TECHNOLOGICAL ORGANIZATION IN THE LATE HOLOCENE: RESULTS FROM THE CLEARVIEW SITE (XMH-1303)

Briana N. Doering
Department of Anthropology, University of Wyoming, 1000 E. University Ave., Dept. 3431, Laramie, WY 82071; bdoerin2@uwyo.edu

Julie A. Esdale
Center for the Environmental Management of Military Lands, Colorado State University, Directorate of Public Works, ATTN: IMFW-PWE (Esdale), 1046 Marks Street, #6000, Ft. Wainwright, AK 99703-6000; julie.esdale@colostate.edu

Senna D. Catenacci
Museum of Anthropological Archaeology, University of Michigan, 3010 School of Education, 610 E. University Ave., Ann Arbor, MI 48109; sennac@umich.edu

ABSTRACT

Roughly 1500 years ago, a group of hunter-gatherers left behind numerous tools and thousands of pieces of lithic production debris at the Clearview site, situated on a rise overlooking the middle Tanana Valley and the Alaska Range in central Alaska. This paper considers the spatial relationships between tool type, debitage production, and material to demonstrate the technological organization at this late Holocene occupation. The diverse assemblage considered here comprises several tools (projectile points, bifacial knives, end and side scrapers, expedient flake tools, burins, and microblades) and raw materials, including obsidian. A comprehensive analysis of this assemblage reveals that the site's occupants undertook a complex lithic reduction sequence focused on intermediate stages of bifacial reduction and late-stage microblade production. Generally, this assemblage appears to represent a residential camp of mobile foragers similar to those associated with the Northern Archaic tradition. The results presented here suggest that significant late Holocene behavioral shifts (e.g., increased subsistence specialization, decreased mobility, increased use of metal and bone tools) occurred after Clearview was occupied.

INTRODUCTION

The middle Tanana Valley has provided archaeologists with a wealth of material data related to subsistence, technology, and mobility spanning the last 14,000 years (Goebel and Potter 2016; Holmes 2008). Archaeologists in this region have developed a comprehensive understanding of human responses to climatic and ecological conditions for the first several thousand years of human history in eastern Beringia (Goebel et al. 2011; Graf and Bigelow 2011; Potter 2011). However, single-occupation sites from later time periods, particularly the mid- to late Holocene, are rarely subjected to comprehensive testing and synthetic analysis that could broaden anthropological understandings of human behavior in the late Holocene and inform our understanding of life in the middle Tanana region.

The lithic assemblage from the Clearview site (XMH-1303) builds on the wealth of data archaeologists have collected through nearly a century of research. This single-component site has an associated lithic assemblage with diagnostic information that can be related to technological organization, raw material use, and settlement patterning. Moreover, radiocarbon dates from this site indicate that it was occupied between two ashfall events that may be linked to the Athabascan transition (Mullen 2012; Workman 1979). Here, we present the results of a comprehensive analysis of this site's lithic assemblage in order to provide additional comparative information for other late Holocene occupations and site use across the region.

BACKGROUND

SETTING AND PREVIOUS RESEARCH

The Clearview site is in the middle Tanana Valley just north of the Alaska Range. The site is in an intermediate ecological zone at the transition from lowlands to uplands in the foothills of the Granite Range, which extends to the southeast (Fig. 1; Gallant et al. 1995). Clearview is situated on a small rise at 460 m above sea level and is so named because of the site's exceptional 360-degree view of the Tanana Valley and Donnelly Dome to the south and west, the Granite Mountains to the southeast, and the Yukon-Tanana Uplands to the northeast. Banjo Lake and a small unnamed lake lie to the north and south of the site, respectively. The site is on the perimeter of productive upland and lowland areas that offer a diverse array of resources in a setting that provides a unique vantage point of the surrounding area.

Archaeologists from Colorado State University's Center for Environmental Management of Military Lands (CEMML) recovered the first artifacts from the Clearview site in 2006 (Robertson et al. 2013). The Clearview site was located through shovel testing during a survey for the construction of the Battle Area Complex at Fort Wainwright, Alaska, and was found eligible for the National Register of Historic Places (Carlson et al. 2017; Robertson et al. 2007).

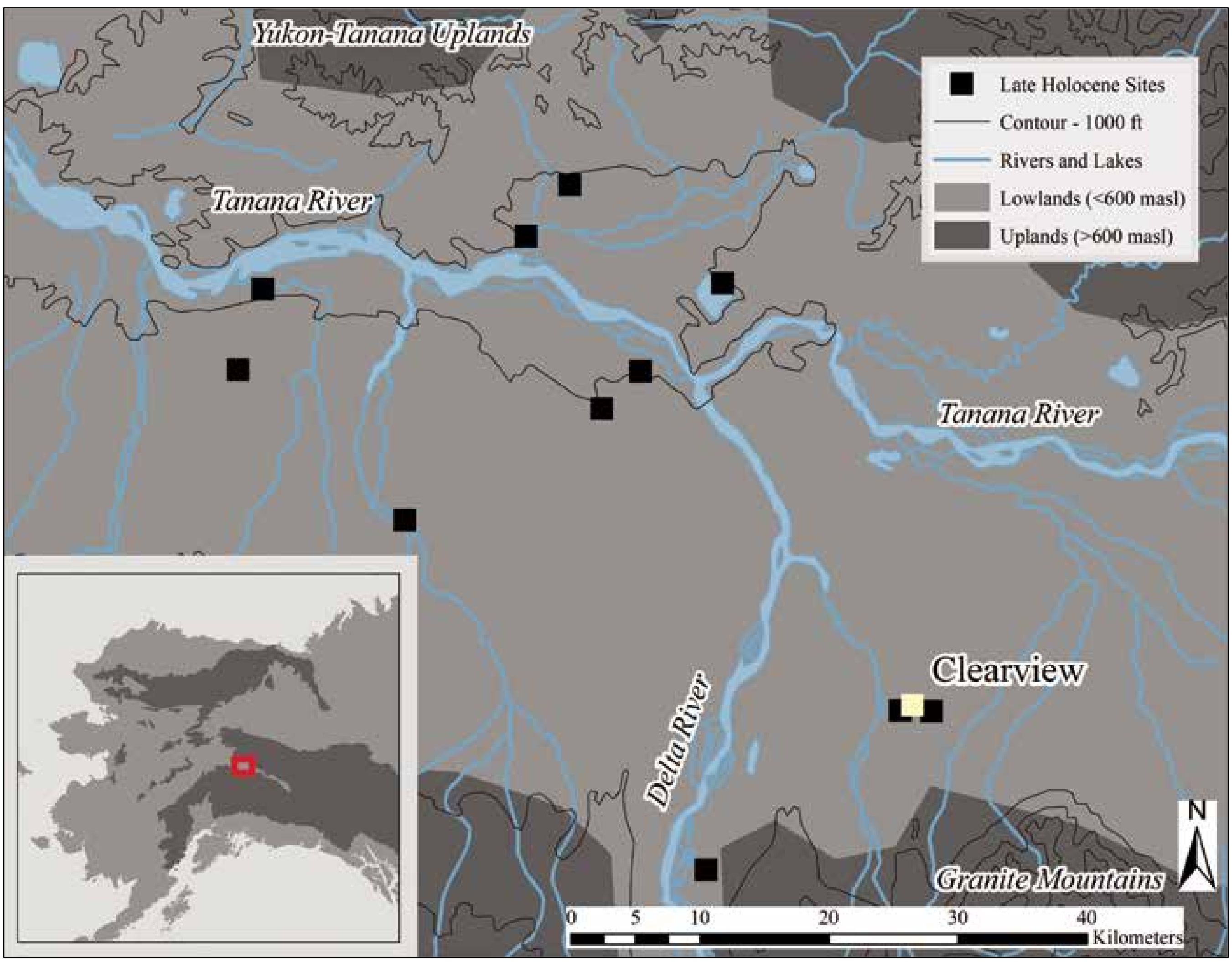

Figure 1. The Clearview Site (XMH-1303) in relation to other late Holocene sites in the middle Tanana River Valley.

CEMML archaeologists returned to Clearview in 2009 for additional site testing, which resulted in 40 systematically placed 1 x 1 m units that defined the site's area and tentatively identified the central activity area of the site (Robertson et al. 2013). Following these investigations, this site became a part of the Jarvis Creek Archaeological District (Carlson et al. 2017). Archaeologists have identified dozens of sites in the Jarvis Creek Archaeological District, but few have been comprehensively tested, and many lack the stratigraphic context or materials that are appropriate for radiocarbon dating (Robertson et al. 2009, 2013). Further, very few of the sites that archaeologists have tested and radiocarbon dated have late Holocene components. Therefore, Clearview has the potential to further our knowledge of behavior during this time as one of the few sites within the Jarvis Creek Archaeological District that has been comprehensively tested and dated to the late Holocene.

THE LATE HOLOCENE IN CENTRAL ALASKA

Anthropologists have provided detailed documentation of central Alaska life for almost a century, beginning with Rainey (1940) and Osgood (1937) in the 1930s. Archaeological and ethnographic research conducted over the last century suggests that central Alaskans pursued a semisedentary, logistical subsistence strategy based on accumulating seasonally abundant resources such as salmon and caribou (Potter 2016). Central Alaskans moved seasonally between large residential encampments, beginning with salmon camps in the summer, transitioning to fall hunting camps, and later moving on to winter trapping camps. Archaeological evidence from late Holocene sites in central Alaska such as Dixthada (TNX-004) and Nenana River Gorge (HEA-062) shows evidence for large seasonal aggregations with a range of material culture, including copper tools and pottery (Plaskett 1977; Shinkwin 1979), which resemble ethnographically documented summer fish camps (Andrews 1975; Osgood 1937). This extensive research provides a general account of life during the late Holocene that could be improved by additional archaeological investigations at sites that represent different roles within the seasonal round.

Archaeological research focused on the earlier periods of Alaska history has provided material evidence from sites across central Alaska, particularly in the middle Tanana Valley (Goebel and Potter 2016). Archaeologists have documented dozens of radiocarbon-dated occupations from the late Pleistocene through the late Holocene with assemblages that are indicative of small, short-term hunting camps with little evidence for repeated occupations (Potter 2008, 2016). However, evidence from the latest pre-European sites and ethnographic records (cited above) suggests that central Alaskans occupied large seasonal camps repeatedly. This discrepancy has led archaeologists to argue that either: (1) taphonomic processes have obscured these larger seasonal camps or village sites (Yesner 1996), or (2) central Alaskans pursued a highly mobile subsistence strategy until 1500 to 1000 years ago, when groups in the region began to return to camps seasonally (Potter 2008). Additional archaeological evidence from the late Holocene could address this discrepancy in occupation strategies spanning the Holocene.

Researchers have interpreted the long cultural record of central Alaska in terms of Binford's (1980) model of residential and logistical mobility, based in part on observations he made of Alaska subsistence hunters in the Brooks Range. Residential mobility is associated with a series of medium-sized generalized base or residential camps, where a wide variety of subsistence behavior is carried out and consumers move to resources. In contrast, logistically mobile groups occupy several smaller, task-oriented sites that move resources to a larger central residence. Despite the potential archaeological ambiguity between these systems of residential mobility, archaeologists have drawn heavily on this model to contextualize the significant changes documented in the central Alaska material record and have suggested that central Alaskans shifted from a system of high residential mobility to a logistically mobile, semisedentary system during the late Holocene.

Anthropologists have argued that increasing sedentism and logistical mobility coincided with changes in subsistence and technology in central Alaska. Archaeologists have recovered very little material evidence for extensive fishing in central Alaska prior to the late Holocene (Potter 2016), when consistent salmon exploitation began. Additionally, archaeologists have argued that stone tool technology was replaced by bone, antler, and copper tools during the late Holocene, based on several assemblages from central Alaska and Yukon (Holmes 2008; Potter 2008). Finally, evidence from ice patches in Yukon suggests that atlatl and dart technology was replaced by the bow and arrow at this time (Hare et al. 2004). These behavioral changes in subsistence and technology are comparable to other North

American hunter-gatherer transitions to semisedentism that took place throughout the Holocene (Chatters and Prentiss 2005; DeBoer 1988).

The late Holocene behavioral transition, inferred from the shifts in the archaeological record outlined above, is also known as the "Athabascan transition" (Helmer et al. 1977). Explanations for these changes have centered around volcanic eruptions emanating from Mount Churchill in the Wrangell–St. Elias mountain ranges in southeast Alaska (Workman 1979). Two late Holocene volcanic events, ca. 1700 cal BP and 1100 cal BP, produced thick layers of ash with possible ecological effects in eastern or central Alaska, and are known as the North and East Lobes of the White River Ash (WRA), respectively (Jensen et al. 2014; Lynch et al. 2018; Mullen 2012). Geologists have described the later East Lobe WRA event in particular as one of the most significant in the region's history (Péwé 1975), and biologists have linked this event and subsequent decimation of lichen populations to a documented genetic bottleneck in the region's caribou herds (Kuhn et al. 2010). Anthropologists have suggested that Athabascan oral histories that reference a massive volcanic eruption tie this behavioral change to the ashfall and provide further evidence for the event's dramatic impact on central Alaska life and subsistence (Moodie et al. 1992; Mullen 2012; Workman 1979). Moreover, paleoenvironmental reconstructions suggest that the impacts of the WRA events may have stood out in an otherwise stable climatic regime (Anderson et al. 2003; Kaufman et al. 2004). The Clearview assemblage offers archaeological context for the impact of the North and East Lobe WRA events, which occurred before and after the site's occupation, respectively.

Additional archaeological evidence from sites that date to this period can provide anthropologists with an improved chronological and theoretical understanding of the late Holocene behavioral transition and potential impacts of the White River Ash events. Clearview was occupied ca. 1500 cal BP, on the verge of the Athabascan transition. The North Lobe WRA event occurred ca. 200 years prior to Clearview's occupation, and the East Lobe WRA event occurred ca. 350 years later. The North Lobe WRA event likely would have had a more direct effect on central Alaskans due to the dispersal of the ash northward rather than eastward. Thus, the Clearview assemblage should reflect any long-term behavioral shifts that took place following the North Lobe WRA event ca. 1700 cal BP (Lynch et al. 2018; Mullen 2012). Evidence from late Holocene hunting camps can also serve as a bridge between the expansive archaeological data sets from earlier periods of Alaska history and the wealth of knowledge found in ethnographic accounts. Therefore, the Clearview site, a comprehensively excavated and securely dated late Holocene hunting camp, provides an important link that can improve our understanding of Alaska's past.

TECHNOLOGICAL ORGANIZATION

Large lithic assemblages present several proxies for behavior that could be used to determine whether the North Lobe WRA event led to increased sedentism and a shift to logistical mobility among central Alaskans. Archaeologists in Alaska and elsewhere have successfully applied artifact class richness, local and exotic material use, and lithic reduction strategy to reconstruct occupation length, mobility patterns, and subsistence strategies. Further, these behavioral correlates can be extrapolated to regional site patterning from different periods of central Alaska history to better evaluate and explain the timing of the Athabascan transition.

Artifact class richness represents the number of tool types present in an assemblage and serves as a proxy for site use (Bamforth 1986; Cowan 1999; Shott 1986). High artifact class richness indicates longer occupations and/or generalized site use associated with residential bases (Habu 2002). In contrast, low artifact class richness indicates specialization and/or shorter occupations, associated with logistical camps. Therefore, artifact class richness conveys broader behavioral patterns related to the functional and organizational role of sites that can be used to compare across assemblages. Additionally, a typological debitage analysis permits a synthesis of the reduction sequence within an assemblage and can build upon information offered by formal tools to show how an assemblage fits in to broader behavioral and settlement patterns (Andrefsky 2005:201–210; Ostahowski and Kelly 2014). At Clearview, numerous and diverse artifacts and debitage would indicate a longer, residential occupation, whereas a logistical hunting camp would exhibit late-stage debitage related to sharpening and retouch (Surovell 2009).

Raw material variability represents broader patterns of mobility and exchange, particularly when exotic materials are present (Andrefsky 1994). Archaeologists have suggested that a lower ratio of nonlocal or exotic materials to local materials correlates with longer occupation lengths (Surovell 2009:79). Within Alaska assemblages, the presence and source of obsidian also demonstrates broader trends in mobility and trade that the North Lobe WRA event may have disrupted due to its proximity to Wiki Peak, an important Alaska obsidian source (Reuther et al. 2011). Indeed, previous raw material sourcing research on pyrometamorphic rocks, or clinkers, traded in the Northwest Territories, Canada, has indicated that the East Lobe WRA disrupted trade in the western subarctic (Kristensen et al. 2019). Decreased use of Wiki Peak obsidian could represent larger disruptions in mobility or trade related to the preceding North Lobe WRA event.

The association between raw material use and tool type can further indicate patterns in skill acquisition and division of labor (Amick 1999) and serve as a proxy for environmental variability, predictability, and risk mitigation. A reliance on complex, patterned reduction strategies can result in more efficient use of raw materials (Elston and Brantingham 2002) but necessitates a great deal of skill and can be risky in resource-poor environments (Bamforth and Finlay 2008). If the North Lobe WRA dramatically increased ecological unpredictability and risk, we would expect to see reliance on generalized and easily maintained tools, such as bifaces, and absence of complex, patterned reduction or specialization at Clearview. In sum, if the volcanic activity associated with the North Lobe WRA event resulted in a rapid shift in central Alaskan behavior, Clearview should demonstrate reduced trade in exotics, debitage consistent with a generalized toolkit, and a low artifact class richness associated with a shift to logistical mobility.

METHODS

EXCAVATION METHODS

Between 2016 and 2018, CEMML archaeologists conducted additional testing as part of mitigation related to the construction of a fire break around the range's target complex. These excavations expanded the previously excavated 1 x 1 m test units into a 6 x 5 m block to identify specific lithic production areas within the area of highest artifact concentration, as well as three 2 x 1 m blocks that investigated other areas with high potential to yield additional artifacts. All excavated artifacts will be permanently housed at the University of Alaska Museum of the North (UA2016-136, UA2017-92, UA2018-71). Excavation methods remained consistent during the four seasons of excavation completed between 2009 and 2018. Each 1 x 1 m unit was excavated in arbitrary 5 cm levels by 50 x 50 cm quadrants. Through this excavation strategy, approximately 10% of the total site area was excavated. Diagnostic materials were three-point provenienced using a Sokkia Set 6 Total Station, and all material was screened through ⅛-inch hardware cloth.

During excavation, charcoal samples were collected for chronological control, and strata were sampled and recorded for geoarchaeological analysis. Four samples of culturally associated wood charcoal from two locations were submitted for AMS radiocarbon dating at the National Ocean Sciences Accelerator Mass Spectrometry facility at the Woods Hole Oceanographic Institution (Table 1). The first location, N 501 E 97, was targeted for sampling because of the association between a visible charcoal lens and several diagnostic artifacts at the base of Stratum III. Three radiocarbon dates were submitted from this context. The second, N 497 E 97, also represented a cluster of charcoal associated with a dense cluster of lithic debitage that was used to corroborate results from the first location. Soil samples were collected at 5 cm intervals to understand the impact of soil acidity on preservation at Clearview. Soil pH was assessed by Matt Ferderbar at the Cold Regions Research and Engineering Laboratory, Fort Wainwright.

Table 1. Radiocarbon results and calibrated dates from Clearview.

NOSAMS lab no.	Field sample no.	Northing	Easting	RCYBP (1σ)	Cal BP (2σ)
OS-130783	478	497.828	97.29	1250 ± 40	1168–1278
OS-130784	467	501.467	97.015	1720 ± 40	1545–1715
OS-130785	468	501.323	97.323	1540 ± 30	1365–1524
OS-130786	474	501.37	97.268	1550 ± 30	1377–1527

Radiocarbon dates calibrated with Calib 7.1 using the IntCal13 curve (Stuiver et al. 2019)

ANALYTICAL METHODS

Lithic Analysis

All excavated materials were analyzed at the University of Michigan Museum of Anthropological Archaeology following widely practiced identification methods (Andrefsky 2005; Esdale 2009). Tools and debitage were analyzed separately. Tool and tool fragments were weighed, and material type was assessed through comparison to toolstone types found in local drainages (e.g., Jarvis Creek) and neighboring sites (e.g., Banjo Lake). Finally, tools and tool fragments were analyzed in comparison to known tool types from central Alaska and sorted into six broad technological categories: uniface, biface, burin, blade, microblade, and retouched flake.

A typological analysis of lithic debitage took place in three general phases. First, artifacts were counted, weighed, and cleaned, and the raw material of each piece was identified through a visual analysis. Jeff Rasic, National Park Service, analyzed the obsidian debitage separately with X-ray fluorescence with a portable Bruker Tracer III-V. Second, lithic pieces with an intact bulb of percussion, platform, and terminating edge were counted and separated for additional analysis. These pieces of debitage were individually weighed and assigned a size class on a base two scale, beginning at 1 cm^2. Next, these pieces were assessed individually for presence of cortex, heat treatment, and use-wear.

Finally, each piece of debitage was assigned one of 13 production-phase categories, following Esdale (2009). General production phase categories distinguished between early reduction, bifacial reduction, unifacial reduction, and microblade reduction. Early reduction flakes were further separated into primary decortication (> 50% cortex), secondary decortication (10%–50% cortex), and interior flakes (0%–10% cortex). Debitage related to bifacial reduction was separated into early thinning, late thinning, edge preparation, alternate, and bifacial pressure flakes. Microblade reduction debitage was sorted into core face rejuvenation flakes, platform rejuvenation flakes, and linear flakes.

Following this visual analysis of lithic materials, the results were compared using statistical methods to assess the variation between material type, tool type, and phase of production. Statistical comparisons between material and tool types were made using a Fisher's exact test. Fisher's exact tests evaluate categorical data in a 2 x 2 contingency table and are similar to chi-square tests but better accommodate comparisons between small (e.g., $n < 10$) and large samples. Therefore, this test is well suited to Clearview's lithic assemblage. In this study, results with $p < 0.05$ are considered significant.

Spatial Analysis

As a single-component site, spatial data associated with the recovered artifacts from the Clearview site were considered in the horizontal plane. This analysis revealed the boundaries of artifact clusters, specific areas of activity across the site, and spatial relationships between raw materials and tool types. Two-dimensional spatial data was input into ArcGIS Desktop 10.6 as raster and point data. Raster data comprised lithic debitage, and point data comprised individual diagnostic tools and tool fragments. Artifact distribution was assessed based on raw material type, debitage category, and presence of cortex.

To identify other underlying patterns in tool manufacture and use, debitage recovered in the central block of Clearview was considered in two phases following methods standard in geospatial statistical analysis and artifact patterning (Wandsnider 1996). First, two distinct activity areas, or centers of debitage production, were spatially designated through a *k*-means cluster analysis, and debitage results were either attributed to one of these two spatial clusters or excluded from the analysis if they were outside these central activity areas. Second, Fisher's exact tests were applied to assess differences in lithic production based on debitage type, phase, and raw material between these two activity areas. In sum, we evaluate technology production at Clearview based on spatial and artifact attributes.

RESULTS

EXCAVATION RESULTS

During four seasons of fieldwork at Clearview, CEMML archaeologists excavated 76 m^2, resulting in the recovery of 5138 lithic artifacts and an average density of 67 artifacts per m^2. The artifact density at the Clearview site is consistent with a single-component site. Archaeological materials were primarily recovered in Levels 2 and 3, approximately 10–20 cm below surface (Fig. 2). Flake frequencies by unit produced unimodal distributions across the site, indicating that the materials recovered from the Clearview site were deposited synchronically. No faunal materials were recovered during these excavations.

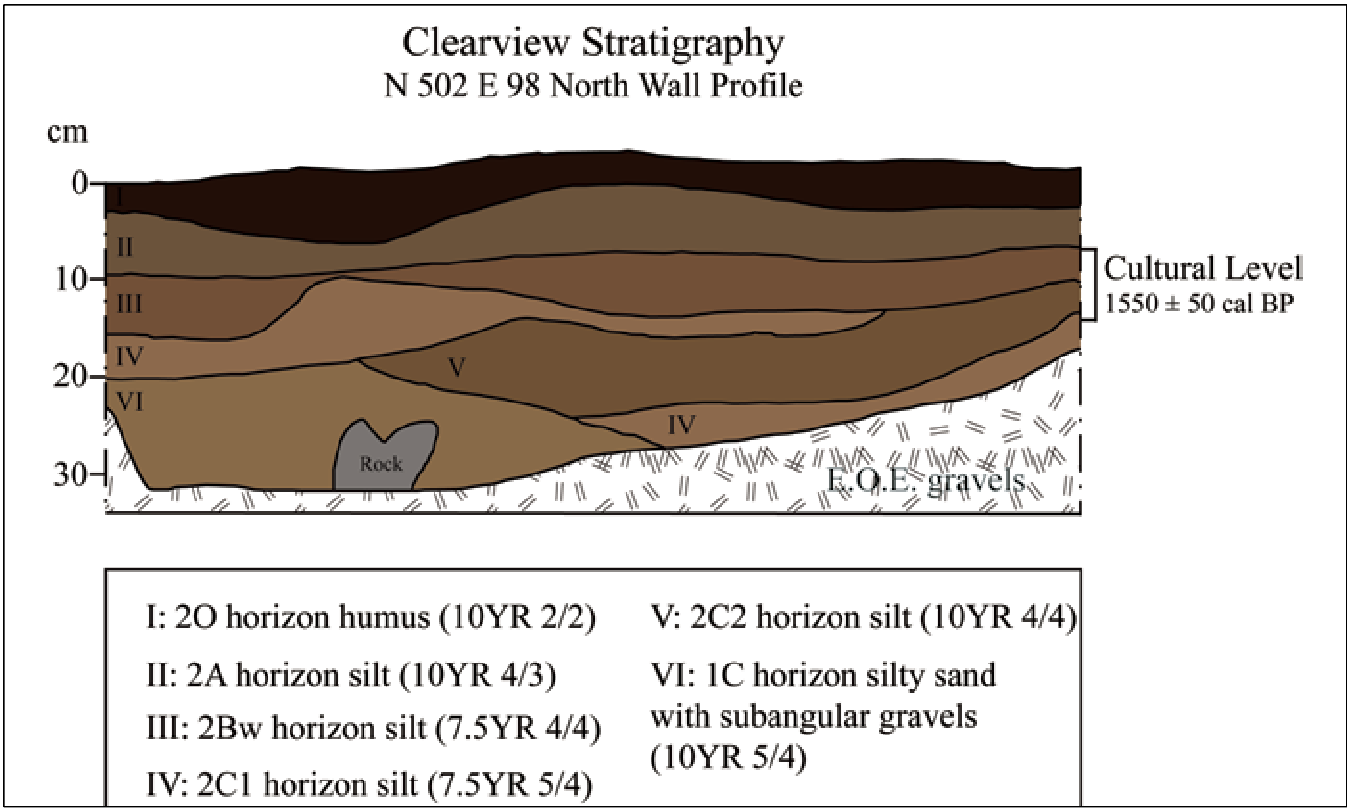

Figure 2. Stratigraphy at Clearview. Drawn in the field by Katherine Mulliken.

Stratigraphy

Macromorphological indicators suggest that Pleistocene glacial processes and Holocene aeolian activity likely shaped the parent material at the Clearview site. Further, its stratigraphic context is very similar to the neighboring Banjo Lake site (Esdale et al. 2015). The sediments at Clearview can be organized into three primary stratigraphic units: glacial outwash, silts with evidence for several episodes of soil formation, and humic mat. The deepest stratigraphic unit comprised poorly sorted glacial outwash, likely derived from subglacial eskers and kames (Reger et al. 2008). In 2009, excavations recovered no archaeological materials in this stratum, and all subsequent excavations were terminated at contact with this stratigraphic unit, approximately 30–40 cm below surface.

Above the glacial deposit, a thick layer of silt is further divided into four horizons based on color with evidence of soil development, likely related to the succession of several coniferous boreal forests throughout the Holocene (Ping et al. 2008). Cultural materials primarily appeared in a weak B horizon (Bw) 10–20 cm below surface in the upper silt. Finally, Stratum I represents the humic mat of the organic horizon. Although some vertical mixing of artifacts may have occurred, disturbance to the stratigraphic integrity of the site appears minimal due to the concentrations of lithic material, which will be discussed in greater detail in the following section.

Site Chronology and Soil Chemistry

All four charcoal samples collected from Clearview resulted in radiocarbon dates that are consistent with a late Holocene occupation of the site, ca. 1500 cal BP (Table 1). The results of a pH analysis on soils collected from different stratigraphic units at Clearview show that Stratum III, which contains the majority of the cultural material at Clearview, is also the most acidic unit. With a pH of 4.39, this stratum falls within the pH range least conducive to the preservation of faunal material (Table 2).

ANALYTICAL RESULTS

The Clearview assemblage contains 55 tools, tool fragments, and cores. Both expedient and formal tools and tool fragments are present in the assemblage (Figs. 3–5). Over half of these are complete tools (56.4%), including expedient flake tools, burins, blades, and bifacial points and knives. The other items present in the assemblage are bifacial fragments (e.g., projectile point bases and tips) or

Table 2. Results of soil pH analysis on each stratigraphic unit.

Field sample no.	Stratum	pH 1:5 DI H_2O	pH 1:5 0.1M $CaCl_2$
149	I	4.8	4.77
150	II	4.51	3.84
151	III	4.39	3.38
152	IV	5.28	5.06
148	V	5.83	5.11
153	VI	5.46	4.41

microblade cores. The assemblage also contains 82 microblades and microblade fragments, or linear flakes with evidence for use-wear. The range of technology present at Clearview signifies the broad range of activities that may have taken place during the occupation of the site.

More than 4400 pieces of debitage were recovered during excavations at the Clearview site. Debitage, including complete flakes and shatter, represents 86% of the total artifact assemblage. Complete flakes (debitage with intact platforms and identifiable bulbs of percussion) represent 34% of the total flake assemblage (Table 3). The average weight of complete flakes was 0.71 g,

Figure 3. Bifaces (a–c) and biface fragments (d–f) recovered from Clearview (University of Alaska Museum of the North accession numbers UA2011-401, UA2016-136, UA2017-92, UA2018-71). Photographed by Whitney McLaren.

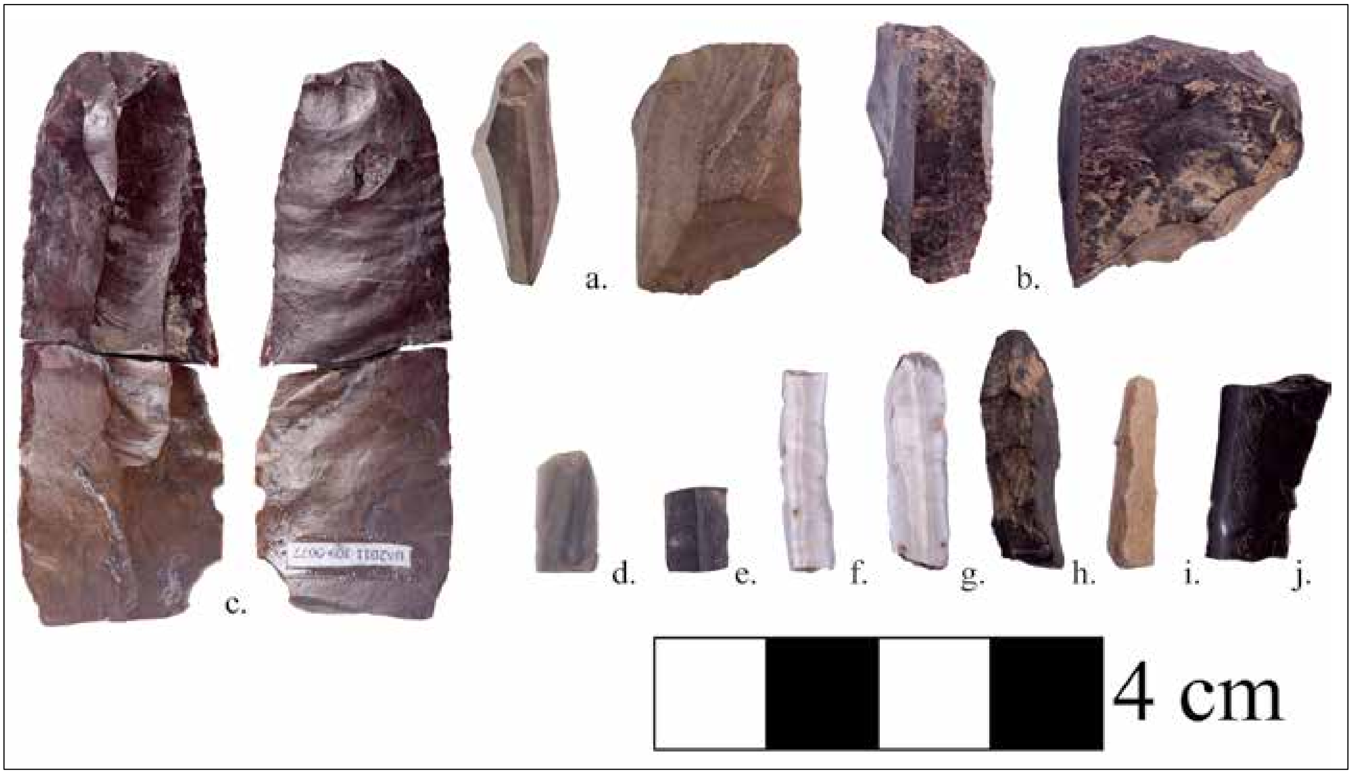

Figure 4. Microblade core fragments (a–b), blade (c), and microblades and microblade fragments (d–j) recovered from Clearview (University of Alaska Museum of the North accession numbers UA2011-401, UA2016-136, UA2017-92, UA2018-71). Photographed by Whitney McLaren.

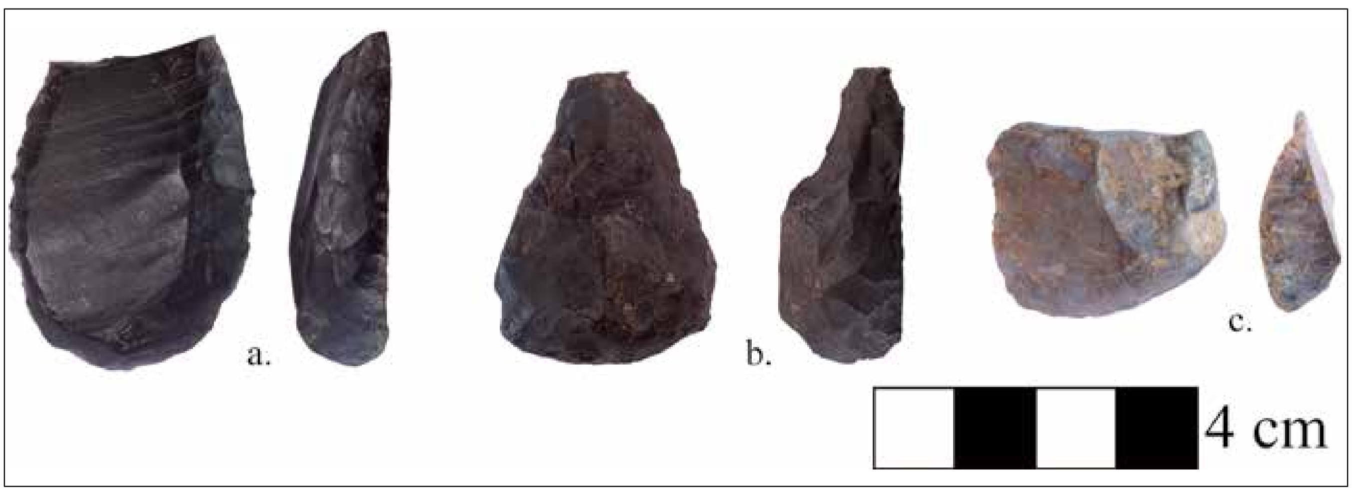

Figure 5. End scrapers recovered from Clearview (a–c), including one composite end scraper and shaft straightener (c) (University of Alaska Museum of the North accession numbers UA2011-401, UA2016-136, UA2017-92, UA2018-71). Photographed by Whitney McLaren.

Table 3. Results of debitage analysis by production phase and material type.

	Initial core reduction					Microblade Reduction				
Raw material	Primary decortication	Secondary decortication	Interior flake	*n*	%	Core face rejuvenation	Platform rejuvenation	Linear flake	*n*	%
Andesite	4	9	8	21	45.7			1	1	2.2
Banded gray chert	1	1	3	5	11.4			9	9	20.5
Black chert	4	13	34	51	8.3	1	3	80	84	13.6
Brown chert								1	1	6.7
Chalcedony		1	4	5	5.1	1	1	2	4	4.0
Gray chert	9	7	25	41	7.9	1	2	29	32	6.2
Obsidian								16	16	69.6
Red chert			1	1	4.0					
Rhyolite	1	3	14	18	2.4	2	1	17	20	2.6
Quartz		1	1	2	28.6					
Quartzite										
White chert										
Total	**19**	**35**	**90**	**144**	**6.6**	**5**	**7**	**155**	**167**	**7.7**
%	**13.1**	**24.3**	**62.5**			**3.0**	**4.1**	**92.8**		

	Bifacial reduction							Unifacial reduction		All
Raw material	Early thinning	Late thinning	Edge preparation	Alternate	Bifacial pressure	*n*	%	Unifacial pressure	%	*n*
Andesite	10	7	7			24	52.2			46
Banded gray chert	15	7	1	1	5	29	65.9	1	2.3	44
Black chert	218	129	78	20	31	476	77.0	7	1.1	618
Brown chert	8	3	3			14	93.3			15
Chalcedony	27	31	17	5	9	89	89.9	1	1.0	99
Gray chert	123	160	69	34	57	443	85.5	2	0.4	518
Obsidian	3	2			2	7	30.4			23
Red chert	6	9	2	2	5	24	96.0			25
Rhyolite	103	308	113	83	112	719	95.0			757
Quartz	1	2	2			5	71.4			7
Quartzite	2	1	1			4	100.0			4
White chert	4	3	2		1	10	100.0			10
Total	**520**	**662**	**295**	**145**	**222**	**1844**	**85.1**	**11**	**0.5**	**2166**
%	**28.2**	**35.9**	**16.0**	**7.9**	**12.0**					

and 78% of these flakes were 1 cm^2 or smaller. Finally, only 54 pieces of debitage exhibited any evidence of cortex. These data suggest that the debitage deposited at the Clearview site was primarily related to intermediate tool production and maintenance.

Raw Materials at Clearview

A visual analysis of color, grain size, and luster revealed that at least 13 individual cobbles or raw materials were brought to this site. Of these, there were seven subcategories of semisedimentary chert or chalcedony, three subcategories of volcanic material, and two subcategories of metamorphic rock (Table 3). Within these subcategories, any additional variations in color and texture were determined to be too minimal to warrant additional objective subdivision. Additionally, only three artifacts in the assemblage demonstrated possible evidence of heat treatment, including coloration, heat fracture, or pot-lidding. This, combined with the absence of hearths at the site, indicates that these artifacts may have been heat treated off-site. The raw materials present within Clearview's assemblage show that a wide variety of local and nonlocal stone was brought to the site, and heat treatment was uncommon.

Local materials dominated the lithic assemblage from Clearview. Black chert, gray chert, and rhyolite comprised 85% of the assemblage. A short survey of the seasonal Jarvis Creek, 2 km west of the site, resulted in the recovery of large cobbles of each of these materials. Previous toolstone surveys suggest that these materials are also easily found in eroding glacial kames throughout the area (Esdale et al. 2015). These sources are within 20 km of the site, or a day's walk, and meet Surovell's (2009:78) definition of local toolstone. Cortex present on primary reduction debitage appears to be cobble cortex, further indicating that these materials were collected from riverbeds rather than mined from geological sources. Based on the results of a comparative visual analysis, the overwhelming majority of raw materials used at Clearview are locally abundant.

The assemblage contains at least one type of obsidian derived from a nonlocal source. Alaska archaeologists have generated comprehensive geochemical profiles of Alaska obsidian using portable X-ray fluorescence and have identified four sources of this raw material across the region (Reuther et al. 2011). One obsidian microblade was conclusively sourced to Wiki Peak, located more than 300 km to the southeast in the Wrangell–St. Elias Mountain range (Doering et al. 2019). Seven additional microblade fragments were tentatively sourced to Batza Tena, though these fragments were too small for a confident quantitative sourcing assessment. Nevertheless, it is clear from these data that occupants of Clearview used obsidian from at least one distant source. Aside from obsidian, exotic or nonlocal materials within the assemblage are more difficult to assess with certainty. Other potential nonlocal materials include fine-grained red and white chert, chalcedony, and jasper (Esdale et al. 2015).

Early Stage Core Reduction

Early reduction debitage, identified by the presence of cortex on individual pieces, flake scars, and overall size, represented only 9.3% of the total assemblage. Only cobble cortex was identified in the assemblage, indicating that no materials were quarried from bedrock outcrops. None of these pieces were produced on exotic raw materials, and 80.7% were produced on rhyolite, black chert, or gray chert. Further, no cobble cores or tested cobbles were recovered during excavations at Clearview. Overall, early reduction debitage comprises a small part of the overall assemblage and is made from the dominant local raw materials.

Bifacial Technology

Bifacial projectile points and projectile point fragments represent approximately one-third of the tools within the Clearview assemblage (32.7%). More than half of the bifacial technology in the assemblage is fragmentary, with only five complete bifaces. Nevertheless, fragmentary and complete bifacial technology in the assemblage indicates that at least three styles of bifacial technology were used at the site: bifacial knives, lanceolate projectile points, and straight-based projectile points. Only two of the 18 bifaces or biface fragments were made on a potentially nonlocal type of chert.

In comparison, nearly two-thirds of intact debitage (74.8%) is related to the reduction of large flakes or blanks into bifaces, reflecting the importance of intermediate bifacial reduction at the site. However, bifacial pressure flakes, typically removed with soft percussion to sharpen or resharpen the edge of a biface, were not common and represent only 12.0% of bifacial debitage. Additionally, the assemblage contains only one biface blank and no bifacial cores associated with early bifacial production. The lack of blanks and bifacial pressure flakes is surprising given the quantity of bifaces and biface fragments at the site and extensive evidence for intermediate bifacial reduction in the assemblage. Finally, very few pieces of bifacial debitage were produced on nonlocal materials (6.0%) in contrast to microblades and related debitage (see below), reflecting general trends for raw material use observed in bifacial tool fragments recovered from the site.

Blade Technology

Three microblade cores or core fragments, three blade fragments, and 155 microblades are present in the Clearview assemblage. However, no microblade core tablets or blade cores were recovered. The three microblade cores recovered at Clearview are all consistent with a wedge-shaped style that is common in Alaska assemblages from the mid- to late Holocene (Coutouly 2012). Two cores were made on biface fragments and one was made on a large flake, suggesting that the use life of raw materials at Clearview was extended by converting spent bifaces into microblade cores. Further, several crested blades in the assemblage provide additional evidence that microblades were commonly made on expended bifaces or biface fragments. This style is common in the small number of Alaska assemblages containing microblades that have been dated to the late Holocene (Holmes 2008).

Two of the three microblade cores are made from potentially nonlocal or rare red chert and agate, and the third is made of rhyolite, which suggests that microblade production served to conserve rare toolstone. Three blade fragments were recovered from Clearview. Two of these blade fragments refit and show signs of retouching. These blades are nearly 2 cm wide and significantly larger than the microblades in the assemblage, and no cores or core fragments were recovered, suggesting that these finished blades were brought to the site. All three fragments are made from chert, though the two refitting and retouched fragments are the only examples of dark red fine-grained chert in the assemblage, suggesting that this material may be locally rare or exotic.

Microblades and debitage related to microblade production were present but not abundant in the overall assemblage (11.0%). This indicates that bifacial production was significantly more important than microblade production. Further, debitage related to microblade production contains many exotic pieces (12.1%), including 15 pieces of obsidian, one of which was confidently sourced to Wiki Peak. The results of a Fisher's exact test that compared the use of exotic and local materials in the production of bifacial and microblade technology indicated a statistically significant ($p = 0.01$) difference between the raw materials selected for biface and microblade reduction.

Other Lithic Technologies

Unifacial scrapers and fragments represent 20% of the overall tool assemblage. Of these, one is a side scraper while the vast majority appear to have been used as end scrapers. Additionally, one unifacial tool appears to be a composite end scraper and shaft straightener. Unifacial technology at Clearview was overwhelmingly produced on locally available raw materials such as gray chert and black chert, though there are two complete chalcedony end scrapers present in the assemblage. This indicates that bifacial technology and unifacial technology raw material use strategies were approximately equivalent at Clearview.

Complete pieces of debitage linked to unifacial production represented a very small part of the overall debitage assemblage (0.7%), in contrast to the number of unifacial tools and tool fragments recovered ($n = 11$) during excavations at Clearview. The low number of intact debitage related to unifacial production may relate to the difficulty of distinguishing between bifacial and unifacial debitage, particularly pressure flakes, and the short reduction sequence of unifacial tool technology (Esdale 2009). However, this may also indicate that unifacial tools were used at Clearview but not produced on the same scale as bifacial or microblade technology.

The assemblage contains three transverse burins and five diagnostic burin spalls that were generated through burination, or edge modification of a flake for use as a graver or scraper (Barton et al. 1996). While the three burins were made from locally abundant raw materials, the burin spalls comprised red and white cherts that may be less abundant in the region. With such a small sample, it is not possible to determine whether the difference in raw material selection for specific technologies is statistically significant. However, burin production certainly employed a variety of raw materials.

Finally, utilized and retouched flakes were likely used as expedient tools and represent 23.6% of the tools at Clearview. These may have been used as flake knives during the occupation of the site and were made on locally available raw materials, including rhyolite, black chert, and gray chert.

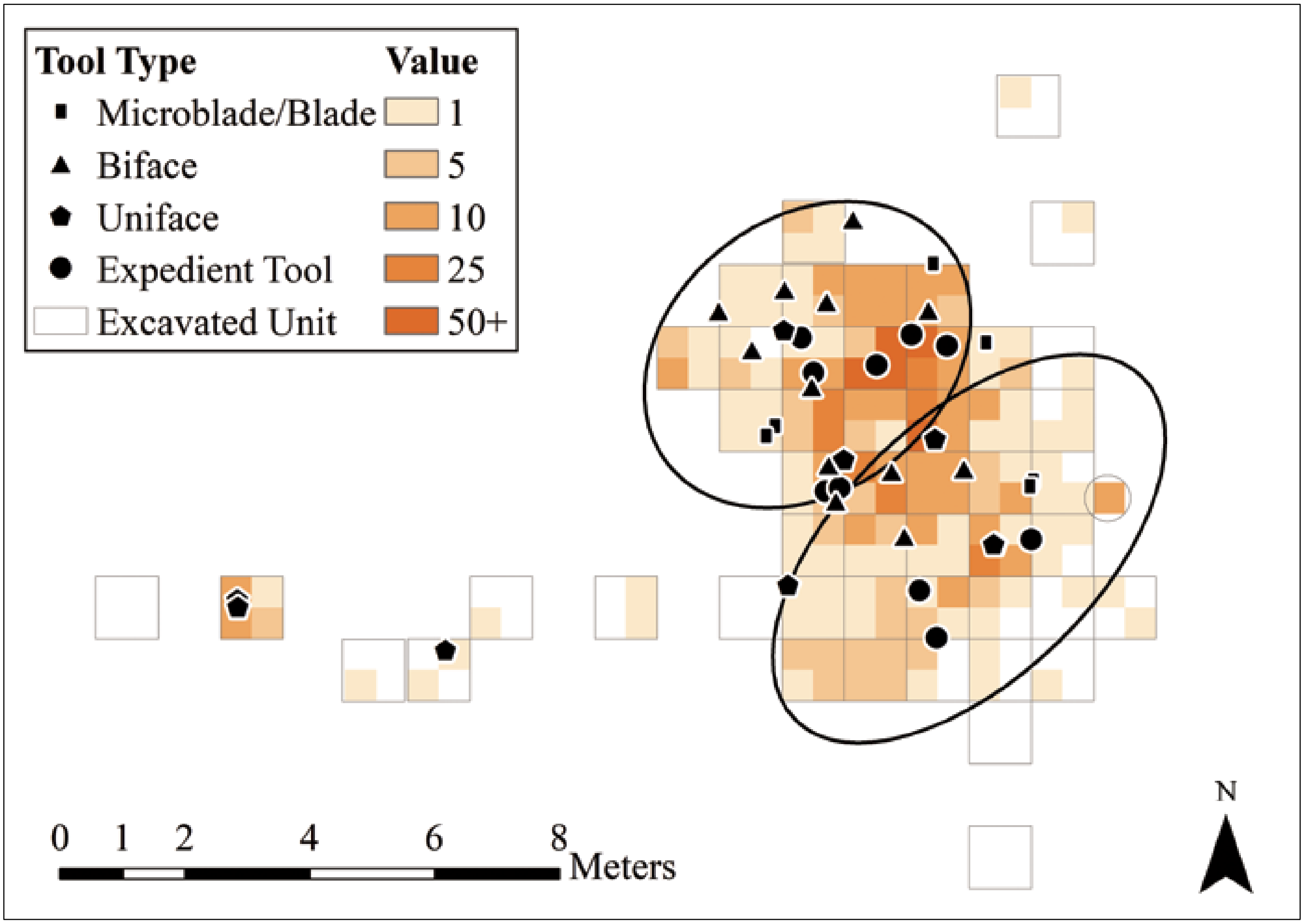

Figure 6. Lithic technology recovered from the excavated area of the site. Illustrated by Briana Doering.

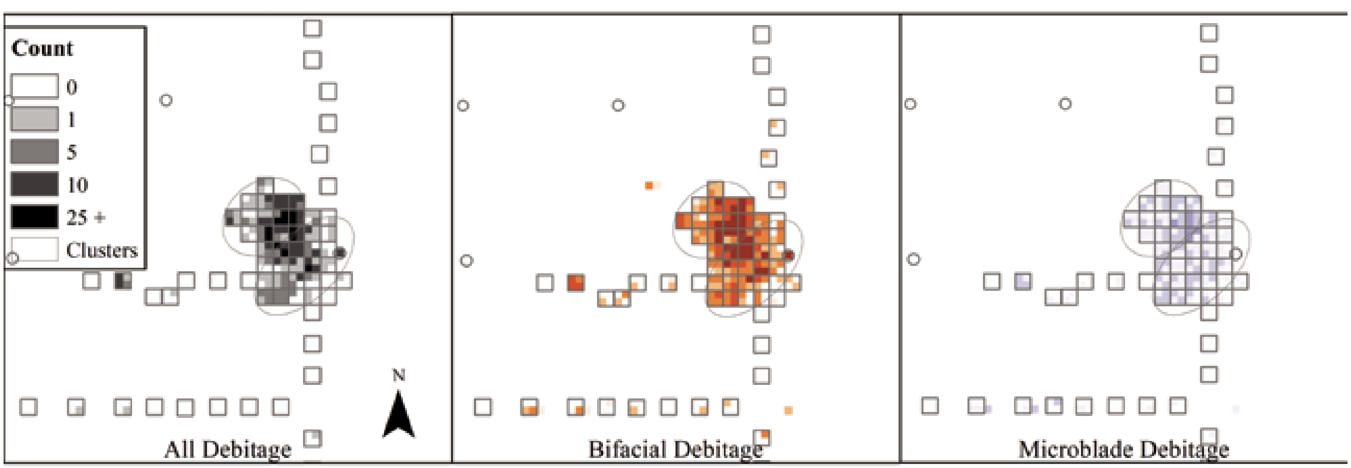

Figure 7. Debitage clusters by functional type; one square = 1 m^2.

Spatial Analysis

To preliminarily identify spatial patterns in artifact use and manufacture at Clearview, the distribution of diagnostic tools and tool fragments was compiled in ArcGIS Desktop 10.6 (Fig. 6). A series of *k*-means cluster analyses of tools, raw materials, and complete debitage conducted in RStudio showed two likely activity areas within the central excavation block. The composition of the two activity areas was compared to determine whether any significant differences in raw material and tool types existed, which could relate to differences in tool production activities. The difference in number of debitage pieces related to microblade and bifacial production in the two activity areas is not statistically significant ($p = 0.49$), indicating that both tool types were produced in similar numbers in both areas (Fig. 7). Early and intermediate bifacial reduction also occurred in both loci with no significant differences in distribution ($p = 0.55$). However, late bifacial reduction occurred at a slightly higher rate than early reduction in the smaller southern cluster ($p = 0.044$).

In contrast, raw material use varied significantly between the two areas (Fig. 8). Specifically, the difference in the amount of black chert and rhyolite tools and debitage is statistically significant ($p < 0.001$) between the two clusters, as was the amount of black chert and gray chert tools and debitage ($p < 0.001$), and gray chert and rhyolite ($p < 0.001$). These data suggest that black chert and rhyolite were primarily used in the northern activity area, and gray chert was primarily used in the southern activity area (Fig. 8). However, local and nonlocal material distributions do not differ significantly ($p = 0.09$) between the two clusters, indicating that the production of tools on nonlocal materials took place in both activity areas.

TECHNOLOGICAL ORGANIZATION AT CLEARVIEW

The results of the comprehensive lithic analysis presented above provide several correlates of human behavior that suggest the North Lobe WRA event did not generate a sudden wide-scale shift in mobility, diet, and organization among central Alaskans. First, the high artifact class richness and diversity of raw materials at Clearview indicate that the site was used for a relatively long period of time and implies that the site likely served as a residential base, not a logistical hunting camp. Second, exotic raw materials recovered from Clearview, including Wiki Peak and likely Batza Tena obsidian, suggest that patterns of long-distance exchange and/or high regional mobility persisted after the North Lobe WRA event. Finally, the complex reduction sequence and diverse toolkit described above does not appear consistent with expectations for a resource-poor environment. Combined, the aspects of the lithic assemblage indicate that the North Lobe WRA event did not produce a sudden, drastic shift in behavior among central Alaskans.

The extensive excavations at Clearview failed to recover any faunal materials that could have shown how subsistence strategies may have shifted during this period. Archaeologists have associated the lack of faunal materials at Alaska archaeological sites with acidic soils, which are common in coniferous boreal forests (Ping et al. 2008; Yesner 2001). Previous research has shown that faunal remains are best preserved in neutral (pH = 7) or slightly alkaline (pH = 7.5–8) soil environments (Nicholson 1996). In contrast, acidic soils with a pH of 3.5–4.5 provide the worst environment for faunal preservation, though low soil

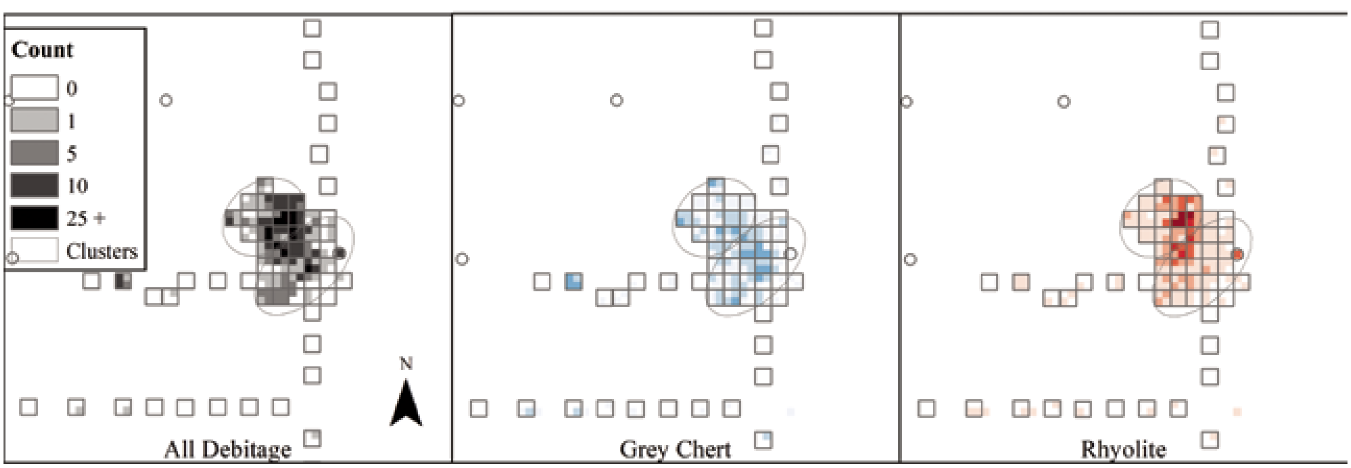

Figure 8. Debitage clusters by material type; one square = 1 m². Illustrated by Briana Doering.

pH can also limit the growth of destructive microbes and does not necessarily connote a poor preservation environment (Manifold 2012). However, low soil pH, along with the complete lack of faunal material at Clearview, suggests that any faunal remains deposited during the site's occupation have subsequently decomposed in these acidic soils. Nevertheless, Clearview offers a wealth of lithic data that can be related to other sites to reveal larger patterns in mobility and land use.

The lithic assemblage from Clearview is comparable to Northern Archaic residential camps in the vicinity, such as Banjo Lake. This neighboring site features a similar and complex reduction sequence, diverse raw materials, obsidian sourced to Batza Tena, and assorted tool types (Esdale et al. 2015). However, the reduction sequence at Banjo Lake is incomplete across raw material types, meaning that the assemblage does not contain artifacts that represent the full sequence of lithic production for any single material type. This suggests that tools were made or maintained on whatever raw materials were available. Additionally, the site features extensive evidence for late-stage bifacial reduction and retouch. In contrast, Clearview's assemblage represents the full sequence of lithic reduction in artifacts of each material type, and few late-stage bifacial reduction and retouch flakes were recovered during extensive excavations. This important contrast in intra-assemblage variability suggests that the residents of Clearview may have been preparing tools for use at a logistical camp rather than refining tools for immediate use (Binford 1979). However, more assemblage and subsistence data from this and other sites from the late Holocene are necessary to identify larger patterns in mobility and landscape use at this transitional period.

CONCLUSION

The broad range of lithic technology and raw materials present at Clearview indicate that a group of residentially mobile hunter-gatherers occupied the site for a relatively long period of time. As a peripheral upland site with extensive evidence for large mammal hunting, represented indirectly by large lanceolate projectile points and hide working tools, Clearview is comparable to a summer or fall camp, according to Potter's (2016:548) model of seasonal subsistence for the Northern Archaic tradition. The focus on intermediate lithic production suggests that Clearview's residents may have been transitioning from high mobility to semisedentism, but additional excavations and analysis from other central Alaska sites from this period are necessary to conclusively reconstruct shifting late Holocene settlement patterns. The lithic assemblage associated with this single occupation provides critical information relating late Holocene subsistence, technology, and mobility that can be used to clarify broader archaeological understandings of human activity through Alaska's history.

The research presented here provides further evidence that materials excavated as part of larger public works projects have the potential to address some of the most interesting debates in Alaska anthropology. The lithic assemblage recovered from Clearview provides a critical lens on central Alaska life around a time of significant behavioral changes. Modeling patterns of site use and residential mobility using a typological assessment of debitage can further our understanding of hunter-gatherer mobility and subsistence in central Alaska. Additional research on lithic assemblages from the late Holocene can enhance our understanding of life at the cusp of a major behavioral transition.

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