New insights into Eastern Beringian mortuary behavior: A terminal Pleistocene double infant burial at Upward Sun River

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Here we report on the discovery of two infant burials dating to ∼11,500 calibrated years (cal) B.P. at the Upward Sun River site in central Alaska. The infants were interred in a pit feature with associated organic and lithic grave goods, including the earliest known North American hafted bifaces with decorated antler fore-shafts. Skeletal and dental analyses indicate that Individual 1 died shortly after birth and Individual 2 was a late-term fetus, making these the youngest-aged late Pleistocene individuals known for the Americas and the only known prenate, offering, to our knowledge, the first opportunity to explore mortuary treatment of the youngest members of a terminal Pleistocene North American population. This burial was situated ∼40 cm directly below a cremated 3-y-old child previously discovered in association with a central hearth of a residential feature. The burial and cremation are contemporaneous, and differences in body orientation, treatment, and associated grave goods within a single feature and evidence for residential occupation between burial episodes indicate novel mortuary behaviors. The human remains, grave goods, and associated fauna provide rare direct data on organic technology, economy, seasonality of residential occupations, and infant/child mortality of terminal Pleistocene Beringians.

mortuary archaeology | Beringia | terminal Pleistocene | skeletal remains | Paleoindians

The few known Ice Age North American burials offer important insights into mortuary and ritual behaviors otherwise invisible in the archaeological record (1–3). In 2010, we added to that record through recovery of a cremated 3-y-old child (4) dating to ∼11,500 calibrated years (cal) B.P., within the hearth of a residential structure at Upward Sun River (USR), Alaska (Fig. 1). In 2013, we excavated below the residential feature to further explore site structure and organization; in the process, another burial containing two unburned infant skeletons was discovered. Both were interred within a circular pit (F2011-13) directly below the cremation hearth (Feature 5, or F2010-5) (Figs. 2 and 3). Here we report on the context and implications of these discoveries.

The USR site is located on a loess-mantled sand dune in the central Tanana River basin. The site contains four components, dating between 13,200 and 8000 cal B.P.; the cremation and burials were within Component 3 (∼11,500 cal B.P.). Site stratigraphy, site formation and disturbance, faunal, and lithics from 2007 to 2010 investigations have been reported (4, 5). Backscatter plots confirm a general lack of postdepositional disturbance (Fig. 3 and *SI Appendix*, Fig. S1), which is consistent with geoarchaeological observations, including horizontal paleosols (Ab horizons) that extend for several meters with no evidence of turbation (5, 6).

The F2010-5 hearth extended from 70 to 80 cm below datum (cm BD) at its deepest point (43 cm below the occupation surface). A few faunal fragments and small charcoal flecks were recovered between 84–106 and 114–127 cm BD within the F2011-13 pit fill. Some fauna are burned, but the sediment shows no oxidization or consolidated charcoal lenses, indicating that they came from an upper hearth disturbed by excavation of the burial. The remains were at the bottom of the pit, with Individual 1 near the western edge and Individual 2 near the center, both within an ochre-rich matrix at 121–129 cm BD (∼40–50 cm below the cremation hearth and 90 cm below the occupation surface). The pit has a nearly flat bottom with steep sides and is approximately the same diameter as the bottom of the cremation hearth. In contrast to the cremation, there is no charcoal or ash below the ochre matrix, suggesting a lack of burning or other treatment of the burial pit before interment. A thin organic-rich layer (>1 mm) overlies the infants and grave goods.

The USR chronology is established through 27 carbon-14 (^{14}C) dates on 13 cultural features, 9 stratigraphic charcoal, and 5 snail shells (succinids) located stratigraphically between components 1 and 2 (4, 5). Radiocarbon assays were calibrated by using Calib (Version 7.0.2) and the IntCal13 dataset (7, 8). Secure dating for the burial was accomplished through radiocarbon analysis of charcoal (*Betula* sp.) adhering to one antler rod (see below), dating to 9930 ± 50 ^{14}C yr B.P. (Beta-371567) (11,600–11,230 cal B.P.). This age is statistically similar to three dates already obtained for the cremation and is consistent with the suite of radiocarbon dates from older and younger stratigraphic contexts (4) (Fig. 3). Additional evidence for contemporaneity with the cremation and Component 3 includes the thin, unimodal vertical distribution of all cultural materials, consistent horizontal depth below surface, and absence of postdepositional disturbance. The cremation hearth and burial pit dates ($n = 4$) overlap at 1 SD (*SI Appendix*, Table S1) and are statistically the same ($\chi^2 = 7.81$; df = 3; $P < 0.05$), with a mean pooled radiocarbon age of 9970 ± 30 B.P. (11,600–11,270 cal B.P.). Given similar ages for trees (*Populus balsamifera*) and short-lived shrubs (*Betula* sp.) and context, we argue that the burial and cremation represent nearly contemporaneous events, associated with a single hunter–gatherer

Significance

Two interred infants with associated grave goods and a third cremated child represent the earliest known human remains from the North American subarctic, and they provide evidence for novel mortuary behaviors at the end of the last Ice Age. Two bifacial points with decorated foreshafts represent hafted projectiles, confirming earlier conclusions about Paleoindian weapon system form and function. Excellent faunal and other contextual data indicate broad-spectrum foraging behaviors.

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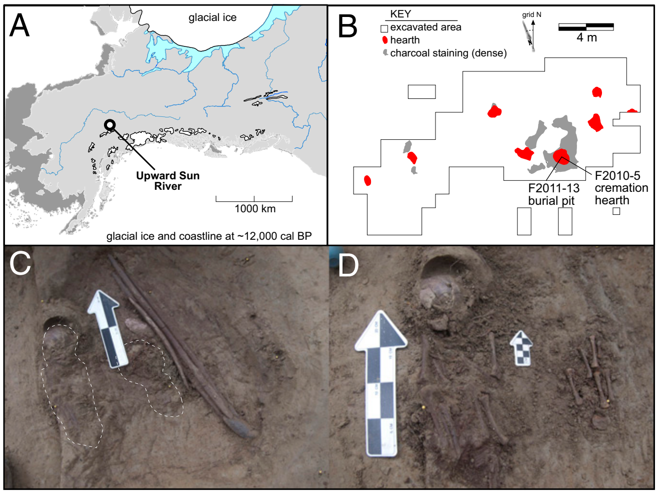

Fig. 1. Burial pit at USR. (*A*) Location. (*B*) Site area showing hearths. (*C*) Individuals 1 (*Right*) and 2 (*Left*) with associated grave goods. (*D*) In situ human remains.

group. These deaths and interments may have occurred within a single seasonal occupation or within successive occupations.

Several discrete lithic activity areas were identified within Component 3, with broadly similar characteristics (i.e., reduction patterns indicate biface thinning and tool maintenance on a few raw material types). Lithic tools are limited to bifaces, retouched and used flakes, and a flake graver. Most of the lithic raw materials at USR Component 3 are cherts, including flake core fragments with stream-rolled cortex, suggesting that they were secondarily deposited cobbles in nearby braided streams. The single USR obsidian flake is geochemically similar to obsidian from the Hoodoo Mountain source in Kluane National Park, Yukon, Canada (analyzed using a Bruker Tracer III-SD XRF instrument). USR is 600 km to the northwest of the Hoodoo Mountain source area and marks some of the earliest use of this obsidian in Beringia during the terminal Pleistocene (9). Most early Eastern Beringian sites have obsidian from 200- to 300-km distance (9), and the USR data suggest very high mobility or the existence of early long-distance exchange networks.

Faunal analyses (following ref. 10) provide data on economy, seasonality, and association between the burials and cremation. These analyses include all fauna in both features, with matrices sieved through 1/16-in (1.68 mm) mesh, consisting of 827 identified specimens [number of identified specimens (NISP)] within the cremation hearth and 103 within the pit fill (*SI Appendix*, Table S2). Overall taxonomic diversity is similar between assemblages; dominated by salmonids and ground squirrels, similar diets between occupations (or portions of an occupation) are indicated. Both assemblages contained burned specimens, but the pit fill contained proportionally fewer burned remains. Because there are no faunal disposal areas outside the hearths and almost all bone is highly fragmented and comminuted directly within hearths at Component 3, we argue for bone disposal within hearths. There is no indication of the use of bone for fuel, because most of the identified remains are small mammals, fish, and birds. The increased burning in the hearth assemblage could reflect abandonment directly after the human cremation and lack of subsequent food processing/consumption events. The presence of both salmon (*Oncorhynchus* sp.) and immature ground squirrels (*Urocitellus parryi*) constrain the season of occupation to between mid-July through early August (11, 12). The similar abundances of both taxa during a period before the lower individuals were buried and during use of the upper hearth strongly indicate a similar season of occupation.

Other taxa were present, including a small salmonid [likely Coregoninae (whitefish)] that occurs in small numbers in the cremation hearth and the burial pit fill. Large mammals are represented by 51 small fragments (with a total weight of 17.6 g) and were recovered solely from the hearth. Although these could not be identified to genus or element portion, cortical bone thickness (3.9–15.5 mm) indicates a very large size class, likely bison (*Bison priscus*) or wapiti (*Cervus canadensis*) given other terminal Pleistocene and early Holocene faunal assemblages in the region (4, 13–15). These data suggest a wide summer diet breadth and the lack of low-resource-yield high-density elements suggests consumption events rather than early stage processing.

To investigate vertical distribution of fauna throughout the feature, we evaluated NISP by depth (*SI Appendix*, Fig. S2), which indicates a predominance of identified material in the hearth, dropping off sharply below the hearth. The scattered fauna within the burial pit fill are evenly distributed and indicate secondary context. Thus, the upper hearth was not created solely for the cremation, but was used as a cooking/disposal hearth between burial episodes.

Human Remains

The infant skeletal remains were largely complete and in anatomical position, allowing for reconstruction of body positions and orientation relative to the pit, site, and local landforms (Fig. 2). Individual 1 was supine, face up, with the knees tightly flexed toward the chest, left arm flexed across chest with hand near the chin, and right arm extended across the torso to the left. The positioning of Individual 2 was more difficult to ascertain. It appears to have originally been placed upright with knees tightly flexed toward the chest. However, when discovered, the torso was prone over the legs, both of which were semidisarticulated, and the left arm extended beside the back and behind the pelvis. Elevation data confirm that the skull, thoracic vertebrae, and hands were superior to the pelvis, lower limbs, and lumbar vertebrae (*SI Appendix*, Table S3). The forward shift of the torso was likely due to compression from overlying soil. An alternate hypothesis is that Individual 2 represents a secondary burial, perhaps exhumed elsewhere and reinterred when Individual 1 died. Such an explanation could account for the unusual sitting position and disturbance of lower limbs. The position and arrangement of the infants and presence of ochre completely coating the bones suggest that the two were wrapped in shrouds.

Individuals 1 and 2 and the antler rods are all oriented roughly parallel to each other, 9°, 8°, and 359–361° (NNW) respectively. All were approximately perpendicular to the dune crest, the

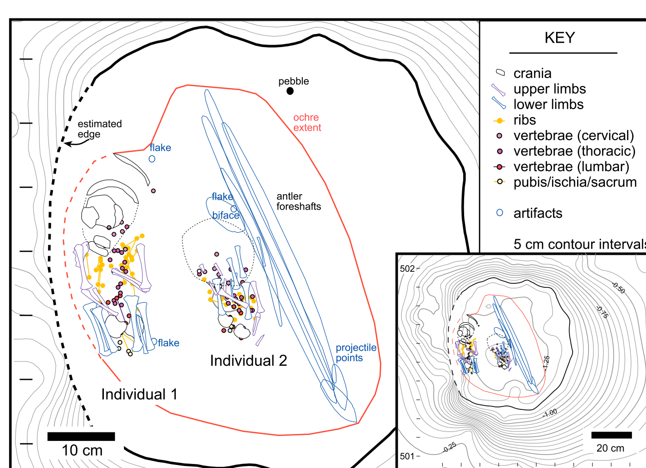

Fig. 2. Plan view of burial feature floor. (*Inset*) Burial pit feature extent.

prominent alluvial terrace to the north, and Tanana River (between 295–310°, WNW). Individual 1 is oriented with the head toward the river, whereas Individual 2 was likely sitting facing the river. The previously recovered cremated individual was likely face up with legs flexed and head oriented ∼250° (SW); there was no clear relationship to the dune crest, terrace edge, or Tanana River, and no grave goods were present. Thus, burial treatment, positioning, and orientation were substantially different between the cremation and inhumations.

The skeletal remains of both individuals are well preserved, and all elements appear to be present. However, postdepositional ground pressure led to considerable breakage of the most fragile elements. As such, the bones and teeth may be described as (*i*) complete, (*ii*) fragmented but can be refitted, and (*iii*) too fragmented to refit and, in some cases, identify specifically. The latter state largely affects the two crania, especially bones of the face and vault.

With the exception of zygomatic length, pars petrosa width, and perhaps pars basilaris sagittal length and clavicle length, the osteometric measurements (*SI Appendix*, Table S4) to estimate age at death indicate that Individual 1 survived birth—anywhere from a few days to perhaps a few months (i.e., >0 to >12 or >16 wk). Assuming that the latter two high-end estimates are outliers, the most consistent age is between birth and 6 wk, based on modern standards. Individual 2 appears to have been a late-term fetus. Measurements (*SI Appendix*, Table S5) suggest a range of >28 to <40, with a mean of 33 gestational weeks. Given the younger age, additional information regarding size can be estimated by using tables for 8- to 8.5-lunar-month-old fetuses and formulae from ref. 16. Based on dimensions of the pars petrosa, pars lateralis, and pars basilaris, the crown–heel length would have been between 40.4 and 45.6 cm, with a mean of 43.36 cm; the weight estimates are 1,330–2,100 g and a mean of 1,725.5 g. Estimates from long bone dimensions are lower. Crown–heel lengths range from 35.7 to 42.2 cm and have a mean of 40.1 cm; weight values are 1,200–1,500 g and 1,377.6 g.

Ages based on deciduous crown development are slightly higher (*SI Appendix*, Table S6). Individual 1 may have lived up to 24 wk after birth (17), but most likely 12–13 wk with a range of >6 to <20 postnatal weeks (18, 19). Estimates from the less-developed, fragmented crowns of Individual 2 are more problematic, yet the formation stage of Coc (i.e., cusp outline complete) in the deciduous maxillary lateral incisor (di2) and Cco-Coc (between coalescence of cusps and Coc stage) in the maxillary canine (dc) are indicative of 38 prenatal weeks to full term (18, 19). The crowns of Individual 1 also allow the scoring of 22 dental nonmetric traits (*SI Appendix*, Table S7). Such data are useful for assessing population affinities of samples (20, 21), although they may provide some insight at an individual level. The study of Native American deciduous morphology is uncommon, but traits in Individual 1 could be compared with those in a pooled prehistoric sample from Ohio (21). Despite some exceptions—e.g., upper central incisors (dui1) that are only minimally shovel-shaped in appearance—nothing is divergent enough to suggest that Individual 1 was anything but a Native American.

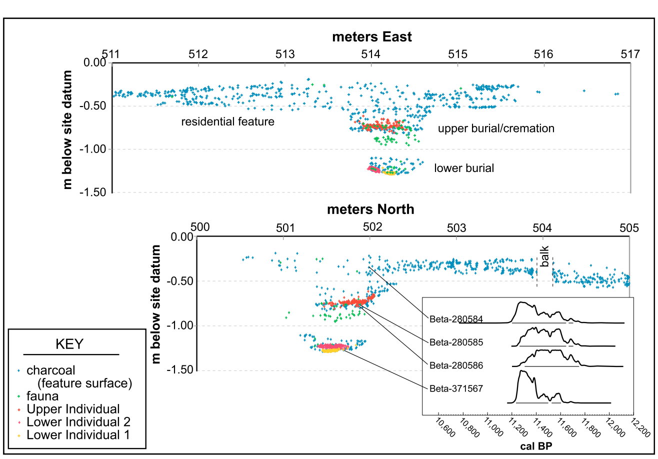

Fig. 3. Backscatter plot of residential structure floor, upper and lower burials. (*Inset*) Calibrated radiocarbon ages and locations.

The skeletal assessment of sex in infants, generally based on morphometric traits of the mandible and pelvis, is difficult (22–24). However, the faint protrusion of a narrow mental eminence and lack of gonial eversion on the mandible (*SI Appendix*, Fig. S3) may suggest that Individual 1 was female (25). The shallow and oblique greater sciatic notch (*SI Appendix*, Fig. S4) on the ilium in Individual 1, as well as Individual 2, is also indicative of a female (25). Successful recovery and analysis of genetic material can confirm these findings (e.g., Y chromosome presence/absence).

Individual 1 may be characterized as an infant, possibly female, who survived birth for a period of days to potentially <20 wk. This description, of course, comes with several caveats, because most estimates are based on studies of recent European and European-derived skeletal samples that may not be representative of the population to which Individual 1 belonged. Most problematic is the variation in age between skeletal and dental methods. Two factors may be involved. First, Native American dental development has been reported to be precocious relative to American whites (17), as confirmed in permanent teeth of Alaskan Natives (26). Second, no skeletal anomalies or pathologies are present, but, given the young age at death, it may be possible that ill health affected growth (27). Thus, developmental age could have lagged behind chronological age. Either way, the age range could plausibly be narrowed to, e.g., 6–12 wk postnatal. Similar issues affect the interpretation of Individual 2 and extend to crown–heel length and weight, particularly given the variation in estimates from cranial (means of 43.36 cm and 1,725.5 g) and long bone dimensions (40.1 cm and 1,377.6 g); again, the more likely estimates may lie between these values. For aging, at least, dental and skeletal methods are concordant enough to confidently identify Individual 2 as a late-term fetus, likely >30 gestational weeks of age.

Another issue concerns the infants' relationship to one another. Individual 1 was clearly a primary burial. Individual 2, based on the disarticulation of some elements and unusual semiupright position, may have been a secondary inhumation. One possible explanation, in a highly mobile foraging society for infants only a few weeks in age apart to be buried together, is that they were twins. Clinical studies show that twins are at greater risk for morbidity and mortality than singletons (28). In addition, the late-term death of one twin in utero (e.g., Individual 2) can adversely affect the second (Individual 1). Premature delivery of the deceased fetus is likely (68%), whereas that for the survivor might occur (57%) (29). Chances of diminished growth, developmental problems, and early death in the survivor increase as well, particularly among monozygotic twins (28–32). There are no key skeletal indicators to explore such a possibility. However, attempts at ancient DNA (aDNA) sampling are ongoing, and if Individuals 1 and 2 are found not to be siblings, an alternative explanation is needed (see discussion below). The concurrent deaths along with the cremated child may represent an instance of above average child mortality for a small hunter–gatherer group.

Grave Goods

Grave goods consist of four antler rods and two projectile points placed parallel to each other and adjacent to Individual 2 and a third biface placed next to the rods (Fig. 4 and *SI Appendix*, Fig. S5). All artifact surfaces are coated with red ochre. All four rods are bibeveled with wear patterns consistent with hafting,

Fig. 4. Decorated antler bibeveled foreshafts and associated bifaces (note: projectile points are shown above associated foreshafts).

and three have multiple incised "X" patterns along their upper surface. These design patterns are unprecedented for known Paleoindian rods in North America (33). Three of the rods are significantly longer than Paleoindian examples (averaging 488 mm) (33) and are similar in size to the rhinoceros horn foreshaft (478 mm) at Yana Rhinoceros Horn Site in northern Siberia (34). The two lithic points were positioned in contact with the beveled ends of two of the rods. Given these positions, the presence of hafting marks on the bevels, and the congruence between the limits of edge-grinding and beveled portion of the rods, we maintain that the bifaces were affixed to the rods, shifting only minimally since burial. These represent the earliest known hafted bifaces in primary context in North America. The associated grave goods comprise functional weapon tips within atlatl–dart or spear systems (35).

The interpretation of materials as grave goods requires clear association and rejection of alternate hypotheses. All lithic and antler artifacts were covered with ochre. There is no indication that this pit was used for other purposes before or after interment and no evidence of disposal behaviors. These materials were not cached for later retrieval, based on placement at the center of the pit touching Individual 2, and continued use of the area, including the hearth directly above these artifacts, reinforce their interpretation as grave goods.

The two USR projectile points are convex-based lanceolate in form, with one (artifact no. 58-87) exhibiting a basal break. Biface attributes are provided in *SI Appendix*, Table S8. Flake scar orientations are variable to subradial, with most flake scars extending to the midline. Edge grinding extends from the bases to 50–65% of their total length. Cross-sections are both lenticular. These two points are distinct from bifaces recovered elsewhere at USR Component 3 (4). The other bifaces likely represent multipurpose bifacial implements given their morphology, asymmetry, beveling, and lack of impact factures or edge-grinding. The third stone tool found within the USR burial pit was a rhyolite biface, with no evidence of edge grinding, which resembled other bifaces within the component in overall form, size, and (random) flaking patterns. These USR bifacial implements are similar in size, morphology, and flaking patterns to the convex-based elliptical and spatulate bifacial knives described from Dry Creek C2 (36).

Various forms of lanceolate bifacial points are ubiquitous in the western Subarctic, but the USR points are most consistent with interior Beringian Denali complex foliate forms (36, 37). Willow-leaf foliate points are common in northwestern North America in the early Holocene, including the Little Arm phase of the Paleoarctic tradition in Yukon Territory (37, 38) and Old Cordilleran assemblages in central and northern British Columbia (39). The two USR points were compared with the three major lanceolate point forms in eastern Beringia during the terminal Pleistocene/early Holocene transition, Denali, Mesa, and Sluiceway complexes (40, 41). In overall dimensions (width and thickness), USR points are smaller than Sluiceway, but similar to Mesa (Type 1/A) points. The USR basal form (strongly convex or constricting base) is distinct from the Mesa type (concave to straight). Sluiceway complex is typified by convex bases but, compared with the USR points, are generally longer, wider, and thicker with a distinct diamond-shaped cross-section (41). However, the USR specimens are similar in dimension and basal form to various Denali complex points, including Dry Creek Component 2, Moose Creek Component 2, Panguingue Creek Component 1, Sparks Point, and Whitmore Ridge in Alaska and Little Arm Phase of the American Paleoarctic tradition in the Yukon Territory (13, 37, 42–45). Given these comparisons and the widespread distribution of Denali complex (or American Paleoarctic tradition) throughout interior eastern Beringia in 12,500–6000 cal B.P. (46, 47), we attribute USR Component 3 materials to this cultural complex.

All four antler rods appeared intact and unbroken, but two (nos. 58-83 and 58-84) had hairline cracks at midpoints, breaking on recovery, suggesting that compression may have facilitated initiation of breakage (*SI Appendix*, Fig. S5). These breaks allowed for inspection of cross-sections to identify the material. A semicircle of trabecular bone surrounded by dense cortical bone indicates that they are antler, and given the size and morphology are likely from wapiti. Given the curvature, they were likely carved from the main antler beam (except possibly for no. 58-82, which was shorter in length, although similar in width and thickness). The antler could have been obtained between autumn and the end of March from live animals, based on the wapiti antler growth cycle (48), or they could have been obtained as shed antlers.

Rod measurements are presented in *SI Appendix*, Table S9. All four rods are bibeveled on the same axis (the side with the trabecular bone present), and all were positioned with bevels down, except no. 58-82, which was oriented along its side. The bevels measured 75.1 ± 7.1 mm long and 13.5 ± 0.7 mm wide for the three larger rods and 47.7 ± 5.3 mm long and 12.5 ± 1.8 mm wide for the smaller rod. The rods were burnished along faceted edges. Cross-sections are convex and slightly flattened on the bottom sides between bevels. All those with incised decorations were placed up with the decorations visible. Similarities in dimension, form, burnishing, and decorative incisions (as well as context) suggest they were manufactured in the same way, possibly by the same person.

In overall form, these rods are similar to Paleoindian beveled rods from various contexts in North America, including Anzick (ref. 49; see review in ref. 50). There are disagreements in the literature on the function of these artifacts: foreshafts for dart points (49), points (51), pressure flakers (52), or sled shoes (53) (see also refs. 33 and 54). We argue that they served as dart/spear foreshafts at USR. The two bifacial points were positioned at the ends of two of the longer rods. The distal ends of the rods were approximately at the same position as the upper limit of edge grinding on the points. The bevels show wear patterns consistent with attachment to other pieces (e.g., the bifacial point and dart shaft). Directly dated ice patch darts in southwest Yukon Territory ranging in age from 9520 to 1070 cal B.P. exhibit diameters from 4.6 to 15.4 mm in width and up to 194 cm in length for complete dart shafts, 10–14 mm wide shafts for antler points, and 22 mm wide antler foreshaft, whereas arrow shaft widths were 4.5–10 mm in width (35). Dart technology was completely replaced by bow-and-arrow technology in the region by 1310–1070 cal B.P. (35), suggesting that the USR implements were foreshafts used in dart systems, although it is possible that they may have been used in thrusting spear or javelin systems.

Ochre covered the foreshafts entirely and the points up to the edge of the haft, suggesting that the hafting material (possibly sinew) was also coated with ochre, but the point tips were left uncoated. The rhyolite biface was treated differently, because both surfaces were coated with ochre. The points and foreshafts were not broken and were in a state of functionality, suggesting that a cost was incurred in placing these tools in burial contexts given production efforts.

Discussion

One of the most intriguing aspects of the site is the differential mortuary treatment of infants and children in the burial and overlying cremation (the latter described in ref. 4). These differences along with evidence for residential occupations before and after the double burial indicate more complex Beringian/North American Paleoindian mortuary behaviors than previously observed (see review in ref. 3) (we note that the term *complex* refers to these novel Paleoindian behaviors, not to more narrow definitions relating to social stratification, etc.). Several hypotheses to explain these patterns are evaluated here. The differences in mortuary treatment could reflect different cultural traditions or diachronic changes within a tradition. We reject these hypotheses given statistically contemporaneous dating and presence of a single widespread cultural tradition (Denali complex) in central Alaska between 12,500 and 6000 cal B.P. The radiocarbon ages, data on seasonality, and overall sequences of site formation within Component 3 also allow us to reject a hypothesis of changing burial treatment through time within a single cultural tradition. Given ethnographic data on subarctic hunter–gatherer group mobility (55, 56), we do not expect multiple disparate groups to sequentially use a single relatively short-term tent/cooking hearth feature sequentially in seasonally specific ways, using a nearly identical suite of faunal taxa. The USR dune is one of hundreds within a 3,500-acre dune field (6). The most parsimonious explanation is that the feature was used by the same local band/family.

Mortuary behavior may vary relative to season of death—in this case, with deep burials in summer and cremations in winter. However, we can also reject this hypothesis because we have clear evidence for summer occupation for the burial and cremation episodes. Other hypotheses relate to culture-specific differences by sex or age-grade (i.e., infants/prenates vs. 3-y-old children). Sex-based hypotheses cannot be evaluated unless aDNA from all three individuals are analyzed (and attempts to extract and amplify mtDNA from the cremated individual have not been successful to date). Evidence for differential treatment of newborns vs. children was reported in Upper Paleolithic Gravettian sites in Western Europe (57). The USR burials may provide similar evidence for treatment of newborns vs. children in early Beringian societies, potentially relating to naming, ensoulment, or other ideological factors.

Infant/child burials with rich grave goods are present in both Paleoindian, e.g., Anzick (52) and European Upper Paleolithic and Mesolithic cultural traditions (58–60). The Sungir (adolescents) and La Madeleine (3 y old) finds have been interpreted as evidence of hereditary social ranking (60); however, ascribed status is unlikely to be present in egalitarian highly mobile foraging cultures (61). Both USR (and Anzick) grave goods consist of functional tools rather than ornaments, suggesting that early North American Paleoindian groups did not exhibit such ranking. Although the similarities in grave good assemblages between Anzick and USR may reflect shared cultural norms, the differential mortuary practices at USR suggest that situational factors (e.g., individuals present/absent during burial rituals or unexpectedness of the deaths) might be significant sources of variation.

USR shares characteristics with other Paleoindian burials, including interment in pits, red ochre, and grave goods (e.g., Anzick, Gordon Creek, and Browns Valley Man; summarized in ref. 3). Anzick, a Clovis child burial, in particular, has close similarities to USR in the form of grave goods (beveled rods, projectile points, and other lithic tools) interpreted as a functional toolkit (49, 62). The presence of the hafted points may reflect the importance of hunting implements in the burial ceremony at USR and within the population as a whole, although we note the predominance of fish and small game at the site. One striking difference, relative to other Paleoindian burials, is the interment at USR within a residential base camp. In this context, USR is more similar to Ushki 1 level 6 in western Beringia where children were buried within residential features (63, 64). USR and Ushki level 6 components also share elements of location (adjacent to large braided rivers), site function (residential base camps), and economy (salmon fishing), and they have many common elements of material culture (46, 64). Although the sample size is small, the conformances may suggest similar mortuary practices and shared ideologies among Diuktai culture/Denali complex populations in northeast Asia and northwest North America at the terminal Pleistocene.

The USR sample size is too small to reconstruct paleodemographic patterns. However, the infant deaths seem consistent with high levels of childhood mortality for highly mobile hunter–gatherers (65–67); these rates can reach 43–45% in recent arctic/subarctic groups (68). The closely timed deaths of two infants and one child could have been of particular detriment to the small USR group concerning long-term demographic effect—if not matched with consequent rapid replacement. Furthermore, the deaths occurred during the summer, a time period when regional resource abundance and diversity was high (69) and nutritional stress should be low, suggesting higher levels of mortality than may be expected given our current understanding of terminal Pleistocene/early Holocene adaptive strategies.

Given the excellent contextual control at USR, we can reconstruct the relationships of the burial with the cremated remains discovered in 2010 (4). Four radiocarbon dates from the bottom of the double burial to the top of the backfilled hearth are statistically contemporaneous—one of many lines of evidence for association between interments. The site was occupied at ∼11,500 cal B.P., where largely domestic activities occurred within a residential feature and base camp. The subsistence economy included a wide array of taxa: salmonid fish, small mammals, and birds, along with large mammals transported from farther away. The two infants died and the pit was dug through the central hearth of the feature 40 cm below the bottom of the (later) hearth and 90 cm below the occupation surface. The infants and grave goods were placed in the bottom of the pit, which was immediately backfilled with sediment containing a small quantity of burned fish and small mammal specimens from earlier consumption events.

If Individuals 1 and 2 were twins, the former survived birth for at least 5 wk, whereas the latter died earlier in utero. If so, the two were not interred together during a single burial event. Individual 1 was clearly a primary interment. Thus, it is possible that Individual 2 represents a secondary burial, placed in the pit after Individual 1 died. This scenario could explain the different positions, i.e., Individual 1 at the edge of the pit and Individual 2 in the center adjacent to the grave goods. The residential feature was occupied and the hearth used at a later time (possibly the same season as the burial or a subsequent year during the same season). The third child (3 y old) subsequently died and was cremated in the residential hearth. Finally, the hearth was backfilled and the immediate area was abandoned. These mortuary practices would seem consistent with the high residential mobility expected of early Beringians (14, 65). Taken collectively, the burials and cremation at USR provide, to our knowledge, the first evidence for more complex mortuary behaviors among terminal Pleistocene Beringians and North American Paleoindians than previously seen, including reuse of a residential feature over a previous burial. Although the sample size is small, the differential mortuary treatment of the three individuals within a single feature is most plausibly related to situational factors or possibly age-grade differences.

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1. Green TJ, et al. (1998) The Buhl Burial: A paleoindian woman from southern Idaho. *Am Antiq* 63:437–456.
2. Owlsey DM, et al. (2010) *Arch Lake Woman: Physical Anthropology and Geoarchaeology* (Texas A&M Univ Press, College Station, TX).
3. Powell JF (2005) *The First Americans: Race, Evolution, and the Origin of Native Americans* (Cambridge Univ Press, Cambridge, UK).
4. Potter BA, et al. (2011) A terminal Pleistocene child cremation and residential structure from eastern Beringia. *Science* 331(6020):1058–1062.
5. Potter BA, Reuther JD, Bowers PM, Gelvin-Reymiller C (2008) Little Delta Dune site: A late-Pleistocene multicomponent site in central Alaska. *Curr Res Pleistocene* 25: 132–135.
6. Reuther JD (2013) Late glacial and early Holocene geoarchaeology and terrestrial paleoecology in the lowlands of the middle Tanana Valley, subarctic Alaska. PhD thesis (University of Arizona, Tucson).
7. Reimer P, et al. (2014) IntCal13 and Marine13 radiocarbon age calibration curves 0-50,000 years cal BP. *Radiocarbon* 55:1869–1887.
8. Stuiver M, Reimer PJ (1993) Extended 14C database and revised CALIB radiocarbon calibration program. *Radiocarbon* 35:215–230.
9. Reuther JD, et al. (2011) *From the Yenisei to the Yukon*, eds Goebel T, Buvit I (Texas A&M Univ Press, College Station, TX), pp 270–288.
10. Reitz EJ, Wing ES (2008) *Zooarchaeology* (Cambridge Univ Press, Cambridge, UK).
11. Buck CL, Barnes BM (1999) Annual cycle of body composition and hibernation in free-living arctic ground squirrels. *J Mammal* 80:430–442.
12. Colburn ML (1986) Suspensory tuberosities for aging and sexing squirrels. *J Wildl Manage* 50:456–459.
13. Guthrie RD (1983) *Dry Creek: Archeology and Paleoecology of a Late Pleistocene Alaskan Hunting Camp*, eds Powers WR, Guthrie RD, Hoffecker JF (Office of History and Archaeology, Anchorage, AK), pp 209-287.
14. Potter BA, Holmes CE, Yesner DR (2013) *Paleoamerican Odyssey*, ed Graf K (Texas A&M Univ Press, College Station, TX), pp 81–103.
15. Yesner DR (1996) *Humans at the End of the Ice Age: The Archaeology of the Pleistocene–Holocene Transition*, eds Straus LG, Eriksen BV, Erlandson JM, Yesner DR (Plenum, New York), pp 255–276.
16. Fazekas I, Kósa F (1978) *Forensic Fetal Osteology* (Akadémiai Kiadó, Budapest).
17. Ubelaker DH (1989) *Human Skeletal Remains: Excavation, Analysis* (Interpretation, Taraxacum, WA), 2nd Ed.
18. Liversidge HM, Molleson T (2004) Variation in crown and root formation and eruption of human deciduous teeth. *Am J Phys Anthropol* 123(2):172–180.
19. AlQahtani SJ (2009) *Atlas of Human Tooth Development and Eruption* (Queen Mary and Westfield College, London).
20. Turner CG II, Nichol CR, Scott GR (1991) *Advances in Dental Anthropology*, eds Kelly MS, Larsen CS (Wiley-Liss, New York), pp 13–32.
21. Sciulli PW (1998) Evolution of the dentition in prehistoric Ohio Valley Native Americans: II. Morphology of the deciduous dentition. *Am J Phys Anthropol* 106(2):189–205.
22. Lewis ME (2007) *The Bioarchaeology of Children: Perspectives from Biological and Forensic Anthropology* (Cambridge Univ Press, Cambridge, UK).
23. Wilson LA, MacLeod N, Humphrey LT (2008) Morphometric criteria for sexing juvenile human skeletons using the ilium. *J Forensic Sci* 53(2):269–278.
24. Wilson LA, Cardoso HF, Humphrey LT (2011) On the reliability of a geometric morphometric approach to sex determination: A blind test of six criteria of the juvenile ilium. *Forensic Sci Int* 206(1-3):35–42.
25. Schutkowski H (1993) Sex determination of infant and juvenile skeletons: I. Morphognostic features. *Am J Phys Anthropol* 90(2):199–205.
26. Hutchinson SO (2009) A radiographic study of permanent tooth calcification and eruption sequences in Alaska Native people. MA thesis (University of Alaska, Anchorage).
27. Sherwood RJ, Meindl RS, Robinson HB, May RL (2000) Fetal age: Methods of estimation and effects of pathology. *Am J Phys Anthropol* 113(3):305–315.
28. Pharoah PO, Adi Y (2000) Consequences of in-utero death in a twin pregnancy. *Lancet* 355(9215):1597–1602.
29. Ong SSC, Zamora J, Khan KS, Kilby MD (2006) Prognosis for the co-twin following single-twin death: A systematic review. *BJOG* 113(9):992–998.
30. Carlson NJ, Towers CV (1989) Multiple gestation complicated by the death of one fetus. *Obstet Gynecol* 73(5 Pt 1):685–689.
31. Prömpeler HJ, et al. (1994) Twin pregnancies with single fetal death. *Acta Obstet Gynecol Scand* 73(3):205–208.
32. Saito K, Ohtsu Y, Amano K, Nishijima M (1999) Perinatal outcome and management of single fetal death in twin pregnancy: A case series and review. *J Perinat Med* 27(6): 473–477.
33. Lyman RL, O'Brien MJ (1998) A mechanical and functional study of bone rods from the Richey Roberts Clovis Cache, Washington, U.S.A. *J Archaeol Sci* 25:887–906.
34. Pitulko VV, et al. (2004) The Yana RHS site: Humans in the Arctic before the last glacial maximum. *Science* 303(5654):52–56.
35. Hare PG, et al. (2004) Ethnographic and archaeological investigations of alpine ice patches in southwest Yukon. *Arctic* 57:260–272.
36. Powers WR, Guthrie RD, Hoffecker JF, eds (1983) *Dry Creek: Archeology and Paleoecology of a Late Pleistocene Alaskan Hunting Camp* (National Park Service, Washington, DC).
37. Workman WB (1978) *Prehistory of the Aishihik-Kluane Area, Southwest Yukon Territory*, National Museum of Man Mercury Series, Archaeological Survey of Canada (Archaeological Survey of Canada, Ottawa), No 74.
38. Hare PG, Hammer TJ, Gotthardt RM (2008) *Projectile Point Sequences in Northwestern North America*, eds Carlson RL, Magne MPR (Simon Fraser Univ Archaeology Press, Burnaby, BC, Canada), pp 321–332.
39. Carlson RL (2008) *Projectile Point Sequences in Northwestern North America*, eds Carlson RL, Magne MPR (Simon Fraser Univ Archaeology Press, Burnaby, BC, Canada), pp 61–78.
40. Kunz ML, Bever M, Adkins C (2003) The Mesa Site: Paleoindians Above the Arctic Circle (US Department of the Interior, Bureau of Land Management, Anchorage, AK), BLM: Alaska Open File Report 86.
41. Rasic J (2011) *From the Yenisei to the Yukon*, eds Goebel T, Buvit I (Texas A & M Univ Press, College Station, TX), pp 128–164.
42. Pearson GA (1999) Early occupations and cultural sequence at Moose Creek: A late Pleistocene site in central Alaska. *Arctic* 52:332–345.
43. Powers WR, Maxwell HE (1986) *Lithic Remains from Panguingue Creek: An Early Holocene Site in the Northern Foothills of the Alaska Range* (Alaska Historical Commission, Anchorage, AK).
44. West FH, Robinson BS, Dixon RG (1996) *American Beginnings: The Prehistory and Palaeoecology of Beringia*, ed West FH (Univ of Chicago Press, Chicago), pp 394–398.
45. West FH, Robinson BS, West CF (1996) *American Beginnings: The Prehistory and Palaeoecology of Beringia*, ed West FH (Univ of Chicago Press, Chicago), pp 386–394.
46. West FH (1996) *American Beginnings: The Prehistory and Palaeoecology of Beringia*, ed West FH (Univ of Chicago Press, Chicago), pp 537–559.
47. Clark DW, Gotthardt RM (1999) *Microblade Complexes and traditions in the interior Northwest as Seen from the Kelly Creek Site. West-Central Yukon* (Yukon Heritage Branch, Whitehorse, Canada) Occasional Papers in Archaeology No 6.
48. Haigh JC, Hudson RJ (1993) *Farming Wapiti and Red Deer* (Mosby Year Book, St. Louis).
49. Lahren L, Bonnichsen R (1974) Bone foreshafts from a clovis burial in southwestern montana. *Science* 186(4159):147–150.
50. Hemmings CA (2004) The organic Clovis: a single continent-wide cultural adaptation. PhD thesis (University of Florida, Gainesville).
51. Frison GC, Craig C (1982) *The Agate Basin Site: A Record of the Paleoindian Occupation of the Northwestern High Plains*, eds Frison GC, Stanford DJ (Academic, New York), pp 161–173.
52. Wilke PJ, Flenniken JJ, Ozbun TL (1991) *J Calif Gt Basin Anthropol* 13:242–272.
53. Gramly RM (1993) *The Richey Clovis Cache* (Persimmon, Buffalo, NY).
54. Pearson GA (1999) North American Paleoindian bi-beveled bone and ivory rods: A new interpretation. *N. Am.Archaeol.* 20:81–103.
55. McKennan RA (1959) *The Upper Tanana Indians* (Yale Univ Press, New Haven, CT) Yale Univ Publications in Anthropology 55.
56. Binford LR (2001) *Constructing Frames of Reference* (Univ of California Press, Berkeley, CA).
57. Zilhão J (2005) Burial evidence for social differentiation of age classes in the Early Upper Paleolithic. *Etud Res Archéol Univ Liège* 111:231–241.
58. Formicola V, Buzhilova AP (2004) Double child burial from Sunghir (Russia): Pathology and inferences for upper paleolithic funerary practices. *Am J Phys Anthropol* 124(3): 189–198.
59. Einwögerer T, et al. (2006) Upper Palaeolithic infant burials. *Nature* 444(7117):285.
60. Vanhaeren M, d'Errico F (2003) *Mesolithic on the Move*, eds Larsson L, Kindgren H, Knutsson K, Leoffler D, Akerlund A (Oxbow Monographs, Oxford), pp 495–505.
61. Kelly RL (2013) *The Lifeways of Hunter-Gatherers: The Foraging Spectrum* (Cambridge Univ Press, Cambridge, UK).
62. Rasmussen M, et al. (2014) The genome of a Late Pleistocene human from a Clovis burial site in western Montana. *Nature* 506(7487):225–229.
63. Dikov NN (1979) *Drevnie Kul'tury Severo-Vostochnoi Azii* (Nauka, Moscow) trans National Park Service (2004) [Early Cultures of Northeastern Asia] (National Park Service, Anchorage, AK). Russian.
64. Goebel TE, Slobodin SB (1999) *Ice Age People of North America: Environments, Origins, and Adaptations*, eds Bonnichsen R, Turnmire KL (Oregon State Univ Press, Corvallis, OR), pp 104–155.
65. Kelly RL, Todd LC (1988) Coming into the country: Early Paleoindian hunting and mobility. *Am Antiq* 53:231–244.
66. Walker R, et al. (2006) Growth rates and life histories in twenty-two small-scale societies. *Am J Hum Biol* 18(3):295–311.
67. Waguespack N (2007) Why we're still arguing about the Pleistocene occupation of the Americas. *Evol Anthropol* 16:63–74.
68. Waguespack N (2002) Colonization of the Americas: Disease ecology and the Paleoindian lifestyle. *Hum Ecol* 30:227–243.
69. Yesner DR (2007) *Foragers of the Terminal Pleistocene in North America*, eds Walker RB, Driskell BN (Univ of Nebraska Press, Lincoln, NE), pp 15–31.