REPORT

BANJO LAKE: A MIDDLE HOLOCENE SITE IN THE TANANA VALLEY

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ABSTRACT

Nearly 6,000 years ago, a group of people stopped to camp on a ridge overlooking Banjo Lake in interior Alaska. Climate indicators show spruce moved into the area and a period of surface stabilization occurred just prior to the occupation of the site. The bone and stone artifacts left behind provide clues not only to camp structure and subsistence activities but also to lithic technological organization. This study uses spatial analyses, minimum nodule analyses, and individual flake analyses to determine when and how lithic raw materials and tools entered the site. The Banjo Lake assemblage is different from traditional middle Holocene assemblages in the North as it is focused on microblade technology and therefore supports expanding our notion of the Northern Archaic.

The Banjo Lake site (XMH-00874) is a middle Holocene-age campsite located on a kame and esker complex southeast of Delta Junction, Alaska (Reger et al. 2008) (Figs. 1, 2). Excavations at the site demonstrate a wide variety of raw materials in late stages of bifacial tool and microblade production. Geological indicators suggest soil stabilization around the time of site occupation with well-established shrub vegetation and a regular fire history. These investigations provide a snapshot into the technological organization of subarctic hunter-gatherers.

Archaeological sites dating to the middle Holocene are prevalent in interior Alaska (Potter 2008a, 2008b). Site density appears to increase after about 6,000 years ago, coinciding roughly with the Northern Archaic Tradition and the appearance of side-notched projectile points (Esdale 2008; Potter 2008a). Anderson originally proposed the Northern Archaic Tradition to describe particular stratigraphic horizons at the Onion Portage site in northern Alaska that contained notched and oblanceolate projectile points and dated between 6,000 and 4,200 years ago (Anderson 1968, 2008). Significantly, the tradition included end scrapers, bifacially flaked knives, heavy cobble tools, net sinkers, and the complete absence of any core and blade material. Several competing concepts, such as the Northwest Microblade Tradition (MacNeish 1959), Late Denali (Dixon 1985), and the Taiga Period (Holmes 2006, 2008), included sites with microblades that were thought to date from the middle to late Holocene (see other less prevalent concepts in Esdale 2008).

The Northern Archaic Tradition has remained the most popular term for discussions of the middle Holocene time period in interior Alaska and coastal Alaska before the onset of the Arctic Small Tool Tradition. The Northwest Microblade Tradition never gained a foothold on the American side of the Alaska–Yukon border and was believed to include sites with mixed assemblages or

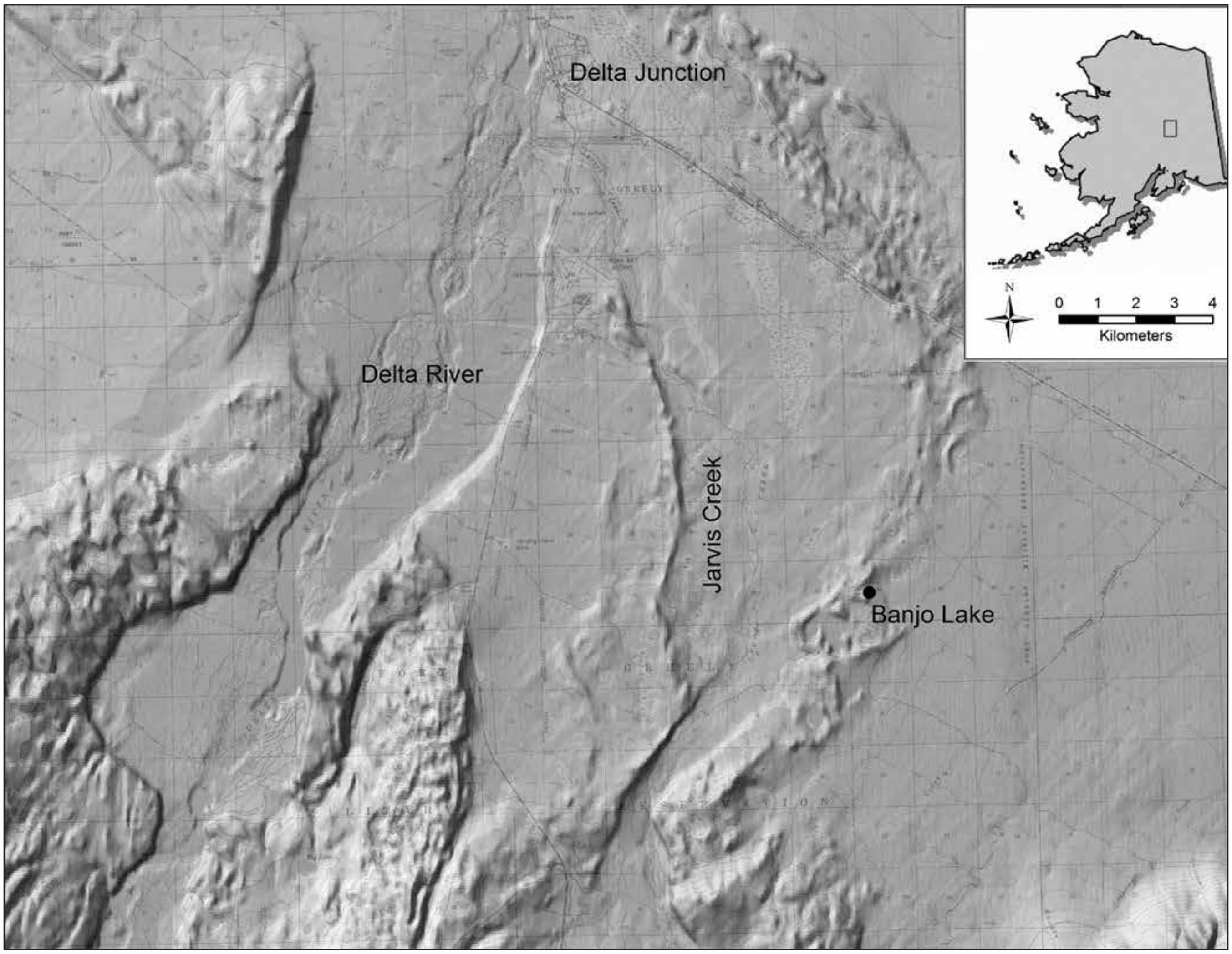

Figure 1. The Banjo Lake site in interior Alaska.

palimpsest deposits. The Late Denali has been primarily used to describe wedge-shaped cores and microblades in later Holocene contexts. Holmes' Taiga Period addresses the coexistence of core and blade technology and notched projectile points in middle Holocene strata of unmixed sites, but the concept has not yet gained popularity. More often researchers have chosen to retain the term Northern Archaic and simply allow for a broader toolkit (e.g., Esdale 2008; Potter 2008a; Rasic and Slobodina 2008).

Research on middle Holocene sites over the last several decades has shown lithic assemblages to be quite diverse (Clark 1992; Cook and Gillespie 1986; Esdale 2008; Potter 2008a). Banjo Lake is among the sites broadening the definition of Northern Archaic assemblage composition. Artifact assemblages associated with the Northern Archaic can vary but generally contain myriad tools ranging from bifacial knives and microblades to end scrapers and side-notched points (Esdale 2008). Middle Holocene hunter-gatherers had a subsistence economy focused on seasonally abundant game, including caribou, fish, and moose (Potter 2008a, 2008b). These kinds of assemblages occur in many sites in interior Alaska, including over a dozen on U.S. Army lands (e.g., XMH-277, XMH-283, XMH-303, XMH-309, XMH-874, XMH-950, XMH-1130, XMH-1168, XMH-1300; Raymond-Yakoubian and Robertson 2005; Robertson et al. 2004). Several sites (FAI-02043, XBD-270, XMH-915, XMH-925), including the excavated Banjo Lake site, have also produced middle Holocene dates from hearth charcoal. The middle Holocene dates from Banjo Lake were also associated with a microblade component (Robertson et al. 2008; Robertson, Gaines, et al. 2009).

This paper presents a detailed report of excavation activities at the Banjo Lake site and the results of lithic, fau-

Figure 2. Banjo Lake site, facing northwest.

nal, spatial, and geoarchaeological analyses. A processual approach taken here to the interpretation of stone tool and debitage analyses aims to reconstruct site activity areas, determine tool life histories, and reconstruct the movement of raw materials in and out of the Banjo Lake site.

Technological analyses of knapped stone aimed at reconstructing tool production sequences and tool life histories have implications for assemblage variability, hunter-gatherer mobility, and technological organization (Bleed 1986; Hayden et al. 1996; Odell 2004). Tool production and use sequence were derived from the Banjo Lake assemblage using typological analyses based on replication and refitting experiments (e.g., Flenniken 1984; Le Blanc and Ives 1986; Pecora 2001; Yerkes and Kardulias 1993), described by several archaeologists (Ackerman 1996; Andrefsky 1987; Bleed 1996; Bryan 1960; Deller and Ellis 1992; Esdale 2009; Flennikin 1987; Frison 1968; Le Blanc and Ives 1986; Magne 1985; Magne and Pokotylo 1981; Newcomer 1971; Odell 1989; Rasic 2000; Tomka 1989; Towner and Warburton 1990; Tuohy 1987; Wheat 1975), and used elsewhere by one of the authors (i.e., Esdale 2009).

THE BANJO LAKE SITE

The Banjo Lake archaeological site is located on late Pleistocene loess-mantled glaciofluvial deposits and overlooks Banjo Lake, located 200 m to the southwest, visible through the spruce and aspen covering the site. A small portion of the surface is exposed immediately south of the crest of the ridge amongst small shrubs, moss, and lichen, although surface visibility is minimal over most of the site.

Banjo Lake was identified and found eligible for the National Register of Historic Places by William Hedman during the 2002 survey and testing of the eastern portion of Fort Wainwright's Donnelly Training Area (DTA) (Hedman et al. 2003). Over 250 flakes, microblades, and broken tools made from rhyolite, basalt, a variety of cherts, and obsidian were found in surficial and buried contexts during this initial investigation.

The site was excavated by Aaron Robertson with a crew from Colorado State University in 2006 and 2007 in advance of construction for military training. During the two field seasons, over 234 m^2 were excavated, producing over 7,000 pieces of stone tools and flaking debris representing both bifacial and core and blade technologies, over 7,000 animal bone fragments, and a hearth feature. Additional shovel test pits were excavated north and south of the site in 2008 to verify site boundaries. Two technical reports (Robertson et al. 2008; Robertson, Esdale, et al. 2009) have been written about the excavations and are on file with the U.S. Army and with the Alaska State Historic Preservation Officer (SHPO).

EXCAVATION METHODS

Excavation focused on the portion of the landform expected to be affected by construction activities. A large block was excavated in the center of the hill with linear trenches running north and south (Fig. 3). Units were excavated with hand trowels by stratigraphic level. The location of all cultural material was recorded using a Sokkia Set 6 Total Station™ and sediment was screened through ⅛" hardware cloth. Artifacts were cleaned and catalogued using guidelines from the University of Alaska Museum of the North (UAMN) and are housed at that facility (UA2011-94, UA2011-231, UA2011-241). Charcoal was recovered for chronological control, and stratigraphic layers were carefully recorded and sampled for geoarchaeological analyses.

The excavation techniques at Banjo Lake allowed for a detailed spatial analysis of all archaeological material. Three-point provenience provided the precise distribution measurements for artifacts. Quadrant and level designations, however, were an adequate source of information in all cases to delineate separate tool-making clusters and to identify possible structures, especially when raw materials were taken into account. The artifact frequency by depth at Banjo Lake is consistent with a single component site. The majority of flakes and other materials were buried in stratigraphic layers 2 through 3, approximately 10–25 cm below surface. Flake frequencies by depth produced normal curves with single peaks in artifact densities in all excavation areas across the site.

Artifacts were analyzed in the horizontal plane to define cluster boundaries, designate specific activity areas within the site, identify spatial relationships between refitted artifacts, and recognize relationships between artifacts and hearth features. Two-dimensional spatial data for each flake and tool recorded during excavation were mapped in ARC GIS. Once plotted, artifact distributions were analyzed based on a variety of characteristics (e.g., raw material type, debitage category, presence of thermal alteration,

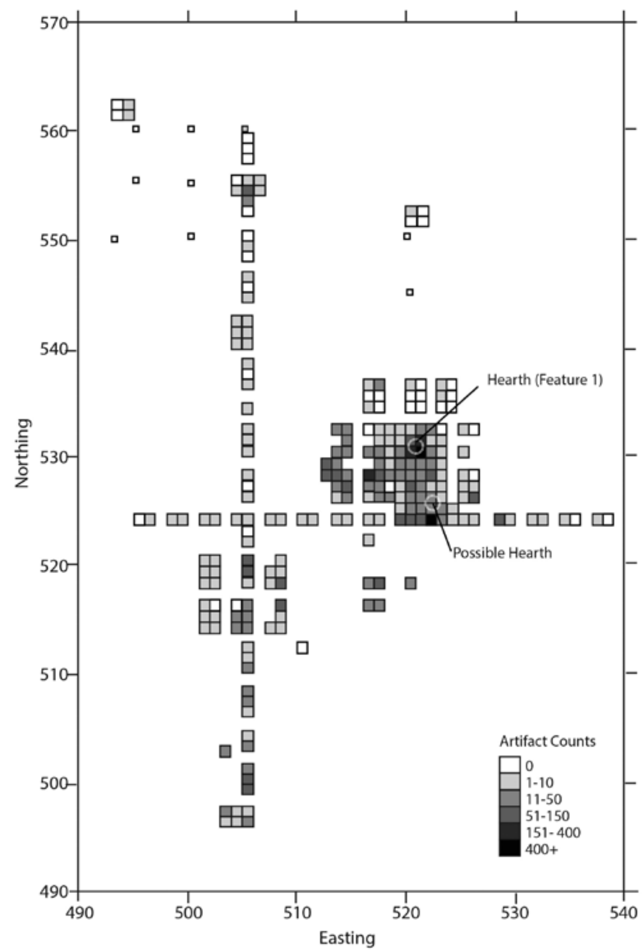

Figure 3. Lithic and faunal artifact densities in excavation units at Banjo Lake.

or presence of cortex). When artifacts were plotted by raw material type, activity-related spatial patterns emerged.

Excavations revealed a clear hearth feature at N531 E520 in the main excavation area (Fig. 4). Spatial data demonstrated that charcoal and thermally fractured artifacts cluster in this area as well as in another area at N524 E522. It is likely that there was a second hearth location and the hearth was either not excavated or was too diffuse to identify during fieldwork. Given that intense heating creates iron oxides and other magnetic minerals (Evans and Heller 2003), the base of the excavated hearth was sampled horizontally and analyzed for magnetic susceptibility in order to characterize the extent and relative magnitude of the magnetic signature (Fig. 5). Magnetic susceptibility is an extremely robust variable and, because of this and its relative ease of measurement, has long been used in archaeological settings to determine the impact of past human activity (Clark 1996). Cultural materials may either enhance the magnetic signal of the soil through fire

Figure 4. Hearth feature from N530 E521 at Banjo Lake.

or the addition of other enhanced materials, or reduce the magnetic signal, as in organic-rich middens.

SITE STRATIGRAPHY AND GEOLOGICAL CONTEXT

Pleistocene glaciation and Holocene aeolian activity have shaped the parent material in which the Banjo Lake site was deposited. The loess mantle overlying the glacial kame and esker deposits has been overprinted by the modern soil at the site, a Eutrocryept with Oe (0 to ~3 cm), Bw/Ajj (~20–50 cm) (a young soil formed under cold climate conditions with a moderately well decomposed organic horizon), 2BC/CB (> ~50 cm) horizonation, developed under a shrub and conifer cover. Because of the shallow nature of the site and lack of major changes in grain size through the profile, sediment color was used to classify the major stratigraphic units (Strata I–IV) at the site (Fig. 6). Therefore, these primary units correspond closely with soil horizons.

The deepest parent material (Stratum IV) is poorly sorted glacial outwash derived from subglacial kames and eskers (Reger et al. 2008). This stratum has fine sand-size to cobble-size clasts with intermittent well-sorted sand lenses. No cultural material was found in this stratum, and excavation units were terminated when it was clear that this material had been reached, at about 50 cm below surface. All strata above glaciofluvial deposits are comprised of silt with varying degrees of soil development.

Stratum III is equivalent to the boreal forest soil's C horizon (unaltered sediment) and is made up of largely unaltered aeolian silty sand-size grains. Roots and cobbles are rare in this layer and there is variation across the site in the thickness of the horizon. The cultural remains cluster in the C horizon at approximately 30 cm below surface. Just below the archaeological materials is a pedogenic lamella, common within soils of the region (Dilley 1998), formed by the downward movement of clay and iron oxide through the soil profile (Miles and Franzmeier 1981; Rawling 2000). This stratum demonstrates little biological disturbance and evidence of cryoturbation varies from little to significant across the site, mixing the upper Stratum II (pedogenic B horizon or middle soil horizon with accumulated soluble organic material and minerals) with unaltered parent material in some places.

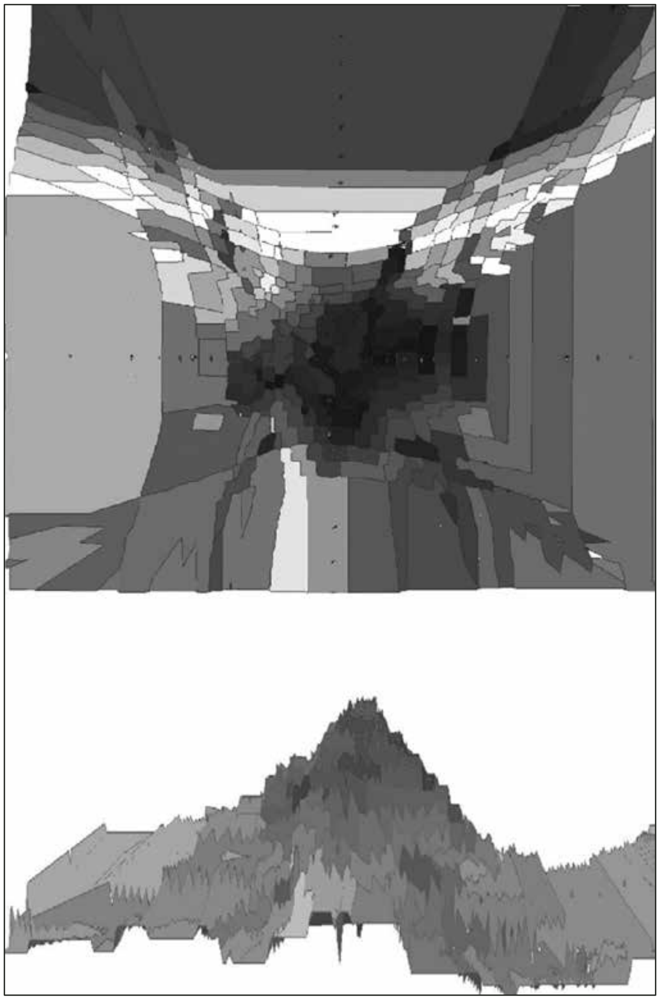

Figure 5. Both 2-D and 3-D renderings of the magnetic susceptibility signal from the hearth feature. The upper vertical 2-D image depicts the focus of the hearth and the lower 3-D oblique image depicts the relative magnitude of the fire-induced magnetic signal. Horizontal dimension of the image is 90 cm.

Stratum II is equivalent to the boreal forest soil B horizon. It is made up of fine silt further separated into three substrata defined by color differences. These differences are sometimes attributed to iron oxidation from wetting and drying cycles (mottling not present in IIa but present in IIb) and in the case of IIc, to decreasing organic content.

Stratum I encompasses both the O (organic horizon; Stratum I) and A horizons (upper mineral soil horizon; Strata Ia and Ib) of the forest soil as well as a thin ash layer (Stratum Ic). The ash has frequent charcoal flecks, varies in thickness from 0.5 to 5 cm, and likely resulted from a forest fire. The soil A horizon (Strata Ia and Ib) occurs immediately beneath the root mat. It has high densities of charcoal and roots, but the fine silts have little evidence of either bioturbation or cryoturbation. Some thick pockets of ash resulting from a 1955 fire are found in this stratum. The root mat or organic horizon (Stratum I) varies in thickness from 1 to 7 cm, depending on landscape position and the degree of surface compaction. High charcoal densities result from the 1955 fire, and signs of bioturbation are abundant.

SITE CHRONOLOGY

Six AMS radiocarbon dates were produced from charcoal samples in two locations across the site (Table 1). The first location, N531 E520, was a hearth area in the center of the site (Figs. 4, 5). The second area, N516 E505, had charcoal at the base of the cultural zone, and the samples are interpreted as possible limiting dates for the occupation. Apart from the one late Pleistocene date, which was on a birch twig, all of the radiocarbon dates are consistent with a middle Holocene occupation of the site.

Table 1. Radiocarbon dates from Banjo Lake charcoal. Wood was identified by Claire Alix. Calibrated online using curve from Fairbanks et al. (2005) at http://radiocarbon.ldeo.columbia.edu/research/radcarbcal.htm.

Field #	Location N/E	Wood Taxon	RCYBP	cal Years BP	Lab No.
2800	531/520	Pinaceae family	5720 ± 50	6650–6400	Beta-227160
1728	516/505	*Picea* sp. / *Larix* sp.	5990 ± 50	6950–6720	Beta-227158
3063	531/520	*Betula* sp.	10870 ± 60	12930–12800	Beta-227161
2692	516/505	*Picea* sp. / *Larix* sp.	5900 ± 50	6850–6640	Beta-227159
9598B	531/520		5460 ± 40	6310–6200	Beta-271220
9598B	531/520		5450 ± 40	6300–6190	Beta-271221

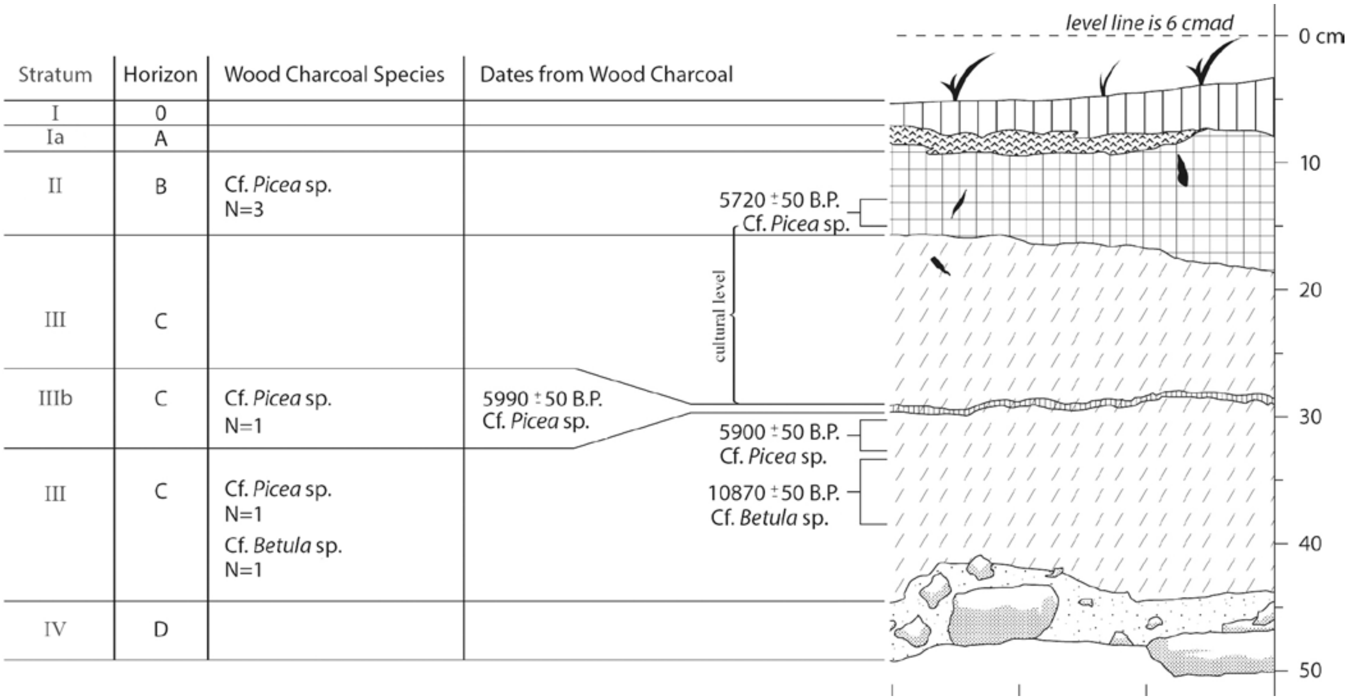

Figure 6. Generalized stratigraphic profile from the Banjo Lake site.

PALEOENVIRONMENT

The paleoenvironmental history of the site was reconstructed from the glacial and soil stratigraphy, stable isotope data ($\delta^{13}C$), magnetic susceptibility patterns, particulate charcoal distribution, and biogenic silica (e.g., phytolith) data. Studies show that a large proportion of the phytolith record at a site represents localized deposition and phytoliths are therefore reliable indicators of site vegetation (Piperno and Pearsall 1988). Eight samples were collected from a vertical profile for phytolith and charcoal analyses and processed using techniques in Johnson and Bozarth (2008).

Phytolith data from the outwash-loess transition and lower loess mantle (Strata III/IV) indicate the site was occupied by a treeless C_3-dominated grassland and is interpreted as a cold, slightly mesic environment. A tenfold increase in phytolith concentration from Stratum IV to III indicates a relatively stable surface at the lower loess level (Stratum IIId). Although a cold, treeless grassland environment is indicated by Stratum IIIb, conditions were more mesic than earlier, with surface stability increasing. Data from the lowermost cultural zone (Stratum IIIa) display a shift in C_3 grass species, appearance of a shrub component, significant surface stability, and regional fire occurrence. *Picea glauca* (white spruce) and fine particulate charcoal appear in Stratum II and continue into Stratum Ic, at which time *Alnus* sp. (alder) enters the community and charcoal concentration increases. Near the surface, in Stratum I, *P. glauca* declines about 50%, *Alnus* increases ten-fold, and *Betula* sp. (birch) appears. High frequencies of algal statospores in the uppermost strata indicate that the upper soil presently remains moist for an extended period of time during the year due to rain and snowmelt. There is also a 4.5-fold increase in charcoal concentration and increase in charcoal particle size, which suggest commonly occurring local fires.

Several paleoecological studies have been reported for interior Alaska (e.g., Anderson et al. 2004; Bigelow and Edwards 2001), and the Tanana River valley was the focus of some of the earliest work (see Ager 1975). Notably, the *Picea* rise at about 6.8 kya has been documented within the region and corresponds with major surface stabilization and occupation at XMH-00874. The site was occupied between 6,000 and 5,000 years ago when the boreal forest was fully established and local site vegetation was probably very similar to modern times.

ANALYSIS AND INTERPRETATION OF ARCHAEOLOGICAL MATERIAL

LITHIC RAW MATERIALS

The lithic assemblage at Banjo Lake is made up of a variety of volcanic rocks (31%), over a dozen different kinds of chert (68%), metasedimentary rocks (< 1%), and sedimentary rocks (< 1%). Raw materials were separated based on observable characteristics such as color, luster, grain size, cortex type, and fracture characteristics (Brantingham et al. 2000; Kelly 1985; Knell 2004; Larson 1994). Using these traits, twenty-four different material types were recorded at XMH-00874 (Table 2).

Provenance studies have only been conducted for obsidian, but quartzite is known from geological maps to outcrop within 50 km of the site. Cherts and volcanic rocks other than obsidian are found in the Alaska Range approximately 100–150 km southwest of Banjo Lake and may occur in glacial and alluvial deposits closer to the site (Beikman 1980; Nokleberg et al. 1982; Reger et al. 2008).

Obsidian samples were analyzed by the Smithsonian Institution's Museum Conservation Institute using an X-ray fluorescence (XRF) spectrometer and/or laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) (see Slobodina and Speakman 2008 for a complete description of these methods). Of the 53 obsidian artifacts analyzed, 51 came from Batza Tena, a major obsidian source in northcentral Alaska approximately 450 km to the northwest, and two samples came from Wiki Peak, a mountain in southeastern Alaska approximately 280 km southeast of the site.

Table 2. Raw material frequencies in the Banjo Lake assemblage.

Raw Material		Quantity	Percent
Volcanic Rocks (31%)	andesite	1	0.02
	basalt	610	13.18
	rhyolite	420	9.08
	gray rhyolite	306	6.61
	obsidian	76	1.64
Cherts (68%)	banded black chert	5	0.11
	banded gray chert	3	0.06
	black and gray chert	30	0.65
	black chert	1,785	38.57
	brown chert	1	0.02
	chalcedony	60	1.3
	dark gray chert	179	3.87
	green chert	32	0.69
	gray chalcedony	2	0.04
	gray chert	408	8.82
	red chert	18	0.39
	speckled black chert	2	0.04
	white and gray chert	588	12.71
	white chert	6	0.13
Metasedimentary Rocks (< 1%)	gray quartzite	80	1.73
	rose quartz	1	0.02
	white quartzite	3	0.06
	slate	1	0.02
Sedimentary Rocks (< 1%)	limestone	9	0.19
	sandstone	2	0.04
Total		**4,628**	**99.99**

LITHIC TECHNOLOGY

The goals of the Banjo Lake assemblage flaked stone tool analyses were to identify and describe the different technological processes and tool reduction strategies used by site occupants, describe and explain the composition of the total assemblage with reference to raw material availability in the surrounding area, and compare this assemblage with other assemblages from the region. The analysis includes 100% of formal tools and 70% of the debitage component.

The results of the debitage analysis are provided in Table 3. These data indicate that initial core reduction from stone nodules was not a common on-site activity. Only eighteen flakes in total retained cobble cortex, and most of the initial core reduction flakes found were interior flakes. This was true for almost all raw materials. Primary reduction flakes make up large percentages of the quartzite (33%), andesite (67%), and slate (100%) flakes found on site. Nearly 20% of basalt flakes and 10% of green chert flakes were core reduction flakes, but for most raw materials they were a minor component (0–10%). Only one flake core, consisting of rose quartz, was found on site. Primary decortication flakes were removed from the face of the core but cobble cortex was still present on the exterior and little further alteration occurred. These data suggest that the majority of raw materials came to Banjo Lake as flake or biface blanks.

Table 3. Debitage counts by raw material and reduction sequence

Raw Materials	Initial Core Reduction Flakes					Microblade Core Reduction Flakes								
	primary decortication	secondary decortication	interior flake	*n*	%	core tablet	crested blade	core face rejuvenation	platform ridge	platform rejuvenation	linear flake	microblade	*n*	%
andesite	2			2	66.7									
basalt		1	7	8	1.2	3	1	2	2	7	8	29	52	8
black and gray chert			1	1	7.1	1							1	7.1
brown chert												1	1	100
basalt	11	1	28	40	18.3			3				1	7	1.8
chalcedony			2	2	7.7						1		1	3.8
dark gray chert			1	1	1.7						1		1	1.7
gray chert			4	4	1.4		2		1		3	111	117	42.1
gray chalcedony														
green chert			2	2	10.5									
gray rhyolite	1		6	7	5.6					1	1		2	
banded black chert														
banded gray chert														
obsidian			1	1	3.1							1	1	3.1
quartzite	2		3	5	33.3							1	1	6.7
red chert												2	2	25
rhyolite			5	5	2.6		1	2		1	1	14	19	9.8
slate			1	1	100									
white chert												1	1	25
white and gray chert			1	1	0.5		1				3	2	6	3
white quartzite														
Total	**16**	**2**	**62**	**80**	**4.3**	**4**	**5**	**7**	**3**	**9**	**18**	**163**	**209**	**11.3**

Raw Materials	Biface Production Flakes							Uniface Production Flakes			All
	early bifacial thinning	late bifacial thinning	bifacial pressure	edge preparation	alternate flake	*n*	%	unifacial pressure	*n*	%	*n*
andesite				1		1	33.3				3
basalt	3	29	341	187	21	581	89.2	10	10	1.5	651
black and gray chert		1	8	2		11	78.6	1	1	7.1	14
brown chert											
basalt	3	10	64	88	8	173	79	2	2	0.9	219
chalcedony			17	4	2	23	88.5				26
dark gray chert	2	12	28	12	3	57	96.6				59
gray chert		6	91	53	5	155	55.8	2	2	0.7	278
gray chalcedony				2		2	100				2
green chert		2	5	8	2	17	89.5				19
gray rhyolite	1	7	49	53	5	115	92.7				124
banded black chert			1			1	100				1
banded gray chert			1			1	100				1
obsidian		1	19	8	2	30	93.8				32
quartzite			2	7		9	60				15
red chert		3	1	2		6	75				8
rhyolite	1	6	81	75	6	169	87.1	1	1	0.5	194
slate											
white chert			2	1		3	75				4
white and gray chert		2	130	49	5	186	93	7	7	3.5	200
white quartzite				1	1	2	100				2
Total	**10**	**79**	**840**	**553**	**60**	**1,542**	**83.1**	**23**	**23**	**1.2**	**1,855**

BIFACIAL TECHNOLOGY

Bifaces were separated into categories based on stage in a production sequence (after Andrefsky 1998; Rasic 2000; Whittaker 1994). Early stage biface production is represented by twenty-eight discarded biface blanks and blank fragments. Blanks were commonly formed from large interior flakes, and several have spiral fractures indicative of having broken during manufacture. Blank fragments discarded in the assemblage were made from black chert, basalt, gray rhyolite, rhyolite, and white and gray chert. Nine preforms (bifacial blanks further reduced by regular pressure flaking), mainly in fragmentary form, were found at the site and made from black chert, white and gray chert, and gray rhyolite. Three of the preforms discarded on site are nearly complete.

Regular shaping of the sides, tip, and base of a preform using the pressure flaking technique created the ten finished projectile points found at Banjo Lake. Small tip and midsection fragments made of a variety of raw materials (rhyolite, white chert, basalt, gray chert, and black chert) were found in the assemblage.

The fragmentary nature of the majority of the projectile points makes it difficult to discuss morphology and on-site production sequences. It is clear, however, that projectile points were commonly made using local raw materials that were also plentiful in blank and preform stage. Detachment scars present on several projectile points suggest they were produced from large flakes, and preform size was greatly reduced before reaching finished form.

Two lanceolate point basal fragments have been recovered from Banjo Lake (made from white chert and basalt). Lanceolate points are common in Alaska, northern Canada, and Siberia and have been found in multiple cultural contexts in Alaska. Edge grinding is common on the lower half of lanceolate projectile points and is also found on the two samples in this assemblage.

The two most distinctive finished points in the assemblage are a concave-based and small straight-based triangular projectile points (Fig. 7). Concave base projectile points have been found in multiple cultural contexts, including mid-Holocene contexts in the southern Yukon (Greer 1993; Hare 1995; Hare et al. 2008). Although no notched projectile points were found in this assemblage, many have concave bases, and it is possible that this concave base point was a preform for a notched variety. Small triangular projectile points found in interior Alaska are commonly attributed to the Nenana complex (ca. 10,000–11,000 ^{14}C years BP) because of their presence at many well-dated late Pleistocene/early Holocene sites in interior Alaska, including the lower components of Broken Mammoth (Holmes 1996), Swan Point (Holmes 1998; Holmes et al. 1996), Healy Lake (Cook 1996), Dry Creek and Owl Ridge (Hoffecker, Powers, and Bigelow 1996; Hoffecker, Powers, and Phippen 1996) and Moose Creek (Pearson 1997). Many triangular forms remain undated, however, and this point morphology may have existed over a broad time span or have a technological rather than chronological driver.

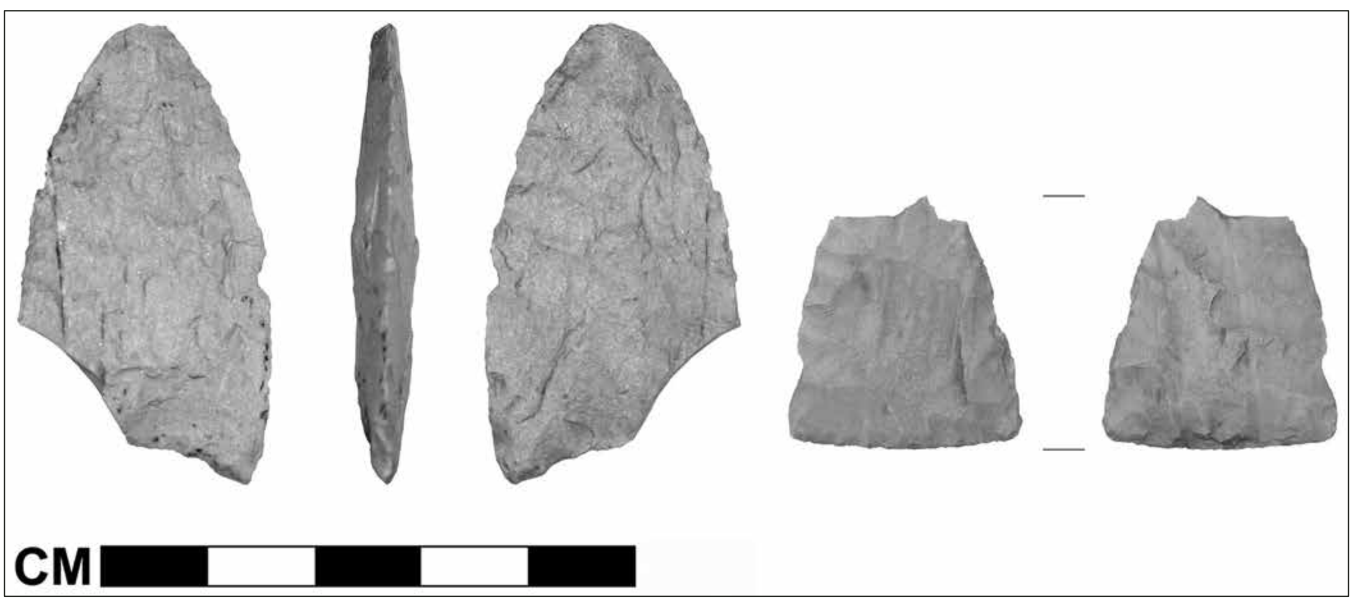

Figure 7. Two bifacial projectile points from the Banjo Lake assemblage.

Bifacial thinning and shaping flakes make up the majority of the diagnostic debitage assemblage at Banjo Lake (83.1%; Table 3). Over half of the bifacial reduction flakes were pressure flakes (54%) while only 6% were associated exclusively with blank reduction. These data point to late stage preform reduction and projectile point production occurring on site from cores that were brought to Banjo Lake in biface blank form.

This trend is consistent for all raw material types involved in on-site bifacial reduction, although slight variations in activity are evident for some of the raw materials. For example, the number of black chert bifacial tools found at Banjo Lake suggests that blank, preform, and finished projectile points were brought to or worked on site. Debitage counts emphasize preform and projectile point working over blank production. For basalt, blanks and projectile points were found in the artifact assemblage, and all bifacial reduction debitage reflects projectile point shaping and repair. Although 155 gray chert bifacial reduction flakes were discovered, only one small projectile point tip was found. It is possible that one or more projectile points with broken tips were repaired at the site and later removed for use. No gray rhyolite projectile points were found at Banjo Lake and debitage reflects preform shaping and pressure flaking. If a finished tool resulted from activities at the site, the tool left the site before it was discarded. Rhyolite blanks, however, were common and pressure flaking debitage suggests that projectile point shaping with this material was an on-site activity. Several points were broken and resharpened on site. Very little white chert debitage was located in association with the projectile point midsection of the same material. This point was probably brought on site broken and then discarded. In summary, significant amounts of late-stage projectile point shaping debitage were present in the assemblages. Bifaces and preforms of most materials were most likely formed into finished tools that left the site.

The majority of discarded bifacial tools were discovered in the primary excavation near the hearth area shown in Figure 8, but also around the potential hearth area described above where many thermally fractured flakes were found. These represent two possible activity areas.

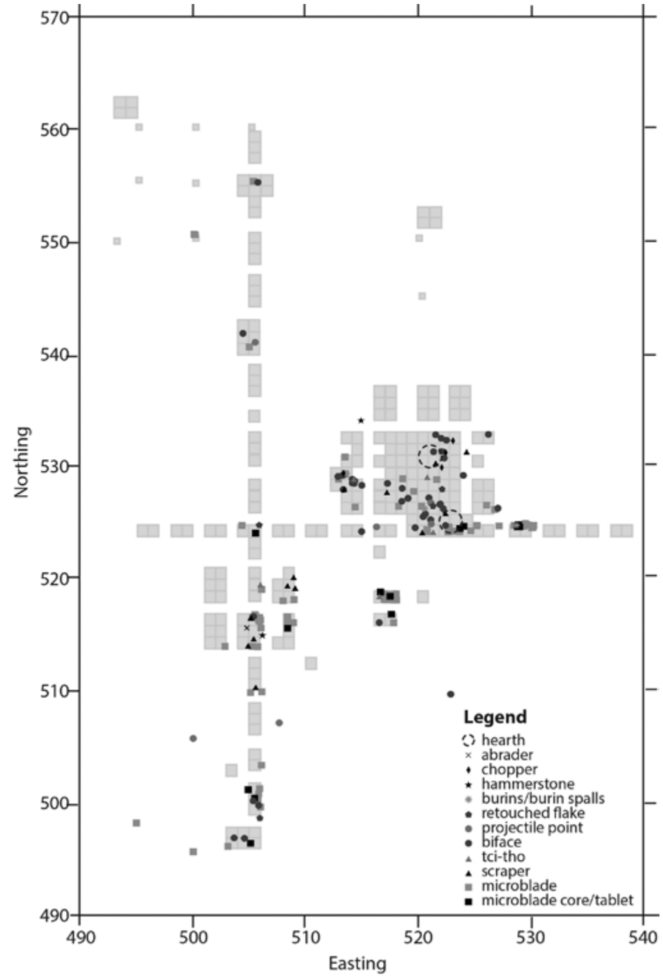

Figure 8. Plan view of tool distribution at Banjo Lake.

UNIFACIAL TECHNOLOGY

Three different types of unifacial tools were discovered at Banjo Lake: side and end scrapers, cobble spall scrapers or tci-thos, and retouched flakes. Stages for unifacial tools are less formally defined because these tools undergo a much shorter reduction process. The vast majority of unifacial flaked tools begin with large flakes that are flaked on the distal end, lateral edges, or both. Further reduction only occurs after damage by use. Although scrapers are generally thought to be an expedient technology, some side and end scrapers demonstrate extensive resharpening and may have been hafted at some point during their use. Tci-thos and retouched flakes, on the other hand, were most likely expedient tools that were prepared and used as needed.

Side, end and side, and end scrapers are a continuous class of flake tools generally having retouch on the dorsal surface, along the distal end, and/or one or both lateral margins. Scrapers are commonly classified by retouched end shape (e.g., straight, convex, concave, or convergent) (Andrefsky 1998; Goebel 1990:192); however, functional or stylistic reasons for these classifications have not yet been identified. Much discussion in the archaeological literature has been centered on the continuous evolution of scraper (and retouched flake) shape and form with reduction through the use life of the tool (Dibble 1984; Hiscock and Attenbrow 2002, 2003; Shott and Weedman 2007). Here, scrapers are simply classified by retouch location with respect to the platform of the original flake. In the Banjo Lake assemblage, nine end scrapers, four end and side scrapers, and two side scrapers were found; they were made from a variety of raw materials (black chert, gray chert, white and gray chert, black and gray chert, red chert, basalt, and rhyolite).

The majority of scrapers in the assemblage were made on chert flakes ($n = 9$; basalt $n = 5$; rhyolite $n = 1$) and all but six had retouch only on the distal end of the tool. Edge angles for end scrapers were blunt, approaching 90° (Fig. 9). The flakes used for end scrapers were thick, large (size class 3), interior flakes. Retouch on lateral edges of side and side and end scrapers was generally shallower but still restricted to the dorsal surface.

A total of six tci-thos have been recovered from Banjo Lake. These tools were made on primary and secondary decortication flakes removed from chert, basalt, and andesite cobbles using the bipolar manufacturing technique.

Seven flakes with shallow and light retouch along one or more lateral margins were also discovered in the assemblage. All retouched flakes were made from cryptocrystalline materials such as chert, chalcedony, and basalt. Late bifacial thinning flakes or large flake fragments were used as preforms for these expedient tools.

Unifacial reduction debitage is infrequent in the assemblage but may be underrepresented due to the difficulty in identifying some unifacial pressure flakes. The flake platform of unifacial pressure flakes is made up of the ventral surface of the flake tool and flake/platform angles often approach perpendicular (Frison 1968). The distal end of the flake can also resemble a hinge or plunging fracture as force of the break removes the edge of the tool (Shott 1995). Unifacial pressure flakes were found for several Banjo Lake raw materials including black chert, black and gray chert, basalt, gray chert, rhyolite, and white and gray chert (Table 3). Scrapers of many of these materials were also discarded on site. Several of these scrapers were probably repaired and retouched during their life cycles, resulting in corresponding debitage.

Unifacial tools were found across the Banjo Lake archaeological site with no clear clustering (Fig. 8), although end scrapers are most frequent in excavation units surrounding the main hearth; side and side and end scrapers are more prevalent in the southwestern portion of the excavation area.

MICROBLADE TECHNOLOGY

Microblade technology makes up a significant portion of the Banjo Lake assemblage. Exhausted cores at this site are wedge-shaped like many other cores in interior Alaska sites (e.g., Cook 1968; Mobley 1991; Powers et al. 1983; West 1967). These cores were prepared on flake blanks in the Campus method (Coutouly 2011; Mobley 1991). The flake end opposite the core face is commonly bifacially or unifacially retouched, presumably to aid in hafting.

In this analysis, microblade cores were identified by stage of reduction: core preforms (core shaped but discarded prior to removal of microblades), intermediate stage cores, late stage cores, or exhausted cores (small cores with significant evidence of platform and face rejuvenation and very narrow microblade arises). Five of the nine microblade cores in the collection were found in late stages of reduction, and one core was completely exhausted

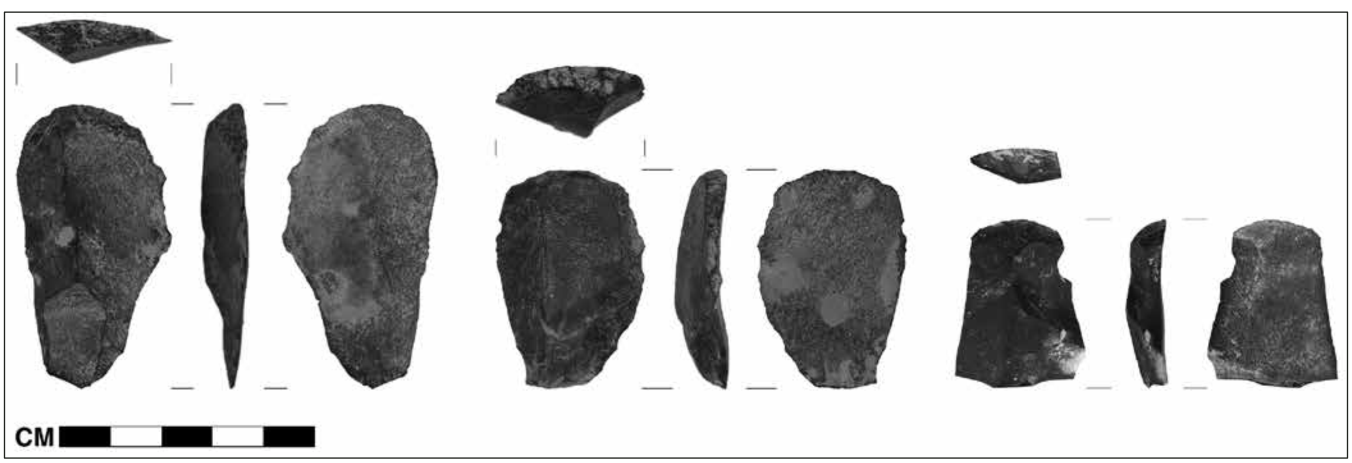

Figure 9. Banjo Lake end scrapers.

(Fig. 10). These cores were discarded at the end of their use life due to the small size of the core or mistakes during reduction. One core was discarded in an intermediate stage of reduction. Two of the microblade cores found in the site were minimally altered flakes. Only a few linear flakes were taken from the distal end of a flake, parallel to the original platform of the flake. In these two tools, a platform was not extensively prepared, and it is difficult to discern whether the tools were meant as microblade cores or burins. Cores were made from a variety of materials including black chert, gray chert, rhyolite, and obsidian.

Debitage related to microblade core reduction and microblade production makes up over 11% of the flake assemblage at Banjo Lake (Table 3). Microblade production is secondary only to bifacial projectile point production at the site. Core flakes consist of two main types: flakes that repair or adjust the platform, and flakes that repair or are removed from the face of the core.

Core tablets, platform ridge flakes, and platform rejuvenation flakes are taken perpendicular to the face of the microblade core to repair hinge fractures and other platform irregularities in anticipation of further microblade production. Sixteen of these types of flakes were discovered in the Banjo Lake debitage collection. Core tablets are the largest of these flakes and result from the removal of the entire platform, thus reflecting the shape of the core. Three black chert core tablets and one brown chert core tablet were recovered from the site and were removed from wedge-shaped microblade cores.

Core face rejuvenation flakes and linear flakes are also present in the debitage assemblage (*n* = 25). Linear flakes are fairly common and reflect early stages of microblade production. Both linear flakes and core face rejuvenation flakes had parallel facets on their dorsal surface. These flakes produce new core fronts, free from hinge fractures to aid in the systematic removal of more microblades (Goebel 1990:185; Mobley 1991:99). Five core face rejuvenation flakes of three different raw materials were found at Banjo Lake.

The presence of core reduction flakes in the debitage assemblage indicates active microblade production occurred on site. Even the earliest stages of microblade core

Figure 10. Banjo Lake microblade cores.

reduction, indicated by crested blades (the first core tablet; $n = 5$) and linear flakes ($n = 18$), are represented (Table 3).

On-site microblade core shaping and microblade production is indicated for black chert, basalt, gray chert, gray rhyolite, red chert, rhyolite, and white and gray chert. Core production flakes of these materials were left in activity areas. Only two materials, black chert and gray chert, account for over 75% of the microblade core-related debitage. For these materials it is evident that microblade core production, shaping, microblade production, and exhausted core discard occurred on site. A brown chert core passed through the site, leaving only two pieces of debitage. At least one basalt core was formed on site, but not used to make microblades before being transported elsewhere. A gray rhyolite core was shaped on site and discarded without producing microblades, and an obsidian microblade core was discarded on site, but there is no evidence of this tool being reduced. A small amount of core debitage was discovered for red chert, rhyolite, and white and gray chert, indicating some core shaping and microblade production, but only red chert and rhyolite cores were discarded at the site.

Microblades are the end product of microblade core production and shaping sequences, and some were utilized tools (microblades can fall in both the tool and debitage categories, depending on use after production). Little evidence of microblade use is generally found in archaeological sites, however, unless the microblades are discarded at the end of their life cycle. Utilized microblades are often medial segments that show retouch along one margin (Esdale 2009). Only one such microblade was discovered at Banjo Lake (a medial section of a gray chert microblade). This is not surprising, however, as most microblades chosen for tools would have been hafted and taken off site to be used. Microblades were not removed from the haft and replaced at this site.

The majority of microblades at Banjo Lake are proximal and medial sections that are approximately 1 cm long, less than 0.5 cm wide, and just over 1 mm thick with two or three dorsal facets indicating previous microblade removals (proximal, $n = 71$; medial, $n = 73$; distal, $n = 22$). Microblade production was an important flint knapping activity at this site, and gray chert, black chert, and rhyolite were the primary materials used for microblade production.

Microblade cores were found in all areas with archaeological evidence across the Banjo Lake site. However, microblades and other microblade production debitage are not evenly distributed (Fig. 8). Microblades occur primarily around the main hearth feature and in the other large excavation to the southwest, which also had several discarded scrapers. Microblade and core reduction debitage do not appear to cluster very well. This may suggest some postdepositional disturbance, likely through trampling given the high proportion of flake fragments in the assemblage (61%).

OTHER TOOL CLASSES

Burins make up a small part of the lithic assemblage at Banjo Lake: one gray chert burin and three black chert burin spall fragments were found on site. The burin was discovered 7 m west of the main hearth area. One spall was found just south of the hearth, and two were found in a small excavation area in the southwest corner of the site. One possible perforator made from gray chert was recovered in the southern part of the site. The artifact was unifacially retouched, leaving a pointy edge similar to other flake tools elsewhere in central Alaska (Goebel 1990). A broken sandstone abrader was also found in this area.

DEBITAGE SPATIAL ANALYSIS

Debitage was mapped by raw material and flake type across the entire Banjo Lake site using ArcGIS. By comparing these two variables, specific activity areas across the site could be defined. Figure 11 is a simplified diagram of these activities areas. For more detail, including piece-plotted flakes, see Robertson, Esdale, et al. 2009. The Banjo Lake site stretches over 100 m north to south and over 70 m east to west. Because the site was not excavated in its entirety, natural cluster boundaries could be determined when activity areas were less than approximately 1.5 m in diameter. In general, there was poor clustering across the site of raw material and flake types. This, combined with the high percentage of flake fragments found at the site (61%), suggests some postdepositional site disturbance.

Thermal stress fracture and alteration of flakes were also noted for a more complete picture of debitage taphonomy (Rasic 2004). Heat-treated or fire-damaged stone provides clues about past behavior and also allows for a direct association between radiocarbon dates from hearths and stone tools at the sites. Two types of thermal effects are present on nineteen flakes and one microblade core from the Banjo Lake archaeological site. These effects were potlidding (small, circular, convex fragments of stone that have popped off the surface of

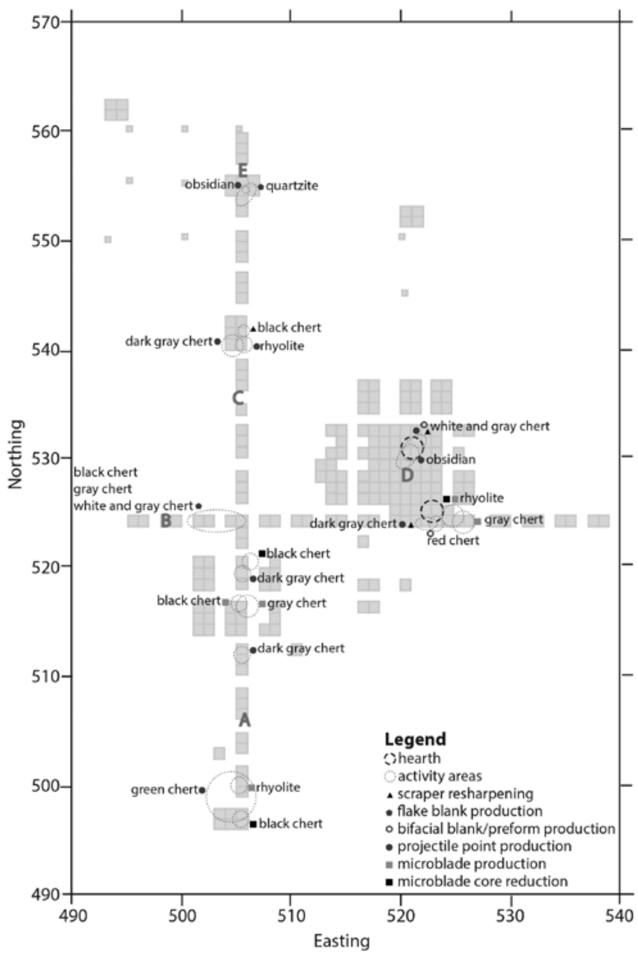

Figure 11. Activity areas at Banjo Lake based on flake type and raw material distribution.

a flake by differential expansion and contraction of the rock during heating and cooling; Crabtree 1982:49; Luedtke 1992:97), and crazing (cross-hatched or semicircular surface cracks; Crabtree 1982). Charcoal fragments were plotted in addition to thermally fractured artifacts. Charcoal was scattered across the site but only clustered with thermally fractured flakes in two excavation areas: N524–526 E522–524 and N530–532.5 E520–522. These data coincide with the presence of Feature 1, a hearth, at N530 E521 and suggest the possibility of a second hearth 5 m to the south (Figs. 8, 11).

Despite disturbances noted at the site, some specific activity areas were evident, and hearth-based activities were found near the excavated hearth (N530 E520) and possible hearth (N524 E522) areas (Fig. 11). In the southern portion of the site (south of A in Figure 11), three main activities are evident: a black chert microblade core was shaped and reduced, microblades were made from a rhyolite microblade core, and a green chert bifacial preform was shaped into a projectile point. The point was not found in the assemblage and was likely transported off site after manufacture. North of A on the map are several microblade and projectile point production areas. Black, gray, and dark gray chert are the primary raw materials that cluster in this area. From south to north, a dark gray chert projectile point was resharpened, gray chert and black chert microblades were made, a dark gray chert preform was shaped into a projectile point, and a black chert microblade core was shaped.

The main activity in the west-central portion of the site, near the B in Figure 11, was flake blank production. Three raw materials—black chert, gray chert, and white and gray chert—were used to make flake blanks, some of which were discarded on-site. Very little clear artifact clustering was found in the central portion of the site by the letter C in Figure 11. This is likely because of the limited extent of the excavation in this area. Projectile point sharpening is evident for dark gray chert and rhyolite; a black chert scraper was also resharpened. In the northernmost portion of the site, near E, only two activities were noted: a quartzite core was reduced and flake blanks were made and an obsidian projectile point was resharpened.

In the main excavation area in the east-central portion of the site, near D in Figure 11, activities are centered on or around the two hearth features. An obsidian flake scatter in the southern portion of the main hearth indicates preform shaping and projectile point sharpening. White and gray chert flakes are scattered over the hearth area and to the northeast. These flakes are consistent with bifacial blank and preform production, projectile point sharpening, and end scraper resharpening. Four main raw materials cluster around the possible hearth feature 5 m to the south: rhyolite, gray chert, dark gray chert, and red chert. Microblade production activities are evident in this location. A rhyolite microblade core was reduced and microblades were made from both gray chert and rhyolite. Just south of this possible hearth feature a red chert preform was made and a dark gray chert projectile point and scraper were resharpened.

FAUNAL REMAINS

Nearly 12,000 bone fragments were recovered from the excavation units in and around the main hearth feature at Banjo Lake (Fig. 12). Faunal material is rare in sites in the surrounding region (Robertson, Esdale, et al. 2009). The majority of the bone fragments were recovered from within

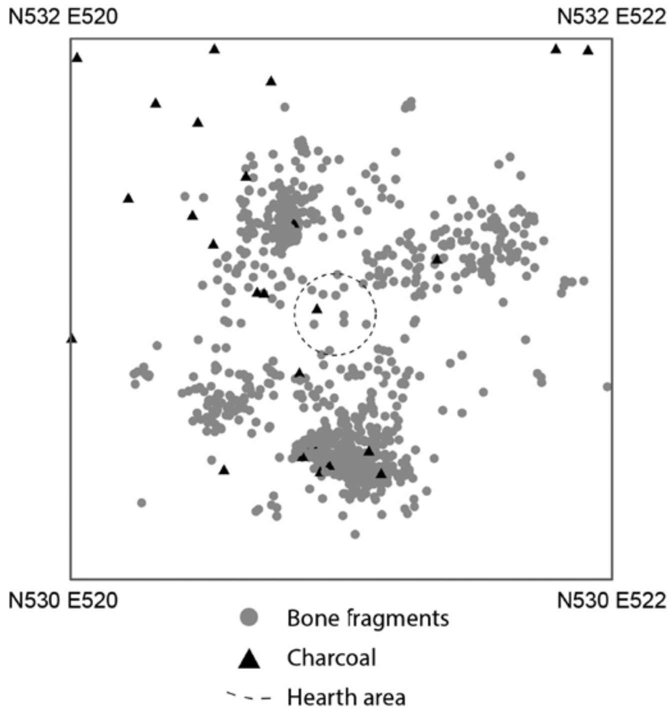

Figure 12. Plan view of units around the main hearth area containing faunal material.

the cultural strata, 10–20 cm below surface. Almost all of the bone fragments are too small and degraded to be identified to species; instead they were sorted by size, composition, color, and texture to determine the type of bone and degree of intentional burning.

Eighty percent of the fragments were cortical bone, 12.7% were a combination of cortical and cancellous bone, and the remaining 7.3% were cancellous bone. Bone was found in a highly fragmentary state: of 11,767 pieces collected, 9,210 were less than 0.75 cm long and only one was over 4.5 cm. The majority of the pieces (11,756 or 99.9%) were burned.

Because most of the fragments were burned, they were analyzed to differentiate purposeful burning from burning that may have occurred from wildfire. Degree of burning was analyzed following Cain's (2005) procedure, excluding cancellous bone (873 pieces). Eleven fragments were classified as unburned, 392 as half-calcined, and 10,491 as fully calcined. Calcined and half-calcined fragments were uniformly burned through the cortical wall, indicating high heat intensity and intentional burning (Cain 2005). Bone may have been crushed and broken before burning to effectively extract the marrow (Enloe 1993; Kooyman 2004) before further processing for the purpose of grease extraction or as a means of destroying refuse (Bonnichsen and Will 1980).

LITHIC PRODUCTION ACTIVITES AT BANJO LAKE

Careful analysis of raw material types, flake types, tools, and spatial distribution of artifacts and fauna has allowed the reconstruction of the main on-site activities at the Banjo Lake site.

RAW MATERIAL TRANSPORT AND PRIMARY CORE REDUCTION

Raw materials travelled on site mainly as biface blanks and flake blanks. Little primary core reduction occurred at Banjo Lake. Only one flake core (rose quartz) was found, and core reduction debitage primarily came from andesite, green chert, basalt, and quartzite. Several biface blanks were discarded on site but were made only from black chert, basalt, rhyolite, and white and gray chert. All but the basalt blank were probably brought to Banjo Lake already in blank form. Only one hammerstone was recognized during excavations, also indicating that early stage tool production was an uncommon site activity.

BIFACIAL PREFORM PRODUCTION

Blanks brought on site were commonly reduced to produce bifacial preforms and projectile points. Discarded preforms are uncommon, however, and were likely either further reduced into projectile points on site or carried off site for later finishing. Flake-type percentages indicate that substantial late-stage biface reduction occurred in all debitage clusters at the Banjo Lake site. Two thirds of all raw materials were made up of biface reduction debitage, primarily late-stage bifacial thinning, edge preparation flakes, and alternate flakes. Preforms of black chert, gray rhyolite, and white and gray chert were manufactured and discarded on site. Preforms of chalcedony, dark gray chert, green chert, gray rhyolite, banded black chert, banded gray chert, obsidian, red chert, white and gray chert, and white quartzite were worked on site and were transported off site in preform or projectile point form.

PROJECTILE POINT PRODUCTION AND REPAIR

Bifacial pressure flakes and broken projectile points were common at Banjo Lake, indicating significant on-site manufacture and repair. On-site projectile point production is indicated for at least eight different raw materials (black chert, basalt, chalcedony, dark gray chert, gray chert, gray rhyolite, obsidian, and rhyolite), and discarded finished projectile points were found in black chert, basalt, gray chert, rhyolite, and white chert. Several of these tools were broken during manufacture, but for some, only tips and heavily resharpened bases were discovered, suggesting that the tools came into the site used and were then replaced. Projectile points of at least four different material types (chalcedony, dark gray chert, gray rhyolite, and obsidian) were made or repaired on site and then transported off site.

UNIFACIAL TOOL PRODUCTION AND USE

Scrapers and retouched flakes are normally considered expedient tools made on site from flakes (although scrapers may have been curated in some cases). Scrapers and retouched flakes found at the Banjo Lake site were made mainly from the most common raw materials (black chert, basalt, gray chert, and rhyolite), suggesting that they were indeed produced expediently on site. Unifacial pressure flakes of these materials were also discovered, indicating that, in most cases, scrapers were made on site and not brought into the site in finished form. Tci-thos were made exclusively from coarse-grained raw materials (andesite and basalt) that are common in glacial deposits in the region.

MICROBLADE CORE AND MICROBLADE PRODUCTION

Microblade core reduction and microblade production were the second most common activities after bifacial projectile point manufacture at Banjo Lake. Microblade cores of six different raw materials (black chert, gray chert, gray rhyolite, obsidian, red chert, and rhyolite) were discarded on site. Three of these cores (black chert, gray chert, rhyolite) were manufactured and reduced on site before being discarded, while the red chert and obsidian cores were brought to the Banjo Lake site fully formed and were used to produce microblades on site. Microblade core reduction material of chalcedony and dark gray chert found at the site suggests that at least two cores passed through the site without being discarded. Microblades made from brown chert, quartzite, and white chert found during excavations may have come into the site on cores or as individual flakes.

CONCLUSIONS

Banjo Lake is a large site spanning over 50 m along the crest of a ridge. The wide spacing of artifacts, poor clustering of raw materials and debitage types, and general fragmentary nature of the lithic assemblage at the site suggests a fair degree of postdepositional disturbance. Even so, some regular clustering of materials and tool types was evident around hearth features. The two main hearth areas at the site contained evidence of projectile point sharpening and microblade production. Expedient activities, such as end-scraper and tci-tho maintenance, were more widespread across the site.

In general, tools were made on flakes of cherts and fine-grained volcanic rocks available in glacial outwash and moraine deposits in the region. No quarry activities occurred in the immediate area, and flake and biface blanks were produced off site. Tools made at Banjo Lake began as these intermediate forms and were made into lanceolate projectile points and wedge-shaped microblade cores.

Although the Banjo Lake site dates within the recognized range of the Northern Archaic Tradition in Central Alaska, the assemblage does not have the traditional hallmarks of a Northern Archaic site. The Banjo Lake site completely lacks notched projectile points, and moreover, the assemblage contains only four finished projectiles. Two of these are generalized lanceolate forms and one is a small triangular point. The fourth projectile point has a concave base and is more reminiscent of Northern Archaic varieties, but the shape is not unique to Northern Archaic assemblages.

Expedient scraper production appears to be an important on-site activity suggestive of game processing. The common end-type scraper made on a flake that was so prevalent at Onion Portage is found in the Banjo Lake assemblage along with side scrapers and tci-thos. Tci-thos are similar to cobble-spall scrapers found in later Holocene sites in interior Alaska and suggest some continuity between the middle Holocene and later Athabaskan tool production strategies.

Microblade production was an important on-site activity and Campus-style cores like those found at Banjo Lake are common in middle Holocene-age assemblages in interior Alaska (Cook and McKennan 1970; Dixon 1985; Esdale 2008; Holmes 2008; Potter 2008a, 2008b). Very few Northern Archaic-age archaeological sites lacking notched projectile points are recognized in Alaska. Besides

Banjo Lake, microblades and middle Holocene radiocarbon dates without associated notched projectile points are found at the Rosaliya site in the central Brooks Range (dating to 5200 radiocarbon years BP) (Rasic and Slobodina 2008), Cultural Zone 1b at Broken Mammoth (dating to circa 4500 BP) (Holmes 1996), and Cultural Zone 3 at the Moose Creek site (dating to 5600 BP) (Pearson 1999).

Some authors have interpreted assemblages like these as snapshots of short occupations and some, but not all, of the activities represented by the whole Northern Archaic toolkit (Rasic and Slobodina 2008). Banjo Lake appears to be one such assemblage. Not only does the site not contain the entire possible Northern Archaic toolkit, only portions of entire production sequences for each separate technology are represented by discarded tools and flaking debris. Only by compiling data from a number of well-dated sites will we begin to understand the full breadth of Northern Archaic technologies and activities. Banjo Lake is interpreted to contain only a portion of a broader Northern Archaic toolkit that represents a larger range of seasonal activities than Onion Portage and some of the other early Northern Archaic sites in Alaska. It also demonstrates technological continuity between the middle and late Holocene lithic assemblages in interior Alaska, which may indicate continuous, long-term occupation of the region.

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