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COMMENT

The Monitor Valley Key and Projectile Point Series: A Response to Smith and Rosencrance

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Smith and Rosencrance (2025) reject my suggestion that archaeologists should abandon the projectile-point-series concept and associated series chronologies. I noted that earlier researchers grouped different point types into different named series incorrectly, assuming that projectile point types that share the same series label also share the same temporal span (i.e., the series time span) and same geographic distribution. I concluded by suggesting that projectile point types in the Great Basin as a whole be statistically differentiated from one another and that the chronology of each point type be developed individually and assessed separately—a response that was viewed by Smith and Rosencrance as unnecessary due to the continued use of the Monitor Valley Key and its series chronologies over the past 40-plus years.[1]

In the middle of the last century, based on a handful of stratigraphically excavated sites (and open sites in some cases), researchers in the Great Basin developed the projectile-point-series concept. These researchers agreed among themselves that different morphological point forms recovered from the same excavation levels share the same temporal span and geographic distribution and that they should therefore share the same primary series label (e.g., Fowler et al. 1973; Hester and Heizer 1973; Lanning 1963).

However, there was no agreement on the exact number of series, the proper series monikers (e.g., Cottonwood, Desert Side-notched, Gypsum, Humboldt, Lake Mohave, Little Lake, Pinto, Rose Spring and Eastgate, Silverlake), or consistency of which point types were specifically included or excluded from a particular series primarily because of the subjectivity of projectile point classification at the time. During this time period, projectile point types were based on subjective "eyeball" classification of point forms—intuited modal types visually differentiated by consensus agreement among researchers when relative dating of projectile point types through stratigraphic excavation was more common than absolute dating with radiocarbon assays.

I referenced Thomas's series chronology and the Monitor Valley Key (MVK; Thomas 1981) in my article because it was the last major effort to aggregate subjective, "eyeball" classified projectile-point types into separate point series in the Great Basin. For the key, Thomas selected 10 subjective modal point types widely thought to have some chronological utility (Hester and Heizer 1973) to develop his series chronologies. Thomas could have provided individual date ranges for each of the 10 point types, but instead he chose to group the 10 types into five series and then associate fixed date ranges with each series based on the limited radiocarbon ages available for the individual modal point types at that time. For Thomas, the analytical units were the point series and the temporal spans of each series—rather than individual point types each with their own unique chronology.

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Based on the MVK, Thomas created a unilineal chronological sequence of point series, where one group of projectile point types replaces another group at fixed points in time, ignoring the possibility that individual point types within a series could have different beginning or ending dates. By grouping point types into series, Thomas asserted that all the point types included in each series share the same temporal span.

Below, I respond to some of the comments and issues raised by Smith and Rosencrance (2025) regarding the concept of point series and series chronologies in relation to the MVK. I offer my opinion on why the MVK continues to be cited in archaeological publications today. I conclude with some specific recommendations for moving beyond the MVK and its associated series chronologies.

Monitor Valley Key

Although the MVK has been described as "one of the most rigorous and objective typological schemes in North America" (Smith et al. 2013:593), it is not a typology, nor is it even a true binary dichotomous key (contra Thomas 1981:24).[2] Rather, different combinations of 11 variables, with different ranges, were applied in different sequences for each of the 10 types, which were then aggregated into five chronological series.

Doran and Hodson (1975:159) make a clear distinction between creating a typology and providing a key to that typology. A projectile point key, such as the MVK, only allows for the assignment of an unknown projectile point to one of the existing types identified in the key; the point types in MVK are not inherently defined, nor is their membership validated by virtue of the application of the key. Keys are closed systems of classification; they cannot create additional classes or types.

Therefore, application of the MVK can only assign a specimen to one of the 10 types in the key. The key cannot, for example, identify any other consensus-based point types or series from the 1960s–1970s (e.g., Pinto series, Gunther Barbed, Bare Creek Eared, Humboldt Basal-notched, etc.) because they are not included in the key. Applying the key to any one of these other point types would incorrectly classify it either as one of the 10 types or as an out-of-key specimen—a catch-all category for unclassifiable specimens that do not fit within the variable ranges for the 10 types in the key.

Subjective Visual Types versus Statistical Types

Although the application of the MVK can produce replicable results (Thomas 1981:10), application of the key does not ensure that point types within the series represent internally cohesive, statistically defensible types—a scientific necessity if archaeologists are to move beyond the visually based, consensus-driven intuited point types of earlier researchers. Rather than presenting descriptive statistics of his standardized attributes to differentiate each of the types in the key (suitable for inference testing), Thomas (1986:620, 2024:53) only provides ranges and their cut points that he inductively derived for the 10 types. There are no inferential statistical tests that can be applied to ratio-scale variables when the datasets are only presented as groups of ranges and cut points. Without statistical validation, point types in the key simply remain visually based, intuited forms that have been grouped into five chronological series.

Thomas (2024:52) states, "I redefined the attributes somewhat to keep things simple—sorting artifacts into time specific categories." As noted, these modal types ("time specific categories") were differentiated by earlier archaeologists through visual classification. Regarding measuring attributes of the key by a student, Thomas and Bettinger (1976:286) state that "after a couple of days' practice, that student can classify artifacts [projectile points] in a manner every bit as valid as that of the most seasoned archaeologist," indicating that analysts visually identify the modal point types prior to any measurement or any classification of the specimen by variables in the key.

This is likely the reason why the MVK has continued to be widely referenced in archaeological literature of the Great Basin over the last 40-plus years. Although there are a few published reports in which ranges and cut points are actually used to classify an assemblage of projectile points, in practice the MVK is not itself used as a classification tool. Rather, the citation to the MVK (Thomas 1981) is used by researchers to provide a justification for visually classifying projectile points types *without the need*

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to apply any of the ranges or cut points within the MVK. Once a specimen is visually typed, variables of the key are then measured, tabulated, and reported.

Visually assigning the point type before classification by the key is corroborated by analysts differentiating Humboldt Basal–notched points from other Humboldt-series points. In the original key, Thomas (1981:17) states that the measurements for the Humboldt Basal–notched point are undefined, yet analysts are able to visually differentiate this previously named type from other Humboldt-series points without reference to ranges or cut points in the key (e.g., South Fork Shelter and Mateo's Ridge [Thomas 2024:Supplement SA2]).

Critical, but not mentioned or discussed in the literature, is that the MVK can only be applied to complete point specimens. Five of the 11 classifying variables are size-dependent variables—weight, length, basal indentation ratio, basal width-maximum width ratio, and maximum width ratio—that can only be measured on complete specimens that have a recognizable tip at the distal end of the projectile point. Weight is a significant size criterion in seven of the 10 types; length (complete length is required to compute some of the ratios) is also a critical attribute in distinguishing seven of the 10 types. Therefore, fragmentary specimens (common in projectile point assemblages) must be visually typed prior to the application of the key.

Some researchers not only visually type fragmentary specimens but also infer the complete type morphology of the specimen (Thomas 1983:Figure 67d, m, and others) and then estimate the missing values for the incomplete specimen. These estimated values are then incorporated into the tabulations of the means and standard deviations of variables of the specific point types (e.g., Thomas 1983:Tables 42–50). Estimates of missing values included in summary statistics create erroneous data and compromise any comparative or statistical analyses between the same point types in different assemblages.

Monitor Valley Key Series Chronologies

Smith and Rosencrance (2025) defend the MVK series chronology stating, "Furthermore, it [MVK] offers empirically based age ranges for those types and the series to which they are assigned in central Nevada." Although the series chronology provided by the MVK in 1981 may have been adequate at the time, it was based on a limited number of radiocarbon ages and created before more recent developments in radiocarbon dating and interpretation (Bayliss 2009).

The limited number of radiocarbon dates available at the time from central Nevada forced Thomas to assess the association of point types and radiocarbon dates at sites throughout the Great Basin (see Note 1). Second, the BC/AD calendar dates assigned by Thomas and other researchers were derived from radiocarbon ages by subtracting 1950 years at a time before which it was widely recognized that atmospheric concentrations of ^{14}C fluctuated. We now know that individual radiocarbon ages require calibration to the BC/AD calendar or cal BP dates before any multidate comparisons for developing series chronologies—100 radiocarbon years in one portion of the calibration curve is not temporally equivalent to 100 radiocarbon years in a different portion of the curve. Third, researchers at the time rounded date ranges to the nearest century or half century of the Gregorian BC/AD calendar, as Thomas (2024) continues to do. Improved dating, calibration, and radiocarbon modeling techniques can now reduce the standard error associated with calibrated ages and provide statistically modeled time spans with known probability estimates.

Summary

In summary, because the 10 visually based types classified by the MVK do not represent statistically distinguishable types, the grouping of these types into named series is an arbitrary exercise. It then follows that any assignments of fixed time spans to these arbitrarily defined point series do not create valid temporal phases, such as those first proposed for the Monitor Valley.

However, the MVK series chronology has now been geographically expanded from a single valley in central Nevada to a temporal sequence of six phases (i.e., series phases) covering the complete prehistoric sequence of the Great Basin. These sequential phases—based on the unilineal point-series chronology of the MVK—include the Early Holocene, Middle Holocene, Gatecliff, Elko, Rosegate, and Desert phases (Thomas 2024:57). These temporal periods were ostensibly confirmed after 28,547 specimens from across the region were assigned to the 10 point types in the key. With the exception of the points assigned to the Early Holocene phase, surprisingly, not one out-of-key point was identified among the 24,986 later dated specimens classified by the MVK (Thomas 2024:Table 2.1).

Smith and Rosencrance (2025) note that Early Holocene points (pre–Mazama age points) were not classified by the MVK. To my knowledge, the ranges and cut points in the MVK have never been modified, nor have any additional point types from the Late Pleistocene/Early Holocene or later periods been incorporated into the key. Consequently, it is not clear how points in the Early Holocene phase were typed or how thousands of out-of-key points (outliers) were identified from this phase. It is also unclear why these untyped outliers must date to the Early Holocene phase, unless they represent multiple Early Holocene point types unidentified by any key. These point-series discrepancies could be clarified by individually analyzing the chronology of all statistically distinguishable point types from the entire cultural sequence in the Great Basin (Schroedl 2025:Table 1), instead of building a basin-wide chronology predicated on 10 subjective point types in the MVK.

Recommendations

Smith and Rosencrance (2025) state that I failed to provide an alternative to the MVK and series chronologies. Below are some suggestions regarding point typologies and chronologies to assist researchers in moving beyond the series concept and the MVK.

Rather than visually assigning specimens to consensus-based named types and then justifying the type assignment by referencing Thomas (1981), researchers should use multivariate analysis techniques (e.g., Shott 1997; Thomas 1978) to develop formal, statistically defined point types instead of assigning points to types based on eyeball classification schemes. Such multivariate analyses can be applied to a variety of measured variables simultaneously to differentiate point types statistically. These analyses would ensure internal cohesiveness within each point type while maximally differentiating individual types from one another.

Multivariate analyses must move beyond simple comparisons of plan view morphology (e.g., Holmer 1978; Thomas 1978) by incorporating geometric morphometric analyses (e.g., Bischoff 2023; Buchanan and Collard 2010) to capture the nuances of the curves and shapes of hafting elements of different point types that were visually recognized by earlier archaeologists (and are still distinguishable today) but that are not captured by simple size variables or inconsistent angle measurements within a projectile point key. Size and shape variables in these multivariate analyses need to be measured from perimeter landmark locations based on point forms (e.g., Holmer 1986:93). Angle measurements for notched and stemmed point types need to be consistently measured from fixed perimeter vertices and measured in positive or negative degrees from the standard position relative to the x-axis.

These analyses should also include the third dimension of size, depth (i.e., point thickness [e.g., Hildebrandt and King 2012; Spencer 2015]), a type-differentiating variable that is noticeably absent from the inductively derived, differentiating variables included in the MVK. Other nonmetric, qualitative attributes and traits that cannot be directly measured or derived from planimetric analyses also need to be included in any formal analysis of projectile point types (e.g., basal edge grinding, collateral versus parallel flaking, fluting, cross-sectional form, edge serration, etc.). The ultimate goal of projectile point classification is a statistically based typology that does not rely on continued visual classification of consensus-based point forms.

The temporal spans associated with these diagnostic point types need to be as fine-grained as possible. Clear, concise time ranges need to be individually developed for all temporally diagnostic point types by moving beyond time spans assigned nearly 50 years ago based on a handful of radiocarbon ages (e.g., Hester and Heizer 1973; Thomas 1981).

Today, there are thousands of radiocarbon ages from prehistoric sites in the West that can be incorporated into analyses of temporal spans of diagnostic point types in the region (see Kelly et al. 2022), These radiocarbon ages, coupled with the refinement of calibration curves (Reimer et al. 2020) and advancements in Bayesian analysis of radiocarbon ages (Bronk Ramsey 2009), can provide scientifically defensible date ranges for each individual point type without the need to rely on the subjective judgments and assessments for the chronological types included in the MVK.

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For example, using Bayesian radiocarbon analysis, researchers have statistically modeled abbreviated time spans (with known error factors) for Late Pleistocene / Early Holocene projectile points (Clovis and Folsom points [Buchanan et al. 2022] and Haskett points [Rosencrance et al. 2024]). There is no reason why similar modeled chronological time spans cannot be developed for all statistically distinguishable point types from the entire prehistoric period in the Great Basin—modeled to decades rather than centuries or half centuries.

If, as noted by Smith and Rosencrance (2025), projectile point typologies in the West continue to be works in progress, it is time to not only retire the projectile point series concept in the Great Basin but also time to abandon the MVK with its outdated series chronologies and outmoded classification scheme, which promotes visually based consensus type assignments over statistical typology. It is time to apply modern archaeological tools of classification and radiocarbon analysis to distinguish all chronologically diagnostic point types in the Great Basin and surrounding regions.

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Notes

1. Smith and Rosencrance (2025) repeat Thomas's (1981) statement that the Monitor Valley Key was not to be applied outside the Monitor Valley, although it has been widely cited across the region since 1981. Despite Thomas's statement regarding the lack of applicability of the key beyond the Monitor Valley region, he clearly implied the utility of the key across the entire Great Basin and beyond when he used the Monitor Valley criteria to reclassify thousands of projectile points from sites throughout the region and also to derive his series date ranges from these sites (Thomas 1981:24–37). Not only does the key continue to be widely referenced beyond the Monitor Valley but Thomas has also now imposed his series-based chronology on almost the entire Great Basin after measuring more than 48,000 projectile points from sites all across the region (Thomas 2024:Table 2.1).

2. A true dichotomous key is a classification scheme that creates a full branching tree diagram, resulting from binary choices. At each descending node, the remaining group is further subdivided based on a single variable or trait, ordered from general to more specific. Because variables in a key need to be applied in an orderly succession from general to specific, the selection of initial root node has a profound effect on how other nodes in the tree descend. There are four main categories of projectile point forms that can be visually separated in the West: lanceolate, notched, stemmed, and triangular, along with their various subtype forms. For the initial node of the MVK, Thomas chose to use point forms. But Thomas grouped the lanceolate, stemmed, and triangular forms into his "shouldered" category to contrast it with the two subtypes of notched forms—corner-notched and side-notched (ignoring basal-notched points). He then applied different variables and ranges at different descending nodes to distinguish among the point types in his analysis. However, the simultaneous application of different ranges of different variables at different nodes in a key does not create a true binary tree, nor can it be considered a multivariate point typology.

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