HIGH-ALTITUDE HUNTER-GATHERER RESIDENTIAL OCCUPATIONS IN WYOMING’S WIND RIVER RANGE*

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ABSTRACT
High Rise Village is a hunter-gatherer residential site containing at least 52 house features at a mean elevation of 3200 m in Wyoming’s Wind River Range. Fifteen radiocarbon dates place site occupation(s) between 4500 and 150 cal BP. Though the 4500 cal BP dates likely result from an old wood problem, dates between 2800 and 150 BP appear more sound, particularly those between 1500 and 500 cal BP. Comparison with other high-altitude residential site radiocarbon dates shows a trend of earlier high-altitude residential occupations to the east of the Great Basin. This has important implications regarding Great Basin-Rocky Mountain culture histories, in particular by calling into question both the Numic Spread hypothesis and the relationship of the site to Rocky Mountain-High Plains hunter-gatherer residential patterns. More importantly, these data emphasize the roles medieval climate and regional population densities may have played in conditioning late Holocene high-altitude hunter-gatherer lifeways across western North America.

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This article reports preliminary results from excavations at a site known as High Rise Village (HRV) in Wyoming’s Wind River Range. It uses these data to place the site in regional historical and evolutionary contexts and to explore generally-applicable hypotheses explaining high-altitude occupations in North America. Focusing mainly on radiocarbon and other dating results, and because the site is in a region associated as much with Great Basin cultural patterns (Shimkin, 1947) as with Great Plains ones (Kornfeld et al., 2010), these hypotheses target, in part, historical questions regarding regional population replacement via the so-called Numic Spread (Bettinger and Baumhoff, 1982; Lamb, 1958; Madsen and Rhode, 1994; Sutton, 1987) by groups spreading northeastward out of the Great Basin. Conversely, they also address the possibility of the site’s association with a middle and late Holocene High Plains pattern focused on group residential mobility and housepit construction and re-use (e.g., Smith, 2005; Smith and McNees, 2011). From evolutionary-ecological perspective, population pressure and the effects of late Holocene climate changes contemporaneous with site occupations are considered as mechanisms explaining anomalous, high-altitude residential lifeways region-wide. It concludes with a discussion of future research trajectories and methodologies for the investigation of high-altitude adaptations both at HRV and in the region more generally.

High Rise Village (48FR5891) is a large residential locus in the northeastern Wind River Range, at elevations between 3320 and 3225 m (10,560-10,880 ft), in an area historically (and currently) occupied by Numic-speaking Eastern Shoshone groups (Figure 1). The site is large, measuring approximately 440 m by 220 m (for a total area of about 19 acres (7.6 ha)), and contains at least 52 lodge pads (rock-ringed and flattened housefloors) and dense archaeological deposits containing flaked stone tools and debitage, groundstone implements, and very small quantities of animal bone and Intermountain Grayware sherds (Adams, 2010; Mulloy, 1958). At least three of the lodges contain what appear to be remnants of their superstructure, consisting of multi-sided cribbed timbers as many as three courses high. The site is on a steep (average slope is ~23 degrees), south-facing slope, roughly two-thirds of which is below modern treeline, within a dense subalpine whitebark pine (Pinus albicaulis) forest. The remainder of the site is in alpine tundra. Like many sites in alpine settings, the availability of water is limited, though a semi-permanent spring in the northwestern portion of the site delivers a trickle of water most years. Site boundaries abut a principal mountain sheep (Ovis canadensis) migration corridor (Thorne et al., 1979). Based on the data presented in this article, the site appears to be a very large alpine-subalpine residential locus, arguably a village site representing large, seasonal population aggregations. These began arguably as early as 4500 cal BP (but more likely around 2800 cal BP) and continued until perhaps as late as 150 cal BP. If these generalizations are accurate, the site would be the largest-, oldest-, and longest-occupied high-altitude village in North America. As shown in this article, however, several of these generalizations are problematic, hinging as they do on
Figure 1. Map showing location of HRV relative to other high-elevation studies in the American West. (1) Summit Lake; (2) Piute Pass; (3) Kings Canyon; (4) Oquirrh Mts; (5) Fishlake Plateau; (6) Pahvant Range; (7) Uinta Mts; (8) Absaroka Mts; (9) Teton Mts; (10) Gunnison Basin; (11) Colorado’s Parks/Front Range; (12) Canaday Surveys.
determining the dynamic occupational history of the site with somewhat questionable high-altitude chronological datasets.

**RESEARCH CONTEXT: WORLDWIDE HIGH ELEVATION ARCHAEOLOGY AND HUMAN ADAPTATION**

Beyond the site’s empirical significance, HRV is interesting because high-altitude village sites are extremely anomalous in North America, and for high-altitude settings worldwide, which tended to be used mainly as summer hunting grounds for prehistoric hunter-gatherer groups (Aldenderfer, 2006). High-altitude hunting-oriented sites are found throughout the globe, in the Caucasus (Adler et al., 2006), the Ethiopian Plateau (Clarke and Kurishima, 1979; Phillipson, 2000), the Tibetan Plateau (Brantingham, 2006; Madsen, 2006), the Alps (Walsh, 2005; Walsh et al., 2006), the Zagros (Mortensen, 1972), and the Andes (Aldenderfer, 1998; Moore, 1998; Reinhard, 2002; Rick, 1980, 1988). Where chronological data are available, low-intensity hunting in these locales was remarkably stable following initial occupation (Brantingham, 2006; Nunez et al., 2002; Phillipson, 2000). Permanent or semi-permanent high-altitude villages with habitation structures are exceedingly rare and temporally constrained in most cases to within the last 5000-2000 years (Aldenderfer, 2006), though there is evidence of arguably permanent high-altitude residential occupations as early as, for instance, about 8200 BP on the Tibetan Plateau (Brantingham et al., 2003). Village sites are linked in nearly all contexts to substantial changes in basic economic pursuits, especially shifts from hunting and gathering to either herding or agriculture (Aldenderfer and Zhang, 2004; Phillipson, 1977; Williams, 2006). Some high-altitude structures appear ceremonial in function and are linked to the development of larger, more complex forms of social organization in late prehistory, especially in Andean South America (e.g., Aldenderfer, 1991; Ceruti, 2004; Janusek, 2006).

Similar patterns pertain in North America, save that evidence for intensive high-altitude residential settlement and village life is even less common and ceremonial structures are arguably quite rare (but see Brunswig et al., 2009; Frison et al., 1990; and Sutton, 2004 for arguments for high-altitude ceremonial and shamanistic use of high altitudes in the central Rocky Mountains). Evidence for long-term, low-intensity, long-range hunting is abundant in California’s Sierra Nevada (Bennyhoff, 1953; Hindes, 1962; Stevens, 2005), across the higher elevations of the Great Basin (Canaday, 1997; McGuire and Hatoff, 1991; Zeanah, 2000), and in the Rocky Mountains (Bender and Wright, 1988; Benedict, 1975; DeBloois, 1983; Frison, 2004; Frison et al., 1990; Kornfeld et al., 2010; Morris, 1990; Stiger, 2001; Stone, 1999). High-altitude residential structures, however, are exceedingly rare. They are found in perhaps two subalpine locations in the Sierra Nevada (Lathrap and D. Shutler, 1955; Morgan, 2006; Wallace, n.d.), two alpine locales in the Great Basin (Bettinger, 1991; Thomas, 1982), likely Historic
Period or Late Prehistoric structures very similar to those at HRV in Wyoming’s Absaroka Range (Scheiber and Finley, 2010; Scheiber et al., 2009) and perhaps in Utah’s Uinta Mountains (see especially Knoll, 2003), though some features associated with the latter appear to be large caches rather than residential features (Johnson and Loosle, 2002; Madsen et al., 2000). Where chronological information is available, building and living in high-altitude residential structures began in earnest roughly 1000 years ago and appear to have intensified shortly thereafter. Combined, this research indicates the extreme rarity of high-altitude residential settlements and the necessity of explaining their occurrence, especially as they relate to climate change, economic intensification, population increase, and migration.

Explanations for anomalous, high altitude residential occupations and their associated adaptations fall into two main camps. In the first, Aldenderfer (2006) defines high altitudes as areas above 2500 m (8200 ft) where hypoxia has its first substantive effects, caloric requirements increase, water is often in short supply, mean biotic productivity and temperature are low, snow oftentimes constrains mobility, and environmental variability, and hence unpredictability, is the norm. Due to these limitations, human adaptation often extends beyond the behavioral (Beall, 2001; Hock, 1970; Mäkinen, 2007), for instance via increased pulmonary capacity (Frisancho et al., 1997) and decreased stature (Pawson and Huicho, 2010). From this perspective, high mountains are considered quintessential marginal environments ripe for addressing the nature and causes of human behavioral and biological adaptation to extreme environments (Della Casa and Walsh, 2007).

The second perspective, however, argues that marginality is relative, dependent on the productivity and predictability of alternative and adjacent environments and the size and resource requirements of the human populations living therein. In this vein, it has long been noted that the Rocky Mountains were seasonally-productive habitats producing essential plant resources like camas and pine nut and, more importantly, forage and browse for the large ungulates upon which the mobile hunter-gatherers of the region often relied (Bender and Wright, 1988; Black, 1991; Kornfeld et al., 2010). High altitudes, it is argued, were thus integral rather than marginal to prehistoric lifeways both in North America and worldwide (Walsh, 2005; Walsh et al., 2006; Wright et al., 1980). Similarly, mountains have been described as playing important social roles, particularly with regard to group identity and, in western Wyoming, oral histories (Loendorf and Stone, 2006; Nabokov and Loendorf, 2004) and contact-period resistance and revitalization movements (Scheiber and Finley, 2011a, 2011c).

There is consequently a dichotomy between those like Aldenderfer (2006) who see high-altitudes as marginal, high-cost, risky environments where one would expect some sort of impetus (usually related to climate change or stressed lowland population-resource dynamics) forcing people into working harder and assuming the risk of living at altitude, and those like Bender and Wright (1988)
and Walsh (2005), who see high altitudes as providing abundant-enough resources and perhaps social and ideological incentives to account for human colonization, exploitation, and residential use on their own.

PREVIOUS RESEARCH AT HIGH RISE VILLAGE

At this point, it is hard to classify prior work at HRV as preliminary, though it is also clear that this earlier work only scratches the surface of the enormous research potential of the site. In brief, the site was discovered in 2006 by Richard Adams and a group of volunteers investigating high-altitude hunter-gatherer use of the range. Since then, attention has focused on identifying and dating several house features and characterizing the surface assemblage of the site (Adams et al., 2006, 2009; Morgan, 2011), assessing the taphonomy of lodges with experimental archaeology (a brief description and photos in Wingerson, 2009), analyzing intra-lodge assemblage variability for a University of Wyoming master’s thesis (Koenig, 2010), and hypothesizing about the role whitebark pine nut, mountain sheep subsistence, and late Holocene climatic fluctuations played in conditioning site occupation as part of a University of Wyoming doctoral dissertation (Adams, 2010). In summary, between 2007 and 2009, a total of 18 lodge interiors had been tested or excavated by Adams and his colleagues (Figure 2), producing copious amounts of mostly chert debitage, several Late Prehistoric arrow points, numerous handstones, manos, and millingslabs, and a small quantity of fragmented animal bone. Hearths were discovered in two of these lodges. Radiocarbon dates were generated from each, as well as from charcoal recovered from lodge fill, residue from a potsherd, and from what appears to be part of Lodge CC’s superstructure: an intact residential timber. Dates range from 4000–1301 r.c.y.B.P. (as will be shown in Table 4). One of the most interesting results from the site was the substantial assemblage variability found when comparing Lodges CC and D, separated in space by less than 10 m (but in time, however, by at least 550 years). Lodge CC contained mostly domestic items like milling tools and over 80 Intermountain Grayware sherds (Mulloy, 1958). Lodge D contained mostly weapons and debitage, suggesting perhaps a gendered division of space in at least this portion of the site (Adams, 2010).

Based on this prior research, Adams hypothesized that the site was a very large alpine-subalpine residential camp, arguably a village site, where men, women, and probably families gathered when the site was snow free (roughly late June to August or September). Site occupants subsisted on wild plants, perhaps geophytes like biscuitroot (Lomatium spp. and Cymopterus constancei) and whitebark pine nut, which they processed with the abundant milling tools on-site. They also probably hunted game like mountain sheep (possible sheep traps are below a ridge some 200 m east of the site) and perhaps marmot (Marmota flaviventris) or even ptarmigan (Lagopus leucura), though faunal remains recovered thus far are scant and mostly fragmentary, precluding taxon identification. Though the context
Figure 2. HRV site map showing environmental characteristics, lodge distribution, excavated lodges, and associated calibrated radiocarbon dates.
of some of the radiocarbon dates may be questionable (especially the later dates from potsherd residue and from Lodge CC’s superstructure), it is possible this pattern was established as early as 4000 rcyBP (~4500 cal BP) and continued until perhaps the Historic Period (Adams, 2010).

2010 AND 2011 FIELD SEASONS AT HIGH RISE VILLAGE

With this research context in mind, and at the invitation of Richard Adams, Utah State University began fieldwork at HRV in 2010. This work consisted of precision site mapping (Figure 2), lodge excavations and paleoenvironmental studies conducted in early summer 2010 and 2011.

Site excavations focused on six lodges: SS, 49, 22, 26, W, and 16, three of which (SS, 22, and 49) had previously been partially excavated by Adams and his colleagues. Lodges were excavated with small hand tools (trowel, dustpan, and whisk broom) following the natural stratigraphy of each feature (typically loose overburden, an anthropogenic “A” horizon, and a weakly-developed subsoil). Cultural strata were excavated in 5 cm levels, with site matrix passed through 1/8” (3 mm) mesh, with all cultural material bagged by provenience (lodge, unit, level, and quad). Diagnostic artifacts were pedestalled and point-plotted prior to removal. Unit level records were filled out for each completed level; scaled profiles were made of diagnostic section walls and features, supplemented with digital photographs. Soil samples were taken from each lodge for macrofloral analyses. The total volume of excavated soil at the site in 2010 and 2011 was 2.85 m². Table 1 describes findings by lodge; lodge excavation summaries follow below.

Lodge SS

Excavations at Lodge SS focused on expanding a 1 × 1 m unit (Unit 1) excavated by Adams and crew the preceding year. One 0.5 × 1 m unit (Unit 2) was excavated adjacent to the south wall of Adams’ Unit 1 and one 1 × 1 m unit (Unit 3) was excavated adjacent to the north wall of Adams’ Unit 1. The backfill was also removed from Unit 1, resulting in a 1 m E-W × 2.5 N-S exposure excavated to a depth of 40 cmbs. The unit contained abundant cultural material, mostly debitage, and two charcoal smear features.

Lodge 49

The main goal of this excavation was recovering better dating samples from the lodge that generated the oldest radiocarbon dates at the site in prior excavations (~4000 BP). Two contiguous 1 × 1 m excavation units (i.e., a 1 × 2 m exposure) were excavated in the center of Lodge 49, to a depth of 40 cmbs. The
<table>
<thead>
<tr>
<th>Lodge</th>
<th>Biface</th>
<th>Uniface</th>
<th>Core</th>
<th>EMF&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Debitage</th>
<th>Mano</th>
<th>Mammal bone&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Millingslab</th>
<th>Projectile point&lt;sup&gt;c&lt;/sup&gt;</th>
<th>Total</th>
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<sup>a</sup>Informal edge-modified flake; <sup>b</sup>all extremely fragmented. <sup>c</sup>including non-diagnostic fragments.
units produced abundant cultural material, mostly chert debitage. Importantly, a large charcoal lens containing fire-cracked rock was found near the base of Unit 1 and was sampled for radiocarbon assay.

**Lodge 22**

One 1 × 1 m unit was excavated in the center of Lodge 22, to a maximum depth of 40 cmbs. The cultural fill in the feature was shallow, extending to no more than 30 cmbs. An amorphous feature of grayish-white, ash-stained anthropogenic soil and a lens of reddish, oxidized soils were encountered in the northern half of the unit, between 15 and 20 cmbs. The feature appears to be a burned housefloor or a large swept-out hearth floor. The unit contained a fair amount of debitage, but little else. Based on this, the shallow cultural deposit, and the amorphous nature of the feature, it was determined other lodges might have higher data potential and excavation of the lodge was terminated after collecting carbon samples for dating.

**Lodge 26**

One 1 × 1.5 m unit was excavated in the southern portion of Lodge 26, abutting the southern retaining wall and rubble fill of the lodge pad foundation, to a maximum depth of 40 cmbs. Excavations here produced abundant cultural material including three manos, five Rose Spring arrow points, and copious late-stage flaked stone reduction and retouch debris. Importantly, a charcoal feature was found between 20 and 30 cmbs in the southern half of the exposure, this resulting in the collection of several carbon and soil samples. Also intriguing was the exposure of the lodge foundation, which indicated the movement and placement of large boulders in the southern, downslope portion of the lodge foundation to create a retaining wall for the feature floor.

**Lodge W**

One 0.5 × 0.5 m shovel probe was excavated as a test of Lodge W. It was excavated to 30 cmbs and revealed a cultural deposit to 22 cmbs, including a charcoal stain 12-13 cmbs in the northern portion of the probe. The unit produced substantial quantities of debitage.

**Lodge 16**

One 1 × 1 m unit was excavated in the center of Lodge 16, to a depth of 25 cmbs. The unit contained abundant cultural materials, primarily chert debitage. There was some charcoal staining which was sampled for radiocarbon and macrobotanical analyses. In addition, a 25 × 50 cm soil sample was collected immediately adjacent to the excavation unit for flotation and macrobotanical analysis.
Paleoenvironment

A dendrochronological/dendroclimatological survey of the HRV vicinity revealed a scattering of dead and downed whitebark pine (*Pinus albicaulis*) trunk remnants at 3355 m (11,007 ft) elevation. These remnants are well above modern timberline and are an indicator of past climate conditions that permitted upright, straight-boled trees to live at higher elevations (e.g., LaMarche, 1978). Seven remnants were found 30-50 m upslope of the site boundary. Approximately 30 more were found in a moderately dense, 70 × 50 m “ghost forest” 100 m west of the site and 100-150 m above modern timberline (Figure 3). Samples of the outside rind were taken using a small handsaw from seven of these latter remnants for radiocarbon dating. One sample was run at the University of Georgia Center for Isotopic Studies (UGAMS 9756). Results indicate the sampled tree died 960 rcyBP, or 880 ± 50 cal BP using CalPal (Weninger and Jöris, 2008; Weninger et al., 2012). Assuming the tree died ca. 900 cal BP and based on the fact that whitebark pine can live to about 700 years suggests treelines were on the order of 100-150 m higher in elevation ca. 1600-900 cal BP, during (as explained in the succeeding section) what appears to be the main period of site occupation.

Figure 3. Map showing relationship of relict treeline to High Rise Village.
PRELIMINARY ANALYSIS RESULTS

At this time, results from the project are preliminary. The site clearly contains numerous cut-and-fill lodge pad foundations with intact cultural deposits containing abundant flaked and ground stone artifacts and intact, though often amorphous, hearth features. Most excavated lodges also produced small quantities of extremely fragmentary faunal bone, the condition of which precludes taxon identification. Several studies, especially dendroclimatological, macrofloral, and zooarchaeological are in-progress and are not reported here. The subsections below provide summaries of the more pertinent data generated thus far.

Flaked Stone

An analysis of a stratified-random sample of 833 flakes distributed between the six lodges excavated in 2010 and 2011 indicates debris from biface retouch and manufacture dominates the debitage assemblage. Like debitage from most other high-elevation contexts (e.g., Morgan et al., 2012; Thomas 1982), most waste flakes (58.6%) represent small, very late-stage core reduction, biface thinning, and pressure retouch (Figure 4). Interestingly, though sample size is fairly small and the distribution of diagnostic flake types appears similar between lodges (Table 2), the difference in debitage assemblages between lodges is statistically significant \( p = 0.0105 \), Fisher’s exact test). This is mainly the result of substantially more pressure flakes in Lodge 22 and a relatively higher proportion of late interior core reduction debris in Lodge 49, but does not detract from the initial generalization that debris from tool manufacture dominates the site’s debitage assemblage regardless of lodge (and ostensibly period of occupation).

Most toolstone consists of locally-available Wind River cherts, along with a very small quantity of locally-available quartzite and extralocal obsidian and basalt (Bohn, 2007; Branson and Branson, 1941; Connor and Kunselman, 1995; Kunselman, 1994; Kunselman, 1998; Scheiber and Finley, 2011b; Smith, 1999; Snoke, 1993). Energy-dispersive X-ray fluorescence spectrographic (for methods see GRL, 2012) analysis of 27 obsidian specimens indicates 78% of the assemblage comes from western Wyoming sources (Crescent H, Teton Pass, Lava Creek Tuff, Obsidian Cliff, and Huckleberry Tuff), with trace amounts coming from as far away as Bear Gulch and Malad, Idaho (see Table 3 and Figure 5).

Groundstone

Arguably as important as the high number of lodge pad foundations is the quantity of groundstone at the site: all of the 52 identified lodges are associated with either a mano, millingslab/metate, or handstone (Adams, 2002; Adams, 2010). Combined with Adams’ data, a total of 57 manos or mano fragments have been identified. Many groundstone processing tools are made on non-local basalts, likely from nearby Absaroka or other sources (Figure 1) (Smedes and Prostka, 1972). The abundance of milling tools (manos and milling slabs) likely evinces plant processing, perhaps of locally-abundant whitebark pine nut or even pemmican.
Figure 4. Debitage analysis results: left, flake type; right, flake size.
<table>
<thead>
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<th>Tool manufacture/retouch</th>
<th>Non-diagnostic</th>
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<tr>
<td></td>
<td>Primary</td>
<td>Secondary</td>
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Table 3. XRF Results Summary

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<th>Teton Pass, WY</th>
<th>Lava Creek Tuff, WY</th>
<th>Obsidian Cliff, WY</th>
<th>Huckleberry Tuff, WY</th>
<th>Bear Gulch, ID</th>
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<td>1</td>
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<tr>
<td>Description</td>
<td>Debitage</td>
<td>Debitage</td>
<td>Debitage</td>
<td>Debitage</td>
<td>Debitage &amp; 1 biface fragment</td>
<td>Debitage &amp; 1 EMF&lt;sup&gt;a&lt;/sup&gt;</td>
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<td>107 km</td>
<td>168 km</td>
<td>178 km</td>
<td>191 km</td>
<td>218 km</td>
<td>249 km</td>
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<sup>a</sup>Informal edge-modified flake
Residue Analysis

A protein-residue study was conducted by the Laboratory of Archaeological Science at California State University, Bakersfield on a projectile point, a small scraper, and two manos recovered from buried contexts at the site. A wide range of antisera were tested, of particular potential relevance: Chenopodiacea, camas, Lomatium, bitterroot, bear, deer, and sheep. All results were negative.

Dating

Chronometric data come from diagnostic projectile points, obsidian hydration, and radiocarbon dates. Projectile point types recovered from buried contexts are exclusively Late Prehistoric. Most \((n = 15)\) are of the Rose Springs corner-notched variety, five of these from Lodge 26. Six Late Prehistoric (i.e., Shoshonean) points
(one Tri-notch, three small Desert Side-notched and two Cottonwood Triangular) were also recovered (Thomas, 1981). Combined, these data suggest site occupation between roughly 1500 and 150 BP, with a strong Rose Springs signal ca. 1500-600 BP. Obsidian hydration measurements \( (n = 17) \) range from 0.97 to 2.97 \( \mu \) (on Bear Gulch, Crescent H, Teton Pass, Huckleberry Tuff, Obsidian Cliff, and Malad obsidians). Though obsidian chronologies and hydration curves are not well established in the region, these data likely indicate occupations in the last 3000 years (Connor and Kunselman, 1995; Smith, 1999). Fifteen radiocarbon dates range from 4000-130 rcyBP (Table 4). Of particular note are the 4000+ yr dates from hearth features in Lodges 16 and 49. These are consistent with the date on lodge fill Adams generated from Lodge 49 in 2008. Also intriguing are the 1400-1100 yr dates from Lodge 26, consistent with the five Rose Springs points recovered there.

In summary, there is problematic evidence (see below), in the form of four radiocarbon dates, for occupation of the site beginning as early as 4480 cal BP. Three AMS dates from Lodge SS indicate an occupation (or occupations) between approximately 2810 and 1480 cal BP. This latter date, and four other dates from Lodges D, W, and 26 are consistent with the dominant Rose Springs projectile point assemblage, ranging from ca. 1470-770 cal BP. The later AMS dates (ca. 450-160 cal BP) from Lodge CC are consistent with the Tri-Notch, Desert Side-notched, and Cottonwood point typologies. Combined, these data suggest a possible early occupation just prior to 4000 cal BP, perhaps sporadic occupations between approximately 2800 and 1900 cal BP, a substantial occupation (or series of occupations) between 1500 and 500 cal BP, and perhaps a later occupation after 500 cal BP. At present, patterning is not readily evident in the spatial distribution of lodge radiocarbon dates, though dates for adjacent lodges W and SS appear to cluster at approximately 1450 cal BP (Figure 2).

Based on these preliminary data, the site appears to represent multi-family, seasonal residential occupations focused to a large degree on processing wild plant foods, perhaps whitebark pine nut or geophytes like biscuitroot. This pattern may have become established as early as 4500 years ago, but likely much later, between 2800 and 1500 years ago, and persisted until nearly historic times. There appears, however, to be fairly strong evidence that this pattern held mainly between 1500 and 500 cal BP.

**EMPIRICAL CONSIDERATIONS**

Several challenges are entailed by the HRV data; these focused mainly on dating. First, however, is the poor preservation of specimens by which to reconstruct subsistence. Ongoing flotation and macrofloral analyses have identified almost no seeds, residue analyses produced no data, and faunal remains, though present, are so fragmentary as to preclude (in most cases) taxon identification.
Table 4. Radiocarbon Dates from High Rise Village

<table>
<thead>
<tr>
<th>Lab</th>
<th>Lab code</th>
<th>Sample ID</th>
<th>Lodge</th>
<th>Context</th>
<th>$^{14}$C age</th>
<th>Cal BP$^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAIS</td>
<td>8382</td>
<td>L26-EU2-FS2.7</td>
<td>26</td>
<td>Hearth</td>
<td>1210 ± 25</td>
<td>1150 ± 50</td>
</tr>
<tr>
<td>CAIS</td>
<td>8380</td>
<td>L26-EU1-FS67</td>
<td>26</td>
<td>Hearth</td>
<td>1480 ± 25</td>
<td>1380 ± 30</td>
</tr>
<tr>
<td>CAIS</td>
<td>8383</td>
<td>LW-SP1-FS3</td>
<td>W</td>
<td>Charcoal lens</td>
<td>1560 ± 25</td>
<td>1470 ± 40</td>
</tr>
<tr>
<td>CAIS</td>
<td>8378</td>
<td>LSS-EU3-FS14</td>
<td>SS</td>
<td>Charcoal smear</td>
<td>1990 ± 25</td>
<td>1950 ± 40</td>
</tr>
<tr>
<td>CAIS</td>
<td>8379</td>
<td>L22-EU1-FS18</td>
<td>22</td>
<td>Burned floor</td>
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<td>2240 ± 60</td>
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<tr>
<td>CAIS</td>
<td>8381</td>
<td>L49-EU1-FS58</td>
<td>49</td>
<td>Hearth</td>
<td>3960 ± 25</td>
<td>4450 ± 40</td>
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<tr>
<td>CAIS</td>
<td>9756</td>
<td>HRV 16.1.3-011</td>
<td>16</td>
<td>Charcoal smear</td>
<td>4010 ± 25</td>
<td>4480 ± 40</td>
</tr>
<tr>
<td>Beta</td>
<td>269156</td>
<td>FR5861 LODGE CC-2</td>
<td>CC</td>
<td>Sherd residue</td>
<td>130 ± 40</td>
<td>160 ± 100</td>
</tr>
<tr>
<td>Beta</td>
<td>248565</td>
<td>FR5891 LODGE CC</td>
<td>CC</td>
<td>Structural timber</td>
<td>420 ± 50</td>
<td>450 ± 80</td>
</tr>
<tr>
<td>Beta</td>
<td>245981</td>
<td>FR5861 LODGE S</td>
<td>S</td>
<td>Hearth</td>
<td>840 ± 40</td>
<td>770 ± 50</td>
</tr>
<tr>
<td>Beta</td>
<td>290219</td>
<td>FR5891 LODGE D</td>
<td>D</td>
<td>Lodge fill</td>
<td>1070 ± 30</td>
<td>1000 ± 40</td>
</tr>
<tr>
<td>Beta</td>
<td>263853</td>
<td>FR5891 LODGE SS-2</td>
<td>SS</td>
<td>Hearth</td>
<td>1570 ± 40</td>
<td>1480 ± 50</td>
</tr>
<tr>
<td>Beta</td>
<td>262495</td>
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<td>SS</td>
<td>Lodge fill</td>
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<td>2810 ± 40</td>
</tr>
<tr>
<td>Beta</td>
<td>290220</td>
<td>FR5891 LODGE 49</td>
<td>49</td>
<td>Hearth</td>
<td>3880 ± 30</td>
<td>4330 ± 60</td>
</tr>
<tr>
<td>Beta</td>
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<td>49</td>
<td>Lodge fill</td>
<td>4000 ± 40</td>
<td>4480 ± 40</td>
</tr>
</tbody>
</table>

$^a$Calibrated with CalPal 2007 (Weninger et al., 2012) using the Hulu calibration dataset (Weninger and Jöris, in press); $^b$University of Georgia Center for Applied Isotope Studies; $^c$Beta Analytic, Inc., Florida—all uncalibrated dates from Beta Analytic previously reported in Adams (2010).
Second, in terms of dating, it is possible HRV occupants burned “old wood” in their campfires (Schiffer, 1986; Thomas, 1994). Whitebark pine can live as long as 700 years and there are “ghost forests” of dead trees above timberline in the range that may date to warmer/drier climatic episodes, for example during the Medieval Climatic Anomaly or the middle Holocene (e.g., Benedict et al., 2008; LaMarche, 1973). As shown in the preceding subsection on paleo-environment, AMS dating of a downed tree near HRV suggests timberline was at least 100 m higher in elevation ca. 900 cal BP (Figure 3). It is thus possible the site’s radiocarbon dates are significantly older than the occupations they date, perhaps by as much as 1500 (i.e., a 700-year whitebark pine lifespan added to a 900-year-old tree remnant) to 3000 years (i.e., dating to the middle Holocene). Importantly, the fact that no diagnostic projectile points have been recovered from site excavations that might indicate occupation during the Middle Archaic (e.g., McKean), suggests the oldest dates from the site (i.e., those centered around 4500 cal BP) represent burning mid-Holocene wood in much later campfires. Supporting this assertion is the fact that the 4500-year-old radiocarbon dates from Lodge 16 pre-date the dominant projectile point type from this lodge (i.e., Rose Springs) by some 3000 years. In two of the lodges that generated both radiocarbon dates and diagnostic projectile points (Lodges CC and 26), however, radiocarbon dates bracket the range of dates associated with artifacts quite well. In any event, given the likelihood of a substantial “old wood” problem at the site, arguments for Archaic, mid-Holocene occupation of the site are clearly moot.

Related to dating is the very concept of village, a term which has been associated with HRV since its discovery. The term has a long history of use and misuse in archaeology, yet hinges upon the idea that villages represent clustered human settlements in rural areas, typically marked by grouped dwellings representing the living quarters of anywhere from as little as 5 to 10 (more often described as hamlets) to 30 families or more (Carneiro, 2002; Flannery, 1972; Marcus, 1976). These are typically permanent and associated with agricultural economies, but can also be transient and associated with hunter-gatherer ones as well (e.g., along the western coast of North America (Rick, 2007)). Villages and the associated term hamlet thus entail more than five economically-interdependent families living close together in residential structures either permanently or on a semi-sedentary basis (Binford, 1990). Within this context, the features at HRV could conceivably not entail village life at all. Rather, over a span of perhaps as many as 3000-4500 years, they could just as easily represent a palimpsest of small group or even single-family occupations and house building. Better temporal control and recovery of datable material from additional lodges would help clarify this problem, but until it is resolved, calling the site a “village” is as much an artifact of the local vernacular and the site’s research history as it is based on economic or demographic information suggesting the manifestation of village or even hamlet lifeways. Palimpsest or not, however, the site
nonetheless represents a striking departure from the norm in terms of the sheer quantity of hunter-gatherer residential features present at high altitude.

**REGIONAL COMPARISONS**

The most important studies for making comparisons with other high-altitude hunter-gatherer residential behaviors are Thomas’ (1982, 1994) work in the Toquima Range in south-central Nevada and Bettinger’s (1991) work in the White Mountains above Owens Valley, in eastern California. Beyond their own citations, these studies are more than adequately discussed and summarized elsewhere (Bettinger, 1996, 2008; Canaday, 1997:4-11; Grayson, 1993:261-269; Janetski, 1985, 2010:17-18; Zeanah, 2000). The crux of these studies is that around 1100 years ago at Alta Toquima and probably a bit later at the 13 residential sites Bettinger identified in the White Mountains, a long-lived logistical alpine hunting pattern began giving way to a residential one focused on house construction, intensive plant food gathering and processing (often of foodstuffs transported from the lowlands), and increasing reliance on hunting smaller-bodied game (Grayson, 1991). Bettinger attributes this shift to population increase causing resource stress in Owens Valley, a phenomenon he argues was associated with the migration of Numic speakers with an intensive, seed-based economic focus into the region some time between about 1000 and 600 BP. Thomas (1994) is far more equivocal, arguing that Numic expansion is irrelevant to the patterns he identified at Alta Toquima. Needless to say, the topic is contentious.

While this research is certainly the most significant of its class in the region (and in North America more generally) and provides the material most ready for comparison to HRV, a number of other studies have been conducted that specifically target high altitude residential occupations in the two decades or more since Thomas and Bettinger first published their work (Figure 1). Perhaps the most ambitious of these was Canaday’s (1997) surveys of five of the high mountain ranges of central Nevada (the Toiyabe and Snake ranges and Ruby, Jarbridge, and Deep Creek mountains). While Canaday’s research focused specifically on determining aboriginal alpine land-use patterns across the central Great Basin, he found very few sites in a rather large (considering the fact that it focused mainly on relatively narrow ridgetops) survey of over 7500 acres. A few had one or two stacked-rock features he interpreted as hunting blinds, rather than as residential features (an interpretation consistent with what Thomas found in the Toquima Range). Using regional projectile point chronologies, he concluded that most of the alpine Great Basin was used sporadically for hunting, mainly since the middle Holocene. Partly because of Canaday’s work (and numerous others in the Rockies, Great Basin, and Sierra Nevada), it became more-or-less safe to say that high elevations in the American West were used by prehistoric hunter-gatherers mainly for long-range hunting and that the alpine villages of the Toquimas and Whites were notable and unique exceptions to the rule (e.g., Grayson, 1993).
But this generalization overlooks more recent research on the periphery of the Great Basin, in the Sierra Nevada, the Utah ranges of the eastern Great Basin, and immediately north of the Winds, in the Absarokas, each of which has identified residential use of subalpine-alpine ecozones, though certainly not on the scale reported by Thomas and Bettinger. In the Sierra Nevada, directly across Owens Valley from the White Mountains, there is a village site very similar to those in the White Mountains. This site, called “Summit Lake,” is just below treeline, at an elevation of 2895 m (9500 ft). The site contains at least nine multi-course rock-ringed house depressions, a very well-developed midden, several pestles, and seven bedrock milling stations containing at least 41 bedrock mortars. Based on the presence of Owens Valley Brownware sherds, the site likely dates to between 600 and 150 BP; no radiocarbon dates have been yet generated from the site (Morgan, 2004, 2006). Summit Lake likely represents the Sierran version of the pattern Bettinger identified in the Whites, both linked to a larger settlement system focused on Owens Valley. Other large alpine artifact scatters, several with midden development, are also documented but as-yet unsampled in the higher portions of the range above north-central Owens Valley (Morgan et al., 2005). Additionally, based on survey and obsidian hydration data generated in the high Sierra overlooking the southern end of Owens Valley, Stevens (2002, 2005) argues that people intensified their use of high elevations, building rock ring features and leaving behind well-developed middens beginning around 1350 BP, a pattern more-or-less consistent with (but a little earlier than) what Bettinger revealed in the Whites.

On the other side of the Great Basin in Utah, several studies point to intensified use of subalpine-alpine settings, including residential use, during the Formative. At 2,389 m (7840 ft) in the Oquirrh Mountains, Janetski (1985) argues use of a hunting camp intensified along with Fremont foraging and horticultural intensification in the valley below (see also Janetski, 1997). He identifies a similar pattern at two sites near 2700 m (9000 ft) on the Fishlake Plateau, with site use switching to a residential focus and more intensive exploitive patterns between about 1700 and 700 BP (Janetski, 2010). Morgan et al. (2012) identify a nearly identical pattern developing above treeline at a site known as Pharo Heights, at 2865 m (9400 ft) in south-central Utah’s Pahvant Range ca. 1700 BP. They argue this high-altitude residential base served as a central place that increased returns on high-elevation logistical hunting, a pattern consistent with the overall trend of Fremont intensification during the Formative. In eastern Utah, in the high elevations of the Uinta Mountains, Knoll (2003) makes a similar argument: that high-elevation residential structures at nearly 3300 m (11,000 ft) served as seasonally-occupied central places geared mainly towards increasing returns on Fremont logistical sheep hunting between approximately 1600 and 1300 BP. Also in the Uintas, Watkins (2000) used groundstone residue analysis and radiocarbon dates to argue that alpine processing of wild plants intensified between approximately 3700 and 700 years ago. In summary, there is evidence of increased
exploitation and seasonal residential use of subalpine and alpine settings in at least four of Utah’s mountain ranges between about 1700 and 700 BP, a pattern closely corresponding in time to Formative Period intensification (Madsen and Simms, 1998).

Closer to HRV, several lines of evidence point to residential use of alpine and other settings in Wyoming. At the Lookingbill Site, situated at 2620 m (8600 ft) elevation in the Absaroka Mountains, Kornfeld et al. (2001) document over 10,000 years of human occupation, including groundstone use in Late Paleoindian/Early Archaic times (Shepherd, 1992) as well as occupations temporally corresponding to those at HRV between 2860 and 360 rcyBP. Also in the Absarokas, Eakin (2005) and Scheiber and Finley (2010, 2011c) document residential features, including cut-and-fill lodge foundations like those at HRV, in the higher elevations of the range, a pattern initially mentioned by Frison (see Kornfeld et al., 2010:402-404). Dating is tentative at this point, but association with Shoshonean and historic artifacts suggests a very late Prehistoric or ethnohistoric timeframe for at least some of these features. Adams (2010) documents five additional sites in the Wind River Range with residential features similar to, though far fewer than those at HRV. Though not at high elevation, the high steppes (i.e., at elevations between approximately 1700 and 2300 m (5500-7500 ft)) of southwestern Wyoming have produced numerous housepit residential sites (e.g., Moore, 2007; Smith, 2003; Smith and Reust, 2004) dating to the mid-Holocene, ca. 9100-3900 cal BP, with most dating between about 6850 and 4500 cal BP (Smith and McNees, 2005, 2011), but also a period of housepit construction between ca. 1800 and 1000 cal BP (Smith, 2005). These have been linked to repetitive, seasonal residential use of the region by hunter-gatherers at least partially dependent on stored and processed plant resources, particularly geophytes like biscuitroot (*Cymopterus bulbosus* and *Lomatium* spp.) (Smith and McNees, 1999).

Finally, to explore this topic in just a bit more temporal depth, widening diet breadth and plant processing in the Rocky Mountains has deep historical antecedents. Several researchers have identified processing tools in places like the parks in the Colorado Rockies, at elevations as high as 2400 m (8000 ft). Pitblado (2003), for instance, notes that it is not uncommon for late Paleoindian and early Archaic sites in the southern Rockies to contain at least some groundstone. She suggests plant processing was part of high mountain economies by the earliest Holocene and that this pattern likely pertained in various permutations through the Archaic. Worth noting, however, is Benedict’s (1992) confounding argument that long-term base-camps and processing sites are unknown above 3000 m (10,000 ft) in Colorado’s front range. In any event, it appears that at least subalpine settings in the Rockies were used for more than just hunting since at least the early Holocene and that plant processing at altitude has deep historical antecedents in the Rocky Mountains.
Within this broad regional context, a few trends stand out. The first is a reiteration: high-altitude plant processing is not an anomaly in many parts of the Rocky Mountains during the Archaic. The second is also quite clear: intensified and residential use (in various permutations and levels of intensity) of high altitudes across the American West appears to develop in many places after about 1800 cal BP. The oldest radiocarbon dates (as well as the widest temporal range) for this type of pattern comes from the east-northeast, particularly at HRV (Figure 6).

There is, of course, substantial temporal overlap, particularly in the critical period of time between about 1800 and 600 BP, when nearly all of the radiocarbon dates from HRV, Alta Toquima, and the high elevation sites from Utah cluster. From this perspective, the pre-1800 cal BP dates at HRV and nearly all of Bettinger’s dates from the White Mountains are the outliers to this wider pattern. Notably, both are situated at opposite ends of the Great Basin’s considerable geographic extent.

This pattern is made clearer when considering the summary statistics describing the distribution of regional high-altitude radiocarbon dates. As Thomas (1994) has already noted, median ¹⁴C dates indicate the main occupations at Alta Toquima precede those in the White Mountains by some 500 years, a conclusion borne out by the mean of these data as well (Table 5). When the data from Utah and Wyoming are entered into the comparison, the data are especially intriguing. Save Janetski’s two sites on the Fishlake Plateau, all of the eastern Great Basin-Rocky Mountain high-altitude residential sites are older, in terms of both mean and median, than either Alta Toquima or the White Mountains villages, on the order of 200 to over 1100 years. Though there is considerable overlap in actual radiocarbon dates, there are potentially important temporal discontinuities reflected in the statistical variation of dates from different mountain ranges. For example, when boxplots are generated from these data, there is little overlap in the interquartile ranges of HRV, Alta Toquima, and the White Mountains, with a trend toward younger dates toward the west (Figure 7). Admittedly, looking at statistical variation in radiocarbon dates rather than actual dates (which ostensibly represent the actual dates when hearths and other features were actually used) is a very rough way of comparing regional occupations, but the data here presented clearly show dates (and occupations) trending younger, without substantial overlap, as one moves from east to west.

To cope with this problem and develop a more robust picture of the occupational histories of regional high-altitude residential sites, 1-sigma calibrated summed probability distributions were generated for each of the six loci described above by pooling all published high-altitude radiocarbon dates associated with residential sites from each range (i.e., the data in Table 5) and using Calib 6.1 (Stuiver and Reimer, 1993) and the Intcal09 calibration curve (Reimer et al., 2009) to generate summed radiocarbon probability distributions for each locale (for a
Figure 6. Sorted scatterplot of uncalibrated radiocarbon dates from high-elevation residential sites in the Mountain-Intermountain West.
Table 5. High Altitude Mountain-Intermountain Uncalibrated Radiocarbon Dates (BP) and Summary Statistics

<table>
<thead>
<tr>
<th>Location</th>
<th>White Mts.</th>
<th>Alta Toquima</th>
<th>Uinta Mts</th>
<th>Pahvant</th>
<th>Fishlake Plat.</th>
<th>HRV</th>
</tr>
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<tbody>
<tr>
<td>Citation</td>
<td>Bettinger, 1991</td>
<td>Thomas, 1994</td>
<td>Knoll, 2003</td>
<td>Morgan et al., nd</td>
<td>Janetski, 2010</td>
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<tr>
<td>160 ± 60</td>
<td>220 ± 70</td>
<td>60 ± 60</td>
<td>1720 ± 40</td>
<td>180 ± 70</td>
<td>130 ± 40</td>
<td></td>
</tr>
<tr>
<td>210 ± 50</td>
<td>220 ± 70</td>
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<td>250 ± 80</td>
<td>420 ± 50</td>
<td></td>
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<td>310 ± 50</td>
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<td>320 ± 80</td>
<td>840 ± 40</td>
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<tr>
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<td></td>
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<tr>
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<td>640 ± 70</td>
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<td>1108</td>
<td>1720</td>
<td>760</td>
<td>2069</td>
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<td>713</td>
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<td>1346</td>
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</table>
in central Utah. Not surprisingly, the curve for the White Mountains sites indicate temporally-constrained, very late Holocene occupations, the Alta Toquima curve shows occupations mainly between 1500 and 500 cal BP, and the Uinta dates are all constrained to the late Holocene, many corresponding to Fremont/Formative occupations. The rough correlation between occupation and altitude is generally supported by the figure for the White Mountains sites, indicating a pattern of increasing occupational and population density with higher altitude and a deeper penetration of cultural traditions into high-elevation residential sites. Full methodological description see Bamforth and Grund, 2012:1770. Though

Figure 7. Boxplots of calibrated radiocarbon dates from high-elevation residential sites in the Intermountain West.
TWO EMPIRICAL AND TWO REGIONAL HYPOTHESES

Based on the chronological data generated thus far from HRV, on preceding summaries of the regional archaeology, and relative to the brief research context developed at the beginning of this article, it is possible to formulate some empirically-guided hypotheses to help drive future research at HRV and in other regional high-altitude settings. This hypothesis-building exercise is divided into two subsections. The first focuses on empirical questions, mainly on the chronology of occupation at HRV and implications derived from the two main alternative interpretations of this chronology. The second considers the implications of the preliminary results from HRV in regional context, exploring potential linkages between high-elevation residential sites in terms of both culture history and adaptation.

Empirical Hypotheses

These two hypotheses consider two alternatives: that the dates at HRV evince long-term, repeated and perhaps punctuated late Holocene hunter-gatherer occupation or that they represent an adaptation centered on the period between approximately 1500 and 500 BP.

1. Pre 1800 cal BP \(^{14}C\) dates at High Rise Village are legitimate and the quantity of residential features indicates village-size group aggregations.

   If any of the dates prior to about 1800 cal BP represent large-scale residential groups aggregations, then HRV would be the oldest village above 3000 m (10,000 ft) in North America and one of the earlier examples of high-altitude village life anywhere in the world. It might thus be considered one origin for intensive, residential alpine lifeways in North America. Equally important is the fact that the dates from HRV thus far point to punctuated but consistent reoccupations and residential construction from arguably 4500, but more likely from about 2800 to 150 years ago. Due to the uniqueness of the large-scale, high-altitude residential lifeway entailed by the site, this time depth suggests certainly adaptational and arguably cultural continuity over the course of roughly the last three millennia of the Holocene. If true, this would argue against the Lamb (1958) model for the Numic spread and the idea that Mountain Shoshone/Eastern Shoshone Numic speakers became emplaced in the area in very late prehistory, perhaps as late as the last 500 years or so (see Larson and Kornfeld, 1994; Wright, 1978). It also argues against the idea that high-elevation intensification of the type seen at Alta Toquima and the White Mountains was strictly a Numic phenomenon that developed out of intensive western Great Basin-California hunter-gatherer lifeways, unless of course the Numa have much deeper historical roots across central Nevada and western Wyoming, as several researchers working in Wyoming attest (Husted and Edgar, 2002; Loendorf and
Figure 8. Calibrated summed probability distributions (using IntCal09 at 1 Sigma) for intermountain-mountain radiocarbon dates. Pahvant Range distribution not summed as its curve represents a single date.
Figure 8. (Cont’d.)
Finally, on the outside chance that the earliest, 4500 cal BP dates at the site are legitimate (they do account for almost 1/3 of the radiocarbon dates from the site), the residential occupations and intensive processing documented at HRV could be linked to or represent the terminal, most intensive (due to the higher caloric costs of working at altitude) expression of the Mid-Holocene seasonal residential transhumance pattern (at least partly predicated on geophyte exploitation) that Smith and McNees (2011) identify for greater southwestern Wyoming.

2. Occupation at High Rise Village was between 1500 and 500 BP.

This possibility ignores dating outliers, accounts for the “old wood” problem, and argues that the majority of the radiocarbon, obsidian hydration, and projectile point data represent the actual residential occupations at the site. If true, such a scenario entails substantial overlap with other high-altitude residential occupations in the greater region, particularly those in the Uintas, Pahvant, Fishlake Plateau, and Toquima Range. In terms of paleoenvironmental-paleoclimatic context, these data might indicate that warming and drying trends during the Medieval Climatic Anomaly (e.g., Jones et al., 1999) desiccated surrounding valleys and plains, reducing returns on gathering and hunting, thereby creating a “push” factor encouraging intensified occupation and exploitation of higher elevation. A warmer and drier period in the Wind River Range is implied by Dahms’ (2002) glacial chronology between 1500 and 350 BP, suggesting the generalized medieval pattern applies to the local setting. Such conditions may also have increased growing season and biotic productivity at altitude, creating a “pull” factor eliciting the same. This scenario also allows for the possibility of an affiliation with a return to residentially-mobile housepit utilization on the steppes surrounding the Wind River Range ca. 1800-500 cal BP (Smith, 2005). It also allows for potential culture-historical discontinuities. Such discontinuities would allow for the recent emplacement of Numic speakers in western Wyoming after 500 BP, in accordance with what Lamb (1958) and others model for the Numic Spread (Larson and Kornfeld, 1994; Sutton, 1987).

Regional Hypotheses

The following two questions ask the more general question, “what, if any, is the relationship of HRV to other regional high-altitude residential manifestations,” in terms of null and alternative hypotheses.

1. There are no significant relationships between regional high-elevation residential occupations.

Based on differences in elevation (e.g., from 2700 to nearly 3600 m (9000-12,000 ft)), lack of overlap in the standard deviations and interquartile ranges of
radiocarbon dates from east to west, and differences in culture and adaptation (e.g., Fremont forager-farmers on the Fishlake Plateau versus central Nevada Numic/Shoshonean hunter-gatherers), it is possible each instance represents either a specialized, local cultural variation or an adaptation to very specific and local ecological or historical circumstances. This possibility essentially comprises a null hypothesis acting as a foil to regional archaeo-ethnological inquiry.

2. There are significant relationships between regional high-elevation residential occupations.

   Based on similarities in lithic assemblages (in terms of reduction strategy and technology if not material type), construction of residential structures, and general environmental settings (i.e., subalpine-alpine), it is possible to develop two subsidiary hypotheses under this heading: one historical, the other evolutionary. The first is that these similarities represent the diffusion of a mountain-centered, intensive hunter-gatherer high-altitude adaptation focused on seasonal residential occupation and structure construction, hunting, and either intensive collection and processing of high-elevation plant foods or transport of such resources to high-elevation locales. This would mean intensive, residential use of subalpine-alpine environments developed first in North America’s largest mountain range, the Rockies, over a period of time spanning perhaps 1300 years or more (roughly 2800-1500 BP). Such an adaptation could conceivably be rooted in the late Paleoindian-Early Archaic high-elevation processing strategies that developed in the Rockies in the early Holocene (Husted and Edgar, 2002) and/or in the large-scale movement of residentially mobile groups at least partly reliant on intensive geophyte exploitation into the Rocky Mountains and High Plains during the middle Holocene (Smith and McNees, 2011). Permutations of these behaviors might then have been incorporated into the development of the intensive forager-farmer lifeways of the Eastern Great Basin during the Formative and eventually by groups living in the western Great Basin, and even California’s Sierra Nevada by 400-500 BP. Evidence supporting this hypothesis is of course scant beyond the simple chronological data presented in this article and a methodology recalling Clark Wissler’s (1923) anachronistic age-area concept, but is presented here mainly to reemphasize the spatio-temporal trajectory of high-altitude intensification across the American West during the late Holocene.

   Much more likely, however, the patterns seen at HRV and other similar locales entail local responses to fundamental similar evolutionary-ecological contexts. These might include increasing population densities, economic intensification (both foraging-based and agricultural), climate change, or some combination of these factors. Increasing population densities and economic intensification may very well pertain in places like Owens Valley and along the Formative Period Wasatch Front, where such phenomena are fairly well documented (e.g., Bouey, 1979; Delacorte, 1994; Massimino and Metcalfe, 1999; Scharf, 2009; Talbot and
Wilde, 1989). In central Nevada's Toquima Range, such an argument is harder to support, given the low population densities recorded in regional ethnographies (Steward, 1938) and the depth of time these ethnographies are thought to represent (Thomas, 1973). In contrast, the climate change permutation of this hypothesis is attractive in one sense because it provides a pan-regional explanation for why people might choose to more intensively exploit and occupy high altitudes at about the same period of time, during the generally warmer and drier, but also markedly variable conditions of the Medieval Climatic Anomaly. This perspective, however, is confounded by two factors:

1. the main occupations in the White Mountains and Fishlake Plateau appear to correspond to ostensibly limiting conditions associated with the onset of the Little Ice Age, after the Medieval Climatic Anomaly (Bettinger, 1991; Campell and McAndrews, 1993); and
2. climate's effects on resources and their distribution is always local (Mann, 2002; Mayewski et al., 2004; Stenseth et al., 2002), meaning the effects of the variable Medieval Climatic Anomaly (Bradley et al., 2001; Hughes and Diaz, 1994a, 1994b; Stine, 2000; but see Herweijer et al., 2007 and Cook et al., 2010) may very well have been quite different across the broad expanse of the Mountain West.

Add to this the possibility, derived from the first empirical hypothesis described in the preceding subsection (that HRV was occupied over a 3000 year or more period of time spanning late Holocene neoglacial, medieval warming, and the Little Ice Age) (Dahms, 2002; Fall et al., 1995), and the initially-attractive climate-change hypothesis loses much of its appeal.

CONCLUSION

The preceding leaves a conundrum: how to best explain regional high-altitude residential manifestations without relying on local historical circumstance or on gross generalizations about paleoenvironmental change. In ecological-adaptive context, such explanations would have to rely on comparisons of proxies for resource productivity, population density, and high-altitude economic behaviors and their intensity from across the mountain-intemountain West. Estimates for resource productivity of course are necessary to determine population-resource dynamics and would have to rely on very localized proxy records derived from locations nearby high altitude residential sites and villages. Fortunately, these are often available. For instance, some of the oldest tree ring records in the world are near the White Mountains villages, very old stands of whitebark pine from which a late Holocene dendroclimatological record are currently being derived from samples in and near HRV, and alpine and subalpine lakes and wet meadows amenable to pollen assay are near HRV, on Utah's Fishlake Plateau and at Alta Toquima. Estimating prehistoric population densities is of course fraught with
difficulty, but the key to this in the context of explaining high-altitude residential patterns is paradoxically to be found in the lowlands and valleys below high-elevation villages. If high-elevation villages are part of a lowland-highland settlement dynamic, then it stands to reason that reconstructing the population histories, demographics, and settlement patterns of lowland camps and villages would clarify the population parameters associated with high-altitude residential living.

When it comes to determining high-altitude economic effort, the first part of this equation is intrinsically linked to the population density question, which hinges on determining the size of the groups who occupied HRV and other high-altitude residential sites. In this context, teasing out the difference between palimpsests of many small occupations versus larger ones entails generating much larger dating samples while controlling for the old wood problem (by dating only short-lived taxa like \textit{Artemisia} spp.) from multiple residential features.

In a related vein, determining the type and intensity of high-altitude subsistence economies (e.g., diet breadth and affiliated return rates) is hampered by the poor preservation of floral and faunal remains at many high-altitude sites, problems that might be solved not only by refined residue analyses, but also by more cutting-edge analyses like ancient DNA taxon identification of faunal remains (e.g., Wilson et al., 2011). Finally, with regard to the subject of identifying additional high-altitude residential sites from which to derive new subsistence and other economic data, additional prospection is clearly required, recognizing that hunter-gatherers built houses far more often than they are identified archaeologically and that their identification can rely as much on artifact patterning as on well-defined features (e.g., Surovell and Waguespack, 2007). The preceding thus argues what a lot of papers do: finding and sampling more sites is required and more robust methods are necessary to tease out patterning in data generated from these studies. But this cliché is all the more apt because of the difficulty of explaining the anomalous nature of high-altitude hunter-gatherer residential behaviors, behaviors that hold such promise for explaining human adaptation to marginal high-altitude and high latitude (altitude’s ecological analog) environments worldwide.

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