REPORT

CULTURAL MATERIALS RECOVERED FROM ICE PATCHES IN THE DENALI HIGHWAY REGION, CENTRAL ALASKA, 2003–2005

Richard VanderHoek
Office of History and Archaeology, Alaska Department of Natural Resources, 550 W. Seventh Ave., Suite 1310, Anchorage, AK 99501-3565; richard_vanderhoek@dnr.state.ak.us

Randolph M. Tedor
Office of History and Archaeology, Alaska Department of Natural Resources

J. David McMahan
Office of History and Archaeology, Alaska Department of Natural Resources

ABSTRACT

The Alaska Office of History and Archaeology conducted ice patch surveys in the Denali Highway region of central Alaska for three seasons. Prehistoric organic and lithic hunting artifacts and fauna had melted from the ice patches and were subsequently recovered. These items include arrow shafts, barbed antler points, lithic projectile points, and what is likely a stick for setting ground squirrel snares. Organic artifacts recovered from this survey date within the last thousand years. Lithic projectile points recovered from ice patches suggest that prehistoric hunters have been hunting caribou on ice patches in the Denali Highway region for at least the last half of the Holocene.

KEYWORDS: atlatl, bow and arrow, gopher stick, mountain archaeology

INTRODUCTION

Ice patches with caribou (*Rangifer tarandus*) dung and cultural material were first noted by the scientific community in August of 1997, when a Canadian biologist noticed a layer of caribou dung on a permanent ice patch while sheep hunting in the Kusawa Lake area of the southern Yukon Territory (Kuzyk et al. 1999). This caught his attention because caribou do not presently occupy the area. Researchers visiting a month later recovered sections of a wooden shaft with sinew twisted around one end on the edge of the ice patch. The shaft, part of a longer atlatl dart, was radiocarbon dated to 2887–3306 cal BC[1] (Kuzyk et al. 1999:216). Subsequent ice patch finds included both atlatl darts and arrows, fragments of a bow, and more perishable items including a stitched hide moccasin (CTFN et al. 2005; Hare et al. 2004a, Hare et al. 2004b). To date, more than 240 artifacts have been recovered from melting ice patches and glaciers in northwestern North America.

In 2003, the Alaska Office of History and Archaeology (OHA) developed a research design for identifying and assessing cultural resources in the northern section of the Tangle Lakes Archaeological District in southcentral Alaska (VanderHoek 2003). Archaeological survey and monitoring of regional ice patches was instituted as one component of a larger management plan (VanderHoek 2007a). The purpose of this paper is to report on the artifact assemblage recovered from ice patches in the Denali Highway region during the 2003, 2004, and 2005 field seasons and discuss the significance of the finds in relation

1 All radiocarbon dates calibrated via Calib 5.0, IntCal04, Reimer et al. 2004.

to the artifact assemblages collected from ice patches in other regions.

The OHA regional ice patch survey centered around two clusters of ice patches in the Amphitheater Mountains that were previously identified as locations with the most promise for producing cultural material (see VanderHoek et al., this volume). The first cluster of ice patches is located at the western end of the Amphitheater Mountains near Basalt Lake. The second cluster is located on a high mountain ridge in the central Amphitheater Mountains near the Delta River falls.

THE BASALT LAKE ICE PATCHES

The Basalt Lake ice patches (BLIPs) are all found within approximately 1 km of Basalt Lake on the northeastern edge of the Maclaren River valley. They consist of four separate locales that were visited in August of 2003 and 2004. The discovery of several artifacts (Table 3) on and around the ice patches resulted in continued survey and monitoring in subsequent years. Basalt Lake ice patch 1 (BLIP 1), the largest ice patch in the region, was the first ice patch where cultural material was found.

BASALT LAKE ICE PATCH 1 (XMH-1081)

BLIP 1 has produced the most cultural material of the ice patches visited to date as part of this project. Artifacts recovered from BLIP 1 include fragments of at least two arrow shafts, a unilaterally barbed antler point, a thick piece of rolled birch bark, and a variety of faunal material (mainly caribou bones, antler, and antler velvet; Table 2).

One arrow shaft, collected in three sections, is virtually complete, having an antler point, two pieces of feather fletching, and sinew lashing in association (Fig. 1). The three sections of shaft, when refit, measure approximately 52 cm in length. The breaks are very clean and square, which suggests post-depositional shearing while frozen in the ice. Multiple faint markings, possibly of ocher, were visible on the pieces when recovered but have since faded. The proximal section of shaft, with the nock on one end, is 148 mm long. The nock groove itself is shaped like a "W" in cross-section, with straight, flat inside walls and deeper cut sides rising to a shallow peak in the bottom center. The complete shaft tapers from the larger distal, or socket, end (9.7 mm in diameter) to the smaller proximal, or nock, end (5.8 mm in diameter).The distal section of shaft was split in order to insert the antler point's conical base. It had also been wrapped several times around with sinew lashing. The fragment of sinew that survived consists of two thin strands twisted together. Wrap marks on the distal-most 25 mm of shaft show the location of the former sinew lashing (Fig. 2).

The arrow shaft is made from a spruce stave that was split from a section of log. Weathering has raised the grain of the wood, making it distinctly visible on the outside and ends of the shafts. Detailed description of arrows made by the Ahtna are absent in the literature, but the

Table 1. Radiocarbon dates for organic items recovered from OHA activities in the Denali Highway region, 2003–2005. All items were recovered from the surface of existing or fossil ice patches. Radiocarbon dates calibrated via Calib 5.0, IntCal04 (Reimer et al. 2004).

Site #/Name	Lab#	Sample # (OHA)	Item	Material Type	Taxon	Technique	Conventional C-14 Age	Calibrated Age Range AD (2 sig.)
XMH-1081 (BLIP #1)	Beta-185014	XMH-1081A	Arrow Shaft	Wood	*Picea*	AMS	60±30	1952–1956 1812–1919 1694–1727
XMH-1082 (BLIP #2)	Beta-201470	XMH 1082A2004	Antler Point	antler	*Rangifer*	AMS (ext. count)	1010±40	901–917 966–1059 1066–1072 1075–1155
XMH-1166 (BLIP #3)	Beta-185015	XMH-1166A	Chopped Antler	Antler	*Rangifer*	AMS	950±40	1016–1179
XMH-1191 (BLIP #4)	Beta-201471	XMH 1191A2004	Arrow (?) Shaft frag.	Wood	*Picea*	AMS	1000±40	975–1155
XMH-1192 (DRIP #5)	Beta-201472	XMH 1192A2004	"Gopher Stick"	Wood	*Picea*	AMS	390±40	1437–1528 1545–1545 1551–1634

Table 2. Fauna from Denali Highway ice patches.

Location	AHRS #	Material	Description	Animal
BLIP 1	XMH-1081	Bone	Skull fragment (maxilla)	caribou
BLIP 1	XMH-1081	Bone	Rear left maxilla with 3 molars	caribou
BLIP 1	XMH-1081	Bone	Skull fragment	caribou
BLIP 1	XMH-1081	Bone	Distal-medial right tibia frag	caribou
BLIP 1	XMH-1081	Bone	Rib	caribou?
BLIP 1	XMH-1081	Bone	Longbone fragment	caribou?
BLIP 1	XMH-1081	Bones	Proximal left ulna and radius	sm.caribou
BLIP 1	XMH-1081	Bones	Two lower mandibles (right and left)	marmot
BLIP 1	XMH-1081	Bones	Eight rib fragments	caribou
BLIP 1	XMH-1081	Bone	Cervical vertebra	caribou
BLIP 1	XMH-1081	Bone	Thoracic vertebra	caribou
BLIP 1	XMH-1081	Velvet	Long thin strips	caribou
BLIP 1	XMH-1081	Antler	Three pieces	caribou
BLIP 1	XMH-1081	Bone	Distal left metacarpal	caribou
BLIP 1	XMH-1081	Hoof	Weathered hoof fragment	caribou
BLIP 1	XMH-1081	Bone/Ant.	Skull fragment with left antler intact	caribou
BLIP 1	XMH-1081	Bone	Right maxilla fragment with molars	caribou
BLIP 1	XMH-1081	Bone	Left metacarpal	caribou
BLIP 1	XMH-1081	Bone/Ant.	Right max. with teeth and small broken tine	caribou
BLIP 1	XMH-1081	Bones	Right metacarpal, two carpals, four ankle bones including one right lunate	caribou
BLIP 2	XMH-1082	Bone	Rib	med. mammal
BLIP 2	XMH-1082	Bone/Ant.	Skull fragment with left antler intact	caribou
BLIP 2	XMH-1082	Bone	Small mammal rib	unknown
BLIP 2	XMH-1082	Bone	Astragilus	caribou
BLIP 2	XMH-1082	Bones	Three metapodial and joint bones	caribou
BLIP 3	XMH-1166	Bone	Right scapula	caribou
BLIP 3	XMH-1166	Bone	Left mandible with teeth	caribou
BLIP 3	XMH-1166	Bone	Rib	caribou?
BLIP 3	XMH-1166	Bone	Gnawed	caribou?
BLIP 3	XMH-1166	Bone/Ant.	Skull fragment with right antler intact	caribou
BLIP 4	XMH-1191	Bone	Proximal left tibia	sm.caribou
DRIP 2		Bone	Distal left femur	caribou
DRIP 2		Antler	Broken tine with velvet	caribou
DRIP 3		Bone	Right mandible with out teeth	caribou
DRIP 3		Bones	Two thoracic vertebrae	caribou
DRIP 3		Bone/Ant.	Two small antlers w/ skull attachments & foramen magnum	caribou
DRIP 4		Bone	Right rib fragment	caribou

Figure 1. Three sections of arrow shaft and two of fletching (at black arrow) from Basalt Lake ice patch 1. The three shaft sections refit to comprise an arrow 52 cm long. Note sinew around short distal segment (upper right). Brown "soil" underneath shaft segments is decomposing caribou dung. Photo by C. E. Holmes.

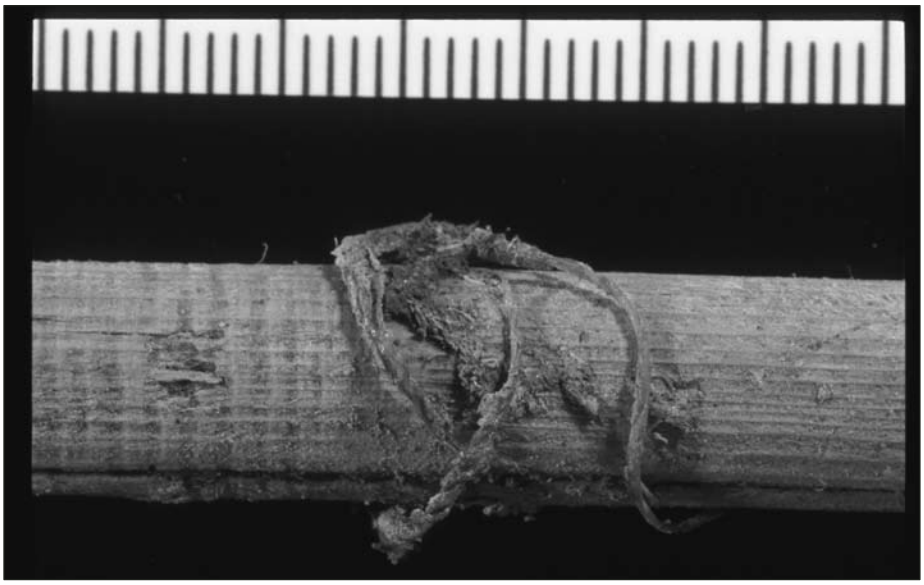

Figure 2. Remains of twisted sinew on distal section of arrow shaft from BLIP 1. Note wrap marks on shaft to left of sinew. Millimeter scale at top. Photo by J. D. McMahan.

neighboring Upper Tanana were known to have favored spruce for arrows (Hosley 1981:535). Of the seven Yukon ice patch arrows that have been identified to wood species, over 50 percent were made of spruce; birch and pine were used as well. Similar to the BLIP 1 shaft, the Yukon shafts were split and shaped from a stave rather than a natural sapling (Hare et al. 2004a; Hare et al. 2004b).

A sample of wood from the interior of the medial section of arrow shaft was submitted to Beta Analytic Inc. for radiocarbon dating. The sample date has three two-sigma (calibrated) intercepts: AD 1952–1956, AD 1812–1919, and AD 1694–1727 (Beta-185014; Table 1). The fact that the wooden arrow has an antler point and sinew lashing implies that it is not modern. Therefore, the arrow shaft is likely between 100 and 300 years old.

The barbed antler point of the arrow (Fig. 3) was found within 2 m of the arrow shaft. The point is 151.1 mm long and finely crafted, with five barbs along one side and a conical base for insertion into the arrow shaft. The distal end is grooved in order to seat a metal, bone, or antler end blade. A metal detector was used at BLIP 1 in 2003 to search for a possible copper or iron point, but no metal artifacts were found.

Archaeological sites in the Copper River region have produced copper arrow points and end blades, presumably designed to arm the tip of an antler point (Hanson 1999;

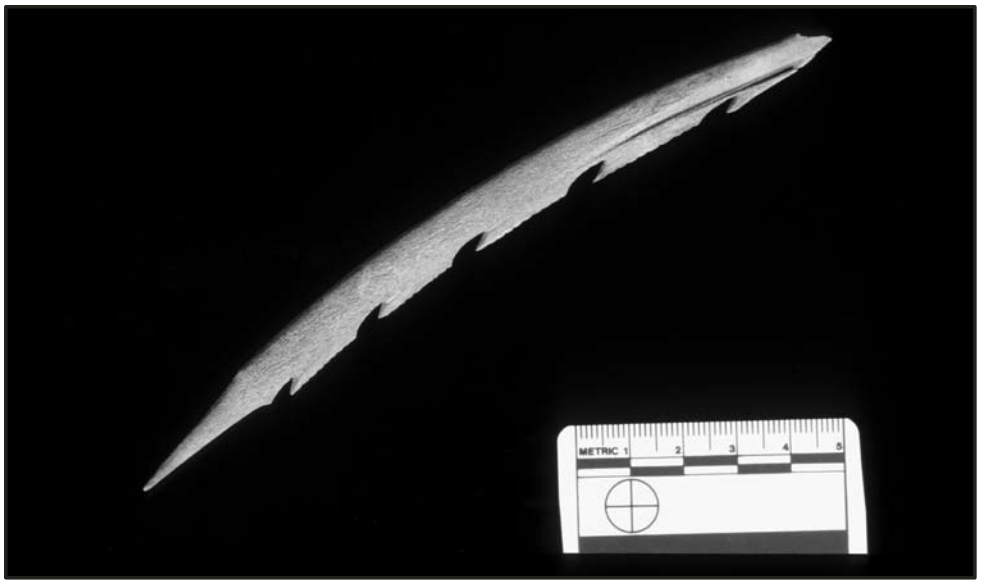

Figure 3. Barbed antler point from Basalt Lake ice patch 1. Note grooved tip for insertion of end blade. Photo by J. D. McMahan.

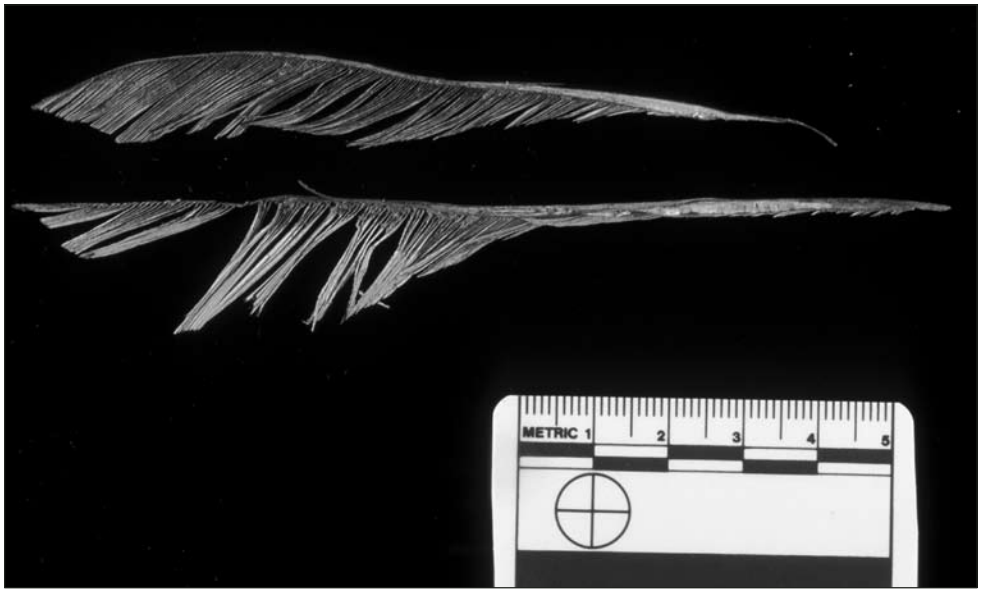

Figure 4. Possible eagle feather fletching associated with the BLIP 1 arrow shaft. Photo by J. D. McMahan.

Shinkwin 1979; Workman 1976). Ethnographic accounts report that the Ahtna used copper arrow points for hunting caribou and other large mammals (de Laguna and McClellan 1981:645; Reckord 1983b:31). Two unilaterally barbed antler points have been recovered from ice patches in the Wrangell Mountains. Both points have green stains in the grooved distal end, suggesting they were armed by copper end blades (Dixon et al. 2005:137). Antler end blades were also used to arm slotted antler points, as shown by the discovery of a barbed antler point and associated antler end blade in a Yukon ice patch in 2004 (CTFN et al. 2005:9; P. Gregory Hare 2004, personal communication). While no antler end blades have yet been recovered from the Copper River valley (William B. Workman 2006, personal communication), the absence of metallic stains in the grooved tip of the point from BLIP 1 suggests that an organic end blade may have been used.

Two feathers were also found in association with the BLIP 1 arrow shaft and point (Fig. 4). Both were identified as the right halves of a vane that had been split down the center and trimmed across the body and along the quill of the feather. The species of bird from which the fletchings were made has not been positively identified, but they are thought to most closely resemble those of an eagle (Carla Dove 2004, written communication). This identification matches feathers identified from Yukon ice patches, where species used for fletching included eagle, gyrfalcon, white-tailed ptarmigan, short-eared owl, duck, and northern flicker (CTFN et al. 2005:10; Dove et al. 2005).

Seven shaft segments were found tightly clustered in the lichen-free zone of BLIP 1. The segments are all made of spruce and range from 26 mm to 119 mm in length. Six of the segments refit to form two sections of shaft approximately 120 mm and 180 mm in length. They all have clean square breaks, again suggesting shearing by ice movement after deposition. The segments range from 3.9 mm to 7.7 mm in diameter and are heavily weathered, presumably representing one or more arrow shafts.

In addition to the previously discussed material, one other item of particular interest was also found at BLIP 1. The item is a section of rolled birch bark weighing 3.1 grams. After being soaked in distilled water, the birch bark was soft enough to unroll. The bark measures 141 mm in length and 98.7 mm in width. It is not apparent what it was destined for: possibly as fire starter, a grease pan, or part of a birch-bark basket similar to the one found near an ice patch in the Wrangell Mountains (Dixon et al. 2005). The absence of paper birch in the region today indicates that it must have been transported from a considerable distance. The birch bark has not been submitted for radiocarbon dating.

Basalt Lake ice patch 2 (XMH-1082)

Basalt Lake ice patch 2 (BLIP 2) is located across a valley almost 2 km southeast of BLIP 1. A nearly complete barbed antler point measuring 270 mm long was discovered among the rocks and caribou dung near the remaining ice (Fig. 5). The point is heavily weathered, which suggests that it was periodically exposed to the elements during high-melt years.

The antler point has four barbs incised along one edge. It appears to have been self-armed because unlike the BLIP 1 antler point, its distal end had been sharpened instead of slotted for an end blade. Although the tip is broken, the distal end is quite thin in comparison to the width (10 mm wide and 2.1 mm thick). Material obtained from the internal portion of the point was AMS radiocarbon dated to AD 901–1155 (Beta-201470; Table 1).

Basalt Lake ice patch 3 (XMH-1166)

Basalt Lake ice patch 3 (BLIP 3) is located in a northeast-southwest trending depression about 100 m northeast of BLIP 1. Two artifacts were recovered at BLIP 3: a cut section of caribou antler and a roll of birch bark. The antler section measures 59 cm long and has the weathered remains of the palm still intact (VanderHoek 2007b:Figure 26). The other end shows clear evidence of chopping around approximately half its circumference. Archaeological evidence from the Yukon indicates the "chop-and-snap" or "groove-and-snap" method was commonly employed for cutting around the antler beam and either separating the antler from the skull or cutting off a section of beam for further use (Morrison 1986:116). The cut sections of beam were subsequently made into arrow points or other tools. The antler was AMS radiocarbon dated to AD 1016–1179 (Beta-185015; Table 1).

Figure 5. Barbed antler point in situ at Basalt Lake ice patch 2. Point is 27 cm long. Photo by J. E. Bittner.

The birch bark roll measures 281 mm in length and 142 mm in width when unrolled. It weighs 45 g and is considerably larger than the one recovered from BLIP 1. Again, the purpose of the bark is unknown; however, similar to the BLIP 1 specimen, its large size indicates that it was probably not deposited by natural processes. The BLIP 3 birch bark has not been dated.

BASALT LAKE ICE PATCH 4 (XMH-1191)

Basalt Lake ice patch 4 (BLIP 4) is one of several fossil ice patches located along the upper northwestern edge of the promontory south of BLIP 2. The area was first surveyed in 2004, with BLIP 4 being the only ice patch to produce cultural remains. The artifact assemblage recovered from BLIP 4 consists of four artifacts: one broken and two complete lithic projectile points and a fragment of wooden shaft (Fig. 6).

Both of the complete points were edge-ground in preparation for hafting. The first point (Fig. 6:1) is made from fine-grained basalt with small "snowflake" phenocrysts. It is 56.4 mm long from proximal to distal end and 26.4 mm wide at the midpoint of the long axis. The thickness at the midpoint of the long axis is 6.5 mm. The base of the point is straight and appears to have been reworked from a break that occurred across the width of the artifact. The edges are straight and parallel for roughly two-thirds of the artifact's length before converging at the distal end.

The second complete point (Fig. 6:3) is made from very fine-grained black chert. It is 65.1 mm long from proximal to distal end and 22.4 mm wide at the midpoint of the long axis. The thickness at the midpoint of the long axis is 7.6 mm. The base of the point is slightly convex, and the edges gently expand for roughly three-quarters of the artifact's length before they shoulder and converge at the distal end.

The broken point (Fig. 6:2) is made from coarse-grained milky gray chert or chalcedony. The distal fragment is 63.1 mm long from the proximal to the distal end and 29.5 mm wide at the midpoint of the long axis. The thickness at the midpoint of the long axis is 7.8 mm. The edges are straight and parallel before they converge at the distal end. Similar to the basalt point, the break occurred across the width of the point, and when the two points are overlaid they are nearly identical in both outline and cross-section.

The wood fragment (Fig. 6:4) is a 21.7 cm long section of spruce shaft. It is similar to the other shaft sections recovered from the Basalt Lake ice patches in that it was made from a stave. The shaft is split in half along its length, and the remaining circumference at its thickest point measures 10.7 mm in diameter. A section of the shaft was AMS radiocarbon dated to AD 975–1155 (Beta-201471; Table 1).

Although the Tangle Lakes are a well-known source area for tool-quality argillite, the projectile points recovered from BLIP 4 are made from three different lithic materials that are, for the most part, considered exotic for the region. Furthermore, the two complete points are substantially different in morphology. The basalt point is short, wide, and only slightly biconvex or lenticular in cross-section. The

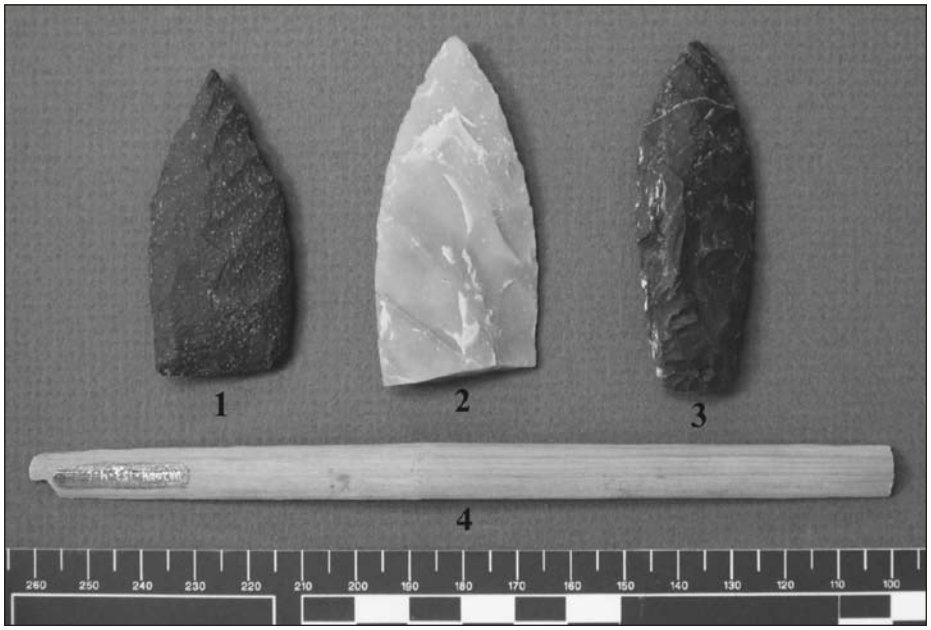

Figure 6. Lithic points (1–3) and shaft fragment (4) recovered from Basalt Lake ice patch 4. Centimeter scale at bottom. Photo by R. Tedor.

Table 3. Cultural materials from Denali Highway ice patches.

AHRS #	UA Catalog #	Location	Material	Artifact	Wt	L	W 1	W 2	T 1	T 2
XMH-01081	UA2004-148-1	BLIP 1	Wood	Shaft	2 g	148 mm	5.87 mm	8.3 mm	5.5 mm	8.1 mm
XMH-01081	UA2004-148-2	BLIP 1	Wood	Shaft	8.8 g	330 mm	8.25 mm	9.54 mm	8.07 mm	8.95 mm
XMH-01081	UA2004-148-3	BLIP 1	Wood	Shaft	1.5 g	54.8 mm	9.32 mm	9.78 mm	8.58 mm	8.77 mm
XMH-01081	UA2004-148-4A	BLIP 1	Wood	Shaft	0.2 g	53.8 mm	4.4 mm	5.3 mm	3.94 mm	5.2 mm
XMH-01081	UA2004-148-4B	BLIP 1	Wood	Shaft	0.2 g	42.3 mm	5.7 mm	6.2 mm	4.7 mm	5.2 mm
XMH-01081	UA2004-148-4C	BLIP 1	Wood	Shaft	0.2 g	37.7 mm	5.9 mm	6.7 mm	5.6 mm	6.5 mm
XMH-01081	UA2004-148-4D	BLIP 1	Wood	Shaft	0.2 g	36.7 mm	6.2 mm	6.2 mm	6.2 mm	6.2 mm
XMH-01081	UA2004-148-4E	BLIP 1	Wood	Shaft	0.2 g	41.7 mm	6.4 mm	6.3 mm	6.0 mm	6.2 mm
XMH-01081	UA2004-148-4F	BLIP 1	Wood	Shaft	0.9 g	119 mm	5.3 mm	6.3 mm	5.3 mm	6.2 mm
XMH-01081	UA2004-148-4G	BLIP 1	Wood	Shaft	0.1 g	26 mm	6.7 mm	7.7 mm	6.2 mm	6.5 mm
XMH-01081	UA2004-148-5	BLIP 1	Antler	Arrow point	7.09 g	151.1 mm	4.3 mm	11.1 mm	5.3 mm	6.23 mm
XMH-01081	UA2004-148-6	BLIP 1	Wood	Birch bark	3.1 g	141 mm	72.1 mm	98.7 mm	0.8 mm	1.4 mm
XMH-01081	UA2004-148-7	BLIP 1	Feather	Fletching	<0.1 g	124.6 mm	2.4 mm	23 mm	1.7 mm	1.7 mm
XMH-01081	UA2004-148-8	BLIP 1	Feather	Fletching	<0.1 g	106 mm	1.6 mm	19.2 mm	1.7 mm	1.7 mm
XMH-01082	UA2004-149-1	BLIP 2	Antler	Arrow point	14 g	270 mm	7.8 mm	11.4 mm	2.1 mm	6.8 mm
XMH-01166	UA2004-150-1	BLIP 3	Antler	Worked	421 g	590 mm	45.2 mm	51.1 mm	33.4 mm	39.5 mm
XMH-01166	UA2004-150-2	BLIP 3	Wood	Birch bark	45 g	281.4 mm	114.7 mm	142.8 mm	3.7 mm	4.8 mm
XMH-01191	UA2004-153-4	BLIP 4	Wood	Shaft	2.6 g	217 mm	8.9 mm	10.6 mm	3.1 mm	6.6 mm
XMH-01191	UA2004-153-1	BLIP 4	Lithic	Proj. Point	11.1 g	56.4 mm		26.4 mm*		6.5 mm*
XMH-01191	UA2004-153-2	BLIP 4	Lithic	Proj. Point	11.4 g	65.1 mm		22.4 mm*		7.6 mm*
XMH-01191	UA2004-153-3	BLIP 4	Lithic	Proj. Point	16.6 g	63.1 mm		29.5 mm*		7.8 mm*
XMH-01192	UA2004-154-1	DRIP 5	Wood	"Gopher stick"	241g	755 mm	18.3 mm	33 mm	11.6 mm	22 mm

MEASUREMENT NOTES:
Wt: Weight in grams
L: Maximum length from distal to proximal end along the long axis
W 1: Minimum width [width at narrowest point on the artifact]
W 2: Maximum width [width at widest point on the artifact]
T 1: Minimum thickness [at thinnest point on the artifact]
T 2: Maximum thickness [at thickest point on the artifact]
* indicates measurement taken at the midpoint of the length (**L**)

chert point, on the other hand, is long, narrow, and moderately convex in cross-section. While there are no dates directly associated with the projectiles, the morphological differences between them may imply that the points are from separate time periods.

THE DELTA RIVER ICE PATCHES

The Delta River ice patches (DRIPs) are located on the northern end of a north–south trending ridge of the Amphitheater Mountains, west of Long Tangle Lake and the Delta River Falls. They were initially visited in August 2004 as part of continuing efforts to identify ice patches containing cultural materials. This cluster was not revisited during the 2005 field season because it was a low-melt summer. As such, there was little chance of finding artifacts recently exposed from the ice. Of the five locales that make up the DRIPs, only one (DRIP 5) produced cultural material.

DELTA RIVER ICE PATCH 5 (XMH-1192)

DRIP 5 is located on the northern tier of a flat-topped peak that is roughly 2.5 km west of Lower Tangle Lake. The single artifact recovered from DRIP 5 is a 75.5 cm long wooden object made from a large spruce stave (Fig. 7). The proximal end of the artifact (Fig. 8) is 3.3 cm wide and worked to a rounded point. The stave tapers toward the distal end, which is marked by a deep notch in one side (Fig. 9). At least 25 growth rings are visible along the side of the stave. An examination of the ends of the stave show these rings are almost flat, indicating that it was split from the outer rings of a sizeable log. Material obtained from a hole drilled into the core of the stave yielded an AMS date of AD 1437–1634 (Beta-201472; Table 1).

The artifact was originally identified in the field as a possible atlatl due to its similarity in size and shape to terrestrial atlatls used throughout the Holocene in the western U.S. However, its age is much younger than atlatl-related technology found in the Yukon, where ice patch data show the transition from atlatl and dart to bow and arrow taking place approximately AD 700 (Hare et al. 2004b).[2] Further analysis revealed considerable wear or damage on the point at the proximal end of the stave, as if it had been repeatedly

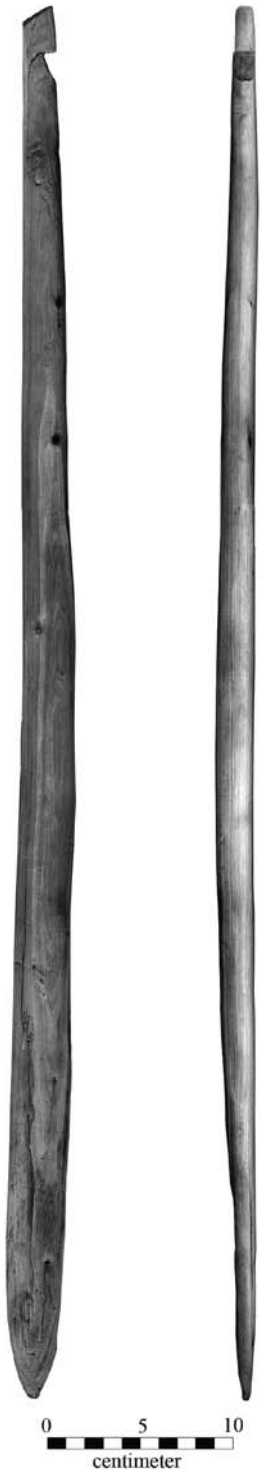

Figure 7. Wooden stave recovered from Delta River ice patch 5. Object, 75.5 cm long, may be a "gopher stick" for setting ground squirrel snares. Scanned image by Boreal Imagery.

2 The discovery of an item identified as a dart dating to cal AD 1450–1635 found melting from glacial ice near the *Kwäday Dän Ts'ínchi* ("long ago person found") discovery (Beattie et al. 2000:138) in northwestern British Columbia, and a possible dart shaft from the Wrangell Mountains dating to cal AD 1270-1389 (Dixon et al. 2005:137, Table 1), raise the possibility that atlatl and dart use continued in some regions to a much later date.

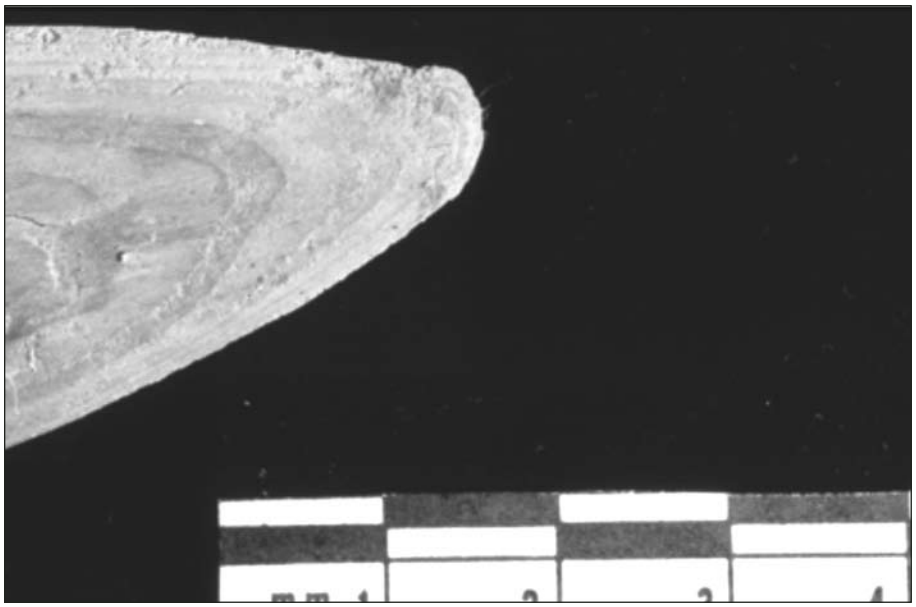

Figure 8. Battering on pointed end of stave suggests it has been thrust into snow or soil, possibly showing use as a "gopher stick" to set snares for ground squirrels. Photo by J. D. McMahan.

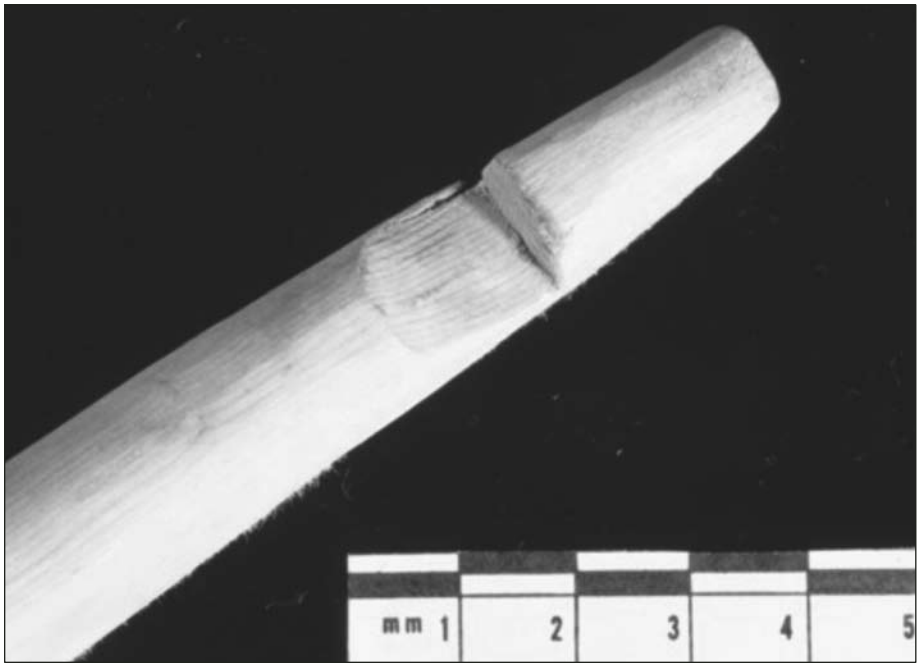

Figure 9. Notch cut in side of spruce stave from DRIP 5. Note growth rings visible in notch. Lack of wear on outer point portion of notch indicates it was not used as a spur for propelling an atlatl dart. Photo by J. D. McMahan.

thrust into the soil (Fig. 8). This evidence suggested that the implement may have been used as a digging stick, though inspection of the area revealed that there were no pieces of rock or soil embedded in the wood.

The recent radiocarbon date on the DRIP 5 stave, as well as the notched side and battered end, support the hypothesis that the artifact is something other than an atlatl. Ethnographic evidence suggests the artifact may be a "gopher stick," similar to those used by Southern Tutchone women to set ground squirrel snares (Beattie et al. 2000:138; Johnson and Raup 1964:194; McClellan 1975:158). A wooden stave used for setting ground squirrel snares in the Kluane Lake region of the Yukon is illustrated by Johnson and Raup (1964: Fig. 53e). The Yukon stave is morphologically similar to the DRIP 5 stave, having a pointed handle at one end and hook at the other, but it is slimmer and considerably longer (116.8 cm).[3] The ground squirrel snare described by Johnson and Raup is a loop made of split eagle feather quill attached to a strip of tanned moose hide and a short, slim stick that is used as a toggle. The authors explained how the snare was installed:

3 Another possible gopher stick is discussed in Beattie et al. 2000:138.

> To set the snare two short sticks are collected. A wooden hook [the "gopher stick"] … is then pushed through the earth over a gopher burrow a few inches from the opening. The moose hide string is placed in the hook and it is drawn back to the surface. A nearby sapling is bent over and held while the moose hide string is tied to the end. The two sticks are placed inside the burrow, one on each side of the string. As the tension is released the toggle lashed to the noose is guided to these sticks. Also the loop is caught with the trigger. The noose is then held in position by the tension of the sapling. (Johnson and Raup 1964:194)

Ahtna excursions into the high country (including the Tangle Lakes region) in the fall often included the trapping of ground squirrels along with hunting, fishing, and berry picking (Reckord 1983a:29–30). Ground squirrels were reportedly roasted around a fire and their rendered fat was collected and stored in birch bark pans and baskets as well as wooden trays. Blueberries were then mixed with the squirrel grease to produce a traditional delicacy called *tseles caadze* (Reckord 1983b:33).

Ground squirrel and marmot burrows were commonly observed by OHA personnel during surveys in the Amphitheater Mountains, including at the foot of several ice patches. The area surrounding ice patches is ideal to construct burrows for several reasons. First, the moist environment from snow melt (as well as nutrients derived from decomposing caribou dung and vegetation) fosters abundant plant growth throughout the summer (Skoog 1968:148–149). Second, nivation processes in conjunction with decaying organic remains creates enough soft sediment to construct burrows in the predominantly rocky substrate. The location of small mammal burrows in close proximity to the ice patches would have provided hunting groups with the opportunity to employ a multipurpose foraging strategy on trips to the high country.

The fact that the wooden stave was found on top of a mountain roughly 760 m above the nearest lake implies that it was not related to fishing activities. The battered end and recent radiocarbon date also indicate that it is probably not related to atlatl and dart technology. There are enough morphological similarities between the DRIP 5 stave and the Kluane Lake specimen to support the interpretation that it was probably used as a "gopher stick" for setting ground squirrel snares. However, its shorter length, more robust nature, and location on an ice patch suggest additional uses such as for self-arrest on the ice patch or to dig a hollow in the snow in which to store caribou meat (Hare et al. 2004b:262).

MACLAREN GLACIER ICE PATCH

James W. Whitney, anthropology curator for the University of Alaska Museum of the North, discovered an ice patch artifact from the Denali Highway region in 2005. The discovery was made, not in the field but in the museum's collections where he came across a self-armed,[4] barbed antler arrow point (Fig. 10) similar to the one discovered at BLIP 2 in 2003. Museum records indicate that it was found on the edge of a "snowfield" west of Maclaren Glacier in 1957. The point is 273 mm long, 11.7 mm wide, and 7.3 mm thick, with five barbs along one edge and a conical tang (James W. Whitney 2005, written communication).

Figure 10. Barbed antler point found on ice patch west of Maclaren Glacier in 1957. Point is 27.3 cm long. University of Alaska Museum Archaeological Collection.

4 Arrow tip is pointed, not grooved for insertion of end blade.

FAUNAL EVIDENCE FROM ICE PATCHES

Faunal remains recovered from the Yukon ice patches are predominantly those of caribou, but elements of other large mammals such as wood bison, moose, sheep, elk, and goat have also been found (Farnell et al. 2004:254). Small mammals are represented by the remains of lemming, vole, and ground squirrel (CTFN et al. 2005:3). No butchering marks have been reported on any of the Yukon fauna.

The identified faunal remains recovered from the Wrangell Mountain ice patches consist of sheep, caribou, fox, and vole (Dixon et al. 2005:136). The assemblage also includes the unidentified remains of several species of birds, small-and-medium sized mammals, and a small fish. As in the Yukon collection, there has been no evidence of butchering reported on any of the Wrangell fauna.

Almost all of the fauna collected from the Amphitheater Mountain ice patches (Table 2) are from caribou. Remains from other species include a marmot mandible from BLIP 1, a rib from an unidentified small mammal collected from a fossil ice patch near BLIP 2, and the wing of an unidentified bird from DRIP 3 that was not collected. No evidence of human butchering was identified on any of the Amphitheater Mountain ice patch faunal remains. Samples of caribou dung were collected for possible radiocarbon dating and biological sampling.

Although the collection is relatively small, a wide variety of caribou body parts are represented. The recovered remains appear to display some patterning. Ribs, vertebra, and lower leg bones are often well represented and intact. Large long bones, on the other hand, are underrepresented, fragmentary, and often display spiral fractures. Caribou skull components (e.g., crania and mandibles) were one of the more common elements found on the ice patches, and indicate a minimum of five individuals. This faunal assemblage is somewhat suggestive of human predation, where body parts associated with high meat utility are carried off site and parts with low meat utility are left on site.

One type of material that initially puzzled researchers was organic fragments that resembled strips of animal hide or intestine. Closer inspection and discussion with Canadian researchers (P. Gregory Hare 2003, personal communication) revealed that these were strips of velvet shed from caribou antlers. Although none of the velvet recovered from the Amphitheater Mountain ice patches has been dated, it is remarkable that this fragile material survived in the ice.

Two antler tines were collected from the DRIPs in 2004. Canadian researchers have suggested that the antler tines they collected were associated with human activity (Hare et al. 2004b:268–269). No sign of human use or modification is evident on the DRIP tines. The slightly spongy outer surface of the tines suggests that they may have snapped off while covered with velvet. One of the tines, collected from DRIP 2, has velvet still attached. Caribou bulls are known to frequent ice patches in the high country in late summer and begin scraping the velvet off their antlers in late August (Batin 1995:61–64). A considerable amount of shed velvet was observed on the Amphitheater Mountains ice patches, and it seems reasonable that tines are occasionally snapped off on the rocks, ice, and snow as the caribou attempt to scrape the velvet off their antlers.

Evidence of nonhuman predation and scavenging was noted in the form of bear, wolf, and fox tracks and scat observed at the base of BLIP 1. This suggests natural deposition, predation, and opportunistic scavenging may be factors in the formation of ice patch faunal assemblages. Caribou bones and antler recovered from ice patches in the Amphitheater Mountains commonly display gnaw marks from a variety of species. Therefore, the question of animal versus human predation of caribou on ice patches appears difficult to determine without finding faunal remains with unquestionable weapon or butchering marks.

DISCUSSION

Archaeological evidence from the Yukon ice patches indicates that hunters have been ambushing caribou at ice patches throughout most of the Holocene. The earliest dated artifact recovered from an ice patch is a dart shaft fragment dated to 7194–7568 cal BC (Hare et al. 2004b:262, Table 2). The next oldest artifact is a slotted antler point dated to 6071–6236 cal BC (Hare et al. 2004b:268, Table 4). This point, armed with microblades along both edges, would have likely tipped the end of a dart. The early Holocene date associated with the point suggests that it was constructed by the microblade-making people of the Denali Complex, who probably used tools like this to hunt caribou in the Tangle Lakes region as well.

Atlatl dart shaft fragments are the most common artifact found in Yukon ice patches (CTFN et al. 2005:8). Most Yukon darts show evidence of being armed with bifacially flaked lithic points, although five examples appear to have incorporated some bone or antler components

(Hare et al. 2004b:265). Lithic points recovered from ice patches show a broad range of styles, including side-notched, stemmed, leaf-shaped, and lanceolate (Hare et al. 2004b:264-265, Fig. 6).

The relatively large size of the lithic projectile points found at BLIP 4 indicates that hunters were using atlatl and dart technology to hunt caribou on Alaska ice patches. One of the BLIP 4 dart points (Fig. 6:3) closely resembles a hafted stone point found on an ice patch in the Wrangell Mountains. This point was attached with sinew to a wooden foreshaft that dates to approximately 2600–2900 BP (Dixon et al. 2005:139, Fig. 6a). The morphology of the other two points recovered from BLIP 4 is similar to several of the hafted points recovered from the Yukon ice patches that are associated with dates between approximately 2,000 and 4,000 years ago (CTFN et al. 2002, 2005).

Examples of dart and arrow shafts from the Yukon ice patches show a distinct transition from dart to arrow technology between roughly AD 700 and 800.[5] The oldest unambiguous evidence of bow and arrow use comes from fragments of a maple bow dated to cal AD 644–876 (1300±60 ^{14}C yrs BP). Incidentally, this date overlaps with a dart shaft dated to cal AD 656–890 (1260±60 ^{14}C yrs BP; Hare et al. 2004b). The youngest Yukon dart shaft and all later arrows were armed with antler instead of lithic points, showing a transition at this time in both weapon systems and in choice of arrow point materials for hunting on ice patches.

The one exception to this otherwise clear atlatl-to-bow transition in the artifacts from the Yukon ice patches is an arrow dating to approximately 1500 BC. This anomalous item is identified as an arrow by its distinct U-shaped nock, yet is much longer than other arrows (100 cm, versus 73 cm for the next longest arrow and 58 cm for the median length of shafts in the collection). It was found in association with a stemmed lanceolate lithic point. The design of this arrow (greater length, distally heavier, and armed with a lanceolate lithic point) suggests that someone familiar with dart construction may have been trying to scale down a dart to function as an arrow.

Bow and arrow technology is believed to have been present along the coast of northern and western Alaska at 1500 BC, but not used at this time in the southern Interior. This anomalous arrow technology dates to approximately the same time as a period of climatic and ecological perturbations, including the eruption of the Hayes Volcano, located 350 km southwest of Basalt Lake in upper Cook Inlet (Begét et al. 1991; Riehle et al. 1990; Riehle 1994). The northeast-trending ash plume of the 1500 BC Hayes eruption covered thousands of square kilometers (Riehle 1994) and must have had a significant ecological effect in central Alaska. Mount Hayes is just one of a number of large volcanic eruptions that occurred in the eastern Aleutian arc during the middle of the fourth millennium BP (Riehle et al. 1998). The ecological effects of these eruptions are poorly understood, but it seems reasonable to presume that there were significant biological and cultural effects felt across Alaska and the Yukon (Bowers and Thorson 1981; VanderHoek and Nelson 2007), possibly causing the movement of people and ideas across the region.

WEATHERING OF MATERIALS IN ICE PATCHES

It is clear that ice patches help preserve the materials entombed within them. The difference in preservation of items found on ice patches is normally attributed to the length of time the item has been exposed to the elements after melting out of the ice (Monahan 2004). Of course, items that have melted out of ice patches are not necessarily exposed to the air from that time forward. Items freed from ice are exposed, usually in late summer, until they are covered with snow later that fall. If the winter's snow accumulation exceeds the next summer's ablation (melting and evaporation), the item may remain reburied in snow, which turns to ice over time. More robust items (like the wooden stave recovered in 2004) may have been exposed and reburied with snow and ice many times before they were recovered by researchers. Fragile items like sinew and hide are not likely to survive more than a few seasons, since repeated exposure and burial can destroy even the most robust artifacts.

Artifacts recovered from ice patches are commonly in a fragile state and need to be carefully conserved. Physical stabilization in the field can be attempted by careful immobilization in rigid containers. Drying of the items during transport can be prevented by wrapping the artifacts

5 An antler projectile point dating to AD 465–499 was recently recovered from an ice patch, or cirque, in the Wrangell Mountains (Dixon et al. 2005). If this is an arrow point, as it appears, it suggests the transition to bow and arrow in the Wrangell Mountains may have preceded that in the Yukon by several hundred years.

with cellophane or placing them in plastic storage bags until they return from the field. Long-term curation of plant and animal remains may necessitate freezer storage (Monahan 2004).

Canadian conservators believe exposure to the elements causes an overall external weathering of the wooden shafts. Severe weathering commonly results in a reduction of the shafts' diameter. Canadian ice patch artifact collections curated by the Yukon Heritage Resources Unit show atlatl darts (evident by the dimple in the proximal end, instead of the notch cut for an arrow nock) that have shrunk to as small a diameter as our smallest arrow segment (~4 mm in diameter). The reduction in diameter highlights not only the process of how artifacts degrade after melting out of ice patches but also how different projectile systems (atlatl dart versus arrow) may not be discernable by simply measuring shaft diameters.

CONCLUSION

Artifacts recovered by this project include a barbed antler point, a wooden shaft fragment, and a chopped section of antler that all date to approximately AD 1000. A wooden stave identified as an implement for setting ground squirrel snares dates to approximately AD 1500. While these dates demonstrate significant antiquity, it is important to reiterate the similarity between the lithic projectile points recovered from BLIP 4 and the points recovered from the Wrangell Mountains and the Yukon, which date to several thousand years earlier. These tentative typologic associations imply that the Amphitheater Mountain ice patches may have been hunting destinations for earlier groups in the area. It is therefore reasonable to suspect that continuing research will eventually push the chronology of ice patch use in the region back at least several thousand years.

Ice patches are valuable sources of archaeological, paleontological, and paleoenvironmental data. They are geomorphic features that provided predictable and reliable locations for hunters to ambush game. They are unique in the sense that they preserve fragile organic materials that are only occasionally found in frozen or wet sites. Unfortunately, the same environmental factors that have caused these materials to emerge from the ice are also causing their destruction. As such, ice patches should be seen as a vanishing resource that requires urgent attention from arctic researchers.

ACKNOWLEDGEMENTS

The authors wish to express their appreciation to Tom Andrews, E. James Dixon, and P. Gregory Hare for their willingness to share information on cultural materials related to their ice patch research. Diane K. Hanson, Mary P. Hermon, Charles E. Holmes, and William B. Workman provided helpful comments on earlier versions of this manuscript. A special thanks to Sheila Greer and Ruth Gotthardt for providing insights gained from their ice patch research, sharing information on gopher sticks, and commenting on an earlier draft of this manuscript.

REFERENCES

Batin, C.
1995 *Hunting in Alaska: A Comprehensive Guide*. Alaska Hunter, Fairbanks.

Beattie, O., B. Apland, E. W. Blake, J. A. Cosgrove, S. Gaunt, S. Greer, A. P. Mackie, K. E. Mackie, Dan Straathof, Valerie Thorp, and P. M. Troffe
2000 Kwaday Dan Ts'inchi Discovery From a Glacier in British Columbia. *Canadian Journal of Archaeology* 24(1):129–147.

Begét, J. E., R. D. Reger, D. S. Pinney, T. Gillispie, and K. M. Campbell
1991 Correlation of the Holocene Jarvis Creek, Tangle Lakes, Cantwell, and Hayes Tephras in South-Central Alaska. *Quaternary Research* 35:174–189.

Bowers, P. M., and R. M. Thorson
1981 A Geo-Archaeological Perspective on Tephrochronology in Central Alaska: A Summary of Existing Data. Paper presented at the 8th Annual Meeting of the Alaska Anthropological Association, Anchorage.

Carcross-Tagish First Nation (CTFN), Champagne and Aishihik First Nations (CAFN), Kluane First Nation (KFN), and Kwanlin Dün First Nation (KDFN)
2002 *Ice Patch.* Newsletter published by Carcross-Tagish First Nation, Champagne and Aishihik First Nations, Kluane First Nation, and Kwanlin Dün First Nation, Yukon, Canada. On file, Champagne and Aishihik First Nations, Whitehorse. Also available on line at www.cafn.ca.

Carcross-Tagish First Nation (CTFN), CAFN (Champagne and Aishihik First Nations), Kluane First Nation (KFN), Kwanlin Dün First Nation (KDFN), Ta'an Kwäch'än Council (TKC), and Teslin Tlingit Council (TTC)
2005 *Ice Patch*, Issue 2. Newsletter published by Carcross-Tagish First Nation, Champagne and Aishihik First Nations, Kluane First Nation, Kwanlin Dün First Nation, Ta'an Kwäch'än Council, and Teslin Tlingit Council, Yukon, Canada. On file, Champagne and Aishihik First Nations, Whitehorse.

de Laguna, F., and C. McClellan
1981 Ahtna. In *Handbook of North American Indians,* Vol. 6, edited by J. Helm, pp. 641–664. Smithsonian Institution, Washington, D.C.

Dixon, J, E., W. F. Manley, and C. M. Lee
2005 Emerging Archaeology of Glaciers and Ice Patches: Examples from Alaska's Wrangell-St. Elias National Park and Preserve. *American Antiquity* 70(1):129–143.

Dove, C. J., P. G. Hare, and M. Heacker
2005 Identification of Ancient Feather Fragments Found in Melting Alpine Ice Patches in Southern Yukon. *Arctic* 58 (1):38–43.

Farnell, R., P. G. Hare, E. Blake, V. Bowyer, C. Schweger, S. Greer, and R. Gotthardt
2004 Multidisciplinary Investigations of Alpine Ice Patches in Southwest Yukon, Canada: Paleoenvironmental and Paleobiological Investigations. *Arctic* 57(3):247–259.

Hanson, D. K.
1999 Interim Report of Archaeological Activities at the Ringling Material Site (MS 71-2-020-5), Gulkana, Alaska. Report No. 76, Alaska Office of History and Archaeology, State of Alaska Division of Parks and Outdoor Recreation, Department of Natural Resources, Anchorage.

Hare, P. G., S. Greer, and R. Gotthardt
2004a Punctuated Technological Change in Southern Yukon: Interpretations of the Ice Patch Archaeological Assemblage. Paper presented at the 31st Annual Meeting of the Alaska Anthropological Association, Whitehorse.

Hare, P. G., S. Greer, R. Gotthardt, R. Farnell, V. Bowyer, C. Schweger, and D. Strand
2004b Ethnographic and Archaeological Investigations of Alpine Ice Patches in Southwest Yukon, Canada. *Arctic* 57(3):260–272.

Hosley, E. H.
1981 Environment and Culture in the Alaska Plateau. In *Handbook of North American Indians,* Vol. 6, pp. 533–545, edited by J. Helm. Smithsonian Institution, Washington, D.C.

Johnson, F., and H. M. Raup
1971 Geobotanical and Archaeological Reconnaissance. In Investigations in Southwest Yukon. *Papers of the R. S. Peabody Foundation for Archaeology,* Vol. 6(1). Phillips Academy, Andover, MA.

Kuzyk, G. W., D. E. Russell, R. S. Farnell, R. M. Gotthardt, P. G. Hare, and E. Blake
1999 In Pursuit of Prehistoric Caribou on Thandlät, Southern Yukon. *Arctic* 52(2):214–219.

McClellan, C.
1975 My Old People Say: An Ethnographic Survey of Southern Yukon Territory. *National Museum of Man Publications in Ethnology* 6(1), Part 1. National Museums of Canada, Ottawa.

Monahan, V.
2004 Looking after Ice Patch Artifacts: Practical Strategies for the Recovery, Treatment and Storage of Archaeological Materials Recovered from Alpine Ice Patches. Paper presented at the 31st Annual Meeting of the Alaska Anthropological Association, Whitehorse.

Morrison, D.
1986 Inuit and Kutchin Bone and Antler Industries in Northwestern Canada. *Canadian Journal of Archaeology* 10:107–125.

Reckord, H.
1983a That's the Way We Live: Subsistence in the Wrangell-St. Elias National Park and Preserve. *Occasional Paper* No. 34. Anthropology and Historic Preservation, Cooperative Park Studies Unit, University of Alaska Fairbanks, Fairbanks.
1983b Where Raven Stood: Cultural Resources of the Ahtna Region. *Occasional Paper* No. 35. Anthropology and Historic Preservation, Cooperative Park Studies Unit, University of Alaska Fairbanks, Fairbanks.

Reimer, P. G., M. G. L. Baillie, E. Bard, A. Bayliss, J. W. Beck, C. Bertrand, P. G. Blackwell, C. E. Buck, G. Burr, K. B. Cutler, P. E. Damon, R. L. Edwards, R. G. Fairbanks, M. Friedrich, T. P. Guilderson, K. A. Hughen, B. Kromer, F. G. McCormac, S. Manning, C. Bronk Ramsey, R. W. Reimer, S. Remmele, J. R. Southon, M. Stuiver, S. Talamo, F. W. Taylor, J. van der Plicht, and C. E. Weyhenmeyer
2004 IntCal04 Terrestrial Radiocarbon Age Calibration, 0–26 Cal Kyr BP. *Radiocarbon* 46:1029–1058.

Riehle, J. R.
1994 Heterogeneity, Correlatives, and Proposed Stratigraphic Nomenclature of Hayes Tephra Set H, Alaska. *Quaternary Research* 41:285–288.

Riehle, J. R., P. M. Bowers, and T. A. Ager
1990 Hayes Tephra Deposits, an Upper Holocene Marker Horizon in South-Central Alaska. *Quaternary Research* 33:276–290.

Riehle, J. R., R. B. Waitt, C. E. Meyer, and L. C. Calk.
1998 Age and Formation of Kaguyak Caldera, Eastern Aleutian Arc, Alaska, Estimated by Tephrachrology. In *Geologic Studies in Alaska* by the U.S. Geological Survey, 1996, *Professional Paper* 1595, edited by J. E. Gray and J. R. Riehle, pp. 161–168. U.S. Government Printing Office, Washington, D.C.

Shinkwin, A. D.
1979 Dakah Denin's Village and the Dixthada Site. *National Museum of Man Mercury Series* Paper No. 91, Ottawa.

Skoog, R. O.
1968 Ecology of the Caribou (*Rangifer tarandus granti*) in Alaska. Unpublished Ph.D. dissertation, Department of Biology, University of California, Berkeley.

VanderHoek, R.
2003 Archaeological Survey and Management of the State of Alaska Tangle Lakes Archaeological District/Special Use Area and Associated Denali Block, 2003 Research Design. Manuscript on file, Office of History and Archaeology, State of Alaska Division of Parks and Outdoor Recreation, Department of Natural Resources, Anchorage.

2007a Cultural Resource Management Plan for the Denali Highway Lands, Central Alaska. Draft Report Number 112. Alaska Department of Natural Resources, Division of Parks and Outdoor Recreation, Office of History and Archaeology, State of Alaska Division of Parks and Outdoor Recreation, Department of Natural Resources, Anchorage.

2007b Cultural Resource Management Activities in the Denali Blocks, Denali Highway, Central Alaska, 2003–2005. Draft Report Number 113. Alaska Department of Natural Resources, Division of Parks and Outdoor Recreation, Office of History and Archaeology, Anchorage.

VanderHoek, R., and R. E. Nelson
2007 Ecological Roadblocks on a Constrained Landscape: The Cultural Effects of Catastrophic Holocene Volcanism on the Alaska Peninsula, Southwest Alaska. In *Living Under the Shadow: The Cultural and Environmental Impacts of Volcanic Eruptions*, edited by J. P. Grattan and R. Torrence, pp. 133–152. Left Coast Press, Walnut Creek, CA.

Workman, W. B.
1976 Archaeological Investigations at GUL-077, a Prehistoric Site Near Gulkana, Alaska. Alaska Methodist University. Unpublished manuscript on file at Office of History and Archaeology, State of Alaska Division of Parks and Outdoor Recreation, Department of Natural Resources, Anchorage.