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RESEARCH REPORT



A Latest-Paleoindian-Aged Pronghorn Trap in the Goshute Valley, Eastern Great Basin, USA

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ABSTRACT

We report the discovery of a large-scale artificial pronghorn (*Antilocapra americana*) trap located near Silver Zone Pass in the northern Goshute Valley, eastern Elko County, Nevada. Evidence comes from three closely related and closely spaced surface scatters of lithic artifacts called the Silver Zone Pass Complex. Two of the scatters represent a single kill zone, or corral, while the third represents an associated campsite. The assemblage of 282 bifacial points and fragments from the three scatters is characterized by short-stemmed Windust and Pinto forms, elsewhere dated to the early-mid Holocene, about 8500–7500 calendar years ago. With this discovery, we can firmly conclude that large-scale communal trapping of artiodactyls began in the eastern Great Basin 2000–3000 years earlier than previously thought, and is coincident with other significant changes in human technology, subsistence, and settlement documented for the Paleoindian-Archaic transition in the region.

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KEYWORDS

Paleoindian-Archaic transition; large-scale traps; pronghorn (*Antilocapra americana*); Windust; Pinto

1. Introduction

The study of large-scale traps is receiving increased attention for a variety of reasons, principle among them being their ability to highlight past social interactions such as communal gatherings that are sometimes difficult to ascertain in the archaeological record (Arkush 2014; Brink 2016; Carlson and Bement 2018; Enloe 2006; Hockett et al. 2013; Hockett and Dillingham 2023; Hockett and Murphy 2009; Lemke 2021; Lubinski 1999; Rodríguez-Hidalgo et al. 2017). Archaeologically delineating communal activities can be especially challenging when studying past hunter-gatherers who exhibit a relatively high degree of mobility that results in a relatively sparse material record. The construction of large-scale traps by hunter-gatherers, however, may result in features and concentrations of stone artifacts whose inter- and intra-site spatial relationships and integrity survive for many millennia (Hockett and Dillingham 2023).

Large-scale traps cannot be effectively planned and constructed by a single individual or family (Arkush 1986, 252; Hockett et al. 2013). By extension, then, the successful trapping or ambushing of multiple migrating artiodactyls that results in a mass kill by Native peoples requires communal cooperation. Following Hockett et al. (2013) and Hockett and Dillingham (2023), we

define large-scale traps as rock and/or wood features constructed through group or communal effort to trap or ambush migrating artiodactyls with the intention to complete a mass kill. Large-scale artificial traps can take the form of driveline features consisting of lines of stacked rocks, cairns, and upright triangular-shaped flat rocks often referred to as stone hunters or stone dummies (*inuksuit* in the North American Arctic (Brink 2005)) to ambush migrating artiodactyls along the line or to guide the animals to a pre-determined ambush spot. They may also take the form of corrals or pounds intended to trap and hold animals guided or funneled into the feature by wings or fences. The round or oval corral is often made of some combination of rock and wood. In places like the western portion of the Great Basin of North America, rock is most often used as anchors to hold the base of vertically placed tree limbs that form the corral. In these cases, if the wood completely decays due to age, the outline of the corral, marked by the circular arrangement of dozens to hundreds of rock anchors, may be maintained for millennia and hence recognizable to archaeologists. Large-scale corrals constructed in eastern Nevada and western Utah, however, were often built entirely of wood (Hockett 2005; Hockett et al. 2013; Hockett and Dillingham 2023; Hockett and Murphy 2009). Instead

of anchoring tree limbs with rocks, the vertically placed limbs were anchored directly into loose, silty sediments, and additional limbs were interwoven horizontally across the anchored limbs to form a more solid oval-shaped corral fence. In these cases, once the wood completely decays there may be no surface evidence of the existence of a large-scale trap – except, perhaps, for the presence of bifacial projectile points used to dispatch the trapped animals.

Numerous large-scale traps across the western, eastern, and central Great Basin show evidence of large concentrations of complete and broken bifacial points at existing corral entrances and near the back ends of corrals, suggesting the animals were shot as they entered the traps or dispatched inside the features. Such concentrations have been called “kill spots” or “kill zones” (Hockett and Dillingham 2023). When found alone without the added luxury of rock-lined features or still-extant wooden corrals that have not completely decayed, they can still provide evidence for the existence of a large-scale trap in the absence of the structural elements of the feature (Hockett and Dillingham 2023; Hockett and Murphy 2009; Petersen and Stearns 1992).

In western and eastern Nevada, although bifacial-point concentrations indicative of communal hunting by Native peoples are well-documented from Late Prehistoric times (ca. 700–150 calendar years ago (cal yr BP); with Desert Side-Notched points) back through the Middle Archaic (to ~5000 cal yr BP; with Humboldt, Gatecliff, and Elko points) (Hockett et al. 2013; Hockett and Murphy 2009), earlier-aged concentrations are rare. The Cobre and Hill kill zones associated with corrals in northeastern Nevada (Hockett and Murphy 2009), the Mt. Augusta driveline in central Nevada, and the Excelsior Corral in western Nevada (Hockett et al. 2013; McGuire and Hatoff 1991) (Figure 1), have yielded large numbers of Large Side-Notched points initially manufactured during the Early Archaic. Although these features could not be radiocarbon dated, chronologies from nearby rockshelters with rich Large Side-Notched assemblages (e.g., Bonneville Estates Rockshelter, Camels Back Cave, and Pie Creek Shelter) suggest they could range in age from as early as ~8000 cal yr BP to as late as 2000 cal yr BP (Elston 2005; Goebel et al. 2021; Hockett and Spidell 2022; McGuire, Delacorte, and Carpenter 2004). Given this broad age range for Large Side-Notched points, patterning indicative of large-scale traps has not been found in an unequivocal Early Archaic complex, let alone a Paleoindian, Western Stemmed context, leading to the current model that communal hunting by Native peoples in the Great Basin began during the early Middle Archaic

Period, after 5500 cal yr BP (e.g., Hockett et al. 2013), rather than the Paleoindian or Early Archaic periods prior to that time.

In this paper, we report on a remarkable set of three closely spaced lithic scatters called the Silver Zone Pass Complex and assigned to the Paleoindian-Archaic transition period. We hypothesize that the complex represents two kill zones and one related campsite associated with a large-scale trap that decayed long ago in the eastern Great Basin. If our interpretation is correct, these sites represent the oldest evidence yet for large-scale artiodactyl trapping in the Great Basin, and one of the oldest artificial trap features in all North America.

2. Working hypotheses

As noted in the Introduction, there is reason to think that the Silver Zone Pass Complex (SZPC) was related to large-scale trapping of migrating artiodactyls. In previously published research on existing large-scale corrals and associated kill zones at the Spruce Mountain Trap Complex, located 50 km southwest of the SZPC (Figure 1), it was shown that kill zones typically contain extremely high tool:debitage ratios (Hockett and Murphy 2009). Specifically, kill zones are expected to display primarily bifacial projectile points with limited debitage if tool maintenance and repair occurred elsewhere at a nearby campsite following the kill. In these cases, breakage patterning on bifacial points is expected to display relatively high percentages of catastrophically shattered midsections and tips along with some bases and complete points. Many of the points would be expected to shatter as they hit their targets, creating multiple mid-section fragments per specimen. Tips would remain at the kill zone if they did not adequately penetrate the flesh of the animal and were deposited, along with shattered fragments of the midsection, at the kill zone. If the points were hafted onto atlatl foreshafts or thrown as spears, we expect that complete and basal sections of points still bound to the foreshaft would be differentially retrieved following the kill. The foreshaft would be considered the most valuable piece of hunting equipment to retrieve. The retrieval of foreshafts would differentially remove complete and basal sections of points as these would still be hafted to the foreshaft. These retrievals are likely to have been taken to a nearby campsite where the animals were butchered and eaten. The complete points would be ready or near-ready for re-use. In some cases, retrieved points may have sustained broken or damaged tips only, and the remaining point could be resharpened and reused. This would result in the deposition of microflakes at the campsite. If the basal sections

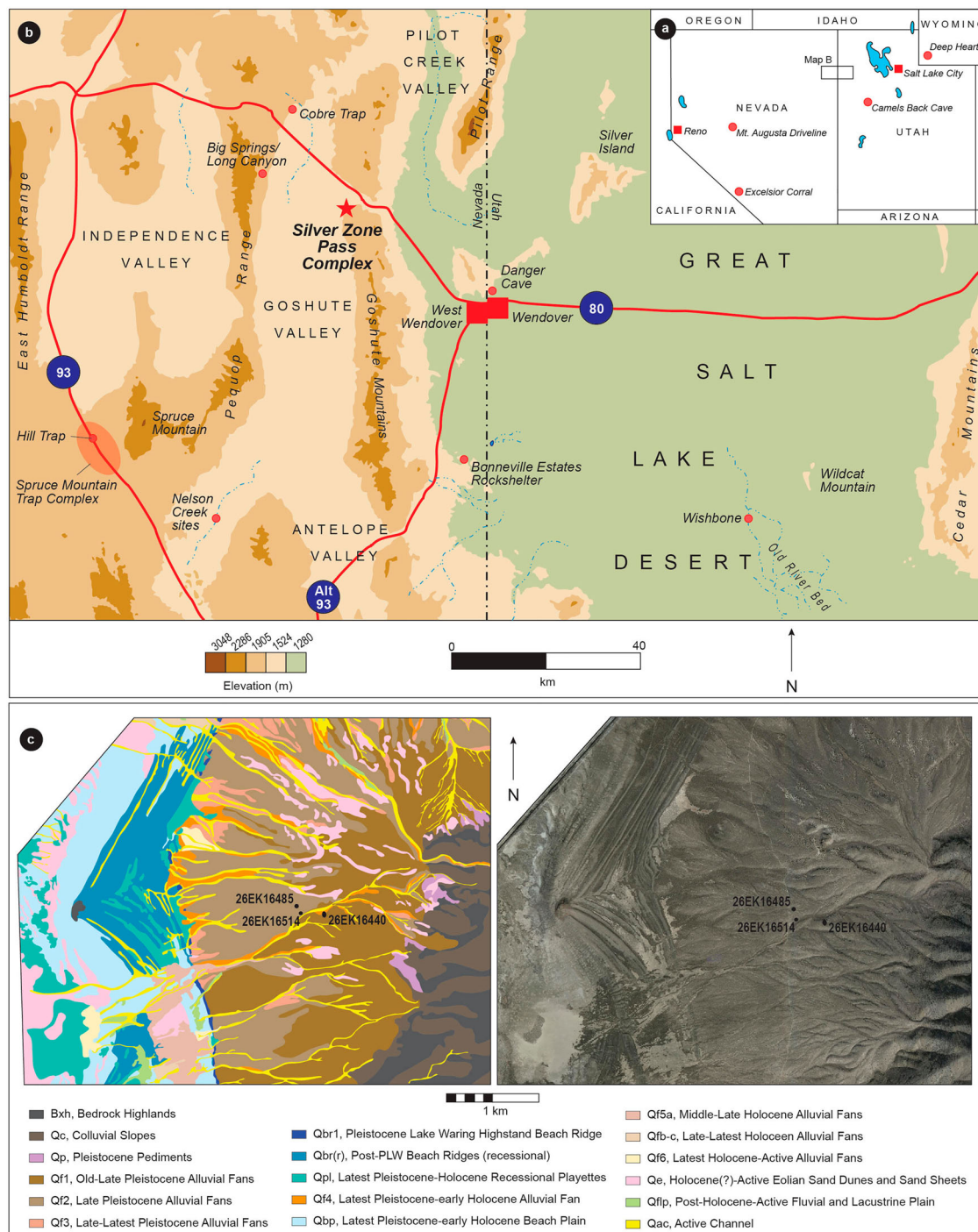


Figure 1 Location and setting of the Silver Zone Pass Complex (and other archaeological sites mentioned in text): (a) broad regional map; (b) regional topographic map; and (c) local geomorphic setting (geological units adapted and redrawn from Stoner, Hildebrand, and Mueller (2020)).

could not be effectively reworked into a usable projectile point, then they may have been unhafted and abandoned at the campsite.

These expectations would result in kill zones containing relatively high percentages of midsections and tips compared to bases, as well as some complete points that were not recovered, perhaps because they became

completely buried under sediment or lodged in vegetation that hid their presence following the kill. In contrast, campsites would contain relatively higher percentages of bases compared to midsections and tips. Some midsections and tips also would be expected at the campsite, but in lower proportions, as these likely represent portions of projectile points that had become

embedded in the animals during the kill, their carcasses (or carcass parts) having been transported the short distance to the campsite for butchery. Campsites would also be expected to contain a wider array of tools such as scrapers, awls/drills, and bifaces together with higher proportions of debitage related to tool refurbishing and replacement.

Hockett and Murphy (2009) demonstrated this patterning at the Spruce Mountain Trap Complex (Table 1). At Spruce Mountain, kill zones consisting of primarily bifacial points that were lying at the entrances or backends of existing large-scale traps display twice as many midsections but only one-half the number of bases compared to campsites. In addition, tips are more common at kill zones than campsites. Complete points display equal percentages at both types of sites. These patterns indicate that the kill zones are, in fact, what their namesake implies, and that it was a common practice for hunter-gatherers to retrieve spent foreshafts following the kill before retiring to a campsite some distance away from the trap. This behavior leaves relatively high proportions of midsections and tips at kill zones, high proportions of bases at campsites, and about equal proportions of complete points at both site types. These patterns can be useful in delineating kill zones and campsites in the region that are not directly associated with an existing large-scale trap because the feature has completely decayed, leaving no other traces except their associated lithic assemblages.

Hockett and Murphy (2009) and Hockett and Dillingham (2023) also show that kill zones and campsites differ in their microtopographic setting. Entrances to corrals designed to capture migrating herds of pronghorn (*Antilocapra americana*) in valley floor settings were usually placed at or near the base of a finger

ridge or hill. The backend of the corral would be placed on the opposite side of the ridge or hill so that it could not be seen by the animals as they were being guided into the trap. As a result, we would not expect to see kill zones located on tops of ridges or hills unless a kill was made in the central portion of the corral. While bifacial points have been found throughout interiors of existing corrals, most of them, and especially the dense kill zones consisting of dozens to hundreds of points, are almost always located at the entrance or backend of the features, at the bases of ridges or hills rather than the tops. Campsites, in contrast, were often established on the tops of nearby ridges or hills.

Together, these data can form powerful hypotheses to interpret potential large-scale traps in the Great Basin archaeological record using only lithic assemblages. Namely:

Hypothesis 1: If a lithic assemblage consists of large numbers of catastrophically-shattered bifacial points that contain relatively high percentages of midsections and tips compared to bases, as well as limited debitage and other tool types, and is located at or near the base of a ridge or hill, it likely represents the remains of a kill zone associated with large-scale trapping.

Hypothesis 2: If a lithic assemblage consists of large numbers of broken bifacial-point bases compared to midsections and tips, as well as relatively abundant debitage and other tool types, and is located at or near the top of a ridge or hill, it likely represents a campsite that may be associated with a nearby large-scale trapping event.

3. Methods

We conducted fieldwork at the SZPC during August 2020. For each site, after setting a datum and establishing a grid, we conducted a careful surface survey, first with 3-m transects and second with even closer examination of high-density locations. Using a Sokkia electronic distance measurer (EDM), we recorded the provenience of each identified artifact. Given nearby active mining activity, we made a 100% surface collection, to preserve the assemblages and to facilitate obsidian-geochemistry analysis and low-power microscopic analysis of bifacial-point breakage. Collections are permanently curated at the Nevada State Museum in Carson City.

Morphometric analysis of bifacial points focused on nine variables (Figure 2(a)). Base shape is defined as concave, straight, or convex, with negative and positive measures (in mm, taken with digital calipers) representing concave and convex basal margins, respectively, and with a measure of zero representing a straight basal margin. We measured proximal shoulder angle (PSA)

Table 1 Bifacial-point breakage patterns at kill zones associated with existing large-scale traps and campsites within the Spruce Mountain Trap Complex (adapted from Hockett and Murphy 2009, 726, table 5).

Sites	Bifacial-point breakage pattern			
	Complete	Base	Midsection	Tip
Traps				
Liza Jane	7	11	14	2
Valley Mountain	12	53	71	32
Mizpah	15	73	129	45
Cobre	35	21	43	14
Spruce Pond	8	3	3	0
Hill	3	5	7	4
Traps <i>n</i>	80	166	267	97
Traps %	13%	27%	44%	16%
Campsites				
Hourglass Overlook	4	8	2	1
Antelope Ridge B	14	70	31	15
Campsites <i>n</i>	18	78	33	16
Campsites %	12%	54%	23%	11%

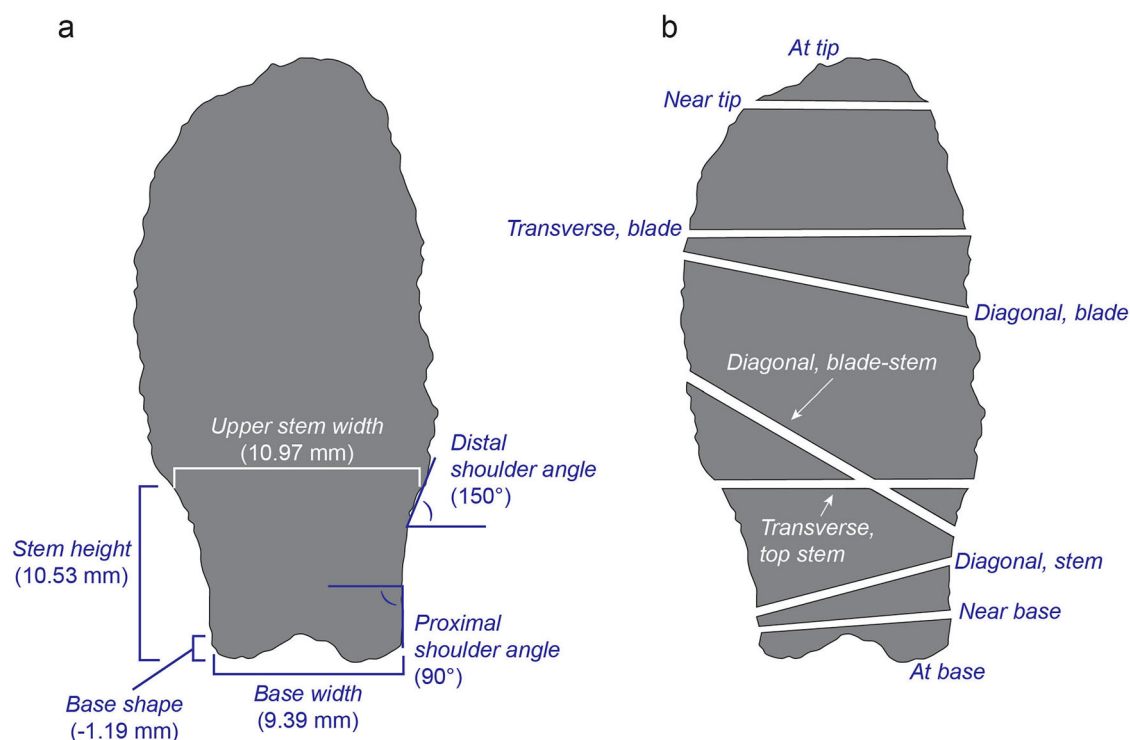


Figure 2 Morphometric variables (a) and breakage locations (b) analyzed on bifacial points.

by placing the point over a polar-coordinate grid (with tip-end toward the top of the page), with 90° projecting downward and 0° projecting to the left of the center of the grid, so that an acute PSA (i.e., $< 90^\circ$) represents a contracting stem, an obtuse PSA represents an expanding stem, and a 90° PSA represents a straight stem. We measured distal shoulder angle (DSA) by again placing the point over the polar-coordinate grid, but this time with 180° projecting upward and 90° to the right. Hence, a horizontal shoulder yields a measure of 90° ; a weak, upward-projecting shoulder measures between 90° and 180° ; and a downward-sloping shoulder, between 0° and 90° . When possible, we measured PSA and DSA twice on each point (i.e., for both the left and right lateral margins) and averaged for analyses. We measured stem height and basal width with a pair of digital calipers, the latter from the left basal corner to right basal corner, defining corners as the points where the stem margin passes from greater than to less than 45° from the horizontal. We measured upper stem width from left margin to right margin at the top of the stem, immediately below a perceivable shoulder, while measuring upper stem thickness at that same place on the point. We scored edge grinding using an ordinal scale, with zero representing no grinding; 1, weak grinding; 2, moderate grinding; 3, strong grinding; and 4, extreme grinding, to such an extent that the stem's bifacial edge is virtually obliterated.

Technologically, we scored bifacial-flaking pattern evident on the faces of the points, with parallel flaking representing a series of long, narrow retouch scars that extend across the face of the point perpendicular to the point's long axis; parallel-oblique flaking representing such scars that extend at a diagonal from the long axis; and irregular flaking representing no such obvious patterning.

To measure breakage of bifacial points, we categorized each according to its condition: complete, basal fragment, midsection fragment, or tip fragment. Small, inexpressive fragments with only one bifacial edge were typically assigned to the midsection category, while those with minimal damage (e.g., missing a small portion of a basal corner or the very tip) were assigned to the complete category. We also scored the locations of breakage (Figure 2(b)), following Bird (1969), as well as the type of breakage, following primarily Weitzel et al. (2014) but also consulting other experimental sources (e.g., Bergman and Newcomer 1983; Fischer, Hansen, and Rasmussen 1984; Odell and Cowan 1986; Titmus and Woods 1986). We interpreted fluting, burination, crushing, spin-off fractures, and step-terminating bending fractures as representative of impact damage, again following these experimental studies, especially Weitzel et al. (2014, 92).

For measuring variability in lithic raw materials, we scored each artifact as obsidian, microcrystalline silicate

(MCS; i.e., cherts and chalcedonies), and basalt. Alex Nyers at Northwest Obsidian Research Obsidian Studies Laboratory (Corvallis, OR) conducted geochemical analyses of a sample of 283 obsidian artifacts from the three sites, using a Thermo NORAN QuanX-EC energy dispersive X-ray fluorescence (EDXRF) spectrometer. Jason Henry at Willamette Analytics (Corvallis, OR) conducted obsidian-hydration analysis of a smaller sample of artifacts ($n = 34$) geochemically sourced to Browns Bench. Nyers' and Henry's reports are presented in SOM.

Because more than bifacial points were recovered from the sites, we also typologically analyzed other artifacts, grouping them into standard categories. For tools, these included unhafted bifaces (further typed as early-stage (edged biface), mid-stage (thinned biface), and late-stage bifaces (preform), following Andrefsky (2005)) and scrapers (unifacially worked tools with invasive retouch). For debitage, we first distinguished flake shatter (i.e., fragments of flakes without platforms) from flakes (i.e., with platforms), following Andrefsky (2005, 76), and then further categorized flakes into the following types: cortical flakes, core-reduction flakes, biface-reduction flakes, tiny pressure flakes with either complex or smooth platforms, and impact spalls, the last presumably being catastrophically detached from bifacial points during use as projectiles. We also categorized cores based on their number of platforms and fronts.

We carefully attempted to refit each bifacial-point fragment to another fragment in the three assemblages, but did not find any conjoining pieces. We did this by sorting the points into basal, midsection, and tip fragments, and then carefully attempting to conjoin all bases to all midsections and tips, and all midsections to all tips, not just within sites but also between sites.

4. Sites and their setting

The three sites we investigated, 26EK16440, 26EK16485, and 26EK16514, are all open-air lithic scatters located south of Silver Zone Pass on the western flanks of the Toano Range in Goshute Valley, eastern Nevada (Figure 1). They were initially reported by Western Cultural Resource Management, Inc., during cultural-resources survey for a proposed gold-mine-expansion project in Goshute Valley (Stoner, Hildebrand, and Mueller 2020). At the time, Stoner, Hildebrand, and Mueller (2020) recognized the potential for all three sites to be related behaviorally to large-scale trapping, possibly representing a chronologically discrete set of sites left behind during a single event. All three sites were closely spaced to one another on the landscape, and each

contains similar short-stemmed points commonly referred to as Windust in the region.

As a complex, the three sites collectively measure approximately 300 m E-W by 150 m N-S (Figure 3). The northwestern lithic scatter (26EK16485) measures approximately 65 m by 30 m (Figure 4(b)). Its surface assemblage consists of 19 projectile points and four pieces of debitage. The southwestern lithic scatter (26EK16514) measures approximately 50 m by 35 m and yielded 144 bifacial points and six pieces of debitage (Figure 4(c)). The eastern lithic scatter (26EK16440) measures approximately 45 m by 45 m (Figure 4(b)). Here, 120 projectile points, two bifaces, one scraper, and 303 pieces of debitage were collected.

The SZPC is situated on the eastern edge of the Goshute Valley, immediately downslope of the western side of the Goshute Mountains of the Toano Range. This northeastern area of the valley is characterized by well-dissected bedrock ridges of the western slope of the mountains that grade into a localized bajada system of coalescing alluvial fans. Subsequent lacustrine processes associated with the latest Pleistocene transgression of pluvial Lake Waring truncated the bajada (Stoner and Bullard 2022; see also Mifflin and Wheat (1979) for description of Lake Waring). All three sites are located on alluvial-fan features, approximately 1 km upslope of the highest fossil shoreline of Lake Waring (Coats 1987) (Figure 1(c)). Site 26EK16440 is situated on the surface of a Qf1 alluvial-fan feature at 1833 m asl; this is interpreted to be among the oldest fan features found along the eastern margin of the valley (Stoner and Bullard 2022). The other two sites, 26EK16485 and 26EK16514, rest on a slightly lower, less ancient inset fan, Qf2, at about 1815 m asl. The specific positions of both Qf1 and Qf2 on the landscape, with Qf1 being truncated by Qf2 and the Lake Waring high shoreline cross-cutting Qf2, suggest both of these alluvial-fan features predate the Lake Waring highstand (18,000–15,000 cal yr BP; Stoner and Bullard 2022; Stoner, Hildebrand, and Mueller 2020).

The SZPC sites 26EK16485 and 26EK16514, located on the inset Qf2 fan, are exposed in a surface context; however, there are areas where minimal eolian deposition of fine sediment has occurred, especially near clumps of shrubs which have formed very localized sediment traps. These areas may contain additional artifacts in a buried context. Site 26EK16440 is also primarily a surface site, yet this higher, more open surface on the Qf1 fan lacked an obvious eolian cap. Despite this, we encountered concentrations of tiny pressure flakes in recently formed ant hills, indicating that buried artifacts may also occur there, too. Stoner, Hildebrand, and Mueller (2020) also mapped a very small remnant

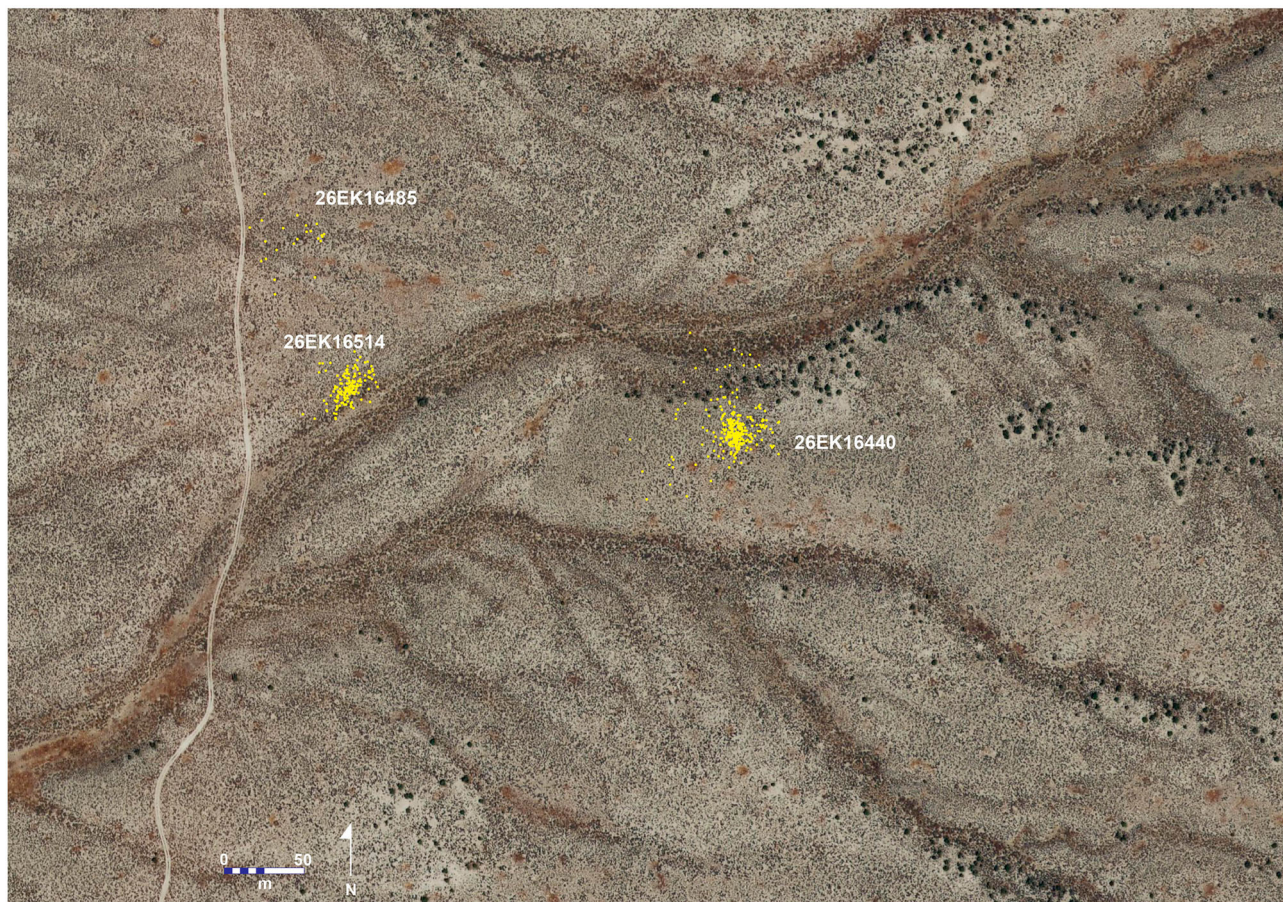


Figure 3 Aerial view of the three sites that make up the Silver Zone Pass Complex, with yellow dots representing locations of recovered artifacts.

section of a latest Pleistocene to early Holocene-aged fan (Qf4) and modern alluvium (Qac) immediately adjacent to the northeastern and northern margins of the site, respectively. Presumably artifacts could be found buried in this area as well. In all of these cases, however, if buried artifacts occur, they are likely in secondary contexts.

Vegetation on the fans around the SZPC is dominated by scrubland sagebrush (*Artemisia rigida*), but a few other shrubs are present such as shadscale (*Atriplex confertifolia*), gray horsebrush (*Tetrademia canescens*), green Mormon tea (*Ephedra viridis*), snakeweed (*Gutierrezia sarothrae*), and big sagebrush (*Artemisia tridentata*). Big sagebrush is located only in the drainage that passes through the southern margin of 26EK16514. Small clumps of bunch grass, likely Indian rice grass (*Achnatherum hymenoides*), are also found scattered across the sites; however, the exact species of grass is unknown because each clump had been shorn close to the ground by feral horse or pronghorn during spring and summer months prior to our fieldwork, when the grasses are included in the animals' diets while foraging for forbs (Byers 1999). Finally, several Utah junipers (*Juniperus osteosperma*) are present within the

boundaries of 26EK16440, only two are present near 26EK16514, and none on 26EK16485.

This open landscape with its combination of sagebrush and bunch grasses, which was at times in the past better-watered and thus consisted of a healthier primary biomass with more numerous, and perhaps more diverse, vegetation of shrubs, forbs, and grasses, would have made for prime pronghorn browse and graze. The low slope yet uneven surface topography offered by the higher Qf1 and lower QF2 landforms, as well as the availability of juniper limbs and trunks for trap-building material, provided an ideal setting for prehistoric hunters to construct a trap for pronghorn.

5. Lithic assemblages

We recovered 600 artifacts from the three SZPC sites. Overall, these include 283 bifacial points, three unhafted bifaces, one scraper, and 313 pieces of debitage (Table 2).

5.1. Bifacial-point morphology and breakage

Of the 283 bifacial points from the SZPC, nearly all are fragmented; however, metric data useful for

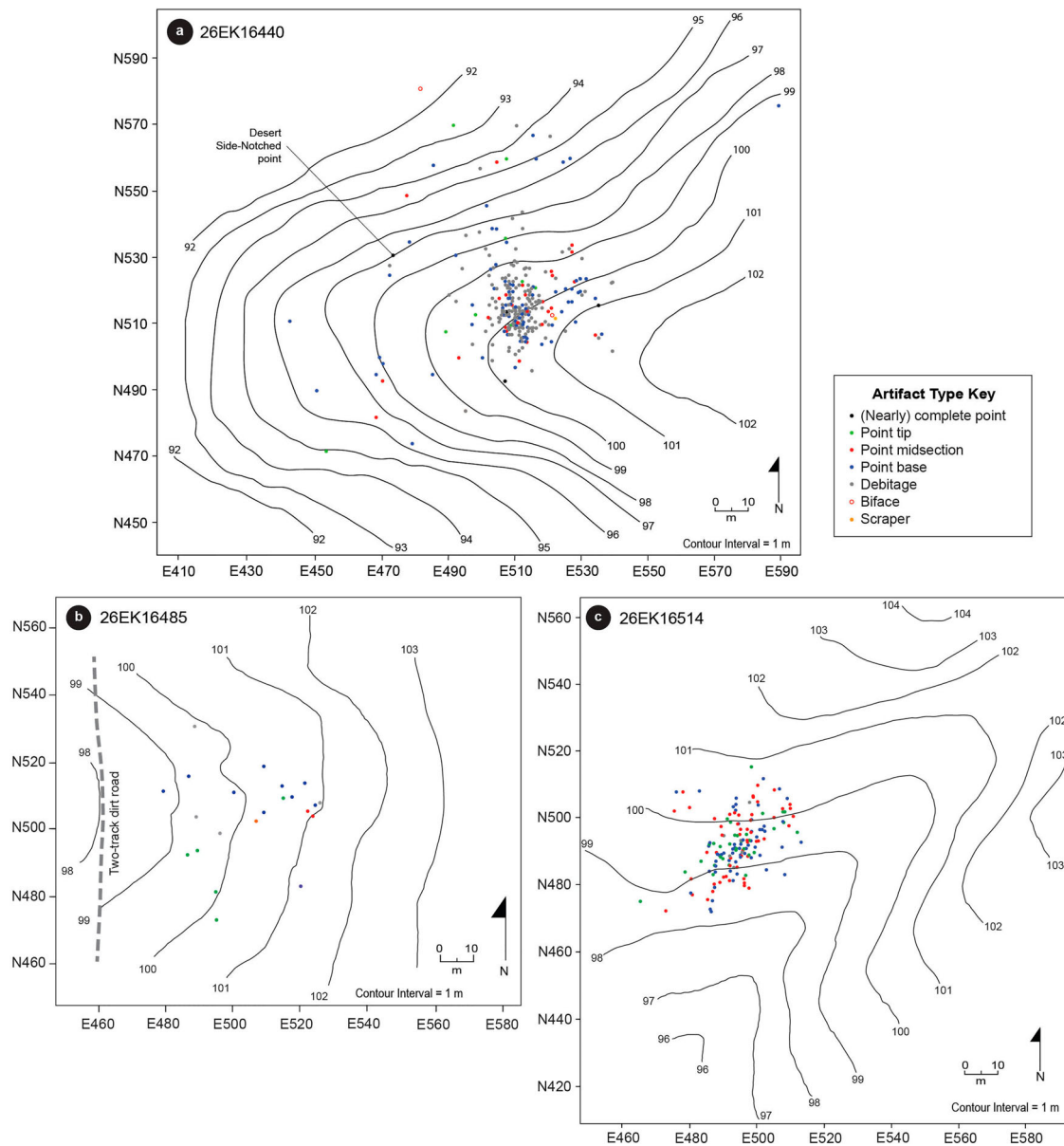


Figure 4 Topographic settings and distributions of artifacts of (a) 26EK16440, (b) 26EK16485, and (c) 26EK16514.

characterizing the basal (hafted) ends of the points still could be gathered to permit morphometric characterization of the assemblage.

All typeable bifacial points generally fall into two types: Windust and Pinto (Figure 5). Leonhardy and Rice (1970) defined Windust points using collections from the Lower Snake River in Washington, and the type is considered part of the Western Stemmed Tradition. Amsden (1935) defined the Pinto type from work in the Mojave Desert. It has been suggested that the Western Stemmed Tradition and Pinto types chronologically overlap in the Great Basin (Hamilton 2012; Haynes 2004). Such a chronological overlap is not present at Bonneville Estates Rockshelter just to the east of the SZPC. (Hockett and Goebel 2019), but

clearly this possibility exists in the northeastern Great Basin with the evidence presented below.

The Windust and Pinto points from SZPC exhibit metrics that grade into one another rather than exhibiting sharp distinctions, indicating a close technological relationship between the two forms. Overall, the SZPC points exhibit straight to near-straight basal margins, with a mean base shape of -0.144 mm (i.e., slightly concave), and with 77.7% of point bases falling within 1 mm of a straight base, being either slightly concave or slightly convex (Figure 6(a)). Proximal stem angles have a mean of 86.06° (i.e., slightly contracting), and nearly 90% of the assemblage falls within 10° of straight (i.e., 90°), either contracting or expanding (Figure 6(b)). All measured distal shoulders project upwards (i.e., are

Table 2 Number and type of lithic artifacts recovered from the Silver Zone Pass Complex.

Artifact type	26EK16485 kill zone	26EK16514 kill zone	26EK16440 campsite
Debitage			
Flake shatter	1	4	81
Cortical spall	1	0	19
Core-reduction flake	0	0	15
Biface-reduction flake	2	0	44
Pressure flake (complex platform)	0	0	63
Pressure flake (smooth platform)	0	0	22
Pressure flake shatter	0	0	58
Impact flake	0	2	0
Core fragment	0	0	1
Debitage total	4	6	303
Bifacial point			
Complete/near-complete bifacial point	0	1	6
Distal fragment	6	30	5
Midsection fragment	5	52	31
Basal fragment	8	61	78
Bifacial point total	19	144	120
Biface	0	1	2
Scraper	0	0	1
Totals	23	151	426

greater than 90°) and average 150.27°, with 95.2% being within 20° of the mean (i.e., sloping upward, 130–170°) (Figure 6(c)). Basal stem widths are relatively narrow compared to other Western Stemmed point forms, averaging only 10.82 mm wide and ranging from 5.17 to 18.49 mm, with 67.2% being within 2 mm of the mean (i.e., ~9–13 mm wide) (Figure 6(d)). Upper stem width is slightly less variable, with a mean of 13.21 mm and range of 7.87–18.08 mm, and with 78.3% of cases falling within 3 mm of the mean (Figure 6(e)). Thickness at top of stem averages 4.96 mm, with 86.1% being within 1 mm of the mean (Figure 6(f)). Stem height is somewhat variable, with a mean of 11.45 mm and range of 5.46–17.19 mm, and with 67.7% cases falling within 2 mm of the mean (Figure 6(g)), indicating that as a rule these points are relatively short-stemmed, with stem heights similar to stem widths. Nearly all of the stems bear edge grinding along their lateral or basal margins; however, the grinding is characteristically light, with a mean rank of only 0.9 (Figure 6(h)). Bifacial-flaking pattern is typically irregular (74.6%); however, a quarter of the points exhibit parallel-oblique (24.2%) or parallel (1.1%) flaking (Figure 6(i)). These data indicate an assemblage of carefully designed bifacial points characterized by relatively short, straight-based, and slightly contracting stems with light edge-grinding, weakly defined, upward-projecting shoulders, and occasional parallel-oblique

flaking. Variation grades from a slightly contracting Windust stemmed form to a “fishtail-like” Pinto form with an expanding stem and upward-projecting shoulders creating laterally indented stem margins. The upward-projecting distal shoulders and low degree of edge-grinding on nearly all of these points, as well as their relatively diminutive size, distinguish them from typical Windust points from other Western Stemmed complexes in the Intermountain West, for example Paulina Lake (Connolly and Jenkins 1999), Bonneville Estates Rockshelter (Goebel 2007), and Buhl (Green et al. 1998) (see also Beck and Jones 2015, 131; Brown et al. 2019; Leonhardy and Rice 1970). The expanding-stemmed Pinto-like forms from the SZPC are potentially analogous to those from the Old River Bed (e.g., Hamilton 2012), although again being more diminutive in size.

Overall, the assemblage of Windust and Pinto points is characterized by significant fragmentation. Of 282 points, only 7 are complete or near-complete (2.5%). Of the 275 fragments, 146 (51.8%) are basal, 88 (31.2%) are midsection, and 41 (14.5%) are distal fragments (Figure 7(a)). Locations of breakage on the points are quite variable, with 88 fragments (26.8%) having broken at or near the tip; 84 (25.6%), transversely or diagonally across the blade; 84 (25.6%) at or near the shoulders; and 38 (11.6%) at or near the base (Figure 7(b)). For the macroscopic breakage analysis, 456 breaks on 278 point fragments and near-complete points exhibit 523 breakage attributes. Of these, cone-initiating fractures (23.7%) and hinge-terminating bending fractures (22.8%) are most common; however, following Weitzel et al. (2014), nearly half (47.7%) of the attributes identified are strongly suggestive of high-velocity impact (Figure 7(c)). These include spin-off fractures (19.7%), fluting (10.7%), burination (10.1%), crushing (5.5%), and step-terminating bending fractures (1.7%). Moreover, 221 of the 456 breaks (48.5%) and 181 of the 278 points (65.1%) exhibit at least one of these attributes of impact damage (Figure 7(d)). Undeniably the fragmented Windust and Pinto points from the SZPC were employed as weapon tips, likely deployed using spear-throwers for high velocity.

5.2. Lithic assemblages

5.2.1. Raw materials

Lithic raw materials at the SZPC are chiefly obsidian ($n = 494$), while MCS numbers 105 pieces, and basalt, 1 piece. Between sites there are significant differences in proportions of these raw-material classes, with MCS occurring more frequently than expected at site 16440 and less frequently than expected at site 16514 (Figure 8(a); $X^2 = 17.730$; $df = 2$; $p = 0.000$).

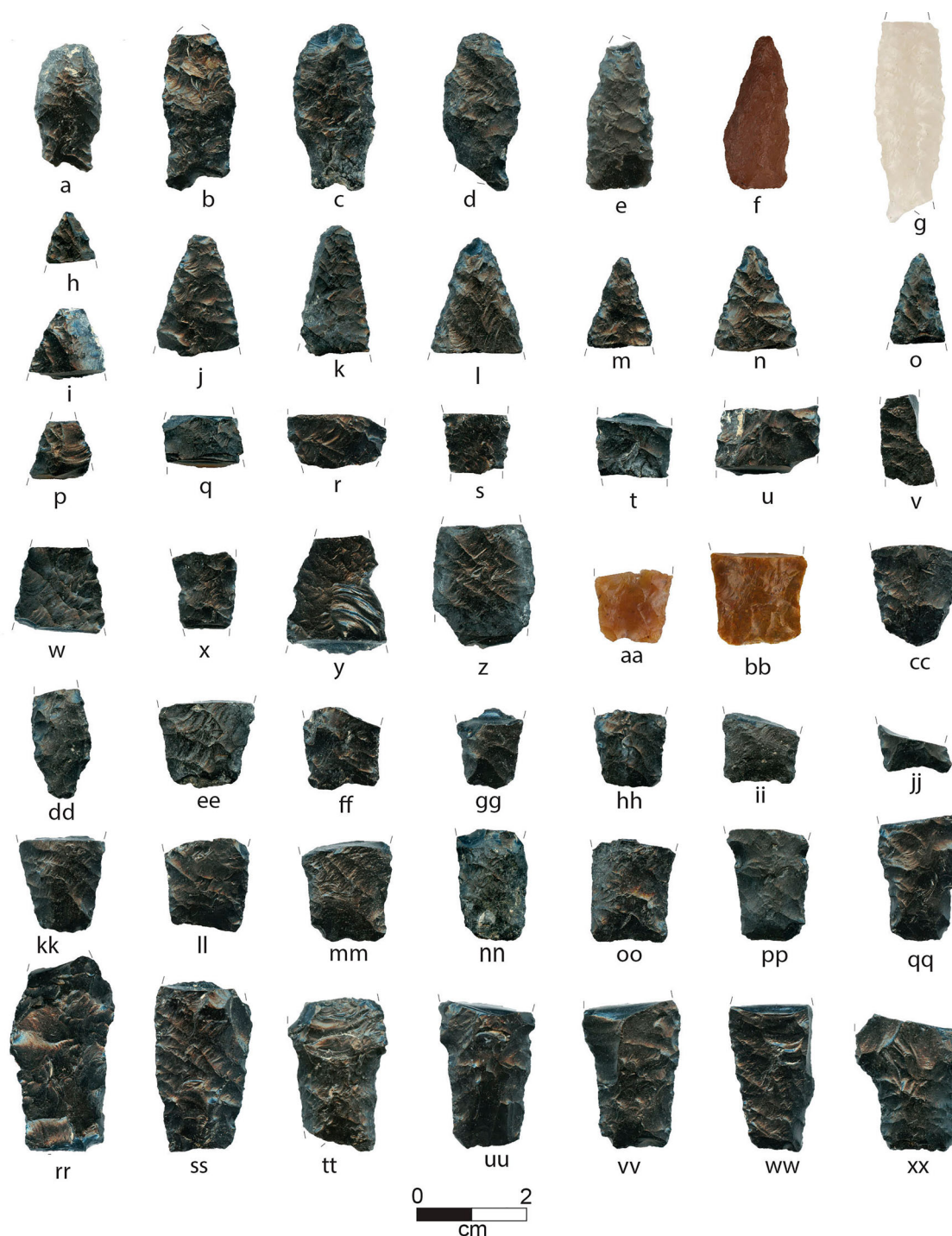


Figure 5 Complete to nearly complete bifacial points (a–g), tip fragments (h–o), midsection fragments (p–z), and basal fragments (aa–xx) from the Silver Zone Pass Complex (26EK16440: a–f, cc–vv; 26EK16514: g, m, ww; 26EK16514: h–l, n–bb, xx) (artifact numbers, from a to xx: 231, 134, 24, 263, 11, 62, 1, 148, 102, 122, 116, 111, 10, 84, 15, 41, 23, 134, 115, 10, 101, 87, 108, 78, 81, 135, 20, 95, 13, 300, 28, 14, 170, 34, 128, 29, 16, 3, 93, 23, 240, 45, 15, 79, 12, 210, 185, 306, 12, 94).

Among obsidians, of 297 artifacts subjected to XRF analysis, 277 (93.3%) geochemically correlate to Browns Bench/Browns Bench Area, 9 (3.0%) to Topaz Mountain, 8 (2.7%) to Malad, 2 (0.7%) to Ferguson Wash, and 1 (0.3%) possibly to Wildcat Hills (Figure 8(b)). The high proportion of Browns Bench obsidian is not

surprising, given that it is the nearest major obsidian source to the SZPC, with primary flows as close as ~125 km north, and secondary occurrences perhaps only ~80–120 km north (e.g., Hughes 2015; Figure 9). Topaz Mountain and Malad were also important major sources to the early inhabitants of the Goshute

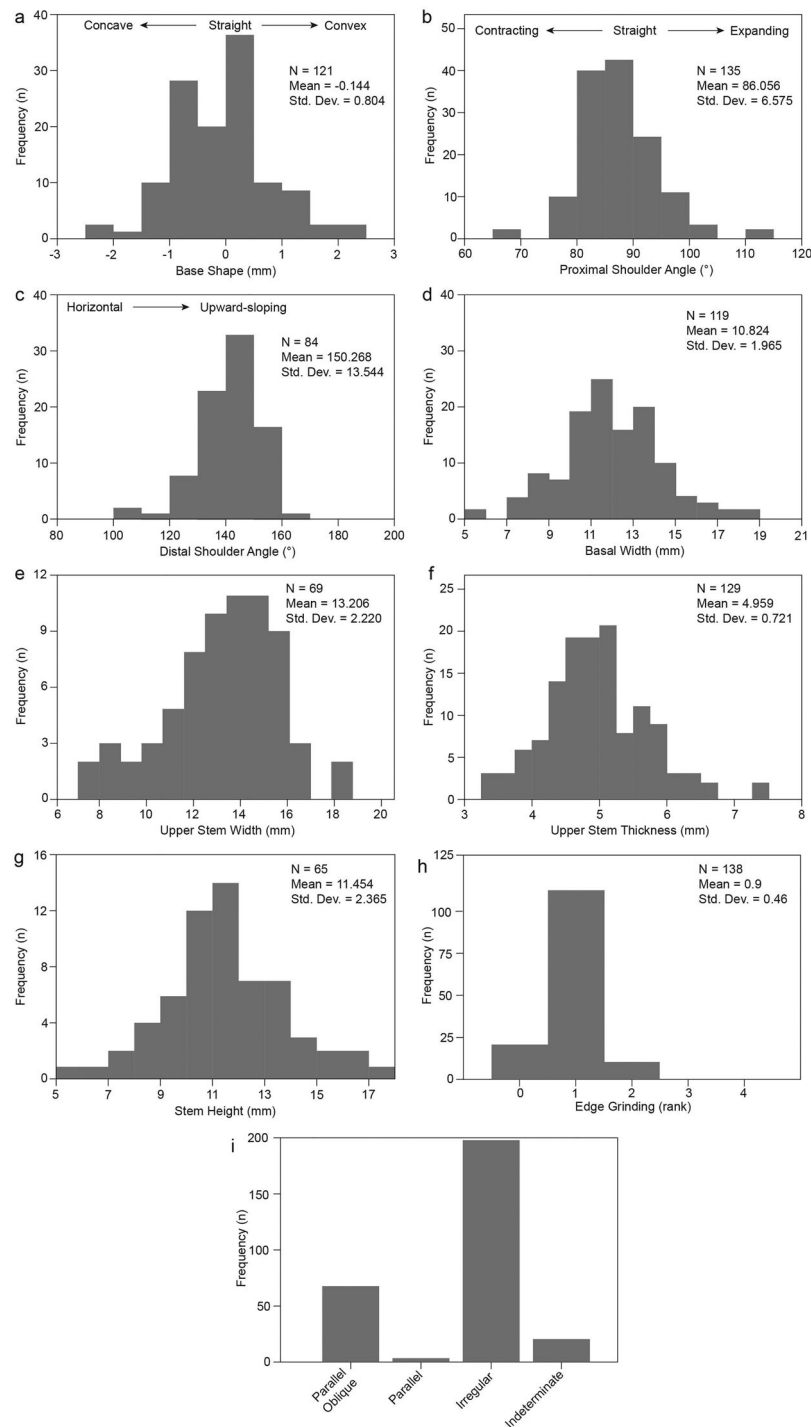


Figure 6 Metric (a–g), ordinal (h), and nominal (i) scale data for the bifacial points combined from the three Silver Zone Pass sites.

Valley and neighboring Western Bonneville Basin, but they are located across the Great Salt Lake Desert ~170 km southeast and ~215 km northeast of the site area, respectively. Ferguson Wash and Wildcat Hills are minor obsidian sources respectively located ~60 km southeast (in the Lead Mine Hills) and ~155 km northeast (immediately north of Great Salt Lake). Inter-assembly analysis of obsidian source between the three sites of the SZPC indicates no

significant difference in proportions of Browns Bench versus the other less-common obsidians ($X^2 = 5.508$; $df = 2$; $p = 0.064$).

5.2.2. Debitage and flaked-tool assemblages

Site 26EK16440 ($n = 128$; Figure 10; Table 2) is characterized bydebitage (71.1%), bifacial points (28.2%), bifaces (0.5%), and a scraper (0.2%). Amongdebitage pieces ($n = 303$), excluding 81 pieces of flake shatter,

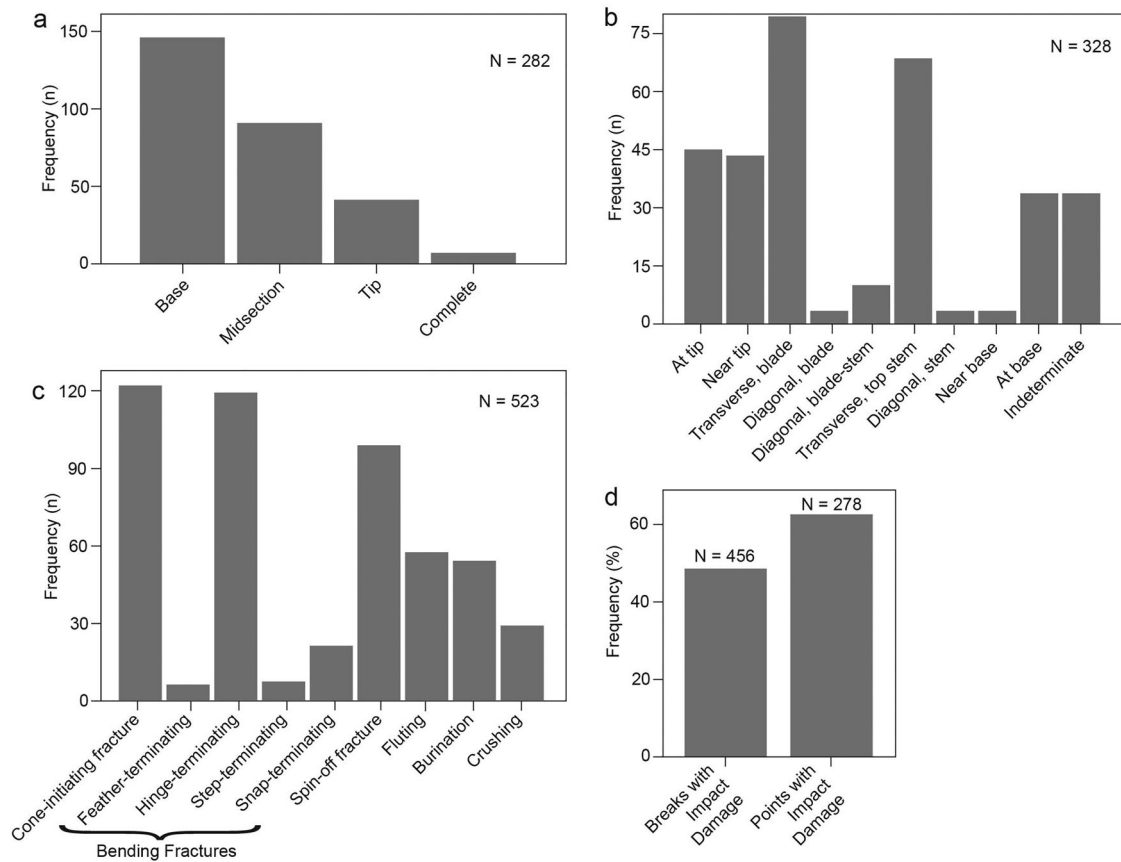


Figure 7 Results of breakage analysis of bifacial points combined from the three Silver Zone Pass sites (a, fragment type; b, fragment location; c, breakage type; d, impact damage on breaks (left) and points (right)).

64.4% are tiny pressure flakes (44.1% with complex platforms, 15.4% with smooth platforms, and 40.1% fragmented), 19.8% are larger biface-reduction flakes with complex platforms, 8.6% are cortical flakes, and 6.8% are core-reduction flakes. Considering variation in raw

material among major debitage groups, there is a significant relationship ($X^2 = 157.343$; $df = 3$; $p = 0.000$): cortical spalls, core-reduction flakes, and large biface-reduction flakes are disproportionately made on MCS, while tiny pressure flakes are disproportionately made

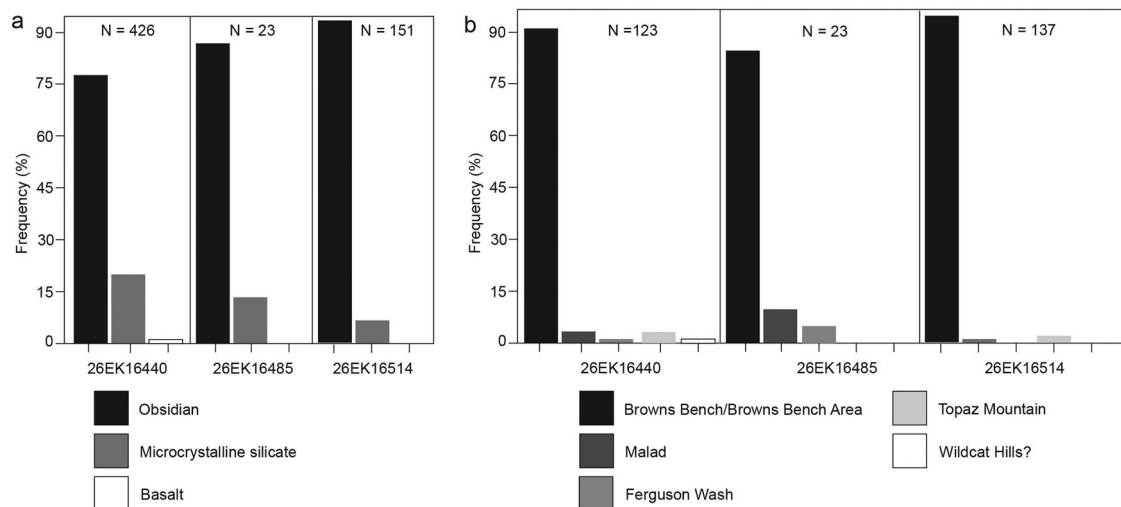


Figure 8 Inter-assembly comparisons of lithic raw materials in the three Silver Zone Pass assemblages (a, major raw-material groups; b, geochemically sourced obsidians).

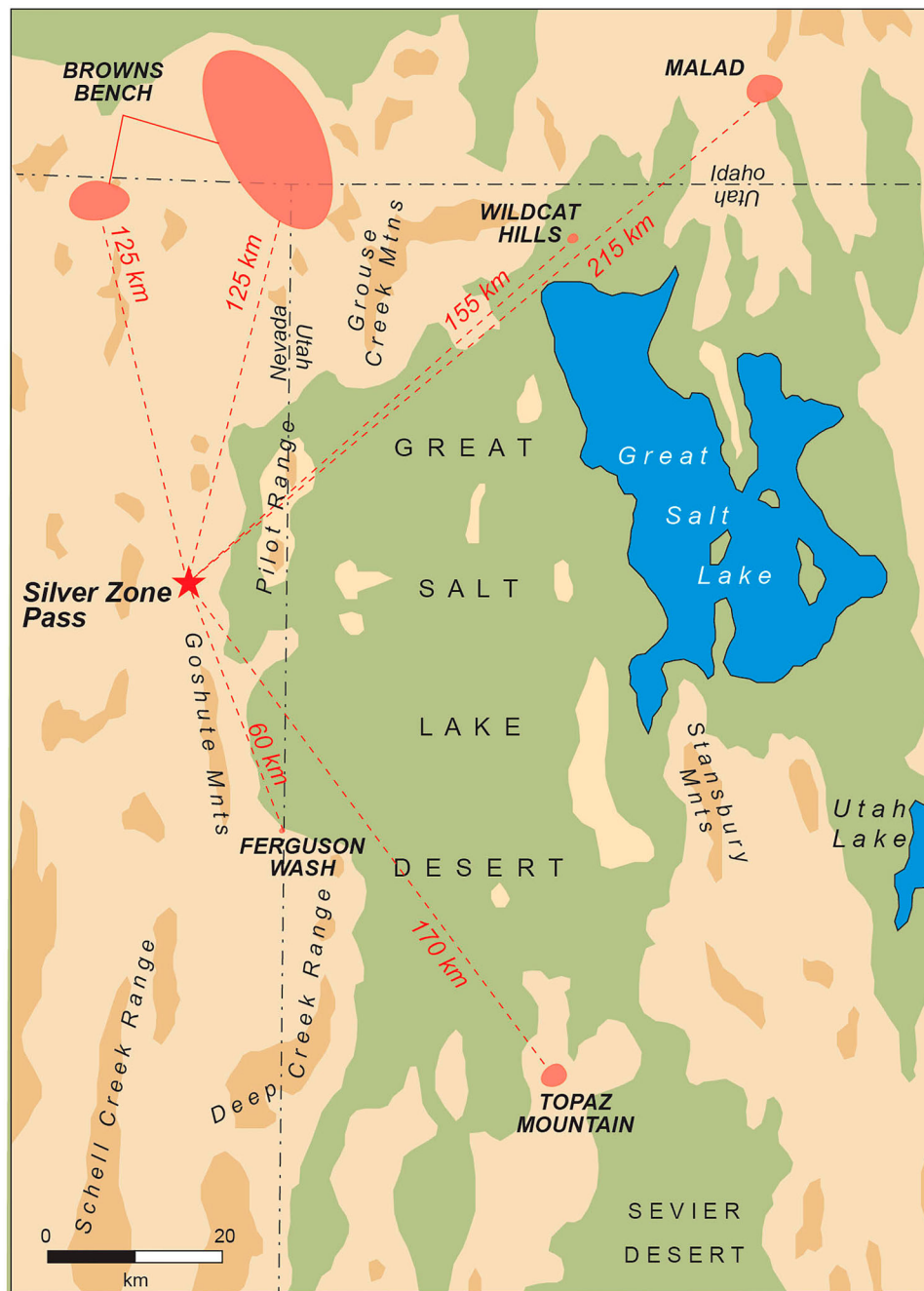


Figure 9 Locations of obsidian sources represented in the Silver Zone Pass assemblages.

on obsidian. The single core in the assemblage, a fragment of a rotated flake core with multiple platforms and fronts, is also made on MCS. Of the typeable bifacial points, all of them are Windust or Pinto points except for a fragment of a small Desert Side-Notched arrow-point recovered from the western margin of the site (Figure 4(a)). The Windust and Pinto points include six (5.0%) complete or nearly complete specimens, 77 (64.7%) basal fragments, 31 (26.1%) midsection fragments, and 5 (4.2%) tip fragments. All of these are on obsidian except for one medial fragment on MCS. Of

117 points with 181 observable breaks, there are 227 identifiable breakage features. Inferred impact damage occurs on 81 (44.8%) of the breaks and 71 (60.7%) of the points. One of the unhafted bifaces is a finished and complete leaf-shaped biface on MCS that does not appear to have been hafted. The other is a fragment of a mid-stage biface also made on MCS. The scraper is a small fragment of a unifacially worked flake tool on Browns Bench obsidian.

The 26EK16485 assemblage ($n = 22$; Figure 10; Table 2) contains debitage (17.4%) and bifacial points (82.6%)

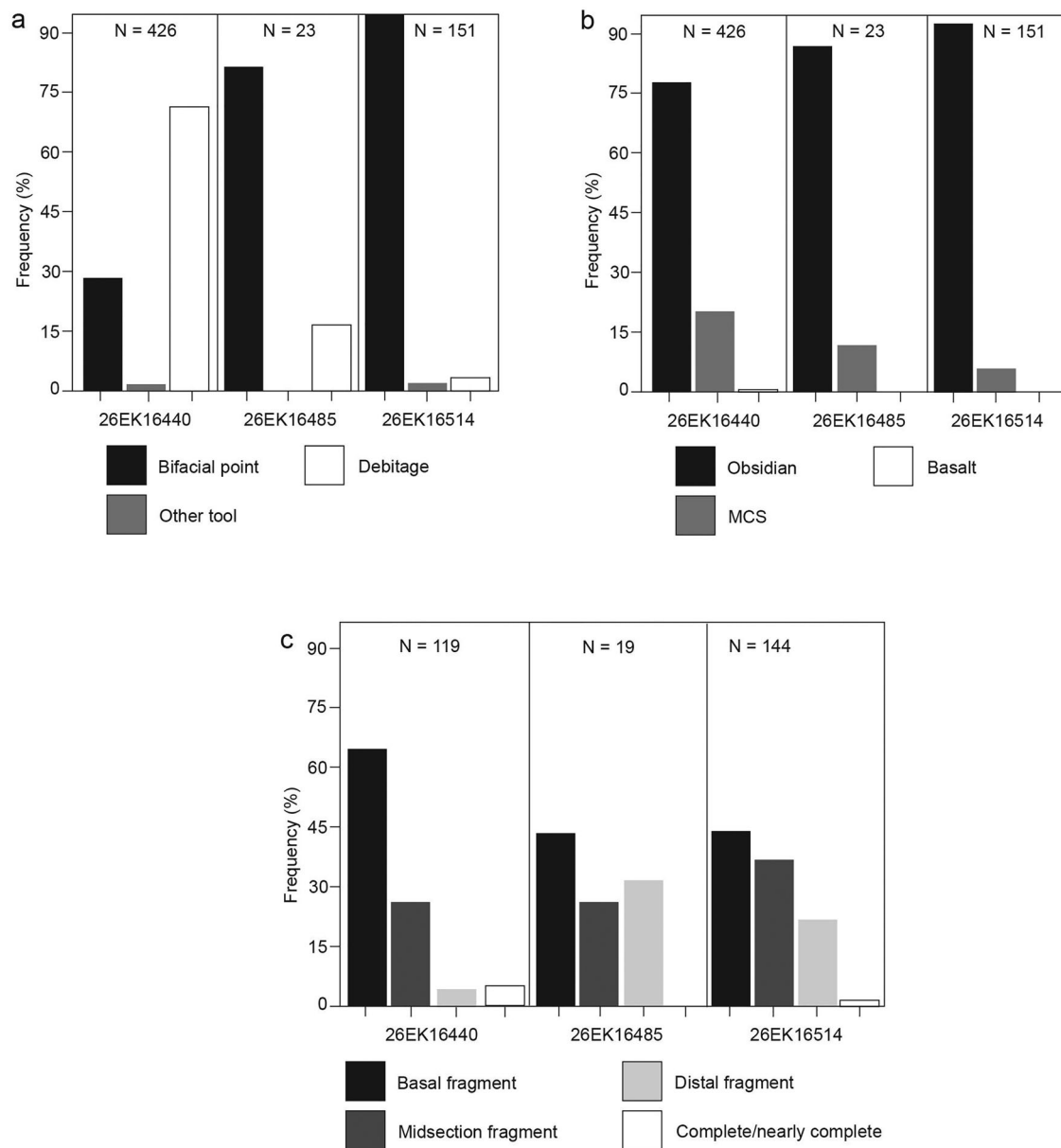


Figure 10 Inter-assembly comparisons of (a) major artifact groups, (b) major raw-material groups, and (c) bifacial-point condition.

but no other tools. The four debitage pieces include two biface-reduction flakes (one on Malad obsidian and the other on MCS), one cortical spall (on Malad obsidian), and one piece of flake shatter (on Browns Bench obsidian). Among the bifacial points are 8 (42.1%) basal fragments, 5 (26.3%) midsection fragments, and 6 (31.6%) tip fragments. All of the points are on obsidian except for one nearly complete midsection fragment and one tip fragment on MCS. Of the 19 points and point fragments, 26 breaks were sufficiently preserved for analysis, leading to the identification of 31 distinctive features. Signs of impact damage occur on 19 (73.1%) of the breaks and 11 (61.1%) of the points.

Site 26EK16514 ($n = 150$; Figure 10; Table 2) is characterized by rare debitage (4.0%) and other tools

(i.e., an unhafted biface, 0.7%) but numerous bifacial points (95.4%). The six debitage pieces include two “impact spalls” presumably from broken bifacial points (both on Browns Bench obsidian) and four pieces of flake shatter (three on Browns Bench obsidian and one on MCS). Among the bifacial points are one (0.7%) complete specimen, 61 (42.4%) basal fragments, 52 (36.1%) midsection fragments, and 30 (20.8%) tip fragments. Of these, 136 (94.4%) are made on obsidian, while 8 (5.6%) are made on MCS, including three basal fragments, four medial fragments, and 1 tip fragment. A total of 265 distinctive breakage features were identified on 143 points/point fragments and 249 breaks. Of these, 121 (48.6%) of the breaks and 99 (69.2%) of the points have attributes indicative of impact damage. The single

unhafted biface is a fragment of an early-stage biface made on MCS with irregular flaking.

5.2.3. Inter-assembly comparisons

The three assemblages making up the SZPC are linked by three important factors: (1) morphometrically the diagnostic projectile points are all classifiable as short-stemmed Windust or Pinto points (with the exception of one Desert Side-Notched point from 26EK16440); (2) the majority of point fragments displays signs of high-velocity impact damage; and (3) nearly all of the bifacial points are made on obsidian from the Browns Bench source. After this, however, there are some important differences.

Proportions of major artifact groups by site are significantly different ($X^2 = 214.947$; $df = 2$; $p = 0.000$). While site 16440 has significantly more debitage pieces and fewer bifacial points than expected, sites 16485 and 16514 are clearly dominated by bifacial points (Figure 10(a)). Likewise, site 16440 has significantly more MCS and less obsidian than expected, while site 16514 has less MCS and more obsidian than expected ($X^2 = 18.157$; $df = 4$; $p = 0.001$) (Figure 10(b)). The high proportion of MCS at site 16440 is expressed almost exclusively by debitage, more specifically a core, cortical spalls, core-reduction flakes, and large biface-reduction flakes.

Another important dimension of inter-assembly variability relates to proportions of bifacial-point fragments (Figure 10(c)). While all three sites have more basal fragments than midsection and distal fragments, there are significantly more basal fragments and less midsection and distal fragments than expected at site 16440, significantly more distal fragments than expected at site 16485, and significantly more midsection and distal fragments than expected at site 16514 ($X^2 = 25.371$; $df = 4$; $p = 0.000$). Furthermore, 6 of 7 complete or nearly complete points come from site 16440.

5.3. Obsidian-hydration analysis

To further test whether the three sites represent a single complex and occupation event, we analyzed the obsidian hydration of 34 artifacts, all made on Browns Bench obsidian. The resulting mean for site 16440 was 9.073μ ($n = 15$), for site 16485, 8.750μ ($n = 6$), and for site 16514, 9.223μ ($n = 13$). A Kruskal–Wallis test of means indicated no significant difference between assemblages ($T = 3.846$; $df = 2$; $p = 0.146$; Figure 11). These results underscore that the three sites represent the same timeframe of occupation, and quite possibly represent the same occupation event.

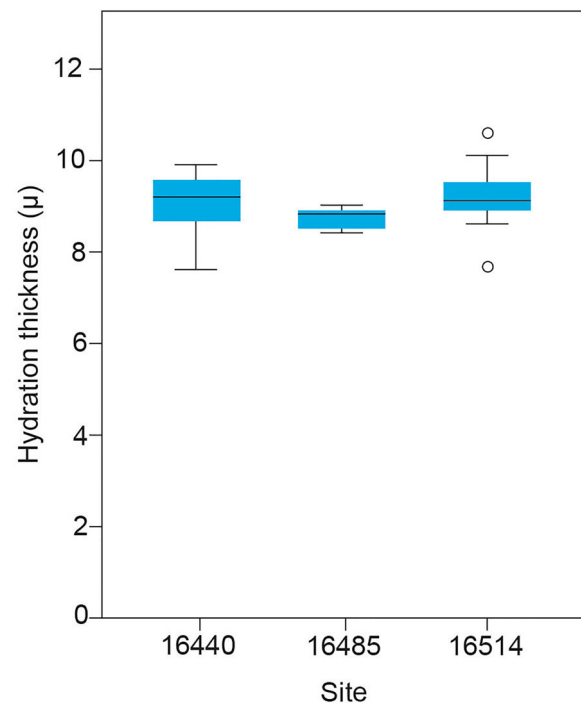


Figure 11 Inter-assembly comparison of obsidian-hydration data for the SZPC.

Comparison of the SZPC hydration data to other cases of Browns Bench obsidian artifacts in northern and eastern Nevada can provide an additional means of relatively dating the SZPC occupation. In a large analysis of 255 typeable bifacial points made from Browns Bench obsidian across northern Nevada (Table 3), Hildebrandt et al. (2016) found that artifacts with readings of $8\text{--}9 \mu$ fall within the transition from the Paleoindian to the Early Archaic periods. Conversely, the average obsidian-hydration thickness for Gatecliff and Humboldt points of the early Middle Archaic (ca. 5500–4000 cal yr BP) is 7.5μ ; the average for

Table 3 Mean obsidian-hydration readings on bifacial-point types manufactured with Browns Bench obsidian. Non-Windust obsidian-hydration measurements after Hildebrandt et al. (2016, 149, table 20). Known dates for each cultural period from the western, central, and eastern Great Basin subregions after Hockett and Spidell (2022).

Bifacial-point type	Mean obsidian hydration (μ)	Cultural period date range
Desert Side-Notched	2.0	Late Prehistoric 600–150 cal yr BP
Rosegate	3.5	Late Archaic 1500–600 cal yr BP
Elko	5.5	Late Middle Archaic 4000–1500 cal yr BP
Gatecliff	7.5	Early Middle Archaic 5000–4000 cal yr BP
Humboldt	7.5	Early Middle Archaic 5000–4000 cal yr BP
Large Side-Notched	8.0	Early Archaic 8300–5000 cal yr BP
Western Stemmed Tradition	10.5	Paleoindian 13,000–? cal yr BP

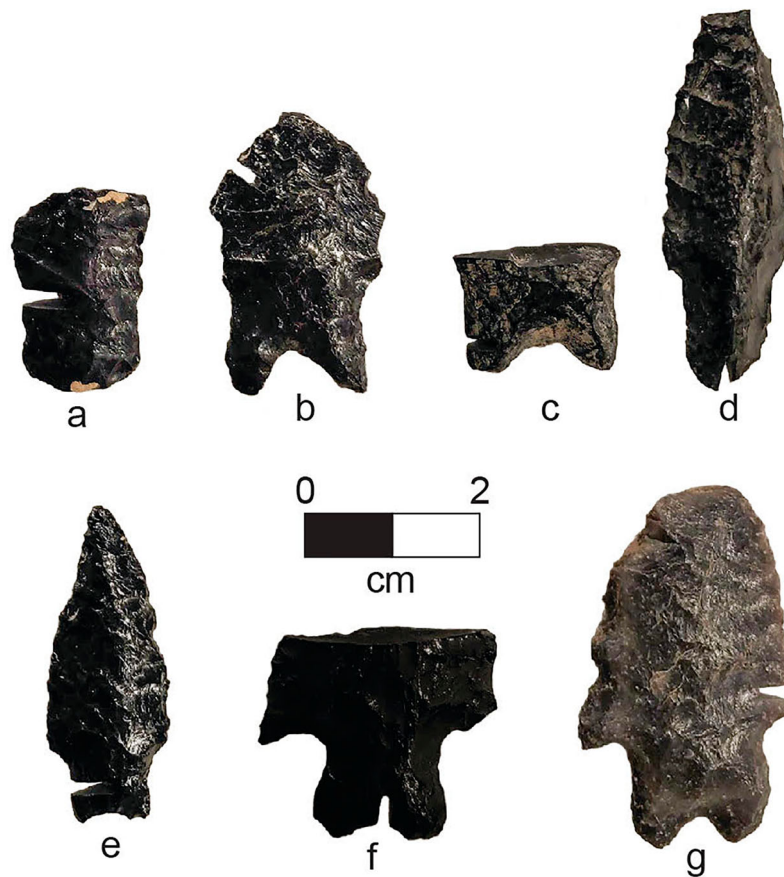


Figure 12 Additional Windust and Pinto points from northeastern Nevada, for which there are obsidian-hydration data similar to the SZPC: (a) Windust, 8.6 μ ; (b) Windust, 8.4 μ ; (c) Windust, 8.6 μ ; (d) Windust, 9.4 μ ; (e) Pinto, 8.1 μ ; (f) Pinto, 9.5 μ ; (g) Pinto, 8.2 μ .

Large Side-Notched points, which may be up to ca. 8300 cal yr BP in this part of the Great Basin but also extend into the Middle Archaic, is 8.0 μ ; and the average for larger and thicker Western Stemmed points than Windust and Pinto points is 10.5 μ . A sample of seven Windust and Pinto bifacial points made on Browns Bench obsidian from eastern Nevada near Goshute Valley produced an average hydration thickness of 8.7 μ (Figure 12). Cross-dating of respective diagnostic bifacial points with those from buried and radiocarbon-dated contexts in the region (Hockett and Spidell 2022), together with the obsidian-hydration results obtained on Browns Bench obsidian across northern and eastern Nevada (Hildebrand et al. 2016; Figure 12), suggest an intermediate age for the SZPC between the Western Stemmed Tradition and Early Archaic, roughly 8500–7500 cal yr BP.

6. Discussion

6.1. Are the SZPC's sites contemporaneous?

Despite the well-known vagaries of trying to relatively date surface archaeology, our findings support the

hypothesis that the three SZPC sites represent the same complex and hence are “contemporaneous”, at least in a culture-historical sense. With the exception of a single Desert Side-Notched point found on the edge of site 16440, the 282 other bifacial points form a cohesive assemblage of short-stemmed Windust and Pinto points, with variation in morphometrics being similarly represented in all three assemblages. Determining whether they represent the same occupation event, however, is more difficult to establish. So far, we have not been able to conjoin any of the point fragments within a site or between sites, despite trying. This is likely due to a combination of two factors: (1) most of the points were manufactured from obsidian which catastrophically shatters, so that finding “clean” refits is extremely difficult; and (2) there are probably hundreds of additional point fragments shallowly buried at the three sites that remain unretrieved. The results of the obsidian-hydration analysis nonetheless indicate no significant difference in the thicknesses of hydration rinds on the artifacts from the three sites, giving us no reason to suggest they represent different-aged occupations. The closeness of the bifacial technology, the geographic

Table 4 Text table showing patterns identified in the SZPC related to it being a kill zone and related camp site.

	Variable	42EK16514	42EK16485	42EK16440
Variables expressing a single Windust/Pinto complex	Dominant raw material	Browns Bench obsidian	Browns Bench obsidian	Browns Bench obsidian
	Obsidian-hydration mean	9.2 μ	8.8 μ	9.1 μ
	Bifacial-point forms	Short-stemmed Windust and Pinto	Short-stemmed Windust and Pinto	Short-stemmed Windust and Pinto
Variables expressing a kill zone – campsite dichotomy	Impact-related damage on bifacial points	49% of breaks; 69% of points	73% of breaks; 61% of points	45% of breaks; 61% of points
	Proportions of bifacial-point fragments	More midsection and tip fragments than bases	More midsection and tip fragments than bases	More bases than midsection and tip fragments
	Frequency of complete or near-complete points	Rare ($n = 1$)	Absent	Infrequent ($n = 6$)
	Other tool forms	Rare ($n = 1$)	Absent	Infrequent ($n = 3$)
	Topography	Swale	Swale	Ridge top

proximity of the sites, and the similar hydration distributions lead us to conclude that they do represent the same occupation event.

6.2. Do the Silver Zone Pass sites represent a kill zone-camp zone pairing?

Based on the evidence presented, our two working hypotheses cannot be nullified (Table 4). Artifact assemblages from 26EK16485 and 26EK16514 are consistent with kill zones, and 26EK16440 is consistent with a

campsite. Furthermore, 26EK16514 rests at the base of a finger ridge of Qf2 alluvial-fan deposits, precisely where we would expect to find the entrance to a large-scale corral, while 26EK16485 lies at the base of the opposite side of the same finger ridge of Qf2, where we would expect to find the backend of a corral. A map showing two hypothetical margins of the trap is presented in Figure 13. This would suggest the migrating prey was moving northward into a south-facing corral entrance. This in turn would suggest a spring-summer occupation for the SZPC, as artiodactyls

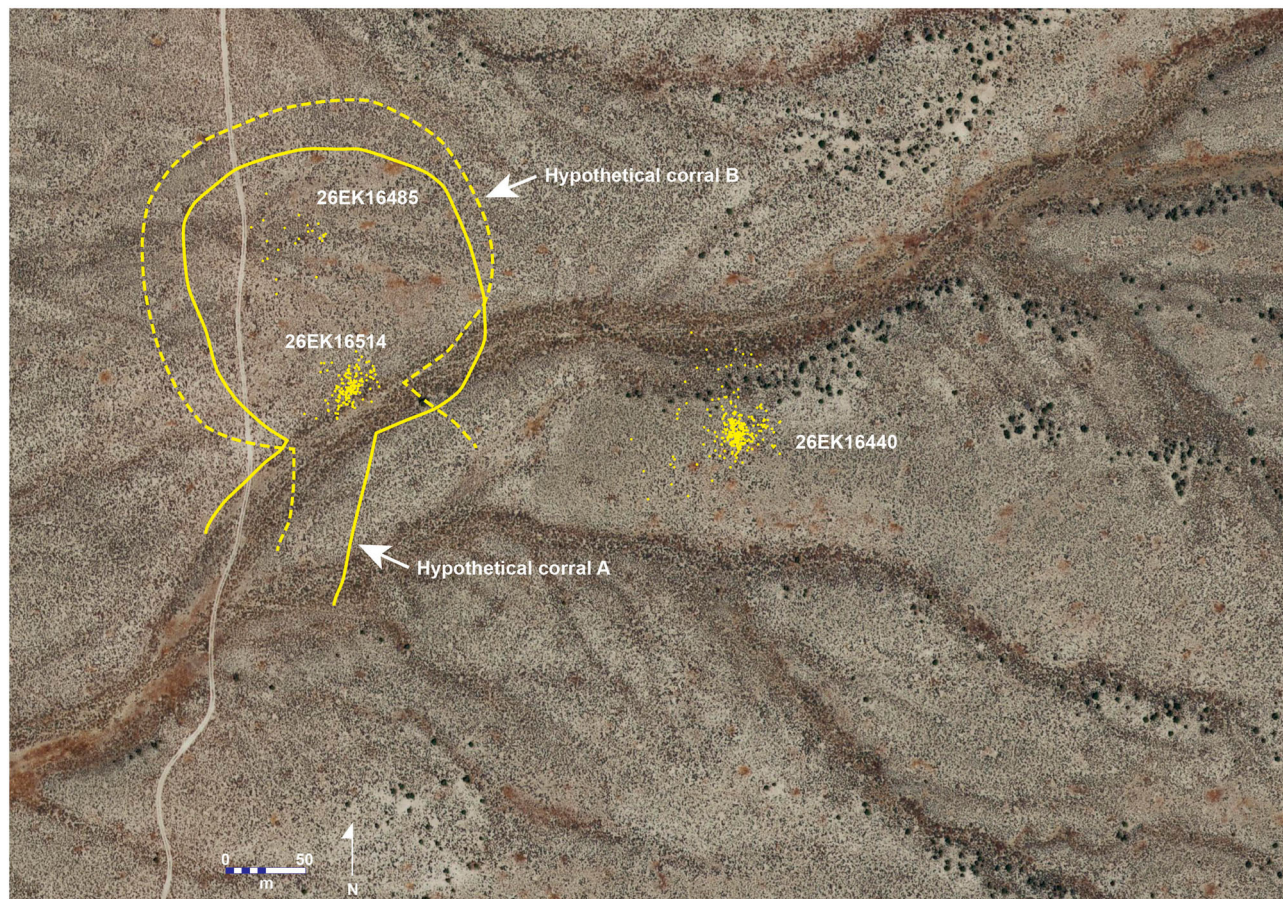


Figure 13 Hypothetical large-scale trap (corral) thought to date to about 8000–7500 cal yr BP, in relation to the three sites that make up the SZPC.

(pronghorn) would be migrating north to reach developing grazing pastures. Site 26EK16440 yielded an artifact assemblage consistent with a hypothetical camp site, as is its location atop a nearby finger ridge of a Qf1 fan, 16–17 m higher than the nearby kill zones. Given that all three sites appear to be contemporaneous, it is likely they were all created at essentially the same time during one or more chronologically closely spaced large-scale trapping events. Given the location of the SZPC complex in a sagebrush-rich vegetation community nearby groves of juniper trees, the prey trapped was likely pronghorn.

6.3. What is the age and culture-historical context of the SZPC?

The SZPC sites cannot be radiocarbon dated, so efforts to define their age and culture-historical context must rely on less precise relative-dating methods: (1) cross-dating of the Windust and Pinto-style points with other nearby archaeological sites that have been radiocarbon dated, and (2) the results of the obsidian-hydration analysis.

Short-stemmed points similar to those recovered from the SZPC have been found in surface contexts in the southern Goshute Valley along Nelson Creek (Goebel and Graf 2001) as well as the west side of nearby Spruce Mountain, 60–80 km to the south-southwest

(Hockett and Goebel 2019); however, none of these have been dated. At Big Springs/Long Canyon, located on the western side of the Goshute valley ~15 km northwest of the SZPC and within its viewshed, excavations yielded six very similar Windust points (Figure 14(a–f); also see Hockett and Goebel 2019, figure 3) associated with hearth and pit features radiocarbon dated from ~7900 to 7700 cal yr BP (Cunnar et al. 2019; see also Goebel et al. 2021, figure 8). All six of these points are short-stemmed and concave based; they also have variably projecting lateral stem margins – two contracting, one parallel, and three expanding – representing much of the same Windust and Pinto variation seen in the SZPC. Distal shoulders are upward-projecting as well, similar to the SZPC points. Although the basal widths of the Big Springs/Long Canyon points fall close to the maximum range of the SZPC points, and the full range of variability in base shape noted in the SZPC Windust and Pinto assemblage (e.g., straight to convex bases) is not evident, they suggest the age of the SZPC is in the 8000–7500 cal yr BP range. Importantly, in the same context of the Windust points at Big Springs/Long Canyon, excavations also yielded Pequop Side-Notched points (Figure 14(g–i); Cunnar et al. 2019; Hockett and Goebel 2019).

The new chronology from nearby Bonneville Estates Rockshelter offers additional clues about the age of the SZPC. Excavations there yielded one point that

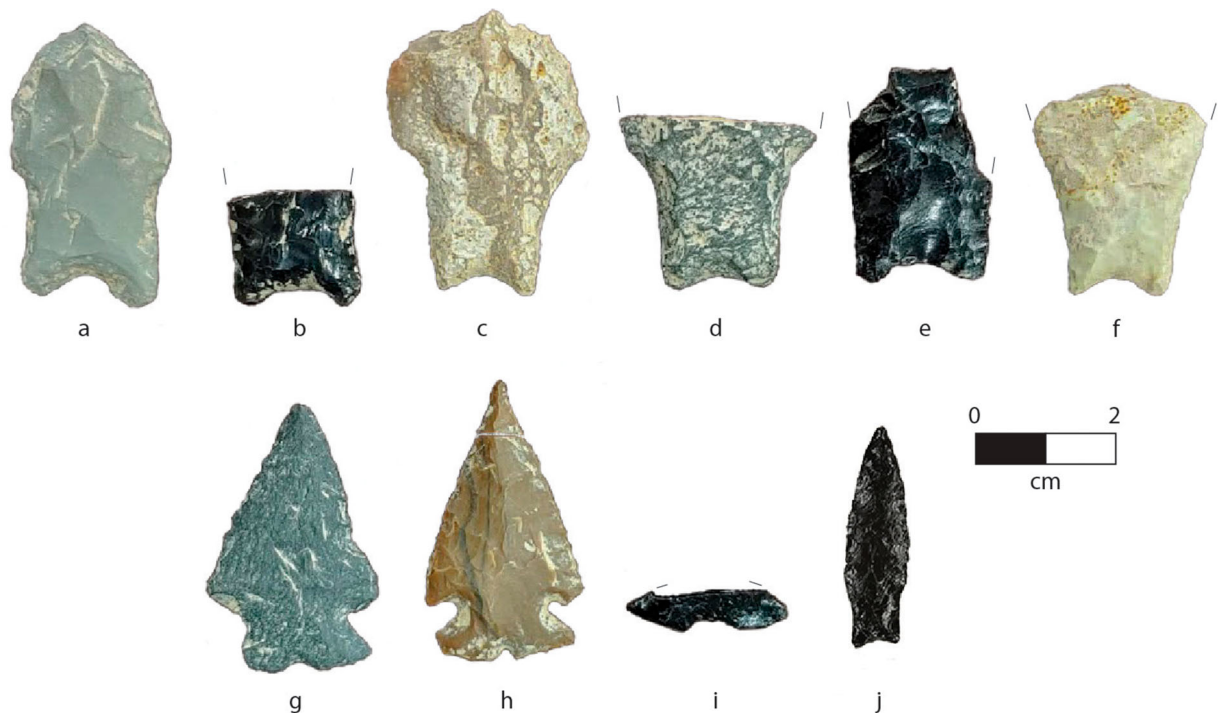


Figure 14 Bifacial points recovered from strata IV and V at the Big Springs site (26EK15282) (a–h) and Bonneville Estates Rockshelter (j) (a–f, Windust points; g–i, Pequop Side-Notched points; j, Pinto point). Cultural features associated with these points were dated between 7900 and 7700 cal yr BP at Big Springs and 8075 and 7600 cal yr BP at Bonneville Estates.

morphometrically fits the Silver Zone “Pinto” pattern: it has a concave base, parallel to slightly expanding lateral stem margins, upward-projecting distal shoulders, and light edge-grinding along one of its lateral margins (Figure 14(j)). The point’s basal width is only 7.41 mm, within the range of the SZPC points, although near the minimum. This artifact came from the stratigraphic contact of strata 16 and 15, both representing early-middle Holocene cultural layers. Although most of above-lying Stratum 14 (~7600–6100 cal yr BP) contains a rich assemblage of Large Side-Notched points, lower lying strata 16 and 15 (~8300–7600 cal yr BP) yielded few other obvious diagnostic points, and they include two Large Side-Notched points (Hockett and Goebel 2019). This SZPC-like Pinto point came from square N5W12 in the stratigraphic connecting trench, in silt-and-rubble sediment in the midst of a complicated array of stacked and overlapping hearth features ranging from 8075 to 7600 cal yr BP. Specifically, the Pinto point was most closely associated with hearth features 07.16 (7644 ± 28 cal yr BP) and 07.18 (7609 ± 42 cal yr BP) (Goebel et al. 2021). Scattered around the excavation square at the same elevation were small pockets of Mazama tephra, independently dated to 7682–7584 cal yr BP (Egan, Staff, and Blackford 2015). Taken together, cross-dating with Big Springs/Long Canyon and Bonneville Estates Rockshelter permit us to conservatively assign an age of ~8000–7500 cal yr BP to the SZPC. Obsidian-hydration data are consistent with this estimate, as reported above.

There are other signs, however, that the short-stemmed points from the SZPC could date to considerably earlier. Danger Cave, located about 30 km southeast of the SZPC, across Silver Zone Pass on the outskirts of Wendover, Utah, also yielded similar diminutive, short-stemmed bifacial points that fit the Windust and Pinto patterns, many of which came from stratum D II (Jennings 1957, 101, 103, 105, 111). Although precise contexts and associations of these points are not known, D II is generally considered to date to 11,500–8000 cal yr BP (Rhode et al. 2005; Rhode, Madsen, and Jones 2006). Farther afield in southwestern Wyoming at the Deep Hearth site, Rood (1993) reported the discovery of yet another similar assemblage of short-stemmed bifacial points that he labeled Deception Creek points, which appear similar to the SZPC’s Pinto-like forms. These were associated with basin-shaped hearth features dated to ~9600–9200 cal yr BP. To the north in the Columbia Plateau region and northern Great Basin of Idaho, Washington, and Oregon, Windust forms appear to date to as early as 11,200 cal yr BP at the Hetrick Site in southwestern Idaho (Manning 2011; Rudolph 1995). These findings

suggest that the SZPC could turn out to date to much earlier than 8000 cal yr BP; however, given their small size, lack of strongly defined shoulders, and relatively shallow obsidian-hydration measures, we hypothesize they date to the transitional period of the Western Stemmed Tradition and Early Archaic period.

If the SZPC does date to just 8000–7500 cal yr BP, given the fact that Large Side-Notched points appear to date as early as 8300 cal yr BP along the western margin of the Bonneville Basin (Hockett and Goebel 2019; Hockett and Spidell 2022), there may have been several centuries of overlap between these two point styles as well as others (e.g., Leppy Hills and Pequop Side-Notched points, the latter being found in association with Windust points at Big Springs/Long Canyon; Figure 14(g–i)) in this subregion of the Great Basin. The transition from the Western Stemmed Tradition (i.e., the Paleoindian period) to the Early Archaic period is not well-understood but gradually coming into focus (e.g., Jones and Beck 2012, 2014), with recent recognition of these mosaic changes in bifacial-point technology alongside the emergence of other new technologies, including increased use of grinding stones, coiled basketry in the eastern Great Basin, and the introduction of other perishable technologies including the production and use of nets and snares (e.g., Coe 2021; Madsen, Oviatt, and Schmitt 2005). The SZPC appears to have been produced during this transitional period.

This interpretation is also consistent with the SZPC’s position on the surface of an ancient alluvial fan that likely formed during the Late Pleistocene, prior to the formation of lower-elevation pluvial-lake-margin features of Pleistocene Lake Waring, which truncated the distal portion of the fan. Although buried artifacts may occur at the SZPC sites, these are likely in secondary contexts, having been deposited through bioturbation or recent eolian activity or alluviation along the unnamed wash running between the sites.

6.4. What are the implications of this discovery for our understanding of the Paleoindian-Archaic transition in the Great Basin?

In the eastern Great Basin, the warm and dry Middle Holocene began about 9500 cal yr BP, with the transition from mesic- to xeric-adapted fauna and more modern-looking floral distributions including the early stages of pinyon pine (*Pinus monophylla*) migration into the region (Goebel et al. 2021; Rhode and Madsen 1998; Rhode, Madsen, and Jones 2006; Schmitt and Lupo 2012). Changes in the archaeological material record at this time compared to earlier-dating Paleoindian times are seen in greater use of grinding-stone

technology and changes in bifacial-point styles, with the predominant Western Stemmed Tradition being largely replaced with primarily Large Side-Notched, Leppy Hills, and Pinto points by at least 8300 cal yr BP. The age of late-dating Western Stemmed points (morphologically consistent with the Windust points) as well as Pinto points between 8500 and 7500 cal yr BP at Bonneville Estates Rockshelter, Big Springs/Long Canyon, and now SZPC suggest chronological overlap in occupation of this subregion of the Great Basin by Native peoples making Windust, Pinto, and Large Side-Notched points, and thus this transitional period was complex and may have involved physical migrations of people or the broader-scale sharing of ideas, or both, at this time. Synchronous with the changes in bifacial-projectile technology is an increase in the use of grinding stones to exploit small-seed resources, as well as other dietary evidence indicating a general broadening of the plant-based diet to include harder-to-process plant foods. The SZPC, together with evidence of the animal-based diet during this time at nearby Bonneville Estates Rockshelter (Hockett 2007, 2015), indicates a broadening of faunal exploitation tactics and technology, in that large-game hunting included both larger-scale communal hunts utilizing the construction of corrals as well as smaller-scale individual or family-based hunts by the Paleoindian-early Archaic transition. Studies of toolstone provenance and settlement organization indicate a reduction in mobility at this time as well (Goebel 2007; Goebel et al. 2017).

Thus, the SZPC adds to the complexity of the Paleoindian-Archaic transition by extending the known age of communally based large-scale trapping of artiodactyls in the Great Basin to this Paleoindian-early Archaic transition period, probably between ca. 8000–7500 cal yr BP. This implies that the pattern of smaller-scale groups coming together to cooperatively participate in constructing large-scale traps to kill artiodactyls *en masse* began earlier than we thought in the Great Basin. Similarly, evidence in Oregon at Buffalo Flats and LSP-1 indicate that communally based trapping of rabbits (*Lepus* spp. and *Sylvilagus* spp.), presumably using nets rather than constructing large-scale traps as defined here, began by about 10,000 cal yr BP (Hockett et al. 2022; Oetting 1994). Clearly, besides important changes in projectile technology, subsistence, and settlement behavior, the end of the Paleoindian period in the Great Basin is also marked by important social changes, with foragers in this increasingly arid environment solving the increased need of maintaining social storage by expanding the scale of social-economic cooperative relationships to include neighboring families and potentially neighboring bands of hunter-gatherers.

7. Conclusions

The three sites that make up the SZPC appear to collectively represent two kill zones and one campsite related to a single or closely spaced-in-time series of large-scale trapping event(s) that occurred between approximately 8000 and 7500 cal yr BP. As such, while the sites were recorded and referred to in this paper as three separate sites, in reality they all represent a single “site” in behavioral and chronological terms. The SZPC is unique because this is the first known case of Western Stemmed and Pinto points found to be associated with large-scale trapping of artiodactyls in the Great Basin. As such, it is also the oldest known evidence for communal large-scale trapping of artiodactyls in the Great Basin. Given its near-valley-floor position and location of the kill zones relative to microtopography, the prey taken was likely pronghorn. The probable south-facing entrance would have meant a spring-summer mass kill.

At about 8000–7500 cal yr BP, this evidence of large-scale trapping of artiodactyls in the Goshute Valley of eastern Nevada is among the oldest known in North America, and it is without question the oldest known case of corral-building. The Drop 45 Drive Lane, now submerged under Lake Huron, is currently the oldest securely dated large-scale trap structure in North America at ca. 9000 cal yr BP (O’Shea et al. 2014). This driveline would have been used to ambush migrating herds of caribou (*Rangifer tarandus*) or possibly bison (*Bison* spp.) (White 2021). Some of the large bison (*Bison* spp.) bonebeds associated with Paleoindian points on the Great Plains, dating to 10,000–9000 cal yr BP, are suspected to have been associated with large-scale traps, but actual structures have yet to be identified, so that we cannot know whether they represent drivelines, corrals/pounds, or both (Frison 2004). Thus, at approximately 8000–7500 cal yr BP, for now SZPC stands as the oldest case of large-scale corral building in North America.

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Disclosure statement

No potential conflict of interest was reported by the author(s).

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References

- Amsden, C. A. 1935. "The Pinto Basin Artifacts." In *The Pinto Basin Site*, edited by E. W. Crozer Campbell and W. H. Campbell, 33–51. Los Angeles: Southwest Museum.
- Andrefsky, W., Jr. 2005. *Lithics: Macroscopic Approaches to Analysis*. 2nd ed. Cambridge: Cambridge University Press.
- Arkush, B. S. 1986. "Aboriginal Exploitation of Pronghorn in the Great Basin." *Journal of Ethnobiology* 6: 239–255.
- Arkush, B. 2014. "Communal Pronghorn Hunting in the Great Basin: What Have We Learned Over the Last Twenty-Five Years?" *Pacific Coast Archaeological Society Quarterly* 49: 17–35.
- Beck, C., and G. T. Jones. 2015. "Lithic Analysis." In *The Paleoarchaic Occupation of the Old River Bed Delta*, edited by D. B. Madsen, D. N. Schmitt, and D. Page, 97–208. Salt Lake City: University of Utah Press. University of Utah Anthropological Papers, No. 128.
- Bergman, C. A., and M. H. Newcomer. 1983. "Flint Arrowhead Breakage: Examples from Ksar Akil, Lebanon." *Journal of Field Archaeology* 10: 238–243.
- Bird, J. B. 1969. "A Comparison of South Chilean and Ecuadorian 'Fishtail' Projectile Points." *Kroeber Anthropological Society Papers* 40: 52–71.
- Brink, J. W. 2005. "Inukshuk: Caribou Drive Lanes on Southern Victoria Island, Nunavut, Canada." *Arctic Anthropology* 42: 1–28. doi:10.1353/arc.2011.0084.
- Brink, J. W. 2016. "Stone Driveline Construction and Communal Hunting Strategies at the Ross Site, Alberta, Canada." In *Stones, Bones, and Profiles: Exploring Archaeological Context, Early American Hunter-Gatherers, and Bison*, edited by M. Kornfeld and B. B. Huckell, 349–389. Boulder: University Press of Colorado.
- Brown, T. J., D. M. Gilmour, P. S. Solimmo, and K. A. Ames. 2019. "The Radiocarbon Record of the Western Stemmed Tradition on the Southern Columbia Plateau of Western North America." *American Antiquity* 84: 471–294.
- Byers, J. A. 1999. *American Pronghorn: Social Adaptations and the Ghosts of Predators Past*. Chicago, IL: University of Chicago Press.
- Carlson, K., and L. C. Bement. 2018. *The Archaeology of Large-Scale Manipulation of Prey*. Boulder: University Press of Colorado.
- Coats, R. R. 1987. *Geology of Elko County, Nevada*. Nevada Bureau of Mines and Geology Bulletin 101. Reno: University of Nevada.
- Coe, M. M. 2021. "Basketry, Cordage, and Perishable Artifact Manufacture at Bonneville Estates Rockshelter: Diachronic Technological Variation." *Journal of Anthropological Archaeology* 64: 101325. doi:10.1016/j.jaa.2021.101325.
- Connolly, T. J., and D. L. Jenkins. 1999. "The Paulina Lake Site (35DS34)." In *Newberry Crater: A Ten-Thousand-Year Record of Human Occupation and Environmental Change in the Basin-Plateau Borderlands*, edited by T. J. Connolly, 86–127. University of Utah Anthropological Papers 121. Salt Lake City: University of Utah Press.
- Cunnar, G., E. Stoner, C. Wheeler, and R. Brockway. 2019. *Treatment and Data Recovery of 130 Sites at the Long Canyon Mine, Elko County, Nevada*, 1e3257. Report Submitted to Bureau of Land Management. Elko, NV.
- Egan, J., R. Staff, and J. Blackford. 2015. "A High-Precision Age Estimate of the Holocene Plinian Eruption of Mount Mazama, Oregon, USA." *Holocene* 25: 1054–1067. doi:10.1177/0959683615576230.
- Elston, R. G. 2005. "Flaked- and Battered-Stone Artifacts." In *Camels Back Cave*, edited by D. N. Schmitt and D. B. Madsen, 92–119. Anthropological Papers No. 125. Salt Lake City: University of Utah Press.
- Enloe, J. G. 2006. "Reevaluations of Reindeer Kill Seasonality and Implications for Site Function at Verberie." In *Paleolithic Zooarchaeology in Practice*, edited by J. A. Haws, B. Hockett, and J.-P. Brugal, 19–28. Oxford: Archaeopress.

- Fischer, A., P. V. Hansen, and P. Rasmussen. 1984. "Macro and Micro-Wear Traces on Lithic Projectile Points: Experimental Results and Prehistoric Examples." *Journal of Danish Archaeology* 3: 19–46. doi:10.1080/0108464X.1984.10589910.
- Frison, G. C. 2004. *Survival by Hunting: Prehistoric Human Predators and Animal Prey*. Berkeley: University of California Press.
- Goebel, T. 2007. "Pre-Archaic and Archaic Technological Activities at Bonneville Estates Rockshelter: A First Look at the Lithic Artifact Record." In *Paleoindian or Paleoarchaic? Great Basin Human Ecology at the Pleistocene-Holocene Transition*, edited by K. Graf and D. Schmitt, 156–184. Salt Lake City: University of Utah Press.
- Goebel, T., and K. Graf. 2001. *Nelson Creek Archaeological Survey, 1999*. Report Submitted to USDI Bureau of Land Management, Elko Field Office (Report No. BLM1-1894).
- Goebel, T., B. Hockett, D. Rhode, and K. Graf. 2021. "Prehistoric Human Response to Climate Change in the Bonneville Basin, Western North America: The Bonneville Estates Rockshelter Radiocarbon Chronology." *Quaternary Science Reviews* 260: 106930. doi:10.1016/j.quascirev.2021.106930.
- Goebel, T., A. Holmes, J. L. Keene, and M. M. Coe. 2017. "Technological Change from the Terminal Pleistocene through Early Holocene in the Eastern Great Basin, USA: The Record from Bonneville Estates Rockshelter." In *Lithic Technological Organization and Paleoenvironmental Change*, edited by E. Robinson and F. Sellet, 235–261. Cham: Springer.
- Green, T. J., B. Cochran, T. W. Fenton, J. C. Woods, G. L. Titmus, L. Tieszen, M. A. Davis, and S. J. Miller. 1998. "The Buhl Burial: A Paleoindian Woman from Southern Idaho." *American Antiquity* 63: 437–456. doi:10.2307/2694629.
- Hamilton, T. A. 2012. "A Case for Paleoindian Use of Pinto Projectile Pints in the Great Basin: Morphological Analysis from the Old River Bed, Utah." MA thesis, Department of Anthropology, University of Nevada, Reno.
- Haynes, G. M. 2004. "An Evaluation of the Chronological Relationship between Great Basin Stemmed and Pinto Series Projectile Points in the Mojave Desert." In *The Human Journey & Ancient Life in California Deserts: Proceedings from the 2001 Millennium Conference*, 117–128. Ridgecrest, CA: Manturango Press.
- Hildebrandt, W., K. McGuire, J. King, A. Ruby, and D. C. Young. 2016. *Prehistory of Nevada's Northern Tier: Archaeological Investigations along the Ruby Pipeline*. Anthropological Papers 101. New York City: American Museum of Natural History.
- Hockett, B. 2005. "Middle and Late Holocene Hunting in the Great Basin: A Critical Review of the Debate and Future Prospects." *American Antiquity* 70: 713–731. doi:10.2307/40035871.
- Hockett, B. 2007. "Nutritional Ecology of Late Pleistocene to Middle Holocene Subsistence in the Great Basin: Zooarchaeological Evidence from Bonneville Estates Rockshelter." In *Paleoindian or Paleoarchaic: Great Basin Human Ecology at the Pleistocene-Holocene Transition*, edited by K. Graf and D. Schmitt, 204–230. University of Utah Anthropological Papers 27. Salt Lake City: University of Utah Press.
- Hockett, B. 2015. "The Zooarchaeology of Bonneville Estates Rockshelter: 13,000 Years of Great Basin Hunting Strategies." *Journal of Archaeological Science: Reports* 2: 291–301. doi:10.1016/j.jasrep.2015.02.011.
- Hockett, B., C. Creger, B. Smith, D. C. Young, J. Carter, E. Dillingham, R. Crews, and E. Pellegrini. 2013. "Large-Scale Trapping Features from the Great Basin, USA: The Significance of Leadership and Communal Gatherings in Ancient Foraging Societies." *Quaternary International* 297: 64–78. doi:10.1016/j.quaint.2012.12.027.
- Hockett, B., and E. Dillingham. 2023. *Large-Scale Traps of the Great Basin*. College Station: Texas A&M University Press.
- Hockett, B., and T. Goebel. 2019. "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." *Nevada Archaeologist* 31: 9–50.
- Hockett, B., and T. W. Murphy. 2009. "Antiquity of Communal Pronghorn Hunting in the North-Central Great Basin." *American Antiquity* 74: 708–734. doi:10.1017/S0002731600049027.
- Hockett, B., E. J. Pellegrini, G. M. Smith, and E. J. Bradley. 2022. "Fauna." In *In the Shadow of the Steamboat: A Natural and Cultural History of North Warner Valley, Oregon*, edited by G. M. Smith, 65–74. Anthropological Papers 137. Salt Lake City: University of Utah Press.
- Hockett, B., and J. Spidell. 2022. *Early and Middle Archaic Projectile Point Typology and Chronology across the Great Basin*. Technical Report 19. Reno: Bureau of Land Management.
- Hughes, Richard E. 2015. "Prehistoric Obsidian Conveyance in the Eastern Great Basin: Evidence from Hogup and Danger Caves, Utah." *Journal of Archaeological Science: Reports* 4: 293–309. doi:10.1016/j.jasrep.2015.08.033.
- Jennings, J. D. 1957. *Danger Cave*. University of Utah Anthropological Papers 27. Salt Lake City: University of Utah Press.
- Jones, G. T., and C. Beck. 2012. "The Emergence of the Desert Archaic in the Great Basin." In *From the Pleistocene to the Holocene: Human Organization and Cultural Transformations in Prehistoric North America*, edited by C. B. Bousman and B. J. Vierra, 105–124. College Station: Texas A&M University Press.
- Jones, G. T., and C. Beck. 2014. "Moving in the Mid-Holocene: The Paleoarchaic/Archaic Transition in the Intermountain West." In *Archaeology in the Great Basin and Southwest: Papers in Honor of Don D. Fowler*, edited by N. J. Parezo and J. C. Janetski, 61–84. Salt Lake City: University of Utah Press.
- Lemke, A. 2021. *The Architecture of Hunting: The Built Environment of Hunter-Gatherers and Its Impact on Mobility, Property, Leadership, and Labor*. College Station: Texas A&M University Press.
- Leonhardy, F., and D. G. Rice. 1970. "Proposed Culture Typology for the Lower Snake River Region, Southeastern Washington." *Northwest Anthropological Research Notes* 4: 1–29.
- Lubinski, P. M. 1999. "The Communal Pronghorn Hunt: A Review of the Ethnographic and Archaeological Evidence." *Journal of California and Great Basin Anthropology* 21: 158–181.
- Madsen, D. B., C. G. Oviatt, and D. N. Schmitt. 2005. "A Geomorphic, Environmental, and Cultural History of the

- Camels Back Cave Region.” In *Camels Back Cave*, edited by D. B. Madsen, 20–45. Anthropological Papers No. 125. Salt Lake City: University of Utah Press.
- Manning, C. R. 2011. “The Role of Salmon in Middle Snake River Human Economy: The Hetrick Site in Regional Contexts.” MA thesis, Portland State University, Oregon.
- McGuire, K. R., M. G. Delacorte, and K. Carpenter. 2004. *Archaeological Excavations at Pie Creek and Tule Valley Shelters, Elko County, Nevada*. Anthropological Papers No. 25. Carson City: Nevada State Museum.
- McGuire, K. R., and B. W. Hatoff. 1991. “A Prehistoric Bighorn Sheep Drive Complex, Clan Alpine Mountains, Central Nevada.” *Journal of California and Great Basin Anthropology* 13: 95–109.
- Mifflin, M. D., and M. M. Wheat. 1979. *Pluvial Lakes and Estimated Pluvial Climates of Nevada*. Nevada Bureau of Mines and Geology Bulletin 94. Reno: University of Nevada.
- Odell, G., and F. Cowan. 1986. “Experiments with Spears and Arrows on Animal Targets.” *Journal of Field Archaeology* 13: 195–212.
- Oetting, A. C. 1994. “Early Holocene Rabbit Drives and Prehistoric Land Use Patterns on Buffalo Flat, Christmas Lake Valley, Oregon.” In *Archaeological Researches in the Northern Great Basin: Fort Rock Archaeology since Cressman*, edited by C. M. Aikens and D. L. Jenkins, 155–169. Eugene: University of Oregon.
- O’Shea, J. M., A. K. Lemka, E. P. Sonnenburg, R. G. Reynolds, and B. D. Abbott. 2014. “A 9,000-Year-Old Hunting Structure beneath Lake Huron.” *Proceedings of the National Academy of Sciences* 111: 6911–6915. doi:10.1073/pnas.1404404111.
- Petersen, F. F., and S. M. Stearns. 1992. *Two Hunting-Related Archaic Sites in Elko County, Nevada*. Sparks, NV: Falcon Hill Press.
- Rhode, D., T. Goebel, K. E. Graf, B. S. Hockett, K. T. Jones, D. B. Madsen, C. G. Oviatt, and D. N. Schmitt. 2005. “Latest Pleistocene-Early Holocene Human Occupation and Paleoenvironmental Change in the Bonneville Basin, Utah-Nevada.” In *Interior Western United States: Geological Society of America Field Guide* 6, edited by J. Pederson and C. M. Dehler, 211–230. doi:10.1130/2005.fld006(10).
- Rhode, D., and D. B. Madsen. 1998. “Pine Nut Use in the Early Holocene and Beyond: The Danger Cave Archaeobotanical Record.” *Journal of Archaeological Science* 25: 1199–1210. doi:10.1006/jasc.1998.0290.
- Rhode, D., D. B. Madsen, and K. T. Jones. 2006. “Antiquity of Early Holocene Small-Seed Consumption and Processing at Danger Cave.” *Antiquity* 80: 328–339. doi:10.1017/S0003598X00093650.
- Rodríguez-Hidalgo, A., P. Saladié, A. Ollé, J. L. Arsuaga, J. M. B. de Castro, and E. Carbonell. 2017. “Human Predatory Behavior and the Social Implications of Communal Hunting Based on Evidence from the TD10.2 Bison Bonebed at Gran Dolina (Atapuerca, Spain).” *Journal of Human Evolution* 105: 89–122. doi:10.1016/j.jhevol.2017.01.007.
- Rood, R. J. 1993. “Deception Creek Projectile Points: A Late Paleoindian Type for the Foothill-Mountain Regions.” *Southwestern Lore: Journal of Colorado Archaeology* 59 (2): 28–33.
- Rudolph, T. 1995. “The Hetrick Site: 11,000 Years of Prehistory in the Weiser River Valley.” Manuscript Submitted to the Idaho Department of Transportation, Boise.
- Schmitt, D. N., and K. D. Lupo. 2012. “The Bonneville Estates Rockshelter Rodent Fauna and Changes in Late Pleistocene-Middle Holocene Climates and Biogeography in the Northern Bonneville Basin, USA.” *Quaternary Research* 78: 95–102. doi:10.1016/j.yqres.2012.02.004
- Stoner, E., and T. F. Bullard. 2022. “Final Report. Phase 2. Geomorphic Mapping in Long Canyon Project Area, Goshute Valley, Nevada. Addendum: Archaeological Potential.” In *A Historic Context for the Authorized and Amended Plan of Operations Areas for the Nevada Gold Mines, LLC Long Canyon Mine in Elko County, Nevada*, edited by C. W. Wheeler, G. Cunnam, E. J. Stoner, R. Brockway, and T. Milliron. BLM Report CCR-1-3429(P). Elko: Bureau of Land Management, Elko District, Wells Field Office.
- Stoner, E. J., J. Hildebrand, and J. C. Mueller. 2020. *A Cultural Resources Inventory of 4,075 Acres for Newmont Long Canyon Phase II Mine Expansion Project Survey in Elko County, Nevada*. Report Submitted to the Bureau of Land Management, Elko, Nevada.
- Titmus, G. L., and J. Woods. 1986. “An Experimental Study of Projectile Point Fracture Patterns.” *Journal of California and Great Basin Anthropology* 8: 37–49.
- Weitzel, Celeste, Nora Flegenheimer, Mariano Colombo, and Jorge Martínez. 2014. “Breakage Patterns on Fishtail Projectile Points: Experimental and Archaeological Cases.” *Ethnoarchaeology* 6: 81–102. doi:10.1179/1944289014Z.00000000017.
- White, A. A. 2021. “A Critique of the Case for Paleoindian Caribou Hunting on the Submerged Alpena-Amberley Ridge.” *PaleoAmerica* 7: 287–304. doi:10.1080/20555563.2021.1942651.