

18. Geoarchaeological and Zooarchaeological Correlates of Early Beringian Artifact Assemblages

Insights from the Little John Site, Yukon

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Although numerous attempts have been made to assess temporal variation in early Beringian sites and assemblages, comparatively little attention has been given to spatial and ecological differences in site contents. In the late 1980s, Powers and Hoffecker (1989; see also Hoffecker 1988; Hoffecker et al. 1988) addressed the geoarchaeological context of early “open-air” sites in interior Alaska, focusing on what was known in the northern Alaska Range region as a result of reconnaissance fieldwork in the late 1970s and 1980s. That work had dual considerations: understanding the taphonomic basis for the preservation of sites, and understanding the reasons for site selection by early human colonists of eastern Beringia. Zooarchaeological work by Guthrie (1983) at the Dry Creek site established some considerations as to possible site utilization. Since that time, considerable additional work has been done on late Pleistocene/early Holocene sites, expanding from the tributary Nenana and Delta river valleys to the main course of the Tanana River valley (Holmes 1996; Holmes and Yesner 1992; Krasinski and Yesner 2008; Yesner 1996, 2001, 2007; Yesner and Crossen 1994; Yesner and Pearson 2002; Yesner et al. 2004).

Recently, work on late Pleistocene/early Holocene Beringian sites has expanded from the lower and middle Tanana valley to the upper Tanana valley (Easton and MacKay 2008; Easton et al. 2007; Easton et al. 2009; Yesner et al. 2008; and see Easton et al., this volume), creating additional impetus for reconsidering the geoarchaeological and zooarchaeological contexts of site preservation and site function. This research has focused on the Little John site, located in the Alaska-Yukon borderlands. This newer work has demonstrated a new, previously unrecognized geoarchaeological context for the preservation of deeply buried early Beringian sites with

excellent faunal preservation, expanding our knowledge of early human adaptations in Beringia. At the same time, this expanded zooarchaeological database, essentially deriving from an east-west transect through interior Alaska and the western Yukon, has created an opportunity for us to gain insights into subsistence variability and settlement patterns in late Pleistocene/early Holocene Beringia. It also allows consideration of regional variability in paleoclimatic and paleoenvironmental change in Beringia during the late Pleistocene/early Holocene period that may help to explain the demise of the late Pleistocene “Nenana complex” as well as the adaptive basis of the succeeding early Holocene “Denali complex” in eastern Beringia.

Previous Geoarchaeological Models of Interior Alaskan Sites

As Powers and Hoffecker originally noted, early “open-air” (non-cave) sites in interior Alaska, such as Dry Creek in the Nenana valley, were generally limited to loess deposits dated to the late Pleistocene/early Holocene period (table 18.1). These loess deposits were largely the result of eolian entrainment and deposition of glaciofluvial valley bottom silts, which were then redeposited on valley edge bluffs. Figure 18.1 shows an example of a deep loess section from the Broken Mammoth site in the Tanana valley. However, colluvial reworking of those and earlier-deposited silts was also involved. Furthermore, even if the silts were purely eolian, their deposition would have been a function of floodplain size, degree of vegetation, distance from floodplain to source, and wind regime. In addition, truncation of deposits as well as deposition must have occurred, especially under conditions of high wind regimes. This makes the attempts by Bigelow (1991; Bigelow et al. 1990), Dilley (1998), and others to derive late

Table 18.1. Geomorphological/Sedimentary Contexts for “Open-Air” Eastern Beringian Archaeological Sites

Loess deposits (post-12,500 ¹⁴ C yr BP)
Deposition: primary eolian va. colluvial; episodic truncation;
regolith: bedrock, river gravels, outwash
Retransported loess in valley bottoms (“mucks”)
Intercalated sand deposits
Eolian/colluvial contexts on valley margins
Post-LGM dune deposits in valley bottoms
Lacustrine sedimentation
Eolian/colluvial deposition in swales between bedrock/outwash “lobes”
Linkages with paleosols
Deposition <i>within</i> paleosol units (Broken Mammoth, Little John)
Deposition <i>between</i> paleosol units (Dry Creek, Gerstle Quarry)

Pleistocene and Holocene loess sedimentation rates from these deposits difficult at best. It is important to note that these deposits have been formed on a variety of regoliths, including bedrock knolls (e.g., of the Yukon-Tanana upland) and terraces formed of river gravel and outwash deposits.

A variety of other potential geomorphological contexts for early sites were examined by Powers and Hofecker (1989), including glaciofluvial outwash, side-valley fan alluvium, older (pre-12,000 ¹⁴C BP [ca. 13,840 cal BP]) loessic colluvium, and primary frozen loess. Glaciofluvial outwash seemed not to be a good medium for site preservation; other contexts were rejected primarily because of difficulties in accessing and testing these contexts. However, where fan sediments and particularly earlier loessic colluvium have been exposed, no site materials have been recorded to date. For example, extensive earlier Pleistocene loess deposits are found above the Broken Mammoth site and in the Jack Wade region near Delta Junction (Crossen et al. 1991; Crossen et al. 1992), but no artifactual materials have yet been recovered. This remains, however, a potential source of site discovery, since it is likely that, like later Holocene loess, many of these earlier loess deposits were truncated in areas of higher wind regimes and differentially retained in more protected settings. Another potential source of sites remains exposures at side-valley stream mouths. For obvious reasons, no archaeological materials have yet been derived from sediments in contemporary valley fills, as in the Tanana River, since they have been reworked by stream meanderings and since additional fluvial deposition occurred throughout the Holocene period, deeply burying any potential sites. However, as Dixon (1993) has pointed out, reworked loess deposited in valley bottoms in the Fairbanks area, recovered as a result of gold mining operations, has provided some

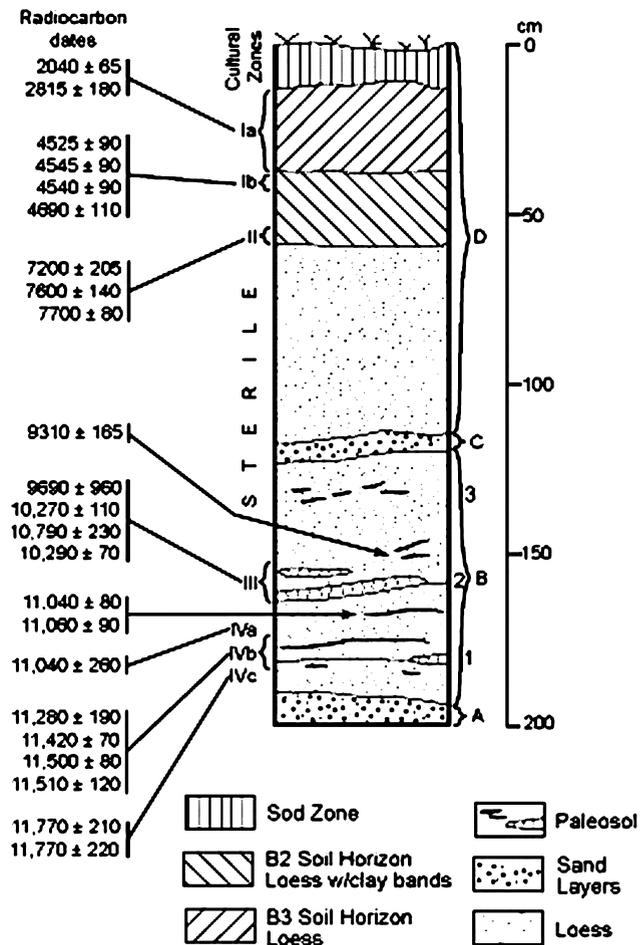


Figure 18.1. Stratigraphy of the Broken Mammoth site, Big Delta, Alaska (Holmes 1996. Used by permission).

limited examples of early artifactual materials in disturbed contexts. Additionally, as Cook (1969) noted some forty years ago, sites such as Healy Lake Village in the central Tanana valley may be preserved in lacustrine deposits, although these also provide unique depositional and erosional challenges.

Besides preservation in silts, there have also been preservation and retrieval of sites from sand deposits. One context is in large blowouts in areas of high-energy deposition along major river settings, such as at the Greeley Overlook site excavated by Bacon and Holmes (1980). Another more recently recognized context is in dunal deposits associated with major late Pleistocene dunefields, as in the area of Shaw Creek Flats in the middle Tanana River valley (Potter et al. 2008). In this chapter we explore an additional, newly recognized context for early site preservation: deeply buried eolian/colluvial deposits entrained in swales between bedrock and outwash “lobes.”

In all of these cases, it has been assumed that rapid

deposition of either silts or sands has been a major factor in preservation of early artifact assemblages. Comparatively little attention has been given to the comparative roles of wind deflation, colluviation, cryoturbation, and other factors in the displacement of materials. Another problem that has not been widely discussed is the relationship of paleosols as indicators of ground surface and vegetational stabilization and artifact assemblages. In some sites, such as Broken Mammoth, all artifactual materials were universally entrained within distinct paleosols (see Yesner 1996, 2001, for a detailed discussion of the Broken Mammoth site). At others, such as Dry Creek, it is clear that artifacts were not always associated with paleosols and in fact were frequently found in loess units unrelated to paleosols (Thorson and Hamilton 1977). We discuss this issue here in relation to new work at the Little John site.

The preservation of faunal remains within eastern Beringian open-air sites appears to be a function of a series of interacting variables affecting the acidity of boreal forest soils. These include the following:

1. The nature of the bedrock source for eolian/colluvial sediment; for example, loess derived from glacial erosion of high-carbonate rocks produces highly alkaline deposits, increasing the probability of faunal preservation.
2. The presence and position of the permafrost table during the late Pleistocene/early Holocene period; for example, a formerly higher permafrost table may have post-depositionally encased bones in ice; this is probably limited to only a few sites.
3. Rapidity of post-depositional burial; for example, very rapid burial would probably enhance the preservation of faunal materials.
4. Depth of sediment deposit; for example, thick sediments prevent acids leached from spruce needles (derived from denser late-Holocene coniferous forests) from interacting with deeply buried bones.
5. The timing of initiation of podsolization; for example, exactly when denser coniferous forest developed.
6. Edaphic exposure, especially southerly exposure limiting effects of cryoturbation.

As a result of these interacting factors, good faunal preservation in most interior Alaskan sites has been relatively rare. In the Nenana valley, only the Dry Creek site has exhibited any degree of faunal preservation, and this

is limited to a few fragments of bison, wapiti, and mountain sheep dentitions (Guthrie 1983). In the middle Tanana valley, good faunal preservation has characterized most sites but is particularly notable at the Broken Mammoth site (figure 18.1) with the thickest loess cap. Farther east within the Tanana valley, at the Gerstle River Quarry site, limited amounts of bison and wapiti bones were recovered, in addition to fragments of mammoth tusk, small mammal bones, and bird bones (Potter 2002, 2007). Newer excavations in the upper Tanana valley, however, have greatly expanded the faunal sample for eastern Beringia.

New Data from the Alaska/Yukon Borderland Region

With the expansion of the database to encompass sites farther east within the Tanana valley, such as Gerstle River Quarry, and now sites of the upper Tanana valley in the Alaska-Yukon borderlands, we have enough spatial and paleoenvironmental data to begin for the first time to consider the relationship between environmental context and the nature of artifactual assemblages over a larger region. Doing so places the earlier work in the lower and middle Tanana valley sites within a regional context that helps to explain the contents of those sites in a paleoenvironmental framework. Guthrie (2001) has noted that, at the time of the last glacial maximum (LGM), which was his main concern, there appears to have been considerable variability within regional faunas, which he used to define a “mesic buckle” in which far eastern (and far western) Beringian faunas (including insects) reflected more continental (i.e., colder and more arid) conditions, whereas those closer to the center of the former land bridge reflected more mesic conditions. In many ways this argument represents a resolution of the LGM “productivity paradox,” in which Yukon (especially northern Yukon) pollen data were seen to reflect much harsher, more continental conditions.

Expanding the “Mesic Buckle”

Why should such a mesic “buckle” be restricted to the LGM? If anything, under the conditions of late Pleistocene/early Holocene amelioration, when seasonal shifts in insolation and biotic productivity became more pronounced, one should expect exacerbation of this trend as the land bridge dissolved and low-pressure systems circulated in both the Gulf of Alaska and Bering Sea regions, bringing increased moisture to the western portions of eastern Beringia. Because of predominant northwesterly airflow across the Alaska Range, furthermore, one should expect east-west differences, for example, between areas of interior Alaska including the lower Tanana and Nenana

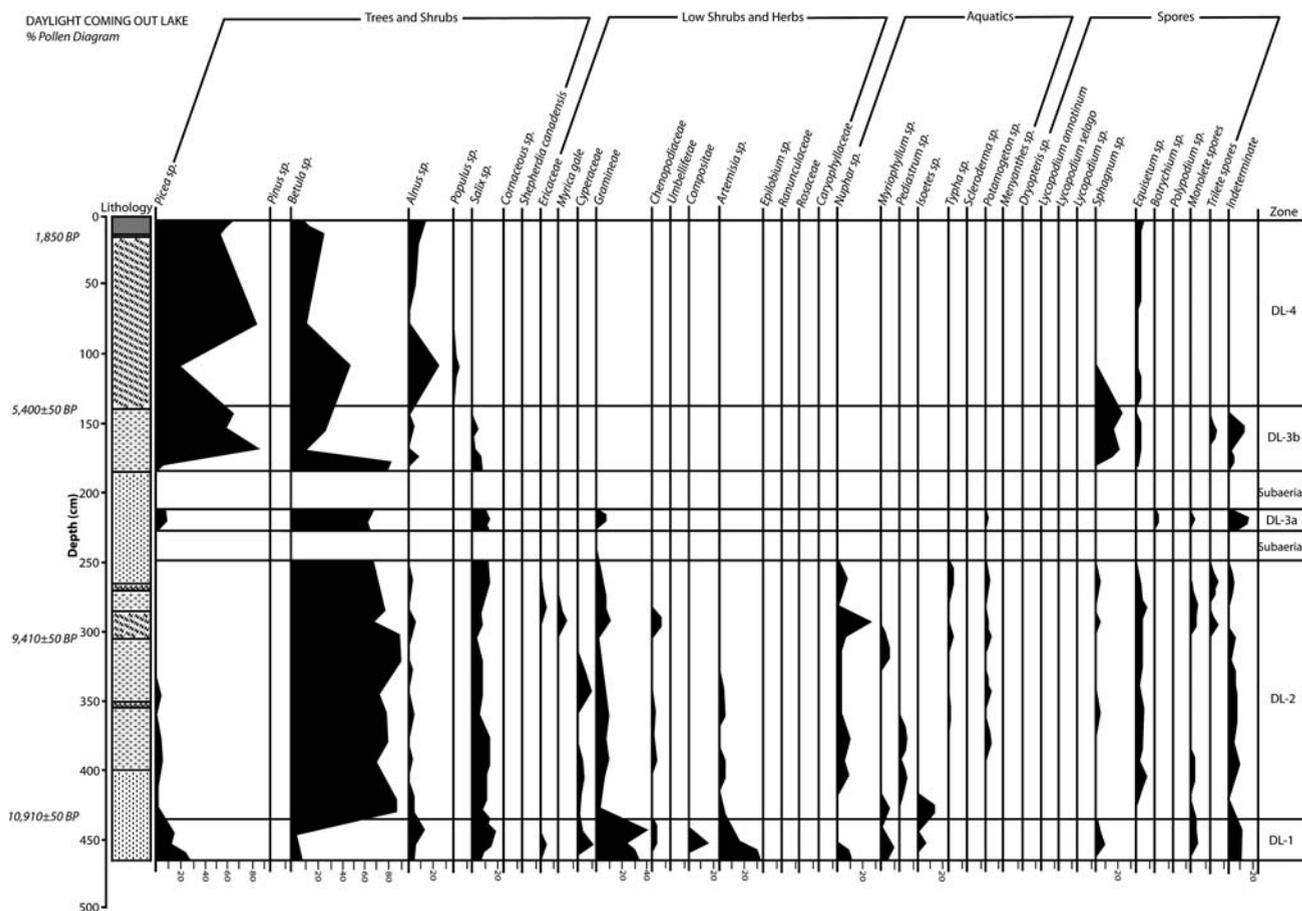


Figure 18.2. Daylight Coming Out Lake pollen diagram (Stuart White, after MacIntosh (1997)).

valleys and the Alaska/Yukon borderlands and upper Tanana valley, which would be much less likely to reflect the same degree of environmental amelioration. Newer pollen work in the area for the late Pleistocene/early Holocene period in the southern Yukon and the Alaska/Yukon borderlands region seems to reflect this (Schweger 1997).

In particular, work by MacIntosh (1997) at Daylight Coming Out Lake in the Alaska/Yukon borderlands (figure 18.2) demonstrates that conditions in this area were significantly different from those in the middle or lower Tanana valley. The terminal Pleistocene “birch rise” that occurs in the middle/lower Tanana valley around 14,000 ¹⁴C BP (ca. 16,690 cal BP) apparently did not take place in the Alaska/Yukon borderlands until about 11,000 ¹⁴C BP (ca. 12,900 cal BP), and the “poplar rise” in the middle/lower Tanana valley after 11,000 ¹⁴C BP was virtually non-existent in the Alaska/Yukon borderlands. In addition, the pollen records at both Daylight Coming Out Lake and Antifreeze Pond in the northern Yukon (Rampton 1971) show that the spruce rise in this region is significantly later than in the middle and lower Tanana valley,

occurring no earlier than 8500 ¹⁴C BP (ca. 9500 cal BP) and perhaps as late as 7500 ¹⁴C BP (ca. 8350 cal BP). This undoubtedly reflects significantly colder and more arid conditions in the upper Tanana valley across these time periods.

The consequences of these regional vegetational differences for variability in early Beringian faunas would have been enormous. Before about 11,000 ¹⁴C BP, the Alaska/Yukon borderland vegetation, apparently still predominantly steppe tundra (with some willow), would have been likely to support primarily caribou populations. In contrast, the birch woodlands of the middle/lower Tanana valley at the same time would likely have supported a more diverse, “mesic” fauna including bison and moose. After 11,000 ¹⁴C BP, when birch finally makes its appearance in the upper Tanana valley, conditions would likely have supported a more diverse, bison-dominated fauna like that present earlier in the middle/lower Tanana valley, and at this time the middle/lower Tanana valley would have supported an aspen parkland and, apparently, significant populations of wapiti as well

as bison (based on evidence from the Broken Mammoth site). However, the later spruce rise in the upper Tanana valley may have meant the persistence of Beringian faunas, predominantly bison, later into the early Holocene period. This may help to explain the later dates on bison remains in southwestern Yukon archaeological sites—as late as 7400 ¹⁴C BP (ca. 8230 cal BP) (Workman 1978). In a sense, the western Yukon may have served as a refugium for bison populations. We explore the consequences of this situation for early human populations in eastern Beringia below.

Geoarchaeology and Zooarchaeology of the Little John Site

Discovery of the Little John Paleoindian site, located in the Scottie Creek drainage of the Alaska/Yukon borderlands (figure 18.3), has created the potential for new perspectives on eastern Beringian archaeology within a broader paleoenvironmental context (Easton et al. 2007, and see this volume). The Little John site represents a geoarchaeological context that has not been previously recognized, that of entrainment of artifacts and bones within deeply buried eolian and colluvial sediments in swales between bedrock and outwash “lobes” (see figure 17.3 in Eaton et al., this volume).

Specifically, at the Little John site there is a western bedrock knob or lobe that overlooks Mirror Creek, a tributary of the Scottie Creek drainage. Here the sediment package is relatively thin (<30 cm) and contains poor stratification, limited to an organic B2 horizon, an undated ash layer, and a relatively homogeneous, massive unit overlying broken shards of fragmented regolith. All radiocarbon samples from this lobe have dated to the mid-to-late Holocene period (Easton et al., this volume). Notched points and related styles from this lobe are consistent with mid-to-late Holocene dates. Microblade materials from this unit are not necessarily diagnostic as to time period within the Holocene. Chindadn-style triangular and subtriangular projectile points have been derived from this unit, but their dating is unclear, as none have been directly associated with any datable material. Faunal materials from this unit are in general poorly preserved, and when preserved are highly fragmented, but identifiable samples suggest a focus on moose and hare (Yesner n.d.).

Approximately 10 m northeast of the northern edge of the West lobe is another area that has produced abundant archaeological materials at the Little John site. A deep swale between the southern edge of the East lobe and the northern edge of the Permafrost lobe (see figure 17.6 in Eaton et al., this volume) has entrained these early archaeological materials. The deposit in this swale contains a loess deposit greater than 1 m thick. This loess unit

contains a basal paleosol complex that has been exposed over a 12 m area. This paleosol has been well dated from 8850 to 10,000 ¹⁴C BP (ca. 10,000–11,480 cal BP) (Easton et al., this volume). All dates in this unit (and the underlying loess unit) have been produced on bone. Hearths (other than a few hearth smears) and significant-sized charcoal fragments are rare in this unit, probably because of extensive cryoturbation and colluviation. Several colluvial units intersect the set of paleosol stringers, which are themselves highly convoluted as a result of freeze-thaw processes.

The paleosol unit produced a wide range of biface fragments, flakes, and at least one example of a wedge-shaped core. During 2009, a Chindadn-style triangular point was also definitively located in this unit. The paleosol unit also contained an abundance of well-preserved faunal remains. Given the models of faunal preservation discussed above, it appears that the most relevant factors operant at the Little John site were the nature of the regolith, the thickness of sediment, the rapidity of burial, and possibly enhanced preservation in a formerly higher permafrost table (Yesner et al. 2008).

Faunal Assemblages from the Little John Site

In characterizing the faunal assemblages from the paleosol units at the Little John site, we have subdivided the data into the results of the 2003–2007 excavations, which focused primarily at the southern end of the East lobe swale, and the 2008–2009 excavations, which focused primarily at the northern end of the East lobe swale. All data presented here are based on NISP (numbers of identifiable specimens) in order to maximize sample size.

Overall, the faunal assemblage from the Little John site is clearly dominated by bison (figure 18.4). Within the large-mammal assemblage (figure 18.5), bison clearly dominates. Caribou was identified as second in importance primarily during the earlier excavations at the site, which suggests localization of specific taxa in different areas of the site, a phenomenon also found during excavations at the Broken Mammoth site (Yesner 2001). It also suggests that cryoturbation and colluvial processes operant at the site have not altered the faunal assemblage sufficiently to cause spatial homogenization of the sample. Moose is also present in small numbers, as at the Broken Mammoth site, but wapiti has a much smaller presence here than at Broken Mammoth (Yesner 2001).

When small mammals are added to the assemblage (figure 18.6), it is obvious that hare is secondary in importance to bison, particularly when compared across all years. Ground squirrel remains are much less important and may represent primarily intrusive animals utilizing krotovenas at the site rather than objects of human

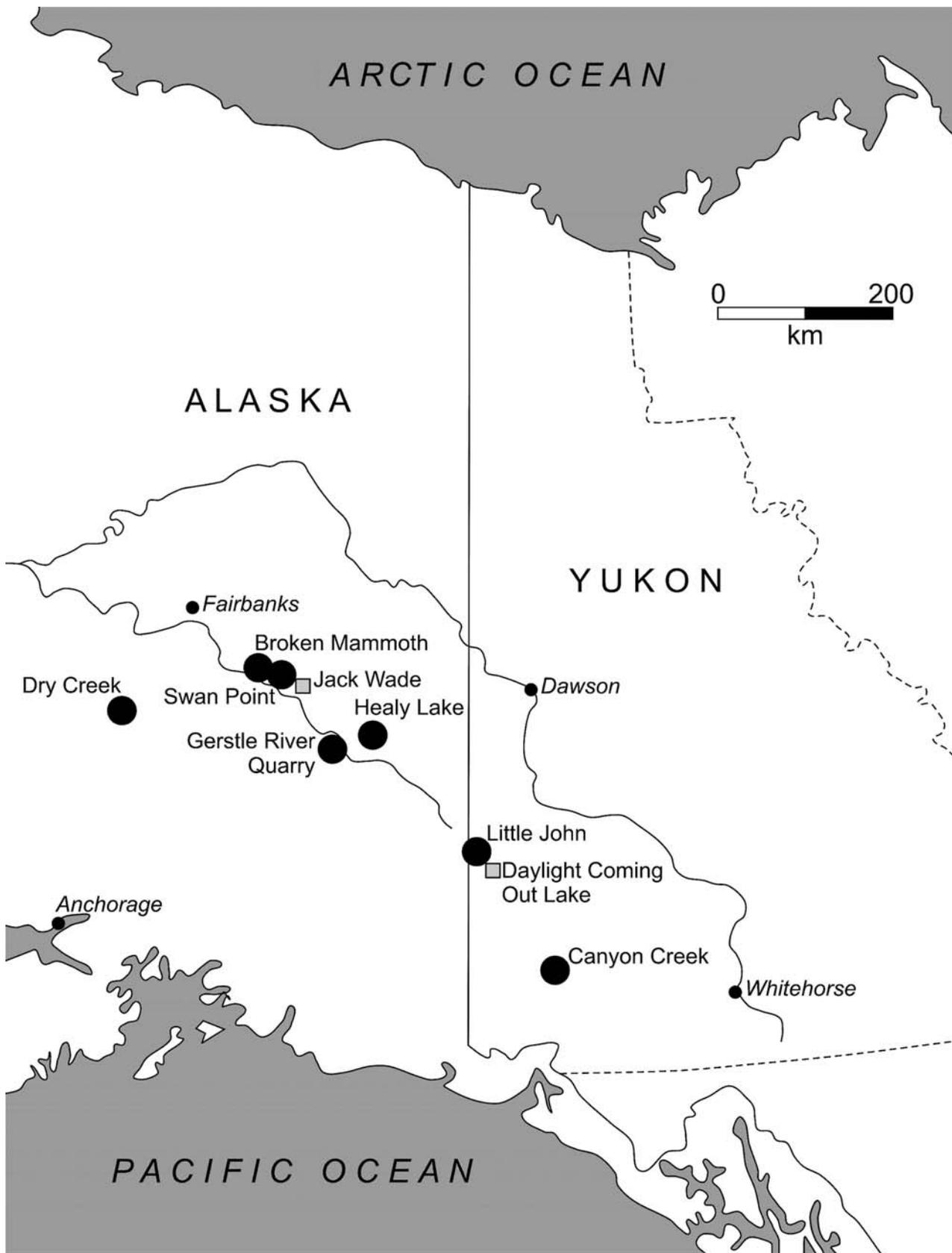


Figure 18.3. Location of the Little John site, Alaska/Yukon borderlands (Ted Goebel).

consumption (again, as at Broken Mammoth). Predators and scavengers whose remains are found at the site include bear and wolf, but arctic fox appears to be the most important (figures 18.5, 18.6), once again as at Broken Mammoth. All of these categories, however, are dwarfed by more generic categories of “large mammal” and “small

mammal” (figure 18.7), because of the high degree of fragmentation and relatively low level of identifiability to taxon or element for this faunal assemblage (probably around 15% of the total assemblage).

In comparison to the relatively well studied Broken Mammoth faunal assemblage, the Little John assemblage shows relatively few examples of bird remains. They are less than other major categories (bison, hare, and “other” mammals; see figure 18.8). These appear to be predominantly small ducks rather than the large tundra swans found at the Broken Mammoth site (Yesner 2001). A few unidentified fish remains have also been found at the site to date.

Skeletal element distributions from the paleosol units at the Little John site appear to reflect taphonomic processes more than human butchering or consumptive patterns. For bison (figure 18.9), meat-bearing units surrounding humeri, femora, and tibiae are relatively poorly represented, as are ribs, although taphonomic factors (e.g., rib breakage and fragmentation) may be at work here. The prevalence of cranial and dental materials, which are relatively durable, may reflect primarily taphonomic processes (i.e., increased survivability of these bones), although the presence of relatively large numbers of bison vertebrae may also suggest butchering processes (common among modern Athabascans) in which skulls and vertebrae may be left behind in butchering areas



Figure 18.4. Bison metapodial from main paleosol complexes, Little John site.

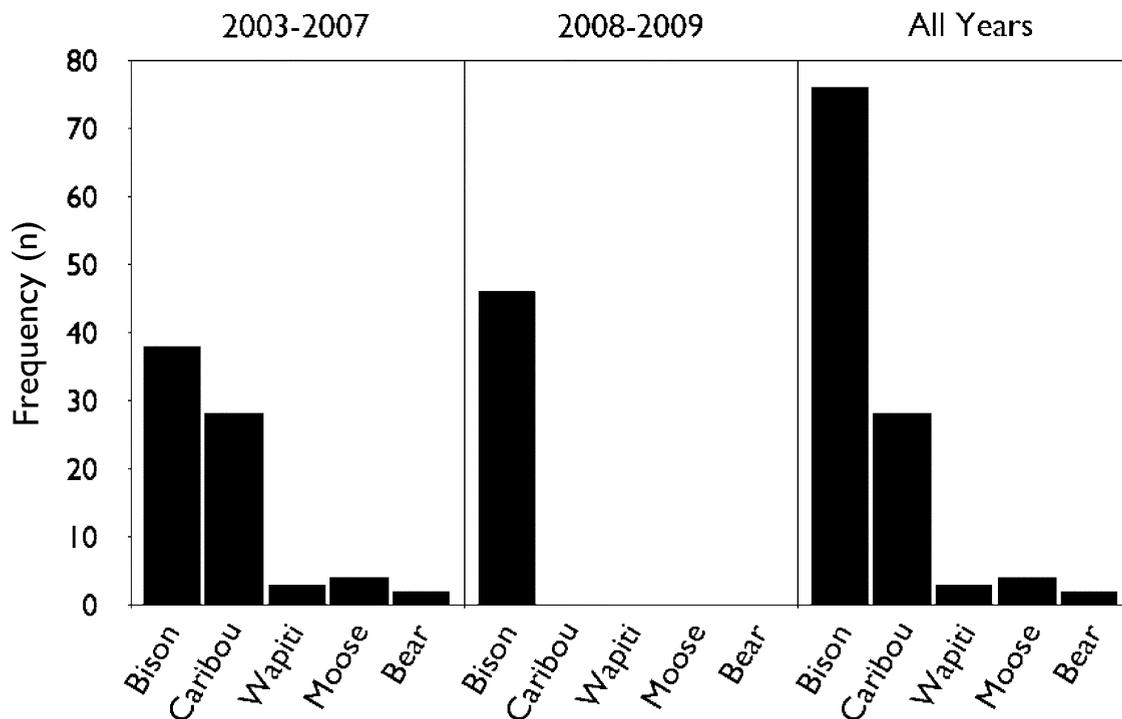


Figure 18.5. Large-mammal faunal data from the Little John site, 2003–2009 (NISP = 93) (Stuart White).

Figure 18.6. Mammalian faunal data from the Little John site, 2003–2009 (NISP = 130) (Stuart White).

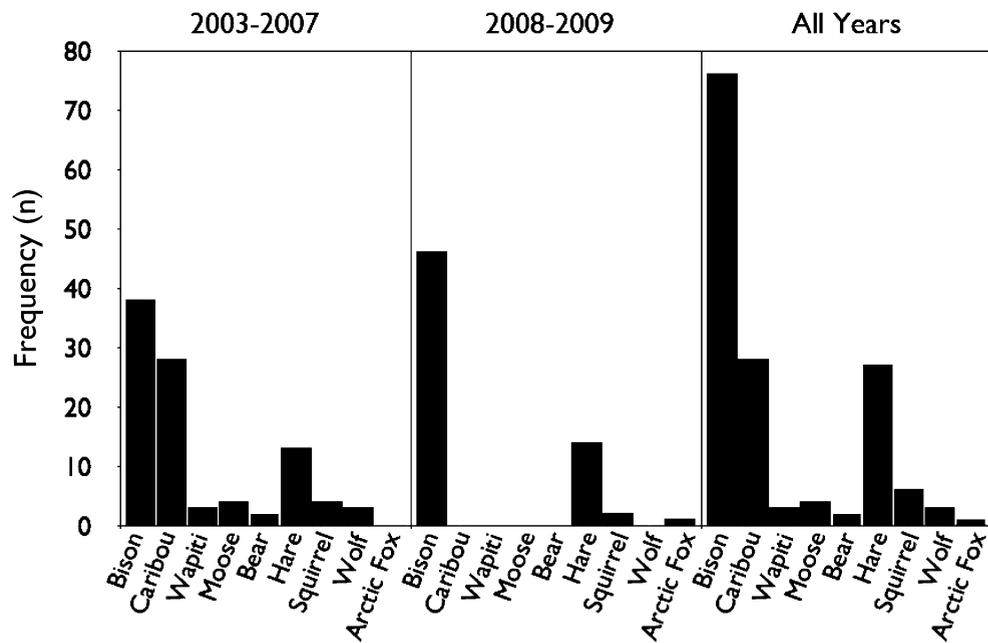
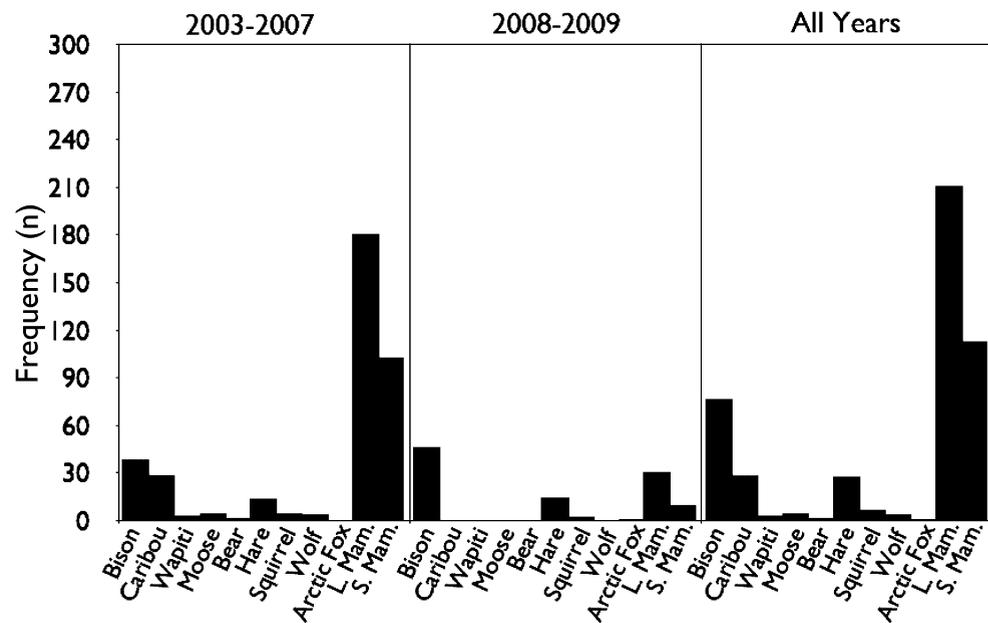


Figure 18.7. Mammalian faunal data from the Little John site, 2003–2009, including large- and small-mammal fragments (NISP = 456) (Stuart White).



(Yesner and Bonnichsen 1979). This may also be true of phalanges, although both metapodials and phalanges may also have been retained for access to marrow. Metapodials were probably also important for tool making (Yesner and Bonnichsen 1979). The fairly large numbers of flat bones (scapula and innominate, especially ilium, fragments) were probably also the result of taphonomic processes. Similar patterns were found for caribou faunal elements,

with cranial, dental, scapular, and metapodial fragments found in relatively large numbers. However, for caribou (figure 18.10) rib fragments were much more common, which may reflect a difference in butchering or consumption patterns, a difference in identifiability, or a difference in taphonomic survival. However, the relatively smaller sample size for caribou remains may come into play here as well.

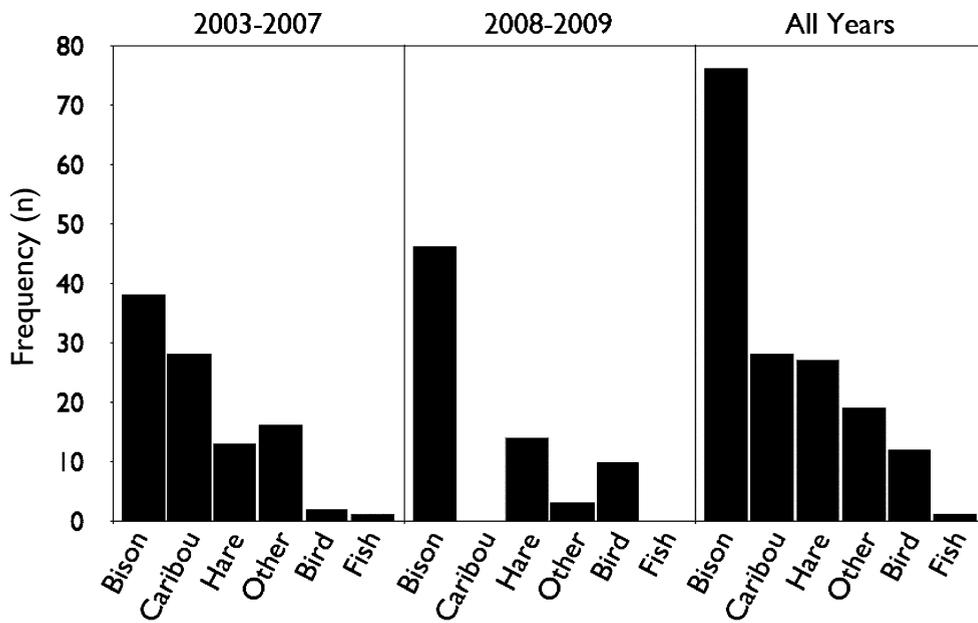


Figure 18.8. Vertebrate faunal assemblage from the Little John site, 2003–2009, including birds and fish (NISP = 469) (Stuart White).

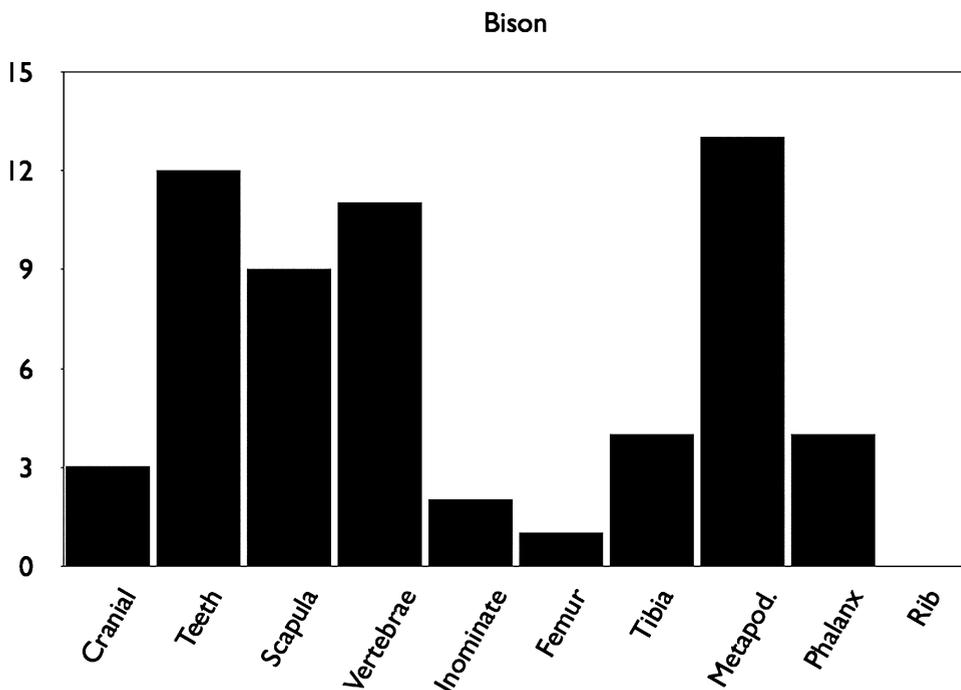


Figure 18.9. Bison skeletal element distribution from the Little John site (NISP = 59) (Stuart White).

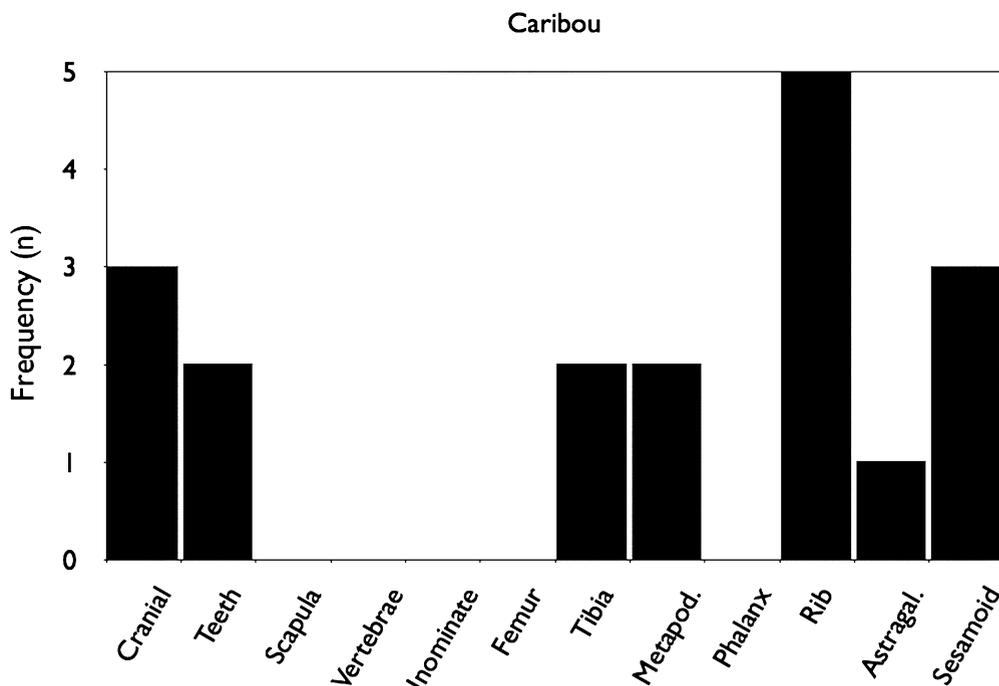
The Sub-Paleosol Loess Unit

During past years of excavation at the site, a loess unit containing archaeological materials had been recognized below the paleosol complex. In this sense, it is like the basal component at Dry Creek or some of the components at the Gerstle River Quarry site (Potter 2002, 2007) that are not directly associated with paleosols. This unit

at the Little John site contains some flakes, scrapers, and cobblestone fragments, but no formal artifacts have been recovered from and no obvious hearth features found in this unit to date.

In addition to the relatively limited number of artifacts, at least two dozen bones and bone fragments have been recovered from the lower loess unit to date. The appearance of bones from this unit is distinctive; they appear

Figure 18.10. Caribou skeletal element distribution from the Little John site (NISP = 18) (Stuart White).



to be fire-hardened and have a vitreous or chalky consistency. It may be that, with reduced bone preservation in the sub-paleosol loess unit, only such fire-hardened bones survived well. This may also be what is responsible for the relatively low collagen content that has made dating bones from this unit difficult. To date, only one of the bison vertebrae proved to have sufficient collagen content and has produced a date of $12,020 \pm 70$ ^{14}C BP (ca. 13,880 cal BP) (see table 17.1 in Eaton et al., this volume). Currently this is among the oldest dates from Beringian archaeological sites, along with Swan Point (Holmes et al. 1996) and possibly Bluefish Caves 1 (Cinq-Mars 1979). As at the Broken Mammoth site, many of the bones have impact points or are spirally fractured (figure 18.11). As far as taxonomic identification is concerned, although the sample size is small, the material contains both bison and caribou, including a definitive astragalus at nearly 1 m below surface (figure 18.12).



Figure 18.11. Spirally fractured fire-hardened bones from the sub-paleosol loess unit, Little John site.

Discussion

If the patterns exhibited to date at the Little John site hold up with further excavation, several explanations can be offered as to the patterns exhibited at the site:

1. The upper Tanana region (Alaska/Yukon borderland) was initially occupied at approximately the same time as the lower and middle Tanana River valley—around $12,000$ ^{14}C BP (ca. 13,840 cal BP). The earlier dates at both ends of the Tanana valley suggest that it was

occupied earlier than the tributary Nenana valley. At both ends of the Tanana valley, early dates seem to be correlated with triangular and teardrop-shaped points of the “Chindadn complex” as first defined by Cook (1969) at Healy Lake and included as an important part of the “Nenana complex” as defined by Goebel et al. (1991). In essence, the upper Tanana valley, including its tributary streams such as Scottie Creek, represents the easternmost extension of



Figure 18.12. Caribou astragalus from the sub-paleosol loess unit, Little John site.

classic Beringian Nenana complex assemblages, which seem to be associated with this always-unglaciated area. This is in part because the late Pleistocene McConnell glaciation, which terminated just to the east of the Alaska/Yukon borderlands, altered the stream pattern in that region and essentially terminated the upper Tanana valley. It may well be that larger herds of bison during Beringian times were primarily associated with the Tanana valley and its tributaries such as the Delta River valley, which forms the core of the habitat for reestablished bison populations in interior Alaska today. In sum, there was likely a correspondence between the Tanana valley, bison populations, and the Nenana complex. To the east, in the formerly glaciated area of the Yukon, early sites are dominated by microblade assemblages (Heffner 2002; see also Clark and Gotthardt 1999; Hare 1995; Workman 1978) and may represent a subsistence base more dependent on caribou, as was the later Denali complex in Alaska (Mason et al. 2001).

2. The presence of caribou (at nearly 1 m below surface) as well as bison in the lowest component at the Little John site suggests that the “buckle” that resulted in a later appearance of birch, poplar, spruce, and alder in the Alaska/Yukon borderlands had some consequences for fauna and therefore the subsistence base of local human populations. Thus, whereas the earliest component at Broken Mammoth had a more “mesic” character, containing moose, otter, and waterfowl, the earliest component at the Little John site—just beyond the reach of the McConnell late glacial ice—may have retained a fauna indicative of colder, dryer conditions, probably correlated with an environment that continued to display largely steppe tundra-like character.

3. Just as in other Alaskan sites, the Little John site

shows a clear stratigraphic and temporal differentiation between a pre-Younger Dryas component and a later, post-Younger Dryas component. The post-Younger Dryas component, dated between 9500 and 10,500 ¹⁴C BP (ca. 10,740–12,510 cal BP), is not yet clearly differentiable from the pre-Younger Dryas component on the basis of the artifact assemblage. This is the case at Broken Mammoth as well (Yesner et al. 2004). The complete dominance of bison in the post-Younger Dryas component at the Little John site suggests that, although conditions had become ameliorated in comparison with the pre-Younger Dryas unit, they were still relatively cold and arid compared with the middle/lower Tanana valley. The faunal assemblage was less diverse, with less representation of wapiti and other taxa probably related to the aspen parkland reflected by the “poplar rise.” The slightly later dates on this component indicate that, as the pollen record suggests, once in place the birch woodland may have lasted from 500 to 1,000 years longer here than in the upper Tanana region, where spruce and alder appear earlier, possibly from a refugium in interior Alaska (Anderson et al. 2006). As noted above, this is further confirmed by bison remains from as late as 7400 ¹⁴C BP (ca. 8230 cal BP) found at the Canyon Creek site in the southern Yukon (Workman 1978), around the time that MacIntosh (1997) suggests spruce colonization of the region was completed. It may also be the case that a later spruce rise meant some retardation in the spread of forest fires in areas of spruce vegetation under the arid, windy conditions of the Hypsithermal period.

4. Even in the early stages of faunal recovery from the Little John site, some trans-Beringian patterns are obvious (table 18.2). Some sites, such as Dry Creek and Gerstle River Quarry, have produced assemblages characterized by relatively low species diversity, even (as is the case at Gerstle River Quarry) where there is a relatively high number of total bone fragments. This may reflect a greater degree of subsistence specialization. Other sites, such as Broken Mammoth and the Little John site, have produced a wider range of faunal resources, even if dominated by bison. This may suggest that the latter sites were used for longer periods. However, given the larger number of bone fragments from both sites—especially from Broken Mammoth—this pattern simply may be a function of sample size, although that in part may be saying the same thing (more debris reflecting a wider range of activities). This situation is likely reflected by the high frequency of cobble tools, cortex flakes, and flakes made of immediately available material in the sub-paleosol loess, a similar situation as in the Broken Mammoth site or many sites in the Nenana valley (Graf and Goebel 2009; and see Goebel, this volume). The lack of distinctive hearths in

Table 18.2. Faunal Remains from Eastern Beringian “Open-Air” Archaeological Sites

	<i>Dry Creek</i>	<i>Broken Mammoth</i>	<i>Gerstle River Quarry</i>	<i>Little John</i>
Mammoth		[Tusk]	[Tusk]	
Bison	x	x	x	x
Caribou		x		x
Wapiti	x	x	x	x
Moose		x		x
Mtn. sheep	x	x		x
Hare		x		x
Fox		x		x
Tundra swan		x		x
Other birds		x	x	x

the sub-paleosol loess unit may also reflect this situation, which would have involved a significantly higher level of mobility in comparison with later, post-Younger Dryas occupations. On the other hand, this situation could be created by colluviation and cryoturbation in the basal unit, displacing some bones from their original points of deposition.

To verify these patterns, a great deal more excavation will be necessary at the Little John site, particularly in the sub-paleosol loess unit, which extends to depths of more than 2 m. It will also be necessary to survey for sites with similar bedrock knobs that may entrain deep swales of eolian and colluvial sediments, such as in the adjacent drainages of the Alaska/Yukon borderlands. Plans are underway to pursue both of these research strategies.

Conclusions

1. In addition to previously recognized geoarchaeological contexts, the Little John site forces us to recognize an additional context in which eolian/colluvial silts are entrained within swales between bedrock and outwash “lobes.”
2. In spite of some problems with colluvial and frost-related processes, it is possible to identify distinct paleosol units in these upper Tanana valley sites. Whereas some archaeological assemblages are associated with these units, others (including the oldest occupation, dating to 12,020 ¹⁴C BP [ca. 13,880 cal BP]) are not.
3. During the late Pleistocene and early Holocene in eastern Beringia, as climatic conditions ameliorated,

seasonality of solar insolation and biotic productivity became more pronounced, the “mesic buckle” became more visible, and potential for regional climatic differences became greater.

4. Regional variation is particularly visible across east-west transects such as the Tanana River valley. This may be particularly true of pre-Younger Dryas times, when very small, highly mobile populations were present. In the lower and middle Tanana valley, occupations had the same degree of antiquity as in the upper Tanana valley, but more mesic conditions may have prevailed, and moose and aquatic species may have been targeted earlier. In both areas, bison (and secondarily wapiti) were the major resources, but caribou may have been important in the colder, more arid conditions in the upper valley area. The Younger Dryas seems to have led to a brief regional abandonment, but pre- and post-Younger Dryas faunas are not appreciably different. A greater diversity of taxa is associated with the less mobile populations characteristic of post-Younger Dryas occupations in all areas. These correlate with greater amounts of occupational debris, diversity of tool types, and number and depth of hearths (Krasinski and Yesner 2008).
5. Faunal remains are preserved in eastern Beringian sites only in specific geoarchaeological contexts. When better preservation does exist, site-specific differences are seen in the diversity of exploited resources. The Broken Mammoth and Little John sites, for example, with similar basal dates, seem to represent a similar diversity of exploited resources. This stands in contrast to other sites from which a more limited range of resources was exploited. In the cases of Broken Mammoth and the Little John site, we would argue that these are areas from which diverse microenvironments could be accessed and a relatively wider diversity of resources could be taken, even though the range of dietary breadth would become more limited during harsher environmental episodes.
6. It is now clear that, although Nenana/Chindadn complex assemblages may have been established as early as 12,000 ¹⁴C BP (ca. 13,840 cal BP) in the Tanana valley, they also lasted until as late as 9000 ¹⁴C BP (ca. 10,200 cal BP) at sites such as Broken Mammoth and Little John. This long-term continuity may contrast with other locations in which microblade technologies were adopted primarily for caribou hunting. (This may also explain the dominance

of microblade assemblages at the Swan Point site, which like pre-12,000 ¹⁴C BP Little John was more focused on caribou exploitation).

After 10,500 ¹⁴C BP (ca. 12,510 cal BP), the post-Younger Dryas world represented the “paradise” of early Holocene Beringian bison hunters, in the transitional open wooded parkland that supported both larger animal populations and larger, more sedentary human populations, as suggested from interior Beringian sites. After about 9,000 ¹⁴C BP (ca. 10,200 cal BP), however, this window of opportunity began to close, as expanding spruce forest began to affect these animal populations. The latter probably included direct effects of vegetational change but also indirect effects such more widespread forest fires during the early Holocene Hypsithermal period, a situation that may well be analogous to contemporary arctic warming (Higuera et al. 2008; Lynch et al. 2004; Tinner et al. 2006; see also Anderson et al. 1994). This may also have been a period of increased wind intensity (Bigelow et al. 1990), which would have fanned incipient forest fires. In any case, the changing conditions undoubtedly had significant impact on regional game populations, leading to a decline of bison and wapiti in particular and endangering sustainability of human populations in the interior forest region.

Mason et al. (2001) have additionally suggested that Beringian subsistence options become restricted in the face of the “younger-Younger Dryas” climatic deterioration around 8200 ¹⁴C BP (ca. 9160 cal BP). However, the variability in terminal dates for early Beringian occupations, with some as late as 8000 ¹⁴C BP (ca. 8890 cal BP), may be more related to regional variability in the final establishment of spruce forest from its probable Pleistocene refugium (Anderson et al. 2006). In any case, by 8000 ¹⁴C BP bison and wapiti populations in the interior were probably in serious decline, with remnant populations in the Alaska/Yukon borderlands. Given that situation, before the establishment of mid-Holocene anadromous fish runs, a variety of alternative subsistence options would have been sought out, including colonization of the formerly glaciated regions of south-central Alaska (Wygall, this volume) and increasing occupation of the coast (Carlson 2008; Yesner 2001). This would have opened a new chapter in Beringian subsistence and brought to a close the classical picture of big-game hunting reflected at sites such as Little John.

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From the Yenisei to the Yukon

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