Chapter 5

Technology and Economy among the Earliest Prehistoric Foragers in Interior Eastern Beringia

Ben A. Potter[1], Charles E. Holmes[1], and David R. Yesner[2]

ABSTRACT
In the past decade, the archaeological record of eastern interior Beringia has seen a transformation in our understanding of the earliest foragers. This presentation focuses on new sites, data, and interpretations of technology and economy from the region, including emerging models of landscape use and settlement systems. Patterns of technological continuity and discontinuity from adjacent regions are evaluated. Pre– and post–Younger Dryas occupations can be distinguished in eastern Beringia, although the signatures of these occupations relate more to changes in behavioral organization and land use than to stylistic changes in technology. Intrasite and intersite patterning in lithic assemblages appears to reflect seasonal or activity-specific variation. Regional variation (e.g., differences between interior and north Alaskan assemblages) may reflect colonization patterns on a larger scale, including distinct populations and timing/direction of colonization, though with some inter-regional technological linkages (e.g., microblade technology). Clovis ancestors may be present in Beringia, but they are not easily distinguished through material culture patterns. Faunal analyses presented here indicate subsistence economic change through time, including (1) relatively broad diet breadth in the Bølling-Allerød period, (2) increased diet breadth during the Younger Dryas, and (3) narrowing diet breadth during the post-Younger Dryas/early-Holocene period. This appears to be a Beringia-wide phenomenon that reflects broad effects of climate change and possibly episodic colonization. These data are used to evaluate technological and economic adaptations relating to the initial colonization of Beringia and subsequent expansion into different ecological niches during the Younger Dryas.

KEYWORDS: Beringia, Younger Dryas, Faunal analysis, Paleoeconomy, Technological organization

Introduction

Central Alaska (in eastern Beringia) contains one of the densest concentrations of late-Pleistocene and early-Holocene sites in the Western Hemisphere (Potter 2011). A total of 46 components older than 10,000 cal yr BP have been reported at 33 sites within the Tanana basin, including 8 sites within the upper Nenana basin (Table 5.1, Figure 5.1). This dataset provides a counterpoint to Clovis complex analyses that tends to dominate the Paleoindian literature (Meltzer 2009; see also Hoffecker and Elias 2007). Given that many of the Beringian sites have been recently discovered and analyzed, these data have not been well integrated into a broader understanding of colonization of the New World. Ongoing investigations by Potter at Upward Sun River, Mead, and Gerstle River (Potter 2005; Potter et al. 2011a, 2011b), by Holmes at Swan Point and Eroadaway (Holmes 2011, Holmes et al. 2010), and by Yesner and Easton at Little John and Broken Mammoth (Easton et al. 2011; Yesner et al. 2011) have pro-

[1] University of Alaska Fairbanks
[2] University of Alaska Anchorage
Corresponding author e-mail: [1]bapotter@alaska.edu

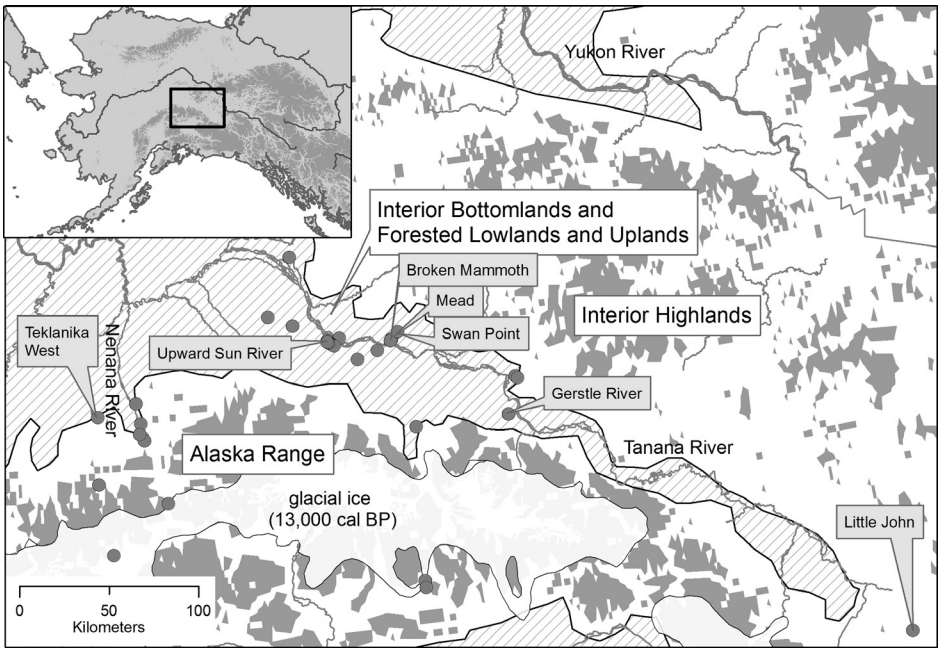

Figure 5.1 Map of Tanana valley and surrounding ecoregions showing the locations of sites dating between ~14,000 and 10,000 cal yr BP. Ecoregions from Gallant et al. (1995), shaded areas above 1000 m asl.

vided substantial new information on technological and subsistence strategies and paleoenvironments of the first Alaskans. Recent work by Gelvin-Reymiller and Reuther (Wooller et al. 2012) has revealed multiple late-Pleistocene sites near Quartz Lake, central Tanana basin. Additional work in the upper Nenana basin at Owl Ridge and Dry Creek (Graf and Bigelow 2011, Graf and Goebel 2009) has largely substantiated and expanded upon earlier interpretations (Phippen 1988; Powers et al. 1983). In addition, a number of previously excavated sites have been re-analyzed, resulting in considerably older occupations: Teklanika West (Coffman and Potter 2011), Carlo Creek (Bowers and Reuther 2008), and Eroadaway (Holmes et al. 2010).

In this paper, we summarize the state of current research at several early components at Mead, Swan Point, and Broken Mammoth sites, and offer our perspectives on subsistence economies and technological organization. We also offer a broad perspective on changes through time in these and other sites in central Alaska, with particular focus on the transition from the earliest components (pre-Clovis or Clovis-age) in the Bølling-Allerød interstadial (~14,700–12,900 cal yr BP) to later components associated with the Younger Dryas chronozone (~12,900–11,500 cal yr BP) and post-Younger Dryas / early Holocene (~11,500–10,000 cal yr BP). While the effects of the Younger Dryas have been debated for central Alaska (see review in Kokorowski et al. 2008; see also Graf and Bigelow 2011), these periods reflect changing environmental conditions for Beringian inhabitants.

Currently, interpretations of eastern Beringian assemblage variability for these periods generally follow two patterns:

1) multiple traditions derived from technological-typological assignments (e.g., Nenana, Chindadn, Mesa, and Denali complexes) (Goebel et al. 1991; Hoffecker 2011; Hoffecker et al. 1993), or
2) a single broad technological tradition where land use and mobility patterns structure assemblage variation (Holmes 2001; Potter 2011; West 1996).

The role of subsistence economy, land-use patterns, and seasonality generally remain poorly linked with technological datasets (Graf and Bigelow 2011; Potter 2008, Yesner 1996, 2006, 2007). We evaluate competing interpretations with new intrasite and intersite data from the lowest cultural zones (CZ4) at Mead, Swan Point, and Broken Mammoth, allowing for investigation of intrasite spatial patterning of lithics, fauna, and features to help elucidate conditioning factors of assemblage variability, and understand broader patterns of adaptation, including the initial colonization of Beringia.

Mead Site

Archaeological investigations at Mead (totaling 128 m^2) have focused on understanding organizational properties, isolating activity areas, and evaluating recurring modes of organization (Potter et al. 2011b). The site is well stratified with a concordant suite of 37 radiocarbon dates, and the lowest components/cultural zones (CZ3b, CZ4, and CZ5) are relatively undisturbed by post-depositional disturbances (Potter et al. 2011b, see also Dilley 1998; Gilbert 2011). Cultural zones 4 and 5 date to the Bølling-Allerød interstadial (13,440–13,200 and 13,110–12,790 cal BP) while CZ3b dates to the Younger Dryas stadial (12,120–11,850 cal BP) (Potter et al. 2011b).

A plan view for all cultural materials associated with CZ4, i.e., directly associated with the lower paleosol complex, is illustrated in Figure 5.2. Three hearths yielded statistically similar ages at ~11,100 ^{14}C yr BP (13,100–12,800 cal yr BP) (Table 5.2). Three lithic activity areas and four large but dis-

Table 5.1 Late-Pleistocene and early-Holocene components in the Tanana basin.

Site	Component	Age, ^{14}C yr[1]	No. ^{14}C dates	Age, cal yr BP[2]	Excavation area (m^2)	Reference
Swan Point	CZ4	12,160 ± 20	8	14,150–13,870	65	Holmes 2011; this paper
Little John	Sub–paleosol	12,020 ± 70	1	14,050–13,720	~100	Easton et al. 2011
Mead	CZ5	11,460 ± 50	1	13,440–13,200	156	Potter et al. 2011b; this paper
Broken Mammoth	CZ4	11,440 ± 60	2	13,430–13,160	326	Holmes 1996
Upward Sun River	C1	11,320 ± 30	3	13,300–13,120	12	Potter et al. 2011a
Walker Road	C1	11,220 ± 90	3	13,310–12,850	200	Goebel et al. 1996
Moose Creek	C1	11,190 ± 60	1	13,270–12,880	50	Pearson 1999
Linda's Point		11,100 ± 40	2	13,120–12,780	13	Sattler et al. 2011
Dry Creek	C1	11,120 ± 90	1	13,210–12,730	347	Powers et al. 1983
Owl Ridge	C1	11,100 ± 60	2	13,140–12,750	27	Phippen 1988; Graf and Bigelow 2011
Mead	CZ4	11,080 ± 20	5	13,110–12,790	156	Potter et al. 2011b; this paper
Bachner	C1	11,030 ± 70	1	13,100–12,700	<4	Wooller et al. 2012
Teklanika West	C1	11,000 ± 40	2	13,070–12,700	12	Coffman and Potter 2011
Eroadaway		10,890 ± 40	1	12,910–12,630	8	Holmes et al. 2010
FAI–2043[3]		11,600 ± 50 10,730 ± 40		13,620–13,300	<4	Gaines et al. 2011; Esdale et al. 2012
Moose Creek	C2	10,500 ± 60	1	12,730–12,560	50	Pearson 1999
Mead	CZ3	10,270 ± 20	5	12,120–11,850	156	Potter et al. 2011b
Broken Mammoth	CZ3	10,290 ± 70	1	12,400–11,780	326	Holmes 1996
Owl Ridge	C2	10,490 ± 30 to 10,020 ± 40	13	12,580–12,230 11,740–11,310	27	Phippen 1988; Graf and Bigelow 2011
Phipps		10,230 ± 70	1	12,380–11,630	?	West et al. 1996a
Upward Sun River	C2	10140 ± 40	2	11,990–11,510	61	Potter et al. 2011a
FAI–2077		10,130 ± 50	1	12,010–11,410	?	Gaines et al. 2011; Esdale et al. 2012
Swan Point	CZ3	10,080 ± 40	3	11,960–11,400	60	Holmes 2008
XBD–308		10,050 ± 70	1	11,960–11,280	5 test pits	Potter 2008
XBD–338	C1	Pre 10,000[4]			9 test pits	Potter 2008
XBD–338	C2	10,000 ± 80	1	11,820–11,240	9 test pits	Potter 2008
Upward Sun River	C3	9990 ± 30	3	11,610–11,280	61	Potter et al. 2011a
Whitmore Ridge	C1	9950 ± 40	3	11,600–11,250	40	West et al. 1996b
Little Delta River #3		9920 ± 60	1	11,610–11,220	4	Potter et al. 2007a
Panguingue Creek	C1	9890 ± 50	3	11,600–11,200	100	Powers and Maxwell 1986
Carlo Creek	C1	9880 ± 20	6	11,320–11,230	45	Bowers and Reuther 2008
Gerstle River	C1	9740 ± 40	1	11,240–11,100	175	Potter 2005
Dry Creek	C2	9660 ± 30	9	11,190–10,810	347	Powers et al. 1983; Bigelow and Powers 1994
Healy Lake Village	Chindadn	9580 ± 110	2 hearths	11,200–10,590	409	Cook 1996
Little John	Paleosol	9510 ± 20	6	11,070–10,700	~100	Easton et al. 2011
Gerstle River	C2	9450 ± 40	2	11,060–10,570	184	Potter 2005
XBD–303		9340 ± 80	1	10,740–10,280	6 test pits	Potter 2008
XBD–312		9290 ± 50	1	10,650–10,290	4 test pits	Potter 2008
Sparks Point		9170 ± 50	3	10,490–10,230	?	West et al. 1996c
Chugwater	C2	9080 ± 90	2	10,500–9920	400	Maitland 1986; Lively 1996
XBD–306		8930 ± 90	1	10,240–9710	4 test pits	Potter 2008
Gerstle River	C3	8880 ± 20	9	10,160–9910	205	Potter 2005
Upward Sun River	C4	8870 ± 30	2	10,170–9800	61	Potter et al. 2011a
Teklanika West	C2	8820 ± 40	1	10,150–9700	12	Coffman and Potter 2011

[1] Average of securely associated C14 dates (based on Potter 2008 or more recent references).

[2] Intcal09 curve, Calib 6.1.0.

[3] FAI–2043 (Esdale et al. 2012) has two stratigraphically associated C14 ages in depth order, but it is unclear which of the two relates to the lithic and faunal material (which includes bison, hare, and waterfowl). It is not included in these analyses.

[4] ~11,300 based on stratigraphy

persed faunal scatters have been defined. A total of ~1500 flakes, 4 flake cores, and 22 tools have been recovered, including 15 modified flakes, 2 burins on snaps, 3 long-axis beveled flakes (e.g., sidescrapers), and 2 bifaces (Figure 5.3). One organic tool, an antler billet, was recovered.

The Mead CZ4 lithic assemblage is dominated by local raw materials (82% by flake count, and 97% by weight) supplemented by non-local materials such as obsidian (Little 2013). Most of the tools are expediently produced modified flakes, and formal tools are almost absent, represented by only two bifaces. Early and middle stages of biface thinning are evident in the chert materials, but the recovered bifaces were from other materials, suggesting that chert bifaces were removed from the site. Broken Mammoth CZ4 produced no complete bifacial tools, and the Swan Point CZ4 bifaces are microblade core preforms. Thus the Mead CZ4 bifaces are the earliest well-dated mid-Tanana basin bifacial projectile points/knives. One point is a convex-base point or knife with limited edge grinding and possible impact damage on the distal end; the other, a triangular-point base, was manufactured from a chalcedony flake. This specimen is similar to small triangular points recovered at Younger Dryas components at Swan Point and Broken Mammoth (CZ3), the former associated with microblades (Holmes 2011). This provides another connection between components dating to the Bølling-Allerød and Younger Dryas, and further supports the interpretation of a single broad cultural tradition bridging these periods.

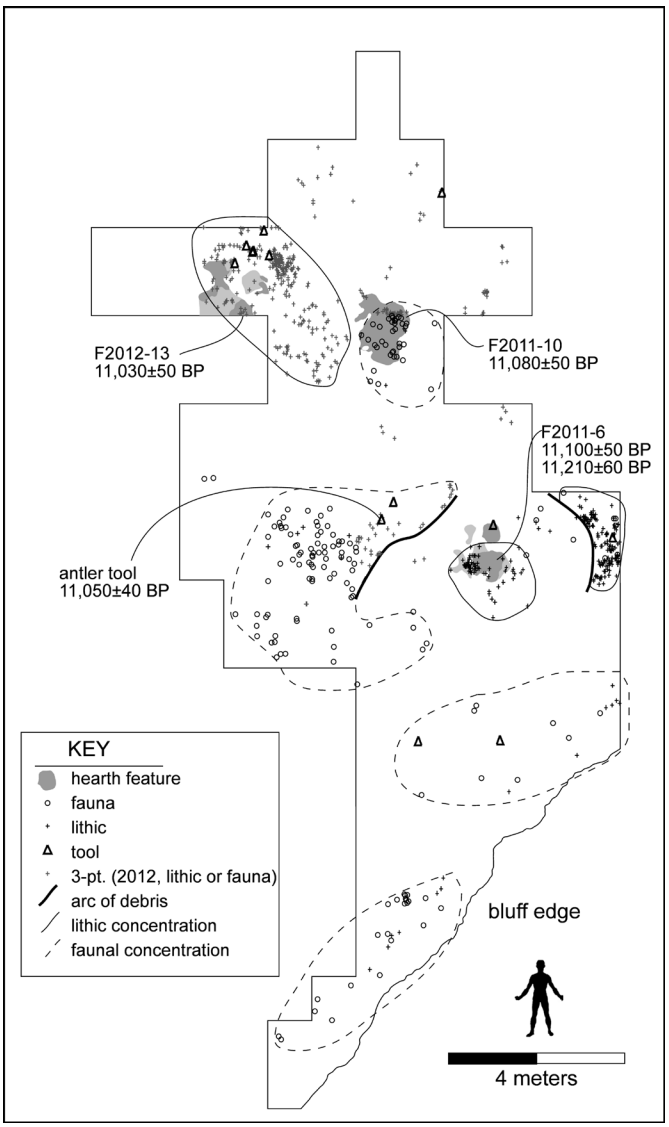

Figure 5.2 Mead CZ4 plan view showing lithics, fauna, and radiocarbon dates.

Many usable flakes (> 2 cm) exhibit no use wear (contrasting with Gerstle River), and there is a relative lack of curated or refurbished formal tools. Gearing-up events (Binford 1979) are absent at Mead CZ4, suggesting more of a forager pose (i.e., maintaining toolkits on an ad-hoc, as-needed basis) (Bousman 1993). Obsidian was present in both Mead CZ4 and CZ3b and all are from Wiki Peak, ~350 km southwest of the site (Potter et al. 2013). This may indicate specific routes of movement for these early populations—essentially east-west from the middle to upper Tanana River valley.

Mead CZ4 lithic patterns contrast with Gerstle River C3, a logistically organized hunting camp dominated by weapons technology (microblades inset in composite points) (Potter 2005). At Gerstle River, there is evidence of embedded procurement of a wide range of materials (~30 types) and similar late stages of bifacial and unifacial tool maintenance as well as microblade production. This contrasts with Mead CZ4 with < 10 material types that are very unevenly distributed and reflect earlier stages of lithic reduction, particularly the local quartz, and relatively lower mobility for site occupants.

While hundreds of faunal fragments have been recovered at Mead CZ4, most are fragmented, but 19 NISP were identified (Table 5.3). Detailed faunal analyses are rare for this period, but Mead CZ4 contrasts strongly with Gerstle River C3 patterns (Potter 2007). At Gerstle River, bison and wapiti were killed nearby, then taken to the site and processed; high meat-yield elements were taken from the site, presumably to a base camp, and low-yield elements were left at the site. Marrow was extracted in the contexts of small hearths, but only elements yielding the greatest marrow were processed, and 28% of NISP were complete elements (Potter 2007). At Mead CZ4, very large ungulate fauna (NISP = 13) exhibit a positive relationship between abundance and bison protein index (from Emerson 1990). Importantly, there is an absence of typically preserved low-yield elements, like metapodials, commonly found in early field processing sites like Gerstle River. The Mead CZ4 assemblage has higher abundance of ribs, approximately six times higher %MAU values compared with Gerstle River, and vertebrae and upper limbs are moderately well represented. At Mead CZ4, none of the very large ungulate elements were complete, and there is no articulation. Thus Mead fauna underwent more processing, likely occasioned by consumption events, and these patterns are consistent with residential camps. Given faunal and lithic patterns described above, Mead CZ4 is interpreted to be a mixed foraging camp with a varied subsistence base, where locally

Table 5.2 Mead CZ4 and CZ5 radiocarbon dates[1].

Beta Lab no.	Material	Feature	^{14}C yr BP	Cal yr BP (2σ)[2]
342930	Wapiti antler tool	N/A	11,050 ± 40	13,100–12,740
337174	Hearth charcoal (*Betula* sp.)	F2011-10	11,080 ± 50	13,120–12,750
337172	Hearth charcoal (unknown, not *Picea* sp.)	F2011-6	11,100 ± 50	13,130–12,770
264530	Hearth charcoal	F2011-6	11,210 ± 60	13,220–12,970
337181	Hearth charcoal (*Populus/Salix*)	F2012-13	11,030 ± 50	13,090–12,720
59121	Charcoal (stratigraphic)	N/A	11,560 ± 80	13,630–13,250
59120	Charcoal (stratigraphic)	N/A	11,600 ± 60	13,630–13,290
264522	Bone collagen (*Bison* sp.)	N/A (CZ5)	11,460 ± 50	13,400–13,200

[1] From Potter et al. 2011b, except Beta 342930, 337172, 337174, 337181, this paper.
[2] Intcal09 curve, Calib 6.1.0.

available small game and waterfowl were exploited. Large ungulates like bison were transported to the site already processed to some extent, probably from logistically organized spike camps like Gerstle River.

The Mead CZ4 fauna is broadly similar to that recovered from Mead CZ3b, associated with 10 hearths, dating to ~10,270 ^{14}C yr BP (12,120–11,850 cal yr BP), which also yielded a highly fragmented assemblage, including 46 NISP (Table 5.3). One important addition is a single vertebra of *Oncorhynchus* sp. fish recovered in 2012 (the entire 2012 faunal assemblages have not been fully analyzed). Smaller-bodied caribou and sheep-sized ungulates are notably absent in all early Mead assemblages. Steppe bison predominates the faunal record for CZ5, CZ4, and CZ3b, spanning multiple periods of climatic change. Faunal patterning is further discussed below in context with broader regional datasets.

Arcs of debris are evident surrounding Hearth feature 2011-6. Space maintenance is considered indicative for longer-term occupation and re-occupation (Stevenson 1991). Lithic materials directly associated with Hearth 2011-6 indicate tool maintenance of non-local materials (Little 2013), contrasting with the primary reduction of local (on-site) quartz elsewhere. The arcs of debris may border a residential structure (e.g., surface tent), and Hearth 2011-6 may represent an indoor hearth. Faunal patterning also supports the interpretation of CZ4 as a residential base camp (see above). Coupled with the spatial data, the dispersed bone clusters around this feature may reflect bone dumps after on-site consumption events. The space outlined by the arcs of debris is ~3.7 m x 4.3 m, with an estimated area of ~12.5 m^2. This is roughly comparable to the Upward Sun River C3 structure, fully excavated in 2011, also with a central hearth, with an area estimated at ~13.7 m^2 (Potter 2012). Another potential east Beringian residential structure (tent) may be present at Walker Road, defined there by circular distribution of lithics around a hearth (Goebel and Powers 1989; Higgs 1992).

Table 5.3 Mead CZ4 and CZ3b faunal summary, 2009-2011 (NISP).

Taxon	CZ4	CZ3b	Total
Bison priscus (*steppe bison*)	5	10	15
Cervus canadensis (wapiti)	1[1]	-	-
Alces alces (moose)	-	1	2
Lepus sp. (hare)	-	2	2
Urocitellus parryi (ground squirrel)	-	2	2
Canid	1	7	8
Unidentified very large mammals	9	14	22
Unidentified small mammals	1	4	5
Total mammals	**17**	**40**	**57**
Waterfowl (duck-sized)	-	1	1
Waterfowl (goose-sized)	2	3	5
Total birds	**2**	**5**	**7**
Total fish	-	**1**	**1**
Total NISP	**19**	**46**	**61**

[1]This specimen is an antler tool.

Swan Point

Swan Point excavations totaling 65 m^2 have yielded substantial technological and faunal information for components dating to both the Bølling-Allerød (CZ4) and Younger Dryas (CZ3) (see Holmes 2011). Radiocarbon dates associated with two hearths clearly indicate a Bølling-Allerød age of about 12,160 ^{14}C yr BP (14,150–13,870 cal yr BP) (Table 5.4), and along with extensive refits between hearths (see below), indicate contemporaneity of the CZ4 occupation. The CZ4 assemblage has been assigned by Holmes (2001) to the East Beringian tradition, Diuktai phase, while the CZ3 assemblage has been assigned to the later Chindadn phase.

The Swan Point CZ4 lithic-tool assemblage was based almost entirely on microblade and burin technology. Microblades were made on cores prepared by the Yubetsu/Diuktai technique (Gomez Coutouly 2012) from bifacially shaped blanks (Figure 5.4). Burins of various styles (e.g., transverse and dihedral) were produced on unifacially trimmed flakes. Burin use is apparent across the site, with discarded burins and burin spalls focused around hearths. Several burins have been fitted to series of sequential spalls, demonstrating that a burin was used and rejuvenated at one location but later discarded at another location (Figure 5.6B). CZ4 burins could be used a number of ways: to cut grooves or channels of varying widths and depths; to carve or whittle; or to scrape or

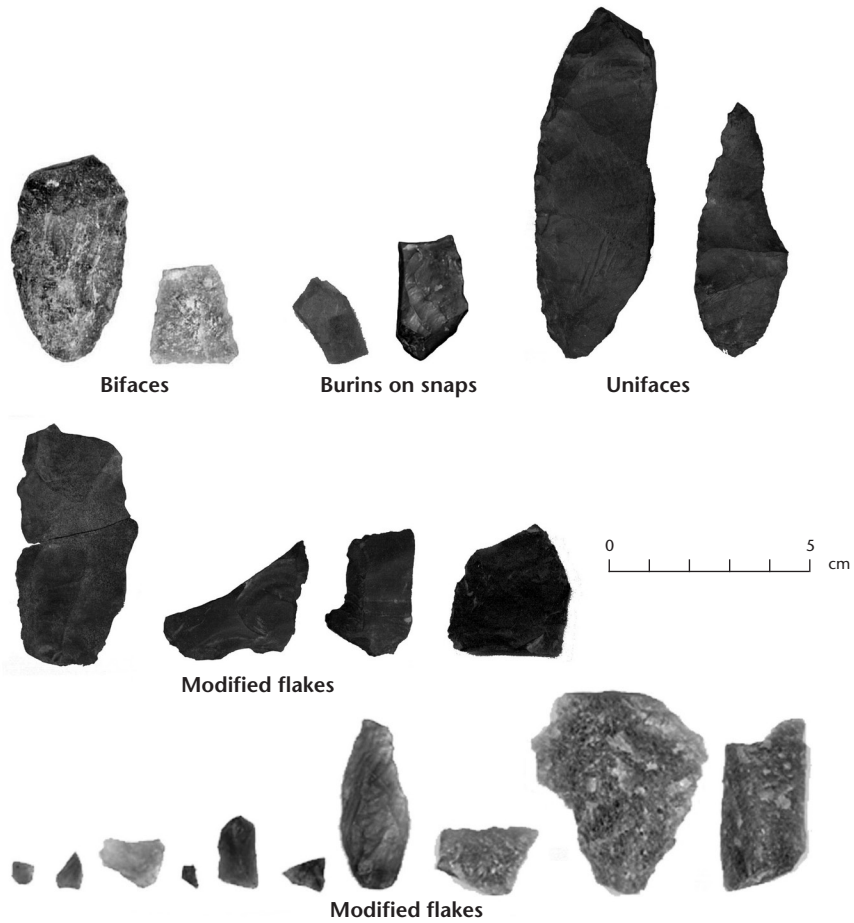

Figure 5.3 Mead CZ4 tools.

plane. The application depends on the configuration of burin facets and the bulk and thickness of the burin.

These tools were fundamental to the acquisition of antler- and ivory-bearing animals and the subsequent processing of these materials into useful objects. The production of microblades and the use of burins are evident in the distribution of lithic artifacts in and around hearths (Figure 5.6). Both antler and ivory would have played an important role in material culture, being substitutes for wooden handles, shafts, traps, etc., in an environment where wood was scarce. The absence of bifacial projectile points and the abundance of microblades support the hypothesis that hunting weapons were made with microblades inset in bone, ivory, or antler projectiles. The dominant lithic material in CZ4 is

Table 5.4 Swan Point CZ4 radiocarbon dates[1].

Lab no.	Material (letter refers to Figure 5)	Feature	^{14}C yr BP	Cal yr BP (2σ)[2]
CAMS-17405	**A** Mammoth ivory tusk collagen		12,060 ± 70	14100-13750
AA-19322	**B** Soot/residue on microblade core tablet	Hearth 1a	11,770 ± 140	13900-13330
Beta-175491	**C** Residue (carbonized fat/grease)	Hearth 1a	12,110 ± 50	14120-13800
Beta-QA-619	**D** Hearth charcoal (Populus/Salix)	Hearth 1b	12,040 ± 40	14020-13770
Beta-170457	**E** Residue (carbonized fat/grease)	Hearth 1b	12,360 ± 60	14910-14050
AA-74249	**F** Horse molar collagen		11,950 ± 100	14030-13490
AA-74251	**G** Mammoth ivory tusk collagen		12,050 ± 120	14230-13500
Beta-209883	**H** Residue (carbonized fat/grease)		12,100 ± 40	14100-13800
Beta-209884	**I** Residue (carbonized fat/grease)	Hearth 2	12,220 ± 40	14480-13870
Beta-209882	**J** Hearth charcoal (Populus/Salix)	Hearth 2	12,290 ± 40	14850-13970
AA-74250	**K** Mammoth molar collagen	Hearth 2	12,110 ± 120	14530-13680
AA-98488	**L** Mammoth ivory tusk collagen		12,500 ± 150	15160-14100

[1]From Holmes 2011, except AA-98488, this paper,
[2]Intcal09 curve, Calib 6.1.0.

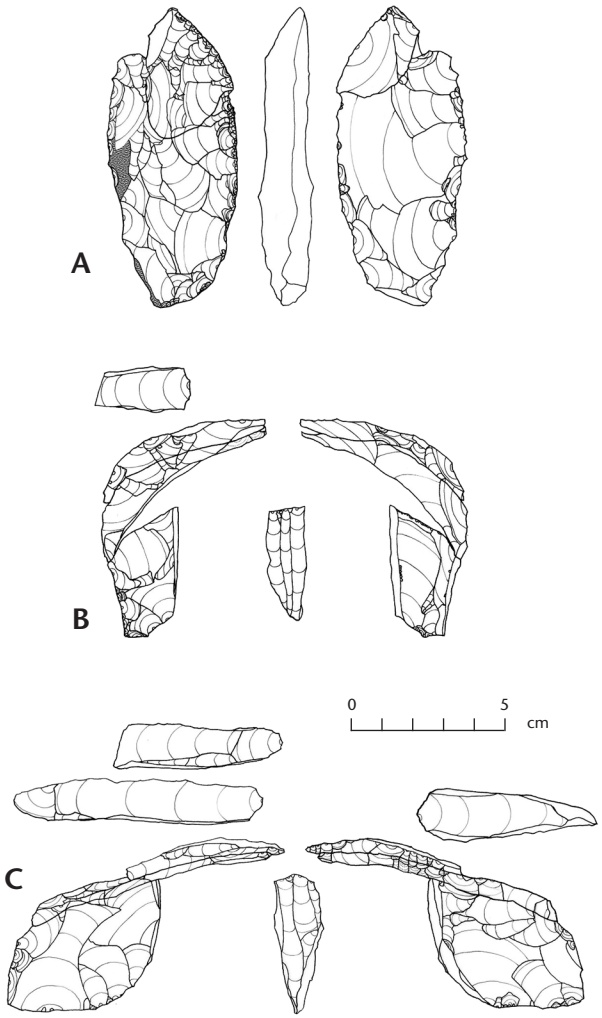

Figure 5.4 Yubetsu/Diuktai technique at Swan Point CZ-4: **A**, biface blank preform; **B**, microblade core with a refit platform rejuvenation ski spall and a ridge spall; **C**, microblade core with two refit ski spalls. Illustrated by Yu Hirasawa.

grayish green basalt, but obsidian (all geochemically sourced to Group H, with an unknown source) is present in the form of microblades (Speakman et al. 2007).

A major activity at the site was reducing mammoth tusks into smaller pieces, presumably to manufacture tools and other objects. The site is littered with small, 5–25 cm long, unworked ivory fragments, e.g., as many as 80/m^2. Rare worked pieces and large broken tusk segments are present as well. One nearly complete tusk from a ~15-year-old female (based on annual growth indicators along the exposed dentine surface) had had a long piece removed by the groove-and-splinter method (Figure 5.5): Burins were used to groove parallel longitudinal channels through the exterior cementum of the tusk that allowed the piece to be removed. The presence of multiple mammoth remains (a ~15-year-old female, a ~5-year-old juvenile, and a < 1-year-old baby) suggests selective hunting.

A scatter of mammoth molar plates associated with one of the hearth features appear to be from unfused molars belonging to a juvenile or young adult mammoth, perhaps resulting from breaking the maxilla to remove the tusks. Other mammoth remains include two crypt bones, a pair of molars from a 5-year-old, and several ribs belonging to a < 1-year-old (Holmes et al. 2012). What appears certain is that selected anatomical parts of several individual mammoths were brought to the site for further use.

Antler, likely wapiti, was also reduced for further treatment, possibly split apart by a wedge. The two matching pieces of antler appear to have been polished following their separation.

Horse is represented by dentition (Holmes 2011). At least two mandibular premolars that may not have been fully erupted were found between two hearth areas. The horse evidence at Swan Point is significant in part because it is the youngest dated occurrence of Pleistocene horse in Alaska. Faunal remains at the southeastern extent of the excavation

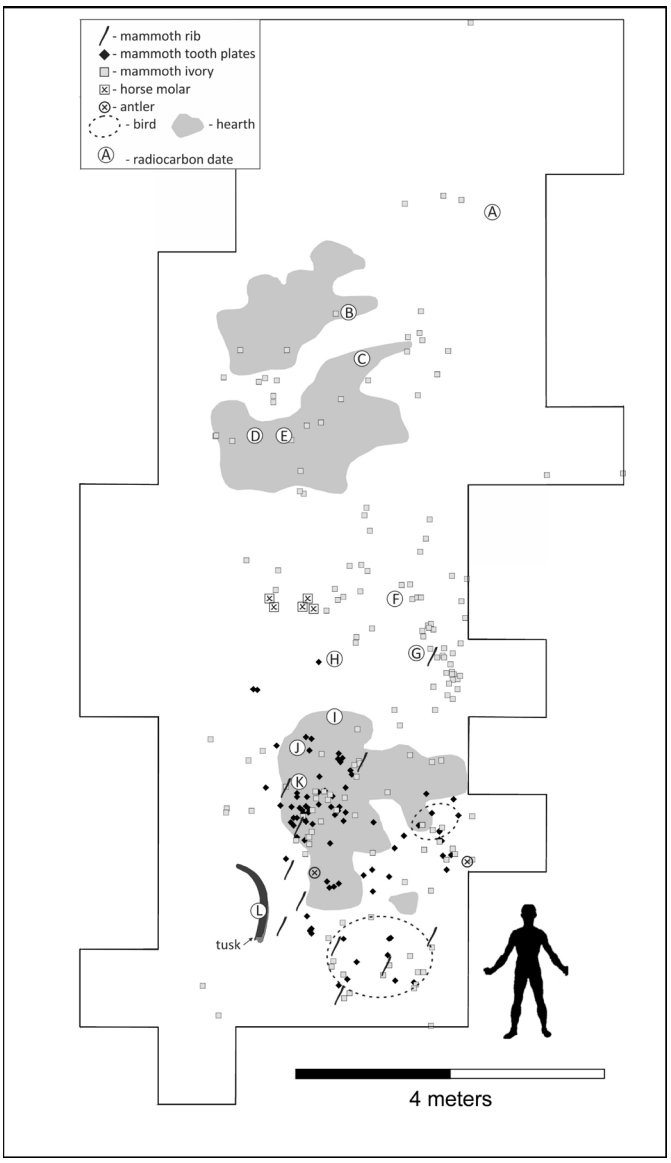

Figure 5.5 Swan Point CZ4 fauna and radiocarbon dates (refer to Table 5.4 for dates).

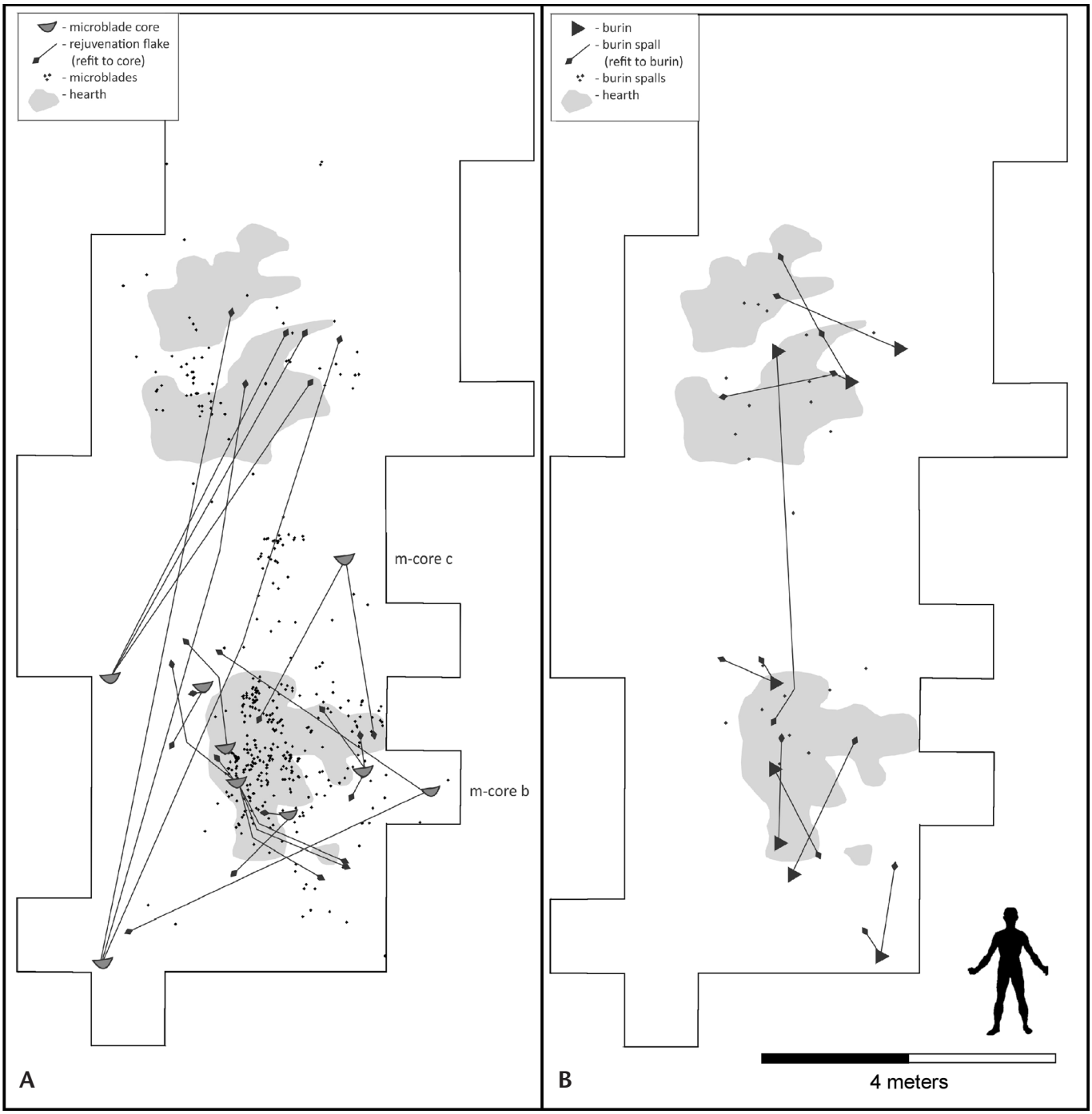

Figure 5.6 Swan Point CZ4 refits. **A,** microblades, microcores, and ski spalls, **B,** burins and burin spalls.

suggest people were hunting waterfowl and upland birds (Figure 5.5). Other small mammals, e.g., hare, are likely represented as well, but poor preservation and high fragmentation render them difficult to identify. The fact that bones were used extensively to fuel the camp fires (Crass et al. 2011; Kedrowski et al. 2009) is another variable in the taphonomy at Swan Point, where both natural and cultural processes influence the biotic record.

Unlike the microblade-dominated lithic technology of Swan Point CZ4, the Younger Dryas and later period in the Tanana valley is based principally on bifacial tools, though microblades are found within the Swan Point CZ3 horizon (Holmes 2008, 2011). A broad range of small bifacial projectile forms first appear at Swan Point and Broken Mammoth in CZ3. These biface tools are often called or compared to Chindadn points (Cook 1969, 1996; Holmes 2001). Similar bifaces, typically made on flakes without invasive retouch, have been documented at other sites in the mid-Tanana valley (e.g., Healy Lake) and the Nenana valley, defining along with the absence of microblades, the Nenana complex. Microblade technology

in the Younger Dryas period, e.g., Moose Creek C2 (Pearson 1999), Tangle Lakes sites (West 1981), was transformed from Yubetsu/Diuktai technique to the Campus technique, and has been referred to as the Denali complex (West 1967, 1975).

Broken Mammoth

After the initial discovery of well-preserved archaeofaunas and hearths in the lower units of the Broken Mammoth site in 1989, and subsequent discovery of well-preserved organic tools, excavations (1990–93, 1998, 2000, 2002, 2005, 2010) focused on reconstructing late-Pleistocene/early-Holocene subsistence and behavioral organization at the site (Yesner 1996, 2001). A total of 408 m^2 was excavated, encompassing about 82% of the surface area of the terrace, allowing for analysis of intrasite distributions of hearths, lithics, and fauna, and reconstructing subsistence economy (Krasinski and Yesner 2008). The site is highly stratified, with four major components, two of which date to the late-Pleistocene period (Table 5.1). A suite of seven radiocarbon dates is available for this unit, all of them in stratigraphic sequence (Table 5.5). The lower components are linked to paleosol complexes and are relatively free from post-depositional disturbance (Dilley 1998; Crossen et al. 1993). CZ4 dates reliably to ~11,440 ^{14}C yr BP (~13,440–13,200 cal yr BP) based on several AMS dates, including two hearth dates. A distinct lower paleosol stringer, resting on the basal sand underlying the loess, has two dates of 11,770 ^{14}C yr BP (~14,060–13,210 cal yr BP).

Plan views for cultural materials associated with Broken Mammoth CZ4 from 1990–2005 are illustrated in Figure 5.7. Three well-defined hearths were uncovered in CZ4, with at least 11 less well defined hearths and hearth smears. In addition, 3 distinct lithic manufacturing areas were recovered in CZ4, all deriving from reduction of quartz ventifacts. A total of 802 lithics have been recovered from CZ4, including 13 unifacial convex scraper-planes, 2 smaller unifacial endscrapers, 2 unifacial sidescrapers, and 5 quartz flake cores. The higher cortex frequency in CZ4 lithics (38% of a sample of 258 lithics), compared with CZ3 lithics (8% out of a sample of 1,234 lithics), supports the notion that local materials were being used for on-site tool production. Although the formal artifacts and workshops largely comprised quartz ventifacts, chert and basalt constitute 42% of the total lithic inventory at CZ4.

Despite the differences in lithic sources in CZ4 and CZ3, reflecting a shift from a more expedient, highly local assemblage to one derived from cherts, there are basic continuities in the overall lithic assemblage. These include unifacial tools (end- and sidescrapers), cobble tools, and the mammoth-ivory foreshafts. As at Mead, it is possible to argue that the lithic assemblage at Broken Mammoth temporally spans the Younger Dryas boundary. Whether or not there was regional site abandonment during the early part of the Younger Dryas (~12,800 to 12,100 cal yr BP), it appears that the occupations were closely related.

The faunal sample from Broken Mammoth makes the continuities more apparent. It is clear that the basic focus of human subsistence pre– and post–Younger Dryas was bison and wapiti, particularly the former. Bison contributed 11% of the megafaunal assemblage from CZ4 and 73% of the much larger megafaunal assemblage from CZ3, based on NISP (Yesner 2013; see Table 5.6). Wapiti were also prevalent during the post–Late Glacial Maximum Poplar Rise, contributing 77% of the megafaunal assemblage from CZ4 and 19% from CZ3. Moose contributed slightly to the CZ4 assemblage, and caribou to the CZ3 assemblage. The latter may reflect a shift from more mesic to colder, more arid conditions in the Younger Dryas, a fact reflected by the prevalence of waterfowl in CZ4, particularly tundra swans, white-fronted geese, and a variety of dabbling ducks. In addition, the presence of otter, muskrat, and beaver in CZ4 and marmot, pika, ground squirrel, and wolf in CZ3 may reflect changing climate conditions in the Bølling-Allerød vs. Younger Dryas periods. In

Table 5.5 Broken Mammoth CZ4 radiocarbon dates.

Lab no.	Material	Cultural zone	^{14}C yr BP	Cal yr BP (2σ)[1]
WSU-4265	Charcoal (stratigraphic)	CZ4a	11,280 ± 190	13,490–12,690
CAMS-5358	Hearth charcoal	CZ4b	11,420 ± 70	13,420–13,140
CAMS-5358	Bone collagen (swan)	CZ4b	11,500 ± 80	13,560–13,170
WSU-4262	Hearth charcoal	CZ4b	11,510 ± 120	13,650–13,140
AA-17601	Tusk collagen (mammoth)	CZ4b	11,540 ± 140	13,720–13,140
WSU-4351	Charcoal (stratigraphic)	CZ4c	11,770 ± 210	14,060–13,210
WSU-4364	Charcoal (stratigraphic)	CZ4c	11,770 ± 220	14,100–13,180

[1]Intcal09 curve, Calib 6.1.0.

Table 5.6 Large-medium mammal diversity (NISP) at Broken Mammoth.

Taxon	CZ4	CZ3
Bison priscus	21	333
Cervus canadensis	144	87
Rangifer tarandus	0	6
Alces alces	4	0
Ovis dalli	0	11
Canis lupus	0	1
Alopex lagopus	13	18
Lutra canadensis	6	0
Total	**188**	**456**

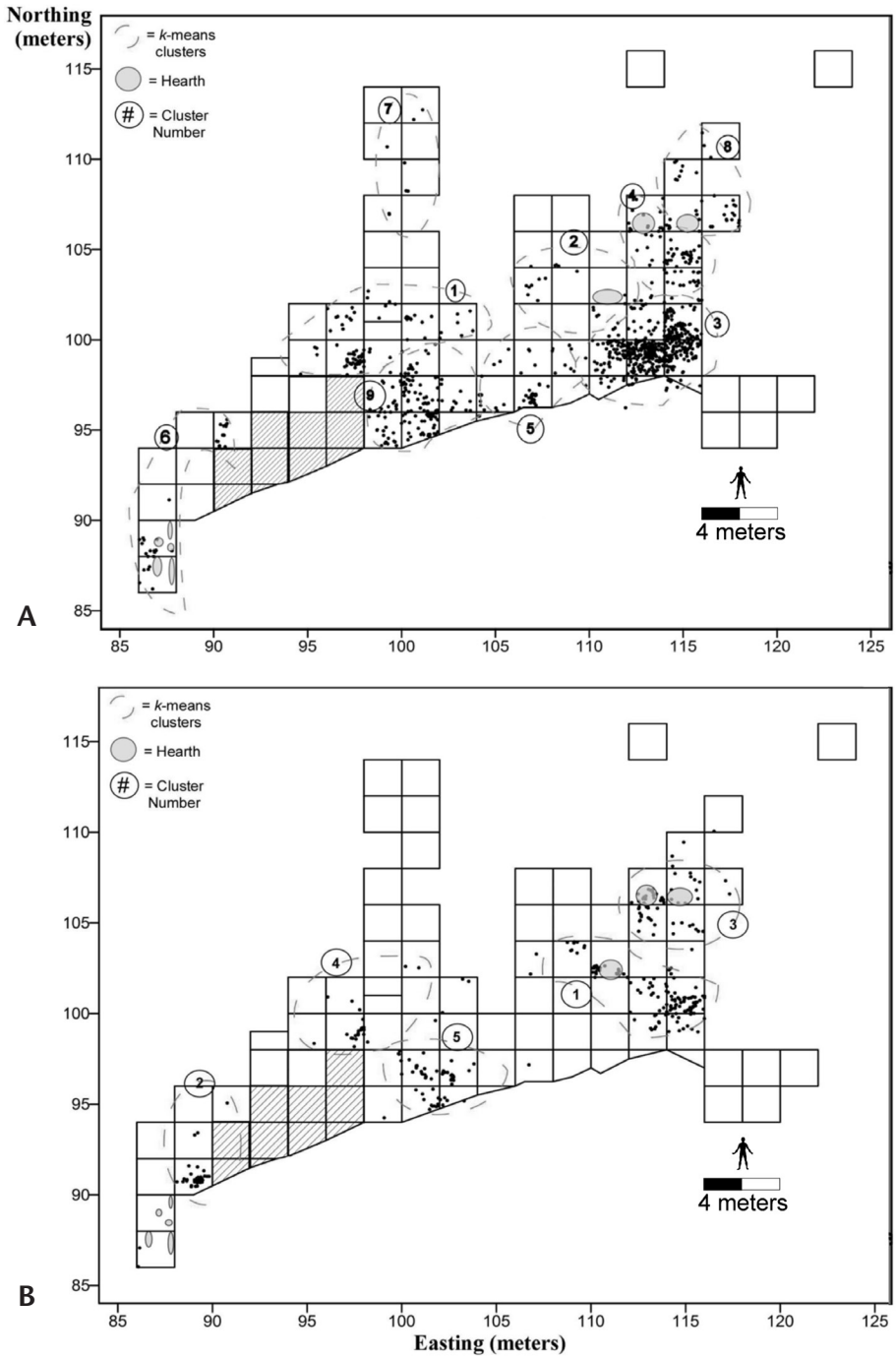

Figure 5.7 Broken Mammoth CZ4 plan views. **A**, faunal distributions; **B**, flake distributions (adapted from Krasinski and Yesner 2008).

terms of large game, the shift from a more diverse faunal strategy to a focal strategy on bison seems to be characteristic of the later Younger Dryas period, and is coupled with widening diet breadth, incorporating a more diverse array of smaller mammals and fish (see below).

Taken together, these data suggest basic continuity in subsistence and settlement across the Younger Dryas boundary, coupled with shifts indicative of climatic effects and cultural responses. The single date on mammoth ivory in CZ4 of 11,540 ^{14}C yr BP is equivalent to charcoal hearth dates and may indicate some mammoth survival later than at Swan Point (see below).

One confounding aspect of this analysis is potential shifts in seasonality of site occupation reflected in CZ3 and CZ4 at Broken Mammoth. To this end, Yesner (2013) analyzed annual structures in dental cementum from large-mammal dentitions from Broken Mammoth, focusing on loose teeth. These data showed very different patterns in annual quartiles from CZ3 and CZ4 (Figure 5.8). CZ4 showed a pattern of greater spring utilization for both bison and wapiti, along with some fall and early winter utilization, while CZ3 showed much more concentration in the fall and early winter periods, with correspondingly less spring utilization. This fact may help explain the emphasis on waterfowl in CZ4. Thus

the subsistence shifts seen at Broken Mammoth may reflect changing climates and seasonality of site occupation.

Faunal Analysis and Subsistence Economies

Substantial new faunal data from well-dated sites allow for synthetic treatment of paleoeconomy of the earliest Beringian foragers. These data include multiple components at Mead (Potter et al. 2011b, 2013), Broken Mammoth (Yesner 2013), Swan Point (Holmes 2011), Upward Sun River (Potter et al. 2008), Little John (Yesner et al. 2011), Gerstle River (Potter 2012), and Teklanika West (Coffman and Potter 2011). Table 5.7 provides taxonomic data on 24 dated components, 8 from the Bølling-Allerød period, 5 from the Younger Dryas, and 11 from the early Holocene (to 10,000 cal yr BP).

For the Bølling-Allerød interstadial, eight components with identifiable fauna are present in eastern Beringia, all in the Tanana River basin. Most of the associated radiocarbon ages cluster between 11,300 and 11,100 yr BP, but three components are older: Swan Point CZ4 (Holmes 2011), Little John subpaleosol unit (Easton et al. 2011), and Mead CZ5. Faunal data from these sites provide an avenue to evaluate potential transitions from an earlier period, associated with the initial colonization of Beringia, with the later more robust faunal record from the 11,300–11,100 yr BP period (Yesner 1996, 2001). While Little John, Mead CZ5, and Broken Mammoth CZ4 (lowest paleosol stringer) provide evidence of bison exploitation, Swan Point CZ4 is unique in containing mammoth postcrania and horse remains dating to the occupation, though both are commonly found in western Beringia records (see below). As noted above, we have no evidence of later exploitation of either horse or mammoth in eastern Beringia, and these data may be interpreted in two ways. One scenario posits a continuation of Diuktai-like subsistence activities focused on large-bodied grazers like mammoth, horse, and bison among the earliest eastern Beringian populations. Climate-related habitat reduction associated with deglaciation may have allowed mammoth and horse to survive into the Bølling-Allerød interstadial, but not through the Poplar Rise toward the end of that period. These climate changes may have been linked to greater rainfall as low-pressure systems moved into the Gulf of Alaska after dissolution of the land bridge, creating more mesic habitat in areas like the central Tanana valley (Guthrie 2001). Simultaneously, as a result of these climate changes, human over-predation, or a combination of both, mammoth and especially horse became rare enough to lower encounter rates, pushing these prey out of optimal diets and forcing more reliance on bison and wapiti as well as small mammals and waterfowl, which were regionally abundant. Another scenario posits a wide-spectrum subsistence strategy among early foragers as they expanded into eastern Beringia. Mammoth and horse were already rare (owing to climate change associated with deglaciation) and did not form a stable component of subsistence economies. The zooarchaeological data are too sparse to more rigorously test either scenario at present; however, Guthrie (2003, 2006) points out that although horse disappeared ~12,000 cal yr BP, mammoth overlapped with humans for another 500 years during the marked increase of bison and wapiti.

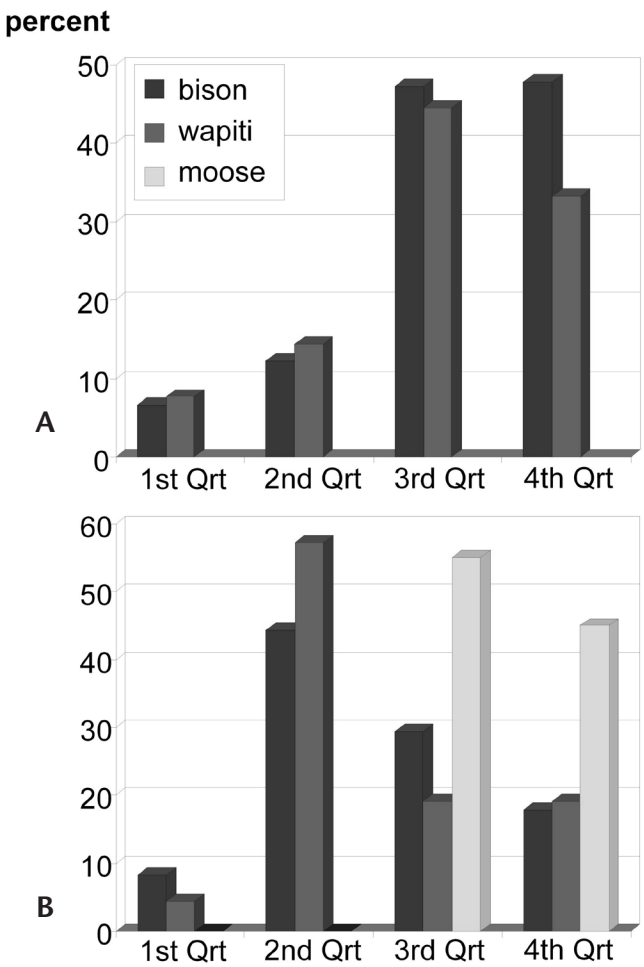

Figure 5.8 Broken Mammoth dental cementum annual quartiles: **A**, CZ4; **B**, CZ3.

The early and continued importance of bison is demonstrated throughout multiple periods of climatic change (~14,000–8900 cal yr BP). Bison were probably the most prevalent taxon on the landscape during the Last Glacial Maximum (Guthrie 1968). At the Mead and Little John sites, bison is the most abundant taxon through multiple components (Potter et al. 2013; Yesner et al. 2011). Bison also appears before and during/after the Younger Dryas within the same sites, thus controlling for local environment through periods of climate change: Mead, Broken Mammoth, Little John, and Teklanika West. Bison are represented through various ecological and physiographic regions (following Gallant et al. 1995), including interior bottomlands (most sites considered here), interior highlands (Little John), and Alaska Range (Teklanika West), though they are primarily found in lowland components, following expectations from the ecological literature regarding bison habitat in Alaska (Stephenson et al. 2001).

Another significant pattern is the exploitation of fish, likely salmonid, present in four sites, all dating to the latter

Table 5.7 Faunal summaries for late-Pleistocene and early-Holocene components in central Alaska.

Taxonomic group	Component (%)		
	Bølling-Allerød (n=8)	Younger Dryas (n=5)	Early Holocene (n=11)
VL mammals (bison-, moose-, wapiti-sized)	100	100	82
Small mammals	38	60	27
Birds	38	80	27
Fish	-	80	-
Mammuthus primigenius (mammoth)[1]	13	-	-
Equus sp. (horse)	13	-	-
Bison priscus (bison)	63	60	55
Cervus canadensis (wapiti)	38	40	27
Rangifer tarandus (caribou)	25	20	18
Alces alces (moose)	13	20	-
Ovis dalli (sheep)	25	20	18
Canidae (includes *Canis* sp. and *Alopex* sp.)	38	40	-
Lepus sp. (hare)	13	60	-
Urocitellus sp. (ground squirrel)	13	60	9
Lutra canadensis (river otter)	13	-	-
Marmota sp. (marmot)	13	40	-
Castor sp. (beaver)	-	20	-
Ursus sp. (bear)	13	20	9
Wapiti and/or bison	75	60	55
Caribou and/or moose	25	20	18

[1]Postcrania only.

half of the Younger Dryas chronozone (~12,200–11,500 cal yr BP): Broken Mammoth CZ3 (Yesner 2001), Mead CZ3 (Potter et al. 2013), Swan Point CZ3 (Holmes 2011), and Upward Sun River (Potter et al. 2011a). Fish remains are also present at Ushki Lake I, level 6 (Dikov 1979). While the small samples suggest opportunistic use of fish, we do not suggest that salmon were intensive exploited or stored.

When considering trends through time, there are several novel patterns identified here. These trends include local extinction of mammoth and horse during the Younger Dryas; the apparent increase in small game like hare and ground squirrel during the Younger Dryas in both upland and lowland sites; the absence of mammoth and horse during the Younger Dryas; and the apparent limited (i.e., with no evidence of storage) exploiting of salmon. Using these coarse-grained data as proxies for diet breadth, we can posit an increase in diet breadth during the Younger Dryas to incorporate more small game and fish. This probably represents an adaptive response to regional climatic stress during the Younger Dryas. Lake-level data from the Tanana valley (Edwards et al. 2000) suggest that the Younger Dryas climatic effect in eastern Beringia was due more to increased aridity than decreased temperature, and this may correlate with a loss of mesic habitat for waterfowl. However, the dietary shift toward small game and fish could also be due to patterns not directly related to climate change, such as the loss of gregarious grazers like mammoth and horse. Conversely, there is a clear narrowing of diet breadth during the early Holocene, shifting from 13 to 7 (of 16 taxa groupings used here). Small mammals and birds are less commonly represented among components, and fish, moose and canids are absent. This narrowing of diet breadth is also supported by the gourmet strategies employed by hunters at Gerstle River C3 (Potter 2007), indicating low nutritional stress in the early Holocene.

In terms of economy and land-use patterns, in general, sites in the Alaska Range foothills, such as Dry Creek and Teklanika West, appear to represent narrower diet breadths (though this may be due to taphonomic bias) while bottomland sites tend to have broader diets represented. In general, this is consistent given known ethnographic uses of bottomlands and highlands in the region (e.g., McKennan 1959), and consistent with more comprehensive databases on fauna within archaeological contexts (Potter 2008), indicating limited seasonal opportunities in the latter and multiple resources that can be acquired on a multi-seasonal basis (Shinkwin et al. 1980).

These patterns offer new insights into Beringian economies. Local land-use patterns are likely embedded in local ecology, and we can thus compare Upward Sun River, Mead, Swan Point, Broken Mammoth, and Gerstle River, which share a similar patch (interior bottomlands in the middle Tanana basin), but yet yield very different signatures in terms of suites of animals taken and processed. Variation among these assemblages is largely structured by site function and social groups represented at the site and associated foraging activities, distance from large game kill and processing sites, and seasonality.

The occurrence of bison and wapiti as the major ungulate

constituents of most faunal assemblages between ~14,000 and 9000 cal yr BP in interior Alaska suggests contemporaneity in similar environments. Bison and wapiti share many characteristics of diet and behavior (Geist 2004; Guthrie 1983; Kingery 1996; Singer and Norland 1994), and both may have occupied similar graminoid-rich patches in the Tanana lowlands during part of the summer and early fall, and perhaps overwintered in windswept areas. Although wapiti have a harem-like structure and bison are characterized by multisex herds of varying size (depending on season), methods of procuring bison and wapiti may have been similar, given the similarities between species in terms of large body size, gregariousness, and habitat overlap, as well as the archaeological correlations between microblade/composite points and large-bodied lowland ungulate fauna (Potter 2008). This convergence in animal behavior and linked hunting styles may have increased under more forested conditions, as agonistic competition between bison herds abated (Guthrie 1990). Mortality profiles and economic utility analyses (Guthrie 1983; Potter 2007; Yesner 2013) suggest the use of efficient, probably long-range (dart) weapons systems and either encounter or ambush strategies (see Stiner 1990, 1994).

While there is disagreement about whether mid-latitude Paleoindian economies were more specialized (relying on large bodied terrestrial mammals) or more generalized (relying on a broader spectrum of large and small game and plant resources) (Grayson and Meltzer 2003; Surovell and Waguespack 2009), high-latitude Paleoindian foragers would have been constrained by the relative lack of plant resources (Kelly and Todd 1988). The eastern Beringian faunal record shows a clear predominance of large ungulates in nearly all assemblages, though a wide range of mammals, birds, and fish (and likely plants) were also exploited.

Kelly and Todd's (1988) behavioral model for early Paleoindians is consistent with the eastern Beringian faunal record, namely, highly mobile groups with necessary reliance on megafauna, but generally opportunistic with respect to regional/local variations of specific prey and small mammal, birds, and plant resources. Seasonal movements, local availability, and abundance of bison and wapiti were likely principal conditioning factors for scheduling tasks in eastern Beringia, though seasonally available waterfowl could be important. Differences in faunal assemblages in habitation sites (Upward Sun River C3 and Mead CZ4) and short-term logistically organized hunting camps (Gerstle River C3) indicate the importance of both central-based foraging for locally available small game, birds, and fish, as well as logistically organized foraging for obtaining high-ranked bison and wapiti. Kelly and Todd (1988) further suggest that the principal Paleoindian strategy for mitigating resource stress (e.g., local or regional variation in prey abundance) was movement into new territories, in other words, the emphasis was on residential patterns, logistical strategies, and range mobility. Archaeological implications of this strategy appear to be met in eastern Beringia, including relatively undifferentiated technological traditions in different regions, at least for the Younger Dryas and early-Holocene periods. Other expectations consistent with the eastern Beringian record include short-term and redundant use of local resources, low diversity of site types and few highly specialized locations or stations, lack of long-term storage facilities, and ephemeral, short-term residential camps.

Outside of the Tanana basin, there are few early sites with clearly associated faunal remains. Northern Alaska data associated with Mesa, Sluiceway, or Northern Fluted Point complexes, while sparse, suggest a separate ecoregion during the late Pleistocene and early Holocene. Early speculations include bison as a key resource (Loy and Dixon 1998; Kunz et al. 2003); however, caribou are the primary taxon represented at Raven Bluff and Serpentine Hot Springs, two fluted-point sites dating to the Younger Dryas (Hedman 2010; Young and Young 2007). Bison became regionally extinct about 12,000 cal yr BP in the Brooks Range (Rasic and Matheus 2007), suggesting at least two distinct ecoregions or megapatches that could explain contrasting technological and typological patterning for these areas. Interior eastern Beringia is characterized by conservative Diuktai-derived technology, which persisted throughout the late Pleistocene to middle Holocene, while northern/northwestern Alaska is characterized by potentially Plains-derived Paleoindian technology (Kunz et al. 2003) that may have been amalgamated with existing regional technologies (e.g., microblades) after about 12,000 cal yr BP.

The eastern Beringian data can be compared with antecedent Diuktai subsistence economies in western Beringia and Siberia (see also Goebel and Potter in review). Faunal reviews indicate predominance of Arctic Steppe grazers, namely horse, bison, and possibly mammoth (Goebel 2002; Mochanov and Fedoseeva 1996; Basilyan et al. 2011), although bison and cervids are common (Lorenzen et al. 2011). Browsing ungulates like moose and red deer, and small game, birds, and fish, are present, but rare. Fauna at Swan Point CZ4 may provide evidence of a transition from Diuktai economies based on grazers like mammoth, horse, and bison, to later eastern Beringian economies based on bison and wapiti, supplemented by small game, birds, and fish.

Conditioning Factors of Technological Organization

Within eastern Beringia, our limited understanding of technological organization has created considerable ambiguities. In the 1990s, a clear cultural historical sequence of Nenana complex (defined by the absence of microblade technology, rarity of burins, the presence of small teardrop-shaped to triangular "Chindadn" points, and high frequencies of endscrapers) followed by the microblade-dominated Denali complex "explained" the late-Pleistocene/early-Holocene record (Bever 2001; Hamilton and Goebel 1999; Powers and Hoffecker 1989; Goebel et al. 1991). Among the various lines of evidence countering this sequence, the most salient are presence of microblade and burin technology at Swan Point CZ4 predating sites assigned to the Nenana complex, nonmicroblade components assigned to the Denali complex on

the basis of bifacial morphology (Bowers 1980; Mason et al. 2001), and "Chindadn" bifaces at Swan Point CZ3, Mead CZ3, and Broken Mammoth CZ3, dating to a period of widespread microblade use in central Alaska. An alternative hypothesis proposes an explanation consistent with a number of lines of evidence, namely that the four non-microblade assemblages associated with small triangular points in the Nenana valley reflect technology associated with upland caribou and sheep hunting within a broader interior Alaskan cultural tradition, which included microblade-composite weapons more closely associated with large fauna in the lowlands (particularly bison and wapiti) (see Potter 2011).

An alternative perspective is a broader Beringian or East Beringian tradition that encompasses assemblages in the region that date to both Bolling-Allerod and Younger Dryas (Holmes 2001; West 1996). Evidence from Mead, Swan Point, Broken Mammoth, Upward Sun River, and Gerstle River sites in the Tanana valley of central Alaska indicates that a complex adaptive strategy operated within a single cultural system. Specialized big-game hunting occurred in association with outdoor hearths and a narrow technological range of weapon-maintenance activities at Gerstle River, while broad-spectrum foraging in the context of a mixed-foraging group occurred at Upward Sun River (Potter 2007, Potter et al. 2011a). Broken Mammoth CZ3 and CZ4 reflect exploitation of a wide range of taxa; widely diverse activities, including animal butchery, tool manufacture, hide processing and clothing manufacture, and caching of tools and animal parts; and sufficiently dense occupation to warrant numerous hearths (Yesner 2013). This type of behavioral flexibility has also been inferred in Paleoindian cultures in North America; e.g., Hill et al. (2011) showed that place-oriented and high-tech forager models "reflect complementary structural poses within the overall behavioral system."

Our recent research has indicated that patterning of technology, subsistence, and site structure clearly exists in eastern Beringia, and we identify some factors that condition technological organization and assemblage variability in eastern Beringia.

Site Structure and Function Lithic materials associated with a residential structure, part of a residential base camp at Upward Sun River C3, include bifacial knives and modified flakes, but no hunting weapons (e.g., projectile points or microblade/composite points), though it is situated temporally and geographically in an area dominated by so-called "microblade-rich" Denali complex sites. In contrast, hunting camps have yielded widely divergent assemblages, even when dating to the same time period (e.g., Carlo Creek, Eroadaway, and Gerstle River [Bowers 1980; Potter 2005; Holmes et al. 2010]).

Technological Organization and Raw-material Availability Reduction strategies, portions of reduction present at individual components, differential treatment of raw materials, technological indices (blank form, etc.), tool and toolkit design are all expected to vary relative to raw-material abundance, quality, and package size/shape (Andrefsky 1994, 2006). Early-stage reduction of locally available chert cobbles at Little Delta River #3 (~11,500 cal yr BP) yielded several biface roughouts but no microblades or finished points (Potter et al. 2007a) and can be contrasted with similarly aged sites in the region where later reduction stages are better represented (Potter 2011). This varies within sites, as seen at Mead CZ4 and Broken Mammoth CZ4, with both curation and maintenance of nonlocal obsidian tools and intensive primary reduction of local on-site quartz.

Faunal-processing Activities Components vary in terms of taxonomic richness, diversity, and evenness, and this is associated with different assemblage characteristics. For example at Gerstle River C3, associated with primary processing of a narrow range of large-bodied ungulates (wapiti and bison), the lithic assemblage comprises two toolkits representing different on-site technological strategies:

1) maintenance of curated weapons technology and repair kit (microblades, composite points, and burins) associated with very small debitage sizes, and a relatively even distribution of numerous raw materials; and
2) production and use of an expedient toolkit geared toward processing large fauna (boulder spall scrapers and lightly modified flakes) (Potter 2005).

In contrast, Mead CZ4 and Broken Mammoth CZ4 fauna data indicate later-stage processing and consumption, and the lithic assemblages contain few bifacial weapons and no microblades, generally have larger debitage sizes (and higher percent of cortex), exhibit more diverse lithic behaviors, including biface production and flake-core reduction, and contain largely expedient discarded tools (Little 2013; Potter et al. 2013).

Social Context of Technological and Subsistence Activities Paleoindian residential features are very rare (only ~6 in North America), and this source of variability is only rarely considered. With the confirmed presence of young children and females at Upward Sun River C3 (Potter et al. 2011a), we can contrast technologies with Gerstle River C3 (a logistically organized short-term hunting camp) (see above). Differential association of weapon systems by gender (e.g., traps, nets, spear and dart points) should be further evaluated, but mass harvesting technologies such as nets are reflected by the large numbers of waterfowl remains in Broken Mammoth CZ4 (Yesner 2001).

Seasonality Settlement systems in high latitudes are expected to be structured by high seasonal variability. Spring occupations include Broken Mammoth CZ4, summer occupations include Upward Sun River C3 and Carlo Creek, and fall occupations include Upward Sun River C1, Broken Mammoth CZ3, and Gerstle River C3. Even within this small sample, variation in assemblage characteristics is observed, though it may require disentangling from effects of site function and social organization.

There is a directional trend in microblade presence through time in interior Alaska: Microblades are found at one component (13% of total) during the Bølling-Allerød, 5 components (45%) during the Younger Dryas, and 10 components (63%) during the early Holocene. This may indicate:

1) increased reliance on composite implements as climate ameliorated;
2) differential presence of multiple technological traditions;
3) a period of risk-prone technological choices during the initial colonization, followed by risk-averse, conservative behavior during and after the Younger Dryas; or
4) sampling bias.

In terms of microcore morphology, Gomez Coutouly (2012) noted that the shift from the Yubetsu to Campus methods of core manufacture after the Bølling-Allerød interstadial reflects a change to more efficient use of raw material, and could relate to toolstock scarcity in eastern Beringia with the onset of the Younger Dryas chronozone. It is clear from our perspective that microblade and burin technology is not limited to a few specific complexes or traditions (see Potter 2008; Yesner and Pearson 2002); it is found in technological components throughout eastern Beringia in time, from Diuktai to Denali, even encompassing northern Alaskan fluted-point assemblages like Raven Bluff and Serpentine Hot Springs (Hedman 2010; Young and Young 2007) and probably the Mesa site as well (but see Bever 2008). This suggests that considerable technological variability exists for the late Pleistocene and early Holocene throughout eastern Beringia. We are in the early stage of evaluating the causes for this variability, but initial analyses suggest relationships with hunting strategies, seasonal land-use strategies (Holmes 2001; Potter 2008), toolstone conservation (Wygal 2011) and/or climatic factors (Graf and Bigelow 2011). We agree with Shott (2003) that hybrid theory, taking into account models of forager behavioral strategies and regional historical configuration, is needed to fully explicate the complex nature of microblade technology in eastern Beringia, in particular the loss of microblade technology in descendant Clovis-bearing populations as they adapted to mid-continental North American environments in the terminal Pleistocene.

Colonization of North America South of the Glaciers: A View from Eastern Beringia

The data and interpretations presented above can be used to evaluate broad patterns of human occupation during and subsequent to the colonization of eastern Beringia. A series of maps from 14,000 to 10,000 cal yr BP showing all published components from eastern Beringia, Northwest Coast, and western Subarctic are illustrated in Figure 5.9 (and tabulated in Table 5.8). Glacial ice extent (Laurentide ice sheet and Cordilleran glacier complexes) is derived from Dyke et al. (2003), and sea level is derived from Manley (2002).

Only two sites are presently older than 13,300 cal yr BP: Swan Point and Little John. For the period 13,300–13,000 cal yr BP, there are 12 interior components, one site at the southern end of the Ice-Free Corridor, and no sites on the Northwest Coast. The northernmost limit in fluted-point distribution (Ives 2006) coincides with the southern end of the Ice-Free Corridor. While there is still debate about when the corridor was passable, when it could sustain large game, and when it was able to support human habitation (Burns 1996; see also Dickinson 2011; Driver 2001; Mandryk 2000), the corridor opened by 13,850–13,750 cal yr BP (Dyke 2004), and large ungulates were present by 13,450 cal yr BP (Burns 1996, see also Zazula et al. 2009). In our view, this chronology easily permits Beringian tradition populations to expand south, innovating fluting technology and discontinuing microblades (but not macroblade and burin technology; see also Yesner and Pearson 2002).

A total of 13 components are known for the period 13,000–12,000 cal yr BP, generally coinciding with the Younger Dryas chronozone. Most components are found in central Alaska and along the Ice-Free Corridor, while two sites (the earliest) are found along the Northwest Coast (K1 Cave and On-Your-Knees-Cave, bone point). The central Alaskan sites for this period (and subsequent periods in this sample, to 10,000 cal yr BP) are typically attributed to the Denali complex (Potter et al. 2011b; Holmes 2001, but cf. Dixon 1999, 2001). A total of 29 components are known for the period 12,000–11,000 cal yr BP, a period of ameliorating climate, present in central Alaska, Northwest Alaska, Ice-Free Corridor, and Northwest Coast. Northwest Alaskan sites continue the trend of Paleoindian complexes (generally referred to fluted point, Mesa, or Sluiceway complexes, Bever 2001).

These data strongly suggest colonization that is primarily inland and terrestrially oriented, from western to eastern Beringia, by about 14,000 cal yr BP. Subsistence economies appear focused on large mammals, particularly bison, but include a variety of small and medium mammals and waterfowl. Recent evidence at Upward Sun River C3, Broken Mammoth CZ3, Mead CZ3, and Swan Point CZ3 suggest that fish (probably salmonid) were also a part of the diet. Regarding routes of entry, these data suggest the presence of terrestrially oriented technological and economic systems from ~14,000 to 12,300 cal yr BP throughout interior Beringia, including sites along the Ice-Free Corridor.

While coastal and near-coastal sites have been found in the terminal Pleistocene, and early-Holocene sites provide evidence for coastal and maritime adaptations very early in the region (Mackie et al. 2011), none appear until 1400 radiocarbon years (~1100–1600 calendar years) after the earliest interior sites. This absence of early sites might reflect inundation of sites with rising sea level (Fladmark 1979), but there remains debate on the potential for an early (pre-12,600 cal yr BP) colonization via the southern Beringian coast (e.g., Dickinson 2011; Erlandson and Braje 2011). The presence of isostatic rebound in some areas and dated fauna to 14,000 cal yr BP (reviewed Mackie et al. 2011) indicates the presence of landforms suitable for earlier occupations.

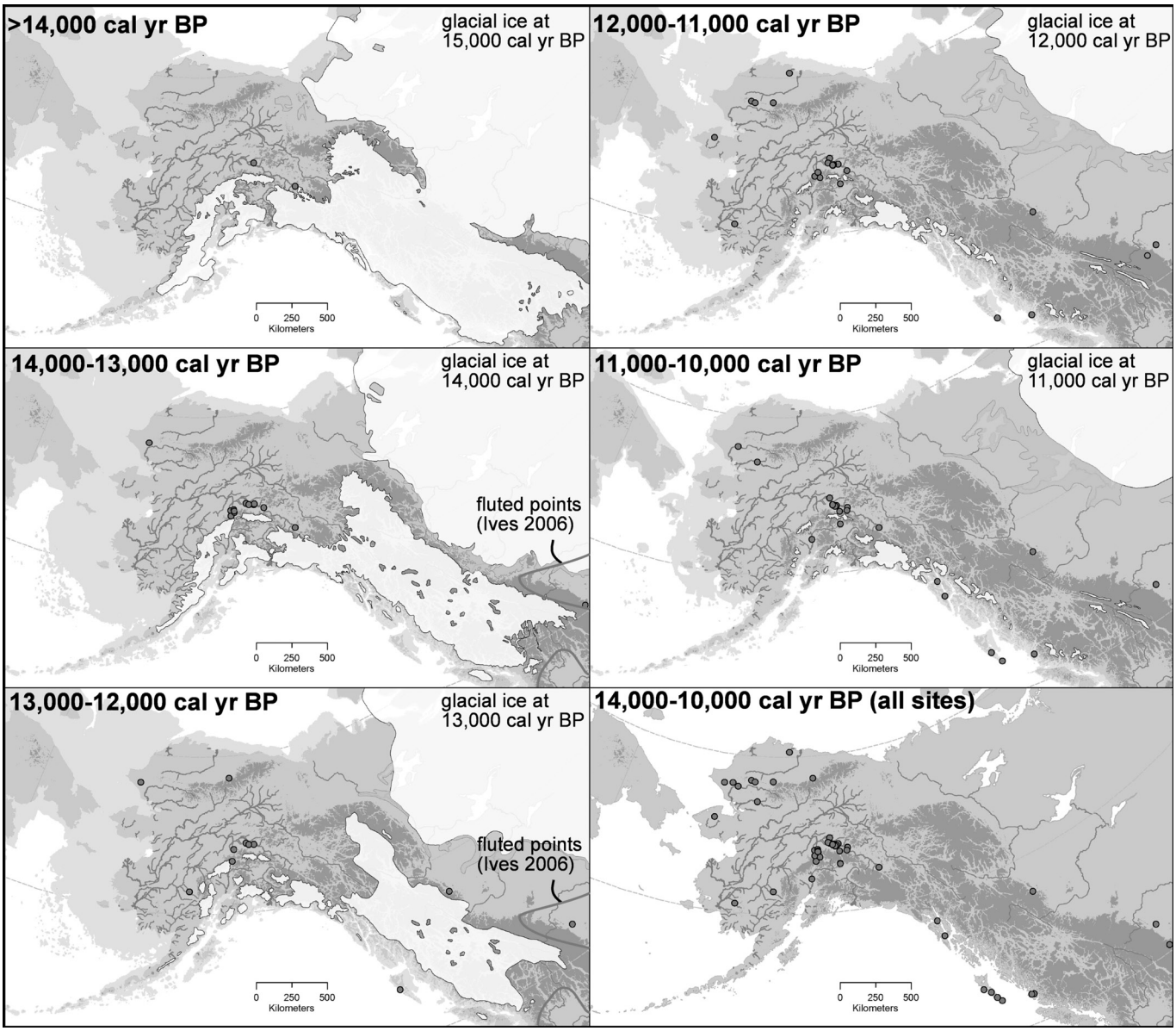

Figure 5.9 Known site distributions in eastern Beringia, Northwest Coast, and interior northwest North America from 14,000 to 10,000 cal yr BP (refer to Tables 5.1 and 5.6). Areas >2000 ft asl are shaded; glacial ice distributions derived from Dyke et al. (2003); and exposed continental shelf derived from Manley (2002).

Other known cultural constructs in the region with evidence for coastal and/or maritime adaptations (all dating to the mid-Holocene and later) have associated inland occupations, including Choris, Norton, Ipiutak, Ocean Bay II, Kachemak, and Koniag, and the absence of Bølling-Allerød near-coastal sites is notable, a point made by Surovell (2003). The widespread northeast Asian Diuktai culture, likely directly ancestral to the East Beringian tradition, exhibits no coastal adaptations in terms of technology, subsistence economy, and/or settlement system (Goebel 1999). There is no evidence of any coastal habitations or maritime economies in the Kurile Islands, Kamchatka, Chukotka, or north coast of the Sea of Okhotsk until the middle Holocene, with the emergence of Tarin (Tarya) and later Tokarevo cultures (Kuzmin 2000; Lebedintsev 1990). Hypothetical early Holocene coastal occupations should be visible, regardless of sea level rise. For the 2000 km between the Alexander Archipelago and the Alaska Peninsula/Aleutian Islands, no sites have been discovered prior to Anangula, 9700–8000 cal yr BP (McCartney and Veltre 1996), though recent work has indicated that at least some of these areas were unglaciated by ~17,000 cal yr BP (Misarti et al. 2012) and that sea-mammal resources were available throughout the Gulf of Alaska/Bering Sea region as early as 15,000 cal yr BP (Pasch et al. 2013).

Technological and typological analyses from the earliest coastal complexes in south Alaska, Ocean Bay, and Anangula traditions indicate derivation from earlier interior traditions (Beringian/Paleoarctic) (Dumond and Knecht 2001; Fitzhugh 2004, but see Steffian et al. 2002). The earliest Northwest Coast assemblages, Kinggi complex, contain foliate bifacial

points and simple flake tools with a later transition (~9700 cal yr BP) to composite microblade points ultimately derived from either undetected coastal groups or from interior Beringia (Fedje et al. 2008:35). However, microblade technology is present at Namu, Ground Hog Bay, On-Your-Knees Cave, and Hidden Falls as early as 10,500 cal yr BP and perhaps earlier (Ackerman 1992, 2007). Fedje et al. (2008) observe that the motives for adopting bifacial points vs. microblade/composite points are complex and may relate to differences in site function and toolstone availability, similar to the patterning in interior Beringia (Potter 2008, 2011; Rasic and Slobodina 2008).

While we agree with Erlandson and Braje (2011) and others that the Pacific Rim could be a plausible route of migration, the absence of pre-12,600 cal yr BP sites along the coast and the preponderance of archaeological data in the interior (north and south of the Ice-Free Corridor) provides compelling evidence for the primary mode of colonization, at least for ancestors of people using East Beringian tradition/ Denali and Clovis technologies (see Buchanan and Collard 2008). Early coastal sites are an important laboratory for examining how terrestrial foragers expanded into new ecological niches during the Younger Dryas, perhaps in response to declining prey density in interior areas. The location of interior eastern

Table 5.8 Other late-Pleistocene/early-Holocene sites in northwest North America.

Site	^{14}C yr BP	No. ^{14}C dates[1]	Area	Reference
Tuluaq C1	11,160 ± 20	5	N Alaska	Rasic 2000
Putu	10,490 ± 70	1	N Alaska	Alexander 1987
Raven Bluff	10,280 ± 30	7	N Alaska	Hedman 2010
Serpentine Hot Springs	10,150 ± 30	3	N Alaska	Young and Young 2007
HAR-006	10,140 ± 90	1	N Alaska	Reanier 2003
Irwin Sluiceway	10,050 ± 50	2	N Alaska	Rasic 2011
Mesa	10,300–9700	51	N Alaska	Kunz et al. 2003
Nat Pass	9960 ± 30	2	N Alaska	Rasic 2008
NR-5	9570 ± 60	2	N Alaska	Anderson 1972
Onion Portage Akmak	9570 ± 150	1	N Alaska	Anderson 1988
K1 Cave	10,960–10,510		NW Coast	Mackie et al. 2011
Gaadu Din 1 Cave	10,620–9930	6	NW Coast	Fedje and Mathewes 2005
Gaadu Din 2 Cave	10,530–9490	12	NW Coast	Fedje 2008
Cardinalis Creek	10,370–10,150		NW Coast	McLaren et al. 2008
On-Your-Knees Cave	10,300 ± 50	1	NW Coast	Dixon 2001
Hunter Island	9940 ± 50	1	NW Coast	Cannon 2000
Namu	9700		NW Coast	Carlson 1996
Kilgii Gwaay	9540-9230	12	NW Coast	Fedje and Mathewes 2005
Hidden Falls	9500		NW Coast	Davis 1996; Ackerman 1992
Arrow Creek 2	9500–9200		NW Coast	Fedje et al. 1996
Ground Hog Bay	9200 ± 70	2	NW Coast	Ackerman 1996
Richardson Island	9290–8700	8	NW Coast	Fedje et al. 2011
Arrow Creek 1	8800		NW Coast	Fedje et al. 1996
Wally's Beach	11,210 ± 40	4	NW Interior	Kooyman et al. 2006
Vermilion Lakes Loc A, C9b	10,770 ± 180	3	NW Interior	Fedje et al. 1995
Lake Minnewanka	10,800–10,000		NW Interior	Landals 2008
Charlie Lake Cave	10,470 ± 50	3	NW Interior	Driver et al. 1996; Fladmark et al. 1988
Vermilion Lakes Loc A, C9a	10,330 ± 60	4	NW Interior	Fedje et al. 1995
Vermilion Lakes Loc A, C6b	10,220 ± 110	2	NW Interior	Fedje et al. 1995
Twin Pines Layer 2	10,140 ± 80		NW Interior	Beaudoin et al. 1996
Vermilion Lakes Loc B, C4	9910 ± 100	3	NW Interior	Fedje et al. 1995
Lindoe (EaOp9)	9900 ± 120		NW Interior	Bryan 2000
Twin Pines Layer 3	9750 ± 80		NW Interior	Beaudoin et al. 1996
Vermilion Lakes Loc A, C6a	9640 ± 100	2	NW Interior	Fedje et al. 1995
Gap site (DlPo20)	9600 ± 240		NW Interior	Reeves and Dormaar 1972
J-Crossing (DjPm-16)	9600–8580	2	NW Interior	Van Dyke 1994
Saskatoon Mountain, Level 11	9380 ± 360	1	NW Interior	Beaudoin et al. 1996

[1]Varying radiocarbon formats are due to inconsistencies in reporting and/or averaging.

Beringian sites relative to likely antecedent groups in Siberia, Diuktai Culture, and the earliest Paleoindian complexes in central North America (i.e., Clovis) provides evidence for continuity in terrestrially oriented economies. An intervening maritime-oriented system, while possible, would require considerable reworking of existing Diuktai material culture in ways that are not demonstrated in the record (e.g., development and retention of harpoons, leisters, fishhooks, sinkers, or boats). These technologies could be transferred to riverine ecosystems and expressed in later Beringian and Paleoindian traditions, but they are not. We infer the colonization of Beringia and North America occurred as a biogeographic expansion of Siberian populations, geared toward exploiting a variety of large, medium, and small game, from interior northeast Asia to interior northwest North America during the episode of climatic amelioration associated with the Bølling-Allerød interstadial. Later geographic expansions (e.g., Northwest Coast and north Alaska) are associated with the Younger Dryas period, and may reflect expansion of Beringian populations and exploitation of new ecological areas or responses to resource stress in interior eastern Beringia.

Acknowledgments

Funding support for Mead includes Denali, LLC workforce development grants and the National Science Foundation (grant #1223119). Funding support for Swan Point includes the National Science Foundation (grant #0540235) and the Alaska Office of History and Archaeology (Historic Preservation grant). Funding support for Broken Mammoth includes the National Science Foundation (grant #9112174) and the National Geographic Society. We collectively thank the field archaeologists who supported these investigations, including research assistants and field school students. Obsidian sourcing support was provided by Joshua Reuther (U Arizona and Northern Land Use Research, Inc.), and laboratory support included Phoebe Gilbert, Allie Little, and Crystal Glassburn. We thank Barbara Crass (U Wisconsin-Oshkosh) for access to the Mead site and her support of our investigations. We also thank two anonymous reviewers who provided useful comments.

References Cited

Ackerman, R. E. 1992 Earliest stone industries on the North Pacific coast of North America. *Arctic Anthropology* 29(2):18–27.

——— 1996 Ground Hog Bay, Site 2. In *American Beginnings: The Prehistory and Palaeoecology of Beringia,* edited by F. H. West, pp. 424–30. University of Chicago Press, Chicago.

——— 2007 The microblade complexes of Alaska and the Yukon: Early interior and coastal adaptations. In *Origin and Spread of Microblade Technology in Northern Asia and North America,* edited by Y. V. Kuzmin, S. G. Keates, and S. Chen, pp 147–70. Simon Fraser University Archaeology Press, Burnaby.

——— 2004 The Northern Archaic Tradition in Southwestern Alaska. *Arctic Anthropology* 41(2):153–62.

Alexander, H. L. 1987 *Putu: A Fluted Point Site in Alaska.* Department of Archaeology Publication 17, Simon Fraser University. Burnaby, British Columbia.

Anderson, D. D. 1972 An archaeological survey of Noatak Drainage, Alaska. *Arctic Anthropology* 9(1):66–117.

——— 1988 Onion Portage: The Archaeology of a Stratified Site from the Kobuk River, Northwest Alaska. *Anthropological Papers of the University of Alaska* 22(1-2).

Andrefsky, W., Jr. 1994 Raw material availability and the organization of technology. *American Antiquity* 59:21–35.

——— 2006 *Lithics: Macroscopic Approaches to Analysis.* 2nd edition. Cambridge University Press, Cambridge.

Basilyan, A. E., M. A. Anisimov, P. A. Nikolskiy, and V. V. Pitulko 2011 Woolly mammoth mass accumulation next to the Paleolithic Yana RHS site, Arctic Siberia: Its geology, age, and relation to past human activity. *Journal of Archaeological Science* 38:2461–74.

Beaudoin, A. B., M. Wright, and B. Ronaghan 1996 Late Quaternary landscape history and archaeology in the 'Ice-Free Corridor': Some recent results from Alberta. *Quaternary International* 32:113–26.

Bever, M. R. 2001 An overview of Alaskan late Pleistocene archaeology: Historical themes and current perspectives. *Journal of World Prehistory* 15:125–91.

——— 2008 Distinguishing Holocene microblades from a Paleoindian component at the Mesa Site, Alaska. *Journal of Field Archaeology* 33:133–50.

Bigelow, N. H., and W. R. Powers 2001 Climate, vegetation, and archaeology 14,000–9000 cal yr B.P. in central Alaska. *Arctic Anthropology* 38(2):171–95.

Binford, L. R. 1979 Organization and formation processes: Looking at curated technologies. *Journal of Anthropological Research* 35:255–73.

Bousman, C. B. 1993 Hunter-gatherer adaptations, economic risk and tool design. *Lithic Technology* 18:1&2:59–86.

Bowers, P. M. 1980 *The Carlo Creek Site: Geology and Archaeology of an Early Holocene Site in the Central Alaska Range.* Anthropology and Historic Preservation Cooperative Park Studies Unit. University of Alaska Fairbanks, Alaska.

Bowers, P. M., and J. D. Reuther 2008 AMS Re-dating of the Carlo Creek site, Nenana valley, central Alaska. *Current Research in the Pleistocene* 25:58–60.

Bryan, A. 2000 The Lindoe Site, Southeastern Alberta. Non-Permit. Archaeological Survey of Alberta, Edmonton.

Buchanan, B., and M. Collard 2007 Investigating the peopling of North America through cladistics analyses of early Paleoindian projectile points. *Journal of Anthropological Archaeology* 26:366–93.

Burns, J. A. 1996 Vertebrate paleontology and the alleged Ice-Free Corridor: The meat of the matter. *Quaternary International* 32:107–12.

Cannon, A. 2000 Settlement and sea levels on the central coast of British Columbia: Evidence from Shell Midden Cores. *American Antiquity* 65:67–77.

Carlson, R. L. 1996 Early Namu. In *Early Human occupation in British Columbia,* edited by R. L. Carlson and L. Dalla Bona, pp 83–102. University of British Columbia Press, Vancouver.

Coffman, S., and B. A. Potter 2011 Recent excavations at Teklanika West: A late Pleistocene multicomponent site in Denali National Park and Preserve, Central Alaska. *Current Research in the Pleistocene* 28:29–32.

Cook, J. P. 1969 The Early Prehistory of Healy Lake, Alaska. Ph.D.

dissertation, Department of Anthropology, University of Wisconsin, Madison.

——— 1996 Healy Lake. In *American Beginnings: The Prehistory and Palaeoecology of Beringia,* edited by F. H. West. University of Chicago Press, Chicago.

Crass, B. A., B. L. Kedrowski, J. Baus, and J. A. Behm 2011 Residue analysis of bone-fueled Pleistocene hearths. In *From the Yenisei to the Yukon: Interpreting Lithic Assemblage Variability in Late Pleistocene/Early Holocene Beringia,* edited by T. Goebel and I. Buvit, pp. 192–98. Texas A&M University Press, College Station.

Crossen, K. J., D. R. Yesner, and C. E. Holmes 1993 Archaeology and paleoecology of the Broken Mammoth site, central Tanana Valley, interior Alaska, USA. *Current Research in the Pleistocene* 9:53–57.

Davis, S. 1996 Hidden Falls. In *American Beginnings: The Prehistory and Palaeoecology of Beringia,* edited by F. H. West, pp. 413–24. University of Chicago Press, Chicago.

Dickinson, W. R. 2011 Geological perspectives on the Monte Verde archeological site in Chile and pre-Clovis coastal migrations in the Americas. *Quaternary Research* 76:201–10.

Dikov, N. N. 1979 Drevnje kul'tury severo-vostochnoi Azii [Early Cultures of Northeastern Asia]. Nauka, Moscow, 1979, translated by the National Park Service, Anchorage, 2004.

Dilley, T. E. 1998 Late Quaternary loess stratigraphy, soils, and environment of the Shaw Creek Flats Paleoindian sites, Tanana Valley, Alaska. Ph.D. dissertation, University of Arizona.

Dixon, E. J., Jr. 1999 *Bones, Boats and Bison: Archaeology and the First Colonization of Western North America.* University of New Mexico Press, Albuquerque.

——— 2001 Human colonization of the Americas: Timing, technology and process. *Quaternary Science Reviews* 20:277–99.

Driver, J. C. 2001 Paleoecological and archaeological implications of the Charlie Lake Cave fauna, British Columbia, 10,500 to 9500 B.P. In *People and Wildlife in Northern North America: Essays in Honour of R. Dale Guthrie,* edited by S. C. Gerlach and M. S. Murray, pp. 13–21. British Archaeological Reports International Series 944, Oxford.

Driver, J. C., M. Handly, K. R. Fladmark, D. E. Nelson, G. M. Sullivan, and R. Preston 1996 Stratigraphy, radiocarbon dating, and culture history of Charlie Lake Cave, British Columbia. *Arctic* 49(3):265–77.

Dumond, D. E., and R. Knecht 2001 An early blade site in the eastern Aleutians. In *Archaeology of the Aleut Zone: Some Recent Research,* edited by D. E. Dumond, pp. 9–34. University of Oregon Anthropological Papers 58. University of Oregon, Eugene.

Dyke, A. S., A. Moore, and L. Robertson 2003 Deglaciation of North America. Geological Survey of Canada Open File, 1574.

Easton, N. A., G. R. Mackay, P. B. Young, P. Schnurr, and D. R. Yesner 2011 Chindadn in Canada? Emergent evidence of the Pleistocene transition in southeast Beringia as revealed by the Little John site, Yukon. In *From the Yenisei to the Yukon: Interpreting Lithic Assemblage Variability in Late Pleistocene/Early Holocene Beringia,* edited by T. Goebel and I. Buvit, pp. 289–307. Texas A&M University Press, College Station.

Edwards, M. E., N. H. Bigelow, and B. P. Finney 2000 Single-core records as indicators of late-Quaternary Alaskan lake levels: A preliminary assessment. *Journal of Paleolimnology* 24:55–68.

Erlandson J. M., and T. J. Braje 2011 From Asia to the Americas by boat? Paleogeography, paleoecology, and stemmed points of the northwest Pacific. *Quaternary International* 239(1-2):28–37.

Erlandson, J., R. Walser, H. Maxwell, N. Bigelow, A. Higgs, and J. Wilber 1991 Two early sites of eastern Beringia: Context and chronology in Alaska interior archaeology. *Radiocarbon* 3(1):35–50.

Esdale, J. A., E. P. Gaines, K. S. Yeske, W. E. McLaren, M. Shimel, and J. F. Kunesh 2012 Cultural resources survey and evaluation, Fort Wainwright and training lands. Report prepared for Center for Environmental Management of Military Lands, Colorado State University, Ft. Collins.

Fedje, D. W. 2008 2007/08 Gwaii Haanas archaeology and paleoecology. Unpublished report on file, parks Canada Western and Northern Service Centre, Victoria.

Fedje, D. W., and R. W. Mathewes (eds) 2005 *Haida Gwai, Human History and Environment from the Time of the Loon to the Time of the Iron People*. UBC Press, Vancouver.

Fedje, D. W., J. B. McSporran, and A. R. Mason 1996 Early Holcoene archaeology and paleoecology at the Arrow Creek sites in Gwaii Haanas. *Arctic Anthropology* 33:116–42.

Fedje, D., Q. Mackie, D. McLaren, and T. Christensen 2008 A projectile point sequence for Haida Gwaii. In *Projectile point sequences in northwestern North America,* edited by R. L. Carlson and M. P. R. Magne, pp. 41–60. Simon Fraser University Archaeology Press, Burnaby.

Fedje, D. W., Q. Mackie, N. F. Smith, and D. McLaren 2011 Function, visibility, and interpretation of archaeological assemblages at the Pleistocene-Holocene transition in Haida Gwaii. In *From the Yenisei to the Yukon: Interpreting Lithic Assemblage Variability in Late Pleistocene/Early Holocene Beringia,* edited by T. Goebel and I. Buvit, pp. 323–42. Texas A&M University Press, College Station.

Fedje, D. W., J. M. White, M. C. Wilson, D. E. Nelson, J. S. Vogel, and J. R. Southon 1995 Vermilion Lakes Site: Adaptations and environments in the Canadian Rockies during the Late Pleistocene and Early Holocene. *American Antiquity* 60:81–108.

Fitzhugh, B. 2004 Colonizing the Kodiak Archipelago: trends in raw material use and lithic technologies at the Tanginak Spring Site. *Arctic Anthropology* 41(1):14–40.

Fladmark, K. R. 1979 Routes: Alternate Migration Corridors for Early Man in North America. *American Antiquity* 44(1):55–69.

Fladmark, K. R., J. C. Driver, and D. Alexander 1988 The Paleoindian component at Charlie Lake Cave (HbRf 39), British Columbia. *American Antiquity* 53(2):371–384.

Gaines, E. P., K. S. Yeske, S. J. Shirar, W. C. Johnson, and J. F. Kunesh 2011 Pleistocene archaeology of the Tanana Flats, eastern Beringia. *Current Research in the Pleistocene* 28:42–44.

Gallant, A. L., E. F. Binnian, J. M. Omernik, and M. B. Shasby 1995 Ecoregions of Alaska. U.S. Geological Survey Professional Paper 1567.

Geist, V. 2004 Adaptive behavioral strategies. In *North American Elk: Ecology and Management,* edited by D. E. Toweill and J. W. Thomas, pp. 389–433. Smithsonian Institution Press, Washington D.C.

Gilbert, P J. 2011 Micromorphology, Site Spatial Variation and Patterning, and Climate Change at the Mead Site: A Multicomponent Archaeological Site in Interior Alaska. M.A. Thesis, Department of Anthropology, University of Alaska Fairbanks.

Goebel, T. E. 1999 Pleistocene human colonization of Siberia and the peopling of the Americas: An ecological approach. *Evolutionary Anthropology* 8(6):208–27.

——— 2002 The "Microblade Adaptation" and recolonization of Siberia during the late Upper Pleistocene. In *Thinking Small: Global*

Perspectives on Microlithization, edited by R. G. Elston and S. L. Kuhn, pp. 117–32. American Anthropological Association, Arlington.

Goebel, T. E., and W. R. Powers 1989 A Possible Paleoindian Dwelling in the Nenana Valley, Alaska: Spatial Analysis at the Walker Road Site. Paper presented at the 16th Annual Meeting of the Alaska Anthropological Association, Anchorage.

Goebel, T. E., W. R. Powers, and N. H. Bigelow 1991 The Nenana Complex of Alaska and Clovis Origins. In *Clovis Origins and Adaptations,* edited by R. Bonnichsen and K. Turnmire, pp. 49–79. Center for the Study of the First Americans, Oregon State University, Corvallis.

Goebel, T. E., W. R. Powers, N. H. Bigelow, and A. S. Higgs 1996 Walker Road. In *American Beginnings: The Prehistory and Palaeoecology of Beringia,* edited by F. H. West, pp. 356–63. University of Chicago Press, Chicago.

Gomez Coutouly, Y. A. 2012 Pressure microblade industries in Pleistocene-Holocene interior Alaska: Current data and discussions. In *The Emergence of Pressure Blade Making: From Origin to Modern Experimentation,* edited by P. M. Desrosiers, pp 347–74. Springer, New York.

Graf, K. E., and N. H. Bigelow 2011 Human response to climate during the Younger Dryas chronozone in central Alaska. *Quaternary International* 242:434–51.

Graf, K. E., and T. E. Goebel 2009 Upper Paleolithic toolstone procurement and selection across Beringia. In *Lithic Materials and Paleolithic Societies,* edited by B. Adams and B. S. Blades, pp. 55–77. Blackwell, Oxford.

Grayson, D. K., and D. J. Meltzer 2002 Clovis hunting and large mammal extinction: A critical review of the evidence. *Journal of World Prehistory* 16:313–59.

Guthrie, R. D. 1983 Paleoecology of the site and its implications for early hunters. In *Dry Creek: Archeology and Paleoecology of a Late Pleistocene Alaskan Hunting Camp,* edited by W. R. Powers, R. D. Guthrie, and J. F. Hoffecker, pp. 209–87. Report submitted to the National Park Service.

——— 1990 *Frozen Fauna of the Mammoth Steppe: The Story of Blue Babe.* University of Chicao Press, Chicago.

——— 2001 Origin and causes of the mammoth steppe: A story of cloud cover, woolly mammal tooth pits, buckles, and inside-out Beringia. *Quaternary Science Reviews* 20(1-3):549–74.

——— 2003 Rapid size decline in Alaskan Pleistocene horse before extinction. *Nature* 426:169–71.

——— 2006 New carbon dates link climatic change with human colonization and Pleistocene extinctions. *Nature* 441:207–09

Hamilton, T. D., and T. E. Goebel 1999 Late Pleistocene Peopling of Alaska. In *Ice Age Peoples of North America: Environments, Origins, and Adaptations,* edited by R. Bonnichsen and K. L. Turnmire, pp. 156–99. Oregon State University Press, Oregon.

Hedman, W. H. 2010 The Raven Bluff Site: Preliminary Findings from a Late Pleistocene Site in the Alaskan Arctic. Bureau of Land Management Report, March 2010. Report on file at the Alaska State Office of History and Archaeology.

Higgs, A. S. 1992 Technological and Spatial Considerations of the Walker Road Site: Implications from a Lithic Refit Study. M.A. Research Paper, Department of Anthropology, University of Alaska Fairbanks.

Hill, M. G., D. J. Rapson, T. J. Loebel, and D. W. May 2011 Site structure and activity organization at a late Paleoindian base camp in western Nebraska. *American Antiquity* 76(4):752–72.

Hoffecker, J. F. 1983 A description and analysis of artifact clusters in components I and II at the Dry Creek site. Appendix A. In *Dry Creek: Archeology and Paleoecology of a Late Pleistocene Alaskan Hunting Camp,* edited by W. R. Powers, R. D. Guthrie, and J. F. Hoffecker, pp. 307–47. Report submitted to the National Park Service.

——— 2011 Assemblage variability in Beringia: The Mesa factor. In *From the Yenisei to the Yukon: Interpreting Lithic Assemblage Variability in Late Pleistocene/Early Holocene Beringia,* edited by T. Goebel and I. Buvit, pp. 165–78. Texas A&M University Press, College Station.

Hoffecker, J. F., and S. A. Elias 2007 *Human Ecology of Beringia*. Columbia University Press, New York.

Hoffecker, J. F., W. R. Powers, and T. E. Goebel 1993 The colonization of Beringia and the peopling of the new world. *Science* 259:46–53.

Holmes, C. E. 1996 Broken Mammoth. In *American Beginnings: The Prehistory and Paleoecology of Beringia,* edited by F. H. West, pp. 312–18. University of Chicago Press, Chicago.

——— 2001 Tanana River Valley Archaeology Circa 14,000 to 9000 BP. *Arctic Anthropology* 38(2):154–70.

——— 2008 The Taiga period: Holocene archaeology of the northern boreal forest, Alaska. *Alaska Journal of Anthropology,* 6(1-2):69–81.

——— 2011 The Beringian and Transitional Periods in Alaska: Technology of the East Beringian Tradition as Viewed from Swan Point. In *From the Yenisei to the Yukon: Interpreting Lithic Assemblage Variability in Late Pleistocene/Early Holocene Beringia,* edited by T. E. Goebel and I. Buvit, pp. 179–91. Texas A&M Press, College Station.

Holmes, C. E., D. C. Fisher, and A. Rountrey 2012 Dental and Skeletal Evidence Point to the Hunting of Mammoths in central Alaska. Poster Session, 39th Annual Meeting of the Alaska Anthropology Association Feb. 29–March 3, Seattle, WA.

Holmes, C. E., J. D. Reuther, and P. M. Bowers 2010 The Eroadaway site: Early Holocene technological variability in the central Brooks Range. Paper presented at the 37th Annual Alaska Anthropological Association Meetings, Anchorage.

Ives, J. W. 2006 13,001 Years Ago—Human Beginnings in Alberta. In *Alberta Formed—Alberta Transformed,* edited by M. Payne, D. Wetherell, and C. Cavanaugh, Volume 1, pp. 1–34. University of Calgary/University of Alberta Presses: Calgary/Edmonton.

Kedrowski, B. L., B. A. Crass, J. A. Behm, J. C. Luetke, A. L. Nichol, A. M. Moreck, and C. E. Holmes 2009 GC-MS analysis of fatty acids from ancient hearth residues at the Swan Point archaeological site. *Archaeometry* 51:110–22.

Kelly, R., and L. Todd 1988 Coming into the country: Early Paleoindian hunting and mobility. *American Antiquity* 53(2):231–44.

Kingery, J. L., J. C. Mosley, and K. C. Bordwell 1996 Dietary overlap among cattle and cervids in northern Idaho forests. *Journal of Range Management* 49:8–15.

Kokorowski, H. D., P. M. Anderson, C. J. Mock, and A. V. Lozhkin 2008 A re-evaluation and spatial analysis of evidence for a Younger Dryas climatic reversal in Beringia. *Quaternary Science Reviews* 27:1710–22.

Kooyman, B., L. V. Hills, P. McNeil, and S. Tolman 2006 Late Pleistocene horse hunting at the Wally's Beach site (DhPg-8), Canada. *American Antiquity* 71:101–21.

Krasinski, K. E., and D. R. Yesner 2008 Late Pleistocene/early Holocene site structure in Beringia: A case study from the Broken Mammoth site, Interior Alaska. *Alaska Journal of Anthropology* 6:27–42.

Kunz, M, M Bever, and C Adkins 2003 The Mesa Site: Paleoindians above the Arctic Circle. BLM Open File Report 86. Bureau of Land Management, Alaska State Office, Anchorage.

Kuzmin, Y. V. 2000 Radiocarbon chronology of the stone age cultures on the Pacific coast of northeastern Siberia. *Arctic Anthropology* 37(1):120–31.

Landals, A. 2008 The Lake Minnewanka Site: Patterns in Late Pleistocene use of the Alberta Rocky Mountains. Ph.D. dissertation, University of Calgary.

Lebedintsev, A. I. 1990 Early maritime cultures of northwestern Priokhot'e, translated by R. L. Bland, 1990, originally Drevnie primorskie kul'tury Severo-Zapadnogo Priokhot'ia. Nauka, Leningrad.

Little, A. 2013 Lithic analyses at Mead site, central Alaska. M.A. thesis, Department of Anthropology, University of Alaska Fairbanks.

Lively, R. A. 1996 Chugwater. In *American Beginnings: The Prehistory and Palaeoecology of Beringia,* edited by F. H. West, pp. 308–11. University of Chicago Press, Chicago.

Lorenzen, E. D., D. Nogués-Bravo, L. Orlando, J. Weinstock, J. Binladen, K. A. Marske, A. Ugan 2011 Species-specific responses of late Quaternary megafauna to climate and humans. *Nature* 7373: 359–64.

Mackie, Q., D. Fedje, D. McLaren, N. Smith, and I. McKechnie 2011 Early environments and archaeology of coastal British Columbia. In *Trekking the Shore: Changing Coastlines and the Antiquity of Coastal Settlement,* edited by N. F. Bicho et al., pp. 51–103. Interdisciplinary Contributions to Archaeology. Springer, New York.

Maitland, R. E. 1986 The Chugwater Site (FAI-035), Moose Creek Bluff, Alaska. Final Report, 1982 and 1983 Seasons. Unpublished report on file, U.S. Army Corps of Engineers, Alaska District, Anchorage.

Mandryk, C. A. S. 2007 Invented traditions and the ultimate American origin myth: In the beginning . . . there was an ice free-corridor. In *The Settlement of the Americas: A Biogeographical Approach,* edited by G. A. Clark, C. M. Barton, D. R. Yesner, and G. A. Pearson, pp. 196–214. University of Arizona Press, Tucson

Manley, W. F. 2002 Postglacial flooding of the Bering land bridge: A geospatial animation: INSTAAR, University of Colorado, v1. http://instaar.colorado.edu/QGISL/bering_land_bridge/

Mason, O. K., P. M. Bowers, and D. M. Hopkins 2001 The early Holocene Milankovitch thermal maximum and humans: Adverse conditions for the Denali complex of eastern Beringia. *Quaternary Science Reviews* 20:525–48.

McCartney, A. P., and D. W. Veltre 1996 Anangula core and blade site. In *American Beginnings: The Prehistory and Paleoecology of Beringia,* edited by F. H. West, pp. 443–50. University of Chicago Press, Chicago.

McKennan, R. A. 1959 The Upper Tanana Indians. Yale University Publications in Anthropology No. 55.

McLaren, D., S. Rohdin, D. MacDonald, and S. Formosa 2008 Yearly Report for the Stave River Archaeological Management Plan 2006/2007. Report prepared for B. C. Hydro, Kwantlen First Nation, Stolo Nation, and B. C. Archaeology Branch.

Meltzer, D. J. 2009 *First Peoples in a New World: Colonizing Ice Age America.* University of California Press, Berkeley.

Misarti, N., B. P. Finney, J. W. Jordan, H. D. G. Maschner, J. A. Addison, M. D. Shapley, A. Krumhardt, and J. E. Beget 2012 Early retreat of the Alaska peninsula glacier complex and the implications for coastal migrations of First Americans. *Quaternary Science Reviews* 48:1–6.

Mobley, C. M. 1991 *The Campus Site.* University of Alaska Press, Fairbanks.

Mochanov, Y. A., and S. A. Fedoseeva 1996 Dyuktai Cave. Ust-Mil 2. Verkhne-Troistkaya. Ikhine. In *American Beginnings: The Prehistory and Paleoecology of Beringia,* edited by F. H. West, pp. 164–83;189–94. University of Chicago Press, Chicago.

Pasch, A. D., D. R. Yesner, and K. J. Crossen 2013 Late Pleistocene pinniped remains from the recessional area of Bering Glacier, Southcentral Alaska: Implications for early human coastal migration. Submitted to *Glacial Archaeology.*

Pearson, G. A. 1999 Early occupations and cultural sequence at Moose Creek: A late Pleistocene site in central Alaska. *Arctic* 52:332–45.

Phippen, P. G. 1988 Archaeology at Owl Ridge: A Pleistocene-Holocene Boundary Age Site in Central Alaska. M.A. thesis, Department of Anthropology, University of Alaska Fairbanks.

Potter, B. A. 2005 Site Structure and Organization in Central Alaska: Archaeological Investigations at Gerstle River. Ph.D. dissertation, University of Alaska Fairbanks.

——— 2007 Models of faunal processing and economy in early Holocene interior Alaska. *Environmental Archaeology* 12(1):3–23.

——— 2008 Radiocarbon chronology of central Alaska: Technological continuity and economic change. *Radiocarbon* 50(2):181–204.

——— 2011 Late Pleistocene and early Holocene assemblage variability in central Alaska. In *From the Yenisei to the Yukon: Interpreting Lithic Assemblage Variability in Late Pleistocene/Early Holocene Beringia,* edited by T. E. Goebel and I. Buvit, pp. 215-233. Texas A&M Press, College Station.

——— 2012 Transformations of Western Subarctic Archaeology. Paper presented at the 39th Annual Alaska Anthropological Association Meetings, Seattle. AAA Program 39, pp. 47–48.

Potter, B. A., and J. D. Reuther 2012 High resolution radiocarbon dating at the Gerstle River site, central Alaska. *American Antiquity* 77(1):71–98.

Potter, B. A., A. Little, and C. Glassburn 2013 Site structure and organization at Mead, central Alaska. Paper presented at the 40th Annual Alaska Anthropological Association Meetings, Fairbanks. AAA Program 40.

Potter, B. A., P. M. Bowers, J. D. Reuther, and O. K. Mason 2007a Holocene assemblage variability in the Tanana Basin: NLUR archaeological research, 1994–004. *Alaska Journal of Anthropology* 5(1):23–42.

Potter, B. A., P. J. Gilbert, C. E. Holmes, and B. A. Crass 2011b The Mead site, a late Pleistocene–Holocene stratified site in Central Alaska. *Current Research in the Pleistocene* 28:73–75.

Potter, B. A., J. D. Reuther, P. M. Bowers, and C. Gelvin-Reymiller 2007b Results of the 2007 Phase II Cultural Resource Survey of Proposed Alaska Railroad Northern Rail Extension Routes, Alaska. Prepared for ICF Consulting Services, LLC, by Northern Land Use Research, Inc., Fairbanks. NLUR Technical Report #278d.

——— 2008 Little Delta Dune site: A late Pleistocene multicomponent site in Central Alaska. *Current Research in the Pleistocene* 25:94–97.

Potter, B. A., J. D. Irish, J. D. Reuther, C. Gelvin-Reymiller, and V. T. Holliday 2011a A Terminal Pleistocene child cremation and residential structure from eastern Beringia. *Science* 331(6020):1058–62.

Powers, W. R., and J. F. Hoffecker 1989 Late Pleistocene settlement in the Nenana valley, central Alaska. *American Antiquity* 54(2):263–87.

Powers, W. R., and H. E. Maxwell 1986 Lithic Remains from Panguingue Creek, an Early Holocene Site in the Northern Foothills of the Alaska Range. Studies in History 189. Alaska Historical Commission, Anchorage.

Powers, W. R., R. D. Guthrie, and J. F. Hoffecker (eds.) 1983 Dry Creek: Archeology and Paleoecology of a Late Pleistocene Alaskan Hunting Camp. Report submitted to the National Park Service.

Rasic, J. T. 2000 Prehistoric lithic technology at the Tulauq Hill site, northwest Alaska. M.A. Thesis, Washington State University.

——— 2008 Paleoalaskan adaptive strategies viewed from northwestern Alaska. Ph.D. dissertation, Washington State University, Pullman.

——— 2011 Functional variability in the late Pleistocene Archaeological record of eastern Beringia: A model of late Pleistocene land use and technology from northwest Alaska. In *From the Yenisei to the Yukon: Interpreting Lithic Assemblage Variability in Late Pleistocene/Early Holocene Beringia,* edited by T. E. Goebel and I. Buvit, pp. 128–64. Texas A&M Press, College Station.

Rasic, J. T., and P. Matheus 2007 A reconsideration of purported Holocene bison bones in northern Alaska. *Arctic* 60:381–88.

Rasic, J. T., and N. S. Slobodina 2008 Weapon systems and assemblage variability during the northern Archaic period in northern Alaska. *Arctic Anthropology* 45(1):71–88.

Reanier, R. E. 2003 Archaeological and cultural resources reconnaissance in the ConocoPhillips Alaska Exploration Area, National Petroleum Reserve, Alaska, for the Year 2002. Prepared for ConocoPhillips (Alaska) Inc. by Reanier and Associates, Inc. Seattle.

Reeves, B. O. K., and J. F. Dormaar 1972 A partial Holocene pedological and archaeological record from the southern Alberta Rocky Mountains. *Arctic and Alpine Research* 4(4):325–26.

Sattler, R. A., T. E. Gillispie, N. A. Easton, and M. Grooms 2011 Linda's Point: Results from a new terminal-Pleistocene human occupation at Healy Lake, Alaska. *Current Research in the Pleistocene* 28:149–51.

Shinkwin, A. D., J. S. Aigner, and E. F. Andrews 1980 Land Use Patterns in the Upper Tanana Valley, Alaska. Anthropological Papers of the University of Alaska, 9(2): 43–53.

Shott, M. J. 1986 Technological organization and settlement mobility: An ethnographic examination. *Journal of Anthropological Research* 42:15–51.

Singer, F. J., and J. E. Norland 1994 Niche relationships within a guild of ungulate species in Yellowstone National Park, Wyoming, following release from artificial controls. *Canadian Journal of Zoology* 72:1383–94.

Speakman, R. J., C. E. Holmes, and M. D. Glascock 2007 Source determination of obsidian artifacts from Swan Point (XBD-156), Alaska. *Current Research in the Pleistocene* 24:143–45.

Steffian, A. F., E. Pontti-Eufemio, and P. G. Saltonstall 2002 Early sites and microblade technologies from the Kodiak Archipelago. Anthropological Papers of the University of Alaska, New Series 2(1):1–38.

Stephenson, R. O., S. C. Gerlach, R. D. Guthrie, C. R. Harington, R. O. Mills, and G. Hare 2001 Wood bison in late Holocene Alaska and adjacent Canada: Paleontological, archaeological and historical records. In *People and Wildlife in Northern North America: Essays in Honor of R. Dale Guthrie,* edited by S. C. Gerlach and M. S. Murray, pp. 124–58. BAR International Series 944. British Archaeological Reports, Oxford.

Stevenson, M. 1991 Beyond the formation of hearth-associated artifact assemblages. In *The Interpretation of Archaeological Spatial Patterning,* edited by E. M. Kroll, and T. D. Price, pp 269–300. Plenum Press, New York.

Stiner, M. C. 1990 The use of mortality patterns in archaeological studies of hominid predatory adaptations. *Journal of Anthropological Archaeology* 9:305–51.

Surovell, T. 2003 Simulating coastal migration in new world colonization. *Current Anthropology,* 44(4), 580–91.

Surovell, T. A., and N. M. Waguespack 2009 Human prey choice in the late Pleistocene and its relation to megafaunal extinctions. In *American Megafaunal Extinctions at the End of the Pleistocene,* edited by G. Haynes, pp. 77–105. Springer, Dordrecht.

Van Dyke, S. 1994 Oldman River Dam Prehistoric Archaeology Mitigation program, technical series no. 1: Campsites Study, 1988-1991. Archaeological Survey of Alberta, Edmonton.

West, F. H. 1967 The Donnelly Ridge site and the definition of an early core and blade complex in central Alaska. *American Antiquity* 32(3):360–82.

——— 1975 Dating the Denali complex. *Arctic Anthropology* 12:76–81.

West, F. H. (1981) The Archaeology of Beringia. Columbia Press, New York.

——— 1996 Beringia and new world origins II. The archaeological evidence. In *American Beginnings: The Prehistory and Palaeoecology of Beringia,* edited by F. H. West, pp. 537–59. University of Chicago Press, Chicago.

West, F. H., B. S. Robinson, and M. L. Curra 1996a Phipps site. In *American Beginnings: The Prehistory and Palaeoecology of Beringia,* edited by F. H. West, pp. 381–86. University of Chicago Press, Chicago.

West, F. H., B. S. Robinson, and R. G. Dixon 1996b Sparks Point. In *American Beginnings: The Prehistory and Palaeoecology of Beringia,* edited by F. H. West, pp. 394–98. University of Chicago Press, Chicago.

West, F. H., B. S. Robinson, and C. F. West 1996c Whitmore Ridge. In *American Beginnings: The Prehistory and Palaeoecology of Beringia,* edited by F. H. West, pp. 386–94. University of Chicago Press, Chicago.

Wilson, A. and J. T. Rasic 2008 Northern Archaic settlement and subsistence patterns at Agiak Lake, Brooks Range, Alaska. *Arctic Anthropology* 45(2):128–45.

Wooller, M. J., J. Kurek, B. V. Gaglioti, L. C. Cwynar, N. Bigelow, J. D. Reuther, C. Gelvin-Reymiller, J. P. Smol 2012 An ~11,200 year paleolimnological perspective for emerging archaeological findings at Quartz Lake, Alaska. *Journal of Paleolimnology* 48:83–99.

Wygal, B. T. 2011 The microblade/non-microblade dichotomy: Climatic implications, toolkit variability, and the role of tiny tools in eastern Beringia. In *From the Yenisei to the Yukon: Interpreting Lithic Assemblage Variability in Late Pleistocene/Early Holocene Beringia,* edited by T. E. Goebel and I. Buvit, pp. 234–54. Texas A&M Press, College Station.

Yesner, D. R. 1996 Human adaptation at the Pleistocene-Holocene boundary (ca 13,000 to 8,000 BP) in eastern Beringia. In *Humans at the End of the Ice Age: The Archaeology of the Pleistocene-Holocene Transition,* edited by L. G. Straus, B. V. Eriksen, J. M. Erlandson, and D. R. Yesner, pp. 255–76. Plenum Press, New York.

——— 2001 Human dispersal into interior Alaska: Antecedent conditions, mode of colonization, and adaptation. *Quaternary Science Reviews* 20(1-3):315–27.

——— 2006 Peopling of the Americas: A millennial perspective. In *The Settlement of the Americas: A Biogeographical Approach,* edited

by G. A. Clark, C. M. Barton, D. R. Yesner, and G. A. Pearson, pp. 196–214. University of Arizona Press, Tucson.

——— 2007 Faunal extinction, dietary diversity, and hunter-gatherer strategies in eastern Beringia. In *Foragers of the Terminal Pleistocene,* edited by R. B. Walker and B. N. Driskell, pp. 15–31. University of Nebraska Press, Omaha.

——— 2013 Understanding Hunter-gatherer Behavior in Beringia: Applications of Zooarchaeology. Paper presented to the 78th annual meeting of the Society for American Archaeology, Honolulu.

Yesner, D. R., and G. A. Pearson 2002 Microblades and migrations: Ethnic and economic models in the peopling of the Americas. In *Thinking Small: Global Pespectives on Microlithization,* edited by R. Elston and S. Kuhn, pp. 133–61. Archaeological Papers of the American Anthropological Association, Washington, DC.

Yesner, D. R., K. J. Crossen, and N. A. Easton 2011 Geoarchaeological and zooarchaeological correlates of early Beringian artifact assemblages. In *From the Yenisei to the Yukon: Interpreting Lithic Assemblage Variability in Late Pleistocene/Early Holocene Beringia,* edited by T. E. Goebel and I. Buvit, pp 308–22. Texas A&M Press, College Station.

Yesner, D. R., G. A. Pearson, and D. E. Stone 2002 Additional organic artifacts from the Broken Mammoth site, Big Delta, Alaska. *Current Research in the Pleistocene* 17:87–90.

Young, C. and S. Gilbert-Young 2007 A fluted projectile-point base from Bering Land Bridge National Preserve, Northwest Alaska. *Current Research in the Pleistocene* 24:154–56.

Zazula, G. D., G. MacKay, T. D. Andrews, B. Shapiro, B. Letts, and F. Brock 2009 A late Pleistocene steppe bison (Bison priscus) partial carcass from Tsiigehtchic, Northwest Territories, Canada. *Quaternary Science Reviews* 28:2734–42.