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RADIOCARBON CHRONOLOGY OF CENTRAL ALASKA: TECHNOLOGICAL CONTINUITY AND ECONOMIC CHANGE

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ABSTRACT. This research presents the first comprehensive radiocarbon chronology for central Alaska, encompassing the late Pleistocene and Holocene archaeological record. Dated component distributions, comprised of 274 ^{14}C dates from 160 components, indicate changing land-use strategies and subsistence economies, reflecting primarily lowland exploitation of bison, wapiti, and birds prior to 6000 cal BP, followed by increasing caribou and fish exploitation and use of upland areas. Microblade technology is conserved from the earliest components to ~1000 cal BP, and this continuity is not reflected in current cultural history sequences. Using component abundance as a proxy for population, initial colonization is associated with climate amelioration after ~14,000 cal BP, and population declines are associated with the Younger Dryas (13,000–12,000 cal BP) and initial establishment of widespread spruce forests (10,000–9000 cal BP).

INTRODUCTION

The archaeology of central Alaska, defined here as the Tanana, Susitna, and Copper River basins, encompasses an important record (Figure 1). This region is arguably the longest continuously inhabited area in the Western Hemisphere (Holmes et al. 1996; this paper). Archaeological data has the potential to contribute significantly to ongoing debates about the colonization of the New World and late Pleistocene extinctions (Hofman and Todd 2001; Grayson and Meltzer 2002; Waguespack and Surovell 2003; Shapiro et al. 2004). Ethnoarchaeological work on subsistence, settlement, and land-use strategies of hunter-gatherers in high-latitude environments have proven important in broader anthropological theory building (Amsden 1977; Binford 1977, 1978, 1980, 1991; Enloe 1993). However, synthetic work to date has typically been restricted to a few well-known sites (Sheppard et al. 1991), restricted to a limited time frame (Hamilton and Goebel 1999; Mason et al. 2001; Bever 2006) or a limited geographic area (Dixon et al. 1985).

Most current interpretations of prehistory are derived from cultural historical frameworks, which are more descriptive than explanative. These cultural sequences are based primarily on presence/absence of specific lithic tool types and technologies, rather than on differences in subsistence and land-use strategies, site structure, and organization (e.g. Cook and McKennan 1970; Cook 1975; Bacon 1977; Dixon 1985; Powers and Hoffecker 1989; West 1996b). There are limitations to these conceptual approaches as applied to assemblages in this region. These archaeological constructs are descriptive and employ normative concepts of culture, offering relatively few avenues for testing hypotheses for cultural change or adaptation, and can mask patterning in assemblage variability (Binford 1983). Cultural historical interpretations typically rely on relatively few excavated sites, increasing the potential effects of palimpsests on identifying discrete depositional or activity sets (Schiffer 1976; Carr 1985). Dry Creek Component 2 (C2) is a clear example: it is used as an exemplar of the microblade-bearing Denali complex (Powers et al. 1983; Dixon 1985; Hamilton and Goebel 1999), yet only 36% of the spatial clusters contain microblade technology (Potter 2005; Bever 2006). Many of the culturally “diagnostic” artifact types/classes are not restricted in time. The data presented here demonstrates long-term technological continuity that requires a re-evaluation of current cultural constructs and alternate approaches to explaining interassemblage variability.

In the last 30 yr, numerous cultural resource management and academic investigations have resulted in a great increase in empirical data, particularly radiocarbon-dated components, which have yet to be fully evaluated. Most of these data have never been synthesized on a regional basis, nor used as proxies to evaluate population trends. These dated components represent a useful data set for

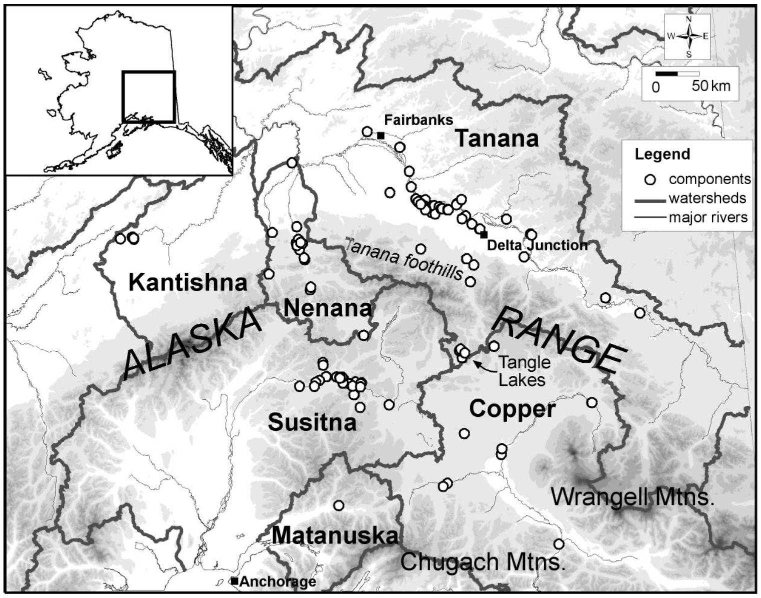

Figure 1 Central Alaska study area, showing dated component locations (elevation shaded in 500-m asl increments). The 2006–2007 surveys described in the text occurred between Fairbanks and Delta Junction south of the Tanana River.

estimating baseline data on technology and economy, as a first step for analyzing interassemblage variability.

This article addresses the limitations in previous intersite analyses by synthesizing a comprehensive record of ^{14}C-dated components and identifying major patterns of technological and economic change. Ambiguities and avenues for further inquiry are evaluated, and implications for cultural history are described. Detailed analysis patterning among lithic technology, faunal remains, residential and logistical mobility, and land use in the Holocene are presented in Potter (2008). The cultural transformation at ~1000 cal BP is explored through competing models of cultural change, population replacement, and taphonomic bias in Potter (forthcoming).

Technology and Chronology in Central Alaska

Cultural constructs in this region have been typically created on the basis of co-occurring sets of features at the level of attribute, type, and class. Thus, presence or absence of a particular type of projectile point (e.g. Chindadn, Kavik, side-notched) or class of lithics (e.g. flake burin), or even technology (e.g. microcore and blade) has been used to demarcate cultural entities, in the form of traditions, phases, or complexes, based on the proclivities of the originator. Cultural sequences vary somewhat, but most follow a basic pattern: an early period (>13,000 cal BP) marked by considerable technological variability (e.g. Chindadn complex, Nenana complex, East Beringian tradition, Northern Paleoindian tradition); followed by an early Holocene period dominated by microblade technology (e.g. Denali complex); followed by a mid-Holocene period associated with new technology (notched bifaces, notched cobbles, tabular cores) and possible continuation of microblade technology (e.g. Northern Archaic tradition, Tuktu phase, Denali phase); followed by the late Holocene Athabascan tradition, associated with increased organic technology and presence of housepits and cache pits (e.g. Cook and McKennan 1970; Dixon 1985; Holmes 2001).

Ambiguities have been identified that affect these basic constructs and sequences, such as potential late occurrence of microblade and wedge-core technology (Cook 1969; Shinkwin 1979; Dixon 1985; Bowers 1999) and potential co-occurrence with notched bifaces, hallmarks of the Northern Archaic tradition (Bacon 1977; Cook and Gillispie 1986; Holmes 1986; Clark 2001; Ackerman 2004). The transition from early to middle Holocene complexes is also not well understood, and an occupation hiatus has been posited between 7700–6200 cal BP (or longer) (West 1996b:552; Potter 2004a). The ^{14}C chronology developed here is used to evaluate these ambiguities.

Previous Radiocarbon Syntheses

This article represents the first comprehensive archaeological ^{14}C chronology for this region. Only a few well-known sites dominate the cultural historical literature for the region (Hamilton and Goebel 1999; Holmes 2001). Previous intersite comparisons focus primarily on late Pleistocene/early Holocene archaeology with little attention to the middle and late Holocene period. The most influential compendium of ^{14}C data were numerous papers in West (1996a), but these were limited to components older than ~7000 BP. These data were used widely in late Pleistocene/early Holocene reviews, focused primarily on the peopling of the Americas (West 1996b; Dilley 1998; Hamilton and Goebel 1999; Dixon 1999, 2001; Yesner 2001; Bever 2006). Mason et al. (2001) expanded parts of this sample, focusing on Denali complex sites in Alaska and Yukon Territory, but again only considered components older than ~7000 BP. A comprehensive ^{14}C database was compiled and calibrated for the Copper River basin and surrounding highlands (Potter 1997), encompassing only a part of this study area.

METHODS

Database Development, Variables, and Data Limitations

This ^{14}C database was compiled from published articles, books, cultural resource reports, and theses, and does not include ongoing investigations where the results have not yet been published. The database includes 274 ^{14}C dates from 160 components at 113 sites (see Appendix). Component delineation followed the original investigators, with exceptions noted below. ^{14}C dates on cultural features were preferred over stratigraphic dates (e.g. Broken Mammoth Cultural Zone [CZ] 4). Bone apatite dates were not considered due to susceptibility of contamination, and soil organic (bulk sampled) dates were only considered if charcoal dates were unavailable. Dates determined to be discordant by the original investigator were not used (with a few exceptions, see below). Multiple dates on single stratigraphic contexts were averaged following Ward and Wilson (1978) using the CALIB v 5.0 program (Stuiver and Reimer 1993), providing a single age estimate. The age estimates were calibrated using CALIB v 5.0 with the IntCal04 terrestrial calibration curve (Reimer et al. 2004). Components were grouped into 1000-calendar yr intervals by the median of each date range to mitigate the lack of precision of single age estimators.

Variables gathered from the primary literature included lithic assemblage characteristics and associated fauna. To counter sample size effects, microblade technology, notched bifaces, and fauna, taxa were denoted as presence/absence. Space-averaging may be affected by environmental differences among subregions (Lyman 2003). Environmental variability in the study area is primarily affected by elevation, with the Tanana-Kuskokwim and Copper River lowlands currently dominated by boreal forests, contrasted with the foothills of the Alaska Range and Talkeetna Mountains dominated by moist and alpine tundra and dwarf and tall shrubs (Warhaftig 1965; Gallant et al. 1995). This dichotomy is evaluated by assigning values of "upland" and "lowland" to components in these 2 environments (the break is around 500 m asl). Five major subregions are distinguished within the study area; 2 primarily lowland areas currently dominated by boreal forest (Tanana and Copper

River basins, areas below 500 and 1000 m asl, respectively), and 3 primarily upland areas dominated by moist and alpine tundra (Upper Nenana and Upper Susitna River valleys and the Tanana foothills/Tangle Lakes area) (Figure 1). Sites within the lower Nenana and Kantishna basins are included in the Tanana basin subregion. Sites within the Matanuska basin are included in the Upper Susitna subregion. Absolute elevation (in m asl) was derived from the 15-min digital elevation models (DEM) for Alaska (US Geological Survey 1979).

Components were grouped by time periods derived from transitions among cultural constructs within cultural historical sequences in order to assess broad levels of economic and technological change. Late Pleistocene (14,000–12,000 cal BP) comprises early complexes like Chindadn and Nenana, and is associated with glacial conditions ($n = 11$ components). Early Holocene (12,000–6000 cal BP) comprises the Denali complex, and is associated with the expansion of the boreal forest ($n = 51$ components). Middle Holocene (6000–1000 cal BP) comprises the Northern Archaic tradition and Late Denali complex ($n = 76$ components). Late Holocene (<1000 cal BP) comprises the Athabascan tradition ($n = 22$ components).

There are several limitations to these data, including cultural contexts, sampling, and taphonomic bias. Many components have associated stratigraphic dates or single dates on cultural features, both of which may reduce dating accuracy and precision. Over half of these components are dated through associated stratigraphic dates ($n = 99$, 62% of the total), 54 (34%) have dates associated with cultural features, and 7 (4%) have unknown/unreported associations. Do these data constitute a representative sample of cultural components within the region? The question is difficult to answer, given the current level of understanding and the relative lack of integrative intersite variability studies (Potter 2005). Site discovery is directly related to sampling effort, which has largely followed development in the region. However, several linear transects cross the study area, oriented both east-west and north-south, providing checks against this bias (e.g. Cook 1977; Aigner and Gannon 1981a,b; Bowers et al. 1995; Potter et al. 2002, 2007a,b). Surveys have resulted in discovery of components from every period of human occupation in North America, and while investigator bias for earlier sites (more common as research topics) may factor here, a recent survey through the mid-Tanana basin resulted in the discovery of 56 buried prehistoric components, 36 of them dated without bias for expected age (Potter et al. 2007b). This distribution generally matches the distribution of previously dated components, with some exceptions noted below.

Taphonomic bias favoring later components is difficult to evaluate without detailed geoarchaeological investigations. However, the exponential population curve peaking in the most recent interval predicted by Surovell and Brantingham (2007) in cases of taphonomic bias is not observed here (compare their Figure 2 with Figure 2, next page). For this reason, the dated components are used as proxies for paleodemography. However, due to the limitations discussed above, the patterns presented here should be seen as tentative pending further research on search image adequacy, stratified sampling, and regional geoarchaeology.

Problematic Sites

A number of sites presented problems in component delineation and age estimation, and for the sake of clarity and completeness, they are detailed here. Teklanika West possibly contains 3 components (Goebel et al. 1996), but the cultural material has not been demarcated on a stratigraphic basis (West 1996c), so I follow Mason et al. (2001) in only listing the earliest component (C1). The later Holocene dates from Donnelly Ridge (West 1967) and the Little Panguingue Creek hearth (Hoffecker and Powers 1996) are tentatively accepted here given their acceptance by other archaeologists (e.g. Shinkwin 1979:161–2), and lack of evidence for contamination.

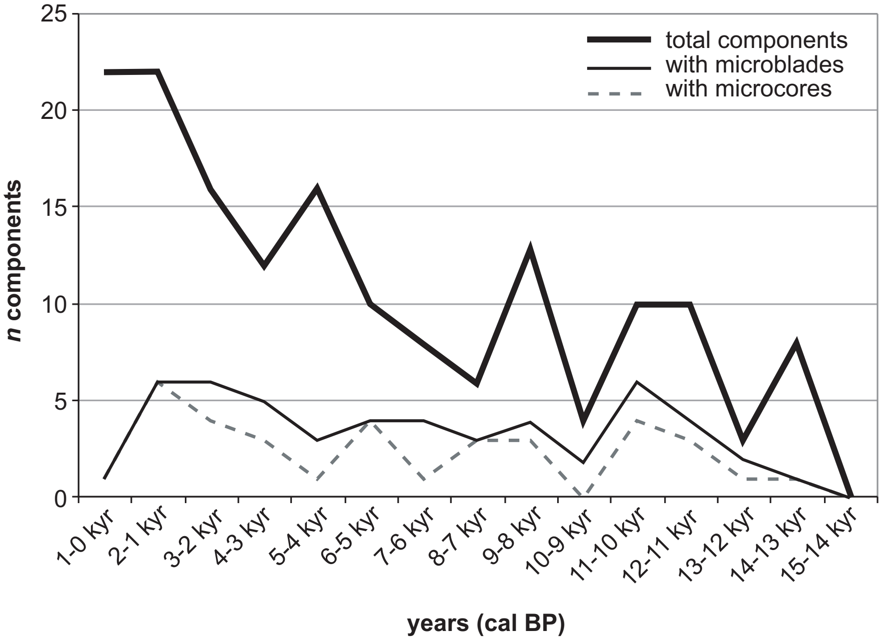

Figure 2 Distribution of component ages and associated technology per 1000-yr age interval (using median calibrated values).

Dry Creek C2 may be composed of multiple occupations (Mason et al. 2001), or Dry Creek C1 and C2 may be a single component with post-depositional disturbance (Thorson 2006). Here, Dry Creek C1 and C2 are considered 2 distinct components, following Powers et al. (1983). Dixon (1993:86) lists new ^{14}C dates for Jay Creek Ridge (~9800 BP), but there is no report on context, so the dates in Dixon et al. (1985) are used here (~7000 BP), following Mason et al. (2001). The chronologically older dates suggest the Upper Susitna area was habitable by at least 12,000 cal BP. West et al. (1996b:388) note that Whitmore Ridge Component 2 occurs in the A2b horizon, with 3 stratigraphically associated dates, 2 of which overlap. Though West et al. (1996b:393) suggest the dates are too young, they are consistent with the overall stratigraphy and ^{14}C chronology, and since no evidence for contamination is provided, the 2 overlapping dates are tentatively accepted here.

The ^{14}C record at Healy Lake Village site has been extensively discussed (Cook 1969, 1996; Erlandson et al. 1991; Dilley 1998). For this synthesis, only dates derived from charcoal are used for Levels 1–5. Cook (1996) defined 3 cultural stages at Healy Lake Village: Athabascan (Levels 1–3); Transitional (Levels 4–5); and Chindadn (Levels 6–10). These distinctions are kept for this synthesis, except that Level 1 is separated from Levels 2–3, given a significantly younger hearth date in Level 1 and overlap of dates in Levels 2–3. Chindadn samples date between 11,400–8000 BP, with no correlation between depth and age. Though multiple occupations are likely, it is interpreted to be a single component dating to the average of charcoal dates, following Cook (1996).

RESULTS

Radiocarbon Chronology

Assuming component abundance reflects population size, the ^{14}C-dated component distribution was used to estimate paleodemography. Figure 2 illustrates the absolute number of dated components per

1000 cal yr BP. The overall trend is a gradual increase in population to a peak of 2000–1000 cal BP. The decrease in the final 1000-yr period reflects the reliance on typological dating during the protohistoric period (e.g. trade beads). At this low resolution, there are peaks and dips in component abundance. This distribution may be affected by sampling bias, particularly disproportional focus on sites of a certain age or stratigraphic setting. For example, the North Alaska Range project that resulted in the discovery and testing of numerous sites in the Upper Nenana Valley was designed to locate intact late Pleistocene landforms (Powers et al. 1983; Hoffecker 1985).

Recent linear surveys in the mid-Tanana basin, yielding 36 components dated without bias for expected age (Potter et al. 2007a,b), offer data to evaluate this possibility. Figure 3 shows component percentages for each interval based on all components from the 2006–2007 surveys (*n* = 36 components) compared with all previously known data (*n* = 124 components compiled in Potter 2004a). The distributions are relatively similar except for relatively more sites in the early Holocene period (9000–5000 cal BP), and fewer sites in the mid to late Holocene (after 5000 cal BP). The early Holocene period is often interpreted as a time of transition, from earlier Beringian technology and subsistence to boreal forest adaptations associated with the Northern Archaic tradition (Anderson and Douglas 1968; Dixon 1985; Clark 1994). Analysis of previous intersite data (Potter 2004a) indicated a possible hiatus in occupation in central Alaska between 7700–6200 cal BP (only 5 components were previously known from this period, ~4% of the total). However, the new data set includes 6 components dating to this period (15% of the new components), demonstrating the presence of human occupation of the region throughout the mid-late Holocene (Figure 2). Technological data indicates many aspects of technology (e.g. microblades, wedge-shaped microcores) were conserved through this period, thus linking the early and later Holocene microblade industries.

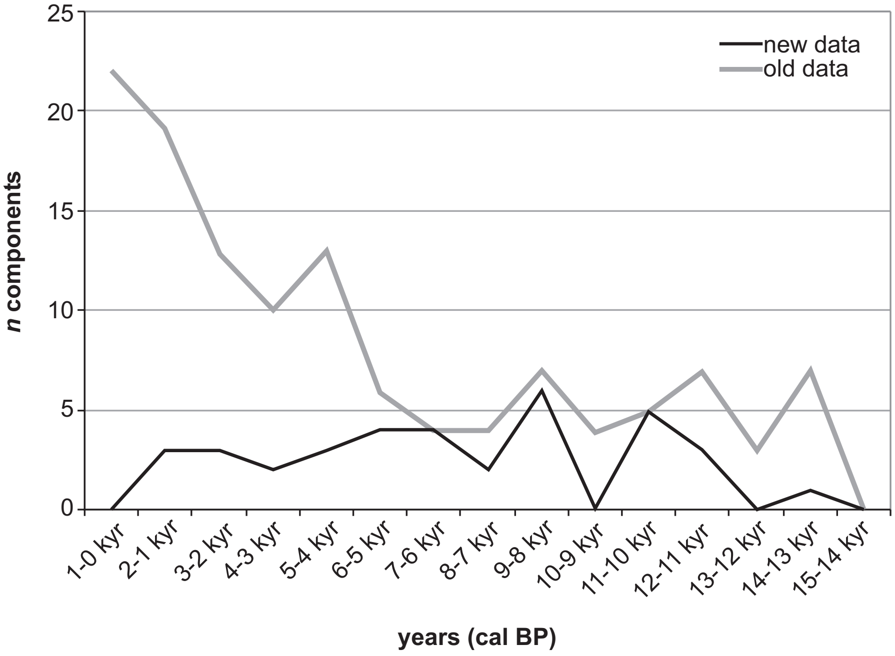

Figure 3 Comparison of component age distributions from recent surveys in the mid-Tanana basin (Potter et al. 2007a,b), labeled "new data," and from previous surveys (Potter 2004a), labeled "old data."

The general similarity of these distributions suggests that these data are representative enough for exploration of this distribution as a proxy for paleo-population. After an initial peak at 14,000–13,000 cal BP, representing the initial occupation of Alaska, the population dips for the next thousand-yr interval, rising again between 12,000–11,000 cal BP. The initial colonization event(s) have been discussed from many different perspectives (e.g. West 1981, 1996b; Powers and Hoffecker 1989; Hamilton and Goebel 1999; Dixon 2001; Holmes 2001; Yesner 2001; Bever 2006), and these dates support a correlation of early colonization with climate amelioration after ~14,000 cal BP, associated with the transition from herb tundra to shrub tundra (Ager and Brubaker 1985; Bigelow and Powers 2001).

The depopulation tracked at 13,000–12,000 cal BP correlates broadly to the Younger Dryas stadial, a cold period that is associated with glacial readvance (Bigelow and Edwards 2001). These data run counter to Bigelow and Powers (2001) and Mason et al. (2001), who noted no decrease in site occurrence during this period, but the latter examined only those sites associated with the Denali complex. This depopulation trend is, however, noted by Bever (2006:612), and importantly this pattern is reinforced here with a more widespread Alaska-wide context, indicating that the effects of the Younger Dryas may have been significant. Bever (2006:613) further notes that the diversity of the pre-Younger Dryas material contrasts with the single Denali complex technology after the Younger Dryas. The continuity of microcore and blade technology evidenced here could be explained by 1) continuity of regional populations using the same technology or 2) population replacement by microblade-using groups from outside the region (Siberia or northwest North America, see technology discussion below).

A second sharp population decrease is inferred for the 10,000–9000 cal BP interval, which might be correlated with the establishment of widespread spruce forests (*Picea* spp.) in the Tanana basin in the early Holocene. Kaufman et al. (2004:536) note the Holocene Thermal Maximum between 11,300–9100 cal BP in this region. West (1981:221–4) argues for an early Holocene peak and subsequent population crash as warming climate and growth of the boreal forest decimated Denali complex populations. The peak at 9000–8000 cal BP is harder to correlate with broader climate or vegetation changes. Mason et al. (2001) examined a selection of early Holocene Denali complex components in Alaska and the Yukon Territory, and their date distribution is relatively similar to the one presented here between 10,000–8000 cal BP. They interpret the spike at 9000–8000 cal BP as increased occupation associated with a cooling event at ~8200 cal BP (Klitgaard-Kristensen et al. 1998) due to increased abundance of caribou (Mason et al. 2001:539). However, faunal analysis using a much larger data set indicates that caribou hunting becomes more dominant after ~5000 cal BP (see below, Potter 2008).

The mid-late Holocene (after 6000 cal BP) is generally characterized with increasing population, especially after 3000 cal BP. The greater relative abundance of sites could also be due to increased archaeological visibility or a biased search image. While no known significant climate or vegetation change is known for this period, new technology and artifact types enter the region (including side-notched biface forms, notched cobbles, and tabular microblade cores) (Cook and McKennan 1970; Dixon 1985). However, older technologies were also conserved and were used alongside the new forms (i.e. wedge-shaped microblade core forms). While the archaeological data could support partial population replacement (Dumond 1969; Workman 1978) or diffusion (Clark 1994), the component distribution may reflect an effective adaptation to the boreal forest (probably through a combination of new technology and new settlement and subsistence strategies).

Regional Chronologies

Different land-use strategies are apparent in the component distributions. Figure 4 illustrates component ages for the 3 upland and 2 lowland areas in the study area. The Tanana basin subregion was largely unglaciated during the late Pleistocene (Kaufman and Manley 2004), and the northern foothills of the Alaska Range (Upper Nenana and Tanana foothills/Tangle Lakes subregions) were first occupied during the late Pleistocene, between 13,000–12,000 cal BP. The Upper Susitna was first occupied by ~8000 cal BP (or ~11,400 cal BP if the early dates in Dixon [1993:86] are considered). The Copper basin was dominated by the glacier-dammed Lake Atna until ~11,600–9700 cal BP (Ferrians 1989:87), but the earliest known components date to ~2500 cal BP.

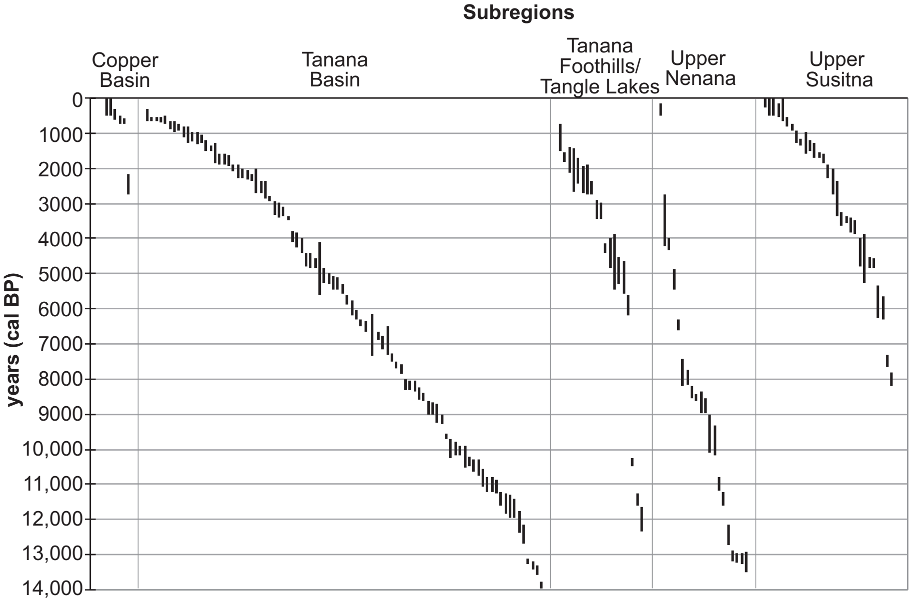

Figure 4 Component calibrated age ranges (2 σ), ordered by median age estimator and subregion

The upland areas are differentially occupied through time, comprising 32% of early Holocene components, 53% of middle Holocene components, and 36% of late Holocene components (the late Pleistocene is not considered since some of the upland areas were not yet ice-free). Elevation data for each component confirms this pattern (Figure 5). Early Holocene components average 424 ± 187 m asl (median = 361) compared with 522 ± 243 m asl (median = 487) for middle Holocene and 462 ± 206 m asl (median = 487) for late Holocene components. Average elevation values are significantly different between early and middle Holocene components (*t* test for independent samples, $t = -2.42$, $df = 25$, $p = 0.017$), whereas middle and late Holocene components have similar distributions of sites relative to elevation ($t = 1.05$, $df = 96$, $p = 0.294$). Average elevation values are similar between the late Pleistocene and early Holocene occupations ($t = -0.89$, $df = 60$, $p = 0.377$), indicating similar land-use strategies in the early Holocene associated with lowland areas, even after upland areas were deglaciated.

While the Tanana subregion has a continuous record with no major breaks, there are several breaks in the upland subregions (Figure 4). These upland areas all have chronological gaps between 7700–6200 cal BP, and the fact that this is replicated in all 3 upland regions may indicate widespread

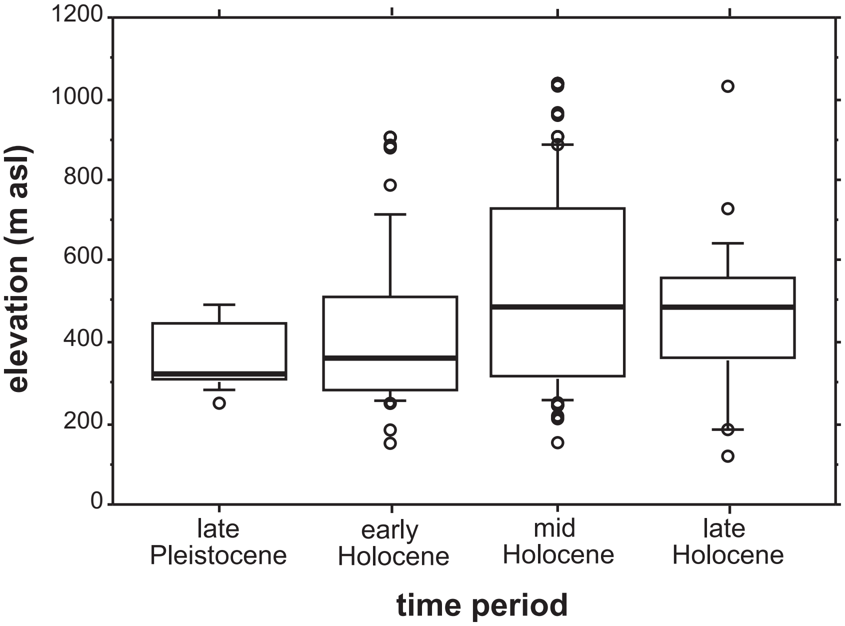

Figure 5 Box plots of elevation by time period

changing land-use strategies in the early to middle Holocene, rather than sampling bias. Consequently, the increased use of upland areas seen after ~6200 cal BP, along with new technologies associated with the Northern Archaic tradition, likely reflects new land-use strategies linked with seasonal caribou exploitation, and is consistent with increased numbers of components with caribou remains during this period (see below, Potter 2008). Shorter chronological gaps between 4000–3000 cal BP in the Tangle Lakes area may be artifacts of small sample size or changes in population or land-use strategies.

DISCUSSION

Technological Continuity

These ^{14}C-dated component age estimates provide baseline data useful for a variety of purposes, including assessing technological and subsistence change and estimating paleo-population change. Continuity of microblade technology is readily apparent, as demonstrated in Figure 2. This not only includes microblades as products of this technology, but also particular core forms, including wedge-shaped microcores with associated core tablets rejuvenation (Holmes 2001, 2004; Yesner and Pearson 2002; see also Bowers 1999). Microblade technology generally parallels overall component abundance throughout the Holocene until ~1000 cal BP.

In the earliest period (14,000–13,000 cal BP), there is 1 microblade-bearing component (Swan Point CZ4) and 7 non-microblade-bearing components. However, only 5 of the latter have more than 14 m^2 excavated—and of these, only Walker Road C1 contains more than 39 retouched pieces. Powers and Hoffecker (1989) posited a non-microblade Nenana complex on the basis of some of these sites, but since then, Chindadn points (diagnostic to that complex) have been found associated with microblades at Swan Point CZ3 (Holmes 2008) and Broken Mammoth CZ3 (Krasinski 2005:32). This supports the contention that Chindadn points and microblades associated at Healy Lake (Cook

1996) are not from mixed contexts as has been suggested (Hoffecker et al. 1993). One may argue that the relatively low frequencies of microblades in Swan Point CZ3 (*n* = 37) and Broken Mammoth CZ3 (*n* = 44) (Krasinski 2005; Holmes 2008) suggest stratigraphic mixing; however, at Gerstle River C3, several contemporaneous and spatially discrete lithic clusters contain microblades at varying frequencies (between 1 and 242, comprising 2% to 29% of total debitage; Potter 2005). This variation could be due to many factors, including activity area differences or the tendency for microblades to be deposited in small discrete loci, easily missed depending on sampling strategies. The point here is that microblades are present in sites assigned to the both Nenana and Denali complexes. This is consistent with the hypothesis that Nenana and Denali complexes represent different portions of a single late Pleistocene technological tradition (West 1996b; Holmes 2001).

After 13,000 cal BP, these data suggest that microblades represent a conservative technology that was well suited to coping with climatic oscillations at the Pleistocene/Holocene transition as well as the expanding boreal forest. Increased upland exploitation in the mid-Holocene seems related to subsistence/settlement strategy changes given the opportunity for exploitation in earlier periods. This coincides with the introduction of cultural material like notched bifaces and notched pebbles, associated with the Northern Archaic tradition (Anderson and Douglas 1968; Dixon 1985). These data show that along with this new technology, early Holocene and middle Holocene populations used the landscape in different ways, partially reflected in increased upland use, but also in faunal assemblage differences (see next section).

Economic Change

Of the 160 components in this study, 87 contain faunal remains (54% of total). Of these 87 components, 26 have fragmented, burned, and calcined fragments that are not analyzed further. The remaining 62 components (39% of total) provide a record for subsistence economies. Table 1 summarizes the variability in faunal presence/absence among components for each time period. Only those taxa present at >5 components are included. Large and small mammal categories follow from the original investigators. The late Pleistocene period is somewhat skewed by the Broken Mammoth CZ4 assemblage, which contains almost all of the listed taxa (Yesner 1996), and the generally small sample size from the Late Pleistocene (*n* = 5) should be considered.

While these data are very coarse grained (ΣNISP is not used), significant patterning is evident. Bison and wapiti occurrence within archaeological assemblages decrease through time, whereas caribou and to a lesser extent moose increases. The sharpest break is between the early and middle Holocene (6000 cal BP). Most small and medium mammals appear in relatively more assemblages in the middle and late Holocene, particularly hare and canids. Fish are also more common in the later Holocene, but interestingly, birds are more common in the Late Pleistocene. These patterns indicate changes in subsistence economies consistent with the land-use patterns noted above. Both of these data sets indicate a shift from a broad subsistence base using primarily lowland areas incorporating bison and wapiti in the late Pleistocene and early Holocene to acquisition of more seasonally abundant game (caribou, fish) in the middle and late Holocene. The growing importance of caribou is reflected in increasing use of upland areas like the Upper Susitna Valley, where faunal assemblages are dominated by caribou remains.

Cultural History

Given these component age distributions, a modification of current cultural historical sequences may be in order. While late Pleistocene material may reflect considerable diversity, the East Beringian tradition proposed by Holmes (2001) may adequately encompass this variability, given that

Table 1 Faunal patterning by time period; cells represent percentages of total components per time period with at least 1 specimen of each taxonomic classification.

Taxa (number of components where they occur)	Late Holocene (0–1000 cal BP) $n = 16$	Middle Holocene (1000–6000 cal BP) $n = 26$	Early Holocene (6000–12,000 cal BP) $n = 14$	Late Pleistocene (12,000–14,000 cal BP) $n = 5$
General Size Classes				
L mammal ($n = 59$)	94%	88%	100%	100%
S mammal ($n = 28$)	56%	50%	29%	40%
Ungulates				
Caribou ($n = 29$)	63%	58%	21%	20%
Moose ($n = 15$)	31%	23%	21%	20%
Bison ($n = 8$)	0%	4%	36%	40%
Wapiti ($n = 7$)	0%	0%	29%	60%
Sheep ($n = 7$)	13%	0%	21%	40%
Other Mammals				
Hare ($n = 15$)	38%	23%	14%	20%
Beaver ($n = 11$)	13%	27%	7%	20%
Canid ($n = 9$)	31%	8%	7%	20%
Bear ($n = 6$)	13%	12%	7%	0%
Birds and Fish				
Birds ($n = 13$)	19%	15%	21%	60%
Fish ($n = 13$)	31%	23%	7%	20%

material diagnostic to both Nenana and Denali complexes are found intermixed. Between ~12,000–6000 cal BP, the archaeology is dominated by cultural material assigned to the Denali complex (or Paleoarctic tradition). The Northern Archaic tradition, typically dated between 6000–3500 cal BP in this region (Dixon 1985), should be extended to ~1000 cal BP on the basis of continuity of lithic types and basic settlement patterns. A distinct Late Denali complex (Holmes 1977; Dixon 1985) is unnecessary, given the continuity of microblade technology. The well-known transformation in settlement, site structure, and technology associated with the Athabascan tradition (Shinkwin 1977, 1979; Clark 1981; Dixon 1985) occurred in this region between ~1300–800 cal BP, tentatively dated to ~1000 cal BP. This transition is explored in detail in Potter (forthcoming).

These data demonstrate continuity in certain technological elements along with economic and settlement system changes. Cultural historical constructs as currently developed on the basis of lithic typology alone may not be adequate to explain this cultural change. Rather, these cultural changes appear to relate more to variation in settlement, mobility, and subsistence systems. Potential avenues for exploring this diverse record involve analyzing site location, site structure, and organization, along with more traditional data sets like lithic typology and faunal remains. In this context, identification and description of recurring depositional and activity sets will be useful. Understanding how tools and toolkits were used as part of adaptive systems, incorporating settlement strategies and subsistence economies within a logistical and residential mobility system will result in more robust explanations of cultural change in this region.

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APPENDIX

Table A1 Radiocarbon-dated component date list (see Methods section for details).

Component[a]	^{14}C assay (BP)	Lab #	Material[b]	Context[c]	Calib. yr BP (2-σ range)	Reference
Swan Point CZ4	11,660 ± 70	Beta-56667	c	stratigraphic	13,693–13,344	Holmes et al. 1996; Holmes 2004
	11,660 ± 60	Beta-71372	c	stratigraphic	13,680–13,360	
	11,770 ± 140	AA-19322	o	organic residue on artifact	13,901–13,320	
	12,040 ± 40	unreported	c	hearth	14,004–13,788	
	12,060 ± 70	CAMS-17045	iv	ivory collagen	14,069–13,768	
	12,110 ± 50	unreported	o	hearth residue	14,090–13,823	
	12,360 ± 60	unreported	o	hearth residue	14,748–14,067	
average	12,003 ± 22				13,956–13,775	
Mead CZ4	11,560 ± 80	CAMS-5198	c	stratigraphic	13,614–13,253	Dilley 1998
	11,600 ± 60	CAMS-4877	c	stratigraphic	13,618–13,302	
average	11,587 ± 48				13,581–13,301	
Broken Mammoth CZ4	11,420 ± 70	CAMS-5358	c	hearth	13,411–13,152	Holmes 1996
	11,510 ± 120	WSU-4262	c	hearth	13,647–13,154	
average	11,443 ± 60				13,415–13,195	
Owl Ridge C1	11,340 ± 150	Beta-11209	c	stratigraphic	13,483–12,919	Phippen 1988
Little Delta Dune C1	11,300 ± 40	Beta-232394	c	hearth –split	13,262–13,105	Potter et al. 2007b
	11,250 ± 60	AA-76863	c	hearth –split	13,263–13,020	
	11,420 ± 60	Beta-233316	c	hearth	13,401–13,173	
average	11,320 ± 30				13,269–13,124	
Walker Road C1	11,010 ± 230	AA-1683	c	hearth	13,377–12,397	Goebel et al. 1996
	11,170 ± 180	AA-1681	c	hearth	13,363–12,834	
	11,300 ± 120	AA-2264	c	hearth	13,379–12,948	
average	11,220 ± 92				13,263–12,938	
Moose Creek C1	11,190 ± 60	Beta-96627	c	hearth	13,209–12,952	Pearson 1999
Dry Creek C1	11,120 ± 85	SI-2880	c	stratigraphic	13,183–12,893	Powers et al. 1983
Moose Creek C2	10,500 ± 60	Beta-106040	c	hearth	12,714–12,160	Pearson 1999
Mead CZ3	10,410 ± 80	CAMS-5197	c	stratigraphic	12,652–12,045	Dilley 1998
	10,460 ± 110	CAMS-4876	c	stratigraphic	12,769–12,045	
	10,760 ± 170	WSU-4425	c	stratigraphic	13,069–12,175	
average	10,469 ± 60				12,671–12,142	
Broken Mammoth CZ3	10,290 ± 70	CAMS-5357	c	hearth	12,386–11,769	Holmes 1996
Phipps site	10,230 ± 70	Beta-63672	c	stratigraphic	12,350–11,624	West et al. 1996a
Swan Point CZ3	10,010 ± 90	Beta-190578	c	hearth	11,956–11,242	Holmes et al. 1996
	10,025 ± 60	Beta-170458	c	hearth	11,805–11,268	
	10,230 ± 80	Beta-56666	c	hearth	12,366–11,616	
average	10,079 ± 42				11,957–11,396	
XBD-308	10,050 ± 70	Beta-219659	c	stratigraphic	11,958–11,286	Potter et al. 2007a
XBD-338 C2	10,000 ± 80	Beta-232397	c	stratigraphic	11,819–11,240	Potter et al. 2007b
Whitmore Ridge C1	9600 ± 140	Beta-64578	so	stratigraphic	11,249–10,525	West et al. 1996b
	9830 ± 60	Beta-70240	so	stratigraphic	11,394–11,161	
	9890 ± 70	Beta-62222	so	stratigraphic	11,609–11,194	
	10,270 ± 70	Beta-77268	so	stratigraphic	12,377–11,761	
average	9953 ± 37				11,603–11,249	
Little Delta River #3	9920 ± 60	Beta-12331	c	stratigraphic	11,610–11,216	Higgs et al. 1999
Panguingue Creek C1	10,180 ± 130	AA-1686	c	stratigraphic	12,379–11,318	Powers and Maxwell 1986
	9836 ± 62	Gx-17457	c	stratigraphic	11,401–11,140	

Table A1 Radiocarbon-dated component date list (see Methods section for details). *(Continued)*

Component[a]	^{14}C assay (BP)	Lab #	Material[b]	Context[c]	Calib. yr BP (2-σ range)	Reference
	9850 ± 140	Beta-55101	c	stratigraphic	11,818–10,777	
average	9893 ± 52				11,599–11,202	
Gerstle River C1	9740 ± 50	Beta-133751	c	stratigraphic	11,247–10,883	Potter 2005
Little Delta Dune C2	9670 ± 40	Beta-232393	c	stratigraphic	11,203–10,796	Potter et al. 2007b
Dry Creek C2	7895 ± 105	SI-2328	c	stratigraphic	9009–8459	Powers et al. 1983; Bigelow and Powers 1994
	8915 ± 70	AA-11730	c	stratigraphic	10,233–9776	
	9340 ± 195	SI-2329	c	stratigraphic	11,186–10,178	
	9340 ± 95	SI-11733	c	stratigraphic	11,056–10,248	
	9690 ± 75	AA-11732	c	stratigraphic	11,236–10,778	
	10,060 ± 85	AA-11727	c	stratigraphic	11,971–11,273	
	10,540 ± 70	AA-11731	c	stratigraphic	12,792–12,238	
	10,615 ± 100	AA-11728	c	stratigraphic	12,845–12,239	
	10,690 ± 250	SI-1561	c	hearth	13,116–11,822	
average	9657 ± 31				11,191–10,801	
Little Delta Dune C3	9650 ± 60	Beta-220218	c	hearth	11,200–10,775	Potter et al. 2007b
Gerstle River C2	9400 ± 50	Beta-183110	c	hearth	11,057–10,571	Potter 2005
	9510 ± 40	Beta-134098	c	hearth	11,075–10,609	
average	9449 ± 41				11,057–10,571	
XBD-303	9340 ± 80	Beta-219658	c	stratigraphic	10,740–10,281	Potter et al. 2007a
XBD-312	9290 ± 50	Beta-220214	c	stratigraphic	10,647–10,285	Potter et al. 2007a
Sparks Point	9060 ± 425	UGa-941	so	stratigraphic	11,335–9033	West et al. 1996c
	9110 ± 80	Beta-64577	so	stratigraphic	10,515–9967	
	9200 ± 60	Beta-62773	so?	stratigraphic	10,514–10,237	
average	9166 ± 47				10,486–10,233	
Healy Lake Village Chindadn (levels 6–10)	8655 ± 280	Gx-2171	so?	stratigraphic	10,406–9010	Cook 1996
	8680 ± 240	Gx-2170	c	stratigraphic	10,287–9092	
	8990 ± 60	Beta-76070	c	stratigraphic	10,245–9916	
	9245 ± 213	AU-1	c	hearth	11,162–9892	
	9895 ± 210	Gx-2174	c	hearth	12,111–10,703	
	10,040 ± 210	SI-739	c	stratigraphic	12,567–10,874	
	10,434 ± 279	AU-3	c	stratigraphic	12,869–11,342	
	10,500 ± 280	Gx-1944	c	stratigraphic	12,925–11,394	
average	9142 ± 51				10,485–10,221	
Chugwater C2	9460 ± 130	Beta-19498	c?	stratigraphic?	11,176–10,304	Maitland 1986; Lively 1996
	8960 ± 130	Beta-18509	c?	stratigraphic?	10,403–9631	
average	9075 ± 92				10,500–9918	
Gerstle River C3	8820 ± 50	Beta-183109	c	hearth	10,156–9686	Potter 2001, 2005
	8830 ± 50	Beta-181678	c	hearth	10,156–9698	
	8860 ± 70	Beta-133750	c	hearth	10,184–9700	
	8890 ± 40	Beta-167397	c	hearth	10,187–9798	
	8900 ± 40	Beta-181679	c	hearth	10,190–9896	
	8910 ± 40	Beta-167399	c	hearth	10,188–9908	
	8950 ± 40	Beta-167395	c	hearth	10,221–9917	
	9030 ± 70	AA-51254	c	hearth	10,374–9913	
	9080 ± 50	Beta-183108	c	hearth	10,386–10,176	
average	8882 ± 17				10,156–9911	
Little Delta Dune C4	8880 ± 40	Beta-232392	c	stratigraphic	10,179–9789	Potter et al. 2007b
XBD-306	8930 ± 90	Beta-220216	c	stratigraphic	10,238–9710	Potter et al. 2007a
Erodeaway	8640 ± 170	WSU-3683	c	hearth	10,184–9305	Holmes 1988
Gerstle River C4	8660 ± 40	Beta-167396	c	hearth	9697–9539	Potter 2005
Carlo Creek C1	8400 ± 200	WSU-1700	c	hearth	9910–8774	Bowers 1980

Table A1 Radiocarbon-dated component date list (see Methods section for details). *(Continued)*

Component[a]	^{14}C assay (BP)	Lab #	Material[b]	Context[c]	Calib. yr BP (2-σ range)	Reference
	8690 ± 330	Gx-5132	c	hearth	10,650–8793	
average	8478 ± 171				10,113–9012	
Gerstle River C5	7600 ± 140	WSU-4888	c	stratigraphic (ULD)	8716–8047	Potter 2005
	8280 ± 60	Beta-98434	c	stratigraphic (LLD)	9442–9037	
average	8174 ± 55				9283–9008	
XBD-307	8070 ± 60	Beta-220217	c	stratigraphic	9240–8720	Potter et al. 2007a
XBD-340	8000 ± 50	Beta-232399	c	stratigraphic	9011–8652	Potter et al. 2007b
XBD-289	7960 ± 70	Beta-219649	c	stratigraphic	9004–8610	Potter et al. 2007a
Houdini Creek	7880 ± 60	Beta-74737	c	stratigraphic	8978–8552	Bowers et al. 1995
Panguingue Creek C2	8600 ± 200	AA-1689	c	stratigraphic	10,189–9137	Powers and Maxwell 1986
	7595 ± 405	Gx-13012	c	stratigraphic	9405–7676	
	7430 ± 270	AA-1688	c	stratigraphic	8971–7691	
	7130 ± 180	Beta-15094	c	stratigraphic	8326–7623	
	7850 ± 180	Beta-15093	c	stratigraphic	9242–8330	
average	7749 ± 97				8970–8371	
Lucky Strike site	7760 ± 50	Beta-196499	c	stratigraphic	8627–8425	Reuther et al. 2003
XBD-326	7740 ± 60	Beta-219663	c	stratigraphic	8627–8410	Potter et al. 2007a
Broken Mammoth CZ2	7200 ± 205	UGa-6281D	c	hearth –split	8401–7659	Holmes 1996
	7600 ± 160	WSU-4264	c	hearth –split	8850–8023	
	7700 ± 80	WSU-4508	c	hearth	8633–8372	
average	7628 ± 78				8592–8222	
Owl Ridge C2	7230 ± 100	Beta-11437	c	stratigraphic	8305–7850	Phippen 1988
	7660 ± 100	Beta-11436	c	stratigraphic	8643–8206	
	8130 ± 140	Beta-5418	c	stratigraphic	9426–8645	
average	7584 ± 63				8539–8213	
Swan Point CZ2	7400 ± 80	WSU-4426	c	stratigraphic	8372–8039	Holmes et al. 1996
XBD-325	7360 ± 40	Beta-220682	c	stratigraphic	8312–8040	Potter et al. 2007a
XBD-291	7350 ± 60	Beta-219650	c	stratigraphic	8318–8024	Potter et al. 2007a
Jay Creek Ridge C1	6970 ± 210	Beta-7304	c	stratigraphic	8187–7435	Dixon et al. 1985
	7240 ± 110	Beta-7306	c	stratigraphic	8321–7853	
average	7182 ± 97				8189–7794	
Teklanika West C1	7130 ± 98	Gx-18518	c	stratigraphic	8170–7754	West 1996a
Owl Ridge C3	6900 ± 265	D-3070	c	stratigraphic	8302–7272	Phippen 1988
	7035 ± 380	Gx-13009	c	stratigraphic	8642–7029	
average	6944 ± 217				8195–7424	
Campus Area J6	6850 ± 70	Beta-97212	c	stratigraphic	7833–7579	Pearson and Powers 2001
XBD-313	6750 ± 60	Beta-219651	c	hearth	7691–7504	Potter et al. 2007a
Long Lake	6606 ± 115	UGa-949	c	stratigraphic	7672–7293	Reger and Bacon 1996
XBD-311	6490 ± 50	Beta-220215	c	stratigraphic	7490–7289	Potter et al. 2007a
Mead CZ2	6070 ± 170		c	stratigraphic	7316–6505	Dilley 1998
XBD-288	6060 ± 60	Beta-219654	c	stratigraphic	7156–6749	Potter et al. 2007a
XBD-282	5920 ± 50	Beta-221332	c	stratigraphic	6882–6644	Potter et al. 2007a
Gerstle River C6	5050 ± 90	N-4958	c	stratigraphic (ULD)	5984–5603	Potter 2005
	6220 ± 80	WSU-4892	c	stratigraphic (LLD)	7308–6912	
average	5704 ± 60				6656–6324	
Moose Creek C3	5680 ± 50	Beta-106041	c	stratigraphic	6631–6321	Pearson 1999
XBD-317	5610 ± 50	Beta-219653	c	stratigraphic	6485–6301	Potter et al. 2007a
XBD-335 C1	5400 ± 40	Beta-232391	c	stratigraphic	6292–6020	Potter et al. 2007b

Table A1 Radiocarbon-dated component date list (see Methods section for details). *(Continued)*

Component[a]	^{14}C assay (BP)	Lab #	Material[b]	Context[c]	Calib. yr BP (2-σ range)	Reference
Flat Knoll C1	5230 ± 140	Beta-7695	c	stratigraphic	6290–5663	Dixon et al. 1985
XBD-328	5170 ± 50	Beta-219664	c	stratigraphic	6171–5750	Potter et al. 2007a
Whitmore Ridge C2	5080 ± 130	I-4231	c?	stratigraphic	6179–5588	West et al. 1996b
	5480 ± 300	UGa-530	so	stratigraphic	6942–5603	
average	5143 ± 119				6189–5616	
Butte Lake C2	5030 ± 200	Beta-10751	c	Feature 11	6270–5323	Betts 1987
XBD-283	5000 ± 50	Beta-219660	c	stratigraphic	5893–5615	Potter et al. 2007a
XBD-342	4670 ± 40	Beta-232395	c	stratigraphic	5575–5312	Potter et al. 2007b
Swan Point CZ1B	4620 ± 40	unreported	u	unreported	5469–5087	Holmes 2004
Broken Mammoth CZ1B	4525 ± 90	WSU-4458	c	hearth –split	5454–4873	Holmes 1996
	4540 ± 90	WSU-4456	c	hearth –split	5466–4881	
	4545 ± 90	WSU-4457	c	hearth	5467–4833	
	4690 ± 110	WSU-4350	c	hearth	5642–5048	
average	4565 ± 47				5446–5047	
XBD-287	4490 ± 50	Beta-219648	c	stratigraphic	5307–4973	Potter et al. 2007a
Panguingue Creek C3	4510 ± 95	Gx-13011	c	stratigraphic	5448–4867	Powers and Maxwell 1986
Mount Hayes 35	4450 ± 140	unreported	u	associated with “dwelling”?	5573–4654	Mobley 1982
Landmark Gap Trail	4330 ± 135	Beta-1726	c	stratigraphic	5309–4533	Mobley 1982
XBD-301	4360 ± 50	Beta-219657	c	stratigraphic	5255–4836	Potter et al. 2007a
North Gerstle Point C2	4290 ± 285	unreported	c	hearth	5589–4092	VanderHoek et al. 1997
Jay Creek Mineral Lick C1	4100 ± 60	Beta-5464	c	stratigraphic	4825–4440	Dixon et al. 1985
	4440 ± 120	Beta-7698	c	stratigraphic	5462–4729	
	4250 ± 110	Beta-7697	c	stratigraphic	5270–4443	
average	4184 ± 48				4844–4574	
Borrow C site C1	4020 ± 65	DIC-2283	c	stratigraphic	4810–4294	Dixon et al. 1985
	4570 ± 100	Beta-7844	c	stratigraphic	5531–4890	
average	4183 ± 54				4847–4539	
XBD-343	4160 ± 40	Beta-232396	c	stratigraphic	4831–4571	Potter et al. 2007b
Tok Terrace C1	4160 ± 100	Beta-40724	c	stratigraphic	4952–4419	Sheppard et al. 1991
	4020 ± 90	Beta-40717	c	stratigraphic	4821–4248	
average	4083 ± 67				4821–4427	
XMH-166	4100 ± 270	I-4592		unreported	5434–3866	West 1972
XBD-316	4050 ± 50	Beta-219652	c	stratigraphic	4807–4418	Potter et al. 2007a
TLM-207 C1	4030 ± 220	Beta-9897	c	stratigraphic	5261–3871	Dixon et al. 1985
Delta River Overlook C3	3980 ± 150	Gx-6752	c	stratigraphic	4840–3997	Bacon and Holmes 1980
Flat Knoll C2	3920 ± 100	Beta-7842	c	stratigraphic	4797–4000	Dixon et al. 1985
Rock Creek East	3866 ± 47	Gx-17392	c	unreported	4416–4154	McKay 1981
Gerstle River C7	3800 ± 70	N-4959	c	stratigraphic	4413–3986	Potter 2005
Dry Creek C4	3430 ± 75	SI-2332	c	stratigraphic	3871–3480	Powers et al. 1983
	3655 ± 60	SI-1934	c	stratigraphic	4149–3835	
	4670 ± 95	SI-1937	c	stratigraphic	5595–5053	
average	3783 ± 42				4346–3989	
Little Delta River #4	3700 ± 70	Beta-123332	c	stratigraphic	4239–3848	Higgs et al. 1999
XBD-297	3620 ± 50	Beta-219661	c	stratigraphic	4088–3777	Potter et al. 2007a
TLM-169 C1	3410 ± 80	Beta-10794	c	stratigraphic	3860–3467	Dixon et al. 1985
North Arrow site	3220 ± 90	Beta-7299	c	stratigraphic	3684–3245	Dixon et al. 1985
	3675 ± 160	Gx-5630	c	hearth?	4495–3586	
average	3329 ± 78				3819–3384	

Table A1 Radiocarbon-dated component date list (see Methods section for details). *(Continued)*

Component[a]	^{14}C assay (BP)	Lab #	Material[b]	Context[c]	Calib. yr BP (2-σ range)	Reference
Fog Creek C1	3160 ± 70	Beta-7687	c	stratigraphic	3557–3215	Dixon et al. 1985
	3180 ± 170	Beta-7685	c	stratigraphic	3829–2957	
	3270 ± 90	Beta-7300	c	stratigraphic	3716–3271	
	3290 ± 60	Beta-7302	c	stratigraphic	3679–3387	
average	3239 ± 40				3559–3382	
Tuff Creek North C2	3210 ± 80	DIC-2286	c	stratigraphic	3632–3262	Dixon et al. 1985
Usibelli	3195 ± 295	Gx-13013	c	stratigraphic	4228–2739	Hoffecker 1985
Healy Lake Village Levels 4-5	4010 ± 110	Gx-2163	c	stratigraphic	4827–4159	Cook 1996
	3020 ± 50	Beta-76063	c	stratigraphic	3358–3074	
average	3190 ± 32				3465–3362	
XBD-336	3040 ± 40	Beta-232398	c	stratigraphic	3362–3082	Potter et al. 2007b
Fish Creek concB1, C2	3005 ± 135	Gx-4110	c	stratigraphic	3476–2808	Cook et al. 1977
	3065 ± 115	Gx-4109	c	stratigraphic	3555–2947	
average	3040 ± 88				3442–2976	
Campus (Mobley)	2725 ± 125	Beta-7075	c	stratigraphic	3240–2488	Mobley 1991
	2860 ± 180	Beta-4260	c	stratigraphic	3450–2500	
	3500 ± 140	Beta-6829	c	stratigraphic	4151–3444	
average	3025 ± 83				3392–2968	
Owl Knoll	3010 ± 110	Beta-123340	c	hearth	3443–2886	Potter et al. 2007c; Higgs et al. 1999
Healy Lake Village Levels 2-3	2875 ± 140	Gx-2169	c	stratigraphic	3357–2753	Cook 1996
	3580 ± 140	Gx-2165	c	stratigraphic	4286–3484	
	3655 ± 426	AU-4	c	stratigraphic	5270–2899	
	2660 ± 100	Gx-2176	c	stratigraphic	3003–2367	
average	2965 ± 69				3342–2952	
TLM-096	2750 ± 215	DIC-2285	c	stratigraphic	3373–2350	Dixon et al. 1985
XBD-281	2760 ± 40	Beta-221333	c	stratigraphic	2951–2774	Potter et al. 2007a
Rainbow Lake Loc. 1	2090 ± 130	Gx-6009	c	stratigraphic	2349–1740	Bacon and Holmes 1980
	4145 ± 240	UGa-3172	c	stratigraphic	5316–3985	
average	2556 ± 114				2855–2349	
Red's Ravine	2485 ± 75	Beta-33300/ ETH-5901	c	stratigraphic	2733–2361	
McCurdy archaeological site	2410 ± 100	Beta-14508	c	hearth	2744–2183	US Bureau of Indian Affairs 1986
Dixthada C1	2420 ± 60	P-1834	c	stratigraphic	2706–2346	Shinkwin 1979
Windy Knoll site	2340 ± 145	DIC-1903	c	hearth	2745–2011	Dixon et al. 1985
Yardang Flint Station C1	2300 ± 180	I-647	c	stratigraphic	2751–1901	Reger et al. 1964
Lake Minchumina C1 (Levels 4/5, Blueberry phase)	1950 ± 320	Gx-7116	c	stratigraphic	2716–1293	Holmes 1986
	2365 ± 140	UGa-634	c	hearth	2752–2062	
average	2298 ± 128				2713–2005	
Delta River Overlook C5	2285 ± 145	Gx-6750	c	stratigraphic	2724–1952	Bacon and Holmes 1980
Broken Mammoth CZ1A	2280 ± 40	unreported	c	hearth	2352–2157	Holmes 2001
XBD-337	2180 ± 40	Beta-232400	c	stratigraphic	2327–2063	Potter et al. 2007b
Fish Creek concA11	2115 ± 140	Gx-4108	c	Feature 1	2434–1719	Cook et al. 1977
Tok Terrace C2	1650 ± 60	Beta-40603	c	stratigraphic	1696–1409	Sheppard et al. 1991
	1980 ± 70	Beta-40712	c	stratigraphic	2121–1740	

Table A1 Radiocarbon-dated component date list (see Methods section for details). *(Continued)*

Component[a]	^{14}C assay (BP)	Lab #	Material[b]	Context[c]	Calib. yr BP (2-σ range)	Reference
	2110 ± 170	Beta-40721	c	stratigraphic	2684–1631	
	2630 ± 90	Beta-40716	c	stratigraphic	2951–2369	
	2690 ± 90	Beta-42600	c	stratigraphic	3062–2497	
	2820 ± 180	Beta-40720	c	stratigraphic	3398–2487	
average	2114 ± 35				2296–1993	
TLM-217 C2	2070 ± 60	Beta-9899	c	stratigraphic	2298–1886	Dixon et al. 1985
XBD-324	2070 ± 50	Beta-219662	c	stratigraphic	2287–1899	Potter et al. 2007a
Portage site C1	2009 ± 225	not reported	u	unreported	2675–1414	West 1972
XBD-296	2010 ± 40	Beta-221334	c	stratigraphic	2103–1876	Potter et al. 2007a
XBD-286	1860 ± 50	Beta-220213	c	stratigraphic	1921–1634	Potter et al. 2007a
Little Panguingue Creek C2	1825 ± 68	AA-1699	c	hearth	1896–1569	Hoffecker and Powers 1996
FAI-045	1820 ± 70	DIC-1552	c	associated with caribou bones	1893–1567	Dixon et al. 1980
Donnelly Ridge	1790 ± 300	Beta-650	c	stratigraphic	2452–1062	West 1967, 1981
	1830 ± 200	Beta-649	c	stratigraphic	2302–1338	
average	1818 ± 166				2135–1377	
Tuff Creek North C3	1800 ± 55	DIC-2284	so	stratigraphic	1867–1571	Dixon et al. 1985
Hurricane Bluff C2	1750 ± 40	Beta-123338	c	stratigraphic	1810–1553	Potter et al. 2007c; Higgs et al. 1999
TLM-216	1880 ± 50	Beta-9892	w	stratigraphic	1930–1705	Dixon et al. 1985
	1670 ± 50	Beta-9898	w	stratigraphic	1702–1417	
	1530 ± 80	Beta-10125	w	stratigraphic	1596–1293	
average	1735 ± 32				1714–1557	
Lake Minchumina C2 (Levels 2 and 3, Cranberry phase)	1610 ± 150	Gx-4233	c	stratigraphic	1870–1273	Holmes 1986
Watana Depression site	1580 ± 110	Beta-7846		depression	1715–1291	Dixon et al. 1985
Swan Point CZ1A	1220 ± 70	WSU-4523	c	stratigraphic	1285–982	Holmes et al. 1996
	1570 ± 70	WSU-4524	c	stratigraphic	1607–1316	
	1670 ± 60	WSU-4522	c	stratigraphic	1706–1415	
	1750 ± 80	WSU-4521	c	stratigraphic	1872–1423	
average	1552 ± 34				1526–1369	
Brown Scraper Kame site	1420 ± 70	Beta-5653	c	associated with calcined bone	1515–1181	Dixon et al. 1985
Mead CZ1	1420 ± 60	WSU-4348	c	stratigraphic	1507–1184	Dilley 1998
Red Scraper site C2	1380 ± 155	DIC-2246	c	stratigraphic	1603–961	Dixon et al. 1985
Borrow C site C3	1260 ± 80	Beta-7845	c	Feature 1	1305–983	Dixon et al. 1985
	1400 ± 55	DIC-2245	c	stratigraphic	1405–1184	
average	1355 ± 45				1345–1179	
Healy Lake Garden	1260 ± 90	GaK-1885	c	hearth?	1312–975	Cook 1969
	1270 ± 80	GaK-1884	c	hearth?	1311–985	
average	1266 ± 60				1294–1063	
East Cove site	1360 ± 120	Gx-5129	c	house floor?	1522–1002	Holmes 1986
	1140 ± 135	Gx-5997	c	hearth	1300–788	
average	1262 ± 90				1314–975	
Mount Hayes 130	1220 ± 190	I-4232	c	possible association with housepit	1515–742	West 1972
XBD-290	1170 ± 40	Beta-219655	c	stratigraphic	1223–975	Potter et al. 2007a
Kosina Creek B	1160 ± 100	DIC-1878	c	hearth	1290–918	Dixon et al. 1985
Lake Minchumina C3 (Level 1, Raspberry phase)	1140 ± 120	Gx-2828	b	from hearth	1292–797	Holmes 1986
Flood's Cabins Cache Pits	1050 ± 60	WSU-2584	c	from storage pit	1118–795	Holmes 1986

Table A1 Radiocarbon-dated component date list (see Methods section for details). *(Continued)*

Component[a]	^{14}C assay (BP)	Lab #	Material[b]	Context[c]	Calib. yr BP (2-σ range)	Reference
Chugwater C3	870 ± 50	Beta-7565	c	hearth?	910–693	Maitland 1986; Lively 1996
	950 ± 105	Beta-9248	c	hearth?	1059–680	
	1120 ± 90	Beta-7566	c	hearth	1269–803	
average	932 ± 40				928–744	
Flat Knoll C3	840 ± 60	Beta-7692	c	stratigraphic	908–674	Dixon et al. 1985
	1060 ± 70	Beta-7693	c	stratigraphic	1170–796	
average	933 ± 46				929–743	
Healy Lake Village Level 1	900 ± 90	GaK-1886	c	hearth	962–675	Cook 1996
Nenana River Dune site	800 ± 50	Beta-196497	c	from cache pit	896–663	Potter 2004b
Little Bones Ridge	740 ± 70	DIC-2253	c	structural timber	793–552	Dixon et al. 1985
Ringling site	460 ± 100	Gx-4391	c	from storage pit 770302	652–305	Workman 1976
	695 ± 115	Gx-4300	c	from storage pit 29	904–509	
	760 ± 125	Gx-4299	c	from storage pit 50	924–538	
	765 ± 125	Gx-4298	c	from storage pit 29	925–540	
	720 ± 60	WSU-4922	c	timbers from housepit 95-36	762–553	Hanson 1999
	780 ± 70	WSU-4923	c	hearth	905–563	Hanson 1999
average	707 ± 36				721–562	
Birches site	640 ± 95	I-2617	c	from house 5	737–504	West 1978
Tok Terrace Cluster G, upper component	640 ± 70	Beta-34233	c	from burned rock layer in steambath	451–0	Gerlach et al. 1989
GUL-076	550 ± 135	Gx-3855	c	hearth	738–300	Clark 1974
	690 ± 135	Gx-3859	c	planking from housepit	921–498	
average	620 ± 95				730–502	
Tok Terrace C3	920 ± 90	Beta-40722	c	stratigraphic	1042–677	Sheppard et al. 1991
	570 ± 80	Beta-40713	c	stratigraphic	677–495	
	450 ± 90	Beta-40718	c	stratigraphic	643–305	
average	640 ± 50				671–545	
Dixthada C2	770 ± 40	P-1832	c	base of midden	764–661	Shinkwin 1979
	390 ± 50	P-1833	c	base of midden	515–315	
average	622 ± 31				659–551	
Batzulnetas Village	410 ± 80	Beta-56552	c	unreported	619–296	AHRS (n.d.)
	570 ± 100	Beta-56551	c	unreported	722–322	
average	472 ± 62				639–319	
VAL-206	460 ± 70	Beta-6692	c	hearth	635–316	Reger 1985
TLM-253	430 ± 130	Beta-10796	c	associated with FCR, calcined bone	668–0	Dixon et al. 1985
TLM-250	370 ± 80	Beta-10798	c	hearth	535–156	Dixon et al. 1985
Nenana River Gorge site C1	460 ± 115	I-9882	c	hearth	666–288	Plaskett 1977
	260 ± 75	I-9883	c	hearth	498–0	
average	320 ± 63				505–154	
Tsusena Creek C1	300 ± 70	DIC-2252	c	hearth	506–0	Dixon et al. 1985
O’Brian Creek	280 ± 60	Beta-56665	c	unreported	496–0	Reger et al. 1975

Table A1 Radiocarbon-dated component date list (see Methods section for details). *(Continued)*

Component[a]	^{14}C assay (BP)	Lab #	Material[b]	Context[c]	Calib. yr BP (2-σ range)	Reference
Permafrost Creek site C2	280 ± 110	DIC-1905	c	hearth	511–0	Dixon et al. 1985
	280 ± 245	DIC-1904	c	hearth	650–0	
average	280 ± 100				510–0	
Bendildenden	260 ± 70	Beta-6828	c	hearth	497–0	Reger 1985
Butte Lake C4	110 ± 60	DIC-3068	c	Feature 2	281–0	Betts 1987
	180 ± 60	DIC-3069	c	Feature 6	307–0	
average	145 ± 42				283–0	

[a] Site prefixes relate to USGS 250,000 scale quadrangles (ANC – Anchorage, FAI – Fairbanks, HEA – Healy, GUL – Gulkana, NAB – Nabesna, TLM – Talkeetna Mountains, VAL – Valdez, XBD – Big Delta, XMH – Mount Hayes). Components are labeled as C# – component, CH# – cultural horizon, CZ# – cultural zone.

[b] Material: c – charcoal; iv – ivory; o – organic residue; so – soil organics; u – unreported.

[c] Abbreviations: ULD – upper limiting date; LLD – lower limiting date; FCR – fire-cracked rock.