First Traces: Late Pleistocene Human Settlement of the Arctic

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Abstract and Keywords

This chapter encompasses the earliest human occupations of the Arctic and Subarctic, focusing on paleoclimate and human-environment interactions and the colonization of Beringia and northern North America. It discusses new discoveries in the high latitudes of Eurasia and North America. For each period, from 32,000 to 12,000 years ago, there are summaries of technology, typology, subsistence economy, and settlement systems. After a Late Glacial Maximum hiatus, humans recolonized northeastern Asia around 16,000 cal B.P. and Beringia by 14,000 cal B.P. Early Beringian diets were diverse, incorporating large and small mammals, waterfowl, and fish. These early populations likely had high residential mobility strategies.

Keywords: colonization of Beringia, paleoclimate, northern Asia, lithic raw material procurement, Siberian late upper Paleolithic, Paleoindian

Introduction

THE global dispersal of early modern humans during the late Ice Age is a principal chapter in the history of our species, and the colonization of the far north was a pivotal step in "getting humans everywhere." Success in the bitterly cold, open, and unpredictable Arctic and Subarctic required not only novel, innovative technologies—for example, reliable hunting weapons, substantial artificial shelters, and tailored, insulated clothing—but also complex long-distance social networks and flexible settlement strategies (Hoffecker 2005; Soffer 1994).

Scientific research chronicling early human settlement of the far north has focused primarily on northern Asia and Beringia, because during the late Pleistocene these areas were largely ice-free, while most of Scandinavia, Canada, and Greenland were covered by ice sheets and glaciers. Despite more than 50 years of research, however, Pleistocene archaeology in the region is still in a nascent state, mainly because of its remoteness. Much of the Bering land bridge is now submerged under the Bering and Chukchi seas, and those areas that are above sea level in northern Russia, Alaska, and northwestern Canada are for the most part inaccessible except by helicopter or small boat. Deeply buried Paleolithic sites, moreover, often occur in deeply buried frozen contexts and under dense boreal forest or shrub-tundra vegetation, making their discovery and investigation difficult. Despite these barriers, a few sites are known that suggest humans first colonized the Arctic by 30 thousand calendar years ago (kya), and many more are known that date to the terminal Pleistocene, between 14 and 12 kya, especially in Alaska. Here we synthesize this record and provide a Paleolithic context for the remainder of Arctic prehistory presented in this volume.

(p. 224) Paleoclimatic Framework

Our story begins ~40–30 kya, when anatomically modern *Homo sapiens* first colonized Europe and northern Asia (Hoffecker 2005). Conditions in northern Asia around this time were relatively warm (so warm that Russian paleoecologists refer to this period as the Karga interglacial), but starting ~28 kya, climate deteriorated, culminating with the last glacial maximum (LGM) 24–22.5 kya. Despite the existence of the Bering land bridge during this time, eastern Beringia became separated from the rest of North America by the expansion of ice sheets and glacier complexes in Canada (Clague et al. 2004; Kaufman and Manley 2004) (Figure 9.1). Northern Asia and Alaska, however, remained largely glacier-free during the LGM (Brigham-Grette et al. 2004). Climate was cold and dry, and environments were largely open and treeless, with variable steppe-tundra and shrub-tundra vegetation communities (Ager and Phillips 2008; Elias and Crocker 2008; Hoffecker and Elias 2007; Kuzmina et al. 2008). This tundra-steppe biome supported large-mammal populations, including woolly rhinoceros (*Coelodonta antiquitatus*), horse (*Equus caballus*), steppe bison (*Bison priscus*), and mammoth (*Mammuthus primigenius*) (Guthrie 2006; Lorenzen et al. 2011).

Soon after 22.5 kya, northern climates began to warm and glaciers melt (e.g., Dyke 2004), but not steadily (e.g., Menviel et al. 2011). Significant warming occurred during the Bølling interstadial, ca. 14.7 kya, and in some records this was followed by a brief cold period, the Older Dryas stadial, ca. 14 kya. Relatively warm conditions returned by 13.8 kya, with the onset of the Allerød interstadial. Shrub-tundra communities expanded during this time (Ager and Phillips 2008; Anderson et al. 2004; Hoffecker and Elias 2007), and trees soon followed, with larch (*Larix*) woodlands dispersing across Asian Beringia (Lozhkin et al. 1993) and groves of balsam poplar (*Populus*) appearing in interior Alaska (Brubaker et al. 2005). The disappearance of horse, woolly rhinoceros, mammoth, and saiga antelope (*Saiga tatarica*) from Beringian landscapes may have been a product of these changes (Guthrie 2003; Lorenzen et al. 2011); however, caribou (*Rangifer tarandus*), bison, and Dall sheep (*Ovis dalli*) survived, and wapiti (or red deer, *Cervus elaphus* or *C. canadensis*) appeared for the first time in Alaska. Another noteworthy change was gradual flooding of the Bering land bridge by 12.4–11.3 kya (Hoffecker and Elias 2007).

The Allerød was interrupted 12.9 kya by the last cold episode of the Pleistocene, the Younger Dryas stade, which in global-climate records persisted for 1,300 years (Rasmussen et al. 2006). The effects of the Younger Dryas in northern Asia and Alaska appear to have been variable, with some proxy records indicating substantial cooling and drying, and others, persisting warm climate (Graf and Bigelow 2011; Kokorowski et al. 2008).

The end of the Younger Dryas ~11.6 kya marks the onset of Holocene warming, culminating with a "thermal maximum" in Alaska by 11.5–11 kya (Kaufman et al. 2004). The spread of balsam poplar beyond the modern Arctic treeline, thawing of ice wedges, and widespread development of soils together suggest warmer temperatures than even (p. 225) (p. 226) today. A final important change to the northern landscape was the spread of spruce (*Picea*) across northwestern Canada and Alaska by 10 kya or shortly thereafter (e.g., Anderson et al. 2011).

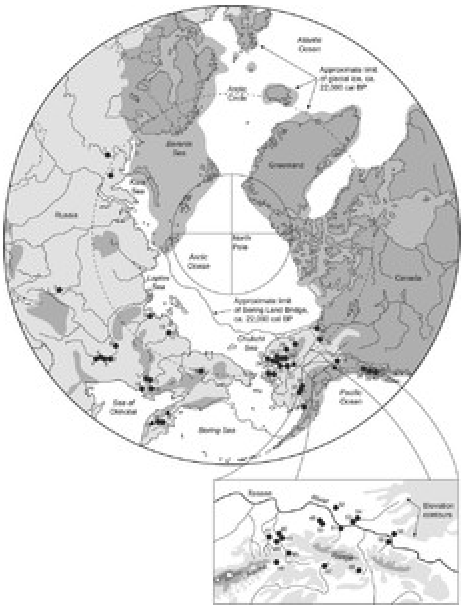

Figure 9.1 Map showing locations of important archaeological sites (circles) and obsidian sources (triangles) mentioned in text: (1) Byzovaia; (2) Mamontovaia Kuria; (3) Nepa-1; 4, Diuktai Cave; (5) Ust'-Mil'-2; (6) Verkhne Troitskaia; (7) Ezhantsy; (8) Ikhine-2; (9) Yana RHS; (10) Berelekh; (11) Achchagyi-Allaikha (paleontological site); (12) Siberdik; (13) Kongo; (14) Uptar; (15) Khaia; (16) Anavgai-2; (17) Ushki; (18) Tytyl'vaam; (19) Serpentine Hot Springs; (20) Trail Creek Caves; (21) Onion Portage; (22) Nogahabara; (23) Raven Bluff; (24) Tuluaq Hill; (25) NR-5; (26) Caribou Crossing; (27) Nat Pass; (28) Sluiceway; (29) Mesa; (30) Putu/Bedwell/Hilltop; (31) Spein Mountain; (32) Ilnuk; (33) Lime Hills Cave; (34) Little John; (35) Bluefish Caves; (36) Engigstciak; (37) Graveyard Point; (38) Groundhog Bay; (39) Hidden Falls; (40) On-Your-Knees Cave; (41) Owl Ridge; (42) Moose Creek; (43) Walker Road; (44) Dry Creek; (45) Carlo Creek; (46) Bull River-2; (47) HEA-454; (48) Tangle Lakes sites (Phipps, Whitmore Ridge, Sparks); (49) FAI-2077; 50), FAI-2019/FAI-2043; (51) Upward Sun River; (52), Chugwater; (53) Broken Mammoth/Mead; (54) Swan Point; (55) Gerstle River Quarry; (56) Healy Lake Village/Linda's Point; (A) KAM-05/KAM-07; (B) KAM-03; (C) Batza Téna; (D) Wiki Peak.

Drawing by Ted Goebel

Earliest Inhabitants of the Far North (42–30 ka)

The earliest evidence of humans in far northern Eurasia, above 60°N latitude, coincides with the relatively warm mid-Upper Pleistocene, or Karga interglacial. In the Pechora River basin of far northeastern Europe, stone artifacts and faunal remains have been recovered from two sites, Mamontovaia Kuria and Byzovaia; however, in both cases, cultural layers were in coarse-grained fluvial cobble beds and likely redeposited. Mamontovaia Kuria yielded two possible stone tools and five flakes loosely associated with remains of extinct fauna, including a worked mammoth tusk; radiocarbon ages suggest an age of 42 kya (Pavlov et al. 2004). At nearby Byzovaia, a lithic assemblage of scrapers, backed knives, and bifaces dates to about 10,000 years later, ~32 kya (Pavlov et al. 2004). Associated faunal remains are dominated by bones of mammoth. Although some of the bones could be the product of human hunting, more likely they resulted from natural mammoth deaths, with humans scavenging the remains for raw material in tool manufacturing (Pavlov et al. 2004).

In Siberia, the earliest far northern Paleolithic sites are roughly the same age as Byzovaia. One of these is Nepa-1, located along the Nizhnaia Tunguska River. Although only minimally tested, Nepa-1 has yielded a small assemblage of stone artifacts (including a bipolar core and several flakes) found in a buried soil sealed by more than 2 meters of silts and sands (Sëmin and Shelkovaia 1991). Associated with the artifacts were remains of horse, woolly rhinoceros, auroch (*Bos primigenius*), and Siberian roe deer (*Capreolus capreolus*), two of which have been AMS radiocarbon (^{14}C) dated to before 30 kya (Goebel 2004). A cluster of early sites also occurs along the Aldan River (Mochanov 1977). The oldest of these seems to be Ikhine-2, which contains multiple cultural layers dating to 34–31 kya, where an excavated area exceeding 215 m^2 yielded only ~20 inexpressive stone artifacts and ~200 bones of large mammals (mammoth, woolly rhinoceros, bison, horse, reindeer, red deer, and moose [*Alces alces*]) and carnivores (wolf [*Canis* sp.], Arctic fox [*Vulpes lagopus*], and fox [*Vulpes vulpes*]) (Mochanov 1977). Like the Pechoran sites, these remains may be redeposited (Goebel 2004).

The Yana RHS site demonstrates humans dispersed into western Beringia before the onset of the LGM. This site, located above the Arctic Circle along the lower Yana River (Figure 9.2), contains a well-preserved cultural layer in a deeply buried, frozen alluvial context. Recent thawing and erosion exposed numerous artifacts and animal bones on the beach in front of the site (Pitulko et al. 2004), among them a beveled projectile foreshaft carved from the horn of a wooly rhinoceros directly ^{14}C dated to 32.2 kya (Pitulko (p. 227) et al. 2004). This, together with 34 other ^{14}C dates, indicates an age of 33–31 kya for the Yana cultural layer (Pitulko and Pavlova 2010). Early occupants produced a unique stone-tool assemblage primarily based on simple core-and-flake and discoidal cores and unifacial retouching of flakes into side scrapers, points, burins, and wedge-like tools (Pitulko and Pavlova 2010). Blades are rare and microblades absent. Mammoth-ivory and bone awls as well as split longbones presumably used as wedges speak to the importance of osseous material for the production of tools (Pitulko and Pavlova 2010). Many of these display ornamental incisions, and numerous beads and bead preforms are signs of art and bodily ornamentation (Pitulko et al. 2012). Subsistence at Yana RHS focused on bison, reindeer, horse, and hare (*Lepus* sp.); at one locus more than 1,000 mammoth bones representing at least 26 individuals have been recovered (Basilyan et al. 2011). A diverse array of other fauna—woolly rhinoceros, musk-ox (*Ovibos moschatus*), red deer, moose, wolf, brown bear (*Ursus arctos*), fox, wolverine (*Gulo gulo*), and beaver (*Castor* sp.)—

round out the assemblage, indicating diverse subsistence activities including the taking of some animals for their furs (Pitulko and Pavlova 2010). The density and extent of finds indicate that Yana represents a sustained, long-term settlement of Arctic northwestern Beringia.

Figure 9.2 View of the Yana RHS site, with archaeologist Vladimir Pitul'ko in foreground.

Photo courtesy of Vladimir Pitul'ko

Whether humans persisted in the Asian Arctic and Beringia through the LGM is an open question, because no other archaeological site has yet been found in the far north that dates between the time of Yana RHS (~32 kya) and the terminal Pleistocene (~14–12 kya). In the Yukon, Canada, early bone artifacts once argued to date to the onset of the (p. 228) LGM (Irving and Harington 1973) are now interpreted to either date to the Holocene (Nelson et al. 1986) or not be artifacts at all, but naturally broken bones (Thorson and Guthrie 1984). Only the refitting mammoth-bone core and flakes from Bluefish Caves, directly ^{14}C dated to ~28 kya (Cinq-Mars and Morlan 1999; Morlan 2003), remain as possible evidence of pre-LGM humans in eastern Beringia, but even these could be of natural origin (Wilson and Burns 1999). Put simply, after Yana RHS, the earliest unequivocal signs of humans in the Eurasian far north date to after the LGM, in Beringia no earlier than 14 kya.

Late-Glacial Beringia (14–12 kya)

Chronology and Colonization

In Interior Alaska at least 30 precisely dated cultural occupations ranging from ~14 to 10 kya have been found (Figure 9.3). These archaeological sites are concentrated in the Tanana River basin, primarily in the middle Tanana valley (near Delta Junction) and middle Nenana valley (near Healy). Typically they occur in deeply buried (up to 2.5 m), well-stratified deposits of wind-blown silt (loess) and sand, and geochronologies are based on reliable radiocarbon dates from wood charcoal or bone clearly of cultural origin. Many sites (for example Swan Point, Broken Mammoth, Mead, Dry Creek, Owl Ridge, Upward

Sun River, Moose Creek, and Gerstle River Quarry) contain multiple stratified cultural occupations, facilitating precise studies of human behavioral change across the Pleistocene-Holocene boundary.

The earliest occupation known in central Alaska is cultural zone 4 at Swan Point, dated to ~14.4–13.6 kya. Its contents include a microblade industry and remains of extinct and extant faunal species from a sealed deposit of loess, ~75 cm below the modern surface (Holmes 2011). Little John, located in the uppermost Tanana basin in southwest Yukon, Canada, may also contain a cultural occupation dating to nearly 14 kya, but this is based on a small assemblage of lithic artifacts in possible association with a dated bison bone (Easton et al. 2011). After this, cultural occupations from 12 sites document the existence of humans in the Tanana and Nenana valleys between ~13.8 and 13 kya (recent reviews include Graf and Bigelow 2011; Potter 2011;Wygal 2011) (Figure 9.3). These sites clearly date to the Allerød interstadial, a relatively warm period of the late glacial when some of the earliest shrubs and possibly even trees dispersed into the region. Occupations post-dating this period and falling within the time frame of the Younger Dryas are fewer in number but apparent at several Tanana basin sites (i.e., FAI-2043, Moose Creek, Mead, Broken Mammoth, Upward Sun River, and possibly FAI-2077, XBD-308, and XBD-338) (Graf and Bigelow 2011; Potter 2008, 2011; Wygal 2011). Some of the extensive component-2 occupation at Dry Creek and Chindadn levels at Healy Lake may also date to this "cold snap," but the numerous artifact concentrations there have not been directly dated with radiocarbon samples of cultural origin (p. 229) (Cook 1996; Powers et al. 1983). Outside the Tanana basin, other interior Alaskan sites contain Younger Dryas occupations, most notably Lime Hills Cave and possibly Spein Mountain (Ackerman 2001, 2011). The earliest Holocene, 11.6–11 kya, is better represented in central Alaska: at least 11 cultural components document continued human occupation.

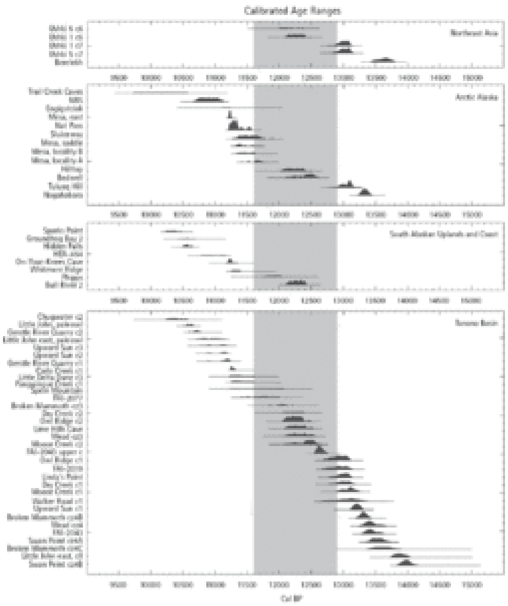

Figure 9.3 Calibrated radiocarbon ages for Beringian archaeological sites of the terminal Pleistocene and earliest Holocene.

Drawing by Ted Goebel

(p. 230) South of the Alaska Range in southern Alaska, early cultural occupations are comparatively few in number. Bull River 2, located in the Nenana-Chulitna divide area of the south Alaska Range, may date to 12.5–12 kya (Wygal 2010), but this site has received limited testing. Other south Alaska Range sites (e.g., HEA-454 along the uppermost Susitna River and Phipps, Whitmore Ridge, and Sparks Point in the Tangle Lakes vicinity) appear to date to latest Younger Dryas or post–Younger Dryas times (Blong 2012; West et al. 1996a, 1996b, 1996c), potentially indicating an initial pulse of upland human activity as postglacial climates warmed significantly. Several archaeological sites in southeast Alaska (and western coast of Canada) suggest a similarly aged dispersal of humans into Alaska's southern maritime regions (Ackerman 1996; Dixon 1999; Fedje and Mathewes 2005).

Ten sites document the existence of late Pleistocene humans in north and northwest Alaska. The oldest, Tuluaq Hill, located in the western Brooks Range, yielded a hearth feature consistently dated to 13.2–13 kya, indicating the presence of humans in Alaska's Arctic during the late Allerød interstadial (Rasic 2011). Other early sites, typically rich in lanceolate bifacial points, including Bedwell, Hilltop, Sluiceway, Nat Pass, and NR5 (Rasic 2011; Reanier 1995), appear to have been occupied during or soon after the Younger Dryas, as do the numerous hearth features and artifact concentrations atop the Mesa site (Kunz and Reanier 1995). Engigstciak and Trail Creek Caves may contain early Holocene occupations (Cinq-Mars et al. 1991; Larsen 1968), but their radiocarbon chronologies are imprecise or equivocal. Similarly, Nogahabara yielded lithic artifacts and faunal remains ^{14}C dated to 13.7–12.8 kya from a sand-dune blowout (Odess and Rasic 2007), but these could not be reliably associated, meaning that some, if not all, of the artifacts could be much younger than the bone, an interpretation that explains the rather late-appearing notched bifacial points in the assemblage (Holmes et al. 2008).

A recent chronological development has been the dating of northern Alaska's fluted-point complex. Although long known from more than 20 surface or near-surface sites that could not be reliably dated (Clark 1991), fluted points were recently recovered from two buried sites in northwest Alaska—Serpentine Hot Springs and Raven Bluff (Goebel et al. 2013; Hedman et al. 2011). At both they appear to date to ~12 kya.

In western Beringia, humans were once thought to have occupied the Ushki sites in Kamchatka by 18–16.5 kya (Dikov 1977 [2003]), but more recent work at Ushki-1 and Ushki-5 demonstrates their basal cultural component (layer 7) dates to only ~13 kya (Goebel et al. 2003). Berelekh, therefore, is the earliest well-documented late-glacial occupation of western Beringia: Arctic hare bones directly associated with human-produced artifacts repeatedly date to ~13.8–13.5 kya (Pitulko and Pavlova 2010). Younger Dryas-aged occupations have also been found at the Ushki sites (layer 6) (Dikov 1977 [2003]; Goebel et al. 2003) and Anavgai-2 (Ptashinski 2009) (both located in central Kamchatka), while post–Younger Dryas occupations have been found at Kongo, Siberdik, Uptar, and Tytyl'-vaam in interior western Beringia, just to name a few (Slobodin 2011).

(p. 231) Raw-Material Procurement

Although few studies of lithic raw-material procurement have been completed in the Beringian region, during the last decade significant developments have been made, primarily through the application of geochemical techniques to define the provenance of obsidian artifacts.

Pioneering geochemical work by Griffin et al. (1969), Clark (1972), and Cook (1995) demonstrated that numerous Alaskan sources of obsidian were used in prehistory. Early work used neutron activation analysis (NAA), a destructive technique, while more recent studies have focused on nondestructive X-ray fluorescence (XRF) analysis (Reuther et al. 2011). To date, 32 obsidian groups have been identified in the archaeological assemblages of Alaska, but for most of these, physical sources remain unknown (Reuther et al. 2011). For example, the earliest cultural occupation at Swan Point contains obsidian from unknown “Group H” (Reuther et al. 2011). Notable known sources include Batza Téna, located in the middle Koyukuk River basin of interior northwest Alaska (Clark and McFadyen Clark 1993), and Wiki Peak, located in the northern Wrangell Mountains near the Alaska-Yukon border (Figure 9.1) (Cook 1995). Both Batza Téna and Wiki Peak obsidians occur in the earliest lithic assemblages of central Alaska—Wiki Peak at Walker Road, Broken Mammoth, and Little John; Batza Téna at Dry Creek (component 2) and Swan Point (cultural zone 3); and both at Moose Creek and Healy Lake (Goebel 2011; Reuther et al. 2011). Batza Téna obsidian is even more common in early northwest Alaskan assemblages, for example Tuluaq Hill, Nogahabara, and Mesa. Distances between these sources and sites are typically on the order of hundreds of kilometers. Walker Road and Moose Creek, for example, are ~350 km from Wiki Peak, while Healy Lake and Tuluaq Hill are

~450–500 km from Batza Téna. Even in southeast Alaska, the region's earliest assemblages have obsidians demonstrating boat transport between the mainland and islands (Lee 2001). Obviously Alaska's late Pleistocene inhabitants were well informed about the locations of high-quality tool stones and transported them great distances, but we still do not know whether these patterns represent high mobility or long-distance trade networks.

XRF analyses in Kamchatka have identified similar patterns of obsidian procurement. Numerous obsidian sources have been distinguished in association with the region's many volcanos (Glascock et al. 2006), and the peninsula's earliest known human occupation, layer 7 at Ushki-1, contains at least six of them, three known, called KAM-03, KAM-05, and KAM-07, which come from different locations in the Sredinnyi mountain range, ~200 km from Ushki (Figure 1) (Kuzmin et al. 2008). Two others (KAM-01 and KAM-10) are suspected to have come from ~300 km south, near the modern city of Petropavlovsk-Kamchatsky (Kuzmin et al. 2008). Layer 6 at Ushki has a similar yet less diverse suite of obsidians. The Ushki obsidian artifacts lack cortex, suggesting that these tool stones were initially worked directly at sources and transported to Ushki as prepared cores or preforms (Kuzmin et al. 2008). Like in Alaska, the diversity and distances (p. 232) between Ushki and its obsidian sources suggest the development of complex procurement strategies early in prehistory.

Procurement of other tool stones in Beringia is less well understood. In the Nenana valley, however, analyses of Nenana complex assemblages suggest they were founded largely on procurement of local raw materials like chert, chalcedony, quartzite, and rhyolite, to create expedient stone tools, while later Denali complex assemblages were sometimes based on exotic raw materials that arrived at sites as formal cores and tools (Goebel 2011; Graf and Goebel 2009). This may suggest fundamental differences in land use between earliest and later occupants of the Nenana valley, but in the middle Tanana valley, this does not seem to be the case—toolstone procurement and use at Mead (CZ4 and CZ3) did not vary (Little 2013). In northwest Alaska, geochemical analysis of cherts has identified at least four recognizable "quarry fields" where early humans procured tool stone that they transported to nearby sites like Onion Portage and Caribou Crossing (Malyk-Selivanova et al. 1998; Rasic 2011). Based on these data, lithic-conveyance zones and settlement systems can be interpreted, but as Malyk-Selivanova et al. (1998) caution, regional databases of as many sources as possible are required. One thing is for certain, however: by the earliest known occupations, Beringians had already acquired detailed knowledge of their lithic landscapes.

Lithic and Osseous Technology

Early northern technologies focused on stone and osseous materials like bone, antler, and ivory, with multiple types of weapon tips evident. A few early Beringian assemblages contain slotted osseous projectile points presumably inset with microblades. At Lime Hills Cave 1 in interior southwest Alaska, fragments of three bilaterally grooved antler points were recovered, two directly dated to ~12.2–9.7 kya (Ackerman 2011). At the nearby Ilnuk site, a medial fragment of a grooved antler point was also found but not dated (Ackerman 2011), and at Trail Creek Cave 2, Seward Peninsula, five nearly complete slotted antler points were recovered in association with bone conventionally ^{14}C dated to ~10.3 kya (Larsen 1968). These inset osseous points likely functioned as dart or spear points and/or knives (Hare et al. 2004; Zenin et al. 2003), though they have also been postulated to have served as arrow points (Ackerman 2011; Dixon 2011), gravers or awls (Ackerman 1985), or saws (Yi and Clark 1985). Numerous Beringian sites contain microblade cores and microblades, indirect evidence that slotted projectile points were frequently used during the terminal Pleistocene and early Holocene throughout the region (Potter 2011). Among these is the earliest site yet known from Alaska—Swan Point—where microblades occur in deposits securely dated to ~14 kya (Holmes 2011). Other early microblade sites occur in central Alaska (e.g., Dry Creek component 2, Phipps), northwest Alaska (Onion Portage), southwest Alaska (Graveyard Point), interior Chukotka (Khaia, Kongo, Siberdik), and Kamchatka (Ushki layer 6), indicating the widespread use of this projectile technology well into the Holocene.

(p. 233) Nonslotted osseous projectile technologies also occur. At Broken Mammoth, these are represented by a cache of three ivory artifacts—two points and one possible atlatl handle (Holmes 1996; Yesner 1994, 1996)—as well as a carved and decorated bone rod broken into three sections, potentially representing a complex atlatl dart (Yesner et al. 2000). A bone needle from Broken Mammoth and additional fragments of worked ivory from this site as well as Swan Point, Mead, Berelekh, and Gerstle River indicate the importance of osseous materials for the production of tools during the late Pleistocene and early Holocene in Beringia.

Stone bifacial points are also common across Beringia, but they vary greatly across space and time. In central Alaska, after Swan Point the earliest sites typically contain small stone points made on flakes and shaped into triangular or teardrop-shaped forms, often called “Chindadn points.” In the Nenana complex sites of the Nenana valley, for example, teardrop-shaped points have been recovered from Walker Road (Goebel et al. 1996), triangular points from Dry Creek (Powers and Hoffecker 1989), and both from Moose Creek (Pearson 1999) (Figure 9.4). These are small and thin, typically made on flakes and incompletely worked on both faces. At Walker Road, conjoining basal and tip fragments of two teardrop-shaped points were found around the same hearth features (Goebel et al. 1996), suggesting their use as hand-held knives; while at Dry Creek, two of three triangular points were just basal fragments (Powers and Hoffecker 1989), suggesting they functioned as projectiles. Chindadn points also occur in Younger Dryas-aged occupations at Broken Mammoth and Swan Point (Holmes 1996, 2001, 2011; Holmes et al. 1996), as well as at Healy Lake, where they were first described (Cook 1969), and at Little John and Chugwater (Easton et al. 2011; Lively 1996). The western Beringian sites Berelekh and possibly Ushki layer 7 have yielded teardrop-shaped points similar to Chindadn forms; at both sites they seem to date to ~13.5–13 kya (Goebel and Slobodin 1999; Pitulko 2011). At Ushki, however, most of layer 7’s small bifacial projectiles are stemmed and shouldered (Dikov 1977 [2003]; Goebel et al. 2003). The widespread occurrence of Chindadn points in the terminal Pleistocene occupations of Beringia indicates they represent a unique *fossile directeur* of early Beringians.

Central Alaskan assemblages typically ascribed to the Denali complex often contain lanceolate-shaped bifaces, larger than Chindadn bifaces and frequently in association with microblades (Powers and Hoffecker 1989; West 1981). These stone points were typically manufactured from large bifacial preforms and secondarily flaked to midlines, creating thick lenticular or diamond-shaped cross sections. They have straight to convex bases and long downwardly contracting "stems," lack obvious shoulders, and are widest nearer the tip than the base. Many basal fragments display impact fractures (Powers et al. 1983), suggesting their use as weapon tips, and at Upward Sun River, convex-based lanceolate points were recovered in a burial pit with decorated bibeveled antler foreshafts (Potter et al. 2014)

In northern Alaska, early period bifacial points are distinctive and often characterized as "Paleoindian" (Smith et al. 2013). Most obvious are the northern fluted points found at sites like Putu, Batza Téna, and Serpentine Hot Springs (Clark 1991; Goebel et al. 2013). These typically have deeply concave, sometimes V-shaped bases, multiple (p. 234) (p. 235) flutes on both faces, and edge-ground proximal margins, features suggestive of affinities with late Paleoindian industries of temperate North America, not surprising given their presumed ~12 kya ages at Serpentine and Raven Bluff. Another northern Alaskan point form, Mesa, is distinct from northern fluted points in that it has a shallow concave base, is basally thinned but not fluted, and has proximal lateral margins that contract downward (Kunz and Reanier 1995), features common on nonfluted late Paleoindian projectile points in temperate North America (e.g., Goshen/Plainview). Sluiceway points of northwest Alaska also fit the northern Paleoindian pattern. These points are large and long, lanceolate-shaped with excurvate, edge-ground bases, and have thick, biconvex cross sections (Rasic 2011). Many have impact fractures, indicating their use as projectile tips, and many show signs of resharpening and recycling, an indication of differential land-use intensity in the Brooks Range and its foothills (Rasic 2011).

Figure 9.4 Northern Paleolithic artifacts referred to in text. (a) Woolly rhinoceros foreshaft: Yana RHS; (b) osseous inset point with microblades: Chernoozer’e-2; (c) osseous inset point: Tashtyk-2; (d–e) osseous inset points: Kokorevo-1; (f–g) osseous inset points: Trail Creek Caves-2; (h) ivory foreshaft: Broken Mammoth; (i) osseous eyed needle: Yana RHS; (j) osseous diadem: Yana RHS; (k) tooth pendant, Yana RHS; (l–n) stone pendants: Berelekh; (o) stone pendant: Khaia; (p–q) stone beads: Ushki-5; (r) stone pendant: Uptar; (s) stone tablet with incisions interpreted to represent huts: Ushki-1; (t) wedge-shaped microblade core: Dry Creek; (u–v) microblades: Ushki-5; (w) wedge-shaped microblade core: Swan Point; (x) wedge-shaped microblade core: Diuktai Cave; (y) biface: Diuktai Cave; (z, aa, bb) backed points: Yana RHS; (cc–dd) bifacial stemmed points: Ushki-5; (ee–ff) bifacial Mesa lanceolate points: Mesa; (gg) bifacial Sluiceway point: Caribou Crossing; (hh) bifacial Sluiceway point: Upper Kelly site; (ii) end scraper: Kokorevo-1; (jj) flake graver: Mesa; (kk) burin: Dry Creek; (ll–oo) bifacial Chindadn points: Healy Lake Village; (pp–qq) bifacial Chindadn points: Walker Road; (rr) bifacial triangular point: Dry Creek; (ss) bifacial fluted point: Serpentine Hot Springs; (tt–uu) bifacial lanceolate points: Dry Creek; (vv) biface: Byzovaia

Sources: (a, z–bb) Pitulko and Pavlova 2010; (b) Petrin 1986; (c–e, ii) Abramova et al. 1991; (f–g) Larsen 1968; (h) Yesner et al. 2000; (i–k) Pitulko et al. 2012; (l–n, x–y) Mochanov 1977; (o, r) Slobodin 2011; (p–q, u–v, cc–dd) Goebel et al. 2003; (s) Dikov 1977; (t, kk, pp–rr, tt–uu) Goebel et al. 1991; (w) Holmes 2011; (ee–ff, jj) Kunz and Reanier 1994; (gg–hh) Rasic 2011; (ll–oo) Cook 1996; (ss) this volume; (vv) Boriskovskii 1984. Drawings by Ted Goebel

Besides projectile tips, studies of tool technology in late-glacial Beringia have focused on other bifacial tools, unifacial tools, cores, and debitage. In central Alaska, the few comprehensive technological studies that have been conducted suggest the use of a combination of informal and formal technologies. Nenana complex industries of the Allerød interstadial, on the one hand, are characteristically informal, being based on simply prepared flake and blade cores, with tool assemblages being dominated by marginally worked unifacial tools (Goebel 2011; Graf and Goebel 2009). Even bifaces are uncommon and often just bimarginally or invasively retouched. Denali complex industries of the Younger Dryas stade, on the other hand, contain higher frequencies of formal cores (e.g., wedge-shaped microblade cores) and tools that are either carefully designed (e.g., microblades for use in composite projectiles, burins, and hafted bifacial points) or intensively reduced (e.g., side scrapers and cobble tools) (Graf and Goebel 2009). Burins are especially common in early central Alaskan assemblages, and they seem to most frequently co-occur with microblades, leading to the inference that they were used to trim, carve, and incise hard osseous materials (Powers et al. 1983). In northern Alaska, Paleoindian industries often have small, marginally worked tools like gravers and end scrapers, but these were often made on biface-thinning flakes (Kunz and Reanier 1995), by-products of a formal technology. The Sluiceway complex of northwest Alaska is characterized by similar flake tools as well as bend-break tools on broken bifaces (Rasic 2011). Burins are rare or absent in the northern Paleoindian assemblages, a further sign of a reliance on well-designed stone projectile points instead of inset osseous points.

Early Beringians obviously left behind a diverse array of artifacts and assemblages in their sites, and this variability is expressed not just in their projectile technologies but also in the manners in which they procured raw materials, prepared cores, and manufactured hafted and unhafted tools. Explaining this technological variability is a daunting task, one that has been debated by archaeologists for decades (Goebel and Buvit 2011), with some explaining it in terms of normative cultural differences (e.g., Dixon 2001; Dumond 2011; Hoffecker 2011; Hoffecker et al. 1993; Kunz and Reanier 1995; Slobodin 2011), others in terms of behavioral differences (Bever 2001; Graf and Bigelow 2011; Holmes 2001; Potter 2011; Rasic 2011; West 1996).

(p. 236) Subsistence Economy

Economic patterns among late Pleistocene eastern Beringian colonizers and later populations adapting to oscillating climatic conditions are difficult to establish. Taphonomic factors within the modern boreal forest act to inhibit organic preservation, with birds and fish potentially being underrepresented in the faunal record. High residential-mobility strategies likely employed would have yielded relatively ephemeral sites (Kelly and Todd 1988; Powers et al. 1983). Work over the last 20 years in eastern Beringia, however, has yielded significant patterning of early economic strategies and subsistence patterns. Several middle and upper Tanana valley sites (especially Broken Mammoth, Swan Point, Mead, Upward Sun River, Little John, and Gerstle River) have produced multiple components before, during, and after the Younger Dryas with substantial faunal preservation (e.g., Easton et al. 2011; Holmes 1996, 2011; Potter 2007; Potter et al. 2011a, 2011b; Yesner 2001, 2007; Yesner et al. 2011).

The debate regarding early Paleoindian subsistence strategies is sometimes dichotomized as (1) large-mammal specialization and (2) broad-spectrum generalization (Grayson and Meltzer 2003; Waguespack and Surovell 2003; see review in Scott 2010), with some explaining variability in terms of logistical organization, resource scheduling, and seasonality (Potter et al. 2011b), local microenvironments (Yesner et al. 2011), or climate change (Graf and Bigelow 2011; Mason et al. 2001). The eastern Beringian data for the Allerød come from sites in the Tanana basin (and none elsewhere), specifically Dry Creek, Broken Mammoth, Swan Point, Mead, Upward Sun River, and Little John (Holmes 2011; Holmes et al. 1996; Powers et al. 1983; Potter et al. 2011a; Yesner 1996, 2001; Yesner et al. 2011). These sites contain varying frequencies of large ungulates, primarily steppe bison and wapiti, but low frequencies of moose, caribou, and Dall sheep. Other important taxa include waterfowl (including swan and ducks), other birds (e.g., ptarmigan [*Lagopus lagopus*]), and small mammals, notably hare and ground squirrel.

Terminal Pleistocene (Younger Dryas) occupations at Broken Mammoth, Swan Point, Mead, and Upward Sun River include much the same suite of resources, but with the notable reduction in avian remains and addition of salmonid fish (at Upward Sun River and Broken Mammoth) (Potter et al. 2011b; Yesner 2001). Two additional sites in northwest Alaska (Raven Bluff and Serpentine Hot Springs) are notably different from the central Alaskan data, in that they have yielded small-sized ungulate remains, specifically caribou at Raven Bluff, associated with fluted points (Goebel et al. 2013; Hedman et al. 2011). While some have argued for bison as the economic mainstay of northern Paleoindian sites (e.g., Kunz et al. 2003; Loy and Dixon 1998), paleontological data indicate regional extinction of bison in northwest Alaska by the end of the Pleistocene (Rasic and Matheus 2007). Moreover, the archaeological data suggest caribou was a more important resource. The implications of these new findings have not yet been incorporated into economic models, but they suggest considerable regional economic variability during the Younger Dryas.

Post-Younger Dryas occupations with fauna between 11.5–9 kya (Dry Creek component 2, Gerstle River components 1–3 and 5, Little John, Healy Lake Village, and Carlo (p. 237) Creek) indicate continued exploitation of large ungulates (bison and wapiti), small game, particularly hare, and to a much lesser extent, avians (Bowers 1980; Cook 1996; Easton et al. 2011; Potter 2007; Powers et al. 1983). Caribou is uncommon in these assemblages (except Little John) and does not become a substantial element in central Alaskan diets until after 6 kya, when vegetation and fire-regime changes may have reduced bison habitat (Mason and Bigelow 2008; Potter 2008).

While these data are coarse grained and subject to varying interpretations, some tentative conclusions can be drawn. There is no indication that late Pleistocene or early Holocene eastern Beringian foragers practiced strictly megafaunal specialization or broad-spectrum foraging strategies, but rather complex strategies exploiting predictable resources that varied seasonally (Potter et al. 2011b) and regionally (Yesner et al. 2011).

Data from contemporaneous sites indicate seasonal differences in procurement (Bowers 1980; Potter 2007), even controlling for local environment (e.g., Broken Mammoth cultural zones 3 and 4; Yesner 2001). Excluding the earliest Swan Point occupation, intersite analyses in central Alaska indicate that overall there appears to be little difference in economy before, during, or after the Younger Dryas. Instead, the first major economic transition occurred in the middle Holocene, when caribou replaced bison and wapiti as the major ungulate resource (Potter 2008).

Direct data on western Beringian subsistence economies are rare. From Ushki-1 layer 7, a moose antler fragment was recovered (Goebel and Slobodin 1999), and from Ushki-1 layer 6, Vereshchagin (1979) reported steppe bison, mountain sheep (*Ovis nivicola*), horse, lemming (*Lemmus* or *Dicrostonyx* sp.), and a deliberately buried dog (*Canis familiaris*), while Dikov (1990) added birds (possibly duck) and fish (possibly salmon). At Berelekh, remains of extinct hare (*Lepus tanaiticus*) and various birds dominate the assemblage, while mammoth, rhinoceros, bison, reindeer, horse, musk-ox, and cave lion (*Panthera* sp.) are minimally represented (Mochanov 1977; Vereshchagin 1979). The mammoth, rhinoceros, and cave-lion remains may have been scavenged from a nearby "mammoth cemetery," or may be intrusive (Pitulko 2011).

The extent and nature of mammoth exploitation in Beringia has been a matter of some debate (see review in Hoffecker and Elias 2007). In northwest Beringia, mammoth-bone accumulations at the Berelekh and Achchagyi-Allaikha sites are not temporally associated with human occupations (Pitulko 2011; Nikolskiy et al. 2010). However, recent work at a mammoth locality (YMAM) near the Yana RHS site indicates anthropogenic accumulation (Basilyan et al. 2011; but see Pitulko and Nikolskiy 2012:26). Mammoth-tusk fragments are relatively common in eastern Beringian assemblages (e.g., Broken Mammoth, Swan Point, Mead, Gerstle River), but no postcranial remains have been recovered, suggesting scavenging of ivory for tools.

Thus, in the broadest view, an economic focus on gregarious, grazing megafauna (horse, bison, mammoth, and woolly rhino) is evident early in the Upper Paleolithic of western Beringia (i.e., at Ikhine-2 and Yana RHS), along with evidence for small game exploitation, while in eastern Beringia during the late glacial, horse and mammoth drop out by ~14 kya (perhaps evident only at the earliest known component at Swan Point (Holmes 2011), and bison and wapiti remain the dominant large ungulate prey until ~6 (p. 238) ka, when they are largely replaced by caribou (Potter 2008, 2011). Compared with the earliest Paleoindian assemblages south of the ice sheet, a broader subsistence economy (Waguespack and Surovell 2003) or similarly broad economy (Grayson and Meltzer 2003) is evident in late-glacial Beringia, based on megafauna, medium and small mammals, birds (particularly waterfowl), and, to a lesser extent, fish (probably anadromous), with clear seasonal differences.

Settlement Organization

A general Beringian settlement-system model would be unrealistic given the observed and inferred ecological and physiographic variation throughout this large area; however, regional systems of land use have been conjectured. An early influential settlement model was developed by Guthrie (in Powers et al. 1983) for central Alaska, where archaeologically visible sites like Dry Creek were interpreted to represent "spike camps" where recently acquired game was processed for transport to base camps. Yesner (1996) has argued these base camps may have been preferentially located on valley bottoms, and thus differentially eroded. More recent models include Rasic (2011) and Potter (2011), who posit settlement systems or land-use strategies at various scales for northwestern and central Alaska, respectively. In these models, seasonal resource availability and abundance (particularly of caribou and bison) as well as mobility are key elements constraining potential land-use patterns. These models, while useful for regional problems, may not be suitable for extrapolation to regions with less archaeological coverage, particularly western Beringia, where horse and mammoth may have been economically more important. Other Alaskan settlement models focus on specific aspects of technology, for example seasonal constraints on technology (Wygal 2011), or on later time periods (e.g., Mason et al. 2001). Climatic effects on animal and plant distributions have been argued to have altered technology and settlement strategies before, during, and after the Younger Dryas (Graf and Bigelow 2011), though other analyses (Potter 2011) suggest broadly similar subsistence-settlement systems for these periods.

For western Beringia, well-dated stratified sites are rare, but Ushki-1 contains multiple features interpreted by Dikov to represent three types of structures, semisubterranean houses with central rock-lined hearths and entrance tunnels inferred to be winter dwellings, surface houses without entrance tunnels inferred to be contemporaneous summer dwellings, and irregularly shaped charcoal smears inferred to be earlier dwelling structures (Dikov 1977 [2003]). Ushki, however, remains unique in Beringia, and no other dataset suggests such multiseasonal occupations.

Art, Ornamentation, and Ritual

Examples of art and ornamentation are rare in the Arctic's late Pleistocene and early Holocene archaeological record. Incision marks regularly occur on worked ivory, bone, (p. 239) and antler tools; however, often these are related to manufacture or use, not decoration. Nonetheless, numerous osseous tools at Yana RHS are ornamented (Pitulko and Pavlova 2010), a fragmented ivory point from Broken Mammoth (cultural zone 3) has patterned incisions suggesting a nonutilitarian, stylistic origin (Yesner et al. 2000), and an antler-point fragment from Lime Hills Cave bears signs of a reddish pigment (Ackerman 2011), suggesting the use of ochre as decoration.

Beads, pendants, and other items of personal adornment have not been recovered from securely dated early contexts in Alaska; however, in western Beringia they are more common. At Yana RHS hundreds of beads and bead preforms have been recovered (Pitulko et al. 2012). At Berelekh, five stone pendants occur on round to oval-shaped pebbles and have biconically drilled holes near one end; two of these display parallel incisions around their perimeters (Mochanov 1977). Raw materials vary and include green jadeite and white calcite. At Ushki, hundreds of small stone beads and a few stone pendants were found, primarily from layer 7 dating to ~13 kya, but also from layer 6, 12.5 kya (Dikov 1977 [2003]). The beads typically are tiny and disk-shaped with biconically drilled holes; most were recovered from a burial pit at Ushki-1, but they also occur in domestic settings preserved at Ushki-1 and Ushki-5 (Dikov 1977 [2003]; Goebel and Slobodin 1999; Goebel et al. 2003). A few labrets were also found in layer 6 at Ushki-1. Stone pendants also have been recovered from presumed early contexts at the Khaia and Uptar sites, both located near Magadan, Russia (Slobodin 2011).

Works of Paleolithic art, so common in Europe and western Siberia, are so far rare from the early record of Beringia. Two possible exceptions are an engraving of a mammoth on a fragment of tusk, found along the Berelekh River by local collectors in 1965 (Mochanov 1977), and a stone slab from Ushki with numerous incisions interpreted to represent conical-shaped huts (Dikov 1977 [2003]).

The near absence of clear signs of ornamentation, artwork, and ritual in Beringia's early archaeological record may be a sign of high levels of mobility among the region's late Pleistocene and early Holocene occupants (Goebel 2002), or it could be due to sampling—an obvious bias toward discovery and investigation of short-term camps and special-task sites instead of long-term settlements or villages. Not surprisingly, when obvious habitation features have been encountered, for example at Yana RHS, Ushki, and Upward Sun River, ornamented artifacts, works of art, and/or ritual features have been unearthed.

Human Remains

There are only two known terminal Pleistocene sites containing human burials in Beringia, consistent with the high mobility and small co-residing population sizes inferred for early populations. The first, Ushki-1, Kamchatka, consists of two such features, the older (layer 7) containing a single adult burial (with only bone outlines preserved) within a rock-lined pit spatially separated from residential structures (Dikov 1977 [2003], 1996). Items within the ochre-filled pit included hundreds of stone beads, (p. 240) stone cobbles, and a few stone tools. The younger Ushki component (layer 6) yielded two unburned burials of children in small pits within separate houses (Dikov 1979; Slobodin 2006). Items within one of these included ochre, a pendant, numerous lemming incisors, and elements of microblade technology (Dikov 1979, 1996). Layer 6 at Ushki also yielded a dog burial which had been dug into the floor of a house. Some of the bones and surrounding sediment were stained by red ochre, and the burial pit contained an obsidian knife and end scraper, as well as a sandstone plate (Dikov 1979).

The second Beringian burial site is Upward Sun River, in central Alaska (Potter et al. 2011a, 2014). A child of about three years old was cremated and buried in a pit hearth (~45 cm deep) within a residential structure (which was abandoned after the cremation).

Dental traits indicate a Sinodont pattern (Potter et al. 2011a). Directly below the child cremation was a second burial, which contained the remains of two infants, four bibeveled antler rods (three with multiple X-shaped incisions), and two lanceolate bifacial points in positions to suggest they had been hafted to the antler rods at the time of burial (Potter et al. 2014). All of the artifacts were ochre-stained. Overlapping ^{14}C ages of ~11.5 kya on the two features suggest they are nearly contemporaneous, both being the product of either the same or successive seasonal occupations (Potter et al. 2014).

Conclusions

Given the record presented above, we offer the following tentative conclusions about the late Pleistocene settlement of Arctic Asia and America. It is evident more work—from field investigations in areas that have received relatively little attention (for example, the lower Kolyma basin, parts of interior Alaska) to larger, open excavations to evaluate site structure and organization—is necessary to test the many points of debate raised above.

(1) Initial human colonization of far northeastern Asia occurred by ~32 kya, based on the record from Yana RHS in Arctic western Beringia, as well as from a few scattered sites in the Lena and Nizhnaia Tunguska basins, Subarctic Siberia. Little is known about these early human inhabitants of the Arctic and Subarctic; however, at Yana we know they were full-time residents of the far north who produced an Upper Paleolithic style of material culture and subsisted on a diverse array of fauna, much of it now extinct. At present, there is no clear linkage between these initial Arctic occupants and later populations that colonized the New World.

(2) Sustained human settlement of Arctic and Subarctic Siberia and Beringia through the last glacial maximum has not been demonstrated. Instead, the data suggest humans reappeared in the region during the late glacial, certainly by 16 kya in Iakutia and 14 kya in Beringia.

(3) Late Upper Paleolithic humans postdating the last glacial maximum in Siberia typically produced composite weapon tips inset with microblades. The earliest (p. 241) late-glacial Beringian occupation, dating to 14 kya at Swan Point in central Alaska, also contains evidence of microblade technology.

(4) After 14 kya, the late-glacial Beringian archaeological record, from Kamchatka to central Alaska, is characterized by diverse projectile-point technologies and forms. Some early industries are northeast Asian in character (i.e., they contain microblade technologies—the Denali and Diuktai complexes), some are North American in character (e.g., the Mesa and fluted-point complexes of northern Alaska), and some are distinctly Beringian in character (e.g., the Ushki layer 7 and Nenana complexes). Archaeologists still do not agree on how to explain this variability, whether it represents cultural or behavioral differences, or some combination of the two.

(5) Lithic raw-material procurement studies are still emerging, but already they are hinting at complex procurement and transport systems even in the earliest sites of Kamchatka and central Alaska. Without question, their occupants had “mapped onto” the Beringian landscape by 14–13 kya.

(6) Beringian economies were internally quite diverse, with eastern Beringian populations focusing on bison and wapiti during the terminal Pleistocene and early Holocene. Early Beringian diets also incorporated other large ungulates, small and medium mammals (some furbearing), waterfowl and other birds, and fish.
(7) Although at Yana RHS the earliest Beringians appear to have regularly subsisted on mammoth, during the late glacial current evidence suggests mammoths were not regularly hunted. Instead humans appear to have scavenged mammoth carcasses or “boneyards” for ivory to be used as tools. This may have important implications for resolving the extent to which human predation and climate change affected these and other late Pleistocene megafauna.
(8) Late-glacial Beringian settlement organization is more difficult to generalize. Most sites reflect short-term, limited-activity occupations of mobile hunter-gatherers, but two sites, namely Ushki and Upward Sun River, contain evidence of longer-term, potentially multiseason habitations with dwelling and burial features. As our site samples increase and our understanding of land use and organization of space develops, we suspect a more complex picture of Beringian settlement strategies and land use will emerge.
(9) Items of personal adornment, art, and ritual behavior are relatively rare in the Beringian record. The dearth of mobile art is consistent with the high mobility inferred for these early Beringians; however, the few sites that have yielded such articles in abundance represent habitation sites.

Important questions remain unresolved and suggest avenues for future research. Did modern humans disperse from western Beringia into Alaska before the last glacial maximum, or did they make it no further than Yana RHS? If the latter, what ecological or demographic variables affected this expansion? How is late-glacial lithic-assemblage variability to be interpreted? To what extent did normative and functional/behavioral factors influence this variability? Another major unknown is whether pre-13 kya (p. 242) archaeological occupations exist on the North American northwest coast, indicating a second migration route into North America. How did early Beringians adapt technology, subsistence, and settlement to the radically changing environments of the north during the late Pleistocene and early Holocene? Did they have a primary role in extirpating certain megafauna? Finally, what role did the early Beringians have in the overall peopling of the Americas south of the Canadian ice sheets? Answers to these questions must await new discoveries as well as the application of new methods and theoretical perspectives that permit an investigation of the adaptive as well as historical components of the human past.

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