# Weapon Systems and Assemblage Variability during the Northern Archaic Period in Northern Alaska

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*Abstract.* The Rosaliya (49-KIR-196) site is a small, single component microblade production and weapon repair location in the central Brooks Range of northern Alaska dated to 5200 years B.P. Although surrounded both geographically and chronologically by sites ascribed to the Northern Archaic tradition (NAT), the Rosaliya assemblage differs from them. It lacks the side-notched projectile points that are considered a hallmark of the tradition, and is instead dominated by the products of microblade technology, which is not, however, widely accepted as a NAT trait. We propose that regional scale NAT assemblage variability results in part from the use of multiple weapon systems with lanceolate-shaped bifaces functioning as spear heads, side-notched bifaces as dart tips, and microblades as components of arrowheads. The Rosaliya site assemblage, because it represents a short occupation involving specialized activities, reflects only a narrow range of this broader Northern Archaic period technology.

## Variability in the Northern Archaic Period

The Northern Archaic tradition (NAT) is a label applied to archaeological assemblages from mainland Alaska and Yukon dated to after approximately 6000 to 4200 B.P.[1] or later (Anderson 1968, 1984, 1988; Clark 1981, 1992). Side-notched bifacial projectile points are the hallmark of the NAT, but assemblages sometimes contain lanceolate-shaped projectile points, products and byproducts of microblade manufacture, unifacially shaped tools such as side- and endscrapers, notched pebble percussors, bifacial knives, and heavy cobble or core tools. These implements and technologies occur in widely variable combinations and proportions among the many assemblages assigned to the NAT. Some assemblages, for example, contain dozens or even hundreds of unifacial scrapers while others have none. Lanceolate-shaped projectile points are found in some assemblages, while side-notched projectile points are found in nearly all.

Discussions of NAT assemblage variability have frequently focused on two of these dimensions: side-notched projectile points and microblade technology (Anderson 1984; Clark 1992, 2001). Archaeologists are interested to know why these artifacts occur together, and to understand the underlying processes influencing their absolute numbers, condition, and the kinds of raw materials from which they are made. These questions apply to all artifact classes, not only microblades

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and notched projectile points, and they are fundamental to understanding prehistoric land use and human behavior during the Northern Archaic period, given an archaeological record composed almost exclusively of stone tools and the debris from their manufacture.

Explanations for NAT assemblage variability have been framed primarily in terms of processes such as diffusion and migration (Anderson 1968; Clark 1992; Clark and Clark 1993:227; Dumond 1980) or are said to result from in situ cultural change (Anderson 1988:75). Clark (1992), for example, states that the NAT components within the stratified sequence at the Onion Portage site, which lack microblade technology, represent "pure" NAT assemblages, while many other site assemblages represent "technological amalgamation or hybridization" of Northern Archaic and the earlier, microblade-using, American Paleoarctic tradition. At the heart of these discussions is 1) the concept of notched projectile points as emblematic of forest or subarctic-adapted Archaic peoples or technologies with origins south of Alaska (Anderson 1968; Campbell 1962; Clark 1992; Workman 1978) and 2) the idea of microblade technology being rooted in an earlier Paleoarctic tradition with ties to Asia and tundra or arctic-adapted ways of life (Anderson 1968, 1988; Clark 1992; Dumond 1980).

Site formation processes have also been discussed as an important source of variation among NAT assemblages. Specifically, assemblages containing both notched projectile points and microblade technology have been posited to reflect artifact accumulations from multiple time periods or cultural traditions (Anderson 1988:151, 1970; Clark 1992; Hall 1975). From this perspective such "mixed" assemblages are reasonably seen to offer information of more limited use in pursuing questions about a specific time period or prehistoric system. The occupation history of sites and the nature of artifact samples certainly does have a profound influence on assemblage content and is a fundamental concern in the interpretation of the many surface and shallowly buried assemblages known for the NAT period. The accumulated body of evidence as it stands today, however, suggests that microblade technology co-occurs with notched projectile points frequently and in enough clear, well-dated contexts to support a meaningful association between the two technologies (Clark 1992; Esdale this volume). Microblade technology, in other words, is reasonably considered to be one facet of the Northern Archaic technological repertoire that was used along with side-notched projectile points, lanceolate-shaped projectile points and other tools. Altogether three tool or weapon systems are evident in archaeological assemblages from northern Alaska during the interval from approximately 6000 to 4000 B.P.

Osgood's (1940) description of Ingalik material culture provides a useful glimpse from an ethnographic context of how complex hunter-gatherer toolkits and tool use can be. In the realm of weapons alone the Ingalik employed three delivery methods: thrusting spears, darts, and the bow and arrow. Included were five arrow designs suited for particular game, three types of thrusting spears for fish and one for large terrestrial game, and a single type of dart. Each of these weapons or weapon components was different from the others in regard to the location of manufacture, season of manufacture, season of use, and intended prey. The roles of manufacturer, owner, and user of certain tools also varied, independently of other factors, so that for some tools each role was filled by a different individual. An archaeological implication of this scenario, even if only some of these processes operated in the more distant past, is that simple conceptions concerning the contents of prehistoric toolkits and an expectation of substantial site-to-site assemblage redundancy for a given time period are unrealistic.

In this paper we focus on three weapon or tool systems evident in NAT period archaeological sites in northern Alaska and examine a set of functional explanations for why different assemblages contain different things. We leave aside the question of which particular historical processes or mechanisms of cultural transmission presented these different technological options to the middle Holocene hunter-gatherers in Alaska. Instead we look at how these tools were used from a narrow, functional perspective (i.e., as dart, arrow, or spear armaments) as well as from a broader, strategic perspective (i.e., associated with particular hunting tactics, seasons, or prey). We take an essentially synchronic approach in developing a model for how the use of these tool systems articulated with subsistence and land use practices, which were played out on a regional scale and produced a regional scale archaeological record.

Our discussions focus on northern Alaska, an area that encompasses the upper Koyukuk River drainage, the southern flanks of the Brooks Range, and the lands to the north of the Brooks Range to the Arctic coast (Fig. 1). This region contains key sites at which side-notched projectile points were first documented in the north (e.g., Giddings 1960, 1962; Giddings and Anderson 1986), and sites that were central to the formulation and development of the Northern Archaic concept (e.g., Anderson 1968, 1972, 1988; Campbell 1961; Clark and Clark 1993).

We also discuss in some detail a recently discovered site from northern Alaska called Rosaliya (49-KIR-196) that falls within the same time period as the most reliably dated Northern Archaic sites in northern Alaska, but which contains an assemblage that differs from what is

typically assigned to the NAT. The Rosaliya artifact assemblage lacks the side-notched projectile points that are so characteristic of the tradition, and is instead dominated by the products of microblade technology, which is not widely accepted as a NAT trait. The unique character of the Rosaliya assemblage in the context of other middle Holocene sites in northern Alaska prompts consideration of how NAT assemblage variability is approached and perhaps indicates some of the limitations of unit concepts like the NAT.

## Context and Content of Northern Archaic Assemblages in Northern Alaska

Some notable NAT sites from northern Alaska are portrayed in Figure 1 and include the Palisades site located near the Chukchi Sea coast (Giddings 1962), the Tuktu site near Anaktuvuk Pass in the Central Brooks Range (Campbell 1961, 1962), the stratified, multi-component Onion Portage site on the Kobuk River (Anderson 1968, 1988), the Kuparuk Pingo site near the Arctic coast (Lobdell 1986, 1995), a site complex at Agiak Lake (Wilson and Slobodina 2007), and sites adjacent to the Batza Tena obsidian source area in the Koyukuk River drainage (Clark and Clark 1993). Dozens of additional undated surface assemblages and isolated finds of notched projectile points are also known from the region (e.g., Davis et al. 1981; Hall 1975; Kunz 1991), but in dealing with questions related to artifact associations and chronology, sites with uncomplicated occupation histories or "fine grained" contexts, and independent dating (see Table 1) are especially useful because a high degree of confidence can be given to the associations among artifacts as well as the associations between artifacts and dated materials (Hall 1982; Sullivan 1992; Wandsnider 1998).

We considered fine-grained contexts to be those in which artifacts are found and recorded 1) in relatively small, discrete clusters on the scale of 5 to 10 m in diameter, a scale consistent with ethnographically documented hunter-gatherer activity areas of short duration; 2) on expansive landforms that would not have focused re-use in a single location and led to time-averaged palimpsest deposits; or 3) in rapidly buried and sealed deposits that reduce the likelihood of admixture of artifacts from different periods.

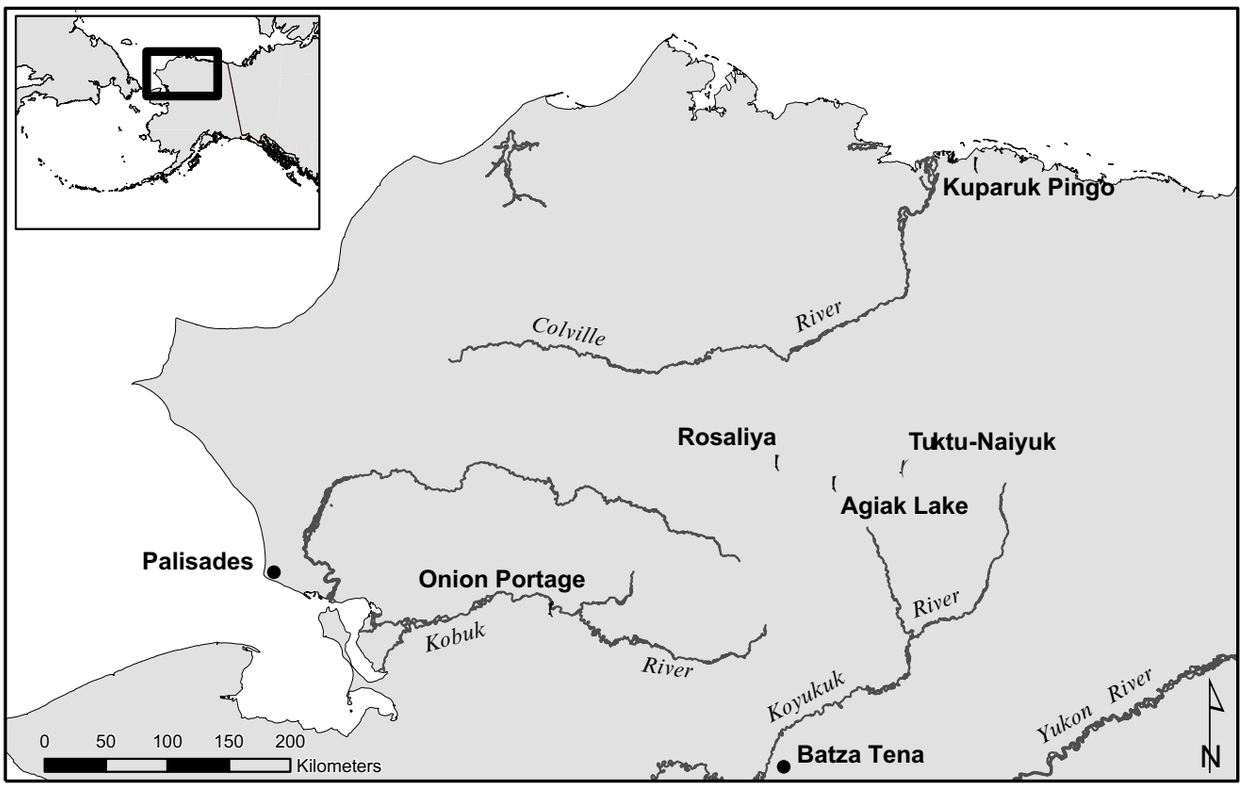


**Figure 1. Map of northern Alaska showing the Rosaliya site and other radiocarbon dated Northern Archaic tradition sites.**

**Table 1. Northern Archaic Period Sites in Northern Alaska with Excellent Context and Dating.**

| Site | Age ($^{14}$C yrs B.P.) | Lab ID | Reference |
|---|---|---|---|
| Kuparuk Pingo | 5915±295 | UGa-5083 | Lobdell 1986, 1995 |
| Onion Portage | | | |
| Phase 1 (Palisades) | 5200–5800 | Various | Anderson 1988 |
| Phase 2 (Palisades) | 5000–5200 | Various | Anderson 1988 |
| Phase 3 (Palisades) | 4400–5000 | Various | Anderson 1988 |
| Phase 4 (Palisades) | 4300–4400 | Various | Anderson 1988 |
| Phase 5 (Transitional) | 4275 | Various | Anderson 1988 |
| Phase 6 (Portage) | 4100–4250 | Various | Anderson 1988 |
| Agiak Lake | 4430±40 | Beta-210714 | Wilson and Slobodina 2007 |
| | 4430±40 | Beta-210707 | |
| | 4580±40 | Beta-210710 | |
| | 4760±40 | Beta-210708 | |
| | 4850±40 | Beta-210709 | |
| Rosaliya | 5120±40 | Beta-210701 | This paper |
| | 5280±40 | Beta-214539 | |
| Tuktu-Naiyuk (Napaaq Locality) | 5070±40 | Beta-197646 | Esdale and Gal 2006 |
| | 5109±41 | AA67870 | |
| | 5109±42 | AA67869 | |
| | 5126±42 | AA67868 | |
| | 5255±59 | AA67867 | |

The Kuparuk Pingo site (Lobdell 1986, 1995), for example, is a fine-grained context consisting of a small lithic and bone scatter with at least two notched projectile points and an associated hearth feature. The small, discrete, and isolated distribution of the artifacts supports Lobdell's interpretation of the site as a single, briefly occupied NAT camp. The close spatial association of the artifacts with a hearth feature dated to 5915±295 B.P. (UGa-5083) supplies both an absolute age and a situation in which the date is solidly associated with one and only one set of artifacts.

At the Agiak Lake locality two sites (49-XCL-89 and 49-XCL-118) contain numerous tent ring features that are closely and repeatedly associated with artifact scatters that include notched projectile points, but lack lanceolate points or microblades. Hearths from several of the tent rings have yielded dates between 4200 and 4800 B.P. (Wilson and Slobodina 2007).

The sequence of rapidly buried and stratified deposits at the Onion Portage site (Anderson 1988) also contains NAT assemblages in a high resolution context. Assemblages in the successive layers seem to indicate a progression of projectile point designs from notched to lanceolate forms, and there is little evidence of microblade technology.

In contrast, artifacts from the Tuktu site as it was originally recorded and described by Campbell (1961, 1962), do not constitute a fine-grained assemblage since cultural materials were found across an extensive area of a prominent landform that attracted repeated use over time. Campbell noted 15 notched projectile points, 17 leaf-shaped (i.e., lanceolate) projectile points, 59 microblades, and at least 5 microblade cores, but the nature of the association among these technologies has remained ambiguous in the absence of precise artifact locations and the likelihood of site re-use. A recent reinvestigation of the Tuktu site, however, has identified spatially discrete clusters of artifacts that can be considered as fine-grained assemblages (Esdale and Gal 2006). The work has yielded new radiocarbon ages, and additional notched and lanceolate projectile points in apparent association, but no additional evidence of microblade technology.

## The Rosaliya Site

The Rosaliya site (49-KIR-196) is located in the Killik River valley in the central Brooks Range and consists of a small (4 m diameter), shallowly buried lithic scatter with a single hearth feature. Its location on a broad, featureless landform, small size, and discrete spatial pattern all suggest that the site reflects a single, brief episode of occupation. An absolute age is provided by two AMS radiocarbon dates, 5280±40 (Beta-214539) and 5120±40 (Beta-210701) B.P., each from a single piece of

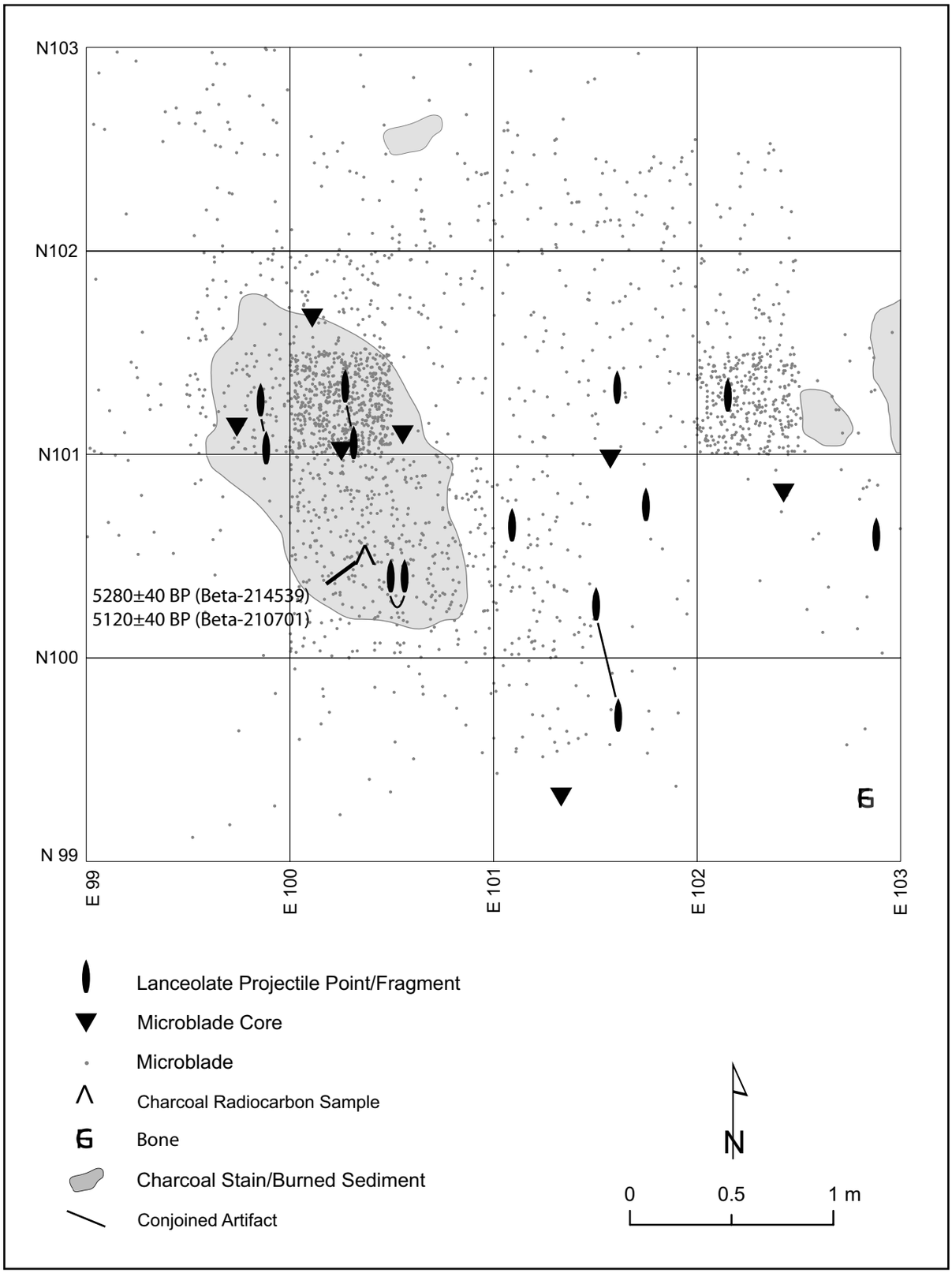


**Figure 2. Map of the Rosaliya site excavation block showing the distribution of selected artifact types. Microblade locations are randomized plots within 50×50 cm collection units and each dot represents two excavated microblades.**

Table 2. Artifacts from the Rosaliya Site.

| Artifact Class | Count |
|---|---|
| Lanceolate Projectile Points | 9 |
| Microblade Cores | 9 |
| Burins | 5 |
| Flake Tools | 8 |
| Abrader | 1 |
| **Formed Artifact Total** | **32** |
| Burin Spalls | 28 |
| Microblades | 1,918 |
| Flaking Debris | 4,100 |
| **Site Total** | **6,046** |

birch (*Betula* sp.) twig found within the burned sediment of a hearth feature. A 16 $m^2$ excavation block encompassed the entirety of the small artifact scatter and is thought to constitute a complete sample of the artifacts deposited at this location (Fig. 2). Table 2 shows the categories that compose the formed artifact assemblage (n=32), which includes bifacial lanceolate projectile points (Fig. 3), wide, oval-platform microblade cores (Fig. 4), expedient flake tools, burins, and an abrader. The debitage assemblage contains more than 6,000 items and includes microblades, burin spalls, and flaking debris.

Microblade production was an important activity at the Rosaliya site and these items were made and discarded in substantial numbers as indicated by the 1,918 microblades, 9 exhausted or rejected cores, and core maintenance debris such as core tablets. Some microblades were also apparently transported to the site hafted in tools and discarded at Rosaliya in the process of tool repair. This activity is represented by a subset of the microblade assemblage that is characterized by a high proportion of medial sections, frequent edge-damage, and the use of rare chert types that are absent from the microblade manufacturing debris assemblage.

Another important set of activities at the site surrounded the final shaping, repair, and resharpening of bifacial tools, namely large, lanceolate-shaped projectile points. The site contains nine such points, which are all broken or worn and were likely discarded from hafts in during the processes involved in re-arming weapons. Other bifacial projectile points were presumably finished or repaired at the Rosaliya site, but not discarded at the site, as indicated by a large volume of bifacial pressure flakes (n=1,613), a few bifacial percussion flakes (n=52), and a small number (n=12) of square-edged "alternate" flakes—a distinctive flake created in the process of re-shaping snapped projectile tips (Towner and Warburton 1990).

## Middle Holocene Weapon Systems

At least three weapon or tool systems are indicated by the lithic components of Northern Archaic period assemblages: tools that employed microblades, lanceolate-shaped bifaces, and notched bifaces. Little information is available about the organic components of these tools and as a result their function is difficult to deduce. We draw on information from a broader area than just northern Alaska and look at data from macroscopic tool damage, breakage, and from discard patterns of the lithic portions of tools, and the rare preserved organic components in order to formulate reasonable hypotheses about the hafting and function of these tools.

### Microblade Function and Delivery

It is widely agreed that microblades were used as elements of composite tools, but their function seems to have varied widely in prehistory. Inset microblades have been used as weapon armaments interpreted as spears or lances (Giria and Pitul'ko 1994), darts (Hare et al. 2004), and arrows (Ackerman 1996; Anderson 1988), and were also used as simple end-hafted cutting tools.

A strong case can be made for the use of microblades as parts of projectile points in early Holocene Alaska. Their continued use in the same manner through the Northern Archaic period remains to be demonstrated, but is at least a reasonable, if not a likely, possibility. The presence of longitudinal ("burin") fractures that run parallel to the length of a microblade and remove all or most of an edge is one line of evidence suggesting a high-energy projectile function. A few examples of preserved organic components of slotted inset tools from early Holocene contexts in Alaska include items that are sharply pointed and symmetrical, which suggests a projectile rather than knife function. The slotted bone or antler points from Trail Creek Caves are good examples (Larsen 1968).

The numbers and portions of microblades that occur in some assemblages offer additional evidence for a projectile function. Sites with large numbers of microblades seem to mark locations at which microblades were mass produced, while assemblages with small numbers of microblades seem to result from either small-scale repair or the loss of tools armed with microblade insets. Of particular interest are the few cave sites in Alaska and Yukon that evidence this latter signature. These contexts represent the accumulated faunal remains from primarily non-cultural processes (i.e., carnivore activities; Sattler et al. 2001), but also contain small microblade assemblages. Cave sites as Lime Hills Cave 1 (Ackerman 1996), Lower Rampart Cave 1 (Sattler 1997), and the early levels of Trail Creek Caves (Larsen 1968) contain microblade assemblages characterized by small numbers of mi-

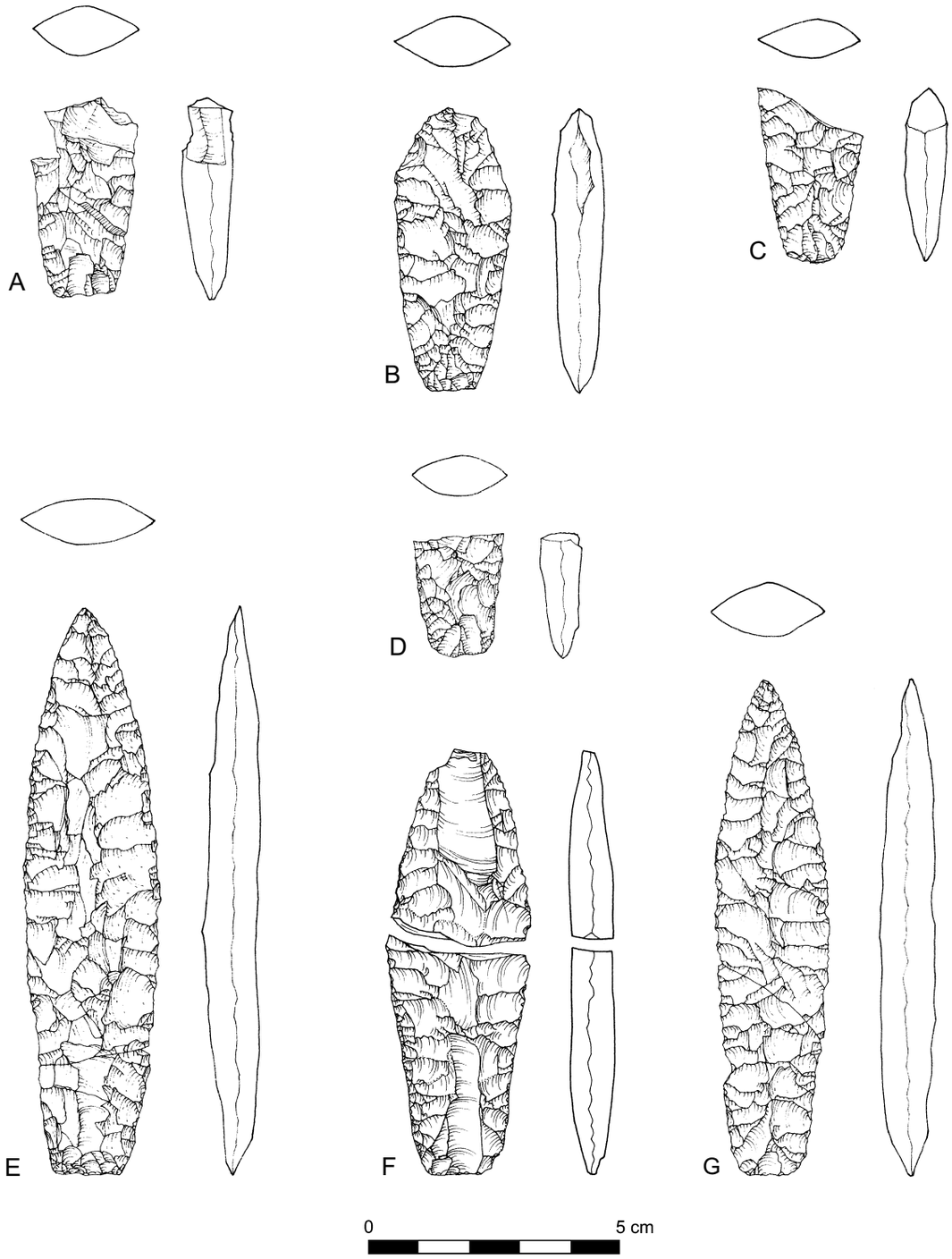


**Figure 3. Lanceolate projectile points from the Rosaliya site. Gates of the Arctic National Park and Preserve specimen catalogue numbers A) GAAR 14814, B) GAAR 14997, C) GAAR 15059, D) GAAR 14995, E) GAAR 14819/14864, F) GAAR 14476/14482, G) GAAR 14954/14955.**

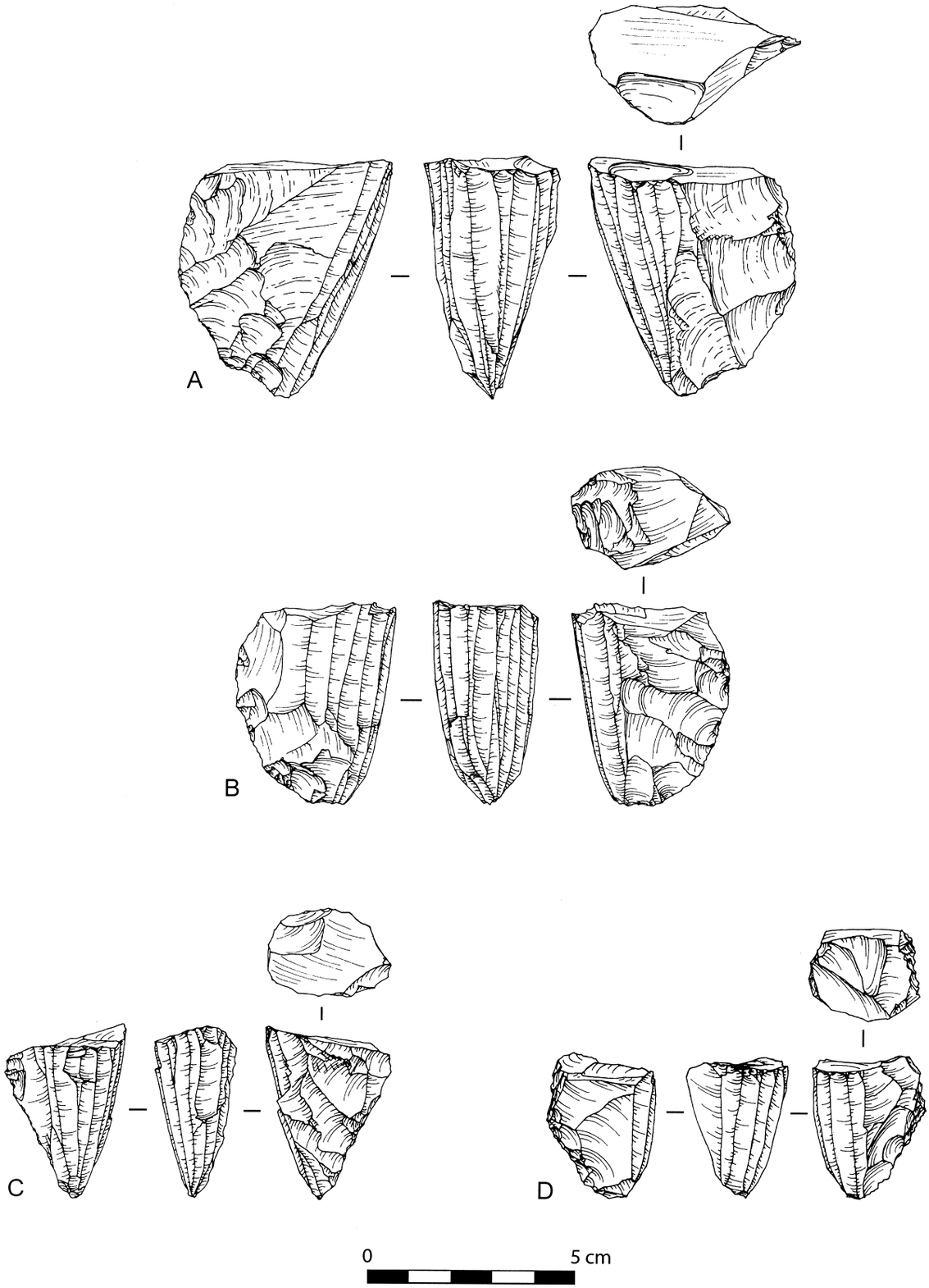


**Figure 4. Examples of microblade cores from the Rosaliya site. Gates of the Arctic National Park and Preserve specimen catalogue numbers A) GAAR 14816, B) GAAR 14956, C) GAAR 14817, D) GAAR 14815.**

croblades, a predominance of straight, medial microblade segments well-suited for use as insets, and in a few cases an association with fragments of slotted organic projectiles. These patterns suggest that microblades served as weaponry components and were introduced into caves embedded within dead or dying animals.

While a projectile armament function seems well-supported, the method of projectile propulsion is somewhat elusive. The relatively lightweight and gracile design of early Holocene slotted organic points from Alaska at Trail Creek Caves and Lime Hills, suggests a flight weapon rather than a weapon designed for close-quarters confrontation such as a lance, which is expected to be durable and robust. The most clearly articulated hypotheses for the propulsion of microblade-armed projectile points in Alaska describes them as arrowheads (Ackerman 1996; Anderson 1970; Clark 1997; Larsen 1968; West 1967). Anderson (1970) posited bow and arrow use in the early Holocene based on the narrow shaft diameter suggested by the notched abraders in the Akmak component at Onion Portage dated to older than about 8200 B.P. He observes that the abrader grooves average 9 mm and are consistent with shafts "well within the range for Eskimo arrows of the last century—which is good evidence that the Akmak complex contained arrows" (Anderson 1970:58). A slotted antler projectile point from Lime Hills Cave has also been interpreted as an arrowhead (Ackerman 1996), and similar slotted projectiles from Trail Creek Caves were classified by Larsen (1968:71–74) as arrowheads. These instances predate the NAT period and so do not provide direct evidence for use of inset microblades as arrowheads, but they do provide a reasonable precedent for this weapon's use in the subsequent NAT period.

Although we see good evidence for the use of microblades as projectile armaments in Holocene Alaska, they were probably not used exclusively so, and an additional function was likely to have been as insets in light duty cutting tools. Again, there is no direct evidence for such use from NAT contexts, but this partly reflects the lack of organic preservation in middle Holocene sites. Very simple and general purpose tools, end- or side-hafted microblade knives, are known from a variety of prehistoric contexts in the Arctic and elsewhere (e.g., Croes 1996; Finlayson et al. 1996; Flenniken 1980; Owen 1984).

## Notched Biface Function and Delivery

Notched bifaces as a general class are present in Northern Archaic period assemblages in Alaska as well as in other older and younger time periods. We focus on the forms commonly described as Palisades or Tuktu type (Fig. 5). There is considerable variety in the shape and technology evident among artifacts assigned this label, with much of the variation in shape resulting from resharpening and rejuvenation. Some variation may also reflect distinct functional categories. Side notched points from the Northern Archaic period are characterized by side to corner notching, excurvate lateral margins, straight to concave bases, and an irregular or unpatterned facial flake pattern. Notched points are not infrequently asymmetric in plan view, and complete specimens are often short, resharpened or repaired versions of longer primary forms.

Strong evidence for projectile function for north Alaskan notched points is the presence of impact damage on many specimens, their sharp tip design, and similarity to tools from ice patch contexts, which are known to have functioned as weapon tips are known from rare frozen contexts (Hare et al. 2004). Although a projectile function is clearly demonstrated, notched bifaces also exhibit evidence of uses other than as projectiles. Giddings and Anderson (1986:310), for example, observed that the notched projectile points from the Palisades type site were so blunt and asymmetrical that they seem better suited for use as knife blades than as projectile tips. Clark and Clark (1993:143) interpret an especially wide notched biface from the RkIh-36 site near Batza Tena as likely to have served as a hafted knife. Notched bifaces such as this, with asymmetric blade shapes, wide blade elements, rounded tips, and beveled edges occur in NAT assemblages. The design and maintenance of these specimens suggest little regard for aerodynamics and balance as would be expected for a projectile armament, but are instead consistent with a hand-held cutting or sawing function (Christenson 1986; Goodyear 1974; Truncer 1990). The multifunctional nature of notched bifaces also implies the use of detachable foreshafts since a suitably long weapon shaft would make an impractical knife handle. Good examples of Northern Archaic period wood foreshafts with notched bifacial weapon heads have been found preserved in alpine snow patches in the Yukon Territory and demonstrate the use as a foreshaft design (Hare et al. 2004).

Notched projectile points are likely to have served as dart armaments propelled with an atlatl. The comparison to ethnographic specimens and other notched bifacial points of known function provide support for this argument. These data come largely from continent-wide samples from dry caves and ethnographic collections of projectile points with known function due to the presence of either dimpled proximal ends designed to receive an atlatl hook, or nocked proximal ends indicative of an arrow function. Thomas (1978) and

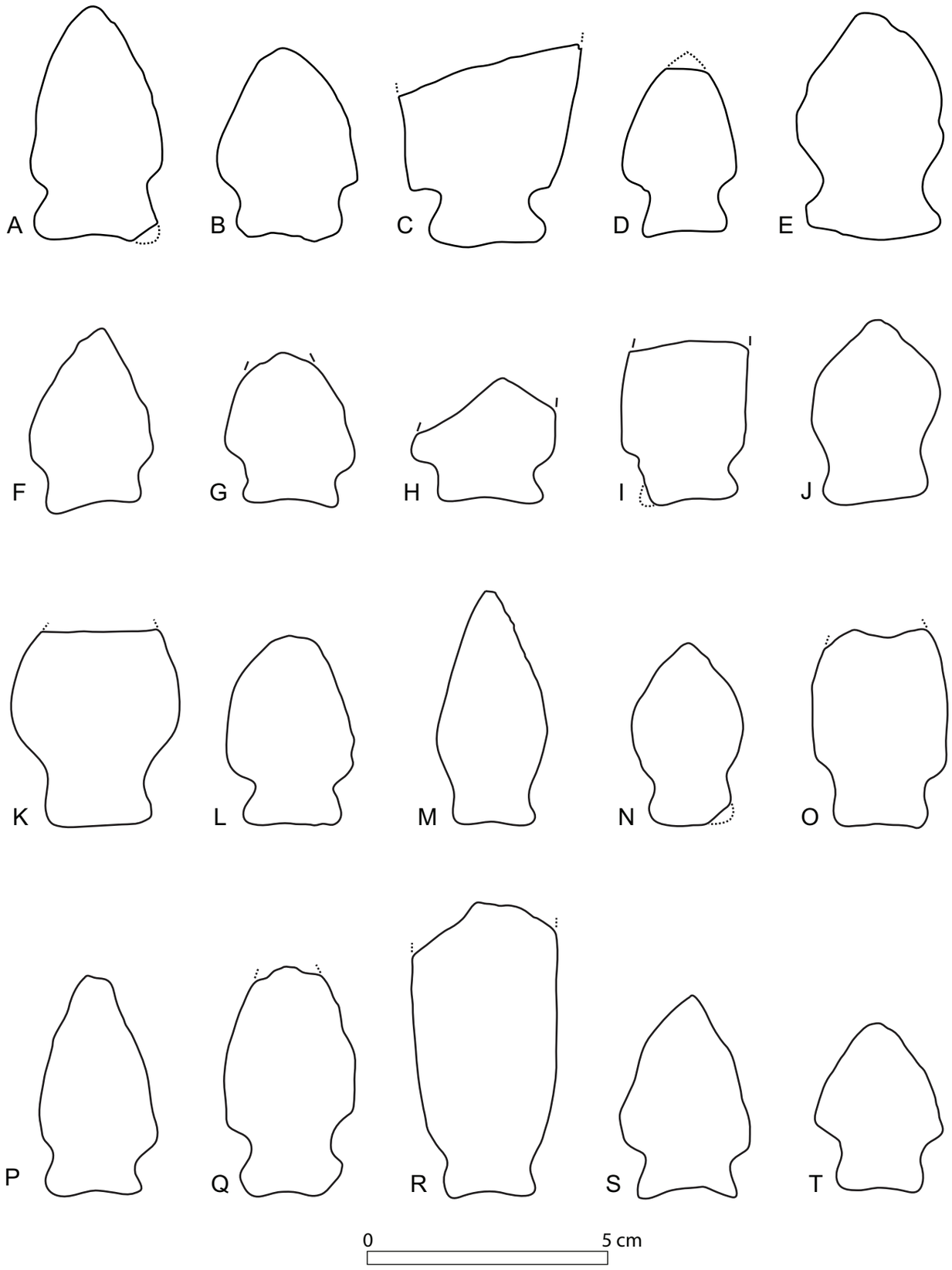


**Figure 5. Examples of Tuktu or Palisades type notched projectile points from archaeological sites in northern Alaska. A) Batza Tena Site RkIG-44 (Clark and Clark 1993), B) Batza Tena site RkIG-X (Clark and Clark 1993), C–I) RBS site (Esdale 2008), J–L) XHP-467 site (Esdale 2008), M) Tom's Bench site (Esdale 2008), N–O) KIR-124 site, P–T) Nauraaq Ridge site (Esdale 2008).**

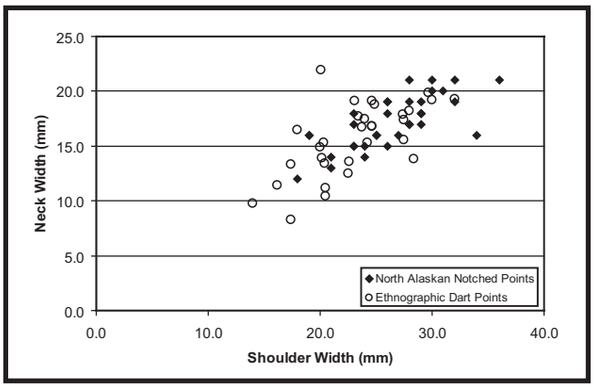


**Figure 6. Comparison of ethnographic dart points (Shott 1997) and Tuktu or Palisades type notched projectile point dimensions from northern Alaska.**

Shott (1997) used these data to test discriminant functions for distinguishing dart points from arrowheads. Shott, using an expanded data set relative to Thomas', found that the single best measure for discriminating between the two was "shoulder width" (i.e., maximum width), and that a threshold value of 20 mm was a good predictor of whether a projectile point was from a dart or arrow. We compared measurements for a sample of Tuktu-Palisades type notched points to Shott's threshold value and found that every Alaskan notched point we looked at fell within the dart range, and interestingly, near the large end of the dart range. This tends to rule out the use of north Alaskan notched projectile points as arrow tips, and supports their use as dart armatures (Fig. 6).

A design argument also supports the use of notched bifaces as dart points. Hughes (1998) and others (Cundy 1989; Flenniken and Wilke 1989) have convincingly argued on the basis of ethnographic, experimental, and engineering studies, that the presence of barbs or other protrusions on projectile tips significantly retards their penetration, but nonetheless may improve effectiveness by causing the point to be retained in the wound to cause continued damage. Where weapon use depends on repeated thrusts, as with a lance, a smooth transition between the projectile tip and its shaft will be favored over a design with barbs or protrusions (Hughes 1998).

## Lanceolate Biface Function and Delivery

Lanceolate-shaped projectile points are frequently found in Northern Archaic period assemblages. They occur, for example, at Rosaliya, the Portage Complex bands at the Onion Portage site, and Tuktu. The shape and flaking patterns of these tools vary somewhat from site to site but typically exhibit straight to convex bases and lateral margins that range from parallel to gently expanding. Some specimens take on a pentagonal form as a result of resharpening or rejuvenation of the distal (blade) end, which serves to shorten these points and create an abruptly converging distal end.

At least one function of lanceolate bifaces was as projectile points as indicated by the fact that they exhibit symmetrical plan views and pointed tips that are consistent with expectations for a balanced armature designed to effectively pierce animal hide. Impact fractures are present on many specimens within this tool class and offer the best direct evidence for their use as weapon heads subject to violent forces. Lanceolate bifaces in Northern Archaic period assemblages lack beveled edges or blade elements that are concave in plan view or that are serrated, all traits which are associated with hafted bifaces used as cutting or sawing tools (Ballenger 1998; Goodyear 1974; Truncer 1990). It is worthwhile to note that the presence of impact fractures as well as careful edge preparation (often including edge dulling or grinding) makes it possible to distinguish finished, functional lanceolate bifaces from preforms that may have been intended for later notching.

The balance of available evidence suggests that the method of propulsion for lanceolate bifaces was as hand held thrusting spears (i.e., lances). The relatively large size of Northern Archaic period lanceolate points suggests they are unlikely to have been used as arrow tips, and therefore served as either dart or spear tips. Examples of complete spears from ethnographic collections exhibit lanceolate shaped weapon heads similar in size and shape to lanceolate projectile points from prehistoric contexts that include those from the Northern Archaic period (Nelson 1899). The basic streamlined design of a lanceolate point suggests a thrusting function. The point, lacking barbs or projections, would have been well-suited for both good penetration and easy withdrawal as expected for a tool used at close quarters for repeated thrusts. This design contrasts with the barbed projections of a side-notched dart point, where the barbs would help to keep the projectile embedded within prey and thereby serve as an effective one-shot, distance weapon (Flenniken 1985; Hughes 1998).

# Weapon Niches, Hunting Strategies, and Assemblage Variability

If Northern Archaic period hunter-gatherers selected among spears, darts, and arrows, we can assume some underlying logic behind these choices. Important criteria were likely to have been related to weapon efficacy in the context of particular

hunting strategies (see Yost and Kelley 1983). The most appropriate weapon for targeting waterfowl or small game, for example, was likely to have been different than one used when stalking large game in open terrain. We focus here on weapon performance—characteristics such as effective range, durability, lethality, and ease of maintenance—as a key set of factors governing the selection of a particular weapon in a particular context. Production and maintenance costs may also have been important considerations (Bleed 1986), but not critical ones since it is the use phase of a weapon's deployment that presents the highest-risk situations with a high cost to failure (Collard et al. 2005; Elston and Brantingham 2002).

Among ethnographic cases in which people drew upon multiple weapon systems, they selectively employed specific weapons according to considerations such as prey type, risk of resource failure, hunting strategy (e.g., pursuit or ambush), season, terrain and vegetation features, size of the hunting party, and the skill of the hunter (Churchill 1993; Collard et al. 2005; Ellis 1997; Osgood 1940; Oswalt 1973, 1976; Torrence 1989, 2001). Here we look at the performance characteristics of weapon systems of concern and propose contexts in which these tools would have been especially effective.

Cross-cultural patterns identified in ethnographic data sets provide one basis for thinking about possible NAT weapon use and hunting strategies. An important study in this vein is Churchill's (1993) examination of the relationships between hunting methods, prey size, and weapon delivery type. Churchill (1993) examined a sample of ethnographic cases in which groups employed spears, darts, or the bow and arrow and found meaningful associations between weapons and hunting techniques. The hunting techniques Churchill defined were: 1) *disadvantage hunting*, which employs means to place prey in a handicapped position, limit their escape, and gain the requisite time or access needed for dispatch; 2) *ambush hunting*, in which concealed hunters gain a surprise advantage; 3) *approach hunting* in which hunters lure or stalk freely moving animals; 4) *pursuit hunting* in which prey are chased or exhausted and weapons are brought to bear after the animal takes flight; and 5) *encounter hunting* in which animals are taken as they are encountered and within weapon range and are not pursued beyond the initial encounter. Hunting is no doubt a complex set of behaviors that defies easy categorization and is not separate from other realms of behavior (Elston and Zeanah 2002; Laughlin 1968; Weissner 2003), but the strategies identified by Churchill provide a useful classification for modeling prehistoric hunting and weapon design.

## Patterns in the Use of Spears

A spear or lance is a weapon that is held in the hand and thrust or, much less commonly, thrown into a target. The hand-held spear is a tool with a widespread, long, and continuous history of use. Although a relatively simple and ancient technology, spears were not replaced in most regions with the advent of new weapons, but were instead used in conjunction with propelled weapons such as darts and arrows (Cundy 1989; Ellis 1997; Flenniken 1991; Frison 1991:296–297; Gould 1970; Hames 1979; Hughes 1998). Even with new weapon innovations, spears continued to fill an important functional niche in hunter-gatherer toolkits (Ellis 1997; Hitchcock and Bleed 1997). An important use of spears was to dispatch animals wounded by other means. Gwich'in hunters in the Subarctic, for example, routinely carried a bow and set of arrows as a primary weapon along with a single spear on daily hunting forays (Heine et al. 2001).

Spears represent a set of tradeoffs for a hunter. Advantages include an ability to be thrust rapidly, repeatedly, and with relatively great precision (Ellis 1997). Spear use, however, requires that a hunter is close to the targeted prey, which introduces risk of injury from large or dangerous animals (Hitchcock and Bleed 1997). Effective spear use also often requires that the movement of prey is constrained as supported by Churchill's (1993) observation of the strong correlation between spear use and disadvantage hunting techniques. Disadvantage techniques, however, can require extra efforts to construct facilities or drive animals into a kind of setting that limits their movement such as snowdrifts, sand dunes, or arroyos (Table 3). All else being equal, the added efforts of constructing facilities or driving game, would reduce energetic return rates for a species and discourage the use of disadvantage/spear techniques. These costs, however, can be outweighed

Table 3. Relationship between Hunting Strategies and Weapon Systems among Recent Hunter-Gatherer Cases.

| Hunting Strategy | Spear | Atlatl | Bow and Arrow |
|---|---|---|---|
| Disadvantage | 37 | - | 18 |
| Ambush | 7 | 3 | 25 |
| Approach | 2 | 2 | 28 |
| Pursuit | 4 | - | 15 |
| Encounter | 1 | - | 7 |
| **Total** | **51** | **5** | **93** |

Data from Churchill 1993:17

in certain contexts such as when hunters can achieve the ability to capture very large bodied prey (Churchill 1993; Ellis 1997:Table 5), or maximize the capture of a fleetingly abundant resource.

### Patterns in the Use of Darts

Darts are projectiles propelled with the aid of an atlatl or throwing board, which greatly increases the leverage and force that can be applied to a projectile relative to one that is hand-thrown (Baugh 2003). As flight weapons, darts have well-documented advantages over hand thrown projectiles (Christenson 1986; Hughes 1998; Raymond 1986). Advantages over the bow and arrow are less clear, and in fact, the bow and arrow is widely regarded as superior to the atlatl. While this is true in some regards, the atlatl seems to have held certain advantages over the bow and arrow. This is evidenced by the fact that in at least some regions the bow did not rapidly replace the atlatl, but was instead used concurrently for a substantial time (Bradbury 1997; Erwin et al 2005; Nassaney and Pyle 1999; Shott 1993, 1996, 1997). An apparently abrupt shift from the atlatl to the bow characterizes other regions (Hare et al. 2004).

Darts are accurate and portable distance weapons (Raymond 1986). One of the most notable performance attributes of the atlatl is its ability to propel a dart of relatively great mass compared to a typical arrow. Heavier weaponry is especially effective with large or thick-skinned game, or in settings with vegetation or windy conditions that may deflect lighter projectiles (Friis-Hansen 1990; Hames 1979; Hughes 1998; Raymond 1986). Late prehistoric use of the atlatl in northern maritime settings was linked to hunting from kayaks and the ability to propel a dart with one hand, thus freeing the other to paddle (Balicki 1970; Boas 1888).

Limitations of the atlatl are best seen in comparison to the bow and arrow. The upright stance required for atlatl use is one disadvantage since it impairs a hunter's concealment and ability to target game unobserved. This would make the atlatl a less effective weapon in open terrain. Also related to the exaggerated throwing motion of darts is a comparatively slower rate of fire. Arrows can be launched more rapidly and from a wider variety of shooting positions than darts (Bergman 1993; Raymond 1986). There are relatively few ethnographically documented cases of atlatl use. Churchill (1993) noted five, and they suggest a possible association with ambush and approach hunting, and in no case was the atlatl associated with disadvantage, pursuit, or encounter hunting strategies.

### Patterns in the Use of Bow and Arrow

The bow and arrow would seem to be the culmination of prehistoric weapon development, and in some regions the replacement of the atlatl and dart was rapid and complete (Hare et al. 2004; Hughes 1998). The bow and arrow represented improvements in accuracy, effective distance, rapidity of fire, and the ability to employ varied shooting positions. The bow and arrow is a versatile weapon. In ethnographic contexts it is used with a variety of hunting techniques, environmental settings and with a diverse range of prey species (Churchill 1993; Osgood 1940). Relative to spears and darts, the bow and arrow is much more often used in open terrain and with encounter, ambush and approach hunting strategies. The bow and arrow is especially well-suited to hunting small game since arrows can be fired quickly, with fast succession, and with high accuracy, although it is also used effectively with relatively large game as well.

## Discussion and Summary

Evidence for a unilinear scheme of weapon evolution—typically assumed to progress from spear to dart to bow—has not been found in any region of North America in which careful study of this topic has occurred. Nor does a unilinear scheme apply to Alaskan prehistory or the NAT. Rather, we interpret some of the diversity observed among NAT lithic assemblages, particularly in regard to items used as weapon tips, to indicate the use of a diverse hunting toolkit that may have contained three basic weapon systems.

Thrusting spears were an essential hunting weapon in many ethnographically documented societies and appear to have been equally important in prehistoric toolkits, where they were often used in conjunction with other kinds of weapons as a tool to dispatch wounded prey or for close-quarters attack or defense. Lanceolate projectile points seem to indicate the use of thrusting spears in the NAT. They occur in clear NAT or NAT-age contexts at sites like Onion Portage and Rosaliya.

Side-notched projectile points from NAT contexts in northern Alaska very closely match in size and shape still-hafted specimens from the midcontinent that are known to have functioned as dart tips (e.g., Shott 1997). NAT notched projectile points seem almost certainly to have armed darts (but see Ackerman 2004), although this may not have been their sole function; many specimens also exhibit evidence for multifunctional use as knives.

Microblade technology is increasingly accepted as a valid part of NAT technology or at least NAT-age assemblages in northern and interior Alaska. The function of microblade inset tools is poorly known, but a few preserved grooved organic hafts from earlier contexts suggest one function was as a projectile armament. Solid evidence

for this function during the NAT, however, must await further research. A perhaps more provisional proposal is that microblade inset projectile tips served as arrow heads. We acknowledge the thin evidence on which this specific proposal is based, and offer it as a hypothesis for future testing. NAT-age bow and arrow use would be an early example of this technology in the New World, but this is not an unprecedented proposal. The bow and arrow in the Old World is generally agreed upon to have been developed during the Upper Paleolithic (Bergman 1993) and in the Americas, Archaic and Paleoamerican age bow and arrow use has been suggested (Ackerman 1996; Amick 1994; Anderson 1988; Bradbury 1997).

While three weapon systems within a single toolkit might seem to represent a degree of unnecessary redundancy, there are many ethnographic and archaeological examples of multiple weapon systems. In fact, describing hunting technology in terms of just three delivery systems glosses over a substantial amount of technological complexity and specialization. Ethnographic cases, in particular, reveal how toolkits can contain an array of arrow types, and different kinds of spears and bows tailored for specific prey, seasons, environments, and hunters. And all of these ethnographically documented toolkits were used by single communities, often individual hunters, in what amounts to an archaeological instant. The prehistoric record, even if it reflects a narrower range of tools, is expected to exhibit at least as much material variation since even the finest archaeological time scales encompass decades, and more often centuries, of behavioral variation.

The concept of weapon niches also addresses the question of redundancy and helps to refine understanding of functional variability between sites. Rather than thinking of weapons on a single scale of efficiency or effectiveness, it is more accurate to conceive of a range of use-contexts, each of which may have a unique optimal weapon. Use-contexts, in turn, reflect differences in available personnel, terrain and vegetation, prey species, and sea-

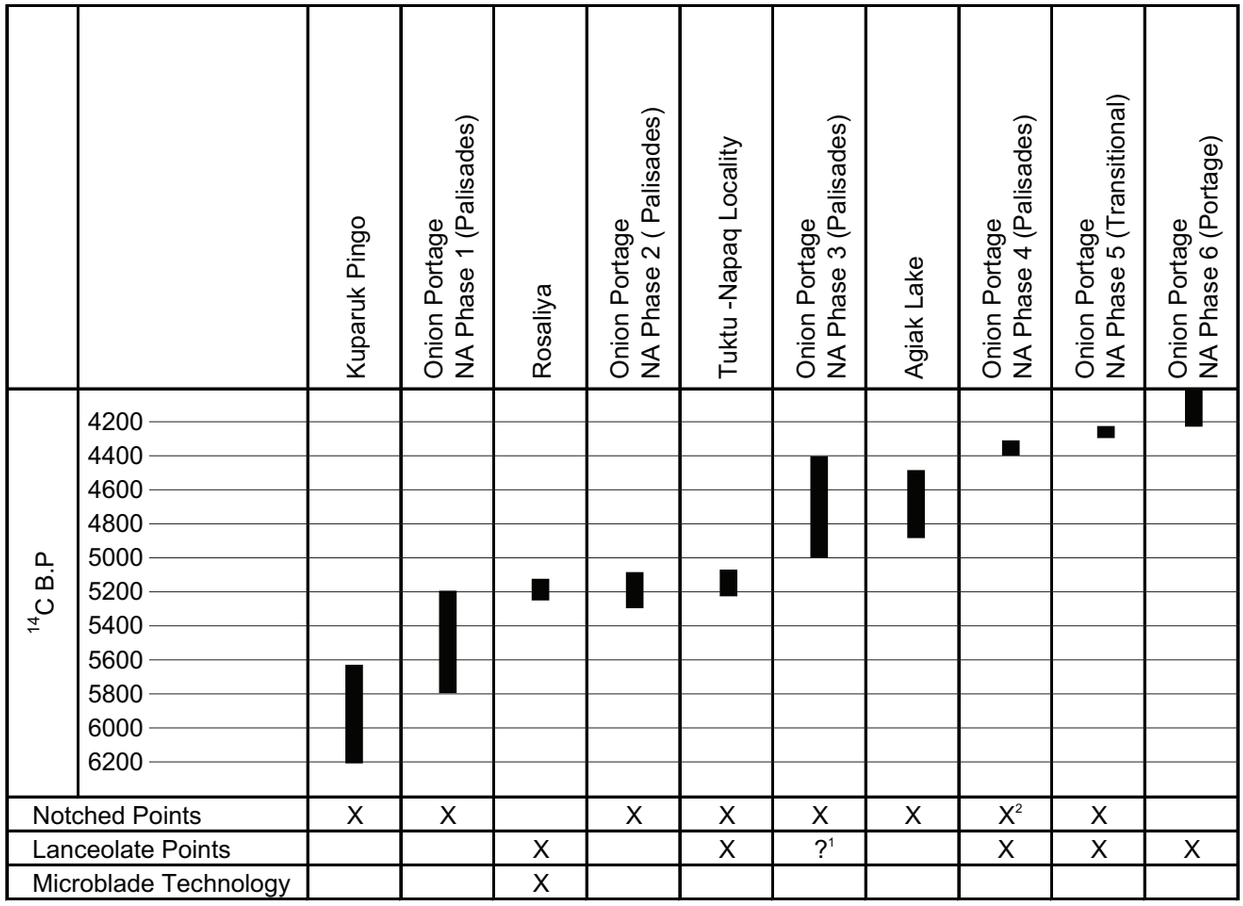


**Figure 7. Summary of assemblage contents for securely dated Northern Archaic age site components in northern Alaska.[1] Possible lanceolate projectile point described as "elongate biface knife blade" (Anderson 1988:77). Possible notched projectile point labeled as "stemmed"[2] (Anderson 1988:78, fig. 78b).**

sonal factors. Cross cultural ethnographic patterns in weapon use seem to support the idea of weapon niches. Strong associations have been identified between specific hunting strategies and weapon systems (Churchill 1993; Ellis 1997). Spears, for example, are strongly associated with disadvantage hunting strategies employed against large, gregarious prey (Churchill 1993; Ellis 1997).

The scheme described here to help understand functional variation among sites is useful for looking at a site like Rosaliya. The site is firmly dated to the period during which assemblages in northern Alaska are normally ascribed to the NAT. If this set of artifacts had been deposited at Onion Portage on the Kobuk River it would be sandwiched between Band 6 and 7, two Northern Archaic "Palisades" assemblages that contain side-notched projectile points and lack microblades. According to the weapon niche model, Rosaliya represents a place on the landscape in which people were mass producing microblades for use, perhaps in arrow heads, and where a handful of lances were repaired. These activities would be expected in the course of open-country encounter hunting. The lances in this case would have been used to dispatch animals wounded with arrows.

The functional model suggested here also accommodates the apparent lack of chronological patterning in NAT age assemblages from northern Alaska and the high degree of inter-site variability (Figure 7). Among the most securely dated sites in the region there does not seem to be a progression from one weapon system to another. While the sequence at Onion Portage alone seems to offer such a progression (from notched to lanceolate points), a broad, regional-scale sample of assemblages does not support the pattern. It is surprising that more microblade assemblages clearly dated to the NAT period are not known in the region, and this is contrary to expectations of the model if microblades were in fact part of a frequently used weapon system. One reason may simply be that surprisingly few microblade components are dated in northern Alaska. Thus it is possible that a number have yet-to-be identified NAT associations.

There are certainly many unsolved problems related to explaining NAT variability and the behavioral strategies of Alaska's inhabitants during this period. The model proposed here hopefully provides some productive avenues for future research.

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## Endnotes

1. Ages are reported as radiocarbon years before present unless otherwise noted.

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