ARCHAEOLOGY OF THE UPPERMOST TANANA BASIN: RESULTS OF A SURVEY OF THE NABESNA AND CHISANA RIVERS, EAST-CENTRAL ALASKA

Joshua J. Lynch
Department of Anthropology, Texas A&M University, 4352-TAMU, College Station, TX 77843; and Center for the Environmental Management of Military Lands, Colorado State University and U.S. Army, Directorate of Public Works, ATTN: IMFW-PWE (Lynch), 1060 Gaffney Road, #4500, Ft. Wainwright, AK 99703; jjlynch@tamu.edu

Ted Goebel
Center for the Study of the First Americans, Department of Anthropology, Texas A&M University, 4352-TAMU, College Station, TX 77843; goebel@tamu.edu

Kelly E. Graf
Center for the Study of the First Americans, Department of Anthropology, Texas A&M University, 4352-TAMU, College Station, TX 77843; kgraf@tamu.edu

Jeffrey T. Rasic
National Park Service, Gates of the Arctic National Park and Preserve, Fairbanks, AK 99709; Jeff_Rasic@nps.gov

Stephen C. Kuehn
Department of Physical Science, Concord University, Athens, WV 24712; sckuehn@concord.edu

ABSTRACT

The middle Tanana River basin has proven to be an important area for investigating the late Pleistocene and Holocene occupations of interior Alaska; however, less research has been reported for the uppermost part of the valley. In 2011, we conducted a reconnaissance cultural-resource survey of landforms along two upper Tanana River tributaries, the Nabesna and Chisana rivers, and nearby uplands surrounding Jatahmund Lake to evaluate the archaeological potential of these areas. Here we report the discovery of eight archaeological sites potentially spanning the last ~7000 years of prehistory. We consider these sites in the context of Holocene human occupation of interior Alaska, especially (1) cultural chronology and (2) the effects of tephra falls on human populations during the middle and late Holocene. Our results also demonstrate the potential for finding late Pleistocene sites, which could eventually provide a record complementary to the middle Tanana Valley.

INTRODUCTION

Archaeological research in the middle Tanana River valley has focused on multicomponent archaeological sites in the Big Delta region, yielding a long sequence of cultural occupations dating from the late Pleistocene, ~14,000 calendar years ago (cal BP), through the Holocene (Cook 1996; Crass et al. 2011; Hamilton and Goebel 1999; Holmes 1996, 2011; Krasinski 2005; Krasinski and Yesner 2008; Pèwè and Reger 1983; Potter et al. 2013; Yesner 1994, 1996, 2001; Yesner et al. 1992; Yesner et al. 2000). Large parts of the Tanana basin and its tributaries, however, remain unsurveyed, but nonetheless they still hold much potential for developing a basin-wide understanding of prehistory and the evolution of subarctic human adaptations.

The uppermost Tanana Valley in the vicinities of Tok and Northway is one such area where archaeological potential has not yet been sufficiently tapped. Forty years ago, research at Dixthada village suggested a rich late prehistoric record for the region (Shinkwin 1977, 1979), while the 1980s Backscatter project, recent cultural resource management survey projects along the Tanana corridor, and excavations at the Little John site across the border in the Yukon (Canada) have together provided clear evidence that the uppermost Tanana region likely was occupied by prehistoric foragers since the beginning of the Holocene and perhaps even the latest Pleistocene (e.g., Easton 2007; Easton et al. 2009; Easton et al. 2011; Gerlach et al. 1989; Potter et al. 2007; Sheppard et al. 1991). Ethnohistorically, the upper Tanana was an important travel corridor connecting peoples of the Interior and southern Alaska's Copper River region (Clark 1981). Moreover, the Wiki Peak obsidian source, located in the Nutzotin Mountains south of the Tok/Northway area, was an important tool-stone procurement area for prehistoric foragers, starting as early as 13,000 cal BP (Goebel et al. 2008; Patterson 2008; Reuther et al. 2011).

To build on these earlier efforts and to better establish the potential for early-period archaeology in the upper Tanana region, in 2011 Texas A&M University archaeologists conducted a reconnaissance inventory designed to expand survey coverage beyond previously researched and easily accessed areas close to the Alaska Highway and associated utility corridor. The team explored the backcountry of the Nabesna and Chisana rivers with three objectives in mind: (1) to evaluate the potential of specific areas for preservation of early-period archaeological sites in buried and datable contexts; (2) to identify sites within the survey area containing archaeological deposits potentially informing on prehistoric chronology, technology, subsistence, and settlement patterns; and (3) to evaluate the significance of the archaeological resources of the uppermost Tanana River basin for investigating early human adaptation to climate and environmental change, from the terminal Pleistocene through the Holocene.

Here we present the results of this field project. The paper first describes the Upper Tanana Tributaries project area and the land parcels selected for survey. It then details the eight archaeological sites discovered during the survey, with descriptions of each site's geomorphology, stratigraphy, dating, and artifact assemblages. Last, the paper addresses the project's success in meeting its stated goals and provides some direction for future research.

UPPER TANANA TRIBUTARIES PROJECT AREA

The 2011 Upper Tanana Tributaries project area is located in east-central Alaska between the city of Tok and the Alaska-Yukon border. In this region, the Tanana basin is an extensive lowland drainage area associated with the Tanana River and two major tributaries, the Nabesna and Chisana rivers (Fig. 1), both of which drain the north slope of the Wrangell Mountains and pass through the Mentasta and Nutzotin mountains, respectively. The project area includes lands managed by the U.S. Fish and Wildlife Service (Tetlin National Wildlife Refuge) and the State of Alaska and includes the northern foothills of the Mentasta Mountains and the Tetlin-Northway flats, south of the Alaska Highway. This land falls within the traditional territories of the Northway and Tetlin Upper Tanana *Dineh*.

The 2011 field survey focused on three subareas: Jatahmund Lake, the middle Nabesna River, and the lower Chisana River, including lower Gardiner Creek (Figs. 1–3). We selected these areas in an attempt to survey a variety of landforms and to discover archaeological sites representing different ages and activities.

The Jatahmund Lake parcel is situated in the southern Tetlin National Wildlife Refuge, between the Nabesna and Chisana rivers, in the foothills ~30 km north and east of the Mentasta Range. Our survey focused on the northern side of the lake (Fig. 2A, 2C) and led to the discovery of three new sites. Excavated deposits were stratified yet relatively shallow, except at one locality, where silts reached more than 1 m thick.

The Nabesna River parcel represents a river-corridor survey accessed by floating the Nabesna River from near the northern boundary of Wrangell–St. Elias National Park and Preserve to the mouth of the Nabesna River near Northway (Fig. 2A). A series of landforms was tested within the Tetlin National Wildlife Refuge, concentrating on terrace surfaces immediately above the modern floodplain of the river. Two archaeological sites were identified (Fig. 2B, 2D).

Our survey of the lower Chisana River was conducted in two parts. Along the Chisana River, we focused on the south-facing bedrock bluffs of Tenmile Hill, accessing the area by motorboat, while along Gardiner Creek we surveyed on foot downstream from the Alaska Highway along the edge of an incised sand sheet (Fig. 3). Both survey areas contain south-facing bluffs that offer extensive

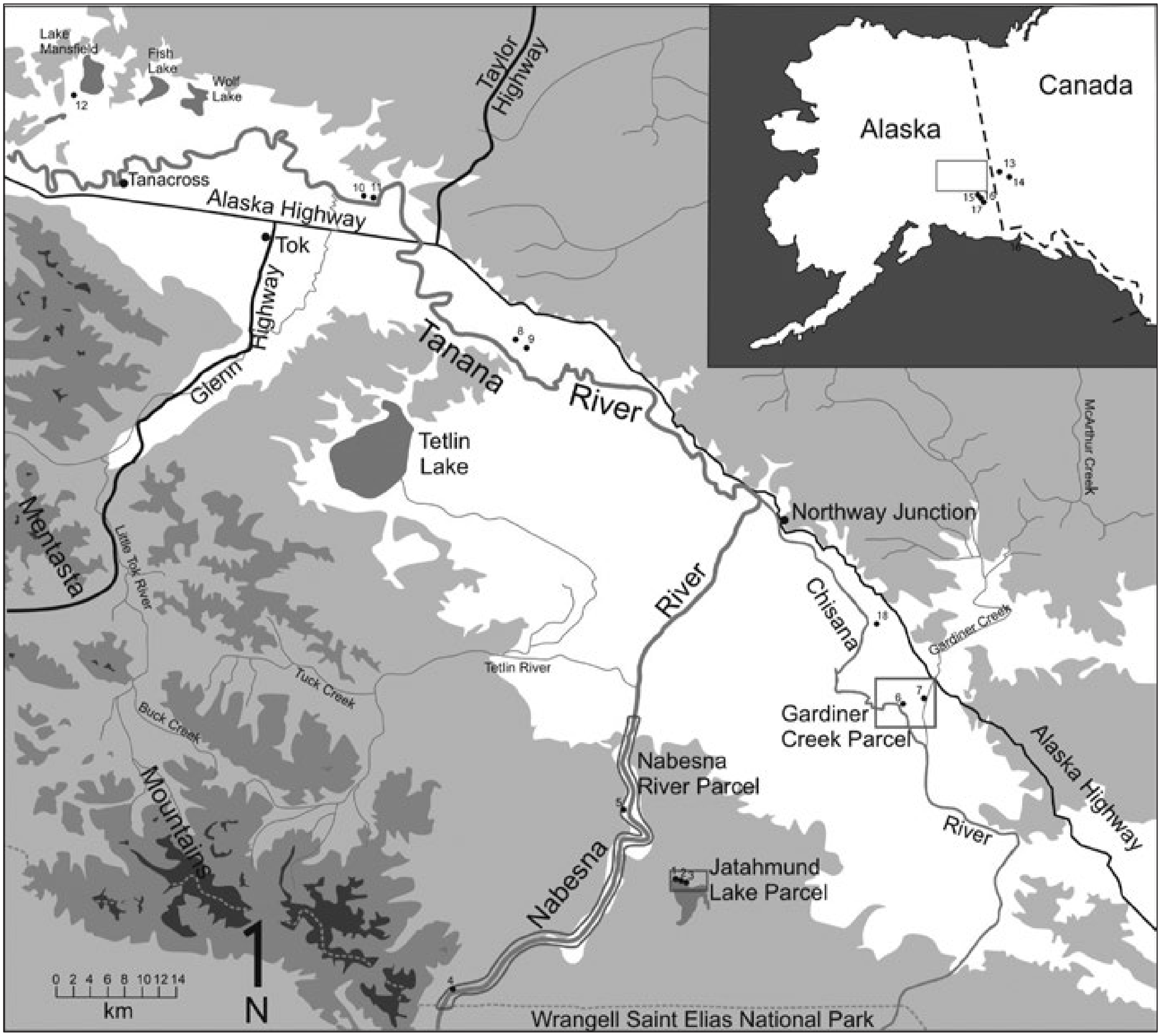

Figure 1. Survey areas in the upper Tanana region and sites mentioned in the text: (1) Jatahmund Lake-2, (2) Jatahmund Lake-1, (3) Jatahmund Lake-3, (4) Nabesna River-1, (5) Nabesna River-2, (6) Tenmile Hill-1, (7) Gardiner Creek-1 and Gardiner Creek-2, (8) TNX- 078, (9) TNX-079, (10) Tok River Overlook, (11) Tok Terrace Northeast, (12) Dixthada, (13) Little John, (14) KaVn-2, (15) XMC-286, (16) XMC-377, (17) XMC-038, and (18) Deadman Lake.

views of the surrounding landscape. Three sites were identified along the Chisana River and Gardiner Creek.

These selected areas allowed us to explore the potential travel corridors of the lowland lower Chisana River and the more upland middle Nabesna River, as well as the shores of Jatahmund Lake, which we expected to serve as an example of a foothills lacustrine setting for human land use.

FIELD AND LABORATORY METHODS

Archaeological fieldwork occurred during approximately four weeks during June and July 2011 and consisted of reconnaissance archaeological survey and test excavations at identified sites. Archaeological survey began with the identification of high-potential locations (recognized on topographic maps, aerial photographs, and

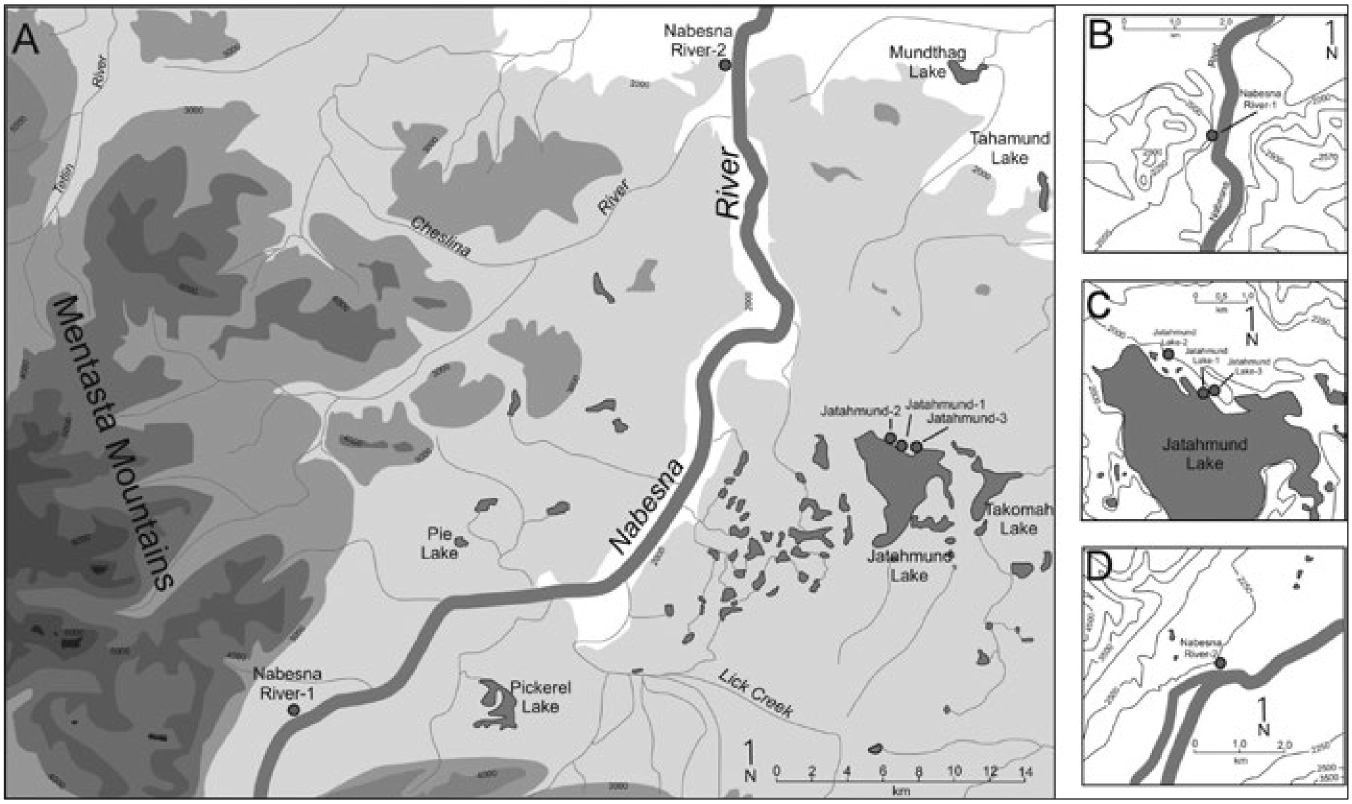

Figure 2. Regional map of the Nabesna River sites and Jatahmund Lake sites.

through aerial survey), allowing the team to isolate pronounced landforms and focus survey efforts. When investigating landforms or ridgelines, pedestrian survey was conducted over their surfaces to locate formal tools, features, and debitage concentrations exposed in eroded contexts.

Subsurface investigations were conducted using 1x1 m test units following natural strata (and within them, arbitrary 5 cm levels) until bedrock was reached or excavations struck permafrost. Excavations, initiated with shovels and continued with trowels if cultural materials were encountered, allowed for the identification of buried sites as well as the collection of floral and faunal remains, charcoal samples for radiocarbon dating, and lithic materials for analysis. Precise locations of all artifacts found in situ were recorded. Excavated sediments were passed through one-eighth-inch mesh, and all archaeological materials found in the screen were collected and subjected to analysis. To establish chronologies for cultural components and sediments, samples for AMS radiocarbon dating were collected from all possible localities during survey and testing. In addition, we collected tephra samples from several of the discovered sites. Samples taken from archaeological components included charcoal, macrobotanical remains, and faunal remains associated with artifacts. Recovered materials were transported to Texas A&M University for analysis; the materials will be permanently curated at the University Alaska Museum of the North.

Locations of surface finds and test excavations were recorded using a Garmin recreation-grade global positioning system device. Additionally, Alaska Heritage Resource Survey forms were completed for each confirmed archaeological site.

Debitage recovered during the test excavations was analyzed following a set of metric and nonmetric variables established in Andrefsky (2005). Variables scored for all debitage included an assessment of debitage class/type, raw material type, and color (using the Munsell Geological Rock Color Chart). For complete flakes and proximal flake fragments, additional variables were recorded, including condition, debitage category, and presence of cortex. Tools were classified as flake tools or bifacial tools, and then assessed using metric attributes and measures of retouch (form, face, and invasiveness). Metric data taken on bifaces included length, width, thickness, and weight. Tool-type assignments followed basic designations for central Alaska (e.g., Goebel et al. 1991). No fire-cracked rock was recovered from the sites investigated.

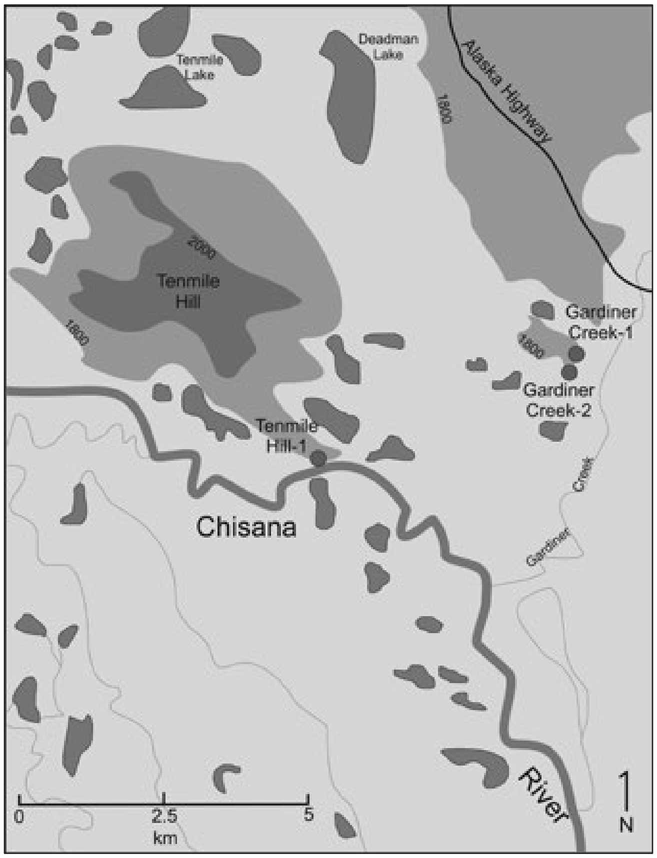

Figure 3. Regional map of the Chisana River survey sites.

Geochemical characterization of obsidian artifacts was carried out using the Bruker Tracer III-SD at the University of Alaska Museum, and results were compared to known and unknown source data in an attempt to define provenance, following, for example, Reuther et al. (2011).

A sample of tephra from the Gardiner Creek-1 site was geochemically analyzed to identify its volcanic source, following the procedures presented in Kuehn (2016). In the laboratory at Concord University, it was cleaned using dilute HCl and Alconox solutions in an ultrasonic bath, and then wet sieved into > 250, 125–250, 75–125, 38–75, and < 38 micron size fractions. Pumice and minerals in the two coarsest fractions were separated by panning in water. Both pumice and mineral fractions for the > 250 and 125–250 micron size fractions were mounted in acrylic discs using epoxy, polished in stages ending at a final grit of 0.25 micron diamond, and carbon coated. Geochemical analyses were performed on an ARL-SEMQ electron microprobe equipped with six wavelength-dispersive spectrometers and one large-area energy-dispersive spectrometer using a 14 kV accelerating voltage and 10 nA beam current.

Samples of organic materials (including charcoal and uncharred wood) were submitted to Beta Analytic, Inc., for standard AMS radiocarbon analysis (see Table 1).

FIELD RESULTS

Eight buried archaeological sites were discovered and recorded during the 2011 Tanana tributaries survey; five have yielded radiocarbon dates. Individual localities are discussed below by survey parcel, with maps, stratigraphic profiles, associated radiocarbon dates, and basic information on artifacts and faunal remains.

JATAHMUND LAKE

Jatahmund Lake is in the southern Tetlin National Wildlife Refuge, between the Nabesna and Chisana rivers, northeast of the Mentasta Range (Fig. 1). Our survey focused on the northern side of the lake, and we conducted subsurface testing at four locations and identified

Table 1. Radiocarbon (AMS) dates from Upper Tanana sites tested in 2011.

Site	Lab Number	^{14}C Age (1σ)	Calendar Age[1] (2σ)	Sample Material[2]	Notes
Jatahmund Lake-1	Beta-315413	1790 ± 30	1620–1817	Charcoal	Cultural component 2, above tephra
Jatahmund Lake-2	Beta-315418	1770 ± 30	1606–1811	Charcoal	Cultural component 1, below tephra
Nabesna River-1	Beta-315416	4450 ± 30	4893–5235	Charcoal	Cultural component 1
Nabesna River-1	Beta-315417	10,770 ± 40	12,652–12,742	Uncharred wood	Basal excavatable stratum, not archaeological
Tenmile Hill-1	Beta-315415	7040 ± 40	7792–7953	Charcoal	Below cultural component
Gardiner Creek-1	Beta-315412	2360 ± 30	2332–2483	Charcoal	Cultural component 1, below tephra
Gardiner Creek-1	Beta-315414	9990 ± 40	11,259–11,611	Charcoal	Cultural component 1, below tephra

1. Radiocarbon dates were calibrated using CALIB 7.1.0, following Stuiver and Reimer (1993).

2. All charcoal samples represent dispersed pieces (i.e., not from recognizable archaeological features).

subsurface archaeological material at three of them (Fig. 2C). At all three sites, excavated deposits were relatively shallow, reaching no deeper than roughly 1–1.5 m (Fig. 4). Two of these sites, Jatahmund Lake-1 and Jatahmund Lake-2, have yielded radiocarbon dates (Table 1).

Jatahmund Lake-1 (JL-1, NAB-0483) is located along a narrow ridgeline immediately north of the northern shore of the lake (Fig. 2C). The ridgeline tested is visible from the lakeshore, and it is located northeast of the opening of a large inlet. Four 1 m^2 test units were excavated. Sediments at JL-1 extended to approximately 40 cm below the modern surface and contained archaeological components above and below a clearly defined layer of volcanic ash. Under the modern O horizon at the top of the stratigraphic profile (Fig. 4), a layer of silt occurs, which contains strong A and B horizons. This is underlain by a tephra (reaching 20–30 cm thick), under which is another layer of silt containing soliflucted Ab and Bb horizons. This lower silt deposit rests directly on top of gravels, which we interpret to represent till of the Wisconsin-aged Jatahmund Lake glaciation (Fernald 1965a). A charcoal sample from the modern B horizon immediately above the tephra yielded an AMS radiocarbon age of 1790 ± 30 ^{14}C BP (Beta-315413).

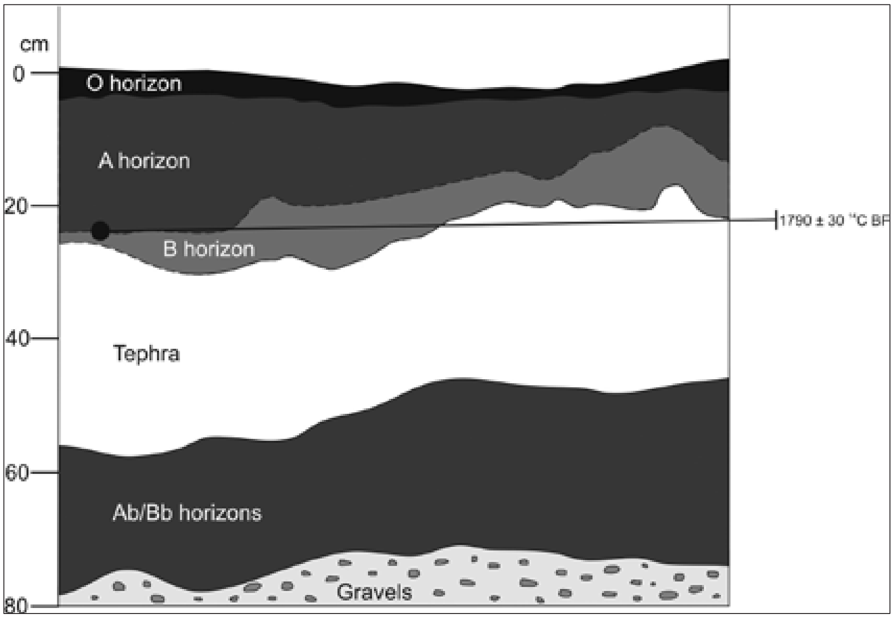

Figure 4. Stratigraphic profile of the south wall of test unit 1 at the Jatahmund Lake-1 site.

Archaeological materials recovered from Jatahmund Lake-1 occurred above and below the tephra layer and include lithic and faunal

Table 2. Jatahmund Lake-1 and Jatahmund Lake-2 debitage assemblages.

Debitage Category	Raw Material Category				
	CCS[1]	Obsidian	FGV[2]	Quartzite	Total
Jatahmund Lake-1 Component 1					
Core-reduction flake	1			10	11
Biface-thinning flake		2			2
Medial microblade	1				1
Flake shatter			1	10	11
Spilt cobble				2	2
Angular shatter				1	1
Total	2	2	1	23	28
Jatahmund Lake-1 Component 2					
Core-reduction flake			4		4
Total			4		4
Jatahmund Lake-1 Component 1					
Core-reduction flake			1		1
Cortical spall fragment			1		1
Flake shatter	2		1	4	7
Angular shatter			1		1
Total	2		4	4	10

1. Cryptocrystalline silicate.
2. Fine-grained volcanic.

materials (Table 2). In Component 2, situated above the tephra, four small flakes on fine-grained volcanic rock (basalt) were recovered in association with numerous highly degraded and fragmented bones. From Component 1, underneath the tephra, we recovered 28 debitage pieces, including 11 core-reduction flakes, two biface-thinning flakes, two split-cobble fragments, and one medial fragment of a microblade. These materials are primarily made on quartzite, but the biface-thinning flakes are on obsidian and the microblade fragment on chert (cryptocrystalline silicate, CCS). Two large rocks assumed to be manuports were also found. Material was collected that was tentatively identified in the field as fire-cracked rock (FCR), but further analysis in the laboratory rejected this identification. Ultimately, no FCR was recovered from any of the Jatahmund Lake sites. Faunal remains are fragmentary, calcined, and unidentifiable. Nearly all were from under the tephra (Component 1); however, a few came from within the tephra (near its base) as well as above it in Component 2.

Jatahmund Lake-2 (JL-2, NAB-0484) is located in a similar context as Jatahmund Lake-1, on a ridge crest but farther from the lake margin. Forest cover makes the site visible only from some distance on the lake. Nonetheless, the tall, south-facing, and prominent ridgeline is observable on topographic maps and aerial photos. Stratigraphy at Jatahmund Lake-2 was essentially the same as at JL-1, but artifacts were only found below the tephra. A charcoal sample taken from the silt deposit below the tephra (from where artifacts were found) produced an AMS radiocarbon age of 1770 ± 30 ^{14}C BP (Beta-315418). This date, along with the upper-limiting date from JL-1 (1790 ± 30 ^{14}C BP), brackets the age of the tephra, suggesting it represents the north lobe of the White River Ash (e.g., Lerbekmo 2008; Lerbekmo et al. 1975).

The artifact assemblage at JL-2 was composed of one core-reduction flake and one cortical-spall fragment produced on fine-grained volcanic rock (FGV), seven pieces of flake shatter (four on quartzite, two on CCS, and one on FGV), and one piece of angular shatter on FGV. Two small pieces of calcined bone were also recovered.

Jatahmund Lake-3 (JL-3, NAB-0485), also located on the northern shore of the lake, is situated on a south-facing knob with a view of the modern lakeshore about 350 m southeast of JL-1. The site's stratigraphic profile (~40 cm thick) is similar to the other Jatahmund sites, except that the Ab horizon underlying the ubiquitous tephra lies directly on moraine gravels. Three test pits were excavated, and one of these yielded a single lithic artifact (a lone flake fragment on FGV) from below the tephra, in the lower silt.

The three Jatahmund Lake sites yielded small assemblages of debitage that were largely produced on poor-quality quartzite and FGV. Forty-four debitage pieces were recovered during the excavations at these three sites. Recognizable debitage categories are mostly represented by core-reduction flakes; however, biface-thinning flakes and a single microblade fragment also occur. These sites, although not deeply buried, are clearly stratified and have yielded evidence of human occupation pre- and postdating deposition of the tephra we presume to be the White River Ash. However, deposits predating deposition of the tephra are shallow and unstratified.

NABESNA RIVER

We floated the Nabesna River from near the northern boundary of Wrangell–St. Elias National Park and Preserve to its mouth, surveying high-probability landforms in Tetlin National Wildlife Refuge. Seven landforms were investigated. No surface indications of prehistoric human activity were identified, but subsurface testing led to the discovery of two archaeological sites. Nabesna River-1 is situated on a high bluff overlooking the Nabesna River, near the exit point of the river from the Mentasta Mountains, and Nabesna River-2 is situated on a south-facing terrace ~50 km downriver from the front of the mountain range. Both sites are visible from the river and were accessed on foot from the riverbank (Fig. 2A, 2B, 2D).

Nabesna River-1 (NAB-0481) is located on a south-facing bluff 40 m above and along the west side of the river, ~5 km north of the Wrangell–St. Elias National Park and Preserve boundary (Fig. 2A). The bluff is capped by roughly 4 m of eolian deposits. Two adjacent 1 x 1 m units were excavated, with one unit reaching 435 cm below the modern surface.

Nabesna River-1 stratigraphy is shown in Figure 5. From the top downward, it consists of a thin O horizon overlying distinct A and B horizons in the top 50 cm of the profile. These are underlain by a series of loess deposits reaching 4 m deep and interdigitated with buried A horizons and occasional buried B horizons. A volcanic ash also occurs ~90 cm below the surface, presumably the White River Ash. In the Ab horizons, botanical macrofossils were well preserved, and at a depth of 215–225 cm below surface, an archaeological component was found

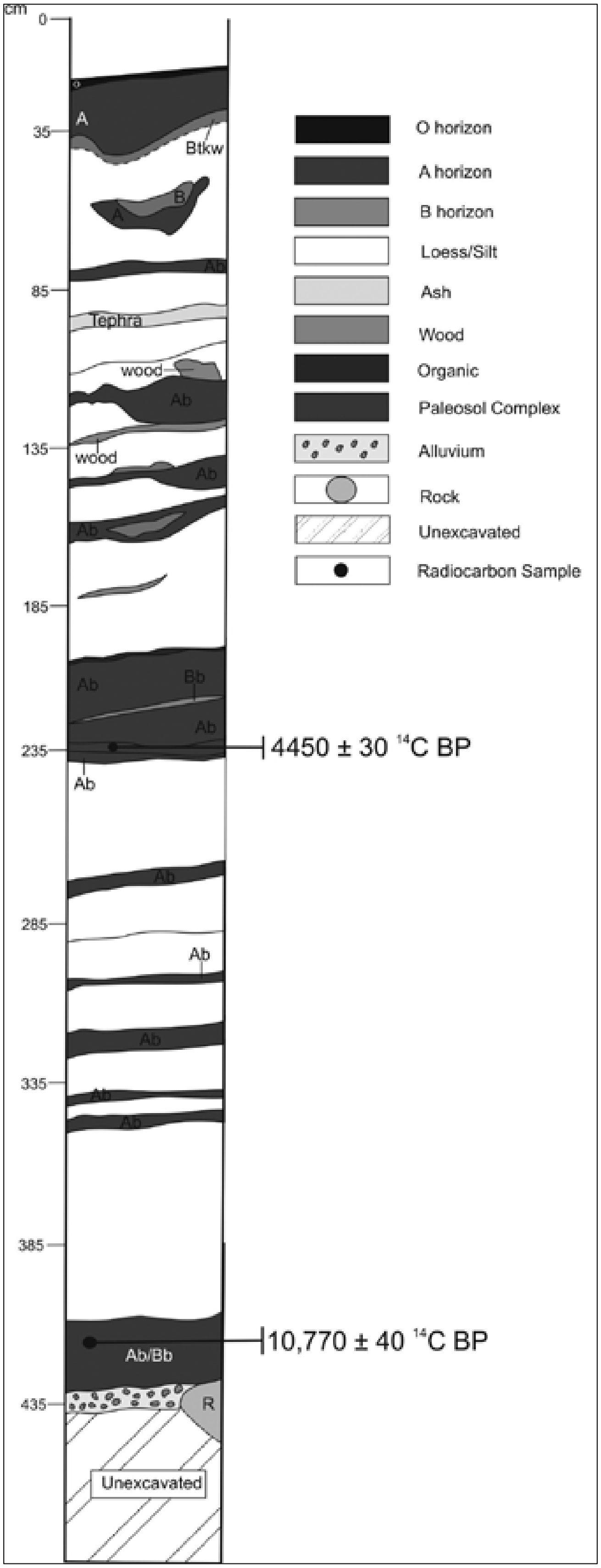

Figure 5. Stratigraphic profile of the north wall of test unit 1 at the Nabesna River-1 site.

associated with one of them. A charcoal sample taken from the site's cultural component yielded a radiocarbon date of 4450 ± 30 ^{14}C BP (Beta-315416). At 405–425 cm below surface, the lowest buried A horizon was found resting on top of alluvial cobbles. A sample of uncharred wood from this basal Ab horizon yielded a date of 10,770 ± 40 ^{14}C BP (Beta-315417). Although no artifacts were found in this basal deposit, the remarkable preservation of plant macrofossils should provide important paleoecological information. Continued study of the site may eventually yield cultural remains, given that the excavated area at this great depth was quite small compared to the overall size of the site's terrace surface.

Seven core-reduction flakes and flake fragments were recovered from the site's cultural component. These were produced on obsidian (4), CCS (2), and quartzite (1). While this artifact assemblage is relatively small, the location of the site, unusually deep Holocene deposits, and excellent preservation of macrobotanical remains suggest high potential for future paleoecological and archaeological investigations.

Nabesna River-2 (NAB-0482) is situated on a finger ridge projecting out to the river (Fig. 2D). One of two test squares yielded archaeological materials near the surface.

The stratigraphic profile at Nabesna River-2 is relatively shallow (~50 cm thick) and simple (Fig. 6). An

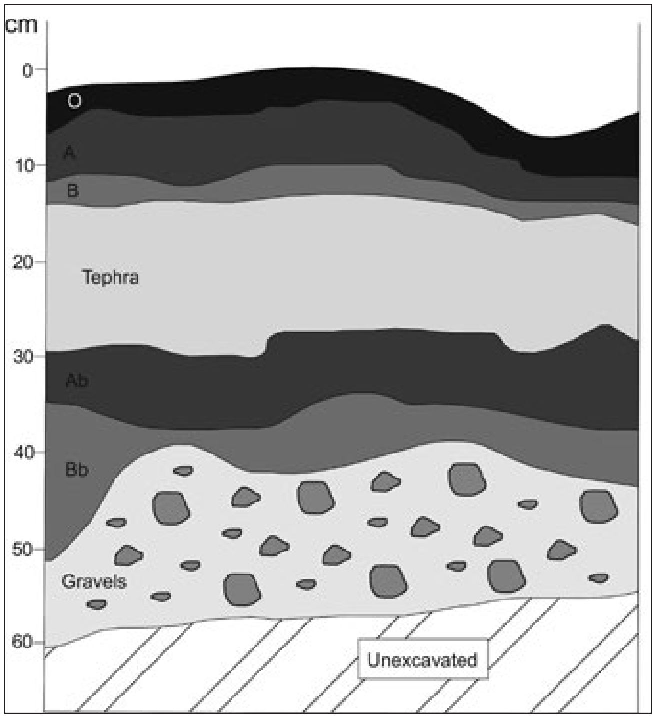

Figure 6. Stratigraphic profile of the north wall of test unit 2 at the Nabesna River-2 site.

O horizon of ~5 cm overlies a silt deposit with developed A and B horizons; together, these vary in thickness from ~4 cm to 10–12 cm. This is underlain by a volcanic ash horizon presumed to represent the White River Ash. The tephra reaches ~14 cm thick and caps a buried pair of Ab and Bb horizons (~11–20 cm thick), which in turn rests directly on weathered alluvium of rounded cobbles and pebbles, potentially drift of the Illinoian-aged Black Hills glaciation (Fernald 1965a).

Archaeological materials were recovered from the buried A horizon below the tephra. If we can safely assume that this tephra is attributable to the White River Ash, it indicates an age of greater than about 1700 cal BP for the cultural component. The Nabesna River-2 assemblage is comprised of three core-reduction flakes, four flake fragments, and one biface-thinning flake, all produced on FGV.

CHISANA RIVER STUDY AREA

Within the Chisana River study area, the survey focused on Tenmile Hill, located ~24 km southeast of Northway Junction and along lower Gardiner Creek, south of the Alaska Highway. The Tenmile Hill survey covered a gently east-sloping bedrock ridge with a steep south-facing bluff overlooking the Chisana River. Two areas were singled out for testing; at one of these, Tenmile Hill-1, archaeological materials were recovered. Survey efforts along lower Gardiner Creek led to the discovery of two new sites. Gardiner Creek-1 is situated at the southeastern tip of a flat terrace mantled by a thick sand sheet, while Gardiner Creek-2 is located on a lower terrace surface about 200 m south-southwest of Gardiner Creek-1 (Fig. 3).

Tenmile Hill

The Tenmile Hill-1 (NAB-0480) site is located on a steep south-facing bluff overlooking the Chisana River, ~4 km downriver of its confluence with Gardiner Creek. This bluff is part of a long east-west-trending bedrock ridge. Two test pits were excavated on the ridgetop overlooking the Chisana River. Test unit 1 was located on a flat surface of the hill's easternmost shoulder, immediately overlooking the Chisana River, and test unit 2 was located about 300 m downriver (west), higher on the ridge, overlooking an open, somewhat gentler bluff. Both excavations were limited by the presence of permafrost, and only test unit 2 yielded artifacts.

Tenmile Hill-1 is characterized by at least 100 cm of fine-grained deposits presumably overlying bedrock (Fig. 7). The top of the exposed profile is an O horizon, underlain by an A horizon of the modern soil (~10 cm thick). The latter rests on a layer of tephra (presumed to be the White River Ash) ~5–12 cm thick, which in turn rests on a silt deposit with buried A and B horizons rich in organics (including charcoal) and ranging up to ~20 cm thick. The silt continues below the paleosol for about 15 cm, and then underlying it is a layer of sand containing angular fragments of weathered quartz, probably natural fragments of an underlying regolith. Before the bottom of this sand deposit could be reached, however, permafrost was encountered approximately 95 cm below the surface, preventing further excavation.

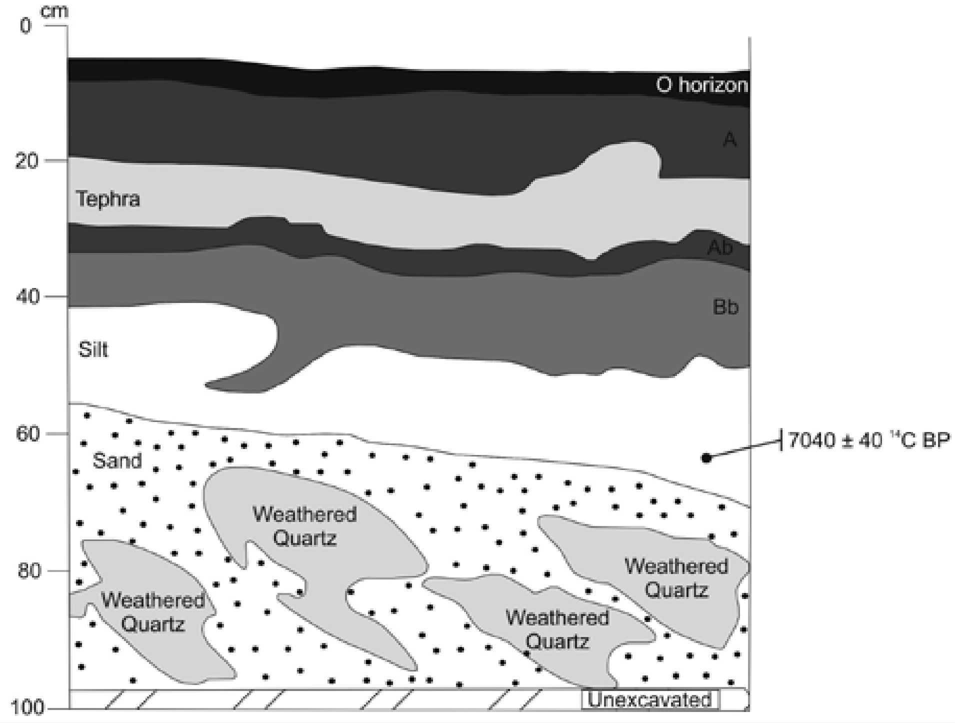

Figure 7. Stratigraphic profile of the north wall of test unit 2 at the Tenmile Hill-1 site.

A sample of wood charcoal was recovered from the unweathered silt near its contact with the lower-lying sand, and it yielded an AMS radiocarbon age of 7040 ± 40 ^{14}C BP (Beta-315415).

A small assemblage of flakes and tools was recovered from below the buried A/B horizon, just above the radiocarbon-dated sample of charcoal. This assemblage included four debitage pieces on FGV (a core-reduction flake, biface-thinning flake, piece of angular shatter, and flake fragment) and a core-reduction flake produced on CCS. Tools included one large end/side scraper produced on CCS, a small uniface fragment on obsidian, and a small nondiagnostic bifacial fragment on obsidian (Fig. 8). Both obsidian tools were made on obsidian from the nearby Wiki Peak source.

Although the recovered artifact sample is small, the underlying radiocarbon age and overlying tephra indicate that the cultural component at Tenmile Hill-1 is middle Holocene in age, ~7000–1800 cal BP, probably closer to 7000 cal BP given its stratigraphic position just above the radiocarbon date.

Gardiner Creek

The survey of Gardiner Creek began at the creek's crossing under the Alaska Highway. About 2 km south of the highway, we discovered two sites. Gardiner Creek-1 (NAB-0478) is located on the southeasternmost tip of the creek's high left (western) terrace at approximately 1,800 m in elevation, overlooking the Chisana/Tetlin wetlands. Gardiner Creek-2 (NAB-0479) is located on a

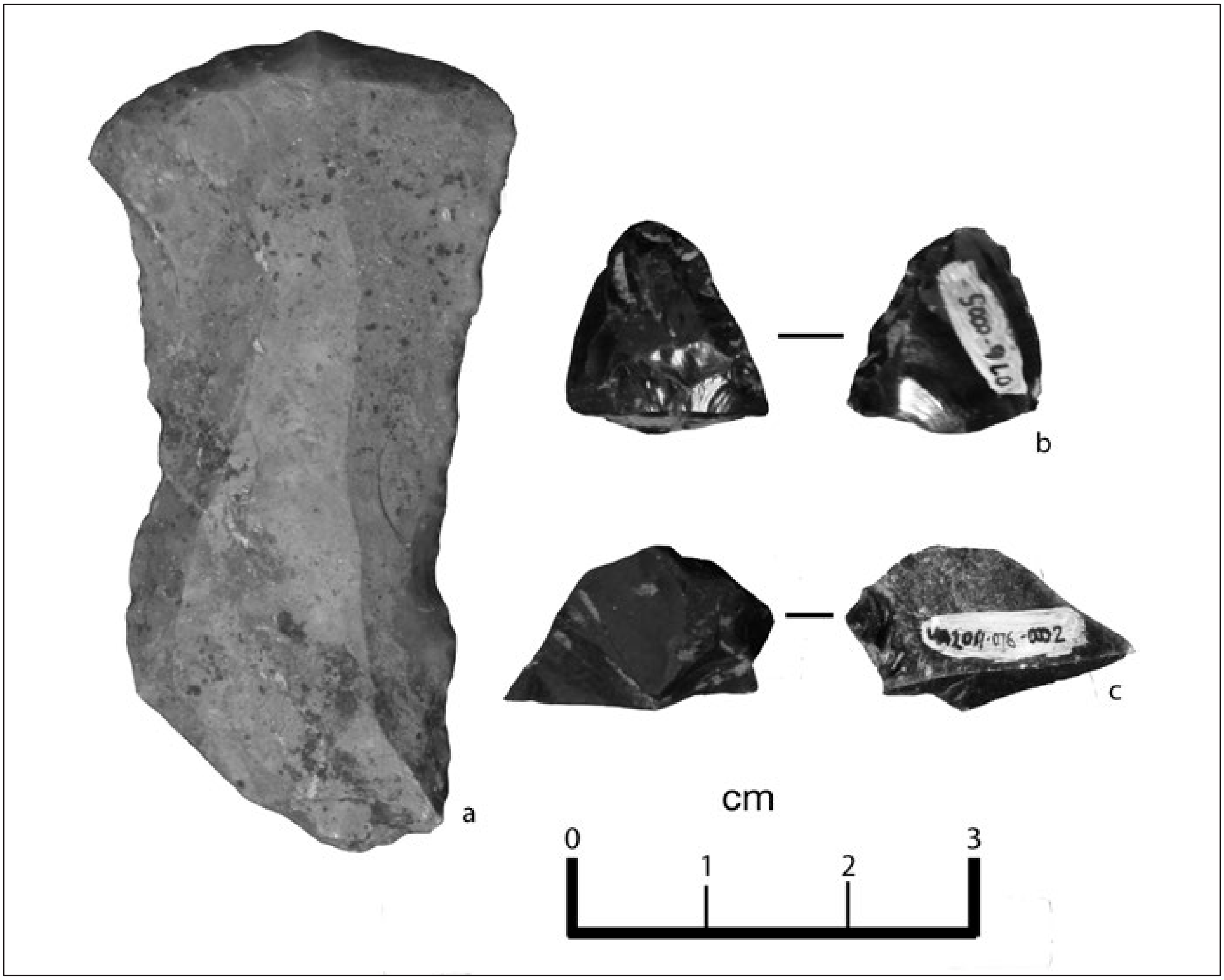

Figure 8. Tenmile Hill-1 artifacts: (a) end/side scraper; (b) small nondiagnostic bifacial fragment; (c) bifacially worked fragment.

lower terrace tip ~443 m southeast of Gardiner Creek-1 and ~20 m lower in elevation (Fig. 3).

Four 1 x 1 m test pits were excavated at Gardiner Creek-1. Test unit 1 was established on a nearly level surface near the tip of the terrace promontory, while test unit 2 was placed 15 m to the north-northwest, near the crest of the ridgeline. Test units 3 and 4 were established 10 m and 15 m (respectively) north of test unit 1, in the widest and flattest area of the terrace tip. All four units yielded archaeological material.

Gardiner Creek-1 deposits are composed of readily distinguishable strata/layers of loess, tephra, and massive sands (Fig. 9). The site is capped by an O horizon that varies from 5 to 10 cm in depth. Immediately below this is an A horizon of the modern soil, a loess deposit that contains the site's upper cultural Component 2. Under this is a layer of tephra, which rests on an Ab horizon of silt ~10 to 15 cm thick. This silt contains Component 1. A distinct contact exists between this layer of silt and a lower-lying massively bedded deposit of sand, reaching 60 cm thick. Below this sand is another layer of silt containing a buried A horizon. This loess unit is readily distinguishable from sand deposits above and below it. An underlying sand was excavated for an additional 20 cm and found to be sterile. We interpret this basal sand unit to be the top of the late Pleistocene sand sheet that blanketed the hills north of the Chisana lowlands, readily visible in many road cuts along the Alaska Highway between Tok and the Alaska–Canada border (Fernald 1965b).

A sample of the volcanic ash was collected from Gardiner Creek-1 for geochemical analysis, the results of which (presented in detail below) demonstrate its assignment to the north lobe of the White River Ash.

A charcoal sample taken from the upper buried Ab horizon, under the tephra and associated with Component 1, produced a date of 2360 ± 30 ^{14}C BP (Beta-315412). A second charcoal sample from the lower Ab horizon under the upper sand yielded a date of 9990 ± 40 ^{14}C BP (Beta-315414). This radiocarbon date serves as an upper-limiting age on the cessation of late Pleistocene sand sheet formation in the Chisana lowlands, confirming early conventional radiocarbon dates obtained by Fernald (1965b).

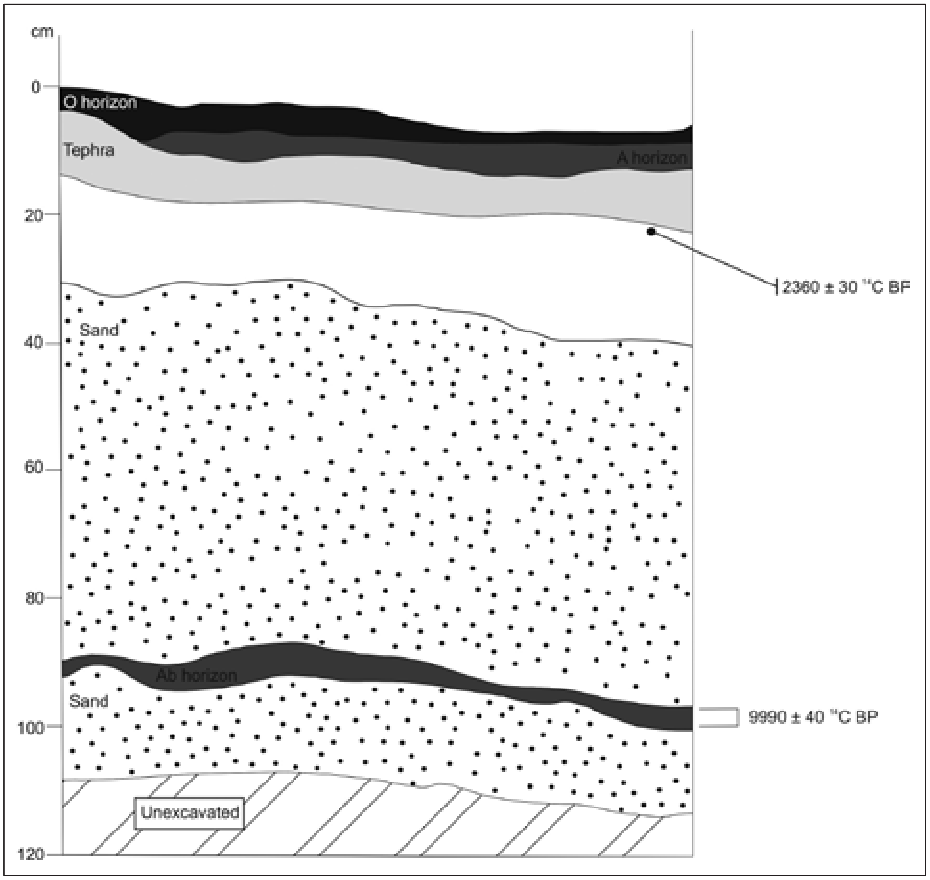

Figure 9. Stratigraphic profile of the east wall of test unit 4 at the Gardiner Creek-1 site.

Besides components 1 and 2, a small set of artifacts was recovered within the White River Ash; these could not be assigned unequivocally to either component, so they were analyzed separately and not included in the component counts and characterizations presented below and in Table 3. Archaeological materials from both components included lithic and faunal elements. Component 2, above the tephra, included 50 debitage pieces, one formal tool, and one utilized flake tool, while Component 1, below the tephra, contained 1282 debitage pieces, eight formal tools, and one utilized flake tool. Faunal remains were recovered in both components, but they were in such degraded, calcined condition that species and element identifications were impossible to achieve.

Raw materials are consistent between the components and dominated by FGV and chert, with lesser amounts of obsidian and quartzite. In both components, large portions of the debitage consist of core-reduction flakes (Component 2, 34%; Component 1, 23%), but biface-thinning flakes also occur. Cortical spalls are rare, making up less than 1% of the Component-1 assemblage, and Component 2 has no cortex present. In Component 1, two medial microblade fragments on two varieties of chert were found. Component 1's nine tools (from below the tephra) include an end scraper, two notched projectile-point bases, and two side scrapers on FGV, as well as a utilized flake and biface fragment of obsidian (Fig. 10a–e). The formal tool from Component 2 (above the tephra) is a lanceolate bifacial projectile-point base produced on FGV (Fig. 10f). A single utilized flake

Table 3. Gardiner Creek-1 debitage assemblages.

Debitage Category	Raw Material Category				
	CCS[1]	Obsidian	FGV[2]	Quartzite	Total
Component 2					
Core-reduction flake	3		12	2	17
Retouch chip		1			1
Biface-thinning flake			1		1
Flake shatter	3		14		17
Angular shatter	3		8	3	14
Total	9	1	35	5	50
Component 1					
Core-reduction flake	106	29	149	5	289
Cortical spall fragment	1				1
Retouch chip	8	5	5		18
Biface-thinning flake	5	2	8	1	16
Proximal cortical spall		1			1
Medial microblade fragment	2				2
Flake shatter	186	58	217	22	483
Cortical spall shatter	1				1
Angular shatter	115	45	276	35	471
Total	424	140	655	63	1282

1. Cryptocrystalline silicate.
2. Fine-grained volcanic.

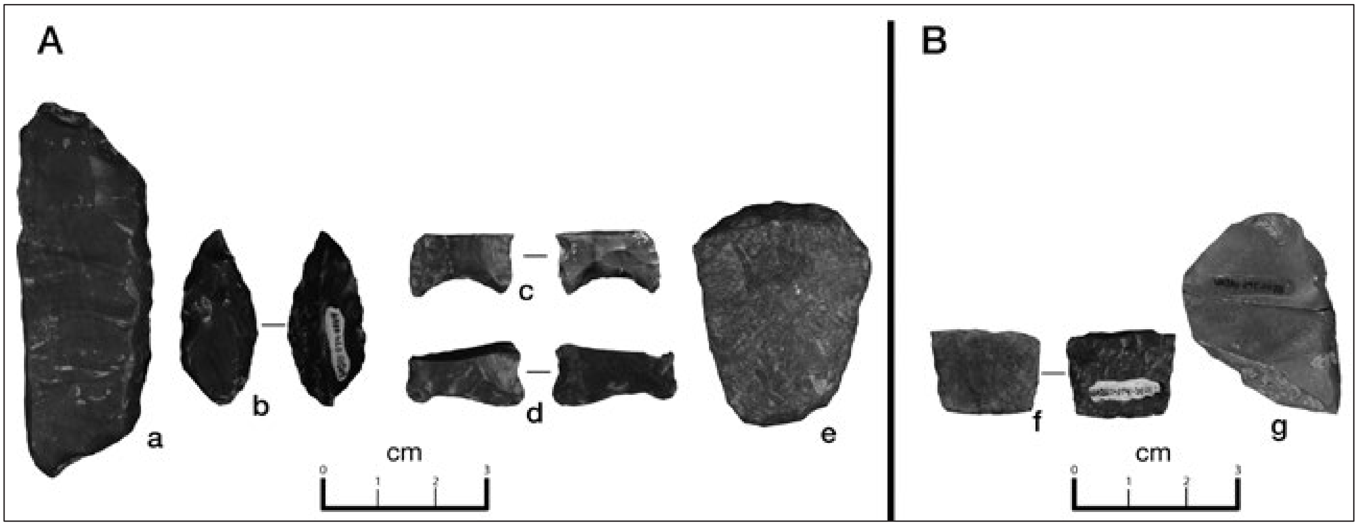

Figure 10. Gardiner Creek artifacts. A, Component 1: (a) side scraper; (b) biface fragment; (c–d) notched-point bases; (e) end scraper. B, Component 2: (f) lanceolate-point base; (g) refit of utilized flake.

produced on a gray CCS was also recovered in this context (Fig. 10g). Eight obsidian artifacts from Component 1 were geochemically analyzed; five are assigned to the nearby Wiki Peak source, one to Batza Tena about 700 km northwest, and two to Group A', a distinct geochemical group for which a geological source has not yet been identified (Cook 1996; Goebel et al. 2008; Reuther et al. 2011). A single obsidian artifact from Component 2 was too small for meaningful XRF analysis.

Gardiner Creek-2 displayed a similar, though shallower, stratigraphic profile as Gardiner Creek-1. A thin O horizon capped an A horizon of silt approximately 10 cm thick. This upper silt was underlain by a horizon of tephra presumed to be the White River Ash (~3 to 4 cm thick), and this in turn rested on a weathered sand with an Ab horizon. Underlying this were laminated sands that alternated between fine and coarse textures and extended to the farthest excavated depth of ~74 cm. Archaeological materials were limited to six small flakes (one of which was a biface-thinning flake) recovered in the upper silt, just above the tephra, and in the top centimeters of the tephra. Hence, they are considered to date to later than 1600–1800 cal BP, the presumed age of the White River Ash (see Lerbekmo 2008; Lerbekmo et al. 1975; and discussion below).

TEPHRA ANALYSIS

We geochemically analyzed a sample of tephra from Gardner Creek-1 to determine whether it indeed represents the White River Ash and to further evaluate whether it could be attributed specifically to either its north lobe or east lobe.

Complete results for glass and Fe-Ti oxides are presented in Table 4 and Table S1, along with comparable data from four reference glasses (Lipari obsidian ID3506, BHVO-2g, NKT-1g, and orthoclase glass) and four Fe- and Ti-rich reference minerals (ilmenite, hematite, synthetic rutile, and titanite).

The tephra contains pumiceous grains up to 1.2 mm in longest dimension. Minerals present as phenocrysts and microphenocrysts include, in order of decreasing abundance, plagioclase (~50%), magnetite, amphibole, apatite, and ilmenite. Glass compositions (normalized as anhydrous) range from about 71.5 to 74.9 wt% silicon dioxide, with a gap between about 73.4 and 74.0 wt% (Fig. 11; Table S1). Mineral abundances and glass compositions closely match those described by Preece et al. (2014) for the White River Ash, and the observed gap in silicon dioxide compositions is similar to that reported for some samples of the White River Ash's north lobe (Fig. 11A; Preece et al. 2014). As is obvious in Figure 11A, though, north lobe and east lobe glass compositions overlap, so that glass chemistry alone cannot definitively distinguish the two eruptions. Instead, as Preece et al. (2014) have shown, ilmenite chemistries more reliably separate the two lobes, and as we show in Figure 11B, the analyzed ilmenite grains from the Gardiner Creek-1 tephra sample clearly plot within the expected range for the north lobe.

With these results, we have unequivocally attributed the tephra at Gardiner Creek-1 to the north lobe of the White River Ash. We consider this to be the same tephra

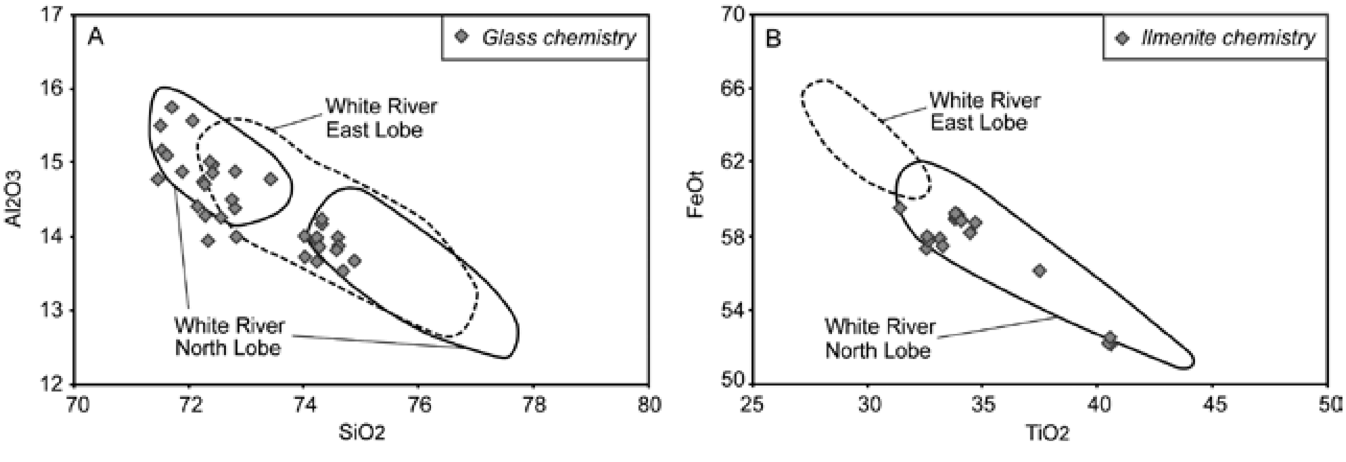

Figure 11. Results of geochemical analysis of the tephra from the Gardiner Creek-1 site. Glass chemistry (A) clearly shows a correlation with the White River Ash, while ilmenite chemistry (B) more specifically matches the north lobe of the White River Ash.

Table 4. Summary of geochemical data from tephra glass, Fe-Ti oxides, and accompanying reference materials.

Sample		Si0^2	TiO^2	Al^{2}0^3	FeOt	MnO	MgO	CaO	Na^{2}O	K^{2}0	P^{2}0^5	Cl	BaO	Total	H^{2}Odiff	*n*
Glass data—Normalized to 100% totals																
Gardiner Creek-1 tephra glass (sample CU1856)	Mean	73.08	0.24	14.44	1.67	0.058	0.39	1.97	4.50	3.21	0.054	0.333	0.129	100.00	1.92	34
	StDev	1.13	0.06	0.59	0.31	0.015	0.10	0.37	0.31	0.18	0.013	0.053	0.027		1.64	
BHVO-2g	Mean	50.38	2.80	13.72	11.05	0.179	7.30	11.45	2.31	0.51	0.28	0.009	0.009	100.00	1.08	14
	StDev	0.15	0.02	0.12	0.13	0.018	0.15	0.07	0.10	0.01	0.005	0.021	0.021		0.48	
USGS reference composition		50.15	2.81	13.73	11.15	0.172	7.30	11.55	2.33	0.52	0.28		0.015	100.00		
NKT-1g	Mean	38.95	3.99	10.49	12.31	0.214	14.76	13.42	3.57	1.28	0.93	0.003	0.090	100.00	1.32	14
	StDev	0.20	0.01	0.07	0.10	0.017	0.10	0.06	0.13	0.02	0.023	0.005	0.030		0.22	
USGS reference composition		39.41	4.01	10.39	12.21		14.60	13.46	3.55	1.30	0.99		0.081	100.00		
Lipari Obsidian ID3506	Mean	74.82	0.070	13.14	1.55	0.064	0.038	0.74	4.05	5.24	0.010	0.342	–0.002	100.00	0.96	14
	StDev	0.24	0.007	0.16	0.05	0.010	0.008	0.02	0.27	0.05	0.005	0.012	0.018		0.76	
USGS reference composition (Kuehn et al. 2011)		74.76	0.075	13.22	1.56	0.066	0.041	0.74	4.10	5.15	0.010	0.345	0.002	100.00		
Mineral data																
CU1856 Ilmenites	Mean		34.85	0.30	57.22	0.36	1.69	0.09						94.51		18
	StDev		2.89	0.12	2.46	0.15	0.10	0.04						1.33		
CU1856 Magnetites	Mean		6.44	2.36	81.55	0.36	1.53	0.16						92.40		7
	StDev		0.86	0.22	0.78	0.03	0.21	0.15						0.90		
Synthetic TiO2	Mean		100.0		0.03	0.00	0.01	0.01						100.05		11
	StDev		0.47		0.03	0.02	0.02	0.01						0.50		
Hematite, Miguel Burnjar (Harvard 92649)	Mean		2.01	0.00	89.04	0.02	0.04	0.02						91.13		11
	StDev		0.01	0.12	0.66	0.02	0.02	0.02						0.63		
Harvard reference composition			2.09		88.85	0.01		0.06						91.00		
Ilmenite, Ilmen, Mtns (USNM 96189)	Mean		47.87	0.01	46.17	4.61	0.34	0.02						99.03		16
	StDev		0.77	0.14	0.98	0.11	0.04	0.01						0.40		
Smithsonian reference composition			45.70	0.02	46.54	4.49	0.35							97.10		
Sphene (titanite) (USGS SPHC)	Mean	30.33	37.27	1.94	0.68	0.10	–0.01	28.57						98.88		16
	StDev	0.29	0.40	0.22	0.05	0.02	0.01	0.29						0.77		
USGS reference composition		30.54	35.72	1.98	0.75	0.09	0.04	28.71						97.83		

Notes: Fe0^t is total iron oxide reported as Fe0 (Fe2+), some materials may contain significant Fe3+ (Fe^{2}0^3);
H^{2}0diff is the difference between the orginal analytical totals and 100%; *n* = number of analyses.

that occurs throughout the uppermost Tanana basin, at every archaeological site reported here.

DISCUSSION

Our 2011 Upper Tanana Tributary Survey project had three goals: (1) to explore the potential of the survey area for preservation of early-period archaeological sites in buried and datable contexts; (2) to identify sites within the survey area that contain archaeological deposits that can inform on prehistoric chronology, technology, subsistence, and settlement patterns; and (3) to explore the potential of the area for investigating climate and environmental change and its effects on prehistoric human populations. Specifically, we hoped to evaluate whether the region's record could contribute to our understanding of the timing and effect of the late Holocene tephra fall represented by the north lobe of the White River Ash.

POTENTIAL FOR DISCOVERY OF A LATE PLEISTOCENE/ EARLY HOLOCENE ARCHAEOLOGICAL RECORD

Ongoing excavations at the late Pleistocene/early Holocene Little John site, located a few kilometers past the Canada-U.S. border from the study area, strongly suggest that similar early-period sites should occur in the uppermost Tanana basin (Easton 2007; Easton et al. 2011; see also Goebel and Potter (2016) for a current summary of early-period archaeology in the region). No such sites were found during the survey; however, our project did identify several contexts where such sites might occur in deeply buried and stratified settings.

First, very deep loess-and-sand profiles with numerous buried A horizons occur on terraces associated with the Nabesna River where it exits the mountains, and similar profiles may exist in similar settings along the Chisana River. Rapid deposition and preservation of plant macrofossils at Nabesna River-1 suggest that these places have high potential to contain well-preserved early sites; however, their investigation will be difficult, given the great depths (> 4 m) at which the deposits occur.

Second, moderately thick and stratified eolian sequences dating to the late Pleistocene and early Holocene (reaching about 1 to 2 m in depth) occur on the low hills in the northern portion of the study area. Specifically, these include the sand sheets along Gardiner Creek and elsewhere near the Alaska Highway. This context undoubtedly represents a prime source for early-period archaeology, given our discoveries of a terminal Pleistocene loess unit and paleosol within the sands of Gardiner Creek-1 (radiocarbon dated to about 11,500 cal BP), as well as earlier geomorphic research in the area that indicated sand-sheet deposition persisted from 14,500 to as late as 9000 cal BP (Fernald 1965b). Continued survey of the sand sheets will likely result in the discovery of early sites.

The foothills of the study area appear to have less potential for preserving deep, well-stratified contexts, given the relatively shallow records found at Nabesna River-2 and along the shore of Jatahmund Lake. Other recent studies, however, suggest that in lowland lakeside settings, for example along the shore of Deadman Lake, relatively thick eolian and lacustrine deposits potentially contain multicomponent sites. For example, the Deadman Lake-9 (DML-09) site has yielded deep deposits extending well into the late Pleistocene (Easton et al. 2017), and a cultural component immediately below the White River Ash has yielded a radiocarbon date of 1906 ± 35 (UOC-4215) ^{14}C BP (N. Easton, pers. comm., 31 July 2017). Therefore, with continued survey in lowland wetland contexts like Deadman Lake, buried and datable early sites eventually may be found.

EXPLORING LATER HOLOCENE PREHISTORY IN THE UPPERMOST TANANA REGION

Our project identified eight later Holocene sites, some containing preserved faunal and macrobotanical remains (Fig. 12). Together with earlier work in the region (e.g., Easton et al. 2009, 2011; Holmes 2008, 2011; Patterson 2008; Potter et al. 2007; Potter et al. 2013; Sheppard et al. 1991; Shinkwin 1977, 1979), they indicate that a rich record of prehistoric hunter-gatherer activities is present in the study area, especially for the middle and late Holocene (Figs. 1 and 12). Given the ubiquitous and prominent occurrence of the White River Ash (north lobe) as a distinct marker bed in the study area, we discuss these sites and their cultural components as either predating or postdating this major tephra fall.

The earliest occupation identified in the 2011 survey may be the Tenmile Hill-1 component (Fig. 12). Its sparse assemblage, lacking diagnostic artifacts, occurred above a sample of dispersed charcoal dated to about 7900 cal BP and below the White River Ash (i.e., 1800–1600 cal BP). This suggests an age range of approximately 8000 to 1500 cal BP, perhaps earlier in this span than later given the position of the component just above the radiocarbon-

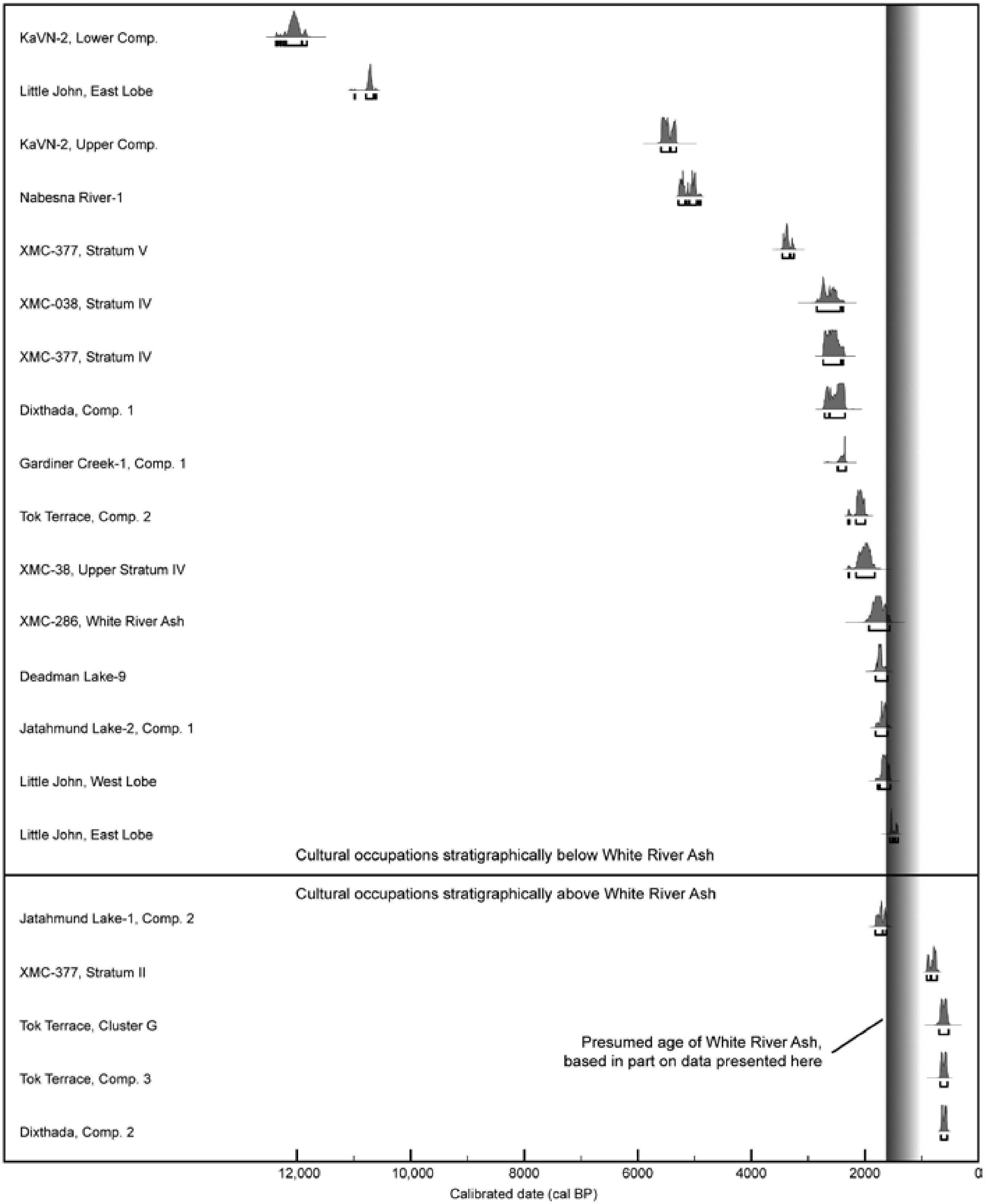

Figure 12. Calibrated radiocarbon dates from cultural occupations in the upper Tanana River basin, Alaska, and adjoining Beaver Creek/upper White River basin, Yukon. Radiocarbon dates are presented in Table 1 and Table 5. Only dates associated with archaeological materials are included in this chart.

dated charcoal sample and below the paleosol underlying the tephra. This suggests the Tenmile Hill-1 occupation can be assigned to the Northern Archaic period of Interior Alaska prehistory (Esdale 2008; Potter 2007). At Nabesna River-1, we encountered a cultural occupation stratigraphically situated below the White River Ash and associated with a radiocarbon age of about 5000 cal BP (Fig. 12). Although no diagnostic bifacial points were found, this date again suggests a Northern Archaic occupation. Component 1 at Gardiner Creek-1, however, did yield two notched projectile-point bases and two medial-microblade fragments, which, along with a radiocarbon age of about 2400 cal BP, clearly indicate a Northern Archaic occupation (see Esdale 2008; Potter 2007). Jatahmund Lake-1, -2, and -3 and Nabesna River-2 (Component 1 at each) also produced small and nondiagnostic lithic assemblages in a paleosol occurring immediately below the White River Ash; a radiocarbon age of about 1800–1600 cal BP from Jatahmund Lake-2 suggests that all four of these occupations may be assigned to the late Holocene, just before the tephra fall. Taken together, these seven assemblages indicate a strong human presence in the study area during the middle to late Holocene, Northern Archaic period. This is supported by previous research in the region at the Tok sites (Sheppard et al. 1991), Dixthada (Shinkwin 1979), the upland Wiki Peak sites near Ptarmigan Lake (Patterson 2008), and KaVn-2 and Little John in neighboring Yukon, Canada (Easton et al. 2011; Heffner 2002) (Table 5; Figs. 1 and 12). Easton's recent work at Deadman Lake-9 is also important in this regard.

Postdating the White River Ash are the Component-2 occupations at Jatahmund Lake-1 and Gardiner Creek-1 as well as the Component-1 occupation at Gardiner Creek-2. These three occupations extend the chronology of occupation in the survey area into the latest Holocene, postdating 1800–1600 cal BP. So far, these sites have produced only very small artifact assemblages; however, Gardiner Creek Component 2 yielded a basal fragment of a small straight-based lanceolate projectile point. This find likely correlates to the Athapaskan period of Interior Alaska prehistory, given that such lanceolate points have been directly dated to the late Holocene in the high-elevation ice patches of the southwestern Yukon (Hare et al. 2004; Hare et al. 2012), and Dixon (1985) included them as a distinguishing artifact form of the Athapaskan tradition. The relative sparseness of the record postdating the White River ashfall seems complemented by previous archaeological research in the region, at least for sites where radiocarbon dates are available. As indicated in Figure 12, seemingly, there are fewer sites postdating than predating 1800–1600 cal BP. They include Stratum II at XMC-377, the Tok Terrace site, and Component 2 at Dixthada (Patterson 2008; Sheppard et al. 1991; Shinkwin 1979).

THE WHITE RIVER ASH AND ITS EFFECT ON HUMAN POPULATION

The uppermost Tanana basin is an important area for investigating the effects of significant tephra fall on prehistoric foragers. The study area was blanketed by a thick volcanic ash that fell during the late Holocene, about 1900–1500 cal BP (e.g., Lerbekmo and Campbell 1969; Lerbekmo et al. 1975). This tephra, called the White River Ash, was ejected from a source near Mt. Churchill in the St. Elias Range of eastern Alaska (Lerbekmo and Campbell 1969). Two major eruptive events deposited two distinct lobes of the tephra: an older and smaller lobe that dispersed north into the Alaska-Yukon borderlands, and a younger and more extensive lobe that dispersed east across southern Yukon and into the Northwest Territory of Canada (Clague et al. 1995; Lerbekmo 2008). Distal signatures of the east lobe are evident in sediment cores across the North Atlantic as far away as northern Europe (Jensen et al. 2014; Pyne-O'Donnell et al. 2012). These truly were major ashfalls that significantly impacted the environments of eastern Alaska and southern Yukon (Mullen 2012), and the north lobe of the White River Ash was an obvious stratigraphic marker horizon everywhere we sampled during our survey of the uppermost Tanana Valley.

The east-lobe tephra fall is well documented to have occurred around 1150–1100 cal BP, based on the AMS radiocarbon dating of tree stumps buried in the tephra about 30 km from its source (Clague et al. 1995) as well as independent ice-core chronologies from Greenland (Jensen et al. 2014). However, dating of the White River Ash's north lobe, which fell over the upper Tanana study area, is not so well controlled. Lerbekmo et al. (1975; see also Lerbekmo and Campbell 1969) presented a single date on a spruce tree killed by the ashfall as well as 10 radiocarbon dates on peat and unburned wood from just below the tephra; the former yielded an age of 1825 ± 90 ^{14}C BP (1947–1542 cal BP) while the latter ranged from 1750 ± 110 ^{14}C BP (1918–1408 cal BP) to 2005 ± 90 ^{14}C BP (2297–1726 cal BP). Standard errors on all these

Table 5. Previously reported radiocarbon dates from the upper Tanana region.

Site	Lab Number	Radiocarbon Age (^{14}C BP, 1σ)	Calendar Age[1] (cal BP, 2σ)	Reference
Late Pleistocene/early Holocene				
KaVn-2, lower comp.	Wk-7841	10,670 ± 80	12,974–912,388	Heffner 2002
KaVn-2, lower comp.	Beta-75868	10,130 ± 50	12,275–211,343	Heffner 2002
Average of 2	—	*10,282 ± 42*	*12,376–311,827*	*This study*
KaVn-2, lower comp.	Wk-7840	3740 ± 170*	4548–3636	Heffner 2002
Little John (East Lobe)	Beta-241525	10,000 ± 60	11,749–711,263	Easton et al. 2011
Little John (East Lobe)	Beta-241522	9580 ± 60	11,152–110,723	Easton et al. 2011
Little John (East Lobe)	Beta-218235	9550 ± 50	11,100–10,705	Easton et al. 2011
Little John (East Lobe)	Beta-217279	9530 ± 40	11,083–10,694	Easton et al. 2011
Little John (East Lobe)	Beta-182798	8890 ± 50	10,190–9785	Easton et al. 2011
Average of 5	—	*9478 ± 22*	*10,992–910,606*	*This study*
Middle Holocene (i.e., before deposition of White River Ash)				
KaVn-2, between comps.	Beta-68509	7810 ± 80**	8979–8412	Heffner 2002
KaVn-2, between comps.	Beta-75866	7770 ± 70**	8721–8393	Heffner 2002
KaVn-2, upper comp.	Beta-75867	4740 ± 60	5592–5322	Heffner 2002
XMC-377/Stratum V	Beta-121643	3150 ± 40	3453–3251	Patterson 2008
XMC-038/Stratum IV	Beta-108863	2690 ± 80	3001–2519	Patterson 2008
XMC-038/Stratum IV	Beta-108864	2490 ± 70	2739–2365	Patterson 2008
Average of 2	—	*2577 ± 73*	*2844–2383*	*This study*
XMC-377/Stratum IV	Beta-121645	2490 ± 50	2738–2379	Patterson 2008
Dixthada, Comp. I	P-1834	2420 ± 60	2706–234	Shinkwin 1979
Tok Terrace, Comp. 2	Beta-40720	2820 ± 180	3397–2489	Sheppard et al. 1991
Tok Terrace, Comp. 2	Beta-42600	2690 ± 90	3057–2499	Sheppard et al. 1991
Tok Terrace, Comp. 2	Beta-40716	2630 ± 90	2951–2439	Sheppard et al. 1991
Tok Terrace, Comp. 2	Beta-40721	2110 ± 170	2683–1629	Sheppard et al. 1991
Tok Terrace, Comp. 2	Beta-40712	1980 ± 70	2120–1740	Sheppard et al. 1991
Tok Terrace, Comp. 2	Beta-40603	1650 ± 60	1698–1408	Sheppard et al. 1991
Average of 6	—	*2114 ± 35*	*2296–1993*	*Sheppard et al. 1991*
XMC-038/Upper Stratum IV	Beta-108865	2030 ± 70	2287–1824	Patterson 2008
Deadman Lake- 9	UOC-4215	1906 ± 35	1927–1737	N. Easton, pers. comm., 31 July 2017
XMC-286/Stratum III	Beta-108862	1830 ± 80	1926–1565	Patterson 2008
Little John (West Lobe)	Beta-182799	1740 ± 40	1774–1551	Easton et al. 2011
KaVn-2, base of White River Ash	Beta-75869	1720 ± 80*	1821–1418	Heffner 2002
Little John (East Lobe)	Beta-231795	1620 ± 20	1562–1416	Easton et al. 2011
Late Holocene (i.e., after deposition of White River Ash)				
XMC-377/Stratum II	Beta-121646	1010 ± 40	1046–796	Patterson 2008
XMC-377/Stratum II	Beta-121647	680 ± 50	674–565	Patterson 2008
Average of 2	—	*881 ± 31*	*908–729*	*This study*
Tok Terrace Cluster G	Beta-34233	640 ± 70	688–527	Gerlach et al. 1989
Tok Terrace Comp. 3	Beta-40722	920 ± 90	980–677	Sheppard et al. 1991
Tok Terrace Comp. 3	Beta-40713	570 ± 80	677–495	Sheppard et al. 1991
Tok Terrace Comp. 3	Beta-40718	450 ± 90	643–305	Sheppard et al. 1991
Average of 3		*640 ± 50*	*672–545*	*This study*
Dixthada, Comp. 2	P-1832	770 ± 40	762–661	Shinkwin 1979
Dixthada, Comp. 2	P-1833	390 ± 50	515–315	Shinkwin 1979
Average of 2		*622 ± 31*	*659–551*	*This study*

1. Radiocarbon dates were calibrated using CALIB7.1.0, following Stuiver and Reimer (1993).

* Date considered aberrant by original researcher.

** Date not from cultural component and not included in Figure 12.

conventional radiocarbon dates were greater than 80 years, leading to a relatively coarse interpretation of the north lobe's age. Two new radiocarbon dates presented here improve the situation by providing more precise bracketing dates for the tephra. From Jatahmund Lake-1, we dated a sample of wood charcoal from immediately above the tephra, producing an age of 1790 ± 30 ^{14}C BP, and from nearby Jatahmund Lake-2 we dated a similar sample of charcoal from immediately below the tephra to 1770 ± 30 ^{14}C BP. These two dates are essentially contemporaneous, and their calibrated pooled mean is 1698 cal BP (two-sigma range, 1808–1618 cal BP). Thus, our new results suggest that the White River Ash's north lobe became deposited about 130 years later than previously calculated (1830 cal BP according to Mullen 2012:36), and as much as 330 years later if the full calibrated range (based on Lerbekmo et al. 1975) is considered. A revised ~1700 cal BP age for the north lobe ashfall is corroborated by lower-limiting radiocarbon dates for the tephra from XMC-286 (1830 ± 80 ^{14}C BP, 1926–1565 cal BP), KaVn-2 (1720 ± 80 ^{14}C BP, 1821–1418 cal BP; a noncultural date), and the West Lobe excavation at the Little John site (1740 ± 40 ^{14}C BP, 1774–1551 cal BP) (Easton et al. 2011; Hutchinson et al. 2007; Heffner 2002; Patterson 2008) (Table 5; Fig. 12). Also from Little John, however, Easton et al. (2011) report a younger radiocarbon date on charcoal from a hearth situated below the tephra: 1620 ± 40 ^{14}C BP, or 1605–1409 cal BP (Table 5; Fig. 12). If correct, this means that the White River Ash fell across the upper Tanana Valley even later than our data suggest, and that our newly reported date of 1790 ± 30 ^{14}C BP from above the tephra at Jatahmund Lake-1 is aberrantly old. For now, we conclude that the north lobe of the White River Ash was deposited between about 1700 cal BP and 1500 cal BP but that the tephra fall could have occurred even one or two centuries later.

The effect of the north lobe's deposition on human populations in the uppermost Tanana Valley is not well understood, and unfortunately, the archaeological survey results presented here do little to clarify whether humans abandoned the region after the tephra fall. The newly reported date for Component 2 at Jatahmund Lake-1 suggests immediate human reoccupation of the region, but the charcoal sample that produced this date did not come from a cultural feature. After this, there is an obvious 300-year hiatus before the next oldest occupation, Stratum II at XMC-377. In a similar vein, Mullen (2012) demonstrated that Wiki Peak obsidian largely disappears from Interior Alaska's archaeological record during the late Holocene, but he also pointed out that there have been too few studies conducted in the north lobe region to analyze temporal site distributions statistically. Unfortunately, our small study cannot contribute to this argument in a concrete fashion; however, we did observe that the archaeological record dating to before the tephra fall yielded larger, richer lithic assemblages than that following the tephra fall, and that at least at one site, Gardiner Creek-1, the frequency of obsidian in the debitage assemblage dropped from 11% before to just 2% after deposition of the White River Ash. Another interesting difference between the two Gardiner Creek-1 assemblages is that in the pre–White River Ash component, only notched points have been recovered, while in the post-Ash component a lanceolate point was found. Although our sample is very small, these differences could reflect a transition from the Northern Archaic to Athapaskan periods (e.g., Potter 2008) that correlates to the eruptions leading to deposition of the White River Ash. Suffice it to say, the Gardiner Creek site is one place that, with additional excavations, we could potentially address the issue of continuity/discontinuity and culture change in the wake of the White River Ash fall, and the upper Tanana Valley certainly is a region where continued research could provide an important case study of how human foragers react to significant and widespread environmental degradation.

CONCLUSIONS

The 2011 Tanana tributaries survey was largely successful in meeting the goals defined at the onset of the project. First, we established several contexts for the preservation of buried, datable sites. Very deep loess-and-sand profiles with numerous buried A horizons occur near the major rivers and tributaries, on terraces where they exit the mountains.

Moderately thick and stratified eolian sequences also occur on the hills in the northern portion of the study area. The White River Ash is ubiquitous in the region and provides an important stratigraphic marker for the late Holocene. Second, while no archaeological sites were located that could inform on the nature of the late Pleistocene/early Holocene occupation of the region, we did encounter contexts where such may exist, and continued survey will likely result in the discovery of early sites. Third, we discovered eight Holocene sites, some containing preserved faunal and floral remains, providing evidence complementing the established record of Holocene occupation in the study area. Fourth, our findings help to more precisely calculate the age of the north lobe of the White River Ash (here inferred to have been deposited ca. 1700–1500 cal BP), and they point to the importance of the area for investigating the effects of environmental catastrophe on small-scale human societies. Additional survey and more complete excavations of these reported sites will provide expanded frameworks for investigating changing technological, subsistence, and settlement strategies in the Holocene.

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NOTES

Supplemental material is located online at https://www.alaskaanthropology.org/ under Publications.

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