Journal of Archaeological Science 38 (2011) 3568–3576

Contents lists available at SciVerse ScienceDirect

Journal of Archaeological Science

journal homepage: http://www.elsevier.com/locate/jas

Through the High Rock and beyond: placing the Last Supper Cave and Parman Paleoindian lithic assemblages into a regional context

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A R T I C L E I N F O

Article history:
Received 13 April 2011
Received in revised form
22 August 2011
Accepted 23 August 2011

Keywords:
Paleoindians
Great Basin
Mobility
Source provenance studies
Obsidian

A B S T R A C T

Based on source provenance data derived from Paleoindian artifacts in the Great Basin, most researchers agree that early groups were mobile and far-ranging; however, current explanations of the behavior reflected by those data differ. Some models portray Paleoindians as residentially-mobile foragers while others portray them as wetland-tethered collectors reliant upon logistical forays. We consider the types of hunter-gatherer behavior that could produce trends in the X-ray fluorescence data from three Paleoindian assemblages in northwest Nevada, where abundant high quality obsidian essentially allows us to hold the effects of raw material availability constant between sites. We conclude that while it is difficult to differentiate between residential and logistical mobility using technological and sourcing data alone, we can nevertheless begin to understand the relative time-averaged importance of particular locations on the landscape and why such places attracted Paleoindians.

1. Introduction

Mobility has long been a central theme in hunter-gatherer research (e.g., Lee and Devore, 1968). This focus is warranted because how foragers move across the landscape influences other aspects of behavior including subsistence, technology, and sociopolitical organization (Kelly, 1992). While the factors that influence decisions of when, where, and how far to relocate are well-documented ethnographically (Kelly, 2007), elucidating prehistoric settlement strategies has proven difficult. Our inability to identify the factors that dictated how, where, and why prehistoric groups moved stems from the nature of the archaeological record and a necessary reliance on proxy data to reconstruct mobility. For example, source provenance studies of lithic artifacts can delineate annual or lifetime ranges (e.g., Jones et al., 2003) but they alone cannot indicate whether those ranges represent movements of residential groups or task specific parties (Kelly, 1992). Similarly, although detailed studies of lithic assemblages can reveal the technological activities conducted at sites, they alone cannot tell us how or why groups moved. Our best opportunities to reconstruct prehistoric mobility occur when we employ source provenance and technological data together and compare multiple sites within a particular region.

In this paper, we use a combination of lithic sourcing and technological data derived from the analysis of projectile points, unhafted bifaces, and unifaces from three sites in northwest Nevada – Last Supper Cave, Parman Locality 1, and Parman Locality 3 – dated to the terminal Pleistocene/early Holocene (TP/EH). The results show that although there are some similarities between the assemblages, there are also key differences capable of elucidating Paleoindian land-use strategies. We argue that although it was extensively visited throughout the TP/EH, Last Supper Cave was never a primary destination for Paleoindians. Conversely, the Parman localities repeatedly attracted groups from far and wide. We draw upon ethnographic and archaeological data to evaluate potential causes for these differences.

2. Paleoindian mobility and territoriality in the Great Basin

Humans likely arrived in the Great Basin before 11,000 ^{14}C B.P. (Gilbert et al., 2008; Graf, 2007). Early populations left behind stemmed and concave base projectile points and crescents (Beck and Jones, 2009). Although the latter remain poorly dated (Beck and Jones, 2010), together with stemmed points they are diagnostic of TP/EH occupations and provide broad estimates (~11,000–7000 ^{14}C B.P.) of when undated open-air assemblages containing them were deposited. Most substantial Paleoindian sites

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0305-4403/$ – see front matter
doi:10.1016/j.jas.2011.08.027

are found at lower elevations on landforms associated with extinct lakes and wetlands (Beck and Jones, 1997; Grayson, 2011), a trend that has led some researchers (e.g., Bedwell, 1973) to emphasize the role that lacustrine resources played in early lifeways. Less is known about Paleoindians' use of higher elevations although it is clear that they were visited at least occasionally (Bryan, 1979; Layton, 1970; Goebel, 2007).

Treatments of Paleoindian settlement strategies vary but most researchers (e.g., Beck and Jones, 1997; Elston and Zeanah, 2002; Jenkins, 2007; Jones et al., 2003; Smith, 2010, 2011) agree that early groups in the Great Basin, like Paleoindians elsewhere in North America (Amick, 1996; Goodyear, 1989; Kelly and Todd, 1988), were mobile. Several lines of evidence support this view: (1) technological analyses of lithic artifacts suggest that Paleoindians employed a flexible and maintainable toolkit – traits well-suited for mobile populations (Bleed, 1986; Kelly and Todd, 1988; Shott, 1986); (2) X-ray fluorescence (XRF) analyses of obsidian and other fine-grained volcanic (FGV) (i.e., basalt) artifacts indicate that some tools were transported substantial distances and that Paleoindians may have operated within geographically-expansive ranges (Jones et al., 2003); (3) comparisons of local and non-local toolstone frequencies at sites indicate that the latter is often well-represented, which is interpreted to reflect shorter-term occupations (Smith, 2011); and (4) there is a lack of storage pits, structures, middens, or other features indicative of longer-term occupations (Elston and Zeanah, 2002; Jones and Beck, 1999).

While researchers generally agree these trends point to high mobility, there is less agreement about the type of settlement strategies that Paleoindians employed. Relying on source provenance data from open-air sites in lower-elevation settings – many of which contained wetlands during the TP/EH – Jones et al. (2003) developed a model emphasizing high residential mobility (*sensu* Binford, 1980) in which Paleoindians moved between wetlands. Groups occupied residential loci for short periods while traveling through extensive north-south foraging ranges. Although subsequent studies suggest that these ranges may have been smaller than initially believed (Smith, 2010), this model nevertheless fully accounts for the trends outlined above. Although Paleoindian occupations in caves and rockshelters are rare in the Great Basin, those that have been studied also point to short stays (Gilbert et al., 2008; Goebel, 2007; Hanes, 1988).

Others interpret these trends differently. Elston and Zeanah (2002), Madsen (2007), and Duke and Young (2007) suggest that marshside residential bases were relatively stable under conditions of resource abundance and that groups relocated camps less frequently and perhaps over shorter distances than Jones et al. (2003) suggest. Madsen (2007) argues that the substantial transport distances exhibited by Paleoindian artifacts reflect far-ranging males provisioning residential bases with critical resources. Put another way, Paleoindians relied upon logistical mobility (*sensu* Binford, 1980) when residential mobility decreased.

Finally, while many researchers argue that exchange did not play a major role in moving raw materials or artifacts long distances during the TP/EH due to low population densities and the potentially dire consequences of being caught without sufficient toolstone (Jones et al., 2003; Smith, 2010), others (e.g., Fitzgerald et al., 2005) suggest that early populations did exchange goods. Distinguishing between direct procurement and exchange is exceedingly difficult for functional commodities like toolstone (Hughes, 1998; Meltzer, 1989). We acknowledge that some goods may have been traded, perhaps during communal events or chance encounters; however, we assume that most toolstone was procured directly by the groups that used it. This possibility seems especially likely in northwest Nevada where toolstone was readily available to anyone seeking it.

Clearly, we are faced with a problem of equifinality in which different interpretations of the same dataset – the high residential mobility model (Jones et al., 2003) and the stable marshside camp model (Elston and Zeanah, 2002; Madsen, 2007) – are equally plausible. Although we cannot resolve this problem here, we do see the potential to advance our understanding of what source provenance and lithic technological data can reveal about Paleoindian settlement strategies when such information is compared between multiple sites. While detailed technological analyses of individual assemblages (e.g., Estes, 2009; Goebel, 2007; Graf, 2001; Smith, 2006) are useful for understanding behavior at specific sites, and while broad overviews of early lifeways (e.g., Beck and Jones, 1997; Madsen, 2007) provide frameworks within which to consider individual assemblages, few studies incorporate multiple sites from a particular area (but see Jones et al., 2003 and Smith, 2010, 2011). This scale of research can improve our understanding of Paleoindian behavior within particular areas of the Great Basin and offer a level of detail broader than assemblage-level data, but not so broad that intersite variability is obscured by regional generalizations. Here, we seek this middle ground to bring meaning to the results of source provenance and technological data from three Paleoindian sites in northwest Nevada.

3. Materials and methods: the Paleoindian record in Nevada's High Rock Country

Northwest Nevada is unlike other parts of the Great Basin in that it is not generally characterized by Basin-and-Range topography. Instead, the landscape is dominated by volcanic tablelands and deep canyons – the southernmost extension of the Columbia Plateau that Layton (1970) dubbed "The High Rock Country." During the TP/EH, pluvial lakes were few and far between and those that did exist (e.g., Lake Parman) were small and spaced far apart (Mifflin and Wheat, 1979). Despite these facts, northwest Nevada is rich in Paleoindian sites (Adams et al., 2008; Amick, 1997; Layton, 1970, 1979; Layton and Davis, 1978; Smith, 2006, 2007). While many early sites are small, contain few chipped stone tools, lack features, and are dominated by non-local toolstone – trends which collectively point to short-term occupations – others like the Parman localities (Layton, 1979; Smith, 2006, 2007) and Last Supper Cave (Layton and Davis, 1978; Smith, 2008, 2009) are more substantial (Fig. 1). The former are four open-air sites interpreted as repeated short-term marshside occupations (Layton, 1979; Smith, 2006, 2007). Almost 1000 stone tools including nearly 200 Paleoindian points were recovered from the four localities, with the most extensive assemblages occurring at Locality 1 and Locality 3 (Smith, 2006). Located along Hell Creek, ~40 km and over 350 m higher than the nearest major pluvial basin, Last Supper Cave also contained evidence of substantial Paleoindian occupations including 44 Paleoindian points (Layton and Davis, 1978). Radiocarbon-dated features indicate that Last Supper Cave was occupied as early as ~10,300 ^{14}C B.P. (Table 1).

The Last Supper Cave and Parman assemblages are ideal for studying Paleoindian settlement strategies. First, obsidian comprises > 90% of the lithic materials in the assemblages – a fact that reflects the widespread availability of high quality obsidian throughout northwest Nevada. Because obsidian dominates each assemblage, we can be confident that trends represented in the samples of artifacts submitted for XRF analysis reflect more general Paleoindian lithic procurement strategies. Second, because we have a good understanding of the geochemical variability and geographic distribution of obsidian in the northwestern Great Basin (Hughes, 1986; Young, 2002), few artifacts are manufactured on "unknown" types, which are unsuitable for reconstructing mobility. Third, because obsidian is available near both Last Supper Cave and the Parman localities

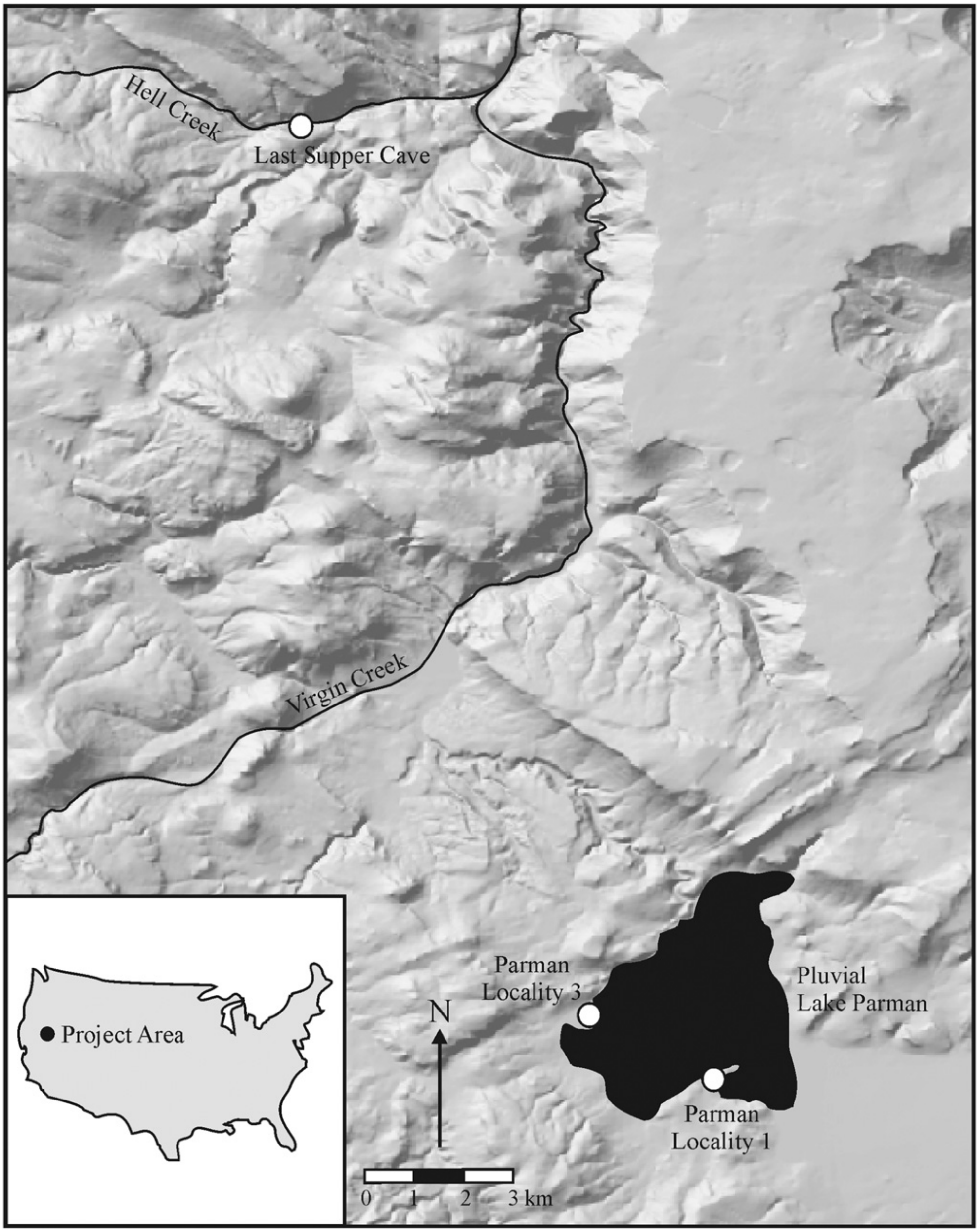

Fig. 1. Location of Last Supper Cave and the Parman Localities, Humboldt County, Nevada.

Table 1
Summary of stratigraphic units and radiocarbon dates associated with the TP/EH occupations of Last Supper Cave.

Major Strata[a]	Field Unit Designations[a]	Temporal Estimates[b]	^{14}C Dates	Lab No.	Material	References
5 Upper Shell	Upper Shell; Middle Shell; Intermediate Shell, Shell 1; Shell 2		6905 320	LSU 73-247	Hearth Charcoal	Layton and Davis (1978)
			8160 50	Beta 242510	Hearth Charcoal	Grant (2008)
		9000–7000 B.P.	8260 90	WSU-1706[c]	Hearth Charcoal	Layton and Davis (1978)
			8630 195	WSU-1431	Shell	Layton and Davis (1978)
6 Lower Shell	Basal Shell; Terminal Shell; Shell 3; Shell 4; Rocky Shell		8790 350	LSU 73-120	Shell	Layton and Davis (1978)
			8920 50	Beta-242511[d]	Hearth Charcoal	Grant (2008)
			8960 190	Tx-2541[c]	Hearth Charcoal	Layton and Davis (1978)
7 White	White; White Rocky	Pleistocene	10,280 40	Beta-231717	Hearth Charcoal	Smith (2008)
8 Pink	Pink; Red	Miocene	–	–	–	–

[a] Both major strata and unit designations made by Layton.
[b] Temporal estimates made by Layton and Davis.
[c] Split-sample obtained from the same feature.
[d] Grant (2008) re-dated the feature from which Layton and Davis obtained their split-sample dates of 8960 190 and 8260 90.

(<5 km), we can hold the effects of raw materials availability – a major influence on technological organization (Andrefsky, 1994; Bamforth, 1986; Odell, 1996) – constant between the sites. Thus, differences in toolstone types and frequencies may be attributed to other factors (e.g., mobility, occupation span). Finally, the assemblages from those sites were recovered from either stratified, well-dated deposits, as is the case for Last Supper Cave, or collected from sites where artifacts from later periods are virtually absent, as is the case for the Parman localities. In the case of the former, Grayson (1988:47) indicated that due to extensive bioturbation, most faunal remains from Last Supper Cave cannot be assigned to particular time periods. While Layton and Davis (1978) noted such disturbance, they felt that the deposits closest to the cave's mouth, which they referred to as the "Control Block", were relatively undisturbed. Additionally, while they acknowledged that the upper strata were bioturbated, Layton and Davis (1978) argue that the lower strata were intact. Although radiocarbon dating of material from Last Supper Cave is ongoing, dates from the lower strata suggest that they are relatively unmixed (see Table 1). In the case of the latter, although the Parman localities are not directly dated, Paleoindian points outnumber Archaic points there by almost five to one. Therefore, Smith (2006, 2007) argues elsewhere that undiagnostic artifacts from those sites can be attributed to TP/EH occupations.

Over the past seven years, we have submitted samples of obsidian and FGV artifacts from Parman Locality 1, Parman Locality 3, and Last Supper Cave for geochemical provenance studies at the Northwest Research Obsidian Studies Laboratory (NWROSL). Using a Spectrace 5000 energy dispersive XRF spectrometer, NWROSL staff determined the trace element composition of the artifacts (e.g., Ti, Mn, $Fe_2O_3^T$, Zn, Ga, Rb, Sr, Y, Zr, Nb, Ba, and assorted peak ratios) and compared them to geochemical profiles collected from geologic source samples. In most cases (>95 percent) artifacts were assigned to particular geochemical types of toolstone from known geologic sources. We bring these samples together in this study to consider the research questions outlined below; additional information about each sample is presented both here (see Table 8 [Supplementary data table containing trace element compositions of the Last Supper Cave artifacts available online]) and elsewhere (Smith, 2006 [see Appendix C for trace element compositions of Parman Locality 1 and 3 artifacts], 2007, 2008, 2009, 2010, 2011). In total, we selected 113 artifacts from Last Supper Cave, 155 artifacts from Parman Locality 1, and 112 artifacts from Parman Locality 3 for this study (Table 2). This sample includes Paleoindian points, crescents, unhafted bifaces, scrapers, combination tools, gravers, knives, notches, and retouched flakes. To create more robust samples we collapsed these categories into three classes: (1) projectile points; (2) bifaces; and (3) unifaces. While this decision obscures some artifact-level patterns, we are primarily concerned with major trends in toolstone source representation here and believe that they are best observed at a broad scale.

We use the sourcing results from those samples to characterize Paleoindian toolstone procurement, and in turn, settlement strategies, at both the intrasite and intersite levels. At the intrasite level, we calculated linear transport distances for each artifact (in km) from the toolstone sources where materials were procured to the sites where tools were discarded. For geographically widespread toolstone types, we calculated the distances between the sites and the nearest source(s) of those materials. Because toolstone frequency generally decreases as distance from source increases (*sensu* Renfrew, 1977), transport distances are highly skewed and unsuitable for parametric statistical comparisons (e.g., *t* tests). Therefore, we compared the mean transport distances of points, bifaces, and unifaces using a non-parametric bootstrapping technique. Bootstrapping repeatedly draws a predetermined number (in this study, 1000) of random samples with replacement from each artifact class to calculate the probability that differences between the samples are significant. We then calculated source diversity for each artifact class using a bootstrapping routine designed to alleviate issues related to different sample sizes. Following Eerkens et al. (2007:592), we report diversity as "average number of sources", which represent "a sample-size-adjusted measure of diversity." At the intersite level, we compared artifact transport distances and source diversity for each artifact class using the same procedures outlined above. We also compared the samples of bifaces by reduction stage, classified according to the criteria outlined in Smith (2006), to consider the types of technological activities conducted at each site.

Using these materials and methods, we developed three questions and related expectations tied to Paleoindian settlement and land-use strategies. First, at the intrasite level, we asked if source diversity and transport distances differ between tool classes. Because Paleoindian points are assumed to have been "curated" by their users (Jones and Beck, 1999), we expected such tools to be made on more toolstone types occurring at greater distances from each site, than bifaces and unifaces. The answer to this question helps identify the types of artifacts transported between sites. Second, at the intersite level, we asked if the degree to which bifaces were reduced differs at each site. Because foragers typically manufacture tools at residential bases and maintain tools at logistical destinations (Binford, 1977, 1979), we assume that if either Jones et al.'s (2003) model of frequent residential relocations or Madsen's (2007) model of stable marshside camps are correct, then the Parman localities should exhibit all stages of biface reduction. This is because in either model, those sites should represent residential bases. Conversely, the distribution of biface stages at Last Supper Cave could differ significantly from those at the Parman localities if the cave was used as a logistical destination, or not, if like the Parman localities, it served as a residential base. Finally, at the intersite level, we asked if source diversity and transport distances differ for each artifact class between sites. Given the importance of wetlands to Great Basin Paleoindians, we assumed that the Parman localities would have attracted more groups, from a greater variety of locations, distances, and directions, than Last Supper Cave – an upland site far from TP/EH wetlands. As such, we anticipated that transport distance and source diversity, both of which might reflect territorial range (Jones et al., 2003; Smith, 2010), would be greater for the Parman localities than Last Supper Cave.

Table 2
Samples of Paleoindian artifacts from High Rock Country used in this study.[a]

Site	Artifact type			Total
	Projectile points	Bifaces	Unifaces	
Last Supper Cave	35	33	45	113
Parman Locality 1	57	44	54	155
Parman Locality 3	31	55	26	112
Total	123	132	125	380

[a] Counts include specimens made on geochemical types whose geographic distributions are unknown ($n = 18$, or < 5 percent of the total sample of artifacts).

4. Results

Fourteen known geochemical types of obsidian and FGVs occur in the samples of artifacts from Last Supper Cave, Parman Locality 1, and Parman Locality 3 (Table 3). Sources of these materials are found throughout northwest Nevada, northeastern California, and southern Oregon and occur between 1 and 229 km from the sites (Fig. 2). Massacre Lake/Guano Valley obsidian dominates each assemblage, which is not surprising because it is distributed over

Table 3
Abundances of Paleoindian artifacts from Last Supper Cave and the Parman localities by geochemical type.[a] Percentages shown in parentheses reflect abundances of individual geochemical types within each artifact class by site.

Geochemical type	Last Supper Cave				Parman Locality 1				Parman Locality 3			
	Distance (km)	Projectile Points	Bifaces	Unifaces	Distance (km)	Projectile Points	Bifaces	Unifacess	Distance (km)	Projectile Points	Bifaces	Unifaces
Badger Creek	26	1 (2.9)	4 (12.1)	6 (13.3)	39	2 (3.8)	4 (9.3)	1 (2.0)	37	2 (7.4)	2 (3.8)	1 (4.3)
Beatys Butte	76	4 (11.9)	–	–	94	1 (1.9)	–	–	94	4 (14.8)	–	
BS/PP/FM[b]	56	2 (5.9)	–	–	50	4 (7.5)	–	–	50	2 (7.4)	–	1 (4.3)
Buck Mountain	90	1 (2.9)	–	–	98	1 (1.9)	–	–	98	1 (3.7)	–	
Cowhead Lake	–	–	–	–	87	3 (5.7)	1 (2.3)	–	87	1 (3.7)	–	
Coyote Spring	22	1 (2.9)	–	1 (2.2)	30	2 (3.8)	6 (14.0)	4 (7.8)	28	1 (3.7)	6 (11.3)	
DH/WH[c]	91	1 (2.9)	–	–	86	7 (13.2)	1 (2.3)	1 (2.0)	86	1 (3.7)	3 (5.7)	
Hawks Valley	21	2 (5.9)	2 (6.1)	4 (8.9)	40	6 (11.3)	–	1 (2.0)	–	–	–	
Indian Creek Butte	–	–	–	–	–	–	–	–	191	1 (3.7)	–	
Long Valley	–	–	–	–	65	1 (1.9)	–	–	63	2 (7.4)	–	
ML/GV[d]	1	22 (64.7)	27 (81.8)	34 (75.6)	5	25 (47.1)	31 (72.1)	44 (86.2)	3	11 (40.8)	42 (79.2)	20 (87.1)
Mt. Majuba	–	–	–	–	–	–	–	–	113	–		1 (4.3)
Surveyor Spring	–	–	–	–	–	–	–	–	89	1 (3.7)	–	
Venator	–	–	–	–	229	1 (1.9)	–	–	–	–	–	
Total		34	33	45		53	43	51		27	53	23

[a] Counts do not include specimens made on geochemical types whose geographic distributions are unknown ($n = 18$, or < 5 percent of the total sample of artifacts).
[b] Bordwell Springs/Pinto Peak/Fox Mountain.
[c] Double H/Whitehorse.
[d] Massacre Lake/Guano Valley.

a large area that encompasses the three sites. Other geochemical types are less well-represented in the assemblages and there is minor variation in how much they occur at each site. Below, we use the results presented in Table 3 to compare transport distances and source diversity at both the intrasite and intersite level.

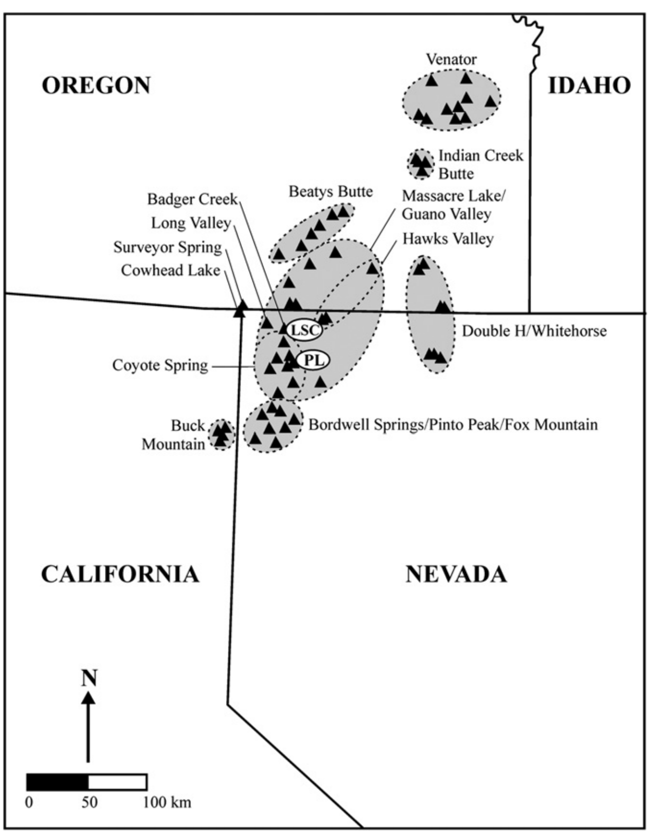

Fig. 2. Geographic Distribution of Volcanic Toolstone Types Represented in the Last Supper Cave and Parman Localities' Assemblages. Note: LSC = Last Supper Cave; PL = the Parman Localities.

4.1. Intrasite comparisons of source provenance data

Table 4 summarizes the transport distances for projectile points, bifaces, and unifaces in each assemblage. At each site, points were transported significantly farther than both bifaces and unifaces. This result is not surprising given that similar disparities between curated tools such as projectile points and other artifact classes are common (Eerkens et al., 2007; Smith, 2007, 2009). Conversely, transport distances for bifaces and unifaces are consistent at each site and indicate that such tools were predominantly manufactured using local toolstone. Because obsidian is available within 1 km of Last Supper Cave and 3–5 km of the Parman localities, these findings are also expected. Table 4 indicates that the average number of sources represented in the three tool classes also differ at each site. Trends in those data track artifact transport distances closely: points are manufactured on significantly more geochemical types than both bifaces and unifaces at each site. In contrast, source diversity does not differ significantly between the latter two tool types at each site. Together, these data indicate that projectile points were commonly transported to the Parman localities and Last Supper Cave from other, sometimes distant, locations but that bifaces and unifaces were predominantly manufactured using local toolstone. Such trends are consistent with groups arriving at locations and replacing exhausted artifacts made on exotic toolstone with new tools made on local materials.

4.2. Intersite comparisons of source provenance data

Whereas intrasite comparisons of transport distances and source diversity reveal uniform patterns of toolstone procurement, use, and discard at Last Supper Cave and the Parman localities, intersite comparisons of these variables show that there are both significant differences and consistencies between the assemblages. Table 5 shows that artifact transport distances generally do not differ for bifaces and unifaces; the sole exception is that bifaces from Parman Locality 1 were transported significantly farther than bifaces from Last Supper Cave (15.4 km vs. 5.2 km; $p = .012$). However, projectile points from both Parman Locality 1 and Parman Locality 3 were transported on average twice as far as those from Last Supper Cave, and these differences are significant

Table 4
Summary of intrasite comparisons of artifact transport distance and source diversity at Last Supper Cave and the Parman localities.[a]

Artifact class by site	Transport distance (km)	Results of statistical comparisons[b]	Average # of sources	Results of statistical comparisons[b]
Last Supper Cave				
Projectile Points ($n = 34$)	20.9	Projectiles vs. Bifaces: $p = .010$	8.1	Projectiles vs. Bifaces: $p = .004$
Bifaces ($n = 33$)	5.2	Projectiles vs. Unifaces: $p = .005$	3.0	Projectiles vs. Unifaces: $p = .013$
Unifaces ($n = 45$)	6.6	Bifaces vs. Unifaces: $p = .505$	3.9	Bifaces vs. Unifaces: $p = .363$
Parman Locality 1				
Projectile Points ($n = 53$)	38.7	Projectiles vs. Bifaces: $p = .005$	10.4	Projectiles vs. Bifaces: $p = .003$
Bifaces ($n = 43$)	15.4	Projectiles vs. Unifaces: $p < .001$	5.0	Projectiles vs. Unifaces: $p = .004$
Unifaces ($n = 51$)	9.9	Bifaces vs. Unifaces: $p = .131$	4.6	Bifaces vs. Unifaces: $p = .556$
Parman Locality 3				
Projectile Points ($n = 27$)	47.7	Projectiles vs. Bifaces: $p < .001$	10.3	Projectiles vs. Bifaces: $p < .001$
Bifaces ($n = 53$)	11.8	Projectiles vs. Unifaces: $p = .001$	3.6	Projectiles vs. Unifaces: $p = .009$
Unifaces ($n = 23$)	11.3	Bifaces vs. Unifaces: $p = .927$	4.0	Bifaces vs. Unifaces: $p = .901$

[a] Counts do not include specimens made on geochemical types whose geographic distributions are unknown ($n = 18$, or < 5 percent of the total sample of artifacts).
[b] p values calculated using a non-parametric bootstrapping routine.

($p = .037$ and .011). Transport distances for projectile points from the two Parman localities do not differ significantly ($p = .415$).

Similar trends occur in comparisons of source diversity between the sites (Table 6). There are no significant differences between either bifaces or unifaces; in both cases only a few local toolstone types were used to manufacture both artifact classes. Projectile points from both Parman localities are made on a wider variety of toolstone than those from Last Supper Cave (8.6 and 11.0 vs. 7.3), although this difference is only statistically significant in the case of Parman Locality 1 ($p = .013$). Like projectile point transport distances, source diversity for points does not differ between the Parman localities ($p = .913$).

Finally, our comparison of biface reduction stages indicates no significant differences in the degree to which bifaces were reduced between sites (Table 7). At each location, all stages of biface reduction are represented, which suggests that biface manufacturing was a major technological activity there. Although an analysis of debitage from Last Supper Cave has not been completed, the analysis of debitage from the Parman localities supports this interpretation (Smith, 2006, 2007). When considered together with source provenance data (see Table 3), which indicates most bifaces are manufactured on local toolstone, the technological data suggest that Paleoindians primarily made, rather than maintained, bifaces at Last Supper Cave and the Parman localities. From this limited perspective then, it appears that the three sites served as residential bases where tool production was a major activity, rather than logistical destinations, where tools were maintained.

In sum, the results of our analysis of projectile points, bifaces, and unifaces from Last Supper Cave and the Parman localities are as follows: (1) at each site, points are made on toolstone procured from sources that are more distant than those used to manufacture bifaces and unifaces; (2) at each site, points are made on a greater variety of toolstone types than both bifaces and unifaces; (3) there are few differences in the transport distances of bifaces and unifaces at each site; (4) there are no significant differences in toolstone diversity between bifaces and unifaces at each site; (5) points at the Parman localities were transported farther than points at Last Supper Cave; (6) points from the Parman localities are manufactured on more geochemical types than points from Last Supper Cave; and (7) bifaces do not differ significantly in the degree to which they were reduced at the three sites.

5. Discussion

Because high quality toolstone is ubiquitous throughout northwest Nevada and available near each site, we can hold the effects of raw material availability constant and turn elsewhere for explanations of what the differences outlined above may represent. At each site, points are manufactured on diverse toolstone types originating from a variety of distances and directions. Thus, Last Supper Cave and the Parman localities likely represent palimpsests of repeated occupations. At Last Supper Cave, where the site's chronology has been established using radiocarbon dates, this possibility is easy to demonstrate (see Table 1). Unfortunately, demonstrating that multiple occupations occurred is more difficult at the undated Parman localities. However, if Jones and Beck's (1999:87) assertion that a few Paleoindian points "may herald a very significant TP/EH occupation" is correct, then the Parman localities likely represent *very* significant, and almost certainly

Table 5
Summary of statistical comparisons of transport distances for projectile points, bifaces, and unifaces from Paleoindian sites in the High Rock Country. Note: LSC = Last Supper Cave; PL 1 = Parman Locality 1; PL 3 = Parman Locality 3.

Transport distance	p	Significant?
Projectile points		
LSC (20.9 km) vs. PL 1 (38.7 km)	.037	Yes
LSC (20.9 km) vs. PL 3 (47.7 km)	.011	Yes
PL 1 (38.7 km) vs. PL 3 (47.7 km)	.415	No
Bifaces		
LSC (5.2 km) vs. PL 1 (15.4 km)	.012	Yes
LSC (5.2 km) vs. PL 3 (11.8 km)	.095	No
PL 1 (15.4 km) vs. PL 3 (11.8 km)	.388	No
Unifaces		
LSC (6.6 km) vs. PL 1 (9.9 km)	.164	No
LSC (6.6 km) vs. PL 3 (11.3 km)	.209	No
PL 1 (9.9 km) vs. PL 3(11.3 km)	.233	No

Table 6
Summary of statistical comparisons of geochemical source diversity for projectile points, bifaces, and unifaces from Paleoindian sites in the High Rock Country. Note: LSC = Last Supper Cave; PL 1 = Parman Locality 1; PL 3 = Parman Locality 3.

Average # of sources	p	Significant?
Projectile Points		
LSC (7.3) vs. PL 1 (8.6)	.013	Yes
LSC (7.3) vs. PL 3 (11.0)	.259	No
PL 1 (8.6) vs. PL 3 (11.0)	.913	No
Bifaces		
LSC (3.0) vs. PL 1 (4.7)	.115	No
LSC (3.0) vs. PL 3 (3.9)	.159	No
PL 1 (4.7) vs. PL 3 (3.9)	.611	No
Unifaces		
LSC (3.6) vs. PL 1 (3.3)	.388	No
LSC (3.6) vs. PL 3 (4.0)	.798	No
PL 1 (3.3) vs. PL 3 (4.0)	.794	No

Table 7
Bifaces by reduction stage at the three study sites.[a] Percentages shown in parentheses.

Site	Biface stage				Total
	Early	Middle	Late	Finished	
Last Supper Cave	4 (12.1)	15 (45.4)	9 (27.3)	5 (15.2)	33
Parman Locality 1	9 (20.9)	11 (25.6)	10 (23.3)	13 (30.2)	43
Parman Locality 3	13 (24.5)	9 (17.0)	11 (20.8)	20 (37.7)	53
Total	26	35	30	38	129

$\chi^2 = 11.61$, $df = 6$, $p = .0713$.
[a] Counts do not include specimens made on geochemical types whose geographic distributions are unknown ($n = 18$, or < 5 percent of the total sample of artifacts).

repeated, occupations. Thus, we are left to consider the types of behavior capable of producing lithic assemblages comprised of toolstone originating from multiple distances and directions.

In his discussion of Mousterian assemblages, Mellars (1996:162–163) outlines three scenarios capable of producing such a pattern. First, logistical parties embark on long distance forays from residential bases and acquire toolstone during those trips. This is similar to Madsen's (2007) suggestion that males embedded toolstone procurement within hunting trips from marshside camps, perhaps in part driven by the opportunity to exchange information or mates with other groups (MacDonald, 1999; MacDonald and Hewlett, 1999). Those forays could produce an assemblage containing broken projectiles made on diverse non-local materials, especially if worn-out implements were transported back to camps and replaced (Binford, 1977, 1979). If this scenario is correct, then the geographic distributions of toolstone represented in assemblages represent the territories covered by logistical parties. Such behavior could occur where the resources targeted by logistical groups were close to camp; however, we discount it here for two reasons. First, like Mellars (1996:163), we would expect such provisioning behavior to result in a variety of artifact types made on non-local materials, not just projectiles, and this is not the case at the sites. Second, it is difficult to conceive of economic reasons to travel the substantial one-way distances implied by non-local points (but see MacDonald, 1999 and MacDonald and Hewlett, 1999 for considerations of social motivations). No subsistence resources offer return rates warranting travel beyond ~30 km from a residential base (Kelly, 2001), and it is equally unclear why groups would have targeted toolstone from distant sources in northwest Nevada when obsidian was available close to the sites (but we do not discount this possibility for places like the Bonneville wetlands, where it was a long walk to even the closest toolstone sources [Page, 2008]).

In Mellars' (1996:162–163) second scenario, a single group periodically revisits a spot on the landscape, perhaps during seasonal subsistence rounds. Each time they arrive at the site, the group replaces worn-out tools produced on non-local toolstone with new implements made on local toolstone. Over time, such behavior could cumulatively produce an assemblage comprised of a small number of formal tools made on a variety of non-local toolstone originating from diverse distances and directions, and a large number of broken tools and debitage made on local toolstone – exactly the pattern noted at Last Supper Cave and the Parman localities. This scenario is enlisted by numerous Great Basin researchers (Graf, 2001; Smith, 2007) and if it is correct, then the geographic distribution of toolstone sources represented in assemblages may provide a minimum estimate of Paleoindian annual or lifetime ranges. Furthermore, if distinct boundaries existed between such ranges, as Jones et al. (2003) have suggested, then different Paleoindian populations may have operated within discrete geographic areas.

In Mellar's (1996:162–163) third scenario, two or more unrelated groups visit a particular place at different times. Like the second scenario, this possibility could produce assemblages comprised of a few tools made on diverse non-local toolstone types and many tools made on local toolstone if groups replenished their toolkits while at those locations. Given the substantial time span over which Last Supper Cave and the Parman localities were probably utilized, unrelated groups almost certainly visited those locations at different times, perhaps during different decades or centuries. However, because subsistence resources are generally not distributed uniformly in either time or space, the cyclical nature of resource availability in the Great Basin should have favored land-use strategies that placed people at certain locations on the landscape at certain times of year. Thus, if conditions were optimal at either location during any given year, then groups inhabiting the High Rock Country may have been attracted to the same places at the same times.

We add the possibility that related groups visited a particular location at the same time to Mellars' (1996) scenarios. Madsen (2007:16) has proposed this very scenario and argued that substantial Paleoindian sites may represent locations where dispersed populations occasionally aggregated for "jamborees." During those events, groups could have replenished their worn-out toolkits with locally available toolstone. Such behavior could produce the high proportions of local toolstone and low proportions of non-local toolstone present at Last Supper Cave and the Parman localities. This possibility is in accordance with ethnographically documented foragers in the Great Basin, who sometimes aggregated at optimal times of the year to communally harvest resources and hold celebrations (Fowler, 1986; Steward, 1938), as well as perhaps exchange information and mates. While we cannot rely too heavily on ethnographic analogy to reconstruct Paleoindian lifeways, there is evidence that early groups in the Great Basin may have harvested leporids communally (Oetting, 1994), at which time both social and economic factors may have come into play.

In sum, we do not subscribe to the model of Paleoindian settlement strategies that hold that logistical parties traveled substantial round-trip distances from residential camps unless these movements were undertaken by groups of young males motivated by factors other than food or toolstone. Such travel is neither warranted by resource return rates nor, in the case of northwest Nevada, raw material availability. Untangling the other possibilities – repeated visits by a single group, visits by unrelated groups, occasional aggregations by related groups, or some combination of the three – is not possible using the coarse-grained data presented here. Whatever was the case, comparisons of source provenance and technological data can help elucidate differences in the relative, time-averaged socioeconomic importance of particular locations during the TP/EH. Specifically, in places where we can hold the effects of raw material availability constant, as at sites in northwest Nevada, assemblages exhibiting high toolstone diversity and substantial artifact transport distances may have represented significant "destinations." These places may have been visited repeatedly by the same groups, at different times by different groups, or occasionally by dispersed populations for special events. In each case the importance of such places to Paleoindian socioeconomic organization is clear. Conversely, sites exhibiting low toolstone diversity and minimal artifact transport distances are best interpreted as less important destinations, perhaps utilized only by local populations. The Parman localities may represent the former type of location; the fact that Lake Parman was a small but apparently rich location situated midway between the larger pluvial basins of western Nevada and south-central Oregon may have made it either a favored stopover point or gathering location during the TP/EH. Last Supper Cave may have represented a different type of location; situated far from wetlands and hidden in one of the many deeply-incised canyons of the High Rock Country, it may not have had the high visibility or offered the abundant resources of the Parman localities. As such, it may have been primarily used by local groups intimately familiar with the landscape, perhaps moving between more important locations, rather than by groups from more distant areas targeting it as a significant destination.

6. Conclusion

The archaeological record of the TP/EH in the Great Basin is a mixed blessing. Because most Paleoindian sites occur in open-air settings, we have little direct information about organic technologies, subsistence, or chronology. The paucity of such data has confounded attempts to understand Paleoindian lifeways. Fortunately, we can mitigate this shortcoming using a rich lithic record. We can confidently estimate where raw materials used to make artifacts were procured. In turn, this allows us to determine the distances and directions that early groups traveled, develop models of Paleoindian territoriality (e.g., Jones et al., 2003), and even reconstruct the sequence in which particular sites were visited (e.g., Jones et al., 2003). This paper has proposed yet another use of data generated by source provenance and technological data – considering the relative socioeconomic importance of different locations. Although most substantial Paleoindian sites almost certainly represent multiple occupations, the time-averaged draw of such places should nevertheless be discernable by comparing the transport distances and directions as well as toolstone diversity represented in lithic assemblages. We have applied this idea to northwest Nevada, where a reliance by Paleoindians on toolstone types well understood by archaeologists make it an ideal test case. We encourage researchers working elsewhere to consider the ideas put forth here but fully anticipate that different patterns may emerge in areas where the distribution of TP/EH wetlands and toolstone sources differed.

The role of the funding source

Funding for the XRF analysis of artifacts from Last Supper Cave was provided by a Lander Grant from the Desert Research Institute and support from the Northwest Research Obsidian Studies Laboratory. Funding for the XRF analysis of artifacts from the Parman localities was provided by the Sundance Archaeological Research Fund and the Great Basin Paleoindian Research Unit, Department of Anthropology, University of Nevada, Reno, and the Northwest Research Obsidian Studies Laboratory.

Acknowledgments

We sincerely thank Tom Layton for generously providing his time, insight, materials, and encouragement related to our work with the Last Supper Cave and Parman localities materials. Tom established much of what we know about the Paleoindian archaeology of the High Rock Country and after more than four decades, his ideas remain both relevant and supported. Thanks are also due to Anan Raymond of the United States Fish and Wildlife Service for supporting our ongoing analyses of the Last Supper Cave assemblage. Craig Skinner conducted all of the XRF work discussed in this paper, and Ted Goebel made additional fieldwork at the Parman localities possible. Thanks to Jonathan Grant for freely sharing his time and additional radiocarbon dates from Last Supper Cave, to Gary Haynes, Bob Kelly, and Tom Jones for providing some helpful ideas about Paleoindian mobility, and to several anonymous reviewers and the editor, who made the finished product a better one.

Appendix. Supplementary data

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jas.2011.08.027.

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