

Great Basin Projectile Point Typology: Still Relevant?

DAVID HURST THOMAS

American Museum of Natural History
Central Park West at 79th Street
New York, NY 10024-5192

*This paper explores the evolution and current practice of Great Basin projectile point typology, with particular reference to the archaeology of the central core of the Intermountain West. Multiscalar perspectives are employed as tools to help to understand the considerable variability, both spatial and temporal, evident here. I examine the distribution of the Northern Side-notched projectile points that track the *entrada* of foragers into the mountainous central Great Basin. Along with the projectile points of the “short chronology” types, these time diagnostics help us understand the rise and demise of logistical hunting across this area. This paper argues that typological analysis today remains absolutely critical to our understanding of the archaeological record, particularly the interrelationship between the paleoclimatic and human behavioral evidence.*

KELLY MCGUIRE (2002:1) HAS QUITE RIGHTLY poked fun at the “love affair between Great Basin prehistorians and their projectile points.” This is an affair with deep roots, and Great Basin archaeologists have indeed labored hard to refine (and, yes, perhaps even reify) those lovely little lithics.¹

Great Basin point chronology was largely developed by Robert F. Heizer and his students at the University of California, Berkeley. Having undertaken an ambitious Basin-wide survey during the 1930s, Heizer returned with his students in 1958–1959 to excavate several key sites, especially Wagon Jack Shelter (Heizer and Baumhoff 1961), South Fork Shelter (Heizer, Baumhoff, and Clelow 1968), and Ruby Cave (Garcia 2006).

Unlike previous investigators, Heizer and his students focused almost exclusively on projectile point chronology to impose temporal order (e.g., Heizer and Baumhoff 1961:123). They found that over an estimated 10,000 years or so, point forms appeared and disappeared at correlative intervals throughout much of the Intermountain West. The Berkeley team effectively constrained the *temporal* ranges of the most important projectile point types (although the *spatial* limits associated with this typology remain a topic of lively conversation among contemporary Great Basin archaeologists, as it should). Almost from the beginning,

Heizer and his student colleagues anticipated the need to further revise this typological system, and the Berkeley typology was presented as a working approximation rather than a final product (Heizer, Baumhoff, and Clelow 1968; Heizer and Hester 1978; O’Connell 1967).

The Berkeley chronology was largely in place when I began my doctoral fieldwork in the Reese River Valley, Nevada. Because I was doing a randomized, systematically-controlled surface collection, workable typological classification and index fossil dating was critical in order to establish a regional framework. Attempting to render the Berkeley typology more operational, I applied a series of standardized metric attributes to a sample of 675 projectile points from the central and western Great Basin (Thomas 1970, 1971; Thomas and Bettinger 1976). At that point, my goal was not to redefine the artifact types of the Berkeley School, but rather to standardize types already in use.

Over the next two decades, I shifted archaeological focus to Monitor Valley (two valleys to the east), where we conducted another probabilistic regional survey, mapping a number of satellite and outlier sites, and excavating nearly a dozen stratified sites (Thomas 1983a, 1988). The most significant typological data came from Gatecliff Shelter, which produced more than 400 typable projectile points tied to a well-established radiocarbon

record.² These data were initially synthesized into the “Monitor Valley classification,” which has been revised several times (Pendleton 1985, In press; Thomas 1981; Thomas and Bierwirth 1983; Thomas and Kelly 1988). Since then, we have assembled a standardized database of Great Basin projectile points, measured and classified according to the most recent “Monitor Valley classification” mentioned above. This paper draws upon an expanded database of nearly 50,000 projectile points, designed to track large-scale estimates of settlement patterns and demographics across the western and central Great Basin.³

There are, to be sure, limitations within this process. Differences in age estimates and typological schemes for individual localities remain a significant problem, with considerable temporal variability across the Great Basin (Basgall and Delacorte 2011; Hildebrandt and King 2002; Holmer 1986, 2009; McGuire, Delacorte and Carpenter 2004:23; Schroedl 1995; Zeanah and Leigh 2002). Obsidian hydration rates have been established for many flows, providing additional clarity on projectile point chronologies, but the potential of obsidian hydration is severely constrained in the central Great Basin.

THE IMPORTANCE OF DEVELOPING MULTISCALAR CHRONOLOGIES

“Chronology is at the root of the matter, being the nerve electrifying the dead body of history” (Laufer 1913:577)

A century ago, addressing the annual meeting of the American Anthropological Association, ethnographer Berthold Laufer pretty much got it right—chronology really does lie at the heart of history, archaeology, and anthropology. Archaeologist Alfred Tozzer (1926:283) echoed similar sentiments about archaeological evidence having “an inert quality, a certain spinelessness when unaccompanied by a more or less definite chronological background.”

To Laufer (1913:576), archaeology and ethnology are “inseparably one and the same—emanations of the same spirit, pursuing, as they do, the same ideal, and working to the same end,” but they operate within vastly different time frames. “When archaeology and ethnology have drawn up each its own chronology, then the two systems may be pieced together and collated,

and the result cannot fail to appear.” In this understated observation, Laufer explicitly recognized how chronology typically operates at multiple levels, effectively defining what today we might call a *multiscalar* approach to chronological control (Thomas 2011).

I’m partial to the analogy of an old-fashioned alarm clock:

The Hour Hand: Great Basin projectile point chronologies have for decades functioned as the “little hand” on the clock, providing fairly gross temporal resolution at the millennial to sub-millennial scale. Projectile point typology helped establish the basic chronological ordering of Great Basin prehistory and, I will argue, when suitably refined with new data and technologies, can continue to provide a tool critical to archaeology at the regional scale.

The Minute Hand: Radiocarbon and obsidian hydration sequences function today as the clock’s “big hand,” generating results that approach a century-level of temporal resolution. Although involving quite different assumptions and producing estimates not entirely comparable, both chronometric tools generate finer-grained results that facilitate more realistic comparisons between century-scale paleoclimatic evidence and increasingly detailed cultural sequences.

The Second Hand: Site seasonality studies generate microchronological controls at the resolution of months or even weeks.

I focus on the two top tiers of this multiscalar temporal framework to discuss and evaluate the role of cultural chronology-building in the western and central Great Basin. This exercise emphasizes the importance of refining and transcending hour-hand chronologies to develop the minute-hand chronologies necessary to synchronize the archaeological record with the rapidly growing and increasingly high-precision paleoenvironmental records available.

GREAT BASIN CHRONOLOGY: THE LONG AND SHORT OF IT

Debate over “long” and “short” projectile point chronologies in the Great Basin was torched off when Aikens (1970) suggested that large corner-notched dart points—the Elko series—enjoy a much longer lifespan in Utah than prescribed in the Berkeley typology (see also Beck 1995; Bettinger and Taylor 1974; Hockett 1995; Holmer 1978; O’Connell and Inoway 1994; Thomas 1975,

1981). Today, most investigators would agree that both chronologies have merit.

The “short” chronology implicit in the Berkeley/Monitor Valley classifications is grounded in the critical assumption that “at any given time during the middle and late Holocene, people in the Great Basin used points of just one or two basic types;...at specific times, they stopped using some types in favor of others; and that changes in type preference occurred in a consistent sequence.... [Except for the assumed transition from dart points to arrow points, at the Elko-Rosegate margin]...none of these patterns are explained. They are empirical generalizations based on dated sequences” (O’Connell and Inoway 1994:175–177). Specific point forms (Elko series included) seemed to define relatively brief temporal spans without overlapping significantly with earlier or later forms. The resulting phase-level time frames subsequently developed throughout the central and western Great Basin depend almost entirely on a simple, unilinear sequence: Northern Side-notched→Gatecliff→Elko→Rosegate→Desert series projectile point forms.⁴

Although the Monitor Valley criteria have proven useful in other areas, including Surprise Valley in California (O’Connell and Inoway 1994) and southwestern Idaho (Boaz 1984), I continue to believe that multiple short chronologies, each with circumscribed spatial limits, are required to address the archaeological variability within the central and western Great Basin. It is becoming increasingly clear that various sub-regions within the Great Basin have unique climatic, demographic, and cultural histories. Far-flung, overly-standardized point typologies tend to mask that variability.

Aikens (1970) was correct that the assumption of sequential, non-overlapping point types fails to hold in many parts of the Great Basin, leading to a series of “long chronologies”—and the temporal distribution of Elko series points clearly demonstrates this fact (see Beck and Jones 1994). Throughout most of the central and western Great Basin, Elko points fall within a relatively narrow temporal range (generally accepted to be roughly 1,500 cal B.C.–cal A.D. 700 or so), consistently post-dating Gatecliff points and pre-dating Rosegate points (see also Elston and Budy 1990; McGuire et al. 2004; O’Connell 1967; O’Connell and Inoway, 1994; Thomas 1981).

But in the Bonneville Basin, Elko points extend back to about 6,000 cal B.C., lasting in some contexts

as late as cal A.D. 1000 (Aikens 1970; Beck 1995; Elston 2005; Holmer 1986:Fig. 6). In eastern Idaho, Elko Corner-notched points date from 6,400 cal B.C. through cal A.D. 800, overlapping with Northern Side-notched points before 3,000 cal B.C., with Gatecliff series points during the 3,800–1,250 cal B.C. interval and with Rosegate series points after cal A.D. 300 (Holmer 2009). Elko series points appear in southeastern Oregon about 5,500 cal B.C., co-occurring with Northern Side-notched and Cascade types, then becoming the predominant type after 2,500 cal B.C. (when they are frequently found with Gatecliff and Humboldt series points) and lasting until about 500 cal B.C. (Aikens, Connolly, and Jenkins 2011:45–47).

The picture becomes complicated along the chronological margins between long and short chronologies. Based on hydration analysis of points made of Browns Bench obsidian, Hockett (1995:48) concludes that “most or all” Elko points postdate split stem points, according to the Monitor Valley classification (Thomas 1981) and evidence from the Upper Humboldt drainage (Elston and Budy 1990). Hockett believes that the Mary’s River may define a fairly rigid boundary between short and long chronologies in northeastern Nevada.

A rather different picture emerges along the northern California–Great Basin interface, a complex boundary zone reflecting elements of both “long” and “short” chronologies. Whereas excavations at Honey Lake and the Sierran Front confirm some aspects of a “short” chronology, Milliken and Hildebrandt (1997:73) recognize a “robust” Elko variant that may have first appeared during the early Archaic (5,000–3,500 rcy B.P.) and lasted through the middle Archaic (3,500–1,300 rcy B.P.). On the basis of extensive obsidian hydration analysis, Hildebrandt and King (2002:21) note a number of distinctive regional variants (such as Fish Slough and Siskiyou Side-notched points) and speak of a “significant chronological overlap” among Elko, Gatecliff, and Northern Side-notched forms (Hildebrandt and King 2002:21). This pattern suggests to McGuire (1997:223) that “in this area of the Western Great Basin, then, it is time to rethink certain assumptions regarding projectile point chronologies; it is probably the case that [Gatecliff and Elko series] point forms do not constitute part of a lock-step unilineal sequence.” And yet, just 50 miles to the north, reanalysis of the Surprise Valley projectile point collection seems to wholly support a

short chronology consistent with the Monitor Valley criteria (O'Connell and Inoway 1994).

Overall, long chronologies unfold in places characterized by continuity from the early to middle Holocene—subregions impacted yet not wholly abandoned during middle Holocene aridity (as summarized in Louderback, Grayson, and Llobera 2010). Quite different chronological scenarios play out in those sub-regions first occupied at the end of the middle Holocene.⁵ Thanks to recently available, more fine-grained paleoenvironmental evidence (coupled with increasingly precise temporal controls in archaeology), we can begin to address the *how* and *why* questions underwriting “long” and “short” chronologies within the greater Great Basin.

In the rest of this paper, I explore some hypotheses regarding the dynamics of the short chronology as it played out in the central Great Basin.

ENCOUNTERING THE CENTRAL GREAT BASIN

I have previously argued that the Great Basin can be profitably dichotomized into two distinct lithic landscapes (Thomas 2012; see Fig. 1⁶):

An **Obsidian Rim** encircles the Intermountain West, spanning roughly three-quarters of the landscape of southern Idaho, southeastern Oregon, western Nevada, southeastern California, southern Nevada, and western Utah. The Holocene archaeological record throughout this vast area is characterized by projectile points manufactured mostly from obsidian (ranging from 100% obsidian usage down to about 20%).

A **Chert Core** is restricted to central and northeastern part of Nevada, defining the Great Basin heartland. The central Great Basin floristic zone covers about 15% of the geographical Great Basin (Cronquist et al. 1972:78), but this vast, mountainous terrain contains less than 2% of the known Great Basin obsidian sources. The archaeological record of the central Great Basin (and portions of adjacent floristic zones to the east) is characterized by projectile points manufactured from various silicates, rhyolite, quartzite, and so forth (with the obsidian use rate typically less than 20% and approaching zero in some cases).

This geological fact-of-life is underwritten by 30 million years of Great Basin lithology.

The *Chert Core/Obsidian Rim* dichotomy, crude as it is, has long conditioned the practice of Great Basin

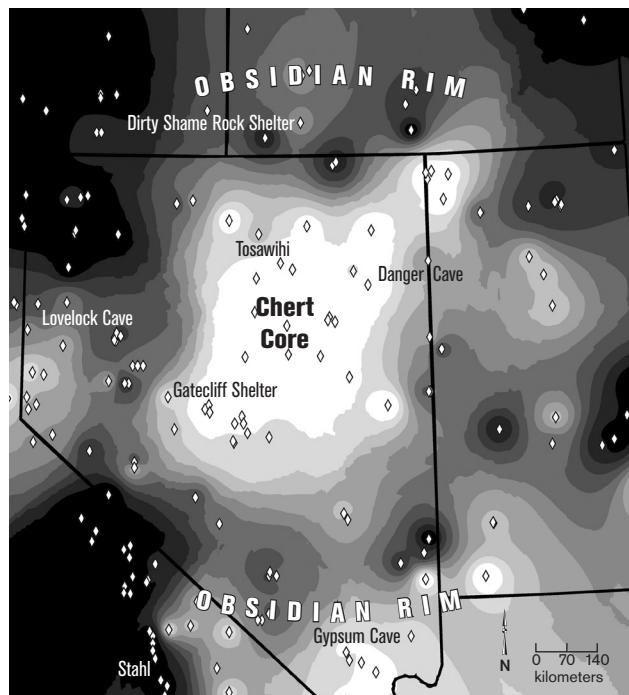


Figure 1. The “Chert Core” and the “Obsidian Rim” in the Great Basin. This map generalizes long-term patterns of lithic source-use by plotting the percentage of obsidian utilization for time-sensitive projectile points (from all time periods) recovered from 151 archaeological sites. Scaled at 5% intervals, total black denotes 100% of the projectile points are made of obsidian and total white shows zero obsidian use (see also Thomas 2012: figs. 15.1 and 15.2).

archaeology, impacting how we classify our artifacts and the measures we use to monitor temporal change. Beyond the obvious typological correlates of raw material, there is also the reality that archaeologists (like myself) working primarily within the Chert Core cannot use obsidian hydration in any meaningful way; accordingly, we have understandably relied (perhaps too heavily) on constructing a cultural radiocarbon record. By contrast, archaeologists analyzing assemblages from the Obsidian Rim have understandably relied (perhaps too heavily) on building obsidian hydration chronologies as a primary chronometric tool; the upshot for the Obsidian Rim—until relatively recently—has been a tendency to overinvest in obsidian hydration at the expense of building independent, yet correlative ¹⁴C records.

This distinction goes further, I believe, because the distinctive foraging lifeways that played out within the Chert Core differed notably from contemporary behaviors in the Obsidian Rim—specifically with respect

to provisioning strategies, patterns of transhumance, exchange relationships, lithic technology, toolstone acquisition, and stone tool curation.

Figure 2 provides a concrete example of this dichotomy by plotting the distribution of roughly 22,600 late Pleistocene and early Holocene diagnostics (stemmed and fluted projectile points) across the central and western Great Basin, with comparative samples added from the northern and southern Basin and northern Mojave desert.⁷ Not surprisingly, early Holocene diagnostics cluster along a western arc running from southeastern Oregon (not fully plotted on Fig. 2), across the Black Rock Desert through the Tonopah floristic zone into the northern Mojave. A second arc of early Holocene diagnostics begins in the Calcareous Mountains (especially in Railroad Valley, the Sunshine locality, and Butte Valley) and joins the northeastern Bonneville Basin (not plotted in Fig. 2).

Figure 2 strikingly arrays the nearly complete absence of Paleoindian and Paleoarchaic diagnostics in the mountainous Chert Core (see also Thomas 1983b).⁸ The central Great Basin was virtually uninhabited during the early Holocene because the first foragers lived between the mountains, not among them. Mountain glaciers still capped the highest ranges—the Rubies and the East Humboldt range along the northern tier, the White Mountains to the west, the Egan Mountains and Schell Creek Mountains to the east. The first intermountain foragers were not mountain people. They stayed away from the stormy, dark, and forested uplands that fringed their wetland ecosystems. They avoided the uplifted Great Basin heartland. Mountains must have been viewed as obstacles back then, not destinations.

The mountainous central Great Basin would be significantly occupied only after the onset of dramatic and fairly rapid paleoclimatic events, as detailed below, (employing data presented in Thomas In press a.).

TRACKING THE RISE AND DEMISE OF LOGISTICAL HUNTING IN THE CENTRAL GREAT BASIN

Broughton et al. (2008) present a controversial hypothesis linking the seasonality of temperature and precipitation with artiodactyl population densities across western North America (see also Broughton et

al. 2011:411–413; Byers and Broughton 2004, Hockett 2005). Their argument holds that the highest quality of forage is typically most abundant in wetter conditions early in the springtime and in the early summer growing season, in turn influencing artiodactyl survival, birth weight, resistance to disease, and ultimately herd size. Bighorn living in arid settings require free drinking water in proximity to the summer range. Spring and summer droughts have demonstrable negative impacts on a wide variety of artiodactyls across western North America. Broughton et al. argue that some climatic conditions will be more favorable than others for enhanced artiodactyl densities. In particular, a broad range of paleoclimatic data indicate that seasonal extremes in temperature peaked during the terminal Pleistocene and early Holocene intervals, followed by a winter-wet, summer-dry pattern that prevailed during the early and middle Holocene—and these conditions depressed artiodactyl densities. Thus, they argue that a shift to summer-wet conditions strongly favored artiodactyl populations. Broughton et al. (2008) conclude that whereas overall effective precipitation is not correlated with artiodactyl indices, the strong influence of seasonality has a demonstrably positive relationship with artiodactyl abundances in the middle and late Holocene.

Models derived from human behavioral ecology further suggest that such high-return prey types would have attracted foragers to the greater hunting efficiency. Although both male and female foragers benefited from the onset of summer-wet conditions at the end of the middle Holocene, Zeanah (2004:10) argues that intensified logistical hunting of artiodactyls—especially bighorn—should take place during such favorable climatic intervals (see also Kelly 2001).

Whereas the Broughton et al. (2008) hypothesis provides a potentially fruitful approach for unpacking changes in Great Basin hunting practices, both the underlying model and its empirical proxies have been criticized on a number of levels (Grayson, 2011:235–238).⁹ By employing multiscale approaches to archaeological chronology, we will explore the Broughton et al. (2008) hypothesis in relationship to the most recent evidence charting the spatial distribution of time-diagnostic projectile points, utilizing a dataset of 498 cultural radiocarbon dates from the central Great Basin (Fig. 3).¹⁰ In this way, it is possible to explore whether summer-wet

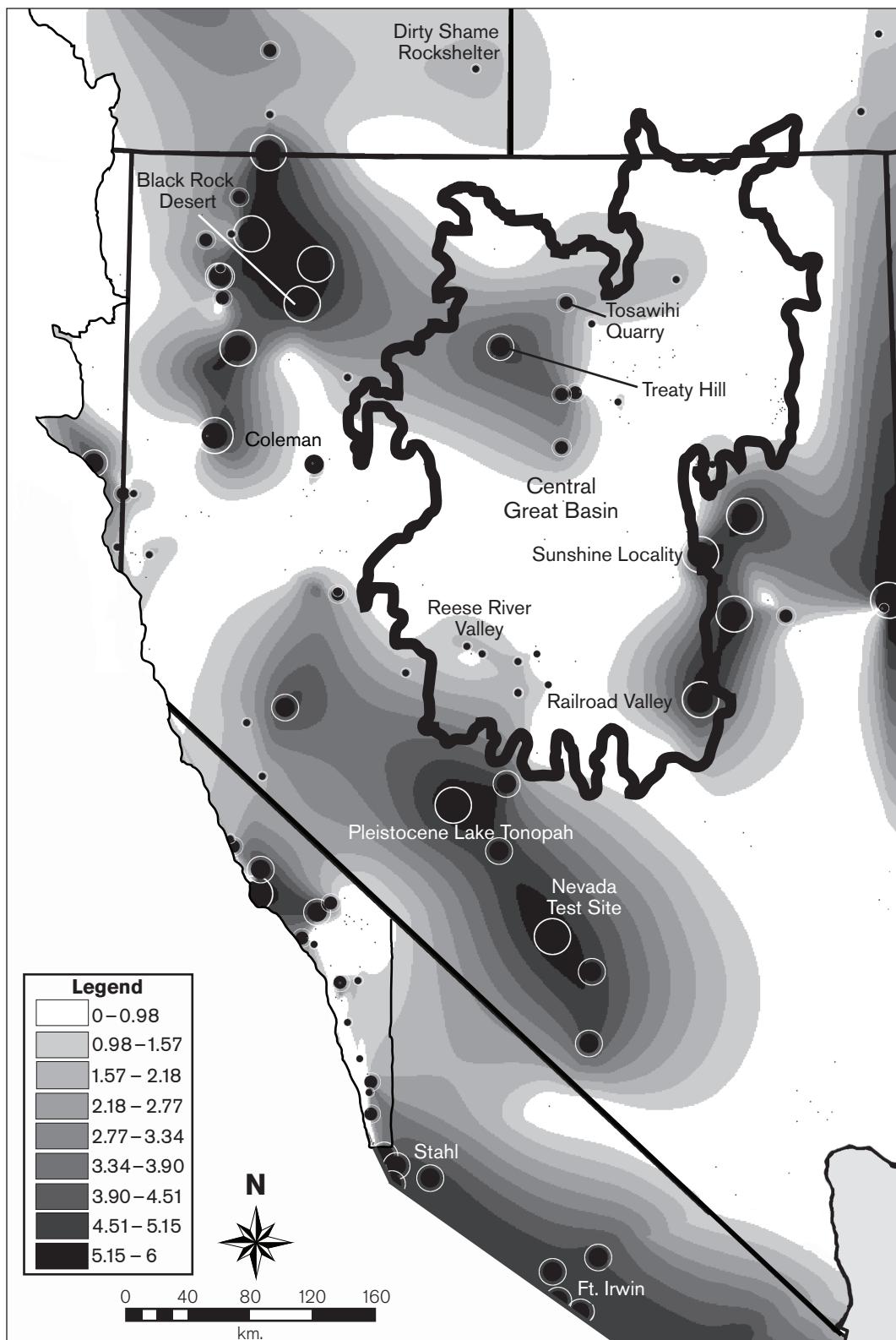


Figure 2. The distribution of approximately 22,600 late Pleistocene and early Holocene diagnostics (stemmed and fluted projectile points) across the central and western Great Basin, with comparative samples added from neighboring areas (corrected for sample size per the protocols in Thomas *In press a.*).

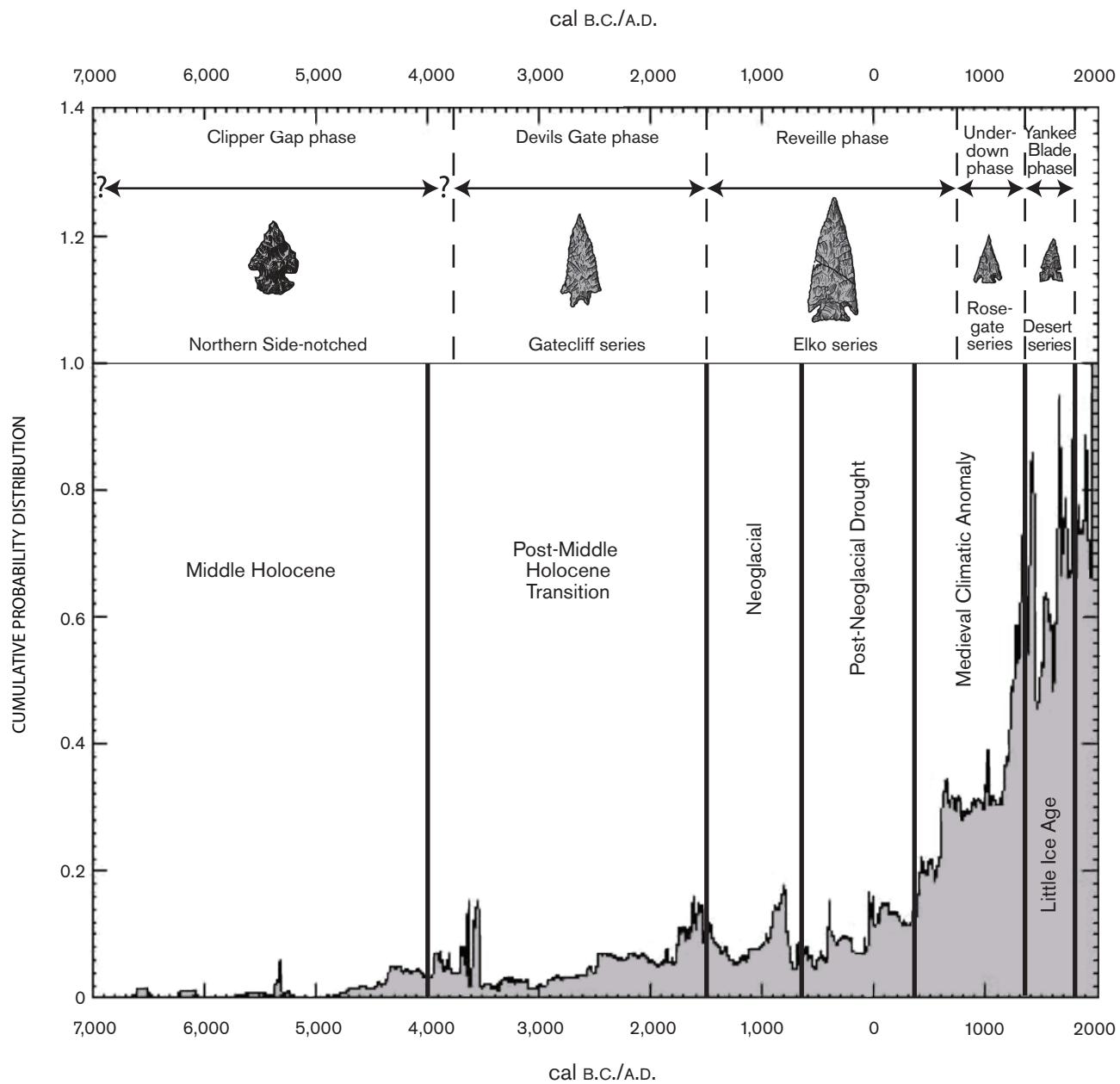


Figure 3. Probabilistic distribution of cultural radiocarbon dates from the central Great Basin (N=498; scaled per the protocols of Thomas In press a.), arrayed against the “short” projectile point chronology.

conditions fostered increases in artiodactyl densities and an upswing in hunting practices in the terminal middle Holocene and late Holocene periods.

Entrada into the Central Great Basin Core

We begin with the simple observation that not a single cultural radiocarbon date from the central Great Basin predates 7,000 cal B.C. This means that the typological and cultural ^{14}C records are in total accord: the (archae-

ologically documented) early Holocene human presence in the central Basin is vanishingly small.

A cluster of cultural radiocarbon dates define the initial significant occupation of the Chert Core (Fig. 3). Three-quarters of these dates come from Monitor Valley (Gatecliff and Triple T Shelter), the rest from Pine Valley, the Diamond Mountains, and Upper South Fork Shelter. This evidence is entirely consistent with multiple paleoenvironmental proxies from the central Great

Basin documenting the onset of summer-wet conditions ending the middle Holocene aridity.¹¹

The Gatecliff and Triple T shelters' dates reflect the initial occupation of these sites (at 4,350–4,100 cal B.C.) and provide the earliest dated examples of the logistical base camps established for hunting bighorn in the highest mountains of the central Great Basin (as elaborated in Thomas In press a.). These first foragers engineered Gatecliff Shelter (and probably also Triple T Shelter) to suit their high-mobility hunting lifestyle. A huge lithic heat sink, these south-facing shelters remained fairly cool in the summertime and held heat in the wintertime. Alpine hunters crafted their personal space in repetitious and redundant ways, building fire hearths in exactly the same places, sleeping in the same spaces, reworking their gear while sitting in the same spots. They field-dressed bighorn at Gatecliff Shelter, lightening the load by discarding waste and likely drying the meat for transport. They painted the walls with red, yellow, black, and white pictographs. Eventually, the hunters picked through their gear, carrying some and caching other things for later, then headed home to residential bases (likely a considerable distance away).

This begins a pattern that plays out in numerous caves and rockshelters (the “Man Caves”) throughout the central Great Basin, including James Creek Shelter (Elston and Budy 1990), Bronco Charlie Cave (Casjens 1974), Ruby Cave (Garcia 2006), Deer Creek Cave (Shutler and Shutler 1963), and to a lesser extent at Pie Creek Shelter (McGuire et al. 2004) and South Fork Shelter (Heizer, Baumhoff, and Clelow 1968; Spencer et al. 1987). The genesis of logistical bighorn procurement—clearly evident in the hunting camps mentioned above—is overwhelmingly confirmed by the distribution of diagnostic projectile points (which reflect hunting catchments spanning out from these Man Caves and elsewhere in the central Basin, as documented in Thomas In press a.).

The hypothesis of intensified logistical hunting during the late Holocene arose initially when we applied a millennial/sub-millennial scale, projectile point-based chronology to the Fort Sage Drift Fence (Pendleton and Thomas 1983:31; see also Thomas 1983a, 1983c). Enumerating more than two dozen rock alignments (including drift fences, corrals, one-man blinds, and soldier cairns) with their associated time-diagnostic assemblages,

Pendleton and Thomas (1983:Table 3) noted that pre-cal A.D. 1300 diagnostics appeared at nearly 95% of these sites, but only a handful of such hunting facilities had associated Desert series projectile points. We suggested that relatively high-cost artiodactyl procurement facilities were “early” patterns (meaning the early segments of the Late Holocene), diminishing through time across the central and western prehistoric Great Basin. A number of researchers have expanded our understanding of logically organized adaptations during the middle Holocene transition (Bettinger 1999; Hildebrandt and McGuire 2002; McGuire and Hildebrandt 2005; Thomas In press a., In press b.). This logistical pattern persisted well into the late Holocene, ending about two thousand years ago (at least in the central Great Basin). This discussion can now be considerably refined because the distribution of time-diagnostic projectile points helps to track the central Great Basin *entrada* far beyond the caves and rockshelters.

The Critical Role of Northern Side-notched Points

Northern Side-notched points are today considered to be time-diagnostic for the middle Holocene (Beck 1995; Hildebrandt and King 2002; Layton 1985; McGuire et al. 2004:53; O’Connell 1971, 1975; O’Connell and Inoway 1994; Weide 1985).¹² Across the northern tier of the Great Basin, this type generally postdates the Mazama ash fall (5,640 cal B.C.; 6,730 rcyr B.P.; Zdanowicz, Zielinski, and Germani 1999) with a terminal age of perhaps 3,700 cal B.C. (Delacorte and Basgall 2012:68; although these estimates likely vary considerably across the region).

Neither the Berkeley chronology nor the derivative Monitor Valley classification dealt very effectively with Northern Side-notched points in the central Basin. In the South Fork Shelter analysis, for instance, Heizer, Baumhoff, and Clelow (1968:6, figs. 1a–h) grouped all large side-notched points into an Elko Side-notched category; re-examination of these pieces shows that at least two are Northern Side-notched. Similarly, when discussing the Monitor Valley chronology, I basically ducked the question by noting the scarcity of Northern Side-notched points in central Great Basin contexts and created a composite category of “Large Side-notched,” ambiguously dated to pre-A.D. 1300 (Thomas 1981). Since then, we have recovered Northern Side-notched points in considerable numbers

during our fieldwork at Alta Toquima and the adjacent Mt. Jefferson Tablelands, and now recognize their pivotal significance beyond the northern Great Basin (as discussed by Pendleton In press).

Beck (1995:Fig. 3) compiled the initial dates of occurrence for (Northern) side- and (Elko) corner-notched forms across the Great Basin, noting that both kinds appear first in northwestern Utah, and slightly later to the south and west. Both forms seemed to date considerably later in the central, western, and southwestern Great Basin—reflecting the long- and short-chronological discussion.¹³

Other investigators have observed that Northern Side-notched points are distributed in an “arc” across the northern Great Basin, generally north of the Humboldt River (Delacorte 1997; Hildebrandt and King 2002; Layton 1985; O’Connell 1975). McGuire, Delacorte, and Carpenter (2004:58) suggest that the Northern Side-notched type “is a marker for a uniquely northern population that inhabited this region more than 4,500 years ago.” Delacorte and Basgall (2012:68) extend this argument further, suggesting that the distribution of the hallmark Northern Side-notched points, made strictly from local obsidians, represent “a linguistic or similarly pronounced cultural boundary.” They define the northern, post-Mazama margin of the Great Basin as extending only to the Humboldt River drainage (Delacorte and Basgall 2012:71, Fig. 4.5), with areas to the north having more affinity with the broad band of sagebrush/grassland extending from the eastern Cascade Range to Yellowstone and beyond. I agree with this basic argument and will extend its implications across the central Great Basin as well.

While Northern Side-notched points are decidedly less abundant south of the Humboldt River, they are now recorded in considerable numbers and across multiple localities, in a distribution I find intriguing. Figure 4 shows the distribution of 1,056 Northern Side-notched projectile points across the central and western Great Basin (with some comparative samples added from the northern Great Basin).¹⁴ These data describe not so much a fan-shaped distribution, but rather a somewhat spotty, yet mostly contiguous spread of Northern Side-notched points throughout the Reese River and Monitor valleys and parts northward. In particular, we note the cluster of Northern Side-notched points recovered in the central

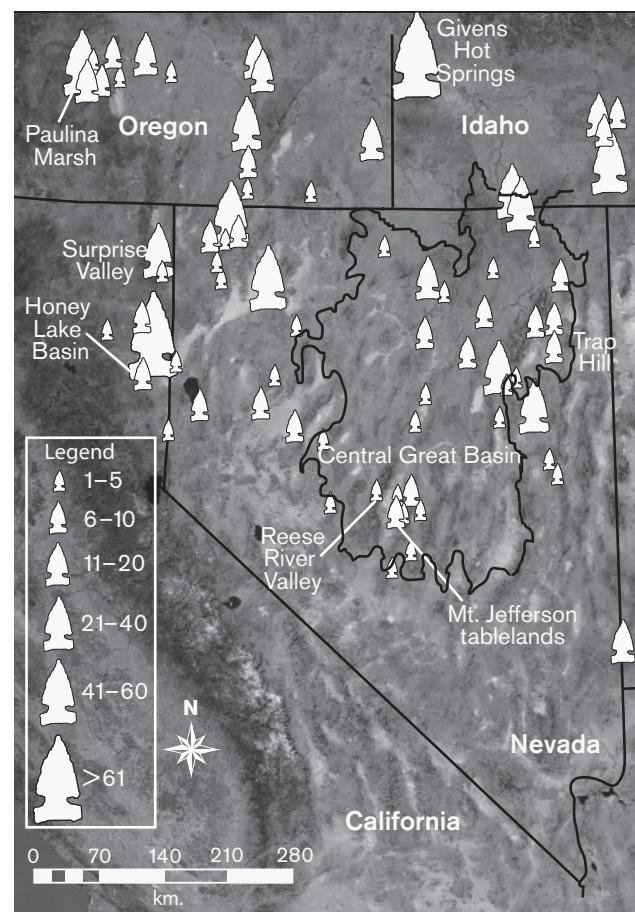


Figure 4. Distribution of 1,056 Northern Side-notched projectile points across the central and western Great Basin (with comparative samples added from the northern Great Basin; scaled as raw frequencies; data from Thomas In press a.).

Great Basin—in exactly the same area conspicuously lacking in early Holocene occupational diagnostics.

Delacorte and Basgall (2012:68, Fig. 4.3) attribute the southern margin of the Northern Side-notched type to linguistic and cultural factors: “Archaeological samples on either side of this distribution line are of comparable size and composition, and lacking prominent physiographic barriers it is hard to imagine that anything but a cultural boundary could produce this pattern.” This makes sense to me.

Although Northern Side-notched points are notoriously difficult to date precisely in central Basin contexts, I suggest they may date toward the very end of the time frame—still dating to the terminal middle Holocene, but perhaps somewhat later than typologically similar points found in Surprise Valley and the northwestern Great Basin. If so, perhaps the “Post-Mazama Boundary of

the Great Basin" (Delacorte and Basgall 2012:Fig. 4.3) migrated southward with the amelioration of middle Holocene aridity, with (late) Northern Side-notched points marking the initial *entrada* into the mountainous heartland of the Intermountain West. As noted later in this paper, significant subsistence and settlement pattern shifts took place *within* the Elko and Rosegate time frames—so why not during Northern Side-notched times as well?

Numerous systematic archaeological surveys amplify these results because we can today plot the specific elevational distribution of such time-diagnostic artifacts (as documented in Thomas In press a.). These elevationally-specific distributions both confirm and expand the evidence from Gatecliff Shelter and the other hunting camps, establishing the widespread logistical hunting of bighorn in the mountains and of pronghorn at lower elevations.

To cite a couple of specific examples, numerous Northern Side-notched points were found at the highest reaches of mountains in the central Great Basin. Our systematic survey of the Mt. Jefferson tablelands plotted nearly five dozen Northern Side-notched points at an elevation of 10,000 ft. (3,048 m.) to 11,949 ft. (3,642 m.). Several of these middle Holocene diagnostics are directly associated with rock cairns, stone walls, and soldier cairns, and they occur on Mt. Jefferson (the third highest spot in the state of Nevada) by the hundreds, if not the thousands—mostly as hunting losses from the high-altitude pursuit of bighorn sheep in their summer range (Thomas In press a.). Northern Side-notched points are also present at the Mt. Augusta drive complex, located at 7,600–8,000 feet in the Clan Alpine Mountains. This hunting facility contains 125 rock cairns stretching along an outwash feature 500 m. in length; McGuire and Hatoff (1991:101–102) also recovered bighorn bone (of a later age) from an associated midden.

Diagnostic projectile point distributions likewise track the evolution of pronghorn procurement during the terminal middle Holocene. Evidence for central Great Basin pronghorn hunting is best preserved at the Spruce Mountain Trap Complex in northeastern Nevada, where no fewer than 31 ancient pronghorn drive corrals, "kill spots," and associated processing sites have been recorded to date (Hockett 2005; Hockett and Murphy 2009).

Cobre Trap, a prime spot for taking pronghorn over a prolonged period, has a surviving corral structure and

dense concentration of points located inside and just outside the corral walls (Hockett and Murphy 2009:732, Fig. 14). Nine Northern Side-notched points were found here (with many more likely still buried or previously carried away by artifact collectors). Seven Northern Side-notched points came from inside the corral wall at Trap Hill, and five more Northern Side-notched points were found atop the overlooking ridge at Storey Trap (Hockett and Murphy 2009:732). The recurrent and redundant use of the facilities at the Spruce Mountain Trap Complex began during the middle Holocene (as evidenced by the presence of numerous Northern Side-notched points) and continued throughout the late Holocene (as is also attested by the concentration of projectile points on most valley floors surveyed in systematic surveys throughout the central Basin; see Thomas In press a.). Although a few ¹⁴C dates are now available from the Spruce Mountain hunting complex, temporal controls rely almost exclusively on the recovery of time-diagnostic projectile points.

In other words, long-term pronghorn procurement began during the terminal middle Holocene and seems to have remained fairly constant throughout the late Holocene. By contrast, logistical bighorn procurement started about the same time in the central Basin, but changed considerably during this time period.

Post-middle Holocene Transition

(4,000 cal B.C. to 1,500 cal B.C.)

The 3,900–2,900 cal B.C. year-old sediments at Gatecliff and Triple T shelters document decreasing overall precipitation and increasing winter-wet conditions (Davis 1983:84; Melhorn and Trexler 1983:93). According to the Broughton et al. (2008) hypothesis, this interval should be pegged as a time of stress on artiodactyl population densities, but the cultural radiocarbon record suggests otherwise. This time frame begins with a significant spike of eleven ¹⁴C dates from Monitor Valley (eight from Gatecliff Shelter and three from Triple T Shelter), with a pooled mean of 3,970–3,780 cal B.C., perhaps reflecting a carry-over of summer-wet conditions from the terminal middle Holocene.

The rest of this millennium-long interval is represented by 21 radiocarbon determinations, with two-thirds of the dates from Gatecliff and Triple T shelters and with additional determinations from Pie Creek Shelter, South

Fork Shelter, Deer Creek Cave, and Tosawihi quarry. Several of these sites are logistical bighorn hunting camps, and the archaeological evidence clearly demonstrates that bighorn hunters were increasingly plying their trade across much of the central Great Basin—despite the increasingly winter-wet conditions.

Summer-wet conditions returned about 2,900 cal B.C., corresponding to another significant spike of three dozen dates reflecting intensified bighorn and pronghorn procurement (including Monitor Valley, Pie Creek Shelter, Ruby Cave, South Fork Shelter, James Creek Shelter, and the Spruce Mountain Trap Complex).¹⁵

Projectile point distributions confirm the intensification of high elevation bighorn procurement during the post-middle Holocene transition, with a major proportion of Gatecliff series points recovered high in the mountains of the central Great Basin. This is certainly true for Monitor Valley, where nearly one-third of Gatecliff series points were found well above the modern piñon-juniper woodland; an equal proportion was found on the valley floor, suggesting both bighorn and pronghorn hunting during this interval (Thomas 1988:409–412, Table 71). Similar patterns hold for the Reese River Valley (Thomas 1971) and the Cortez Mountains/Sulphur Spring Range bordering Pine Valley (Brian Hatoff, personal communication 1995) where one-quarter of the Gatecliff (and to a lesser extent, Elko) series hunting losses took place above the contemporary piñon-juniper zone.

The probabilistic survey of Crescent Valley (Delacorte, Gilreath, and Hall 1992: Map 2) demonstrates that half of the Gatecliff points came from the mountain domain (above 6,500 ft.)—a considerably higher proportion than for later types. Delacorte, Gilreath, and Hall (1992) think this pattern reflects “more extended forays away from residential encampments,” almost certainly in search of bighorn. Systematic surveys of Whirlwind Valley and Mule Canyon (Ataman et al. 1994:24; Elston and Bullock 1994) likewise demonstrate that Gatecliff (and Elko) diagnostics were “by far the most frequent” point forms recovered above 6,000 feet, concentrated along Mule and Deer canyons draining the highest part of the Shoshone Range.

Neoglacial (1,500-650 cal B.C.)

The Neoglacial period marks the cessation of summer storms and a return to winter-dominated precipitation,

with much cooler temperatures. Pollen and plant macrofossils from Gatecliff Shelter indicate that 1,700 to 950 cal B.C. may have been cooler and moister than any time in the last six thousand years (Thompson and Kautz 1983:150; see also Miller et al. 2001:384). The Broughton et al. (2008, 2011; see also Byers and Broughton 2004) hypothesis projects such climatic conditions as being quite unfavorable for maintaining artiodactyl densities at previously high levels. The cultural radiocarbon record seems to support this contention (Fig. 3), trailing off notably from the preceding summer-wet period. By contrast, we note a significant spike in ¹⁴C dates between 1,070–760 cal B.C. (with 19 dates from 11 central Great Basin sites)—during a cooler, winter-wet interval.

Several systematic archaeological surveys from the central Great Basin likewise demonstrate a significant drop in the proportion of Elko series points found at high elevations, but multiscalar issues make these projectile point data difficult to interpret. This is because the timespan of a single point form (the Elko series) begins in the Neoglacial, spans the post-Neoglacial Drought, and extends into the early Medieval Climatic Anomaly. We now know that significant demographic and social changes transpired within the Elko-defined Reveille phase.

Post-Neoglacial Drought (650 cal B.C.–cal A.D. 350)

Major drought cycles striking across interior western North America were punctuated by a “dramatic winter wet event” between 100 cal B.C. and cal A.D. 100 (Wigand 2006:2776).¹⁶ The correlative radiocarbon record from the central Basin shows a significant seven-century gap between 760–50 cal B.C., with only 22 dates recorded (and several document the advent of alpine residences at Alta Toquima, as discussed below—they were clearly not logistical hunting sites). Gatecliff Shelter was apparently abandoned during the post-Neoglacial drought, as were most of the logistical bighorn hunting camps in the central Great Basin, when this four-thousand-year-old pattern ceased (by about 200 cal B.C.).

Setting aside Alta Toquima for the moment, the dramatic post-Neoglacial drought correlates with a distinct hiatus in cultural ¹⁴C evidence. Specifically, the interval from 760 to 410 cal B.C. is represented by only five radiocarbon dates from the central Basin (two determinations from the Little Boulder Basin and

single dates from Deer Creek Cave, Pie Creek Shelter, and Alta Toquima). Except for a smattering of dates from the lower and middle Humboldt River drainage, the radiocarbon record dramatically demonstrates that the mountainous central Great Basin was largely depopulated during the onset of the post-Neoglacial drought (Thomas In press a.). This episode is followed by a huge spike of 28 ^{14}C dates from across the central Great Basin, characterizing the end of the post-Neoglacial Drought period (0 cal B.C.–cal A.D. 350).

Families first began to live at Alta Toquima during the middle of the post-Neoglacial drought, about 410–200 cal B.C., the earliest documented alpine residences in the Great Basin (cf. Bettinger 1991, 1999). Foragers returned to Gatecliff Shelter a bit later (200 cal B.C. and cal A.D. 1), but the site no longer functioned as a logistical hunting camp. Instead, Horizons 4–6 reflect a complex interplay of male and female maintenance, extraction, and fabrication activities. The multiple usages of Gatecliff Shelter (and several other caves and shelters in Monitor Valley) document this distinctive change in settlement pattern—in effect, the Man Caves had become Mom-and-Pop Shelters.¹⁷

The establishment of multiple alpine residences at Alta Toquima and elsewhere on Mt. Jefferson, coupled with the total abandonment of alpine and upland hunting, coincides with a more widespread utilization of the piñon-juniper woodland for both male and female foraging. Beyond the obvious impact of extreme climatic stress, the post-Neoglacial drought likewise marks the shift from logistical, band-like foragers to small, independent household-size groups.

Medieval Climatic Anomaly (cal A.D. 350–1350) and Later

The Medieval Climatic Anomaly was a time of “epoch megadroughts” (Cook et al. 2004:1,018), as Great Basin climates were becoming generally warmer and drier, with a seasonal shift in precipitation to the early summer (Davis 1982; Wigand 1987; Wigand and Nowak 1992; Wigand and Rhode 2002:328; Wigand and Rose 1990). Milder winters reduced the snowpack, and lower lake levels were evident in the western Great Basin. In central Nevada, the total number of plant taxa began to increase in upland areas (Miller et al. 2001:386, Fig. 11). Bison appear in the eastern and western Great Basin

during part of this interval (Schroedl 1973; Wigand and Rhode 2002). Broughton et al. (2011) have argued that these climatic conditions dramatically favored increased artiodactyl densities; in the central Basin at least, it is abundantly clear that considerable bighorn hunting was staged out of residentially-mobile base camps (witness the major “bone bed” with at least two dozen bighorn in Horizon 2 [cal A.D. 1250] at Gatecliff Shelter).

More than 400 Rosegate and Desert series projectile points were recovered from the alpine residences at Alta Toquima, but similar points are virtually absent as hunting losses elsewhere above the piñon-juniper zone (Thomas In press a.). This trend also holds true for Bettinger’s randomized survey and subsequent alpine excavations in Owens Valley (1975, 1991).

In the Crescent Valley systematic survey, Delacorte, Gilreath, and Hall (1992:66) found a high proportion of isolated Rosegate series points, indicating a “general pattern wherein hunting seems to have been most intensively pursued in the piñon-juniper woodland during this interval.” Noting the parallels with Monitor Valley, these investigators record that Desert series points were mostly recovered from the lowland slopes: “the reason for this difference is unclear and somewhat puzzling since the uplands are generally a better place to hunt, supporting larger populations of most ungulates” (1992:65).

Similarly, systematic archaeological surveys universally demonstrate the near total absence of Rosegate and Desert series diagnostics above the piñon-juniper in the Reese River, Pine Valley, Ruby Valley, Owens Valley, and Stillwater Mountains (Bettinger 1975; Casjens 1974; Delacorte 1990; Hatoff, personal communication 1995; Kelly 2001; Thomas 1971). In his Deep Springs survey, Delacorte (1990) found a significant number of Rosegate points at elevation, but virtually no Desert series diagnostics were recovered there. Similarly, the Mt. Augusta hunting complex had two associated Rosegate points, but no Desert series points (McGuire and Hatoff 1991).

CONCLUSIONS AND SOME LINGERING QUESTIONS

Heeding the century-old advice of Berthold Laufer, I have privileged the role of chronology as “...at the root of the matter, being the nerve electrifying the dead body of history” (Laufer 1913:577). Having explored the evolution

and current practice of Great Basin projectile point typology—with particular reference to the archaeology of the central core of the Intermountain West—I argue that typological analysis remains absolutely critical to our understanding of the archaeological record, particularly the interrelationship between the paleoclimatic and human behavioral evidence.

Multiscalar perspectives play out in both spatial and temporal contexts. By plotting the spatial distribution of temporally-diagnostic projectile point forms across regions and sub-regions, we can compare the evidence in buried, tightly confined contexts with broader land-use patterns. With respect to logistical bighorn hunting, monitoring the distribution of time-sensitive point types permits a comparison between the various rockshelters used as logistical field camps with the hunting catchments they served. There are significant elevational changes in time-diagnostic hunting losses from the terminal middle Holocene through the late Holocene periods. There is also a decreasing use of hunting facilities (such as rock walls and soldier cairns) for bighorn procurement, but communal pronghorn hunts seem to persist from the terminal middle Holocene through the historic era. These shifts likely reflect both the shifting paleoclimatic impacts on bighorn populations and the shift from logistical to residentially-based hunting practices.

The Northern Side-notched form—critical to understanding the middle Holocene *entrada* into the central Great Basin—remains the most poorly-defined type in this (short) chronological sequence. For the purposes of this discussion, I use the Northern Side-notched designation, but remain concerned that considerable (unrecognized) variability still exists in the “large side-notched” category of points of the central Great Basin (per Thomas 1981); more refined typological research is clearly in order here (see also Delacorte and Basgall 2012:68). Additional work is also needed on the Humboldt series, which (in my view) remains ill-defined as a workable time-marker in the Great Basin, despite its abundance (even in datable contexts). We need considerably more (rather than less) focused, directed, and task-specific typological analysis in the future.

Pursuing multiscalar perspectives on chronology requires better controls operating at both millennial/sub-millennial and century scales. In much of the Great Basin (read the “Obsidian Rim”), obsidian hydration has

become an indispensable chronological tool, not only helping to calibrate the time frames of “diagnostics,” but also providing independent stratigraphic controls. In my focus on the central Great Basin (the “Chert Core”), obsidian hydration is not a viable option, meaning that radiocarbon dating is the only alternative for establishing century-scale chronologies.

I previously cited the timely words from Jim O’Connell and Cari Inoway (1994:175–177), who warned that temporal types are merely “empirical generalizations” with “...none of these patterns...explained”—words that ring true two decades later. We now understand that many critical changes in subsistence, technology, social organization, landscape use, and climate change within the western and central Great Basin took place within, rather than between, standard cultural phases based on conventional projectile point typologies.

Within the central Great Basin, the single most important demographic shift in the late Holocene took place with the onset of the post-Neoglacial drought (cal 650 B.C.–cal A.D. 350), when the entire central Great Basin—a vast area covering more than 30,000 square miles—was significantly depopulated (although not entirely abandoned). Gatecliff Shelter was (temporarily) abandoned during this “gap” in the ¹⁴C record, and the first alpine residences were established at Alta Toquima. This hiatus, I believe, signaled the end of logistical hunting patterns (that had dominated for more than five millennia) to one involving family-band, residentially-based foraging that carried forward into the historic period.

But if this chronology is correct, then this pivotal shift in the central Great Basin did not take place between the change-over from Elko to Rosegate series points or the shift from Rosegate to Desert points. Instead, the transition from logistical, band-level organization to family bands happened in the middle of the Elko timespan. It would seem that, three thousand years ago, logistical hunters made and repaired their “diagnostic” Elko series projectile points at Gatecliff Shelter—then a thousand years later, family-based foragers living in residential houses at Alta Toquima were still making identical Elko points. This is an “empirical generalization” I find puzzling.

Similarly, in the Inyo-Mono area, Basgall and Delacorte (2011:21) write that the “conventional,”

projectile point-based sequence of Bettinger and Taylor (1974) is “in serious need of revision at the regional level.” They suggest that the most significant social and demographic changes noted in the past two decades of intensive research did not take place at the Elko (Newberry)-Rose Spring (Haiwee) transition nor at the Rose Spring-Desert series (Marana) shift, but rather *midway through* these respective periods, as defined by temporal point types.

So, too, along the Sierran/Cascade front, where Young et al. (2009:21) argue that a reliance on projectile typology alone “has masked important assemblage and component variation” (see also Hildebrandt and King 2002; Milliken and Hildebrandt 1997). Whereas phase-defining Rosegate/Rose Spring projectile points are pretty much considered as diagnostic of the cal A.D. 650–1300 interval, the most significant changes along the western fringe of the Great Basin take place in mid-Rose Spring times (about cal A.D. 1000). Aware of this problem, McGuire (2000:253) defined a series of “patterns” that cross-cut and refine projectile point chronologies and period/phase level distinctions, including the Middle/Late Archaic Pattern (2,000 to 1,000 cal B.P.), Late Pre-Numic Pattern (1,000 to 500–300 cal B.P.) and Numic Pattern (500–300 cal B.P. to contact). While retaining some reservations about labeling archaeological time frames with linguistic terms, I take his point completely.

All of this reminds me of a recent presentation by a couple of my best students (at a national archaeology meeting) in which they argued against typological approaches, concluding with a slide labeled “Typology”—crossed out with a big red “X.” I understand their concerns, yet strongly disagree with their conclusion. To me, the counter-intuitive outcomes mentioned above firmly underscore the need for intensified (rather than diminished) typological conversations in the Great Basin—and elsewhere.

NOTES

¹This paper is part of a much larger tribute to C. William Clellow. Billy and I met as graduate students, but he was already a rock star on the Berkeley scene. Clellow was not only California cool, but was also fully engaged in the neatest archaeology around. I was in awe of who he was and what he did. Billy knew his Great Basin projectile points stone cold and, working with several other Heizer students (including Marty

Baumhoff, my major professor), to help reframe the way we approach Great Basin archaeology.

²Working with Douglas Kennett and Brendan Culleton (Pennsylvania State University), we have recently conducted a high-precision redating of the Gatecliff Shelter sequence, resulting in a sample size now exceeding 75 ¹⁴C dates (these results are presented in full in Thomas In press a.).

³These data are presented and discussed in detail elsewhere (Thomas In press a.).

⁴For this discussion, I will not consider the “Clipper Gap Concave Base” type (Thomas 1983a), which also defines a middle Holocene time frame, but seems to be difficult to identify and is likely very circumscribed spatially.

⁵For the purposes of this discussion, the “middle Holocene” is defined as the interval (7,000 to 4,000 cal B.C.), followed by the Post-middle Holocene transition (4,000 to 1,500 cal B.C.) and the Neoglacial period (1,500–650 cal B.C.), per the conventions set out elsewhere (Thomas In press a.).

⁶Figure 1 plots the percentage between obsidian source distributions and the archaeological record by plotting the percentage of obsidian utilization for time-sensitive projectile points (from all time periods) recovered from 151 archaeological sites. Scaled at 5% intervals, total black denotes 100% of the projectile points are made of obsidian and total white shows zero obsidian use.

⁷These data are drawn from a database of more than 49,000 projectile points from 247 sites and localities (described in detail in Thomas In press a.). This sample concentrates on the central and western Great Basin, with relevant comparative data added from both the northern and southern Basin, as well as the northern Mojave Desert; samples from the Bonneville Basin are not included here. Roughly one-third of these points were examined first-hand and the rest were drawn from published sources. Projectile point frequencies in Figure 2 are controlled for sample size, per the protocols set out in Thomas (In press a.).

⁸We note the small concentration of stemmed points along the middle Humboldt River (at Treaty Hill, Whirlwind Valley, and Tosawihi quarry); an early Holocene presence is also known from Grass Valley (Beck et al. 2002; Jones et al. 2003:28), but is not plotted here due to the lack of quantitative data.

⁹Specifically, Broughton and colleagues employ general circulation climatic models to reconstruct numerous aspects of past environments near Homestead Cave over the past 14,000 rcy B.P., where artiodactyl fecal pellets decreased as the temperature differential between winter and summer temperatures increased, accompanied by decreasing amounts of summer precipitation. They concluded that the paleozoological record matched their prediction of seasonal extremes and should disadvantage local artiodactyl population densities. Grayson (2011:237) points out that such conclusions require “that we have some faith” in the underlying model,

which he does not. Further, his own test of this model vs. relevant paleoenvironmental evidence is “only partially successful. As a result, we do not know exactly how accurate their model is for the Bonneville Basin.” Grayson (2011:238–289) likewise questions the assumption that the changing abundances of artiodactyl pellets in Homestead Cave accurately monitors local population levels of these animals, and offers a number of compelling alternatives, concluding that whereas the Broughton et al. (2008:238) hypothesis is “intriguing, [t]here are many ways whereby their analysis may be problematic.”

¹⁰As part of our overall analysis of Alta Toquima and the Mt. Jefferson tablelands, we have assembled a database of 3,200 cultural radiocarbon dates, including 520 ¹⁴C determinations from the central Great Basin. Elsewhere (Thomas In press a.) we have dissected these data in much greater detail, but for present purposes we find it useful to highlight the relationship between these multiscalar chronologies and the paleoclimatic model of projected artiodactyl densities.

¹¹At 5,500–4,500 cal B.C., summer-wet conditions triggered recurrent floods and debris flows that repeatedly swept into Gatecliff Shelter at intervals of 150 to 250 years (Davis 1983:84; Melhorn and Trexler 1983:95–97). Decreasing pika frequencies at Gatecliff Shelter after 4,350 cal B.C. are consistent with the establishment of a summer-wet climatic regimen (Grayson 2011:258). This trend is confirmed by numerous independent proxies from Ruby Marsh (Thompson 1990, 1992), Kingston Canyon (Smith 2003), and a host of other localities (Tausch, Nowak, and Mensing 2004; Wigand 2010; Wigand et al. 1995; Wigand and Rhode 2002).

¹²Northern Side-notched points have also been called Bitterroot Side-notched in Idaho (Butler 1962), Cold Springs Side-notched on the Plateau (Holmer 2009:21), and Madeline Dunes Side-notched in northeastern California (Riddell 1960).

¹³Beck (1995:226, Fig. 4) also commented on the virtual absence of large side-notched points in the central, western, and southwestern areas; while this is true for the sample of 17 sites she employed, the expanded data set employed in Figure 4 demonstrates their considerable abundance in the central core of the Great Basin.

¹⁴The point distributions are presented here as raw frequencies (rather than corrected for sample size, as in Fig. 2).

¹⁵Post-2,900 cal B.C., both Gatecliff and Triple T shelters return to more fluvial conditions, with voluminous debris flows taking place every 150 to 300 years. This was an interval of increased summer-wet precipitation, perhaps in about the same amount as at present (see also Kautz 1988:251).

¹⁶Drought cycles struck throughout the interior of western North America between 600 cal B.C. and cal A.D. 300 (Stine 1994; Benson et al. 2002; Wigand 2006:2,776), with considerable evidence of lessened precipitation and lowered lake levels (Tausch, Nowak, and Mensing 2004; Wigand and Rhode 2002). The post-Neoglacial Drought was also characterized

by a “dramatic winter-wet event” centered between 100 cal B.C. and cal A.D. 100 (Wigand 2006:2,776). Woodrat middens from the Toiyabe Range also show a local extinction of riparian species during an apparently severe drought, and sedge meadows in the Toiyabe Range convert to dry grassy flats at 150 cal B.C. (Tausch et al. 2004).

¹⁷I am indebted to my friend Bob Bettinger for suggesting this label.

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