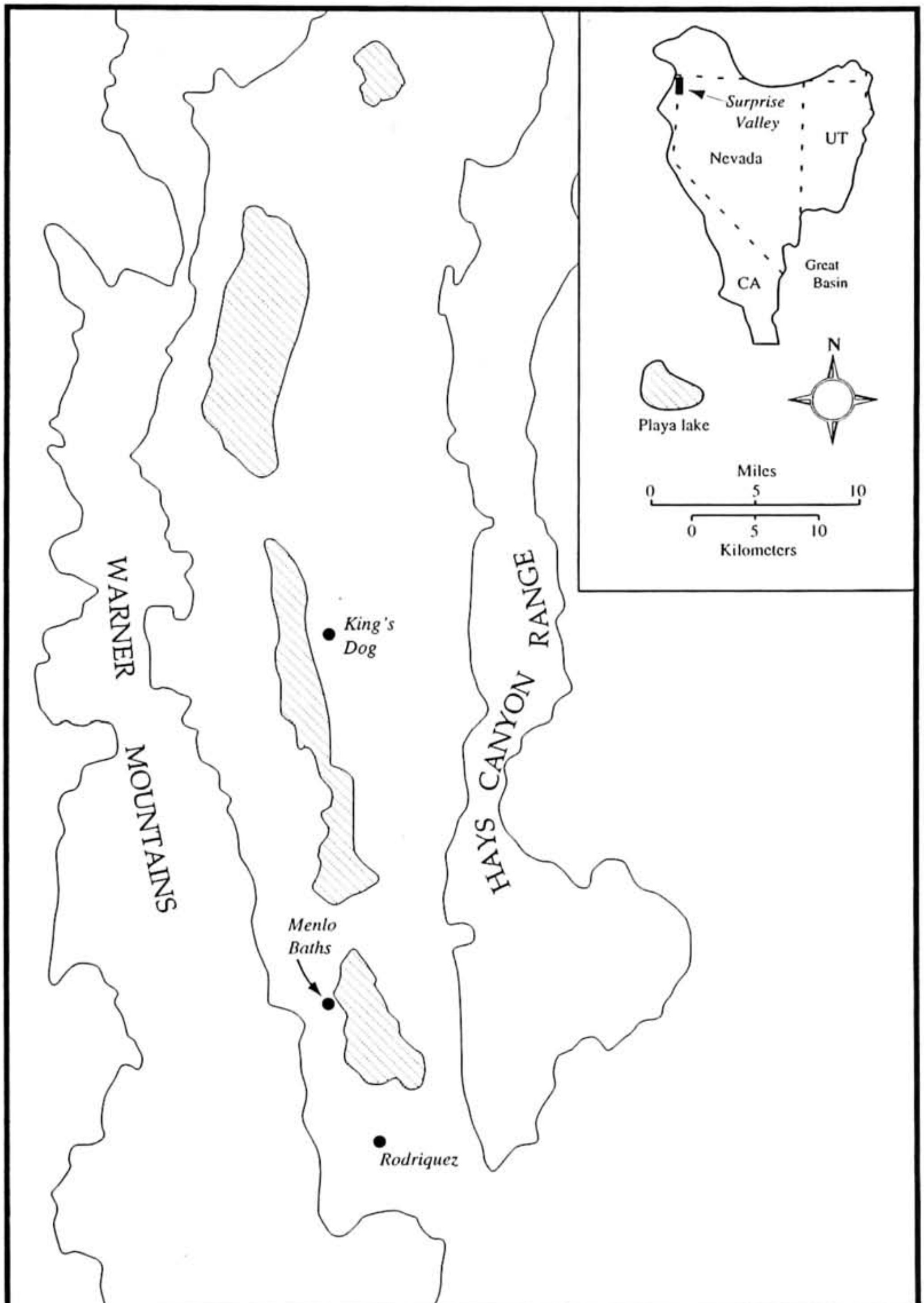

Fig. 1. Map of Surprise Valley showing location of sites mentioned in text.

O'Connell 1967). Using data from several sites in the western and central Basin, they proposed a four-part sequence spanning the past 4,500 years, each part marked by one or two characteristic point types (Table 1). Large stemmed and barbed forms, variously called Pinto and Little Lake, were identified as the earliest, followed in order by large corner-notched Elko points, small corner- and basal-notched Rose Spring and Eastgate types, and small, triangular Desert Side-notched and Cottonwood forms. This sequence, later called the "short" or "Berkeley" chronology, was important primarily because it allowed one to date surface sites by means of commonly encountered artifacts. Most reconstructions of regional settlement patterns in the western and central Basin rely heavily on this chronology (e.g., Weide 1968; Thomas 1971, 1988; Bettinger 1975, 1982; Elston 1982; Kelly 1985; Raven 1990).

Research in Surprise Valley in the late 1960s by O'Connell and others contributed to this work (O'Connell and Ambro 1968; O'Connell 1971, 1975; O'Connell and Hayward 1972; O'Connell and Ericson 1974). Excavations at three stratified, open sites, Rodriguez (CA-LAS-194), Menlo Baths (CA-MOD-197), and King's Dog (CA-MOD-204), yielded large point collections which arguably supported the short chronology and led to the addition of a fifth phase at the beginning of the sequence, defined by Northern Side-notched points (Table 1).

O'Connell's (1971) argument about the sequence was complicated in that the simplest reading of point distributions at these sites actually did *not* match the short chronology. Key types appeared in the predicted order, but once present persisted through all later deposits rather than disappearing at the anticipated times. In other words, the distributions of the types were *cumulative* rather than *successive*. O'Connell countered this by noting that each site had witnessed many episodes of prehistoric house construction, that at least some episodes had involved the excavation of sizable pits or depressions, and that each such prehistoric excavation had likely moved points from early deposits to later. Thus, he suggested, the cumulative nature of the sequence should not be surprising. He argued that a more accurate record of the original sequence might be preserved in collections of points found in direct association with house floors, presumably deposited only during the relatively short period of time each floor was in use. Inspection of these points (especially from the King's Dog site) yielded a dated sequence that matched the short chronology with the addition of the proposed early phase.

Despite this argument and others like it, the short chronology was rejected by Aikens (1970, 1982) and others, who observed that at sites in the eastern and northern Basin, important types had longer, less exclusive chronological ranges than those defined in the Berkeley model. At Hogup Cave, for example, Pinto, Elko, and large side-notched points (called Bitterroot but similar to Northern Side-notched) appeared together in large numbers in deposits of middle Holocene age (Aikens 1970). Once introduced, Elko points persisted to late prehistoric times. If these data were valid, some types in the short chronology (especially Elko) were useless as time markers. Critics countered that Aikens and others had misdefined key types and failed to appreciate the degree of stratigraphic mixing evident at the sites in question (e.g., Madsen and Berry 1975; Heizer and Hester 1978; Holmer 1986).

Important steps toward resolving this issue were taken by Thomas (1970, 1981, 1983), who developed a taxonomic key designed to ensure consistent assignment of points to types, and used it to classify the assemblage from Gatecliff Shelter, an unusually deep, well-stratified site in central Nevada. Some types were renamed in the process, notably Gatecliff, which was seen as formally and chronologically equivalent to

Table 1
SOME GREAT BASIN PROJECTILE POINT CHRONOLOGIES: SHORT VERSUS LONG

Time (^{14}C years B.P.)	Short Chronology (Clewlow 1967)	Surprise Valley Chronology (O'Connell 1975)	Monitor Valley Chronology (Thomas 1981)	Long Chronology (Holmer 1986)[a]
0	Desert series[b]	Desert Side-notched	Desert series	Desert series
1000	Rosegate series[c]	Rosegate series	Rosegate series	Rosegate, Elko series
2000				
	Elko series	Elko series	Elko series	Gatecliff Contracting-stem
3000				
4000		Bare Creek series[d]		Gatecliff, Elko series
	Pinto series		Gatecliff series[e]	
5000				
		Northern Side-notched		Northern Side-notched
6000				
7000				Northern Side-notched, Pinto, Elko series[f]
8000				Pinto series

[a] Eastern and northern chronologies, with simplification.
[b] The Desert series includes Desert Side-notched and Cottonwood type points.
[c] Rosegate includes Rose Spring and Eastgate types.
[d] Bare Creek points are similar to those variously described as Pinto.
[e] The Gatecliff series subsumes Pinto and similar forms under a single name (see Thomas [1981] for terminological details).
[f] Holmer (1986) distinguished Pinto from Gatecliff and Bare Creek.

types previously called Pinto, Little Lake, and Bare Creek (Table 1). Overall, Thomas's results provided strong support for the Berkeley model: points appeared in the predicted sequence with minimal overlap in distribution and in association with radiocarbon dates of expected ages.

Nevertheless, the situation remained complicated. Holmer (1978, 1986) used another, very different key to classify points from Hogup Cave and three other sites in the eastern Basin and nearby parts of the northern Colorado Plateau. His subsequent stratigraphic analysis essentially supported Aikens' "long" chronology, though with significant differences in detail (Table 1). Northern Side-notched, Pinto, and Elko points all appeared early in Holmer's (1978) sequence. Distributions of Northern

Side-notched and Gatecliff points partly matched those reported from other areas (including Surprise Valley). Pinto points were formally distinguished from Gatecliff (cf. Thomas 1981) and dated much earlier than the short chronology suggested. Elko points displayed several peaks in popularity, none of which coincided with the one stipulated by the Berkeley model.

Aikens et al. (1977), Beck (1984), Sampson (1985), Wilde (1985), and Hughes (1986) all reported results from various sites in southern Oregon and northern California that further complicated the picture. As a result, many analysts began to think in terms of at least two projectile point sequences, one for the northern and eastern Basin, and another for the western and central Basin (e.g., Thomas 1981; Holmer 1986).

Flenniken and Wilke (1989) recently added yet another dimension to the discussion. Using data from experimental manufacture and reuse, they suggested that certain differences in point shape were evidence of a repair or "rejuvenation" sequence. Two common forms, Elko and Northern Side-notched, are said to represent alternative initial stages. If broken, they are thought to have been discarded or in some cases repaired by reshaping, sometimes into Gatecliff and Humboldt points (the latter widely encountered in the Basin, but not generally identified as a time marker). Flenniken and Wilke saw the apparent co-occurrence of all four types at various sites over long time periods in the northern and eastern Basin (roughly Aikens' version of the long chronology) as consistent with their model. They rejected all evidence of a short chronology elsewhere on grounds that assignments of points to types, their stratigraphic distributions, or both, have been misunderstood. In the view of Flenniken and Wilke (1989), there is only one Basin point sequence and none of the larger types (Northern, Gatecliff, Elko, or Humboldt) are time markers within it. The Berkeley chronology was seen to be incorrect, as is any argument assuming its validity.

The Flenniken-Wilke model is unusual in that it attempts to explain, rather than simply describe and date, variation in projectile point shape, and so entails a broad range of predictions about artifact form, distribution, and relative frequency. Bettinger et al. (1991) evaluated one of these, namely that putatively recycled forms should be smaller in size on average than types representing earlier stages in the recycling sequence. Data from 31 sites were almost completely inconsistent with this prediction, leading Bettinger et al. (1991) to reject the Flenniken-Wilke argument. Wilke and Flenniken (1991) countered that the prototypes and recycled forms considered by Bettinger et al. (1991) "represent exhausted artifacts derived from some other population or populations no longer available for measurement" (Wilke and Flenniken 1991:173). In Wilke and Flenniken's view, the test is thus irrelevant. They reiterated that the co-occurrence of all stages in the proposed recycling sequence in stratified deposits at some sites requires rejection of the Berkeley chronology, while at the same time supporting their alternative model. Bettinger et al. (1991) maintained that data from the best stratified sites (notably Gatecliff) are inconsistent with both the "long" chronology and Flenniken and Wilke's attempt to account for it.

The Surprise Valley sites provide the basis for a further test. As indicated above, key point types co-occur in midden deposits at all three. This could be read as consistent with the Flenniken-Wilke model and inconsistent with the short chronology. Alternatively, as O'Connell (1971) suggested, these deposits could be seen as mixed through bioturbation. Only those points dropped or cached on house floors might reflect the true sequence. If so, and if the points were correctly typed, the short chronology would be supported and the Flenniken-

Wilke model rejected. The observation that successive house floors at King's Dog yielded essentially monotypic point assemblages in precisely the order predicted by the short chronology is especially telling. Still, since the points were initially typed by eye, without reference to metric criteria other than weight, it may be that the O'Connell classification was inconsistent, either internally or in comparison with those of other analysts. If so, the significance of these data as initially reported is open to question. Given the importance of the continuing controversy, reanalysis is essential.

RECLASSIFYING THE SURPRISE VALLEY PROJECTILE POINTS

Our first step was to reconsider the assignment of points to types. To do this, we used Thomas's (1981) Monitor Valley Key, which led us to consider seven attributes of point form, including overall shape and specific quantitative characteristics of width, shoulder angle, and basal form. During the reanalysis, we had no direct access to the original specimens. Data on points from King's Dog and Menlo Baths were taken from outline tracings which had been made on edge-punched cards when the pieces were first described. The cards also contained information on artifact weight and stratigraphic context. Points from the Rodriguez Site were retyped from drawings, photographs, and other data published by O'Connell and Ambro (1968). In most cases, this approach prevented us from determining whether points had been reworked.

The only serious problem we encountered was distinguishing Elko from Northern Side-notched (in Thomas's terms, Large Side-notched) points. O'Connell (1967, 1971:67) defined Elko points (after Heizer and Baumhoff 1961) as large, triangular, corner-notched specimens with short, broad stems. Thomas (1981:20-21) described them as large, corner-notched pieces, with basal widths > 10 mm. and proximal shoulder angles between 110° and 150°. Comparison of specimens typed as Elko in the Surprise and Monitor collections shows their close similarity (e.g., O'Connell 1971:pl. 11; Thomas 1983:figs. 70-79).

Definitions of Northern or Large Side-notched points are less consistent. O'Connell (1971:71-72) identified them (after Gruhn 1961) as "large, triangular or leaf shaped points, side notched, with straight to slightly convex sides and straight to deeply concave bases." Thomas (1981:18-19) intended his Large Side-notched type to include Northern Side-notched but, as he said, the type was poorly described in the Monitor Key because of the small number of specimens in his central Nevada collections. His type criteria were side-notched, weight ≥ 1.5 g., and proximal shoulder angle (PSA) > 150°. In applying these criteria to the Surprise Valley collection, we found that many points originally called Northern Side-notched were either judged untypeable (side-notched, but with PSA < 150°) or assigned to the Elko series, even though they were clearly side- rather than corner-notched.

Investigating this problem further, we plotted the distribution of proximal shoulder angle values for all measurable, large, stemmed, side- and corner-notched points. A clear trimodal pattern was found (Fig. 2), each mode corresponding to an established type. Thomas's (1981) suggested lower boundary for Elko points (PSA ≤ 110°) is supported, but the proposed > 150° threshold for Northern/Large Side-notched points misrepresents the observed pattern. We selected ≥ 140° as the PSA criterion for this type and reclassified the points accordingly. We retained the name "Northern Side-notched," acknowledging both Gruhn's (1961) terminological priority and conventional usage in the northern Basin and southern Columbia Plateau, where such points are encountered often.

The only other difficulty involved distinguishing finished Humboldt points from unfinished examples ("preforms") of other

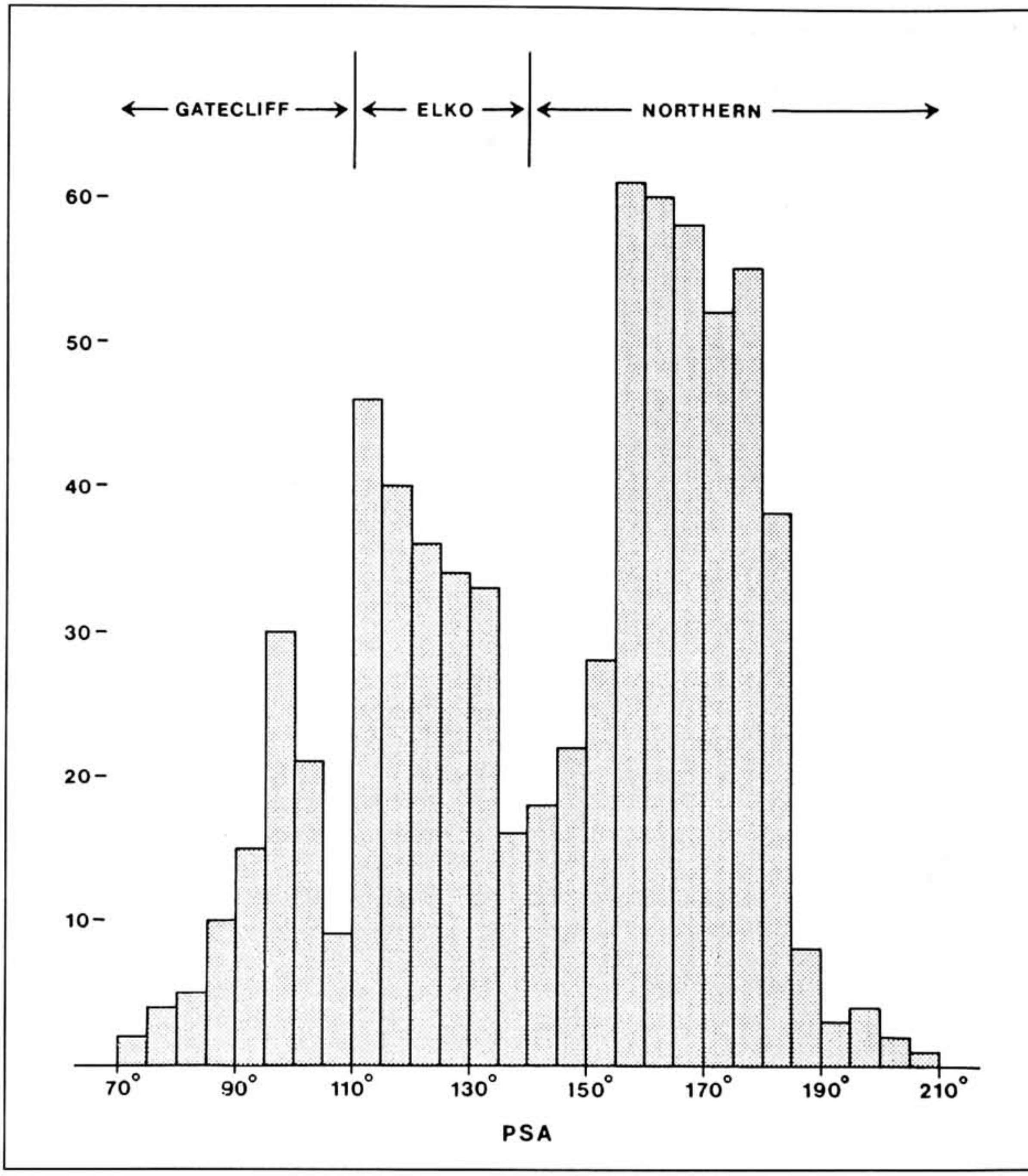

Fig. 2. Distribution of proximal shoulder angle (PSA) values for large points (wt. > 1.5 g.) in the samples from the Rodriguez, Menlo Baths, and King's Dog sites. Limits for Gatecliff, Elko, and Northern Side-notched series as indicated.

types (see Thomas 1981). Because most specialists (e.g., Clewlow 1967; Heizer and Hester 1978; Holmer 1978, 1986) agree that neither Humboldt points nor preforms are time markers, the problem was not important in our reanalysis.

RESULTS OF RECLASSIFICATION

A total of 1,008 points was reanalyzed with about 460 being reclassified (see the Appendix for illustrations of a sample of specimens from King's Dog). Most changes were trivial (e.g., Elko Eared to Elko Corner-notched [cf. Hughes 1986:250, 256], and various locally named, small stemmed, and corner-notched forms to Rosegate), but 160 were potentially significant (Table 2). Nearly half of these (74) involved specimens that had been assigned to chronologically important types but are now unclassified. The Rosegate category lost a net 32 specimens, mainly to Elko and Gatecliff; Northern Side-notched and Humboldt were down a net 38 and 17 specimens, respectively, both primarily to the unclassified category. Elko and Gatecliff gained a net 21 and nine specimens, respectively.

Stratigraphic Implications

Following reclassification, stratigraphic distributions of all types in the sample were reassessed. The results are summarized below by site. Note that all purely descriptive types, except Humboldt, are collapsed into time-significant series (e.g., Elko Eared and Elko Corner-notched into Elko).

Rodriguez. This site is located on an alluvial fan at the mouth of Bare Creek, a perennial stream that enters Surprise Valley at its southwest corner. A road cut through its western edge reveals an extensive midden, 150 m. in diameter and up to two meters thick, capping the fan. The contents of the midden were sampled in a 35-foot long, five-foot wide trench dug to sterile subsoil near the center of the site. The trench transected at least 31 shallow, saucer-shaped house depressions, most arrayed in two parallel stacks about 1.5 m. apart, each stack extending from the bottom of the midden to near its top (Fig. 3). The trench was dug in arbitrary six-inch levels except where the presence of cultural features, mainly house floors, made stratigraphic divisions possible. Excavated sediments were passed through 1/4-in. (6 mm.) mesh screens and a sample of the cultural materials captured (including all artifacts recognized as potentially typeable projectile points) was saved. Few artifacts were recorded in direct association with house floors; most were provenienced by six-inch level. Three radiocarbon dates are available from the trench, all on burned house construction material. The earliest, 2,620 ± 80 RCYBP (UCLA-1222), is associated with a house floor at the base of the midden, 60 to 66 in. below ground surface; the second 2,150 ± 100 RCYBP (I-3209), with a floor 42 to 48 in. below the surface; and the latest 1,050 ± 100 RCYBP (I-3208), with a floor 20 in. below the surface. All structures may have had somewhat higher levels of stratigraphic origin than indicated by their depth from the modern ground surface.

One hundred projectile points were recovered from the excavated sediments (Table 3). Elko, Rosegate, and Gatecliff are the most common categories; Northern Side-notched, Humboldt, and Desert series (the last all Cottonwood Leaf-shaped) are also represented. The deposit was originally divided into three components (R I-III), each consisting of one or more six-inch levels. Levels were grouped on the basis of similarities in the composition of their respective projectile point assemblages. Component R-I included the lowest level (54 to 60 in.), distinguished by the predominance of Bare Creek (now Gatecliff) points; R-II, the next five levels (24 to 54 in.), dominated collectively by the Elko series; R-III, the top four levels (0 to 24 in.), marked by the first appearance of Rosegate types. Despite reclassification, this division remains the most obvious summary of the sequence. Chi square analysis indicates that differences in assemblage composition between

Table 2
SUMMARY OF POINT TYPE REVISIONS FROM REANALYSIS USING MONITOR VALLEY KEY

		Rodriguez	Menlo Baths	King's Dog	Total
Transfers between Pairs					
From	**To**				
various	not typed	10	15	49	74
Rosegate	Elko/Gatecliff	1	2	27	30
Elko	Gatecliff	10	3	3	16
Gatecliff	Elko	--	--	10	10
Elko	Northern Side-notched	--	1	4	5
Northern Side-notched	Elko	--	2	5	7
Northern Side-notched	Humboldt	--	9	1	10
other	various	3	2	3	8
Total		**24**	**34**	**102**	**160**
Transferred Into					
not typed		10	15	49	74
Rosegate		--	--	1	1
Elko		1	4	41	46
Gatecliff		11	5	6	22
Northern Side-notched		--	1	4	5
Humboldt		2	9	1	12
Transferred Out Of					
not typed/other		6	7	4	17
Rosegate		1	2	30	33
Elko		13	4	8	25
Gatecliff		2	--	11	13
Northern Side-notched		1	20	22	43
Humboldt		1	1	27	29

these components are statistically significant (Table 3).

Menlo Baths. This site is located on a low fault-scarp near permanent springs on the west side of the valley floor, 11 km. north of Rodriguez. It is defined as a large midden, more than 500 m. long (N-S) by about 100 m. wide. Because the site was extensively disturbed by construction earlier in this century, excavations were restricted to a 25-foot long, five-foot wide trench near its southern end. The midden is shallow there, except where buried house pits are present. The trench transected one of these, a large bowl-shaped feature roughly five meters in diameter and about one meter deep (Fig. 4). Its partly exposed floor (1.2 m. [42 to 48 in.]

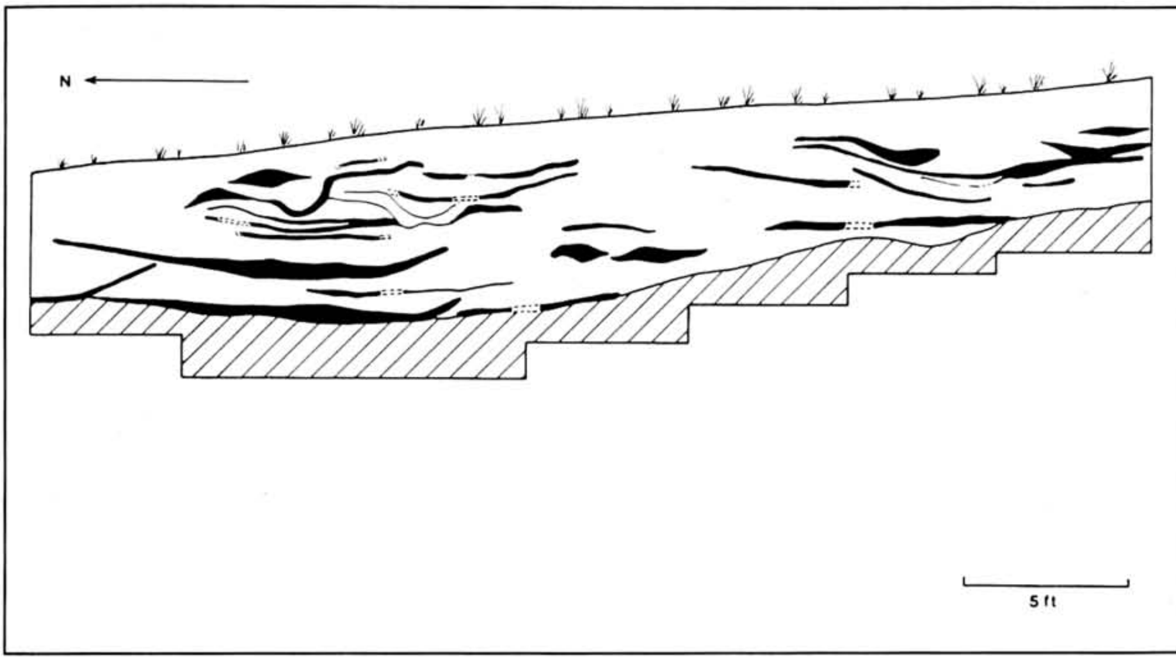

Fig. 3. Simplified stratigraphic section from the Rodriguez site (after O'Connell and Ambro 1968:Fig. 3). Dark strata are interpreted as house floors.

below the modern ground surface) yielded more than 70 identifiable implements, large quantities of debitage, and broken animal bones, all of which were saved. Overlying sediments (mostly contained within the limits of the pit and all stratigraphically above it) were divided into six-inch spits, screened, and a sample of the contents (including all typeable projectile points) retained. Two radiocarbon dates were obtained on collagen from bone found on the house floor. One (13,750 ± 250 RCYBP [I-4604]) is unacceptable; the other is 5,250 ± 120 RCYBP (I-4782).

Fifty-six percent of the points recovered from buried deposits are typed as Northern Side-notched (Table 4). Humboldt and Elko are the next most commonly represented points, followed in order by Gatecliff, Rosegate, and Desert series (Cottonwood Leaf-shaped) points. The deposit was originally divided into three components, defined (as at the Rodriguez site) on similarities in projectile point assemblages associated with arbitrary levels. The lowest component (M-I, 42 to 54 in., including the house floor) was marked by the exclusive presence of Northern Side-notched points; the middle (M-II, 18 to 42 in.) by the introduction of Elko, Humboldt, and Gatecliff forms; the latest (M-III, 0 to 18 in.) by the appearance of the Rosegate series. This division is still possible in the wake of reclassification. The only notable change is the appearance of a few Humboldt and Elko points on and underlying the house floor in M-I. Nevertheless, chi square analysis fails to support subdivision of the deposit on the basis of point distributions. Differences in type frequency across components could be a function of sample error (Table 4).

King's Dog. This site is located on a stabilized dune in a large complex of springs and marshes east of Middle Alkali Lake, near the center of the valley floor. Cultural deposits are like those at Rodriguez and Menlo Baths,

Table 3
DISTRIBUTION OF RECLASSIFIED POINTS BY LEVEL AT THE RODRIGUEZ SITE

Component	Depth (in.)	not typed	Humboldt	Northern Side-notched	Gatecliff	Elko	Rosegate	Desert	Total
R-III	0-6	--	--	--	1	2	9	--	12
	6-12	1	1	--	3	3	7	--	15
	12-18	1	--	1	1	8	5	1	17
	18-24	2	--	1	1	2	2	--	8
subtotal		4	1	2	6	15	23	1	52
R-II	24-30	--	1	--	1	1	--	2	5
	30-36	2	--	1	2	8	--	--	13
	36-42	--	2	1	3	5	--	--	11
	42-48	1	--	--	2	9	--	--	12
	48-54	--	--	--	--	--	1	--	1
subtotal		3	3	2	8	23	1	2	42
R-I	54-60	--	--	1	5	--	--	--	6
subtotal		--	--	1	5	--	--	--	6
Total		7	4	5	19	38	24	3	100

TESTS OF SIGNIFICANCE OF DIFFERENCES IN ASSEMBLAGE COMPOSITION BY COMPONENT

Chi Square Analyses

	Types[a]	df	χ^2	probability
R-II v R-III	GC-EL-RG	2	20.759	0.0001
R-I v R-II	GC-EL	1	7.309	0.0069
Fisher's Exact Test[b]				
R-I v R-II	GC-EL	--	--	0.0034

[a] GC = Gatecliff series; EL = Elko series; RG = Rosegate series.
[b] Fisher's Exact test is preferred where cell values are low.

differing in that at King's Dog they are deeper (>2.3 m.), cover a smaller area (roughly 100 m. in diameter), and have been less disturbed in recent times. Excavations were concentrated near the center of the site (ca. 75 m.^{2} exposed), with 10 five-foot-square pits scattered elsewhere. The large exposure revealed at least eleven house floors distributed from the bottom to near the top of the cultural deposit (Fig. 5). The five deepest floors (from lowest to highest: F28, F27, F39, F25, F26) were superimposed within a sub-circular house pit (Depression 1), 7.5 m. in diameter and about 90 cm. deep. All other floors were shallow, saucer-shaped

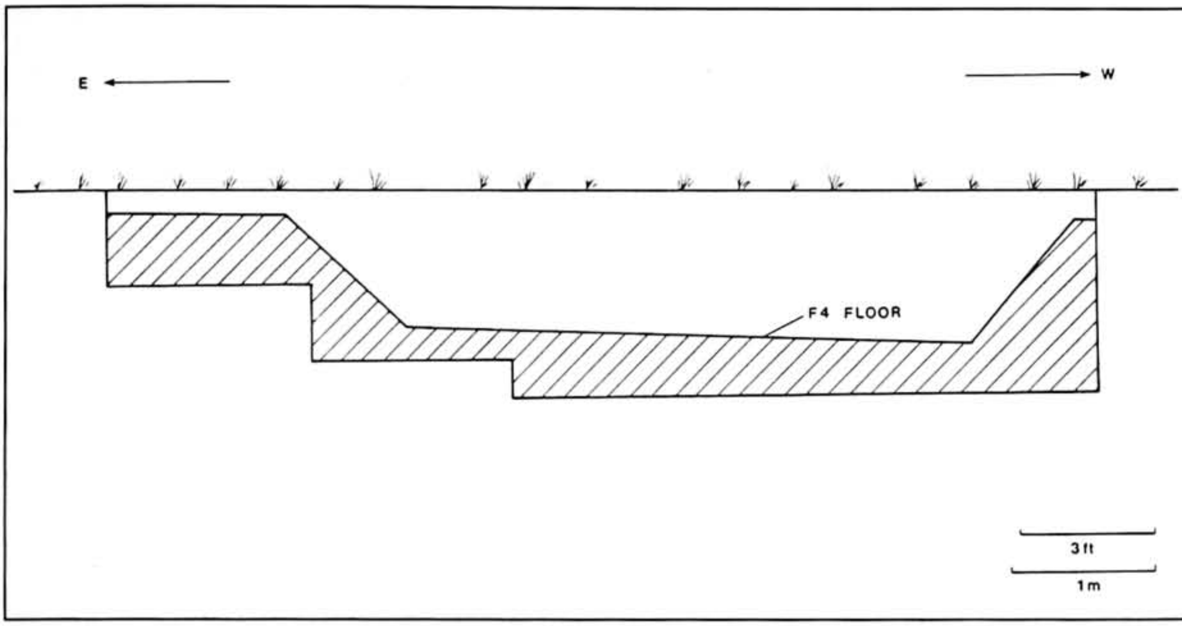

Fig. 4. Simplified stratigraphic section from the Menlo Baths site (after O'Connell 1971:Fig. 6).

features, 3.0 to 5.5 m. in diameter and from 10 to 45 cm. deep. Three (F19, F10, F16) were superimposed within a single depression (Depression 2). The remaining three floors (F69, F34, F1) appeared as isolated features. Excavation techniques were like those used at the other sites. All deposits were screened, and materials recovered were provenienced by six-inch levels, except where found in association with house floors. Two acceptable radiocarbon dates are available, one on collagen from bone on the second lowest house floor (F27) in the exposure (5,640 ± 155 RCYBP [UCLA-1770]), the other on wood charcoal from the highest floor (F1; 1,330 ± 90 RCYBP [GaK-2580]; see O'Connell and Ericson [1974] for a discussion of these and other dates).

Five hundred fifty projectile points were recovered from the main excavation (Table 5). Northern Side-notched points are the most common type (43% of the total), followed by Elko (24%), Gatecliff (11%), Rosegate (9%), and Humboldt (4%). Four Desert Side-notched points are also represented. The deposit was originally divided into four components, each consisting of several arbitrary levels, plus the contents of house floors originating in those levels (Table 5). The earliest (K-I) was dominated by Northern Side-notched, although Elko and Bare Creek points were also represented in small numbers. K-II was marked by the appearance of larger numbers of Bare Creek types; K-IV by Rosegate types. K-III/IV was seen as a mixed component dominated jointly by Elko and Rosegate points.

As reclassified, the points display a slightly different pattern (Table 5). Four types are present throughout the deposit: Northern Side-notched, Gatecliff, Elko, and Humboldt. Northern Side-notched points dominate the lower layers (86% of typeable points found below 48 in.), decline in relative frequency throughout most of the rest of the deposit, then increase in relative numbers above the 12-in. layer. Gatecliff forms are most common from 36 to 48 in. below the surface, Elko from 12 to 36 in. below the surface. Humboldt forms show no marked differences in relative frequency through time.

Table 4
DISTRIBUTION OF RECLASSIFIED POINTS BY LEVEL AT THE MENLO BATHS SITE

Component	Depth (in.)	not typed	Humboldt	Northern Side-notched	Gatecliff	Elko	Rosegate	Desert	Total
M-III	0-6	1	1	17	1	2	--	--	22
	6-12	1	7	8	2	7	1	--	26
	12-18	--	2	11	--	5	2	--	20
subtotal		2	10	36	3	14	3	--	68
M-II	18-24	1	6	11	1	1	--	--	20
	24-30	--	3	10	--	2	--	--	15
	30-36	2	1	13	1	6	--	--	23
	36-42	6	7	16	2	1	--	1	33
subtotal		9	17	50	4	10	--	1	91
M-I	42-48	1	1	13	--	--	--	--	15
	48-54	2	1	1	--	1	--	--	5
subtotal		3	2	14	--	1	--	--	20
Total		14	29	100	7	25	3	1	179

CHI SQUARE ANALYSES OF ASSEMBLAGE COMPOSITION BY COMPONENT

	Types[a]	df	χ^2	probability
M-II v M-III	HB-NS-EL	2	2.693	0.2602
M-I v M-II	HB-NS-EL	2	1.954	0.3764

[a] HB = Humboldt series; NS = Northern Side-notched; EL = Elko series.

Rosegate points appear at 36 in., coincident with the increase in relative frequency of Elko points; then persist in slightly increasing frequency through the rest of the deposit. Simple inspection suggests five components, with breaks at 12, 24, 36 and 48 in., respectively. Chi square analysis indicates that differences between point assemblages in all adjacent pairs of these components, except between K-III and K-IV, are statistically significant (Table 5).

As indicated above, large numbers of points were found on house floors at King's Dog (Table 6; see also the Appendix). They display a pattern quite different from the combined midden and house floor distributions shown in Table 5. On the lowest floors, Northern Side-notched points are by far the most common type. Gatecliff points are absent entirely and Elko and Humboldt forms are barely represented (<8% of all specimens). Gatecliff points are most common on the next three highest floors, but are displaced by Elko on the next two highest. Rosegate points are confined to the uppermost floor, where they are accompanied by single examples of Gatecliff and Elko. Chi square and Fisher's Exact tests indi-

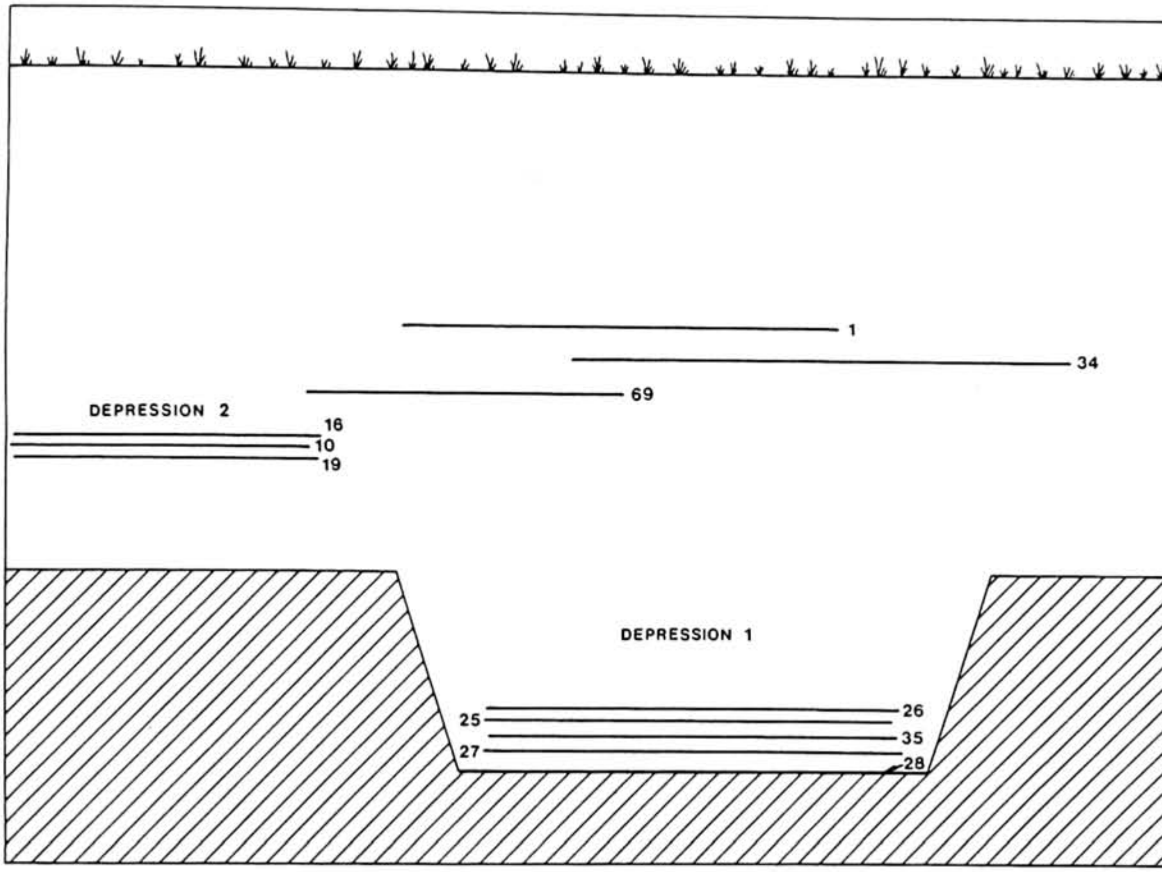

Fig. 5. Schematic view of stratigraphy at the King's Dog site (from O'Connell 1971:Figs. 9-11).

cate that point assemblages on all sets of adjacent house floors differ significantly in type composition.

Summary

Overall, the stratigraphic picture from these three sites differs little from that reported initially, despite the 16% change in chronologically significant assignments to types. Points display roughly parallel changes in relative frequency at each site and, once present, tend to persist through higher levels. Type distributions on King's Dog house floors still differ from those in the surrounding midden. The major differences from the original presentation are the absence of a statistical basis for subdividing the Menlo Baths deposit stratigraphically, the evidence for a different subdivision of the King's Dog midden, and the appearance of greater (but still absolutely small) numbers of Gatecliff, Elko, and Humboldt points in early deposits at King's Dog and Menlo Baths.

ANALYSIS

These results can be used to evaluate both the short chronology and the Flenniken-Wilke model. Consider the short chronology first. Based entirely on archaeological observations (i.e., dated sequences from many sites other than those in Surprise Valley [Heizer and Hester 1978; Thomas 1981]), it proposed that at any given time during the middle and late Holocene, people in the Great Basin used points of just one or two basic types (e.g., Humboldt and Elko); that at specified times, they stopped using some types in favor of others; and that changes in

Table 5
DISTRIBUTION OF RECLASSIFIED POINTS BY LEVEL AT THE KING'S DOG SITE

Component	Depth (in.)	not typed	Humboldt	Northern Side-notched	Gatecliff	Elko	Rosegate	Desert	Total
K-V	0-6	--	--	11	1	5	5	1	23
	6-12	1	2	14	1	6	6	1	31
subtotal		1	2	25	2	11	11	2	54
K-IV	12-18	6	3	11	6	16	11	--	53
	18-24	4	2	15	7	32	7	1	68
subtotal		10	5	26	13	48	18	1	121
K-III	24-30	5	1	20	12	40	14	1	93
	30-36	3	4	30	12	20	9	--	78
subtotal		8	5	50	24	60	23	1	171
K-II	36-42	5	2	13	15	8	--	--	43
	42-48	4	--	23	6	--	--	--	33
subtotal		9	2	36	21	8	--	--	76
K-I	48-54	3	3	15	--	1	--	--	22
	54-60	3	1	10	1	2	--	--	17
	>60	5	4	76	1	3	--	--	89
subtotal		11	8	101	2	6	--	--	128
Total		39	22	238	62	133	52	4	550

CHI SQUARE ANALYSES OF ASSEMBLAGE COMPOSITION BY COMPONENT

	Types[a]	df	χ^2	probability
K-IV v K-V	NS-GC-EL-RG	3	14.538	0.0023
K-III v K-IV	NS-GC-EL-RG	3	2.573	0.4622
K-II v K-III	NS-GC-EL-RG	3	32.74	0.0001
K-I v K-II	NS-GC-EL	2	38.133	0.0001

[a] NS = Northern Side-notched; GC = Gatecliff; EL = Elko series; RG = Rosegate.

Table 6
DISTRIBUTION OF RECLASSIFIED POINTS ASSOCIATED WITH HOUSE FLOORS AT THE KING'S DOG SITE

House Floor Number	Level of Origin (in.)	no type	Humboldt	Northern Side-notched	Gatecliff	Elko	Rosegate	Total
1	27-30	--	--	--	1	1	6	8
34	27-30	--	--	1	--	9	--	10
69	30-36	--	--	1	3	8	--	12
16	36-40	--	--	1	7	2	--	10
10	36-42	--	--	--	6	1	--	7
19	40-44	--	--	--	3	--	--	3
25	56-60	1	--	21	--	1	--	23
27	56-60	--	1	22	--	1	--	24
28	56-60	1	1	19	--	1	--	22
Total		2	2	65	20	24	6	119

TESTS OF SIGNIFICANCE OF DIFFERENCES IN ASSEMBLAGE COMPOSITION BY HOUSE FLOOR SET

	Types[a]	df	χ^2	probability
Chi Square Analyses				
1 v 34/69	EL-RG	1	15.126	0.0001
34/69 v 16/10/19	CC-EL	1	16.014	0.0001
16/10/19 v 25/27/28	NS-GC	1	71.022	0.0001
Fisher's Exact Test[b]				
1 v 34/69	EL-RG	--	--	<0.0001
16/10/19 v 25/27/28	NS-GC	--	--	<0.0001

[a] GC = Gatecliff series; EL = Elko series; RG = Rosegate series; NS = Northern Side-notched.
[b] Fisher's Exact test is preferred where cell values are low.

type preference occurred in a consistant sequence. Apart from the shift from large to small points ca. 1,300 B.P. (which likely represents the appearance of the bow and arrow), none of these patterns are explained. They are empirical generalizations based on dated sequences. Archaeologically, the short chronology predicts that under the simplest circumstances, point assemblages deposited within relatively short periods of time (i.e., over several centuries) will consist of only one or two types; that at stratified sites used over longer time periods, more point types will be represented and will occur in a specified sequence; and that where datable, various types will occur in deposits of predictable ages.

These expectations may be complicated by post-depositional processes. Nonhuman organisms living in sites redistribute things stratigraphically. Surface traffic (i.e., trampling or "treadage and scuffage") may be similarly disruptive, moving objects some distance vertically from their original levels of deposition (e.g., Villa and Courtin 1983; Gifford-Gonzalez et al. 1985; Hofmann 1986). Such displacement may be difficult to detect through simple inspection of site stratigraphy (e.g., Madsen and Berry 1975; Villa and Courtin 1983). As indicated above, prehistoric excavation may also have an important impact. The net effect of these and other stratigraphically disruptive processes will depend on their respective frequencies and intensities, the physical characteristics of the archaeological materials involved, and the nature of the surrounding sedimentary matrix. At sites where sedimentation rates were high, the intensity of site use low, and nonhuman bioturbation limited, the relationship between the stratigraphic distribution of artifacts observed archaeologically and their original order of deposition may be close; where the opposite circumstances prevail, less so.

These and other potential problems notwithstanding, the question is whether the short chronology accurately predicts the distribution of putatively time-sensitive points in the Surprise Valley sites. To answer it, we compared observed assemblage composition in each component with its expected composition based on the short chronology. If observed and expected type frequencies are similar, the model is not refuted. If they are different, either the model is wrong or the sediments under consideration are too mixed to provide an accurate measure of change in point use through time. Given the stratigraphic histories of these sites, mismatches may be anticipated even if the model is accurate.

Comparisons entailed the use of Kolmogorov-Smirnov (K-S) tests on cumulative frequency data (see Thomas 1988:394-414 for background). To illustrate, the model predicts that Northern Side-notched points will be the only time-sensitive type represented in deposits dated 4,500 to 6,500 B.P. (Humboldt points may also be present, but according to the model, are not good time markers and thus not implicated in the array of predictions derived.) Component K-I at King's Dog falls within this time period. Figure 6a shows the points from this component (minus Humboldt) tabulated on a cumulative graph and matched against expected values for a model assemblage of the same size (all Northern Side-notched, n = 109). The curves are similar. A K-S test indicates the maximum difference (D^{max}) between them must exceed 0.184 if they are to be judged significantly different at the 0.05 confidence level. In this case, $D^{max} = 0.073$; thus, the differences between the curves could be a function of sample error. The short chronology is not rejected. Figure 6b shows the same test applied to data from the overlying component, K-II. Here the model assemblage consists entirely of Gatecliff points (n = 65). In this case, $D^{0.05} = 0.239$; $D^{max} = 0.554$. The actual sample is significantly different. Either the short chronology does not predict point assemblage composition in this time period or the sample does not reflect the assemblage as originally deposited.

Table 7 shows the results of analysis for midden components from each site. Early assemblages generally match predictions based on the short chronology, later ones do not. This could mean either that the model predicts point distribution in some time periods but not others, or that some components are more mixed than others. The latter interpretation was originally favored on grounds that construction of house pits might lead to the frequent introduction of points from earlier to later contexts. The general pattern of point distribution in all three

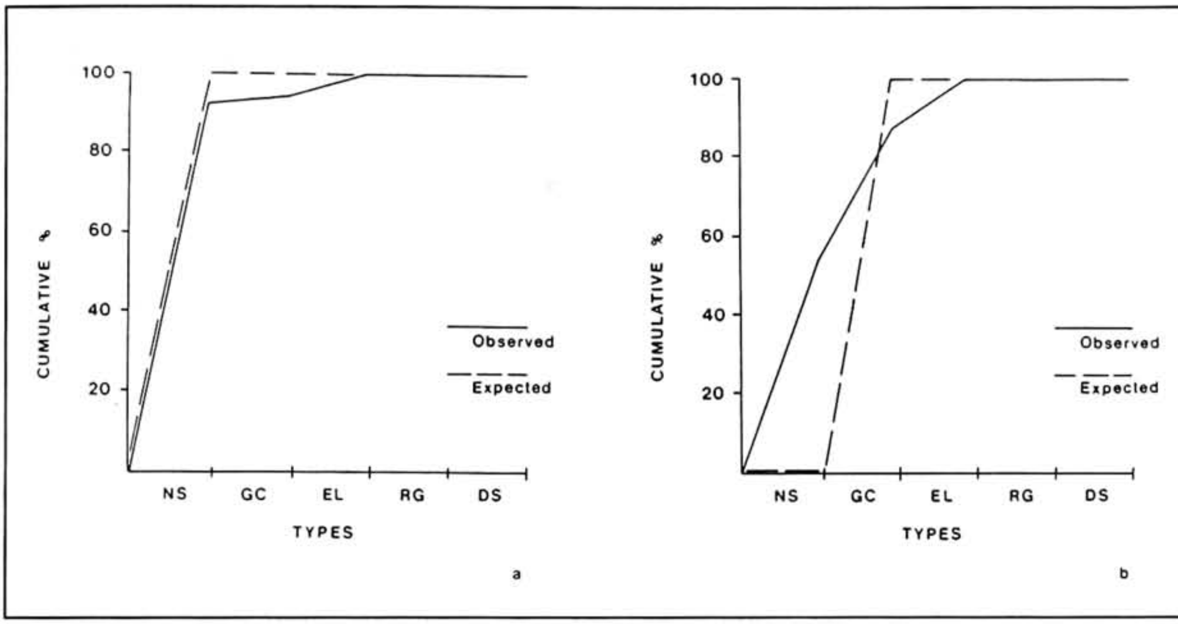

Fig. 6. Cumulative graphs of relationship between expected and observed numbers of projectile points by series: a) King's Dog component K-I, b) King's Dog component K-II.

middens is still consistent with this proposition.

House floor assemblages at King's Dog provide the opportunity for another series of tests. Floors at this site are generally defined as dark, carbon-stained zones up to 5 cm. thick. While occupied, they were likely loose and permeable due to constant traffic. As argued originally (O'Connell 1971), points lost on a floor and subsequently recovered from the carbon-stained zone that defines it should provide an accurate indication of the type(s) then in use. This expectation is potentially complicated in at least two ways: floors may have penetrated significantly older strata, whose contents may be mixed in the carbon-stained zone as it forms, and may be impossible to distinguish from items deposited on (or more precisely, "within") the trampled surface while it was in use; and once abandoned, floors may have been reoccupied by people using later, typologically different assemblages.

Despite these potential problems, *none of the King's Dog house floor assemblages differs significantly from predictions based on the short chronology* (Table 7; see also the Appendix). This result is important because it is precisely the kind of stratigraphic test called for by Wilke and Flenniken (1991), because the predicted type distributions are complex, and because they might have been disrupted by several processes operating independently on the original sequence of deposition. The close match between predicted and observed distributions seems unlikely unless the underlying chronological model is accurate.

Now consider the Flenniken-Wilke model. Initially, one might suggest that our failure to falsify the short chronology with the best stratigraphic data set available from Surprise Valley means that Flenniken and Wilke cannot be right, but this does not necessarily follow. The four key types are, in fact, present in most components with sizable point assemblages, just as the simplest argument based on their model would lead one to expect; and in any case, strictly speaking, our failure to falsify the short chronology does not make it right, only not wrong.

How then can we test Flenniken and Wilke's

Table 7
KOLMOGOROV-SMIRNOV TESTS OF POINT FREQUENCIES IN SPECIFIED COMPONENTS, PREDICTIONS BASED ON THE SHORT CHRONOLOGY

	D^{max}	$D^{0.05}$	Significant[a]
King's Dog			
K-IV v Rosegate	0.821	0.187	Yes
K-III v Elko	0.475	0.153	Yes
K-II v Gatecliff	0.554	0.239	Yes
K-I v Northern Side-notched	0.073	0.184	No
Menlo Baths			
M-III v Rosegate	0.946	0.257	Yes
M-II v Elko	0.769	0.239	Yes
M-I v Northern Side-notched	0.067	0.497	No
Rodriguez			
R-III v Rosegate	0.489	0.281	Yes
R-II v Elko	0.278	0.321	No
R-I v Gatecliff	0.143	0.786	No
King's Dog house floors			
1 v Rosegate	0.25	0.68	No
34/69 v Elko	0.22	0.41	No
16/10/19 v Gatecliff	0.15	0.43	No
25/27/28 v Northern Side-notched	0.05	0.24	No

[a] There is a significant difference between predicted and observed frequencies if $D^{max} > D^{0.05}$ (see Thomas 1988).

argument further? One approach is to use it to develop predictions about variation in type representation through time and space. For example, if Flenniken and Wilke are right, the relative frequencies of prototypes and recycled forms might be expected to vary as a function of access to toolstone. Where toolstone is readily accessible, prototypes may be abundant; where toolstone is more expensive to procure, recycling may be frequent and recycled forms more common. To simplify analysis, it was initially assumed that at Surprise Valley sites, access to toolstone did not vary through time (see below). Thus, at each site, all other things being equal, proportions of types covered by the model (Northern Side-notched, Elko, Gatecliff, and Humboldt) should be similar throughout the deposit. This prediction can be tested by contingency analysis. Significant differences in point representation between components are grounds for rejecting the proposition. The absence of significant differences is equivocal: it could reflect *either* constant proportions of types discarded *or* stratigraphic mixing.

Results of analyses are presented in Table 8. Adjacent components are compared in two ways: numbers of points representing each of the four critical types, and numbers of points

Table 8
CONTINGENCY ANALYSES OF POINT[a] FREQUENCIES IN ADJACENT LEVELS PREDICTED BY THE FLENNIKEN/WILKE MODEL

	χ^2	df	p	Significant
Rodriguez				
R-II v R-III				
HB v NS v GC v EL	0.59	3	0.90	No
(NS + EL)[b] v (GC + HB)[c]	0.03	1	0.86	No
Menlo Baths				
M-II v M-III				
HB v NS v GC v EL	2.70	3	0.44	No
(NS + EL) v (GC + HB)	0.30	1	0.59	No
M-I v M-II				
(NS + EL) v (GC + HB)	0.88	1	0.35	No
King's Dog				
K-V v K-IV				
HB v NS v GC v EL	14.31	3	0.0025	Yes
(NS + EL) v (GC + HB)	1.21	1	0.2709	No
K-IV v K-III				
HB v NS v GC v EL	2.73	3	0.0001	Yes
(NS + EL) v (GC + HB)	0.01	1	0.9418	No
K-III v K-II				
HB v NS v GC v EL	20.92	3	0.0001	Yes
(NS + EL) v (GC + HB)	3.66	1	0.0558	Probably Yes
K-II v K-I				
HB v NS v GC v EL	39.77	3	0.0001	Yes
(NS + EL) v (GC + HB)	17.53	1	0.0001	Yes

[a] point types: HB = Humboldt; NS = Northern Side-notched; GC = Gatecliff; EL = Elko.
[b] types defined as primary.
[c] types defined as recycled.

representing early (Northern Side-notched plus Elko) versus late (Gatecliff plus Humboldt) stages in recycling. The Rodriguez and Menlo Baths assemblages show no significant differences between components on either measure, and at King's Dog no differences on two of eight paired comparisons. Five of the remaining six comparisons show significant differences; the sixth probably does. These six suggest that this particular proposition, based on the Flenniken-Wilke model, should be rejected; all other results are equivocal.

A further set of tests involves points found in association with house floors (Table 9). Contrary to expectations based on the Flenniken-Wilke model, all five analyses show highly significant differences in type representation through time. Recall that these same data were consistent with predictions based on the short chronology.

Now reconsider the assumption that access to toolstone was constant. Hughes' (1986) obsidian-source analysis suggested that, in fact, such access varied through time in Surprise Valley, and may have affected the relative proportions of various point types.[1] When toolstone was more costly to procure, points may have been recycled more often; and conversely, more accessible toolstone would lead to less recycling. If this was the case, one might expect an inverse relationship between prototypes and recycled forms across components within a single site. Analysis of pertinent data from Tables 3-5 shows the opposite pattern, a significant *positive* relationship between numbers of prototypes and recycled forms (for 11 components, $r = 0.66$, $\underline{p} = 0.0272$). Restricting the analysis to assemblages with a smaller range of variation in total size yields a similar but statistically not significant result (for six components with 30 to 100 points each, $r = 0.55$, $\underline{p} = 0.259$).

Still another set of tests is possible, this one comparing the distribution of types found on King's Dog house floors with those in the surrounding midden. The Flenniken-Wilke model implies no significant differences in these distributions, but O'Connell's interpretation of the sequence suggests they might well be apparent. Table 9 shows the results of analyses designed to evaluate this possibility. The first test compares points from floors (F34 and F69) in Component K-III at King's Dog with those in the surrounding midden (the 24 to 36-in. level). According to O'Connell's interpretation of the sequence, Elko points will be more common on these floors than in the surrounding, putatively bioturbated midden. The second test compares points from floors (F16, F10, and F19) in Component K-II with those from the surrounding 36 to 48-in. midden. Here Gatecliff points should be overrepresented on house floors but underrepresented in the midden. Both predictions are strongly supported. These well-defined patterns are unanticipated by the Flenniken-Wilke model.

DISCUSSION

These results, coupled with those reported by Bettinger et al. (1991), lead us to be skeptical of the Flenniken-Wilke model as a general explanation for temporal patterning of Great Basin projectile points. This does not mean that recycling was not practiced nor that it had no effect on point assemblage composition. It simply was not important enough to overshadow patterns in these assemblages accurately described by the Berkeley model.

Given the importance of this problem, one might well anticipate objections to our conclusions. Ultimately, it should be possible to resolve the issue by appeal to hydration analysis (Layton 1970; cf. Hughes 1986:118-120). More than 95% of the points recovered from the Surprise Valley sites are made of obsidian. At King's Dog, an estimated 50% are from a single source (Hughes 1986). If the Flenniken-Wilke model is correct, the King's Dog points from this source in each of the four point forms in question should display a broad, fully overlapping series of hydration values. If, on the other hand, the short chronology is correct, hydration values should vary closely with type in the predicted sequence. Further, putatively early types found in later deposits (e.g., Northern Side-notched points from levels above 48 in.) should have anomalously high hydration values; those found "out of place" in early deposits (i.e., Gatecliff and Elko points recov-

Table 9
CONTINGENCY ANALYSES OF KING'S DOG HOUSE FLOOR ASSOCIATED POINT[a] FREQUENCIES PREDICTED BY THE FLENNIKEN/WILKE MODEL

	χ^2	df	p	Significant[b]
F34/69 v F16/10/19				
NS v GC v EL	18.48	2	0.0001	Yes*
(NS + EL)[c] v GC[d]	16.04	1	0.0001	Yes
F16/10/19 v F25/27/28				
NS v GC v EL	71.19	2	0.0001	Yes*
(NS + EL) v GC	59.69	1	0.0001	Yes*
(NS + EL) v (GC + HB)[e]	51.77	1	0.0001	Yes
House floors v surrounding midden				
24 to 36-in. floors v 24 to 36-in. midden				
(NS + GC) v EL	15.45	1	0.0001	Yes
36 to 48-in. floors v 36 to 48-in. midden				
(NS + EL) v GC	26.98	1	0.0001	Yes

[a] point types: NS = Northern Side-notched; GC = Gatecliff; EL = Elko; HB = Humboldt.
[b] * = analyses in which expected values in one or more cells <5.
[c] types defined as primary.
[d] a type defined as recycled.
[e] types defined as recycled.

ered below 48 in., Tables 5-6) should have relatively low values.[2]

While we expect the results of this analysis to support the Berkeley model, they will not end the argument about regional chronology. The Surprise Valley sequence and the short chronology cover only the last 6,000 years. Data from older sites in the northern Basin apparently indicate that some forms with restricted distributions in this time range (notably Elko) were also used earlier in the Holocene (e.g., Aikens et al. 1977; Beck 1984; Sampson 1985; Wilde 1985; but see Hughes 1986:104-110). Holmer's (1986) analysis indicates an even more complicated sequence in the eastern Basin. As others have observed (Thomas 1981; Holmer 1986), neither the Berkeley model nor the long chronology accurately describes Holocene projectile point distributions throughout the entire Great Basin.

Resolving this issue will require two things: consistent taxonomy and better time control. Thomas (1981) and Holmer (1986) made important advances on the taxonomic front by developing quantitative keys (see also Wilde 1985). The problems we encountered in applying Thomas's key, and the absence of any published evidence that his and Holmer's keys yield assignments consistent with one another, suggest that there is still important work to be done in this area.

Time control also remains a problem. While acknowledging Wilke and Flenniken's (1991) point about the importance of stratigraphic tests, it seems unlikely that these will be sufficient. Refitting exercises done elsewhere over the past decade show that even sites that appear to be well-stratified may not be (e.g., Villa and Courtin 1983; Hofmann 1986; Richardson 1992).

Independent time control is essential, and over much of the Basin, obsidian hydration can potentially provide it. One might expand the dating exercise proposed above to encompass a sample of sites in the northern Basin that have yielded large samples of points from a few known (or knowable) sources, then extend it to other parts of the Basin where obsidian was extensively used as toolstone. Danger and Hogup caves, long the focus of argument about the integrity of their respective sequences, are obvious candidates.

As patterns in the temporal and spatial distributions of projectile points become better described, local archaeologists can begin to confront the questions most have avoided from the outset. What do these patterns mean in behavioral terms? Why are some point types favored widely at some times and in some places, but not at others? Flenniken and Wilke deserve credit for addressing these issues directly. Testable predictions derived from their model have helped eliminate potential explanations.

Obvious alternative explanations are few. "Style," used as a shorthand term for ethnic or linguistic affiliation, has been proposed for years but there is no real warrant for it, at least as applied to projectile points. The near continent-wide distribution of many of these types seems inconsistent with this line of argument and makes it difficult to test.

Functional explanations are also possible, though few have been nominated. So far, the most plausible may be Holmer's (1986) suggestion that point form reflects hafting technique, side- and corner-notched points having been secured with sinew, contracting stem points with resin or pitch. This idea remains to be tested, but, even if supported, begs the question of implied variation in the spatial and temporal distribution of hafting techniques. Still, like Flenniken and Wilke's technological argument, it is a step toward solving a problem which deserves further attention.

NOTES

1. Grayson (1993:275) suggested that the differential relationships between point types and obsidian sources documented by Hughes (1986) mean that Flenniken and Wilke's model cannot be right. We disagree on the ground that differences in the costs of access may affect the recycling frequency and, by extension, the relative representation of types made of materials from different toolstone sources.

2. Layton (1985) has already run a version of the test we propose on point collections from two sites on the High Rock Plateau, just east of Surprise Valley. Although the samples are small and (more important) incompletely controlled with respect to quarry source, the patterns they display are generally consistent with expectations based on the short chronology, and correspondingly inconsistent with those predicted by Flenniken and Wilke. It seems unlikely that better control on source provenience would improve the fit with the Flenniken-Wilke model, but it might do so with respect to the short chronology.

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APPENDIX

It would be useful to publish illustrations of all projectile points recovered from buried deposits at the King's Dog, Menlo Baths, and Rodriguez sites, but the large number of points and the expense of illustration dictate against this. The inherent ambiguity in the "stratigraphic" provenience of artifacts excavated by arbitrary level also limits the utility of some of these data. For these reasons, we illustrate only those points recovered from most secure stratigraphic contexts, house floors at King's Dog (Figs. 7-16), plus a selection of specimens

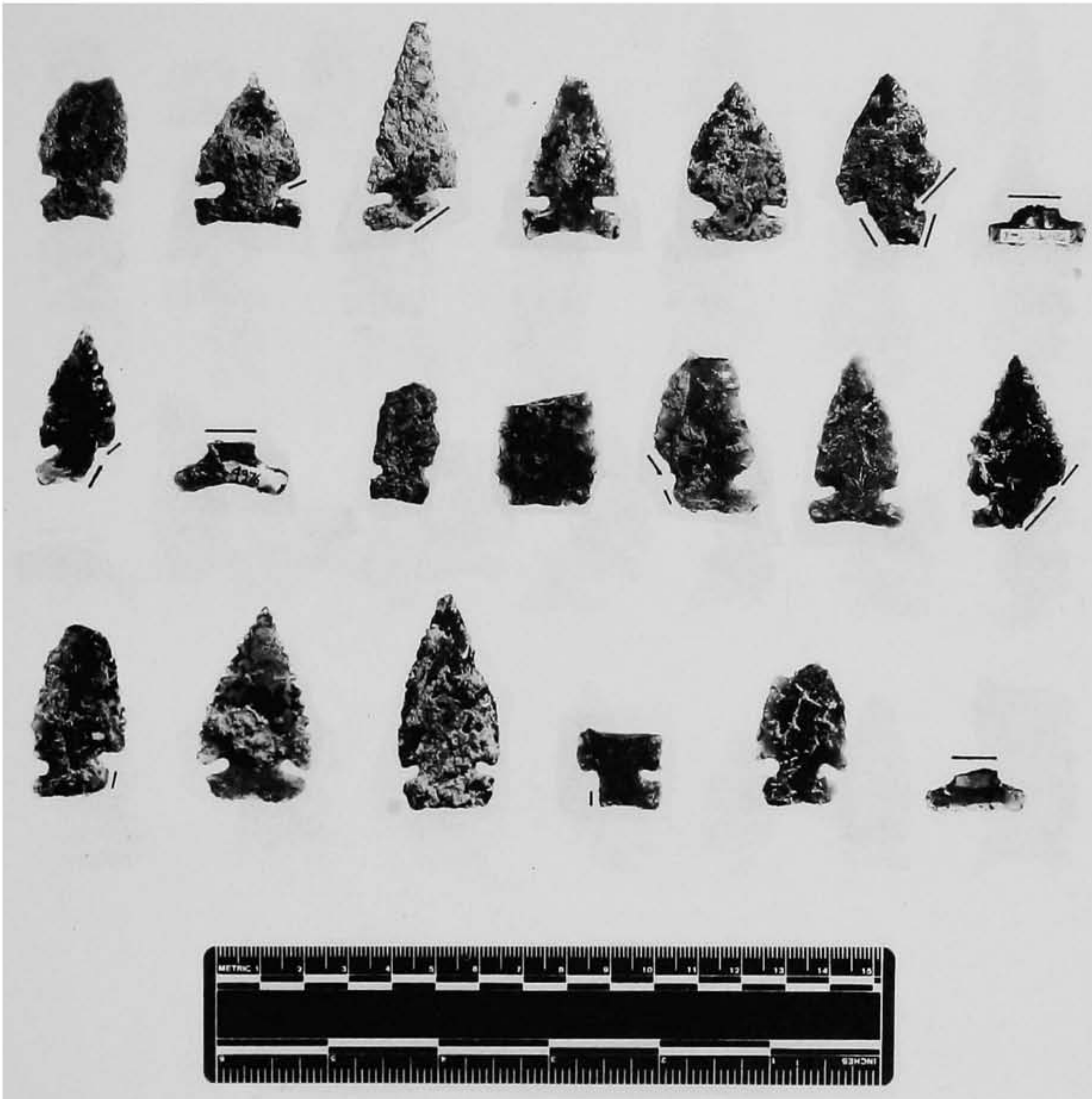

Fig. 7. Points from Feature 28, King's Dog (all Northern Side-notched except as noted). Row 1 (top), left to right: 1-227651, 1-227652, 1-227704, 1-227706, 1-227809, 1-227813, 1-227963; Row 2: 1-228188, 1-228190, 1-228448, 1-228565 (Humboldt), 1-228754, 1-228792, 1-229100; Row 3: 1-229101 (no type), 1-229263, 1-229323, 1-229327, 1-229334, 1-230335. Missing specimens: 1-183829 (PSA = 145), 1-183830 (Elko, PSA = 130).

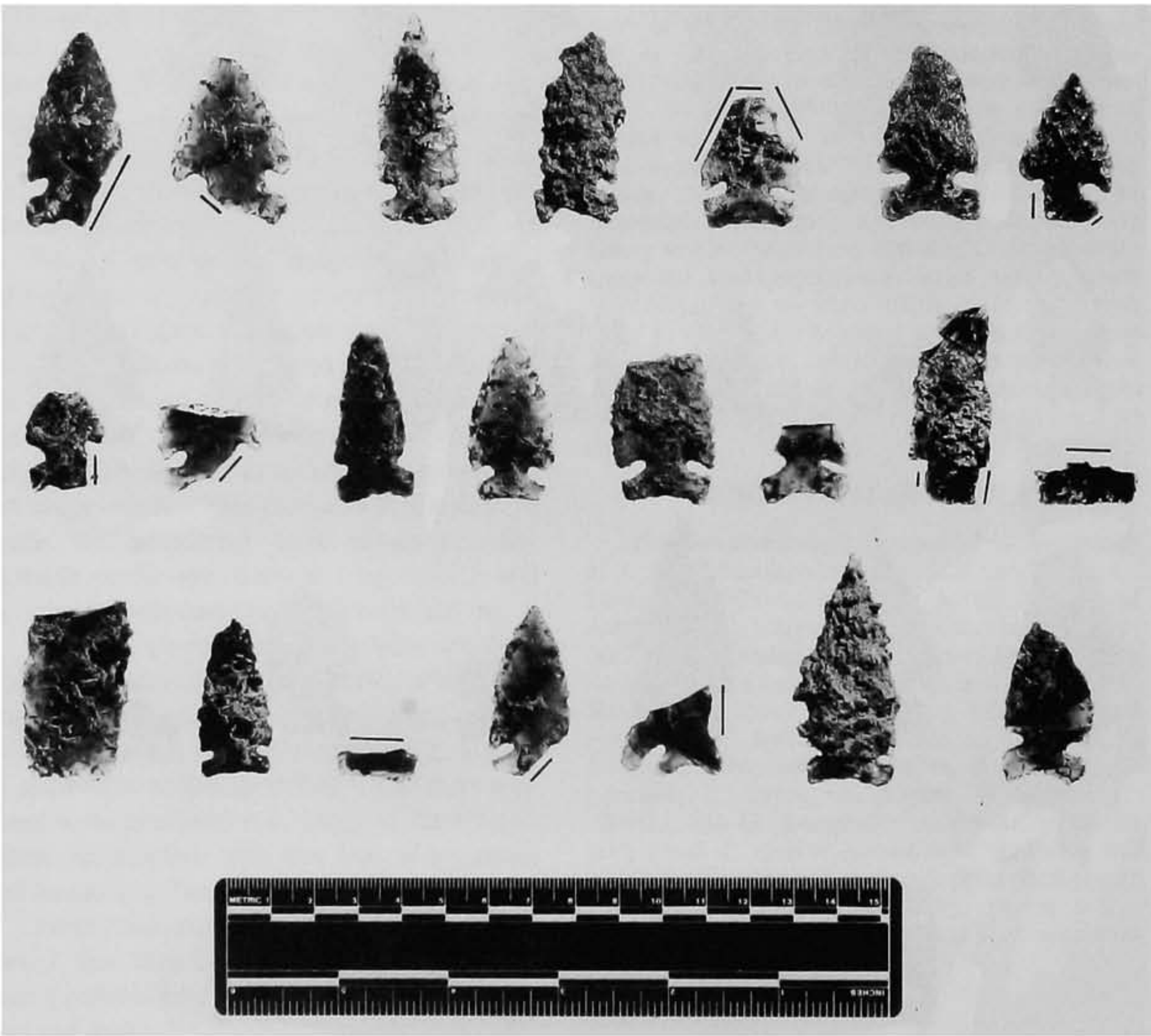

Fig. 8. Points from Feature 27, King's Dog (all Northern Side-notched except as noted). Row 1 (top), left to right: 1-227676, 1-227682, 1-227683, 1-227685 (covered w/heavy silica concretion), 1-228314, 1-228315, 1-228316; Row 2: 1-228319, 1-228439, 1-228443, 1-228555, 1-228771, 1-228773, 1-228891, 1-228892; Row 3: 1-228977 (Humboldt), 1-228983, 1-229096, 1-229274, 1-229277 (Elko), 1-229387 (covered w/heavy silica concretion), 1-229635. Missing specimens: field accession numbers 4588 (PSA = 175), 4589 (PSA = 165).

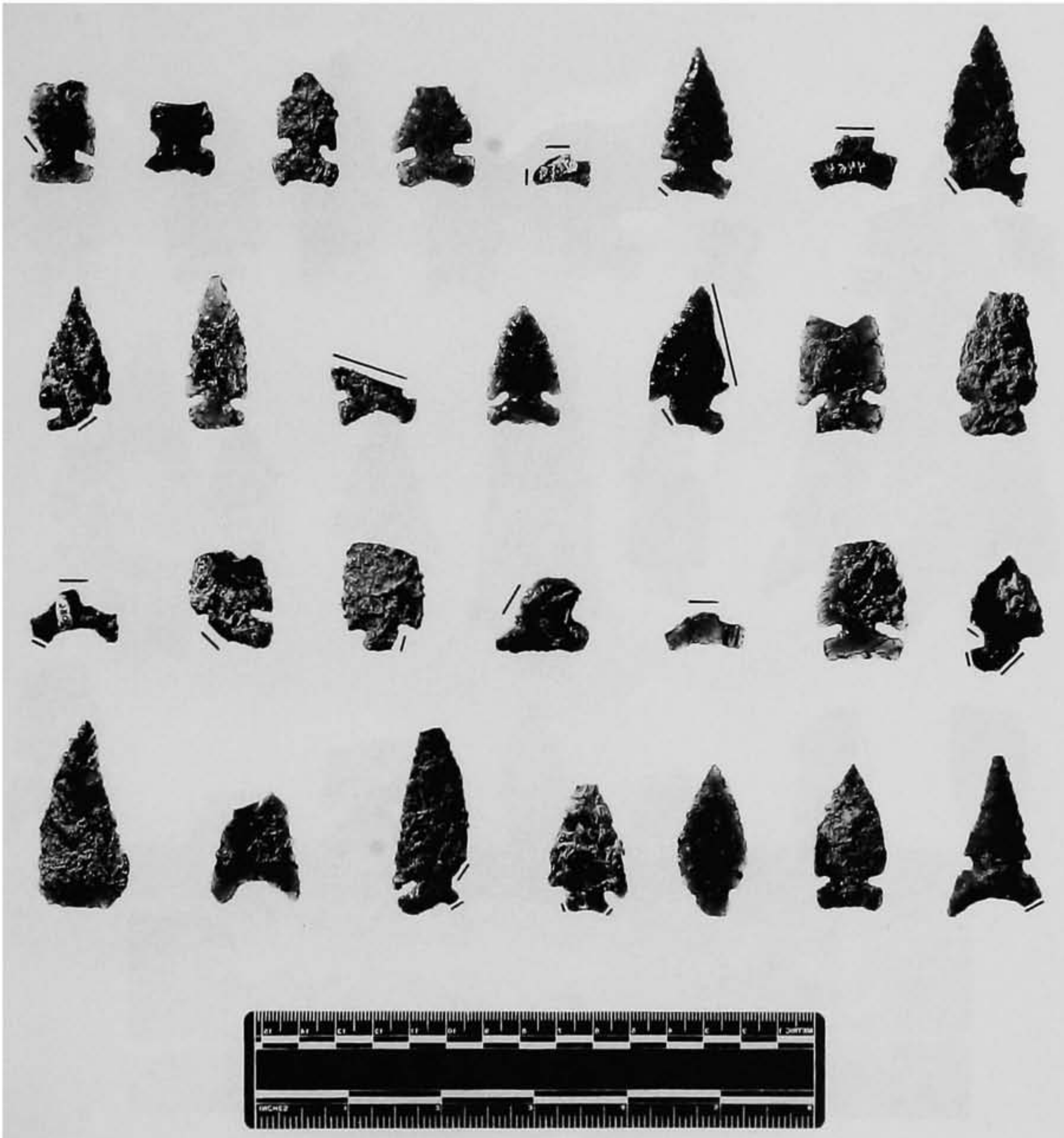

Fig. 9. Points from within House Depression 1 at King's Dog, stratigraphically below Feature 25 (all Northern Side-notched except as noted). Row 1 (top), left to right: 1-227958; 1-227645, 1-228433, 1-228431, 1-229289, 1-228789, 1-227677, 1-194912; Row 2: 1-194834; 1-228178, 1-227949, 1-229253, 1-229251, 1-227643, 1-229319 (covered w/heavy silica concretion); Row 3: 1-228300; 1-228299, 1-228741, 1-228672, 1-194833, 1-229350, 1-227948; Row 4: 1-229295 (no type), 1-228761 (Humboldt), 1-229250, 1-229317 (no type), 1-229318 (no type), 1-228175, 1-227790. Missing specimens: field accession number 4406 (Gatecliff, PSA = 95), museum number 1-164845 (Humboldt).

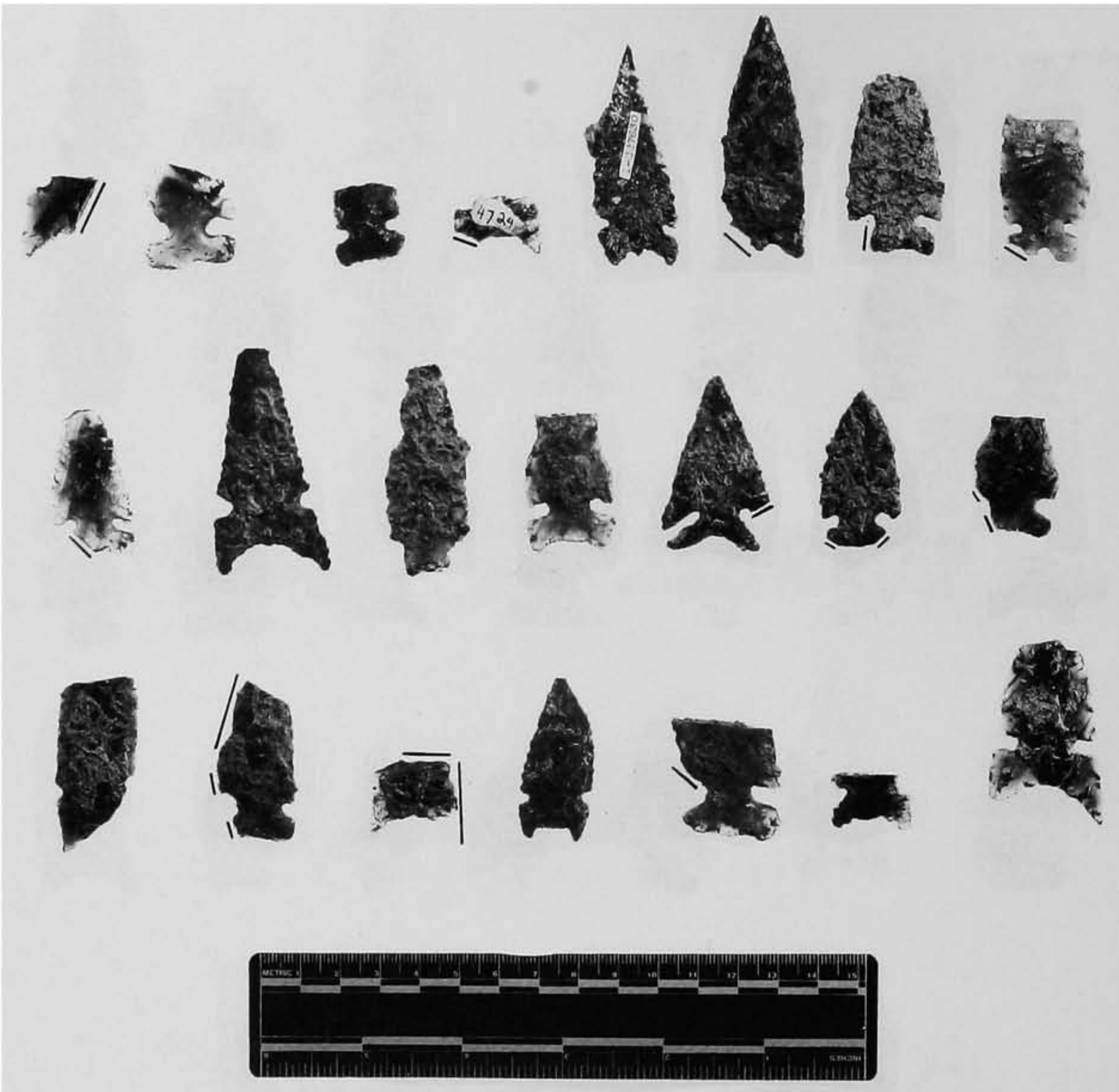

Fig. 10. Points from Feature 25, King's Dog (all Northern Side-notched except as noted). Row 1 (top), left to right: 1-228877, 1-229629, 1-229630, 1-227938, 1-227630, 1-228963 (no type), 1-229271, 1-228768; Row 2: 1-229226, 1-228960, 1-228962 (covered w/ heavy silica concretion, probably Northern Side-notched), 1-229091, 1-228959 (Elko), 1-227631, 1-228961; Row 3: 1-228885, 1-227794, 1-228964, 1-228876, 1-228308, 1-194906, 1-228881. Missing specimen: field accession number 4405 (PSA = 155).

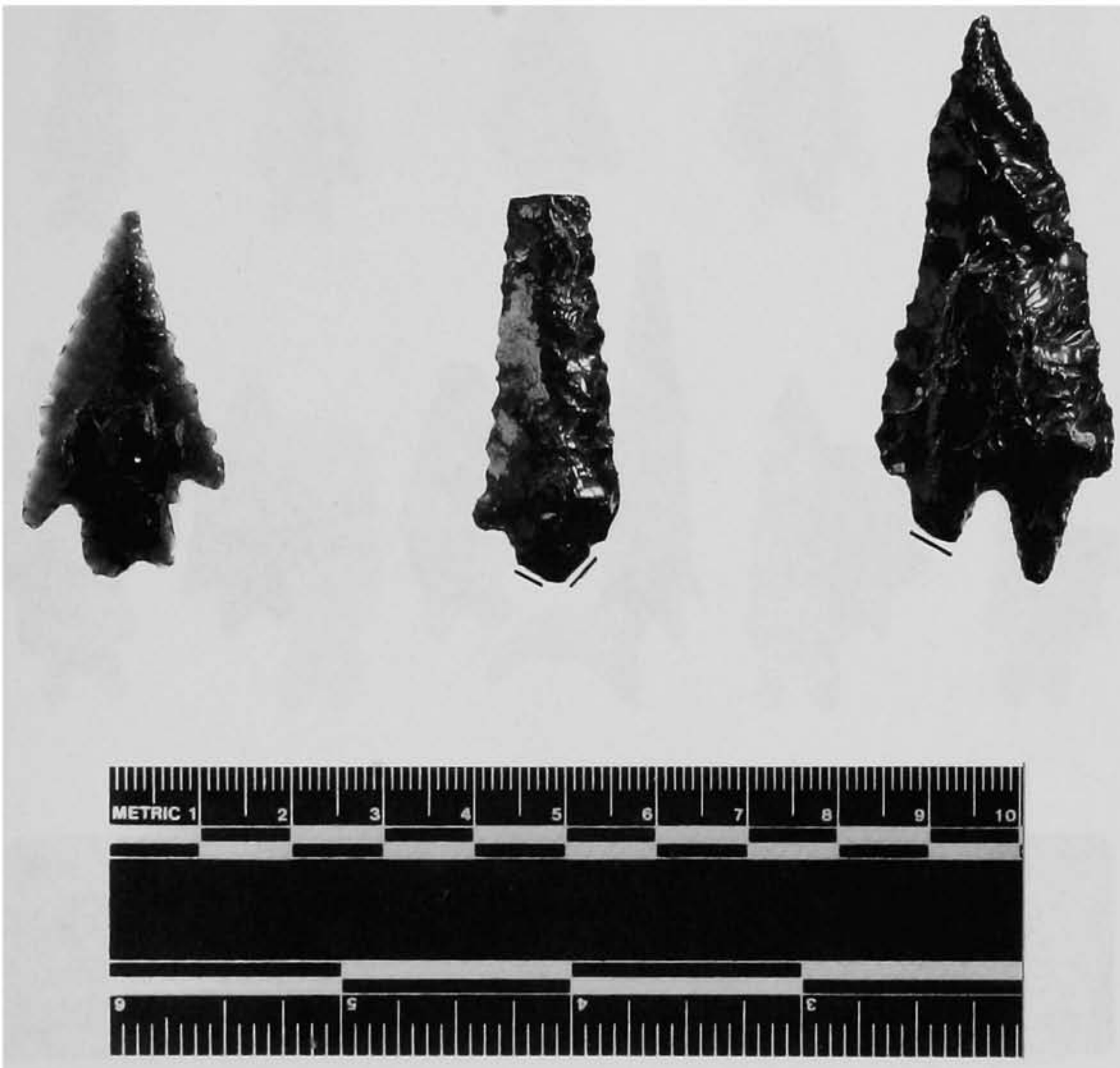

Fig. 11. Points from Feature 19, King's Dog (all Gatecliff). Left to right: 1-194455, 1-194476, 1-164856.

Fig. 12. Points from Feature 10, King's Dog (all Gatecliff except as noted). Left to right: 1-194213, 1-194716, 1-164771, 1-164773 (Elko), 1-164774, 1-164775. Missing specimen: 1-164772 (PSA = 95).

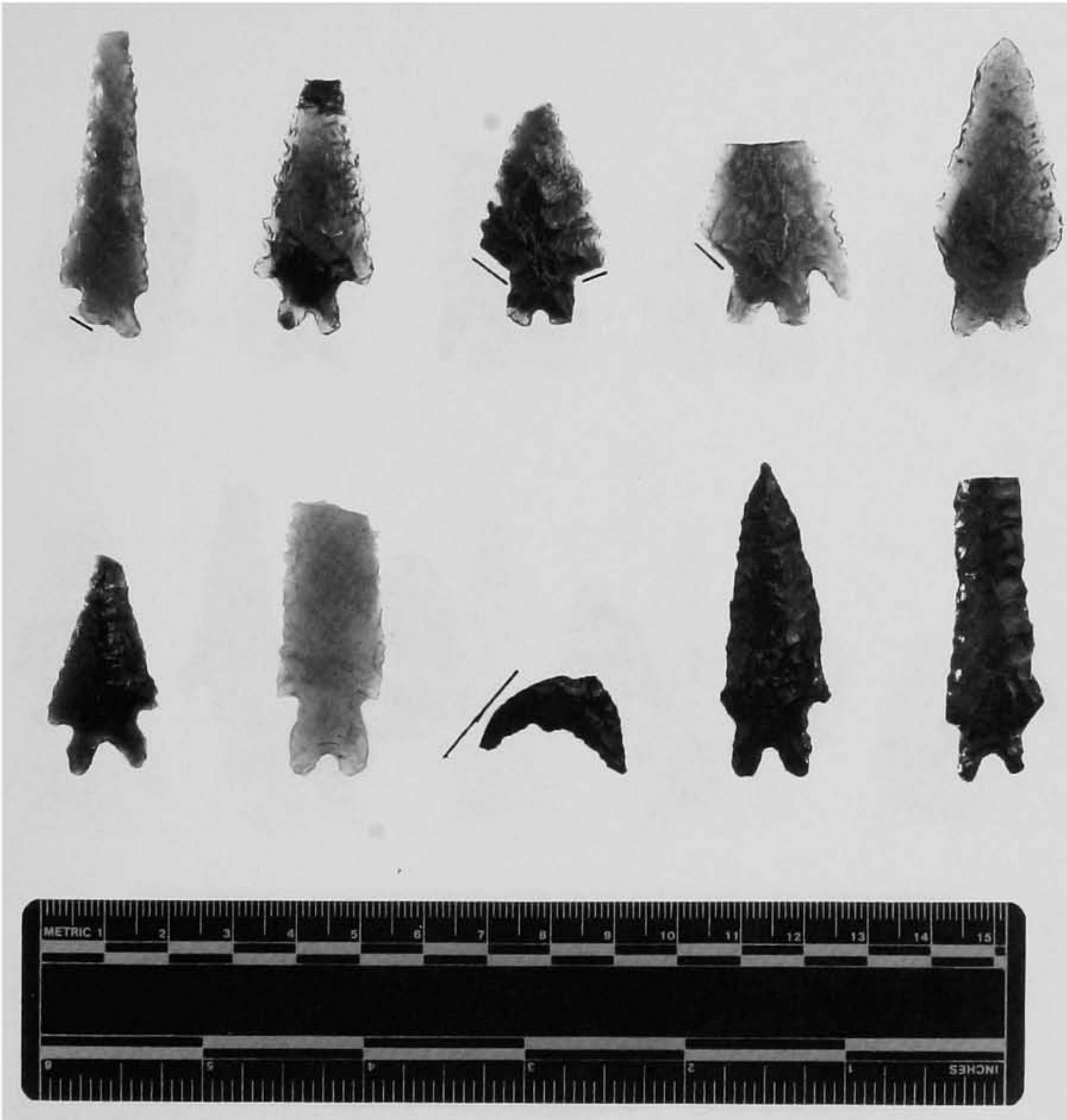

Fig. 13. Points from Feature 16, King's Dog (all Gatecliff except as noted). Row 1 (top), left to right: 1-194051 (Elko), 1-194055, 1-194056, 1-194057, 1-194058; Row 2: 1-194059 (Elko), 1-194209, 1-194715 (Northern Side-notched), 1-164714, 1-164717.

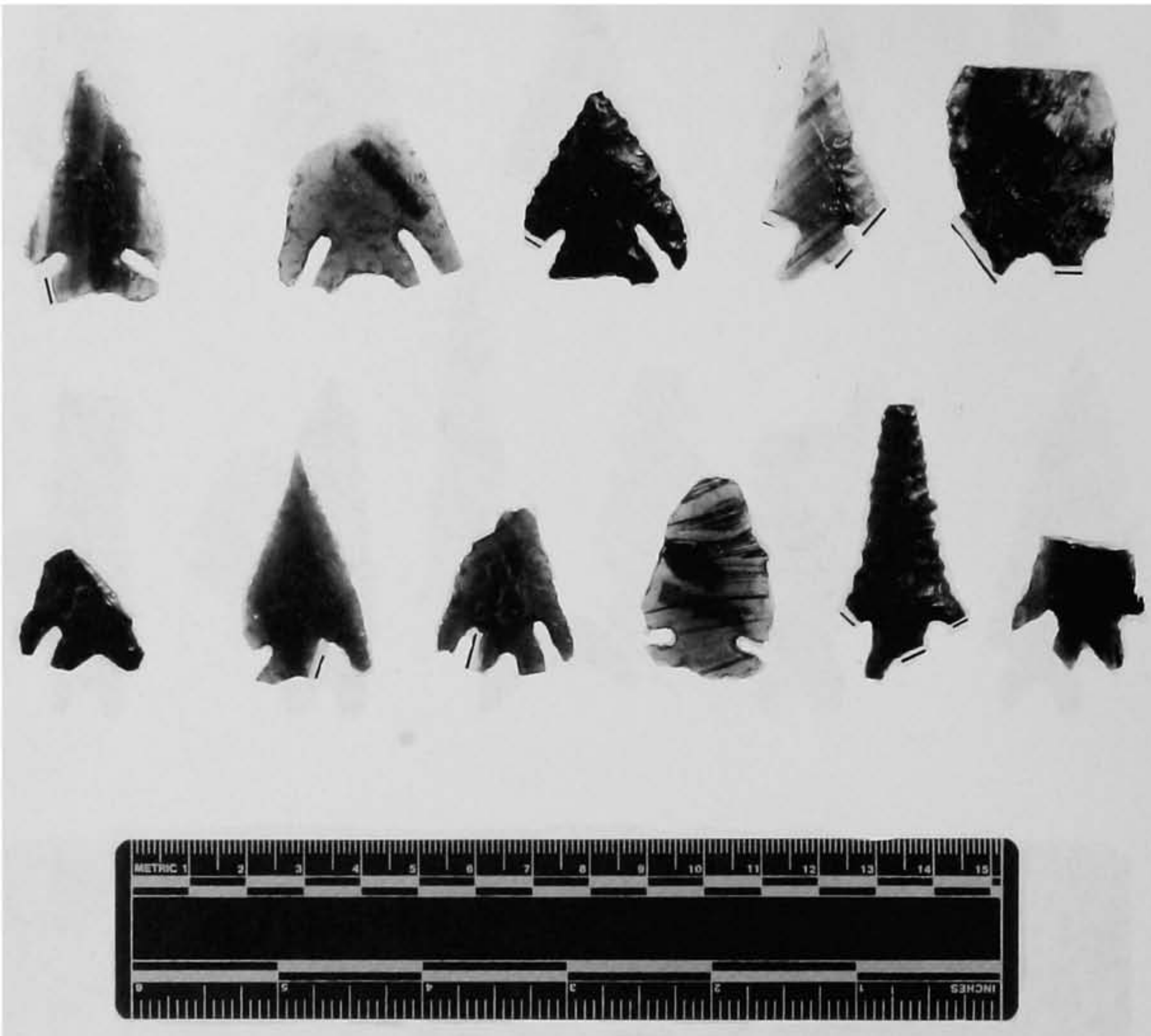

Fig. 14. Points from Feature 69, King's Dog (all Elko except as noted). Row 1 (top), left to right: 1-194555, 1-228092, 1-228393, 1-228631, 1-228632 (Gatecliff); Row 2: 1-228633, 1-228634, 1-228638, 1-228642 (Northern Side-notched), 1-229046 (Gatecliff), 1-229054 (Gatecliff). Missing specimen: 1-194565 (PSA = 120).

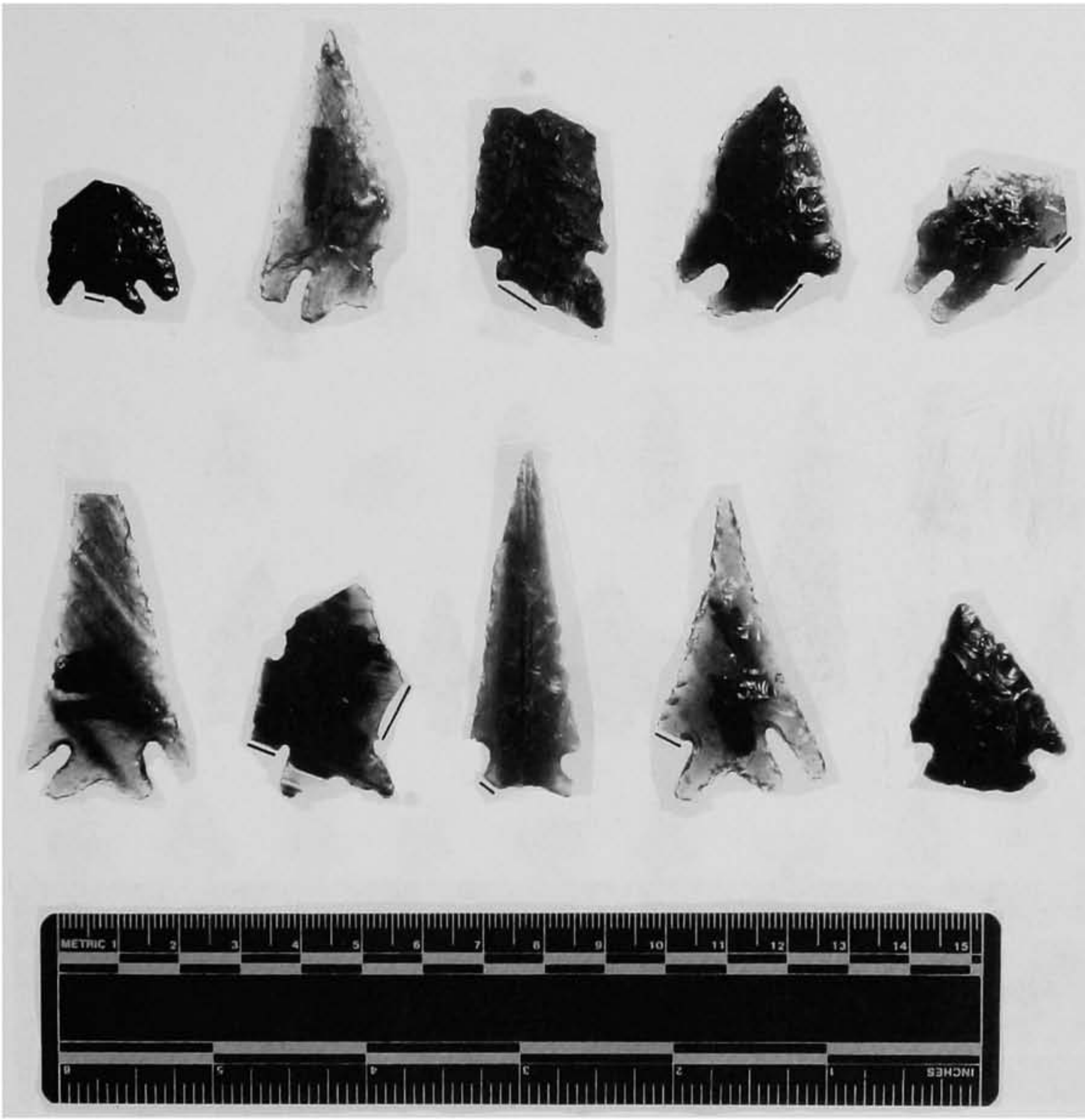

Fig. 15. Points from Feature 34, King's Dog (all Elko except as noted). Row 1 (top), left to right: 1-227875, 1-227884, 1-227885 (Northern Side-notched), 1-228839, 1-228840; Row 2: 1-228846, 1-228847, 1-229171, 1-229172, 1-229174.

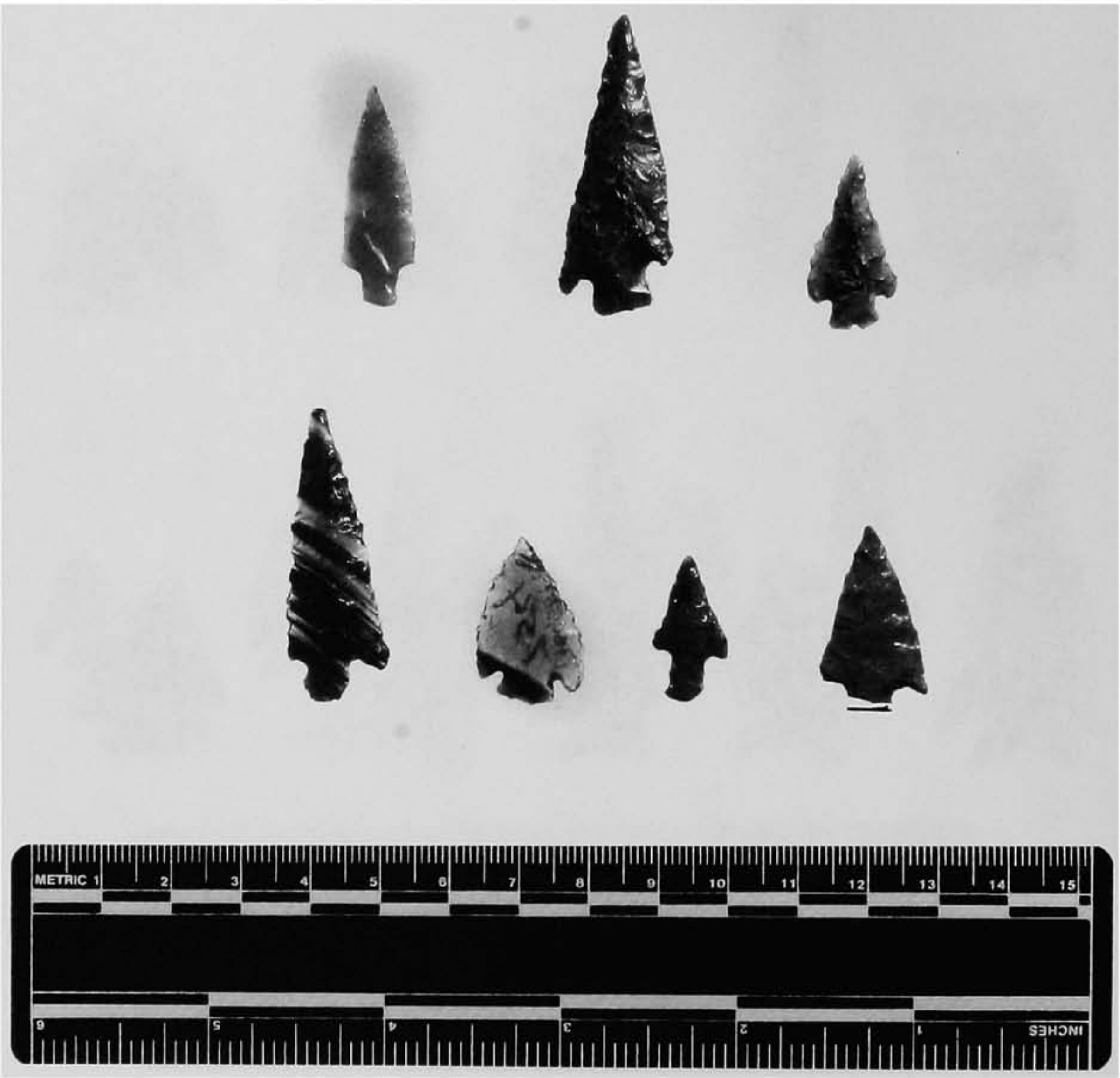

Fig. 16. Points from Feature 1, King's Dog (all Rosegate except as noted). Row 1 (top), left to right: 1-189330, 1-189455, 1-189456; Row 2: 1-189578 (Gatecliff), 1-189587, 1-189621, 1-227581. Missing specimen: 1-189491 (Elko, width of base >10 mm., PSA 110-115, wt. 2.3 g.).

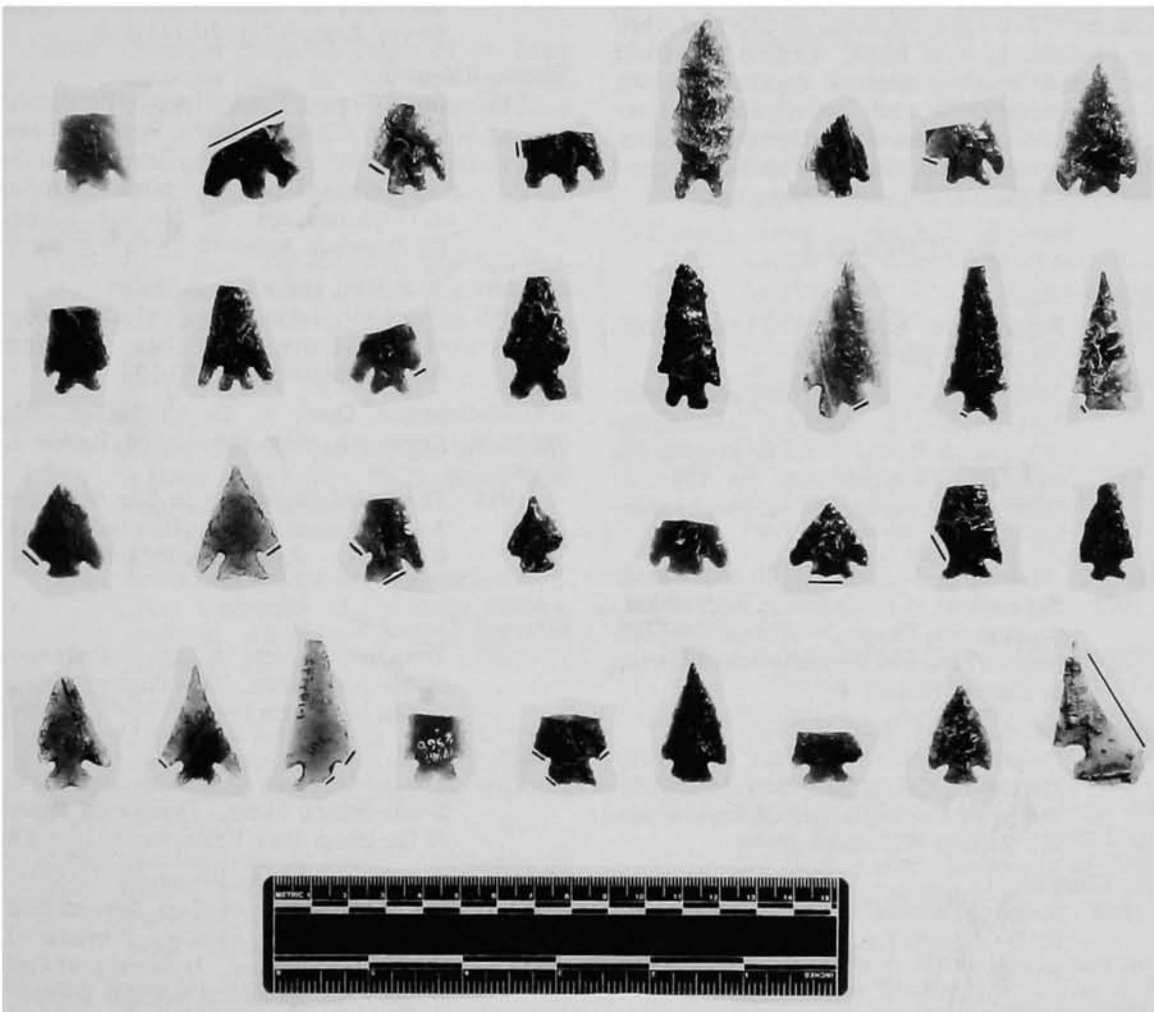

Fig. 17. King's Dog specimens reassigned from Rosegate to Gatecliff (Row 1 [top], first four at left) and Elko (all others). Row 1, left to right: 1-228051, 1-229489, 1-227369, 1-194870, 1-194217, 1-229356, 1-228849, 1-193070; Row 2: 1-189483, 1-227556, 1-227231, 1-194420, 1-194579, 1-164716, 1-228147, 1-228950; Row 3: 1-229357, 1-193113, 1-229061, 1-193035, 1-192971, 1-189271, 1-189396, 1-189442; Row 4: 1-193199, 1-193196, 1-194542, 1-194689, 1-228725, 1-228043, 1-229360, 1-229840, 1-227605.

illustrating the most common pattern of typological reassignment, from Rosegate to Elko and Gatecliff (Fig. 17). All points found on a single floor are shown in the same figure; the figure order parallels the stratigraphic distribution of floors, oldest first (see also Fig. 5). Captions indicate floor number, assignments of individual specimens to types, and museum catalogue numbers. Unfortunately, not all specimens originally assigned to these floors by O'Connell (1971:Table 20) could be relocated when these photographs were taken. Critical data (field acquisition or museum numbers, type assignments, key measurements) for each missing specimen are included in the caption for the pertinent illustration. All breaks (except those at tips) are marked by short lines oriented parallel to the axis of the break.

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