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Articles

The Projectile Points from Bonneville Estates Rockshelter: Description of Two New Point Types and Implications for the Long and Short Chronology Debate in the Great Basin

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INTRODUCTION

Bonneville Estates Rockshelter (BER) is located along the Nevada-Utah border in eastern Nevada, about 20 air miles south of Wendover, Nevada/Utah and Danger Cave (Graf 2007). BER was periodically occupied from about 13,000 cal BP (11,100 14C BP) to historic contact, generally with only a few centuries of non-use between occupations. The only exceptions were a rather lengthy gap with only sporadic occupations between ca. 8,300 and 10,500 cal BP (ca. 7,500 - 9,300 14C BP) corresponding to the latter one-half of the Early Holocene and the first millennium of the Middle Holocene, as well as a ca. 500-year near hiatus between 2,250 and 2,750 cal BP (2,250 – 2,625 14C BP) corresponding to the first one-half of the Late Holocene Dry Period (see Table 1). In addition, BER served primarily as domestic living quarters, a place where hearths were constructed and food processed, rather than as a storage facility or burial place. BER was also spared heavy ravages of rodents churning the sediments by burrowing through the deposits; while some rodent burrows were identified, these tended to be caused by small ground squirrels and thus were localized in their impacts to the stratified sediments. All these factors led to the recovery of well-stratified and securely dated sequences of human occupations and artifacts, including projectile points.

All cultural Periods and Phases previously identified for the northeastern Nevada/Upper Humboldt region were represented in the BER stratigraphic sequence (Table 1). BER is hydrographically located in the eastern Great Basin because it rests on the far western margins of the Bonneville Basin. Obsidian hydration dating research by Hockett (1995), however, suggests that the projectile point typology and chronology of this portion of extreme eastern Nevada generally matches the Upper Humboldt phase sequence more closely than the eastern phase sequence, generally dubbed the "short chronology" and "long chronology", respectively (see also Thomas 1981; Stoner and Cunnar 2018). That said, the results of our analysis of the BER projectile points and subsequent reinterpretation of projectile point sequences in the eastern, northern, and central Great Basin subregions suggests that the "long chronology" is a byproduct of an overly simplistic Great Basin projectile point typology that we argue in this study is no longer valid.

The short versus long chronology debate focuses on the age of Elko Series points, where these points are established at no older than ca. 3,500 – 4,000 cal BP (3,275 - 3,650 14C BP) throughout central, western, and northern Nevada but are argued to date as early as ca. 8,000 – 9,000 cal BP (ca. 7,175 – 8,085 14C BP) in the eastern Great Basin, portions of the Colorado Plateau, and southern Columbia Plateau/Snake River Plain (Jennings 1957; Aikens 1970; Jennings et al. 1980; Holmer 1986; Smith et al. 2013; Keene 2018). The geographic positions of Danger Cave

and BER in relation to this issue is most interesting because these two sites are both located along western shorelines of Pleistocene Lake Bonneville; Danger Cave at the low elevation Gilbert shoreline and BER at the highstand Bonneville shoreline. The projectile points from Danger Cave are often cited as evidence for a "long chronology" because Elko Series points were identified from lower sediments in the cave, but as detailed below, there is no definitive evidence supporting Early Archaic-aged Elko Series points at either Danger Cave or BER. The same holds true for other stratified cave sites located nearby where pre-4,000 cal BP Elko Series points are purported to exist, including Camels Back Cave and Floating Island Cave.

There are three new projectile point types hitherto undefined in the eastern stretches of the Great Basin that resolve the long-chronology problem: (1) a Pie Creek Phase (Early Archaic) "Pequop side-notched" point first identified by Cunnar et al. (2017) and Stoner and Cunnar (2018) that superficially resembles an "Elko-eared" point, and has been typed as Elko in the past (e.g., Aikens 1970:38.Figure 20i-k; Berry 1976:151, Figures 58g, j; Holmer 1986:101, Figure 11c); (2) a Pie Creek Phase (Early Archaic) "Leppy Hills corner-notched" point described and named for the first time here; this point type also has been previously identified as Elko (e.g., Hoskins 2016:67-68, Figures 3.1 and 3.2 [23054.1, 23160.1, 22993.5, 23340.4B, 22993.4, 23662.55, 23730.11, and 23661.4]); and (3) a South Fork Phase (Early Middle Archaic) "Dead Cedar corner-notched" point also first identified from the BER deposits; this point has been previously identified as Elko as well (e.g., Elston 2005:114, Figure 5.15a-e). Further, the previously identified and long-established Pinto point type is sometimes identified as "Elko Series" in the literature (e.g., Hoskins 2016:67, Figure 3.1 [23665.5]).

The characteristics and metrics that qualify these new point types to be established, as well as why non-Elko Series points have been typed as Elko in the past, are illuminated below. We also extend our proposed new typological sequence to a host of other sites scattered across the western, northern, and eastern Great Basin subregions in order to determine if the patterns identified in the nature and timing of projectile points at BER extend beyond this single site. As is detailed below, the patterns we identify in the BER projectile points are commensurate with other key stratified sites previously excavated and discussed below.

WHAT IS AN ELKO SERIES PROJECTILE POINT?

Pequop side-notched, Leppy Hills corner-notched, and Dead Cedar corner-notched points did not exist at the time of the establishment of the Elko Series as a point type (e.g., Heizer and Baumhoff 1961; O'Connell 1967; Hester and Heizer 1973; please refer to Figures 5, 6, 7, 9, and 11 below), nor during discussions of long and short chronologies for Elko points (e.g., Thomas 1981). The proposed existence of a long chronology in the Great Basin is the result of four primary factors: (1) a mid-20th century tendency to subdivide Elko Series points into four subtypes, including "corner-notched", "eared", and "contracting stem" (Heizer and Baumhoff 1961), and, later, "side-notched" (e.g., Hester and Heizer 1973); (2) a half-century practice of evaluating Great Basin point typology under the mantra 'if it's a corner-notched dart point, then it's an Elko point', and therefore many corner-notched dart points outside of the Gatecliff Series were generally typed as Elko Series regardless of their morphological variability; (3) defining the difference between a corner-notched and a side-notched point based on notch angle or proximal shoulder angle (PSA) rather than notch placement on the preform; and (4) a de-emphasis through time on the fact that one of the primary characteristics that

define Elko points is that they were manufactured on triangular preforms rather than lanceolate preforms (Heizer and Baumhoff 1961:128). Each of these concepts is explored in further detail below.

Elko Series points are corner-notched and made on triangular preforms

Designations such as "Elko contracting stem" (Heizer and Baumhoff 1961), "Elko split-stem" (Aikens 1970), and "Elko side-notched" (Aikens 1970; Jennings et al. 1980) had the unfortunate consequence of combining a number of distinct point types into the Elko Series. For example, "Elko split-stem" would later be called Gatecliff split-stemmed (Thomas 1983) and "Elko side-notched" fall under the general type designation 'Large side-notched' (LSN), each of which is a separate type distinct from the Elko Series. Elko corner-notched and Elko-eared are both corner-notched points, and constitute the two valid subtypes that have withstood the test of time. In retrospect, if Elko Series points can be corner-notched, side-notched, contracting stemmed, and split stemmed, then for all intents and purposes all dart points manufactured in the Great Basin are Elko points. Clearly that is not the case, and such lumping defeats the purpose of establishing individual point types that can be metrically separated from one another that may also date to chronologically discrete time periods. Thus, we adopt the original definition for the Elko corner-notched point based on the type site, Wagon Jack Shelter (Heizer and Baumhoff 1961:128): "They are basically triangular in form with sloping shoulders and stems which widen toward the basal end. Alternatively, one could say that these are triangular points with deep, parabolic corner notches."

The definition of a corner-notched point based on notch angle rather than the more appropriate notch placement has contributed to the misidentification of some side-notched points as Elko-eared points, as well as confounded our ability to recognize hitherto undefined point types in the Great Basin. Distinguishing side-notching from corner-notching is vital to testing whether specific regions of the Great Basin display a "long chronology" of Elko Series points because some side-notched points that superficially resemble Elko-eared points are Early Archaic in age. One of the primary metrics used over the past 40 years to distinguish corner-notching from side-notching is the proximal shoulder angle, or PSA (e.g., Thomas 1981). Holmer (1986), however, pointed out over 30 years ago that notch angle may be inadequate to distinguish corner-notched from side-notched points. This is because side-notched points may display notch angles that match those of corner-notched points. Despite this fact, metrics based on notch angle continue to serve as a baseline to distinguish side-notched from corner-notched points, leading to the misidentification of side-notched points as Elko corner-notched or Elko-eared points, as recently seen in the side-notched points identified as "Elko" from Veratic Rockshelter, Idaho (Keene 2018:309, Figure 8i, l, m, o).

Holmer (1986:67-75) succinctly described the primary difference between a side-notched and a corner-notched point over 30 years ago. Namely, side-notched points exhibit "Horizontal notches...moderately high on the sides, forming a slightly contracting stem that is approximately the same width as the blade". In contrast, corner-notched points exhibit "...tangs and an expanding stem that is narrower at its base than the maximum blade width" (Holmer 1986:67, 75). This is the same primary characteristic recently noted by Hockett et al. (2014:564) that distinguishes these two styles of point notching:

> *Because corner notching removes a portion of raw material on either side of the base of the triangular preform, the basal width of Elko points is usually less than the width across the tangs or barbs...In contrast, side notching usually does not remove raw material from the base of the preform; as a result, the basal width of Large Side-notched points is usually greater than or equal to the width across the tangs or barbs, depending upon the symmetry of the preform prior to notching...*

Notch placement on the preform more accurately distinguishes side-notching from corner-notching than does notch angle or the more commonly used PSA measurement because, as noted, the angles of notches placed on the sides of preforms during the manufacture of LSN points may be similar to the notch angles of corner-notched points. As a result, the angle of a notch on a LSN point will not always be horizontal across the blade. Further, it is not uncommon to have one notch perpendicular to the preform and the other notch angled into the preform on the same LSN point. Thus, although notch angle or PSA adequately distinguishes Elko corner-notched points from LSN points that display two horizontally-angled notches, as is detailed below the recently identified Pequop side-notched point often displays one or more angled notches that resemble corner-notching, leading to the misidentification of these points as 'Elko-eared'. In general, notch placement on the preform, rather than notch angle, is a better characteristic to distinguish side-notched from corner-notched points than is PSA or some other measurement of notch angle.

As noted above, one of the primary characteristics of the Elko point type as defined from the type site is that they are made on triangular preforms. The classification of the general shape of a point preform as either 'triangular' or 'lanceolate' can be established by simply comparing the length:width ratios of individual points. It stands to reason that a perfectly triangular preform would display a length:width ratio of 1. Rarely do Great Basin points display such perfect symmetry. Almost all points are elongated triangles to some extent, including Elko points. Nevertheless, triangular points such as the Middle Archaic-aged Elko Series display length:width ratios of 2 or less more than 90% of the time in most site assemblages of that age; in contrast, lanceolate preforms can be defined as displaying length:width ratios greater than 2, meaning the latter are, on average, more than twice as long as they are wide.

To demonstrate this metric, we measured a sample of 46 complete to nearly complete Elko Series points collected from across northern Nevada as part of the Ruby Pipeline Project (Hildebrandt et al. 2016) and the Spruce Antelope Trap Complex surveys (e.g., Hockett and Murphy 2009). The mean length:width ratios of these combined 46 Elko points was 1.62mm (range = 1.16-2.23mm). Only three points (7%) had length:width ratios that measured greater than 2; put the other way, 93% had length:width ratios of 2 or less. Thus, 93% of these Elko points were made on triangular preforms, while 7% were made on lanceolate preforms under our definition. Similarly, the 226 Elko Series points recovered from Gatecliff Shelter in central Nevada displayed a mean length:width ratio of 1.73mm (Thomas 1983). And at Wagon Jack Shelter, the type site for the Elko Series, the average length:width ratio of the 28 Elko points recovered was 1.49mm (Heizer and Baumhoff 1961). Together, these assemblages represent a total of 300 Elko Series points; their combined mean length:width ratio is 1.61mm suggesting that, indeed, Elko Series points were made on triangular preforms greater than 90% of the time.

The pre-4,000 cal BP (pre-3,650 14C BP) Leppy Hills corner-notched and Dead Cedar corner-notched points from BER (described for the first time below) demonstrate that not all corner-notched dart points are Elko Series in the Great Basin, a fact also recognized in the western Great Basin in the 1960s with the identification of the eastern Sierra-based Martis point type (Elsasser 1960). Nevertheless, researchers have tended to type all corner-notched dart points in the Great Basin and surrounding physiographic regions as "Elko" regardless of their morphological variability, age, or location. Recognizing that this interpretation is invalid is an important step to understanding the BER point typology sequence, the point type sequences at hundreds of other sites, and the utility of obsidian hydration relative dating in the Great Basin.

Finally, it is important to note that no metric or series of metrics proposed to distinguish one point type from another will place all of the designated points within their stated metric boundaries 100% of the time. Some points will fall out of the stated boundaries due to a number of factors, including individual flint knapper skill, stylistic tolerances, type of raw material used, number and location of flaws within raw material, and reworking of points. It should not be surprising, then, that a small percentage of Elko points were made on lanceolate preforms as identified above. The metrics discussed here to distinguish Elko corner-notched, Dead Cedar corner-notched, Leppy Hills corner-notched, Pequop side-notched, Pinto, and Black Rock Concave Base points were developed with the understanding that our metrics appear to accurately type these point styles greater than 90% of the time. This is important for the following reason: if a researcher has 30 corner-notched points and 28 of them are made on triangular preforms and two are made on lanceolate preforms, at least two interpretations are possible. One interpretation is that all 30 points are likely Elko Series because greater than 90% of them meet the definition of an Elko point and the 7% out-of-key variance is to be expected. Another interpretation is that the assemblage consists of 28 Elko points and two non-Elko corner-notched points. In these cases, which are expected to occur in most instances with large samples, site context, site chronology, and consistency with other well-dated sites in the region must be taken into consideration in order to form a well-reasoned interpretation. Given the example just stated, our position is that the most parsimonious explanation is that all 30 points are likely Elko Series. This issue also highlights the danger of proclaiming that point types in the Great Basin are not good chronological markers because individual points were found beyond their expected age range. As an example, it is expected that occasionally a corner-notched dart point made on a triangular preform that matches the definition of Elko Series will be found in pre-4,000 cal BP (pre-3,650 14C BP) contexts. Does this mean that Elko Series points are 8,000 years old and not good time markers in the Great Basin? We think the answer must be "no". Individual points are expected to be occasionally found out-of-key and out of their expected chronological range; this is a numbers game we are all playing here that should be based on statistically relevant sample sizes. Large samples of pre-4,000 cal BP (pre-3,650 14C BP) triangular corner-notched points that match Elko Series metrics, or multiple sites with smaller numbers of points at each site that display such metrics, are needed to identify a "long chronology" in certain subregions of the Great Basin. However, individual points and those sites with small sample sizes from disputed dated contexts cannot do the same.

TYPOLOGICAL CLASSIFICATION OF THE BER PROJECTILE POINTS

No site excavated in the history of the Great Basin has produced a longer, nearly continuous human occupation sequence backed by more

than 100 AMS dates than BER. As a result, BER offers the opportunity to take a hard look at projectile point typology and chronology in the Great Basin. The typological classification scheme detailed below builds on the discussion presented above.

Paleoindian points

The classification of Paleoindian-aged (ca. 13,000 to 8,000 cal BP; ca. prior to 7,175 14C BP) stemmed points is rather straightforward. The Western Stemmed points from BER were manufactured on lanceolate preforms with various well-defined stems, some of which are edge ground. Edge grinding is not seen in later projectile point forms. Several subtypes of Western Stemmed points were recovered from the earliest, pre-8,000 cal BP (pre-7,175 14C BP) BER deposits, including Parman, Windust, Haskett/Cougar Mountainand Silver Lake. Evidence from the nearby Old River Bed (ORB) delta demonstrates that the bifurcate-based Pinto style is initiated in the region sometime prior to 9,500 cal BP, after the primary Paleoindian occupation of BER but before the Early Archaic (Duke 2011; Duke et al. 2007; Beck and Jones 2015).

Early Archaic points

It is no secret that LSN points are the quintessential Early Archaic (ca. 5,000 – 8,000 cal BP) (ca. 4,400 – 7,175 14C BP) projectile point type across much of western North America (Delacorte and Basgall 2012). The Early Archaic in the Great Basin witnessed a fluorescence of new point types following some 6,000 years of manufacturing stemmed and fluted varieties. These post-Paleoindian points included the previously recognized LSN, Pinto (Rogers 1939), Black Rock Concave Base (Clewlow 1968), and Cascade (Butler 1961), as well as one recently designated LSN subtype, the Pequop point (Cunnar et al. 2017) and one new point type described below (Leppy Hills corner-notched). Pinto, the only style with a definitive descendant relationship to the Paleoindian period, originates prior to 9,500 cal BP and represents a technological and subsistence relationship with stemmed points and the marshlands of the ORB delta (Duke 2011); they are also found in DII strata at Danger Cave dating prior to 8,000 cal BP (Jennings 1957; also see DII chronological refinements by Rhode et al. 2006), the lowest levels of Hogup Cave (Aikens 1970), and are associated with a date of ca. 10,000 cal BP at North Creek Shelter in the Colorado Plateau (Janetski et al. 2012). A variety of LSN forms typify Early Archaic Period sites across most of the Great Basin, just as they do at BER.

Following the identification of a LSN point based on notch placement on the preform and thickness (generally greater than 4mm in thickness), it is imperative to consider Cunnar et al.'s (2017) and Stoner and Cunnar's (2018) recently defined LSN subtype, the Pequop point, because these points have been identified as Elko-eared points in the past. Pequop points were first identified in northeastern Nevada based on excavations at a series of stratified open-air sites near Big Springs in central Elko County, collectively referred to here as the Big Springs site. Big Springs is located about 25 miles west of BER along the eastern flanks of the Pequop Mountains within Goshute Valley. Cunnar et al. (2017:7-74) recognize 26EK15282 as the type site for the new point type. Pequop points are: (1) side-notched; (2) made on triangular rather than lanceolate preforms; and (3) generally display a small, key-hole notch in the center of the base of the preform. This small notch gives the finished point a superficial "eared-like" appearance, and together with the fact that they are made on triangular preforms has likely led to its misidentification as Elko-eared points in the past (Hockett et al. 2014). The Pequop point with binding or hafting material attached to it from Bob's Cave, Nevada, located near the Nevada-Idaho border north of

BER, and illustrated by Smith et al. (2013:585, Figure 2) demonstrates that the key-hole notch served a functional purpose because the hafting material was tied into both the primary side notches and the key-hole basal notch, presumably to help secure the point to the foreshaft.

Following notch placement and the identification of LSN points, the other key metrics used to distinguish additional point types in the BER Early Archaic and later-dating assemblages include: (1) maximum length; (2) maximum width; (3) the ratio of length:width; (4) stem height; (5) the ratio of stem height:length; (6) thickness; and (7) neck width. There is rarely one single metric that distinguishes the various point types in the Great Basin. In addition, as discussed above, no metric will apply to 100% of individual points that belong to specific point types. As an additional example, Thomas' (1981) projectile point key notes that the basal width of most LSN dart/spear points measure greater than 1cm, while those of most Desert side-notched (DSN) arrow points measure less than 1cm. Nevertheless, we have personally recovered DSN points in northeastern Nevada whose basal widths measure greater than 1cm in width. Fortunately, most dart/spear points in the Great Basin measure greater than 3.5-4mm in thickness, while few arrow points are as thick. In the majority of cases, basal width combined with thickness, as well as overall length and width, can accurately distinguish LSN points from DSN points. These metrics do not necessarily apply across the board to all point types, however, as the newly defined Dead Cedar corner-notched dart points from BER are as thin as many later-dating arrow points.

In order to determine if Elko Series points were recovered from the Early Archaic deposits at BER we utilize three key variables that we propose distinguishes Elko points from the three point types most often typed as 'Elko' in the past: Pinto points; the newly designated Leppy Hills corner-notched point; and Pequop side-notched points.

In order to distinguish between these point types, the first order of business is to determine notch placement, as described above, to determine if the point was, in fact, corner-notched or side-notched because Leppy Hills, Dead Cedar, and Elko are all corner-notched rather than side-notched points. Following that determination, two key ratios are paramount in keying out these point types: length:width and stem height:length.

Plotting the ratios of length:width on the x-axis and the ratios of stem height:length on the y-axis of a bi-plot graph distinguishes Elko points from Pinto and Leppy Hills corner-notched points (Figure 1). The ratio of length:width displays the degree to which a preform was either triangular or lanceolate in shape prior to notching or shouldering. A perfectly triangular-shaped preform will have identical length and width measurements, and thus will display a length:width ratio of 1. Triangular preforms as defined here will have length:width ratios measuring less than 2, while lanceolate preforms will have ratios greater than 2. Elko points were usually made on triangular preforms, and therefore most will display length:width ratios less than 2. Pinto and Leppy Hills corner-notched points, in contrast, were made on lanceolate preforms, and will display length:width ratios greater than 2 in most cases.

Just as in the example of overlap between LSN and DSN basal widths, however, we can anticipate that there will be some overlap at the juncture of our separation of triangular and lanceolate preforms at a ratio of 2. Thus, a second metric further separates these three point types from one another, and this is the stem height:length ratio (Figure 1).

Stem height is defined as the height from the base of the point to the top of the shouldered

stem or notch (as in Pinto points) or the top of a corner-notch that originates from the base of the preform (as in Elko points). Points that we define as long stems display stem height:length ratios greater than .20; this definition applies to most Pinto points. Conversely, points with short stems or low/shallow corner-notches will have stem height:length ratios less than .15; this definition generally applies to most Leppy Hills corner-notched points. Elko Series points generally do not exhibit true stems like Pinto points, but because they are often deeply corner-notched, a fact recognized by Heizer and Baumhoff (1961) when they first defined the type, then their "stem height" measurements often lie between Pinto and Leppy Hills points, or between .15 and .25 (Figure 1). On average, then, Pinto points display length:width ratios greater than 2 and stem height:length ratios between .20 and .40. Leppy Hills corner-notched points display length:width ratios greater than 2 and stem height:length ratios between .08 and .15. Elko points display length:width ratios less than 2 and stem height:length ratios between .15 and .25 (Table 2).

The BER Early Archaic deposits also contained two concave base points (at BER, they are Black Rock Concave Base points; see discussion below). Post-Paleoindian Period there are generally two concave base dart points recognized in the Great Basin: Black Rock Concave Base (BRCB) and Humboldt. BRCB points were first identified by Clewlow (1968) based on surface surveys in the Black Rock Desert of northwestern Nevada. While superficially similar to Humboldt points, BRCB points are significantly wider than Humboldt

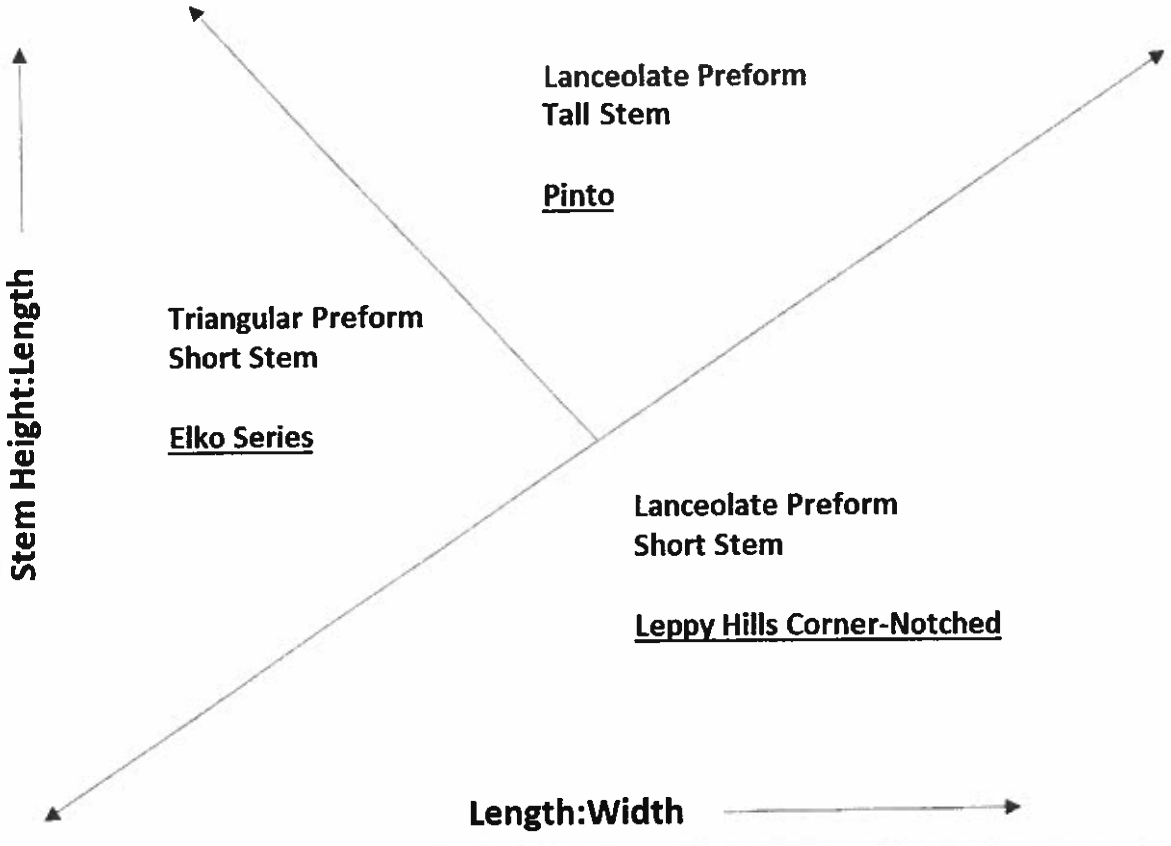

Figure 1. Bi-plot graph that distinguishes Elko Series, Pinto, and Leppy Hills corner-notched points.

points, and may pre-date Humboldt points in some areas of the Great Basin.

Clewlow (1968) recognized a concave base projectile point from the Black Rock Desert that morphologically appeared similar to Midland points of the Plains region in that they looked superficially like Clovis or Folsom concave bases but were too thin for fluting technology to have been employed. However, Clewlow also recognized that the BRCB points were spatially separated from both "Great Basin Transverse" points, as he called them (now called "crescents"), and Great Basin Stemmed points, the latter of which were more closely associated with Late Pleistocene faunal remains eroding from buried contexts. On the spatial distribution of BRCB points, Clewlow (1968:14) states that "... there is some evidence to support the view that an entirely different hunting orientation may have prevailed at the time the points were deposited...".

A comparison of the basal widths of Humboldt points to the basal widths of BRCB points demonstrate that BRCB points are significantly wider than Humboldt points as Clewlow suggested. A sample of 81 Humboldt points from northeastern Nevada (Clover Valley Site; 26EK2789; n=46 [Petersen and Stearns 1992]; Valley Mountain Site; 26EK9946; n=35 [Hockett 2003]) display a mean basal width of 13.1mm, ranging between 8.0 and 17mm. In contrast, the 8 BRCB points from the Black Rock Desert of northwestern Nevada originally identified by Clewlow (1968) display a mean basal width of 23.8mm, ranging between 18.5 and 29mm. There was no overlap in basal widths between the two samples. A t-test comparing the 81 Humboldt basal widths to BRCB points show that this difference is extremely statistically significant at the $p<.0001$ level. Thus, the basal width metric of the two Early Archaic-aged concave base points recovered at BER was used to determine whether they should be typed as BRCB or Humboldt points.

Middle Archaic points

Five primary point types were previously identified during the Great Basin Middle Archaic (ca. 1,450 – 5,000 cal BP) (ca. 1,550 – 4,400 14C BP): Gatecliff, Humboldt, Elko, Martis and Gypsum. In the Great Basin, Martis appears to be restricted in distribution along the Sierran front in the western Basin, and Gypsum points are more common in the southern Great Basin, and are especially abundant at sites such as O'Malley Shelter in Lincoln County, Nevada (Fowler et al. 1973). Thus, these two point types will not be considered further here.

Distinguishing Humboldt from BRCB points was discussed above. In addition, the discussions above detail the metrics to distinguish Elko Series points from LSN, Pinto, and Leppy Hills corner-notched points. Gatecliff points, like Pinto points, were typically manufactured on lanceolate preforms and display tall stems; Gatecliff points tend to display relatively deep corner-notching and narrow, deeply bifurcate-based (downward facing) basal stems, while Pinto points tend to display shouldering and wider, shallower basal notching (see also Thomas 1983:192, Figure 82).

Applying a simple length vs. width bi-plot (Figure 2) combined with thickness and neck width allowed us to also identify another hitherto unrecognized corner-notched dart point in the BER assemblage – this one of early Middle Archaic age. Most of the Elko points from BER measure greater than 3cm in length and 2cm in width. In addition, these points are almost all equal to or greater than 4mm in thickness. In the BER assemblage it was apparent that a number of corner-notched points that superficially look like Elko points were shorter, narrower, and much thinner than these measurements. A number of BER corner-notched points measured

significantly less than 3cm in length, less than 2cm in width, and were as thin as many arrow points recovered from the Great Basin (less than 4mm). We therefore asked ourselves two questions: (1) are these point metrics statistically significantly different than late Middle Archaic-aged Elko points?; and (2) if so, were they dart or arrow points?

Regarding the first question, the L:W ratio, which indicates the placement of the preform along a triangular-to-lanceolate scale as discussed above, places the small and thin corner-notched points from BER more similar to Elko points than to other corner-notched dart points because both styles were made on triangular preforms. L:W ratios for the small and thin points from BER range between 1.29 and 1.91 (n=8), with a mean of 1.59. L:W ratios for Elko points from BER have similar ranges: 1.34 to 2.22 (n=14), with a mean of 1.70. This means both styles were made on triangular preforms. In comparison, L:W ratios for the three Early Archaic-aged Pinto points from BER range from 1.86 to 3.4, with a mean of 2.46, indicating they were made on lanceolate preforms.

The most significance differences between the small and thin corner-notched points and Elko points are in maximum length and thickness. The length of the small corner-notched points range from 18.63mm to 29.21mm (n=8), with a mean of 23.34mm. In contrast, the length of the BER Elko points range from 25.7mm to 47.5mm (n=14), with a mean of 34.6mm. An unpaired t-test demonstrates that this difference is extremely statistically significant at the $p<.0001$ level. Similarly, the maximum thickness of the BER Elko points range from 4.08mm to 5.91mm (n=19), while maximum thickness of the small corner-notched points range from 2.46mm to 3.99mm (n=8). There is no overlap between the thinnest Elko (4.08mm) and the thickest small corner-notched points (3.99mm). Unsurprisingly, an unpaired t-test also shows that differences in point thickness between Elko and the small corner-notched points are extremely statistically significant at the $p<.0001$ level.

Relatedly, Hockett et al. (2014) also showed that Rose Spring and Eastgate arrow points generally have mean thickness values ranging between 3.0mm and 3.5mm, while the thickness of Elko Series points range between 4.4mm and 5.4mm. The mean thickness of the Elko points from BER is 4.86mm, matching the range published by Hockett et al. (2014) for other Elko points in the Great Basin. The mean thickness of the small and thin corner-notched points from the BER Middle Archaic-aged deposits is 3.24mm, matching that of Late Archaic arrow points.

Based on the high degree of metrically statistically significant differences between the two point samples in length and thickness, it is clear that these represent two different point types. As a result, the Middle Archaic-aged small and thin corner-notched points from BER have been designated Dead Cedar corner-notched points. And, as is detailed below, all of the Dead Cedar points from BER pre-date all of the Elko points from the shelter.

Second, were these >4,000 cal BP (>3,650 14C BP) Dead Cedar points dart or arrow points? Hildebrandt and King (2012) developed a "thickness plus neck width index" to distinguish dart and arrow points. Hildebrandt and King (2012) state that an index value of 11.8mm generally distinguishes dart points (>11.8mm) from arrow points (<11.8mm). The dart/arrow index indicates that the small, thin Dead Cedar points dating between ca. 4,000 and 5,000 cal BP (ca. 3,650 – 4,400 14C BP) at BER are dart points. The eight Dead Cedar points from BER have a mean index value of 12.62mm (range 11.07mm-13.43mm). Thus, Hildebrandt and King's index value would accurately classify seven of the eight individual Dead Cedar points as dart points; given variability in metrics of individual points

within a specific type, however, as discussed above, all eight of these points are interpreted as dart points. Finally, a sample of 12 of the Elko Series points from BER have a mean index value of 17.35mm (range 13.08mm-19.71mm), thereby accurately placing all of them as dart points as well, as highlighting once again that the Elko points are substantially larger and thicker than the newly established Dead Cedar points.

Late Archaic points

Late Archaic (ca. 600 – 1,450 cal BP) (ca. 590 – 1,550 14C BP) points in the Great Basin generally consist of Rose Spring corner-notched and Eastgate (basally notched) across the Great Basin, with Thomas (1981) combining the two into a more general "Rosegate" designation. As well, there are a variety of corner-notched and side-notched arrow forms generally restricted to the Sierran front in the western Great Basin (e.g., Gunther barbed), as well as the eastern Great Basin (e.g., Nawthis side-notched), the latter influenced by the Fremont interaction sphere. As a result, it would not be unexpected for BER to contain Fremont-style side-notched arrow points that were morphologically distinct from later-dating DSN points.

We do not think that Rose Spring points are simply reworked Eastgate points; as well, Bettinger (2018) has shown that Eastgate points are generally older than Rose Spring points in the southwestern corner of the Great Basin, and thus they are two distinct point types. Nevertheless, for ease and flow of the presentation below we use the term "Rosegate" here rather than re-state "Rose Spring and Eastgate" in the narrative.

Late Prehistoric points

Two Late Prehistoric (ca. 150 – 600 cal BP) (ca. 150 – 590 14C BP) point styles are recognized in the Great Basin: DSN (including a number of subtypes such as "Sierran") and Cottonwood Triangular points. Both point types are rather easily distinguished from other point types based on their small size and thin (generally less than 3mm) preforms across much of the Great Basin.

Table 1. Typable projectile points, strata, and dates recovered from Bonneville Estates Rockshelter correlated with cultural phase sequence from the Upper Humboldt region, as well as Great Basin-wide general cultural periods and climatic phases.

Cultural Phase	BER Component	Period	BER Strata	Dates[1]	BER Projectile Points Recovered	Climatic Phase
Eagle Rock	I	Protohistoric	[2]1, [3]2	500 – 120 cal BP 500 – 120 ^{14}C BP	2 Desert side-notched 1 Cottonwood	Little Ice Age – modern seasonal climate
Maggie Creek	II	Late Archaic	1, 2, 3a	1,450 – 860 cal BP 1,550 – 900 ^{14}C BP	19 Rosegate 8 Elko 7 Large side-notched 2 Small side-notched[4] 1 Humboldt 1 Gatecliff	Medieval Climatic Anomaly – warmer and wet
James Creek	III	Late Middle Archaic	3b, 4, 5, 6, 7, 8, 9	4,000 – 1,600 cal BP 3,650 – 1,700 ^{14}C BP	23 Elko 6 Large side-notched 2 Humboldt	Encompasses two climatic phases: (1) Neoglacial -Neopluvial (ca. 3,500–2,750 cal BP); Late Holocene Drought (ca. 2,750–1,650 cal BP). Late Holocene Drought may have been drier in some areas of the Basin and wetter in others.
South Fork	IV	Early Middle Archaic	8c, 10, 11	4,700 – 4,150 cal BP 4,200 – 3,750 ^{14}C BP	8 Dead Cedar corner-notched 7 Large side-notched 2 Gatecliff 2 Humboldt	Early Late Holocene; cooler and wetter
Pie Creek	V	Early Archaic	12, 13, 14, 15, 16	8,300 – 4,800 cal BP 7,500 – 4,250 ^{14}C BP	68 Large side-notched 3 Pinto 1 Pequop 2 Black Rock Concave Base 1 Leppy Hills corner-notched	Middle Holocene; warm and dry with notable periods of cooler/wetter climate lasting several centuries at ca. 8,300 cal BP and ca. 7,200 cal BP; amelioration leading to Late Holocene begins by ca. 5,500 cal BP
No Name	VI	Paleoindian	17a, b	10,000 – 8,700 cal BP 8,900 – 7,850 ^{14}C BP	N/A	latter Early Holocene and early Middle Holocene; warming; exceptionally dry between ca. 9,400 and 8,300 cal BP
Dry Gulch	VII	Paleoindian	17b', 18	12,900 – 10,500 cal BP 11,000 – 9,300 ^{14}C BP	9 Western Stemmed	Younger Dryas; cool and wet
Izzenhood	VIII	Pre-Clovis	19	14,450 – 13,400 cal BP 12,300 – 11,500 ^{14}C BP	N/A	Late Pleistocene; cool and wet

[1]Dates have been rounded from Goebel et al. (2018, this volume).

[2]Some stratum 1 materials from the West Block are Eagle Rock and some are Maggie Creek, depending on the unit

[3]Some stratum 2 materials from the West Block are Eagle Rock and some are Maggie Creek, depending on the unit

[4]These small side-notched points are Fremont varieties (e.g., Uinta side-notched) rather than Desert side-notched

Table 2. Length:width and stem height:length ratios for Pinto, Leppy Hills, and Elko projectile points.

Point Type	Length:Width	Stem Height:Length
Pinto	> 2	.20 - .40
Leppy Hills	> 2	.08 - .15
Elko	< 2	.15 - .25

Table 3. Typable projectile points recovered per cultural phase at BER.

	[1]DSN/CTWD	[2]RG/SSN	Elko	[3]Hmblt	[4]Gtcf	[5]DC	LSN	Pequop	BRCB	Pinto	[6]LH	Stemmed	TOTALS
Eagle Rock	3												3
Maggie Creek		21	8	1	1		7						38
James Creek			23	2			6						31
South Fork				2	2	8	7						19
Pie Creek							68	1	2	3	1		75
Dry Gulch/No Name												9	9
TOTALS	3	21	31	5	3	8	88	1	2	3	1	9	175

[1]Desert side-notched/Cottonwood Triangular
[2]Rosegate (includes Rose Spring and Eastgate)/Small side-notched
[3]Humboldt
[4]Gatecliff
[5]Dead Cedar corner-notched
[6]Leppy Hills corner-notched

Table 4. Untypable projectile point fragments recovered per cultural phase at BER.

	Basal Fragments	Midsections	Tips	TOTALS
Eagle Rock	0	1	3	4
James Creek	7	9	8	24
South Fork	0	2	5	7
Pie Creek	0	6	13	19
Dry Gulch/No Name	0	1	0	1
TOTALS	10	23	46	79

Table 5. Total number of typable points and untyped point fragments per cultural phase at BER.

	TOTALS
Eagle Rock	7
Maggie Creek	62
James Creek	55
South Fork	26
Pie Creek	94
Dry Gulch/No Name	10
TOTALS	254

Table 6. Number of points recovered per century per occupation span of each cultural phase at BER.

	Total Points	Occupation Span	Points per Century
Eagle Rock	7	380 years	1.8
Maggie Creek	62	590 years	10.5
James Creek	55	2,400 years	2.3
South Fork	26	550 years	4.7
Pie Creek	94	3,500 years	2.7
Dry Gulch/No Name	10	2,400 years	0.4

BONNEVILLE ESTATES PROJECTILE POINTS: TYPOLOGY AND CHRONOLOGY

Results of our typological analysis of the Bonneville Estates projectile points are based on the metrics and discussions presented above. We do so by discussing the points recovered during each cultural phase/BER Component. Prior to doing so, however, attention is directed to Tables 1 and 3-6, which summarize the results of our typological analysis in space and time. Table 1 presents the cultural Periods and associated Phases used in this analysis, their dates based on stratigraphic position within the BER layers, as well as their correlations to defined climatic phases in the Great Basin. Table 3 then summarizes the number of each typed point recovered per cultural Phase at BER. Table 4 displays the numbers of untypable points. Table 5 lists the total numbers of typable and untypable points recovered per cultural Phase. Finally, Table 6 lists the number of calendar years that each cultural Phase was periodically occupied at BER, and the number of points recovered per century per cultural Phase in order to gauge relative frequencies of projectile point deposition inside the shelter for each cultural Phase. These tables are referenced throughout the remainder of this article.

Period: Undefined
Phase: Undefined Pre-Clovis
BER Component: VIII
BER Strata: 19
Date Range: 13,400 – 14,450 cal BP (11,500 – 12,300 ^{14}C BP)
Projectile Point Types Present: N/A

Discussion: The earliest radiocarbon dates obtained on charcoal and faunal remains from BER represent Pre-Clovis times, prior to ca. 13,100 cal BP (ca. 11,100 ^{14}C BP). No definitive human occupation or intact hearths were recovered; however, a total of five flakes was recovered from pre-Clovis aged sediments lying directly below a later dating Paleoindian feature. It is unclear whether these artifacts were disturbed into lower, pre-Clovis aged sediments or whether they represent a short-term pre-Clovis occupation in which no tools were left behind.

Period: Paleoindian
Phase: Izzenhood
BER Component: N/A
BER Strata: N/A
Date Range: N/A
Projectile Point Types Present: Clovis

Discussion: Hockett and Morgenstein (2003) designated the Izzenhood Phase to cover the Clovis or early fluted point era in northeastern Nevada, generally commensurate with pre-Younger Dryas climate. The Clovis/fluted phase is essentially undated in the Great Basin (Beck and Jones 2007), but it is presumed to date between about 13,100 – 13,400 cal BP (ca. 11,100 – 11,400 ^{14}C BP). This phase may also be represented by the earliest appearance of stemmed points in the Great Basin, suggesting that stemmed and fluted technologies may be contemporaneous in this region of western North America (Beck and Jones 2007). The early fluted-stemmed point tradition was not represented at BER in the radiocarbon chronology. The radiocarbon chronology at BER currently shows a 500-year hiatus between components VIII and VII, and this gap covers the accepted age range of Clovis technology in western North America (Goebel et al 2013). A Clovis projectile point base was recovered during the excavations (Goebel 2007:159, Figure 9.2a), but it was found in the top historic layers within domestic sheep dung, and thus was likely brought into the shelter late in the chronological sequence, sometime after ca. 1850 (Goebel 2007).

Period: Paleoindian
Phase: Dry Gulch
BER Component: VII
BER Strata: 17b', 18
Date Range: 10,500 – 12,900 cal BP (9,300 – 11,000 ^{14}C BP)
Projectile Point Types Present: Western Stemmed, including Parman, Windust, Haskett, Cougar Mountain, and Silver Lake varieties.

Discussion: A total of nine stemmed projectile points and one lateral fragment of a projectile point was recovered from the Dry Gulch Phase (Figure 2), which chronologically corresponds to the Younger Dryas (ca. 11,600 – 12,900 cal BP; ca. 10,100 – 11,000 ^{14}C BP) and first one-half of the Early Holocene (ca. 10,500 – 11,600 cal BP; ca. 9,300 – 10,100 ^{14}C BP) climatic phases. Four varieties of stemmed points are recognized in the BER assemblage: Parman, Windust, Haskett, and Little Lake (cf. Goebel 2007; Schmitt et al. 2007). All 10 points were made from fine-grained volcanics (FGV). Only one stemmed point was complete (Figure 2). This latter point is a close match to the Silver Lake point illustrated by Schmitt et al. (2007:114, Figure 6.3) from 42To1872 along the Old River Bed locale east of BER.

Stemmed points similar to those recovered from BER are relatively common in Goshute Valley, located on the west side of the Goshute Range, and at the base of Spruce Mountain to the west of Goshute Valley (Figure 3).

Period: Paleoindian
Phase: No Name
BER Component: VI
BER Strata: 17a, b
Date Range: 8,700 – 10,000 cal BP (7,850 – 8,900 ^{14}C BP)
Projectile Point Types Present: N/A
Discussion: No projectile points were recovered from the No Name Phase/Component VI sediments in BER. Only four hearths were dated at BER between 8,300 and 10,500 cal BP (7,500 – 9,300 ^{14}C BP), suggesting that, on average, one short-term occupation occurred inside BER every five centuries. Artifacts and faunal remains of any kind were sparse, suggesting that BER served as an episodic, short-term, perhaps overnight-only stopover site. This two millennia-long cultural Phase is represented by the second one-half of the Early Holocene (ca. 9,400 – 10,500 cal BP; ca. 8,300 – 9,400 ^{14}C BP) and the first millennium of the Middle Holocene (ca. 8,300 – 9,400 cal BP; ca. 7,500 – 8,300 ^{14}C BP), and suggests a reduced human presence and/or settlement pattern shift during the biogeographical changes from mesic to xeric-adapted plants and animals in the region.

Period: Early Archaic
Phase: Pie Creek
BER Component: V
BER Strata: 12-16; Layer M2
Date Range: 4,800 – 8,300 cal BP (4,250 – 7,500 ^{14}C BP)
Projectile Point Types Present: Large Side-Notched (including Pequop subtype); Pinto; Black Rock Concave-Base; Leppy Hills Corner-Notched

Discussion: A total of 94 complete and partial projectile point fragments was recovered from Component V at BER. Of this total, 68 Large side-notched, one Pequop side-notched, three Pinto, two Black Rock Concave-Base (BRCB), one Leppy Hills corner-notched and 19 unidentifiable point fragments (six midsections and 13 tips) were identified. Each of the identified point types are treated in more detail below.

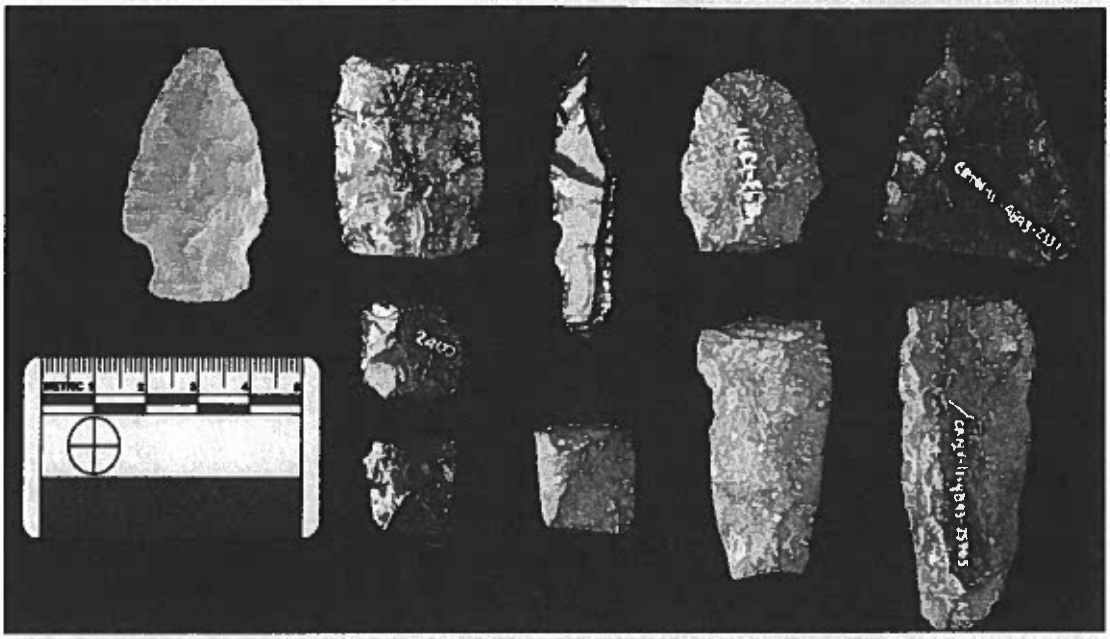

Figure 2. Stemmed points recovered from the Dry Gulch Phase at BER.

Figure 3. Sample of stemmed projectile points recovered from the Goshute Valley-Spruce Mountain areas near BER.

Top row, L-R: basal fragment of an elongated stemmed point from Goshute Valley; complete stemmed point from Goshute Valley; base and partial midsection of a stemmed point from the Spruce Mountain area.

Bottom row, L-R: Three Windust points recently recovered from the Big Springs locale in Goshute Valley by Cunnar et al. (2017). Interestingly, although similar points were recovered from the Dry Gulch Phase in BER, these Windust points recovered from the Big Springs locale were recently securely dated between 7,750 – 7,900 cal BP (6,900 – 7,100 ^{14}C BP), suggesting that Windust points continued to be manufactured into the early Pie Creek Phase in northeastern Nevada.

Large Side-Notched Points

Large side-notched (LSN) points constitute 91% of all the typable points recovered from the Pie Creek Phase (Figure 4). Although LSN points are commonly known to represent the quintessential Early Archaic projectile point type across much of the Great Basin, until recently their age of first appearance was not well documented.

As late as 2003, the earliest well-dated LSN points from northeastern Nevada came from Pie Creek Shelter (Hockett and Morgenstein 2003, Table 1; McGuire et al. 2004), the type site for the Pie Creek Phase. At Pie Creek Shelter, LSN points were found in sediments dated between ca. 4,890 – 5,570 cal BP (4,300 – 4,840 ^{14}C BP) (McGuire et al. 2004), with the youngest of this date range matching the terminal Pie Creek Phase radiocarbon dates for LSN points at BER.

Elston (2005:115, Figure 5.16m,o) reported two LSN points from stratum III in Camels Back Cave. A hearth from stratum III was dated at 8,330 cal BP (7,530 ^{14}C BP), six centuries before the eruption of Mount Mazama at ca. 7,700 cal BP (ca. 6,850 ^{14}C BP). Six other LSN points were found in various strata dating between ca. 4,500 – 8,050 cal BP (ca. 4,000 – 7,200 ^{14}C BP).

Lapp (2007) reported on a number of well-dated LSN points recovered from the more recent column excavations completed in Danger Cave, as well as those recovered from nearby Floating Island Cave. Within the Danger Cave sediment column, six LSN points were recovered from stratum 15 dating between ca. 6,900 – 8,300 cal BP (6,030 – 7,490 ^{14}C BP). At Floating Island Cave, 10 LSN points were illustrated by Lapp (2007); six dated between ca. 7,000 – 7,700 cal BP (6,090 – 6,800 ^{14}C BP); two between ca. 3,940 - 6,500 cal BP (3,610 – 5,670 ^{14}C BP); one between ca. 2,800 and 3,940 cal BP (2,670 – 3,610 ^{14}C BP; and one at 2,240 cal BP (2,220 ^{14}C BP).

Smith et al. (2013) directly dated three LSN points, two of which were Pequop side-notched. Two were from Bob's Cave located north of BER near the Nevada-Idaho border, the other from Elephant Mountain Cave located in northwestern Nevada. These three LSN points dated ca. 7,700 cal BP (ca. 6,850 ^{14}C BP).

Hoskins (2016) dated the binding adhering to a Pequop side-notched point recovered from the original Danger Cave excavations. Results indicated the point was discarded 7,640 cal BP (6,791 ^{14}C BP).

LSN points (including the Pequop subtype) were recently recovered in buried context at the open-air Big Springs locale located in northern Goshute Valley about 25 miles west of BER (Cunnar et al. 2017; Figures 5-6 below). These LSN points were radiocarbon dated between ca. 6,400 – 7,900 cal BP (ca. 5,600 – 7,100 ^{14}C BP). Similar Pequop specimens were found in Danger Cave and illustrated by Jennings (1957:122-123, Figures 98-99), as well as No Name Valley, Nevada, located north of Danger Cave (Berry 1976:151, Figure 58g, j), but these latter points are not securely dated.

At BER specifically, the earliest LSN points were recovered from stratum 16. These points were sealed below sterile stratum 15 above; stratum 15 contained Mazama ash. Two LSN points from stratum 16 date between ca. 7,700 - 8,300 cal BP (ca. 6,850 - 7,500 ^{14}C BP), the same time as the initial human occupation of Camels Back Cave. Thus, both BER and Camels Back Cave demonstrate that LSN points were in the eastern Great Basin by 8,300 cal BP (7,500 ^{14}C BP), ushering in the Early Archaic prior to the eruption of Mount Mazama. The Pequop subtype point from BER was recovered from Layer M2 within stratified woodrat (*Neotoma* sp.) midden dating between 6,200 and 7,500 cal BP (5,380 – 6,600 ^{14}C BP) (Figure 7).

Taken together, BER, Camels Back Cave, Danger Cave, Floating Island Cave, Pie Creek Shelter, Bob's Cave, and the Big Springs locale solidly place LSN points as the quintessential Early Archaic projectile point across the northeastern Nevada and eastern Great Basin regions, between the Upper Humboldt drainage and the western margins of the Bonneville Basin. The Early Archaic begins at least six centuries prior to the eruption of Mount Mazama, generally dating between ca. 4,800 – 8,300 cal BP (ca. 4,250 – 7,500 ^{14}C BP). This 3,000-year cultural period chronologically rests within the four-millennia long warm and dry Middle Holocene climatic phase that began ca. 9,400 cal BP (ca. 8,300 ^{14}C BP). Importantly, however, the boundary of the No Name and Pie Creek Phases at ca. 8,300 cal BP (ca. 7,500 ^{14}C BP) corresponds to a global cooling event that occurred about 1,000 years after the start of the Middle Holocene (e.g., Smith et al. 2011).

Thus, there is not a 1:1 correspondence between the beginnings of the Middle Holocene climatic phase and the beginnings of the Pie Creek cultural phase, the latter dating 1,000 years after the accepted beginning of the Middle Holocene.

Further afield, Oetting (1994) also placed the LSN (Northern side-notched) projectile point as the quintessential Early Archaic projectile point marker in the northwestern Great Basin. Oetting (1994) states that the earliest LSN points date to ca. 7,800 cal BP (7,000 ^{14}C BP) in this region of the Great Basin. If that date is accurate, then the LSN points from BER and Camels Back Cave are older than those currently known from south-eastern Oregon.

Similar to the Dry Gulch Phase, the manufacturers of the LSN points at BER preferred FGV and obsidian over chert. Of the 68 LSN points, 32 (48%) were made from FGV, 26 (37%) were made from obsidian, and only 10 (15%) were manufactured out of chert.

Figure 4. Representative sample of the LSN points recovered from Component V, Pie Creek Phase, at BER. Top row, L-R, BER specimen No. 12660, 26023, 21460, 10931, 28569, 26085; 10071-72 (from Nelson Creek in Goshute Valley west of BER). Bottom row, L-R, BER specimen No. 28948, 29140, 28759, 10653, 20922, 12648, 19052.

Figure 5. Pequop side-notched point from the recently discovered Big Springs locale in Goshute Valley (Cunnar et al. 2017). Specimen No. 26EK15282-648.

Figure 6. Pequop side-notched point from the recently discovered Big Springs locale in Goshute Valley (Cunnar et al. 2017). Specimen No. 26EK15282-652.

Figure 7. Pequop side-notched point from the Pie Creek Phase at BER. Specimen No. 24347.

Pinto Points

The age and geographic distribution of Pinto points have received considerable discussion ever since they were first defined from the Pinto Basin region of southern California (Amsden 1935, 1937; Basgall and Hall 2000; Campbell and Campbell 1935; Rogers 1939; Harrington 1957; Vaughan and Warren 1987; Warren 2002). It was the Campbells, in fact, who first suggested that Pinto points dated to the Late Pleistocene and early post-Pleistocene because of their distribution near ancient Pleistocene lake shores and nearby stream channels (Warren 2002).

Warren (1980) and Jenkins (1987) dated the beginning of Pinto points between 7,860 – 9,450 cal BP (7,000 and 8,400 ^{14}C BP) in the Mojave Desert, and Duke (2011) argues that Pinto points may date as early as 10,500 cal BO in the Mojave.. There is no reason to expect that Pinto points would display precisely the same chronological distributions in different regions of the Great Basin, especially if they had a wide geographic distribution. Warren (2002) notes that the end of the Pinto point is marked by the transition to Gypsum and Elko points in the Mojave Desert.

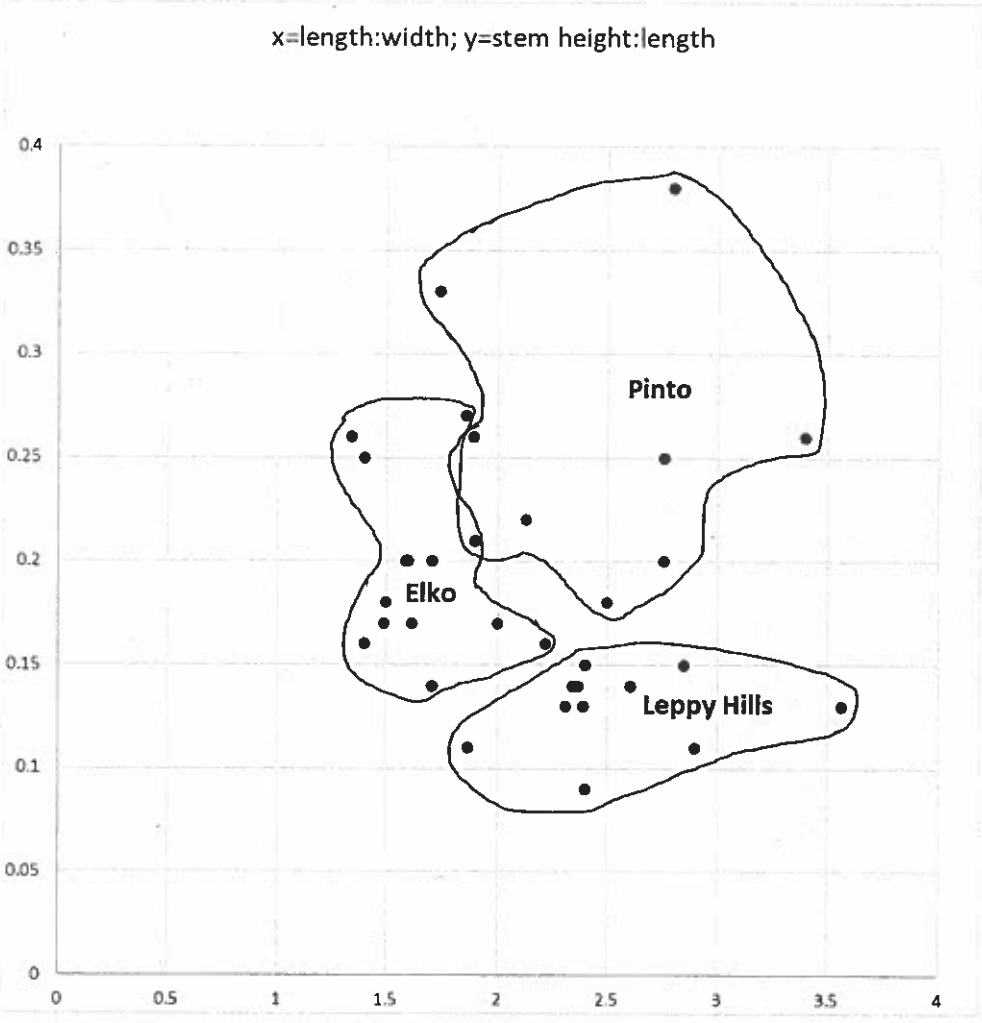

Figure 8. (left) Bi-plot of length:width ratios versus stem height:length ratios of Early Archaic-aged Pinto and Leppy Hills points from BER, Camels Back Cave, Danger Cave, and Floating Island Cave, as well as Middle Archaic-aged Elko points from the post-4,000 cal BP sediments in BER. There is no overlap between the distribution of Leppy Hills points and Pinto and Elko points. There is minimal overlap between the distribution of Pinto and Elko points.

BER Elko points: FS#'s 686, 4614, 2496, 8858, 2606, 2493,6012, 24347, 8541, 17963, 7465, 12007, 12018, and 23697

Pinto points: (BER): FS#'s 24010, 25949, and 32412; (Danger Cave): FS#'s 99.1, 99.2, 93.1, and 23665.5; (Floating Island Cave): FS# 381; (Camels Back Cave): FS# 625.04.

Leppy Hills corner-notched points: (BER): FS# 18757; (Danger Cave): FS #'s 22993.4, 23160.1, 23054.1, 23662.5, 23661.4, 23340.48, 22993.5, 23061.16, and 23730.11; (Floating Island Cave): FS# 395.

Three Pinto points were recovered from BER (Figures 8-9); all date to the Early Archaic, spanning ca. 5,500 – 8,300 cal BP (4,800 – 7,500 ^{14}C BP). One Pinto point was recovered from Camels Back Cave (Elston 2005:114, Figure 5.15m); this point dates between ca. 7,300 – 8,200 cal BP (ca. 8,100 – 9,165 ^{14}C BP). One Pinto point (FS 23665.5) with attached binding has been directly dated from Danger Cave (Hoskins 2016:67, Figure 3.1); this point dates ca. 8,100 cal BP (ca. 7,230 ^{14}C BP). Four additional Pinto points were recovered from the recent excavations in Danger Cave. One point from stratum 11 dates to 8,300 cal BP (7,500 ^{14}C BP); two were recovered from stratum 12 just above stratum 11, and likely minimally date to ca. 7,860 cal BP (ca. 7,000 ^{14}C BP); the fourth Pinto point dates between 6,150 – 6,875 cal BP (5,360 – 6,030 ^{14}C BP).

At Floating Island Cave, two points that metrically graph as Pinto points were recovered: one dating between 6,950 – 7,650 cal BP (6,090 – 6,800 ^{14}C BP), and one later-dating specimen at 3,940 cal BP (3,610 ^{14}C BP) that morphologically resembles a Pinto-shouldered subtype. This latter specimen may be an out-of-key Humboldt given its recent age. Collectively, these data suggest that Pinto points came into the region by 8,300 cal BP (7,500 ^{14}C BP), about the same time as LSN points made their arrival.

Figure 9. Pinto, Leppy Hills corner-notched, and Silver Lake stemmed projectile points from BER and nearby Goshute Valley.

Top row, L-R: First three points: Pinto corner-notched points from surface site CRNV-11-10054, Goshute Valley (Specimen No.'s 65, 67, and 64); Pinto corner-notched point from surface site CRNV-11-10071, Goshute Valley (Specimen No. 21); Silver Lake stemmed point from surface of site CRNV-11-15180, Goshute Valley (Specimen No. 10); Pinto or Silver Lake stemmed point from surface site CRNV-11-10070, Goshute Valley (Specimen No. 33).

Bottom row, L-R: Projectile points from early strata at BER (except 4th point from the left; see below for details): BER specimens No. 13318 (complete Silver Lake stemmed point from the Dry Gulch Phase, re-pictured here from Figure 2); 24010 (Pinto corner-notched point from the Pie Creek Phase); 25949 (Pinto corner-notched point from the Pie Creek Phase); 728 (Pinto-like corner-notched point from the upper strata at BER; this point could be displaced out of sequence or may have been scavenged and brought into the shelter centuries after its manufacture); 18751 (Leppy Hills corner-notched point from the Pie Creek Phase); 32412 (Pinto shouldered point from the Pie Creek Phase).

Leppy Hills Corner-Notched

One Leppy Hills corner-notched point was recovered in the Early Archaic layers in BER (Figures 8-9); this point was recovered from stratum 14, dating between ca. 6,400 - 7,600 cal BP (5,650-6,750 14C BP). Nine Leppy Hills corner-notched points were illustrated in Hoskins (2016) from Danger Cave, with one directly dated to ca. 7,850 cal BP (7,000 14C BP). One Leppy Hills corner-notched point was also illustrated in Lapp (2007:33, Figure 6h) from Floating Island Cave; this point was recovered from strata 6/7, dated to ca. 7,000 cal BP (6,100 14C BP). Thus, Leppy Hills corner-notched points are currently known from BER, Danger Cave, and Floating Island Cave in the eastern Great Basin, and all are Early Archaic in age. They currently post-date LSN and Pinto points by several centuries in the eastern Great Basin.

Black Rock Concave-Base

Two Black Rock Concave-Base (BRCB) points were recovered from the Pie Creek Phase strata at BER (Figure 10). Both appear relatively late in the Early Archaic sequence, ca. 5,000 - 6,000 cal BP (ca. 4,400 - 5,250 14C BP). None of the BRCB points identified by Clewlow (1968) were securely dated, and they remain poorly dated overall.

Period: Early Middle Archaic
Phase: South Fork
BER Component: IV
BER Strata: 8c; 10-11
Date Range: 4,150 – 4,700 cal BP (3,750 – 4,200 14C BP)
Projectile Point Types Present: Dead Cedar corner-notched; Gatecliff; Humboldt

Discussion: A total of 26 complete and partial projectile point fragments was recovered from Component IV at BER. Of this total, eight Dead Cedar corner-notched, seven LSN, two Gatecliff, two Humboldt, and seven unidentifiable point fragments (two midsections and five tips) were identified. Each of the identified point types are treated in more detail below.

Figure 10. BRCB points from the Pie Creek Phase at BER. Specimen No.'s 20182 and 23780.

Dead Cedar Corner-Notched Points

All eight of the Dead Cedar corner-notched points from BER were recovered from the South Fork Phase within Component IV of the Early Middle Archaic, and date between ca. 4,100 and 4,800 cal BP (3,800 - 4,250 14C BP) (Figure 11). Elko points do not appear in the BER record until the James Creek Phase (Component III) of the Late Middle Archaic, and date between ca. 1,600 and 4,000 cal BP (1,700 – 3,650 14C BP).

As discussed above, Dead Cedar points can be distinguished from Elko points using two primary metrics: (1) length:width ratio; and (2) thickness. Figure 12 plots the length:width ratio and thickness of the BER Dead Cedar and Elko Series points on a bi-plot graph. While the length:width ratios are not statistically significantly different between the two samples, a t-test comparison of the thickness between the two samples is highly statistically significant at the $p<.0001$ level, which nicely separates the two point types on the bi-plot graph. As noted earlier, all the Dead Cedar points measure 4mm or less in thickness, while all of the Elko points measure greater than 4mm in thickness. Further, a simple length versus width bi-plot graph (Figure 13) also separates the majority of Dead Cedar points from Elko points. Although two post-4,000 cal BP (post-3,650 14C BP) Elko points cluster with the Dead Cedar points (FS 686 and FS 2496 in Figure 13) on this bi-plot, a t-test comparing the lengths of Elko and Dead Cedar points is statistically significant at the $p<.01$ level. Combined, and with large enough samples, these metrics adequately distinguish Dead Cedar points from Elko points.

Figure 13 also shows the length versus width of the four pre-4,000 cal BP corner-notched points originally classified as "Elko" from Camels Back Cave (Elston 2005:115, Figures 5.15a-d). The average length and width of these points cluster with Dead Cedar corner-notched points. Even with the small sample size from Camels Back

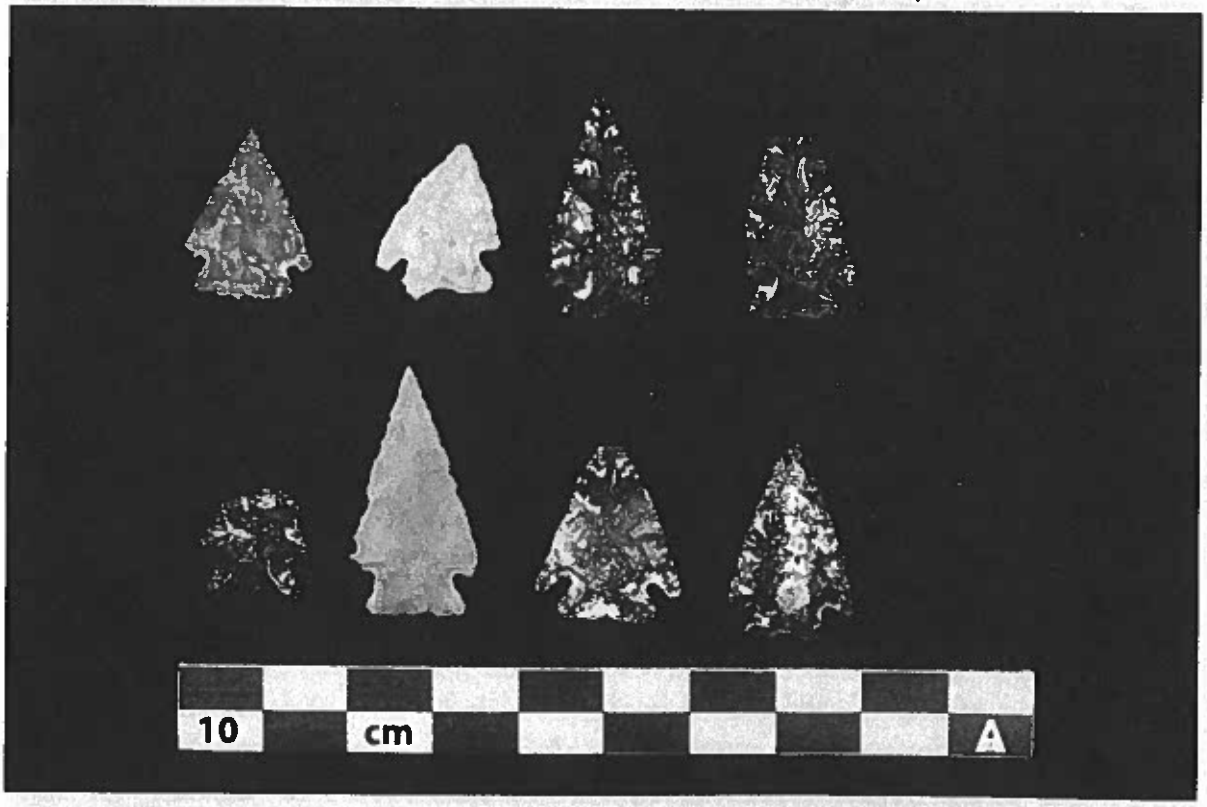

Figure 11. Dead Cedar corner-notched points from the South Fork Phase at BER.

Top row, L-R: Specimen No.'s 15585, 15645, 12662, 12656.
Bottom row, L-R: Specimen No.'s 15647, 15606, 11226, 12657.

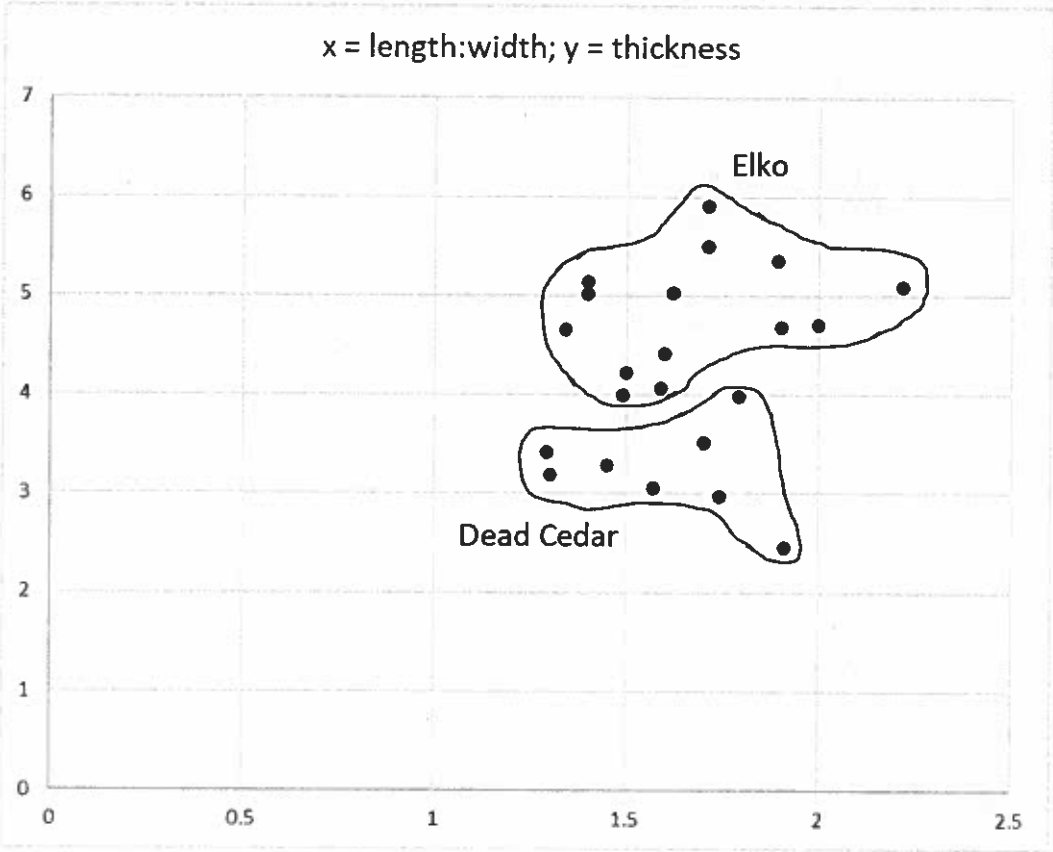

Figure 12. (left)

Bi-plot graph of length:width ratio and thickness for the BER Early Middle Archaic-aged Dead Cedar points and Late Middle Archaic-aged Elko points.

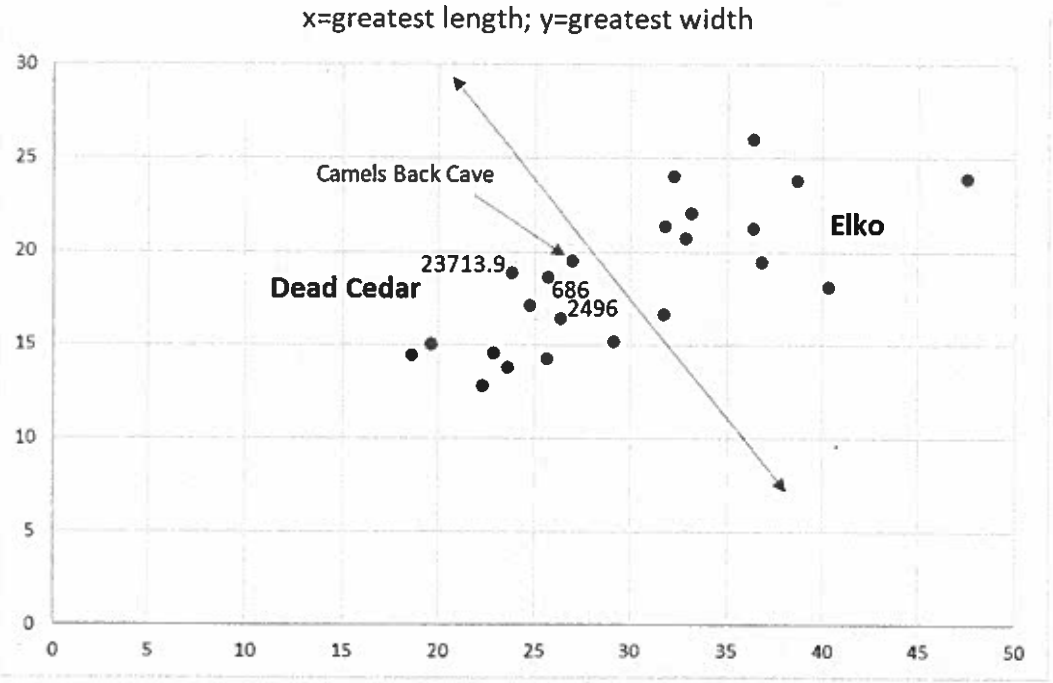

Figure 13. (left) Length versus width for the Dead Cedar points from BER (n=8), Danger Cave (n=1; FS# 23713.9), and Camels Back Cave (n=4; FS#'s 530.01, 587.05, 691.06, and 650.02) plotted against post-4,000 cal BP Elko Series points from BER (n=13). The Camels Back Cave points were recovered from strata VII-IX, dating ca. 6,400 – 7,100 cal BP (ca. 5,630 – 6,250 14C BP).

Cave (n=4), a t-test comparison of the lengths of the BER Elko points and the Camels Back Cave pre-4,000 cal BP corner-notched points show that the two samples are statistically significantly different from each other at the $p<.05$ level, confirming that the Early Archaic-aged corner-notched points from Camels Back Cave should be reclassified as Dead Cedar corner-notched points. There are, therefore, no Elko Series points recovered from the pre-4,000 cal BP sediments in Camels Back Cave.

The four Dead Cedar points from Camels Back Cave date between ca. 6,400 – 7,100 cal BP (ca. 5,630 – 6,250 14C BP), thus making them Early Archaic in age at this site. The Dead Cedar point illustrated in Hoskins (2016:68, Figure 3.2, specimen 23713.9) from Danger Cave (Figure 13) is not securely dated. Although all the Dead Cedar points from BER date to the Early Middle Archaic, those from Camels Back Cave date to the Early Archaic. Those from Camels Back Cave are at least 2,000 years older than those from BER, which extends the current known age range for these small, thin, and corner-notched points to ca. 4,200 – 7,100 cal BP (ca. 3,800 – 6,250 14C BP) in the eastern Great Basin.

LSN Points

A total of seven LSN points was recovered from the South Fork Phase deposits at BER (Figure 14). Either LSN points continued to be manufactured after ca. 4,800 cal BP (ca. 4,250 14C BP) at BER or they were commonly scavenged and re-used post-Pie Creek Phase. Given the large number of LSN points produced over the preceding 3,000 years across the northern Great Basin, this possibility cannot be discounted at this time.

Gatecliff Points

Only two Gatecliff points were recovered from the South Fork Phase deposits at BER (Figure 14). The recovery of only two Gatecliff points is surprising given the fact that hundreds of Gatecliff points have been found in direct association with large-scale antelope (Antilocapra americana) corrals located only 30

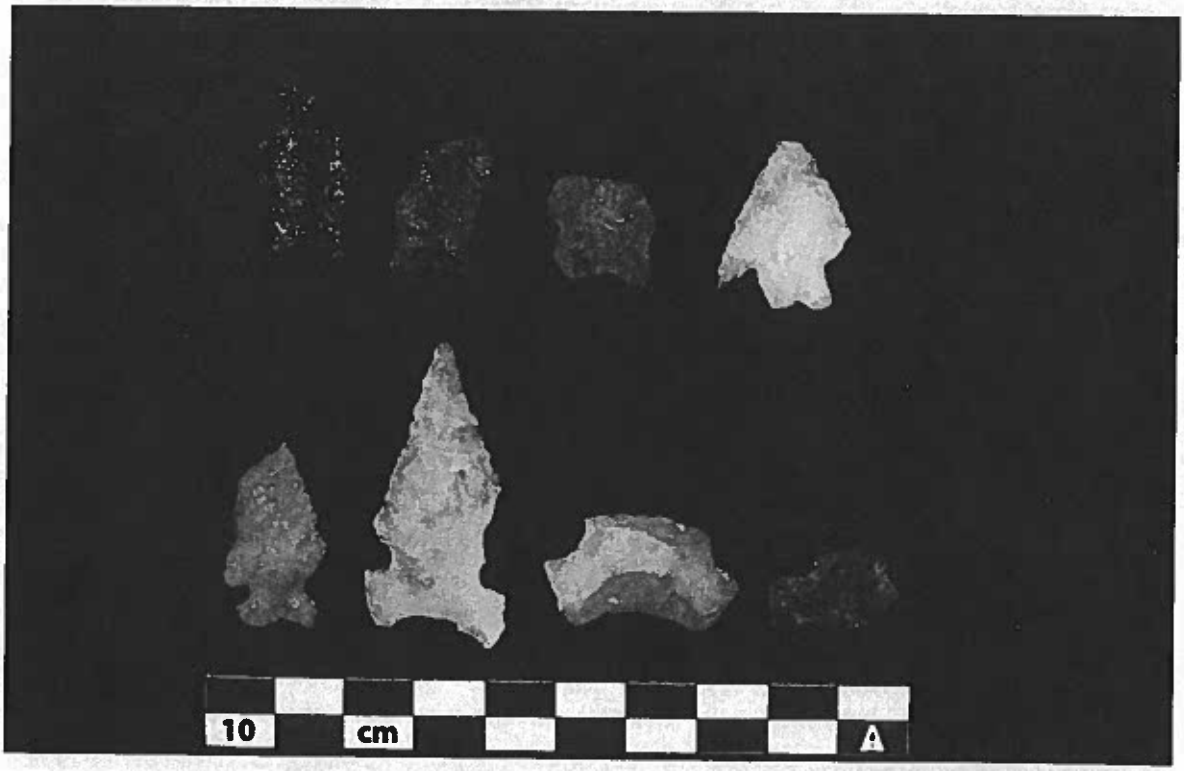

Figure 14. Humboldt, Gatecliff, and LSN points from the South Fork Phase at BER.
Top row, L-R: Humboldt (Specimen No. 32411); Humboldt (Specimen No. 12030); Gatecliff (Specimen No. 23453); Gatecliff (Specimen No. 12655).
Bottom row, L-R: LSN points (Specimen No.'s 10744, 27816, 12016, 11014).

miles west of BER in the Spruce Mountain area (Hockett and Murphy 2009; Hockett et al. 2013) and 30 miles northwest of BER near Silver Zone Pass (Ed Stoner, personal communication, 2018), the latter sites signaling a Middle Archaic increase in communal large game hunting in this region of the Great Basin.

Gatecliff points were first identified as a type by D. H. Thomas based on his study of Gatecliff Shelter, central Nevada (Thomas 1983). At Gatecliff Shelter, 41 of the 45 (84%) Gatecliff points were recovered from Horizons 8 and 9, recently re-dated (Kennett et al. 2014) to ca. 3,575 – 3,760 cal BP (ca. 3,340 – 3,475 14C BP).

Securely dated Gatecliff points from northeastern Nevada are rare, including a poorly dated range of ca. 3,200 to 4,500 cal BP (ca. 3,000 – 4,000 14C BP) at Pie Creek Shelter (McGuire et al. 2004). At Camels Back Cave, Gatecliff points make their first appearance by ca. 4,600 cal BP (ca. 4,060 14C BP) (Elston 2005), about the same time as BER. At Floating Island Cave, one Gatecliff point was recovered from stratum 10 (Lapp 2007:33, Figure 6j), securely dated at 3,940 cal BP (3,610 14C BP). Further west, Smith et al. (2013) directly dated a Gatecliff point from Kramer Cave, western Nevada, to ca. 4,200 cal BP (ca. 3,800 14C BP).

At BER, the two Gatecliff points from the South Fork Phase date between 4,150 and 4,700 cal BP (3,750 – 4,200 14C BP). Gatecliff points made their first appearance in BER and Camels Back Cave about 1,000 years prior to their first appearance in Gatecliff Shelter. Gatecliff points may not be any older than ca. 4,600 cal BP (ca. 4,060 14C BP) in northeastern Nevada and the eastern Great Basin.

Humboldt Points

Despite their ubiquity across much of the Great Basin, the nature and timing of the first appearance of Humboldt points is not well established. Elston (2005:114, Figure 5.15n-r) illustrated five Humboldt points from Camels Back Cave that were recovered between strata XI-XIII/XIV, dating ca. 3,900 – 5,750 cal BP (ca. 3,600 – 4,990 14C BP). Lapp (2007:35, Figure 8a-e) illustrated several Humboldt points recovered between strata 10-14 in Floating Island Cave dating ca. 2,800 – 3,940 cal BP (2,670 – 3,610 14C BP). Six of the eight Humboldt points at Pie Creek Shelter date between 4,500 and 5,600 cal BP (4,000 – 4,850 14C BP) (McGuire et al. 2004). Smith et al. (2013) reported four securely dated Humboldt points: ca. 4,000 cal BP (3,650 14C BP) at Last Supper Cave, northwestern Nevada; ca. 6,700 cal BP (ca. 5,900 14C BP) at Elephant Mountain Cave, northwestern Nevada; ca. 4,500 cal BP (ca. 4,000 14C BP) at the Shinners Site C located in western Nevada; and ca. 4,900 cal BP (ca. 4,300 14C BP) at the Little Sister East Rockshelter located just five miles east of BER along the Nevada-Utah border. In central Nevada, seven Humboldt points recovered from Gatecliff Shelter were recovered from Horizons 12-15, dated between ca. 5,180 and 5,830 cal BP (ca. 4,500 – 5,075 14C BP).

The concave-based and lanceolate Humboldt point makes its first appearance in the South Fork Phase at BER (Figure 14), placing them between 4,150 and 4,700 cal BP (3,750 – 4,200 14C BP).

Collectively, these sites suggest that Humboldt points may have greater antiquity in northwestern and central Nevada than in extreme eastern Nevada along the western margins of the Bonneville Basin, as the Humboldt points from BER and nearby Little Sister East Rockshelter post-date the Pie Creek Phase (ca. < 5,000 cal BP (ca. < 4,400 14C BP); however, those from Camels Back Cave may have made their first appearance there during the waning stages of the Early Archaic. Humboldt points from Elephant Mountain Cave and Gatecliff Shelter have produced securely dated Humboldt points from the late Early Archaic/Pie Creek Phase.

Period: Late Middle Archaic
Phase: James Creek
BER Component: III
BER Strata: 3b; 4-9
Date Range: 1,600–4,000 cal BP (1,700–3,650 ^{14}C BP)
Projectile Point Types Present: Elko, LSN, Humboldt

Discussion: As is the case across much of the Great Basin, during the Late Holocene climatic phase, or sometime after ca. 4,100 cal BP (ca. 3,750 14C BP) a transition to Elko Series (triangular-shaped, corner-notched and eared) projectile points is well documented. A total of 31 typable points was recovered from the James Creek Phase at BER, of which 23 (74%) were Elko Series (Figure 15), six were LSN (19%) (Figure 16), and two (6%) were Humboldt (Figure 16). Similar to the South Fork Phase, the LSN points, while not numerous, could indicate either long-term manufacture of this point type or scavenging and re-use. The two Humboldt points may also indicate that this point style post-dates 4,000 cal BP (3,650 14C BP) in northeastern Nevada, or possibly the re-use of older, discarded points.

Elko Series Points

Previous discussions here have established that the Elko Series points from BER (Figures 8, 12, and 13) are metrically distinguished from older Pinto, Leppy Hills corner-notched, and Dead Cedar corner-notched points. In addition to BER, in which Elko points enter the stratigraphic record at ca. 4,000 cal BP (ca. 3,650 14C BP), Elko points are securely dated at Floating Island Cave by ca. 3,000 cal BP (ca. 2,850 14C BP). The oldest Elko points from Camels Back Cave were recovered from the boundary of stratigraphic Unit XIII/XIV, which dates to ca. 4,000 cal BP (ca. 3,650 14C BP), essentially identical to the oldest Elko points from BER.

Securely dated Elko Series points from northern and central Nevada place all of them after ca. 4,000 cal BP as well, within the radiocarbon age range identified at BER. These sites include Gatecliff Shelter, in which 198 of the 211 Elko Series points (94%) date at or after Horizon 7, ca. 3,530 cal BP (ca. 3,300 14C BP) (Kennett et al. 2014; Thomas and Bierwirth 1983); the Antelope Ridge B large-scale trap near Spruce Mountain at ca. 3,450 cal BP (ca. 3,200 14C BP) (Hockett and Murphy 2009); Pie Creek Shelter where Elko points do not enter the archaeological record until after ca. 3,200 cal BP (ca. 3,000 14C BP) (McGuire et al. 2004); the Dry Susie Creek Site at ca. 3,200 cal BP (ca. 3,000 14C BP) (Reust et al. 1994); and James Creek Shelter at ca. 3,000 cal BP (ca. 2,850 14C BP) (Elston and Budy 1980).

Period: Late Archaic
Phase: Maggie Creek
BER Component: II
BER Strata: 3a
Date Range: 800–1,450 cal BP (900–1,550 ^{14}C BP)
Projectile Point Types Present: Rose Spring, Eastgate, small side-notched (Fremont variants), Elko, Humboldt, Gatecliff, LSN

Discussion: A total of 38 typable projectile points was recovered from the Maggie Creek Phase at BER. Broken arrow points were also common, as 17 arrow point tips, four midsections, and two unidentifiable basal fragments were also recovered. Overall, arrow points only constituted 21 of the 38 typable points (55%), while dart and spear points numbered 17 (45%) from this Phase.

Elko points (Figure 17) and LSN points (Figure 18) are commonly recovered at Fremont-era sites in eastern Nevada and Utah, so their presence in the Late Archaic deposits at BER is not surprising. The single Gatecliff and single Humboldt points were likely either scavenged and brought into the shelter or were deposited in the upper strata after Late Archaic hunter-gatherers disturbed older sediments, as a series of 'sediment dumps' were identified in the shelter, especially in the East Block region.

Figure 17. Elko Series points from the Maggie Creek Phase at BER.
L-R: Specimen No.'s 2605, 2496, 4614, 5163.

Figure 18. LSN points from the Maggie Creek Phase at BER.
L-R: Specimen No.'s 5935, 2524, 2064, 5680.

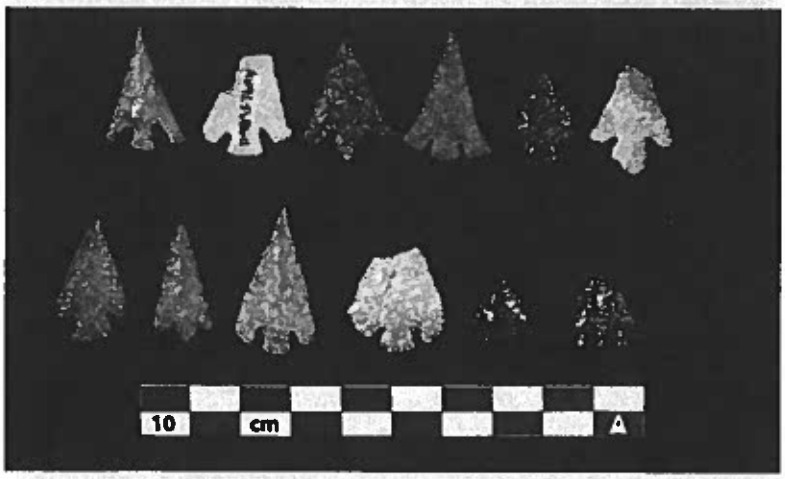

Figure 19. Rosegate points from the Maggie Creek Phase at BER.
Top row, L-R: Specimen No.'s 7861, 7686, 12644, 7699, 5890, 5936.
Bottom row, L-R: Specimen No.'s 31903, 6121, 2531, 8240, 9139, 5911.

Rose Spring and Eastgate Points

BER may hold the earliest record for bow-and-arrow technology entering this part of the Great Basin, at ca. 1,450 cal BP (ca. 1,550 14C BP) (Figure 19). Previous secure and early dates on Rose Spring or Eastgate points from the eastern Great Basin include Camels Back Cave, where they occurred in strata dating to 1,335 cal BP (1,420 14C BP) (Elston 2005). Rose Spring and Eastgate points are also securely dated at a number of sites across northern Nevada, including ca. 1,250 cal BP (ca. 1,340 14C BP) at Elephant Mountain Cave, western Nevada (Smith et al. 2013); 1,200 cal BP (1,275 14C BP) at the Nicholarsen Cache site, western Nevada (Smith et al 2013); ca. 1,150 cal BP (ca. 1,210 14C BP) at the Scorpion Ridge site near Elko, Nevada (Hockett and Morgenstein 2003); and ca. 950 cal BP (ca. 1,030 14C BP) at Oranjeboom Cave on the western flanks of the Goshute Range near BER (Buck et al 2002). In addition, 43 of the 47 (92%) Rose Spring and Eastgate points from Gatecliff Shelter were recovered from Horizons 2 and 3, dated to ca. 845 to 1,025 cal BP (ca. 930 – 1,100 14C BP) (Thomas 1983).

The terminal date of 800 cal BP (860 14C BP) at BER suggests that the shelter was abandoned at least 100 years prior to the transition to the Eagle Rock Phase and the presence of Desert side-notched and Cottonwood projectile points. Securely dated terminal-Late Archaic Rose Spring/Eastgate points are available from the Wells Dump Site at 700 cal BP (760 14C BP) located near Wells, Nevada, as well as the date of 590 cal BP (580 14C BP) at Last Supper Cave, northwestern Nevada (Smith et al. 2013). Thus, the last Rose Spring/Eastgate points appear to have been made between 600-700 years ago in northern Nevada.

Period: Protohistoric
Phase: Eagle Rock
BER Component: I
BER Strata: 1, 2
Date Range: 500 – 120 cal BP (500 – 120 14C BP)
Projectile Point Types Present: Desert Side-Notched; Cottonwood Triangular

Discussion: A total of two Desert Side-Notched/small side-notched, one Cottonwood Triangular, and four point fragments (three tips and one midsection) was recovered from the Eagle Rock Phase at BER (Figure 20).

At Gatecliff Shelter, DSN and Cottonwood points date to after ca. 630 cal BP (680 14C BP). Hockett and Morgenstein (2003) reported that the earliest single component, Eagle Rock Phase site excavated in the northeastern Nevada region prior to the Bonneville Estates excavations was the Carorra's Camp site located between Battle Mountain and Elko, Nevada, and dated to 600 cal BP (590 14C BP). As noted, the latest single component, Maggie Creek Phase site previously excavated in northeast Nevada prior to the Bonneville Estates excavations was the Wells Dump site located at Wells, Nevada, and dated to 700 cal BP (760 14C BP). Thus, the transition from Rosegate/Maggie Creek Phase to DSN-Cottonwood/Eagle Rock Phase appears to be securely established between 600-700 cal BP (590 – 760 14C BP) in northeastern Nevada. The latest Maggie Creek Phase date of 800 cal BP (860 14C BP) and the earliest Eagle Rock Phase date of 500 cal BP (460 14C BP) from BER does not alter this interpretation.

Figure 20. Small Side-Notched and Cottonwood points from the Eagle Rock Phase at BER.
L-R: Small Side-Notched (Specimen No. 12022); Desert Side-Notched (Specimen No. 6586); Cottonwood (Specimen No. 6082).

THE PROJECTILE POINTS FROM BER: SUMMARY NARRATIVES

We first provide a summary of the results of our analysis of the BER projectile points per cultural Period, being mindful of the discussion above on the long and short chronologies debate. This is followed by a discussion of general diachronic trends in hunting intensity through time, as well as a comparison of hunting by small-scale groups as seen in BER to the evidence for communal hunting by larger-scale groups in the nearby Spruce Mountain area.

BER Paleoindian Period Summary

Between 10,500 and 12,900 cal BP (9,300 – 11,000 14C BP) the only projectile point types recovered in the Dry Gulch Phase (Early Paleoindian Period) were several varieties of Western Stemmed points (Table 1). No projectile points were recovered between ca. 8,300 and 10,500 cal BP (7,500 – 9,300 14C BP) during the No Name Phase (Late Paleoindian Period). BER was largely abandoned during this time as the Great Basin climate was shifting during the Early Holocene from the relatively cool and mesic Late Pleistocene to the warm and dry Middle Holocene (ca. 5,000 to 9,400 cal BP; ca. 4,400 – 8,300 14C BP).

BER Early Archaic Period Summary

The Pie Creek Phase (Early Archaic Period) begins at BER ca. 8,300 cal BP (ca. 7,500 14C BP), when LSN points, Pinto points and grinding stones appear in tandem for the first time. The LSN points at BER vary greatly in overall size and shape; we therefore use the general designation of "LSN point" to refer to most of the grouping of points exhibiting side notches. The only exception is the newly designated Pequop side-notched point (Stoner and Cunnar 2018). The

Pequop side-notched point recovered from BER is given special designation from the "LSN" group because, in the past, points that may now be designated as Pequop points were classified as "Elko-eared" points.

One Early Archaic-aged corner-notched projectile point was recovered during our excavations. Combined with data primarily from Danger Cave, a new designated corner-notched and lanceolate point is proposed: Leppy Hills corner-notched.

The Early Archaic at BER also ushers in one other previously named point type in the Great Basin: Black Rock Concave-Base (Clewlow 1968).

BER Early Middle Archaic Period Summary

The proposed Dead Cedar corner-notched points from the early Middle Archaic (ca. 4,150 to 4,700 cal BP [ca. 3,750 – 4,200 14C BP]; South Fork Phase) levels at BER appear, at first glance, to be Elko Series points. If so, this would have extended the known age of Elko points in the northeastern Great Basin another 800-1,000 years from the current well-established and well-dated contexts of these points between ca. 1,300 and 4,000 cal BP (ca. 1,400 – 3,650 14C BP). However, these small, thin, and corner-notched dart points are metrically separated from later-dating Elko Series points of the Late Middle Archaic primarily in length and thickness; hence the new point type proposed here. These Dead Cedar points, along with Leppy Hills corner-notched points, also speak to the fallacy of the 'if it's a corner-notched dart point, then it's an Elko' mantra so common in projectile point typology in the Great Basin and nearby regions. In addition to the Dead Cedar points, lesser numbers of Gatecliff and Humboldt points appear in the BER stratigraphic record for the first time during the Early Middle Archaic. LSN points diminish in popularity, but continued to be manufactured after ca. 5,000 cal BP (ca. 4,400 14C BP).

BER Late Middle Archaic Period Summary

The Late Middle Archaic (ca. 1,600 to 4,000 cal BP [ca. 1,700 – 3,650 14C BP]; James Creek Phase) ushers in the Elko Series point, corroborating the dating of these points at hundreds of sites across the western, central, and northern Great Basin. Humboldt and LSN points, too, may have been manufactured at this time.

BER Late Archaic Period Summary

The Late Archaic (Maggie Creek Phase), marked by the advent of the use of bow-and-arrow technology and the production of arrow points occurs at ca. 1,450 cal BP (ca. 1,550 14C BP) at BER, one of the earliest recorded dates for this time period in the Great Basin. Both Rose Spring and Eastgate points, as well as a variety of Fremont types, are present at BER between 860 and 1,450 cal BP (900 – 1,550 14C BP).

Late Prehistoric Period

Finally, the Late Prehistoric (ca. 120 to 500 cal BP [ca. 120 – 500 14C BP]; Eagle Rock Phase), marked by the presence of Desert side-notched and Cottonwood Triangular points, begins at BER by 500 cal BP.

DISCUSSION

The Long Versus Short Chronology

The long versus short chronology debate centers on the age of Elko Series points. Part of the answer for why the long chronology was established in the eastern Great Basin involves the early identification of Elko points as "Elko corner-notched", "Elko eared" "Elko side-notched", and "Elko split stem" in the 20th century (e.g., Aikens 1970; Fowler et al. 1973; Hester and Heizer 1973; Jennings et al. 1980). As noted previously in this article, if Elko points can be corner-notched, eared, side-notched, and split-stemmed, then for all intent and purposes all dart points manufactured in the Great Basin

are "Elko Series". Clearly, this is not the case based on our current understanding of projectile point typology and the accumulation of a great deal more radiocarbon dates than were available 30 to 50 years ago. "Elko split-stem", for example, are now called "Gatecliff" points (after Thomas 1983). "Elko side-notched" should no longer be used; these points are now usually classified under the general rubric of "Large side-notched" points. It is therefore important to recognize that Elko points are made on triangular preforms, and they are corner-notched dart points with either straight bases (Elko corner-notched) or with a broad basal indentation that form outward flaring 'ears' (Elko-eared) (O'Connell 1967) rather than the downward pointing 'ears' of Gatecliff points.

Thomas (1981) succinctly summarized the long versus short chronology debate nearly 40 years ago. Little has changed over the years. It is probably safe to say that most Great Basin archaeologists accept that the short chronology generally applies to most of the Great Basin, covering the western, central, and much of the northern sectors of the region. And it is probably also safe to say that most Great Basin archaeologists have accepted that the long chronology generally applies to the eastern and southeastern Great Basin subregions. These latter archaeologists also seem to accept that all corner-notched dart points found outside of the Great Basin in the Colorado Plateau and Columbia Plateau/Snake River Plain should also be classified as "Elko" points. Another way of stating this postulate is to say that these researchers accept that point typologies developed specifically for the Middle Archaic occupations in the western and central Great Basin should apply equally well to the Early Archaic of the Colorado Plateau and Columbia Plateau/Snake River drainage regions. It is time to rethink this issue, which can be traced directly to the earlier research of Richard Holmer (1980; 1986).

Issues of the long versus short chronology is just as relevant today as it was in the 1960s, 1970s, and 1980s. It matters because using point typologies and chronologies to cross-date sites that otherwise lack radiocarbon or obsidian hydration dates may place a site containing Elko Series points as either Middle Archaic (short chronology, ca. 1,450 – 4,000 cal BP [ca. 1,550 – 3,650 14C BP]) or Early Archaic – Middle Archaic – Late Archaic (long chronology, ca. 600 – 8,300 cal BP [ca. 590 – 7,500 14C BP]). In this debate, there remains solid evidence that Elko Series points were manufactured for a longer period of time in the eastern Great Basin – but at the younger side of the scale. Corner-notched dart points identified as Elko Series are relatively common in Fremont sites dating between ca. 600 and 1,600 cal BP (ca. 590 – 1,700 14C BP) in the eastern Great Basin. Thus, most archaeologists would accept that Elko Series points in the eastern Great Basin date between 600 and 4,000 cal BP (590 – 3,650 14C BP), while in the western, central, and northern Great Basin Elko Series points were manufactured by at least ca. 4,000 cal BP (3,650 14C BP) but were rarely made after the adoption of the bow-and-arrow at ca. 1,450 cal BP (1,550 14C BP).

So the debate really centers on whether or not Elko Series points were manufactured prior to 4,000 cal BP (3,650 14C BP). In other words, were Elko Series points made during the Early Middle Archaic when Gatecliff, Humboldt, and Gypsum points are recognized for the first time in the Great Basin archaeological record? Were Elko Series points made earlier still, during the Early Archaic when LSN and Pinto points enter the Great Basin archaeological record for the first time? Because the BER projectile point chronology challenges the notion of a "long chronology" in the eastern Great Basin, it is important to consider the debate in light of our recent research.

The long versus short chronology debate is complex because it involves a number of interrelated factors. Among these are: (1) distinguishing side-notching from corner-notching; (2) the degree to which older sites can be trusted to provide evidence for the ages of projectile point types recovered from their sediments; and (3) recent research that challenges accepted norms such as 'all corner-notched dart points are Elko Series' – in other words, there exist hitherto undefined and older corner-notched dart points that are not Elko Series.

The previous evidence for or against a "long chronology" and the 'all corner-notched dart points are Elko' mantra

The three primary Great Basin sites that spawned the notion of a "long chronology" in the eastern Great Basin prior to 1980 were Danger Cave (Jennings 1957), Hogup Cave (Aikens 1970), and O'Malley Shelter (Fowler et al. 1973). Hogup Cave produced eight corner-notched dart points identified as Elko corner-notched between strata 3 and 5, recently re-dated and re-interpreted as ca. 7,700 cal BP in age (ca. 6,850 14C BP) (Martin et al. 2017). All the points illustrated as "Elko corner-notched" in the Hogup report (Aikens 1970:38, Figure 20a-f) would still be classified similarly today. However, there is no way to determine which strata the illustrated points were recovered from. In addition, a total of 20 points was recovered from strata 1-5 and identified as "Elko-eared" in the Hogup report (Aikens 1970:34, Table 4). Based on current typology, only two of the six "Elko-eared" points illustrated in the Hogup report (Aikens 1970:38, Figure 20g-h) appear to be Elko-eared points; the remaining four points are side-notched points. There is also no way of determining whether the two illustrated Elko-eared points were recovered from strata 1-5 dating prior to ca. 4,000 cal BP (3,650 14C BP) or from upper, younger-dating strata. Questions continue to plague the degree to which individual artifacts may be considered valid associations with individual stratigraphic units in which they were recorded during the excavations at both Hogup and Danger caves due to the nature of the excavation techniques used in the 1950s and 1960s. It is possible that corner-notched dart points occasionally were discarded prior to 6,000 cal BP (5,200 14C BP) at these two caves. We will probably never know this answer for certain; however, it does appear that even if corner-notched points were occasionally manufactured at Danger and Hogup caves prior to 4,000 cal BP (3,650 14C BP), they were not the primary style of projectile point on the minds of these Early Archaic hunter-gatherers: that style belonged to the various subtypes of LSN point at both sites.

O'Malley Shelter, located in the southeastern corner of the Great Basin, was excavated in the late 1960s and early 1970s (Fowler et al. 1973). The chronological sequence at O'Malley Shelter was divided into seven occupation Units, labeled I-VII. Cultural Unit I dates between approximately 7,000 and 8,000 cal BP (6,100 – 7,100 14C BP); II between approximately 4,300 and 5,300 cal BP (3,900 – 4,600 14C BP); III approximately 4,000 cal BP (3,650 14C BP); IV approximately 3,200 cal BP (3,000 14C BP); and V approximately 800 cal BP (860 14C BP).

Are there "Elko" points that date prior to ca. 4,000 cal BP at O'Malley Shelter? A total of 54 corner-notched dart points from O'Malley Shelter may be Elko points, although they have yet to be re-examined using the new point typology established here. These 54 corner-notched points were distributed thusly: Unit I contained four 'Elko' points; Unit II contained six 'Elko' points; Unit III contained five 'Elko' points; Unit IV contained eight 'Elko' points; Unit V contained 20 'Elko' points; Unit VI contained 10 'Elko' points; and Unit VII contained one 'Elko' point. The corner-notched dart points from O'Malley Shelter display an unconventional

chronological distribution compared to the majority of the Great Basin. A total of 31 of the 54 (57%) corner-notched dart points were recovered from strata that post-dates 1,000 cal BP (1,100 14C BP), thus post-dating the introduction of the bow-and-arrow. A total of 13 of the 54 (25%) were recovered from strata dating between about 3,200 and 4,000 cal BP (3,000 – 3,650 14C BP), the time frame in which most Elko dart points enter the record throughout much of the Great Basin. Thus, 81% of the corner-notched dart points from O'Malley Shelter date to ca. 4,000 cal BP (3,650 14C BP) or later. Ten corner-notched dart points (19%) were recovered from strata dating between ca. 4,300 and 8,000 cal BP (3,900 – 7,100 14C BP).

O'Malley Shelter, located in the southeastern corner of the Great Basin near the Colorado Plateau may contain the best evidence for the production of early Elko Series dart points of any of the early sites excavated in the 1950s, 1960s, and 1970s. However, similar to Danger and Hogup caves, corner-notched points were not the norm prior to ca. 4,000 cal BP (3,650 14C BP), even at O'Malley Shelter. For example, in Unit II, dating between ca. 4,300 and 5,300 cal BP (3,900 – 4,600 14C BP), there were at least 26 Humboldt, nine Gypsum, nine leaf-shaped, three Gatecliff, and one LSN point recovered along with the six corner-notched points. Of these 54 points from Unit II, then, only 11% of them were corner-notched, while 81% were either Humboldt or Gypsum/leaf-shaped. Similar percentages are seen in the Unit I points, where 14 of the 18 (78%) were either LSN (n=13) or Humboldt/Black Rock Concave-Base (n=1).

One additional site in the Great Basin that was excavated prior to the 1980s that may contain evidence for early Elko Series points is Swallow Shelter (Dally 1976), located along the northeastern Nevada-northwestern Utah border. A total of two corner-notched points was recovered from stratum 2, which dates sometime prior to stratum 3 dated at 3,790 cal BP (3,500 14C BP), but younger than stratum 1 dated at 6,200 cal BP (5,400 14C BP). No dates were obtained directly on stratum 2. It is possible that these two corner-notched points date similar to the oldest Elko points identified at BER, at ca. 4,000 cal BP (3,650 14C BP); additional dating of the Swallow Shelter strata is required to determine a more precise chronology for these two corner-notched points.

The fact that no Elko corner-notched points dating prior to ca. 4,000 cal BP (3,650 14C BP) were recovered from BER, Camels Back Cave, the recent column samples taken from Danger Cave, and Floating Island Cave, sites all located in the same general vicinity of the eastern Great Basin as Hogup Cave, is adequate evidence to question such a pre-4,000 cal BP (pre-3,650 14C BP) existence of Elko points at the latter site. Triangular-shaped and corner-notched points dating prior to 4,000 cal BP (3,650 14C BP) appear to be exceedingly rare across the Great Basin. This fact not only calls into question the validity of the "long chronology" in the eastern Great Basin, but it also calls into question the mantra that Elko Series points 'are not good time markers' in the eastern Great Basin.

Outside of the Great Basin in the Columbia Plateau/Snake River Plain, Colorado Plateau, Rocky Mountains, and northern and western Plains there is evidence for Early Archaic-aged corner-notched points. For example, at Sudden Shelter on the Colorado Plateau, 97% (73 of 75) dart-sized corner-notched points recovered from strata 1-22 came from layers dating prior to ca. 6,000 cal BP (ca. 5,200 14C BP). In addition to these corner-notched points, 168 LSN points were recovered from the strata 1-22 sediments; of these, 92% (154 of 168) came from layers dating prior to ca. 6,000 cal BP (ca. 5,200 14C BP). Clearly, sites such as Sudden Shelter located on the periphery of the southeastern Great Basin demonstrate evidence for the intentional and

relatively frequent production of Early Archaic-aged corner-notched points along with side-notched points.

Should these early corner-notched points from sites outside of the Great Basin be typed as "Elko"? Or should they be named something else? First, as is demonstrated above, these points need to be re-examined to determine if they were produced on triangular (Elko or Dead Cedar in the Great Basin) or lanceolate (Leppy Hills in the Great Basin) preforms. That issue aside, researchers have grappled with this question for many years (e.g., Thomas 1981; Holmer 1986). The tendency of a number of researchers in the past, however, has been to suggest that any corner-notched dart point found in the Great Basin, Columbia Plateau/Snake River Plain or Colorado Plateau, regardless of location or temporal span are Elko Series because that name was initially used to define Middle Archaic-aged assemblages at Wagon Jack Shelter in central Nevada (Heizer and Baumhoff 1961), South Fork Shelter near Elko, Nevada (Heizer et al. 1968) and various sites in the western Great Basin (O'Connell 1967).

Thomas (1981:37), however, in providing specific metrics for Middle Archaic-aged Elko points from the central Great Basin noted that "...we must be certain to restrict the geographic extent of this typology to the central and western Great Basin areas." Nevertheless, Holmer (1980, 1986) liberally applied the Middle Archaic-aged Great Basin Elko Series type to the Columbia Plateau/Snake River Plain and Colorado Plateau regions throughout both space and time. Thus, even before the indiscriminate use of Thomas' (1981) projectile point key outside of the region and time period in which it was forged, claims of 8,000 to 9,000 year-old Elko Series points from outside of the Great Basin were being made (e.g., Holmer 1980). Holmer's (1986) use of the 'corner-notching equals Elko' mantra continues to influence researchers working outside of the Great Basin.

Other researchers, however, have recognized these Early Archaic-aged corner-notched points from outside the Great Basin as either a variety of the more common Northern side-notched or other LSN point varieties named for the region in which they were located (e.g., Husted and Edgar 2002:45) or left them untyped and simply refer to them as "stemmed concave-based" points (Husted and Edgar 2002:186, Plate 16e). Still others have placed these Early Archaic-aged corner-notched points from sites such as the Ptarmigan Site in Colorado into named complexes such as the Mount Albion Complex (e.g., Des Planques 2001).

The similarity of LSN points all dating to the Early Archaic is recognized through a broad region that stretches from the northern Plains to the northern Great Basin during this early time (e.g., Delacorte and Basgall 2012). Across this expanse a number of sites also share a similarity in the production of corner-notched points at this time. Great Basin hunter-gatherers began producing corner-notched points on lanceolate preforms during the Early Archaic (Leppy Hills); it is unknown whether this pattern holds for the Early Archaic in regions surrounding the Great Basin.

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