FAUNAL AND OSSEOUS TOOL ANALYSIS FROM KTZ-036 (KOTZEBUE ARCHAEOLOGICAL DISTRICT), A LATE PREHISTORIC SITE IN KOTZEBUE, ALASKA

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FAUNAL AND OSSEOUS TOOL ANALYSIS FROM KTZ-036 (KOTZEBUE ARCHAEOLOGICAL DISTRICT), A LATE PREHISTORIC SITE IN KOTZEBUE, ALASKA

A

THESIS

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By

Travis J. Shinabarger, B.A.

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Abstract

Osseous tools are often recovered from coastal archaeological sites in Alaska due to favorable preservation conditions. In northwest Alaska, outside of harpoon typology, these osseous tools are not well analyzed. In 2008, the Office of History and Archaeology (OHA) excavated a multi-component site adjacent to the shore in Kotzebue, Alaska. Organic materials and lithic tools were recovered from three components dated to AD 600, AD 1200-1600, and within the last 300 years. The Shore Avenue collection extends the documented archaeological record of Kotzebue by nearly 750 years. Osseous tools and debitage consisted of 175 artifacts within the collection, while an abundant amount of archaeofauna provided a sample of raw materials available at the site for the manufacture of osseous tools.

This thesis focuses on the probability of raw materials being sourced locally, or through the use of long-distance travel, or trade, through an analysis of the archaeofauna from the Kotzebue Archaeological District, KTZ-036. Such analyses identified caribou antler as a locally-available raw materials for tool production. In contrast, walrus and ivory occurred in much lower frequencies. The archaeological findings were compared with contemporary harvest numbers by modern Native hunters from Kotzebue; the result corroborated the archaeofaunal inferences.

Analyses of the recovered osseous tools revealed a relatively high amount (26.3%) of ivory tools (n=23) and debitage (n=23) for what would be expected through the results of the faunal analysis where walrus made up only 4% (n=22) of the identified sea mammal remains. To determine potential contributing factors for this anomaly, the osseous tools were classified into functional and morphological groups to note possible trends within each group. This was coupled with a literature review of the structural and mechanical characteristics of the osseous materials to identify selective pressures for the manufacture of osseous tools that may push tool-makers to look beyond what is locally available.

Finally a cross-site comparison was completed of eight sites in the Arctic and Subarctic to reveal similarities of use in osseous materials spatially and temporally. Overall, it was determined that when the function of an osseous tool requires it to receive an applied force, a raw material is selected based on its properties that allow it to withstand the applied force. When few or no forces are applied to a tool, selection pressure relaxes, and any osseous material is used in manufacture. Aesthetics of ivory should also be considered, where sheen and carving detail can provide more artistic appeal. These trends are fairly consistent across the Arctic but should be considered in more depth to confirm this observation.

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Introduction

Stone tools are frequently in the limelight of archaeological analyses. These durable pieces of human history are the most resilient to the ravages of time. Because of this, lithic tools are often the principal focus of archaeological analysis. When conditions are good enough to preserve more than stone, new questions emerge where animal bones can be seen as more than just a meal on the prehistoric menu, but as a source of resources for the creation of tools.

The permafrost-dominant Arctic coast offers an environment with high preservation potential, allowing for a more intense focus on osseous materials (Betts 2007; Friesen and Morrison 2002; LeMoine 1994, 2005; LeMoine and Darwent 1998; Lewis 1995; McGhee 1977; Morrison 1986). These studies focus on the bone, antler, and ivory industries, and largely harpoon technology.

Osseous tools in the Arctic are made from one of three hard tissues available in an animal: bone, ivory, and antler. The least common geographically is ivory, harvested from walrus along the coasts of the Bering Sea, Chukchi Sea, and Arctic Ocean, or, from mammoth tusks long buried in the earth. When the makers of osseous tools were faced with the question of selecting one of these raw materials, was there much to the decision-making process beyond which materials were immediately at the maker's disposal?

This thesis tests the hypothesis that in the creation of an osseous tool is based solely on the availability of the raw material and does not take into account the potential benefits of a certain material type selected for a particular function. This hypothesis was applied to archaeological collections from the archaeological district KTZ-036 in Kotzebue, Alaska (Figure 1). Faunal data from the site were compared to the modern Iñupiaq harvest in Kotzebue as comparative for potential consistency between the prehistoric and postcontact harvesting data. The identified fauna were then compared to the material types noted among the modified osseous materials also recovered from the site.

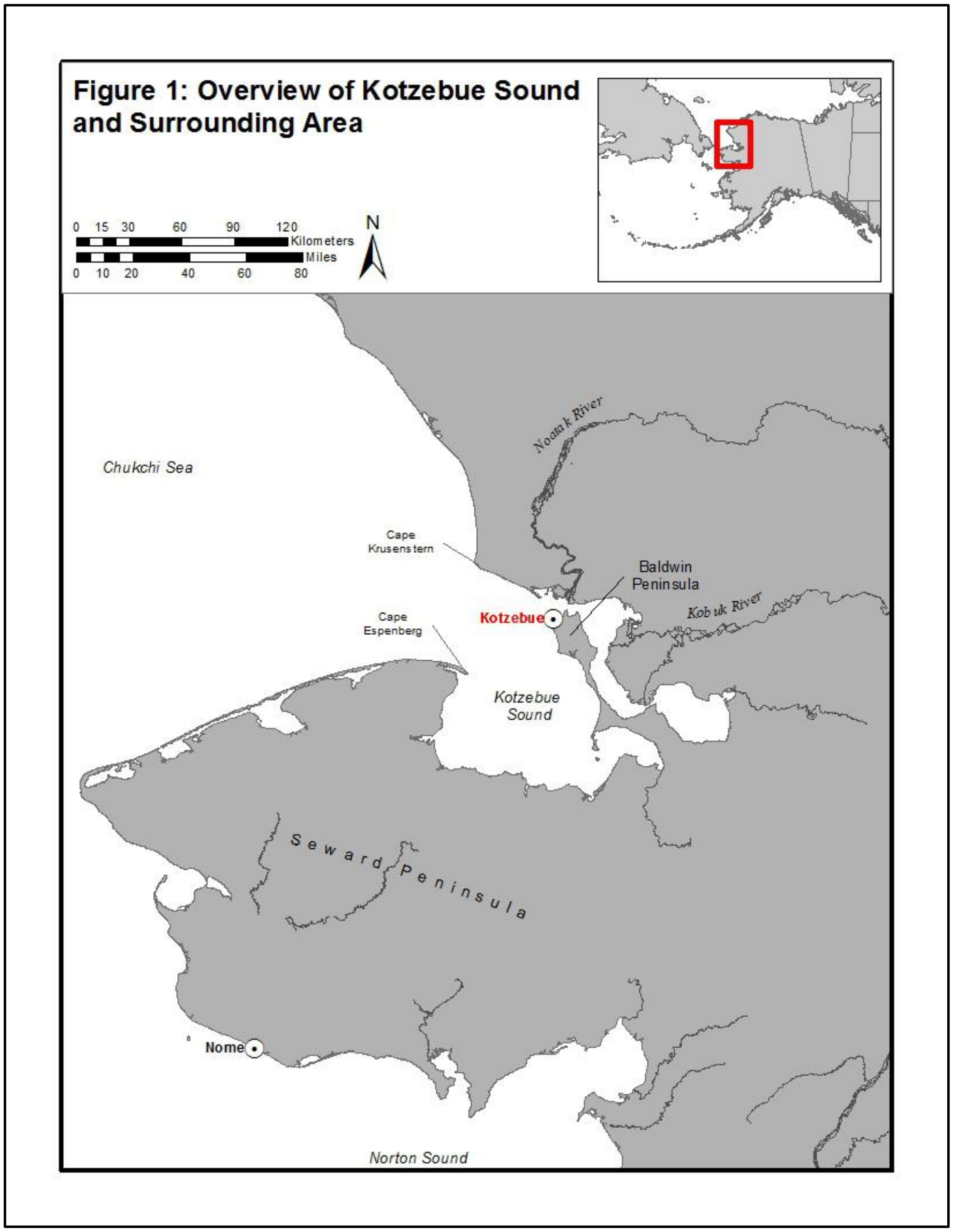

Figure 1: Kotzebue Sound and surrounding area

The osseous material was divided into three classifications. These classifications are the artifact's assumed function as tools, human modified osseous materials with unknown functions, and debitage. This, in turn, allowed for the understanding of whether specific-purpose organic tools were intentionally made with specific raw materials. When the study showed trends in the repeated application of certain material types for the manufacture of a specific type of tool, a review of the structural and mechanical properties of the osseous raw materials was conducted to infer why these materials were chosen.

Finally, to determine whether the perceived selective strategies were more than anomalies, the findings of osseous material trends from KTZ-036 were then compared to a collection of eight coastal archaeological sites from across the Alaskan and Canadian Arctic and Subarctic.

In order to examine these research questions, this thesis is divided into six chapters. Chapter 1 ("Culture History") discusses the archaeological record from the northern Alaska region, as well as the record of EuroAmerican contact and historic occupation of the northern Bering Strait area. Chapter 2 ("Landscape and Subsistence") reviews the contemporary geographical, climatic, and biological characteristics of the northern Bering Strait region and how those landscape features have evolved during the Holocene period. It also considers contemporary subsistence and social organization in the region. Additional background to the investigations is provided in Chapter 3 ("Previous Investigations") which considers earlier archaeological research in the area. Chapter 5 presents the field, laboratory, and analytical methods used in the research. Results of the analyses are reported in Chapter 5, subdivided into sections on faunal remains, lithics, and other non-osseous artifacts, with a larger discussion of osseous tools, including formal tools, tools identified by their morphology, and debitage. A discussion section follows, focusing on tests of the hypothesis and examination of associated research questions, as well as intersite comparisons and broader cultural influences. The final conclusions section derives broader implications of these data sets for Arctic archaeology and considers possibilities for additional research and hypothesis testing.

Chapter 1: Culture History

Alaska has over 14,000 years of occupation history extending to the Late Pleistocene (Ruether et al. 2011), although most of the archaeological record derives from the interior Tanana River and its tributaries (Holmes 2011; Potter 2005). The occupation of the Arctic coast is not recorded until the stabilization of sea level around 5,000 years before present (BP) (Mason 1993). Several archaeological traditions, termed Paleoindian, Paleoarctic, Archaic, and Arctic Small Tool reflect prehistoric cultures that span millennia, often with both temporal and spatial overlaps (Anderson 1984; Dumond 1987a). Though these archaeological traditions are important, this thesis focuses on the late Holocene maritime cultures of northwestern Alaska, especially those that may have influenced Kotzebue Sound, starting with Arctic Small Tool tradition (ASTt).

Arctic Small Tool Tradition

Around 5,000 years ago, seal hunters who employed a distinctive microlithic technology discarded a small amount of bone at Cape Espenberg (Tremayne 2010, Harritt 1994a) and on the beach ridges of Cape Krusenstern (Giddings and Anderson 1986). The finely flaked technology, termed Denbigh, is marked by a distinctive burinated biface, which was used for engraving bone. Denbigh is further characterized by an evidence of art in the uplands of the Noatak River basin (Tremayne 2010). The ASTt, also termed Paleo-Eskimo, is considered by most archaeologists to represent the first sustained occupation of the arctic coasts and, to some, the appearance in Alaska of the ancestors of the modern Inupiaq and Yup'ik peoples (Herrera et al. 2014).

ASTt spread across the entire northern coasts of North America to Greenland and its technology represents the basis for much of the succeeding cultures. Although very little organic technology has preserved in Alaska, ASTt materials in Greenlandic wet sites contain organic artifacts that establish the use of the kayak, the atlatl, and spear (Darwent et al. 2007; J. Anderson 2011). In its generally systematic and distinctive bifacial lithic technology, ASTt is divisible into several phases, depending on the analyst. Minimally, ASTt records a sufficient change around 2,800 BP to warrant the designation of Choris, followed by Norton soon after around 2,500 BP. Based solely on lithic technology, a third phase, Ipiutak, is preferred by Anderson (1984). The presence of ceramic and organic technologies in subsequent phases of ASTt allow a greater delineation of cultural processes and lead to differing classifications.

Choris Culture

The Choris culture first occurred within Kotzebue Sound around 2,750 years BP, and possibly persisted for 500 years. Choris is most notable for its extensive organic inventory, first described from Choris Peninsula at the south margin of Baldwin Peninsula by Giddings (1957). Choris lithics are similar to Denbigh: controlled, parallel flaking technique in lithic tools, although end- and sideblades were noticeably larger, and not quite as exquisitely flaked (Ackerman 1998). During this time, the specialized burin and microblade use waned (Dumond 1987a; Harritt 1994a). The manufacture and use of ceramics, oil lamps, and ground slate are hallmarks of Choris. These features are arguably associated with a more sedentary lifestyle; however, projectile point caches at Cape Krusenstern are evidence of logistical provisioning and increased mobility (cf. Giddings and Anderson 1986).

Choris had faint inland presence along the lower Noatak, and Kobuk rivers, into the Central Brooks Range, and on the Seward Peninsula at Trail Creek Caves and Cape Espenberg (Giddings and Anderson 1986; Schaaf 1988; Anderson 1988, 2011). Choris extends into western Arctic Canada, but is poorly documented south of Kotzebue Sound, being absent entirely from the Yukon delta and Norton Sound. The Choris occupation along Cape Krusentern was ephemeral in terms of housing, but produced numerous middens.

Where present, houses were oval, round and constructed of thin posts (Giddings and Anderson 1986). Giddings (1961) notes that, unlike Denbigh houses, the depressions had no noticeable entryway, inferring that the entryway may have been in the wall, or possibly through the ceiling. Round structures in the Nushagak may be Choris, although most are unexcavated. There are Choris sites at Onion Portage, at Gallahger Flint Station, and at Choris. Other areas such as Cape Krusenstern, Noatak River, the Sagavanirtok River, Utukok River, Lopp Lagoon, Cape Espenberg and Trail Creek Caves reveal evidence for what may be campsites (Harritt 1994a). No mortuary remains are known from Choris.

Dumond (1987a) has suggested a southern origin for Choris with the use of ground slate and oil lamps. People of the Alaska Peninsula and Kodiak Island had been predominately using ground slate as a tool source since the beginning of the Ocean Bay II at 4,500 BP (Clark 1984), within Chaluka between 3,500 and 4,000 BP (Turner et al. 1974), and stone lamps since 6,000 BP (Workman 1982). All appeared prior to ASTt in the Ugashik drainage at 3,000 BP (Dumond 1987a). In most of Alaska, ceramics were not a part of the Denbigh tool kit, so an Asiatic origin has been suggested for Choris, likely from the Chukchi Peninsula (Ackerman 1982; S. Anderson 2011; Dumond 1987a; Harritt 1994a; McGhee 1976; Workman 1982). The convergence of various aspects of different cultures around the North Pacific and Bering Strait at this time is possibly spurred by a brief climatic warming near the beginning of the development of Choris (Mason and Gerlach 1995).

Norton Culture

Norton culture represents a transformative phase in ASTt, completing Giddings and Anderson's (1986) chronology for the culture, or only being the middle of Dumond's (1987a). Norton practices are homogenous throughout its wide range from the Alaska Peninsula to northern Alaska, with an especially dense concentration of villages in the Norton Sound. The Yukon Delta was first occupied during Norton, possibly around 2,500 BP. The culture extends through 1,350 BP.

Norton was closely related to Choris in its lithic technology, both having a high number of chipped stone tools in the form of endblades and sideblades, as well as check-stamped pottery, oil lamps, and some ground slate (Giddings 1966; Shaw 1982). In the tool assemblage, as with Choris, no microblades or burins were present (Workman 1982). Discoidal scrapers were common. Depending upon use wear, these may have been flake cores. Workman (1982) argues that, beyond ceramics, Norton does not look much like its predecessors, but more like the cultures that follow. A local variant of Norton, named Near-Ipiutak (Larsen 1982), occurs only at Point Hope, Cape Krusenstern, Battle Rock, and near the Noatak River around 2,100 BP. Near-Ipiutak was possibly a whaling culture using oil lamps and pottery, which would later go out of use in Northwest Alaska (Larsen 1968; Giddings 1967).

Norton origins are arguably southern, based on the use of ground stone tools and oil lamps However, in the area there is a known hiatus from the earlier Choris culture that ended around 3,000 BP with these Norton sites not reappearing until 2,200 BP and 2,400 BP, respectively (Giddings 1966). This hiatus is thought to have been due to "a rather substantial climatic deterioration" (Dumond 1987a:125).

Norton houses tended to be square, with the entryway slightly more dug out than the rest of the living area. These winter houses are known at Iyatayet and Kugzruk Island. Excavations at these sites showed a heavy focus on sea mammal hunting, but also fishing with some terrestrial mammal hunting (Harritt 1994a). Norton sites from Norton Sound and north seem to have had a subsistence pattern dedicated to hunting seal and caribou. Some of these Norton villages such as at Cape Nome and Unalakleet each had several hundred house pits, hinting at an increased complexity in social structure (Ackerman 1998).

Ipiutak Culture

Contemporary with the later part of the Norton culture was the Ipiutak culture. Its earliest manifestations surface around AD 1 to 250. Ipiutak sites along the coast appear to have dissipated around AD 900, whereas interior Ipiutak sites appears to date to as recent as AD 500 and possibly as recent as AD 1400 (Gerlach and Hall 1988; Gerlach and Mason 1992; Giddings and Anderson 1986). Ipiutak in general is found only in northwest Alaska. Along the coast it appears at Point Hope, the type site, as well as at Cape Krusenstern, Battle Rock, Cape Espenberg, Deering, and Barrow. In the interior, Ipiutak is found at Trail Creek Caves on the Seward Peninsula, at Feniak and Tuluak Lakes near the Noatak River, and far into the interior at Tukuto Lake near the Colville River, Etivlik Lake near Howard Pass, and Hahanudan Lake near the upper Koyukuk River.

The Ipiutak technology resembles earlier Norton, and is similar to Denbigh, with its close attention to fine flaking. The affinities of Ipiutak remain contentious; considering only lithic tools, Ipiutak may be classified as Norton (Giddings 1964; Harritt 1994a; Larsen 1982), while others have said there is a definite difference between the two (Dumond 1987a; Workman 1982), noting the lack of ground stone tools, pottery, and oil lamps (Workman 1982). The ivory and antler works of the Ipiutak were sometimes used for arrowheads, elaborate harpoon heads, lance heads, labrets, open work carvings, etc. (Dumond 2000; Shinkwin 1977).

Ipiutak houses were often large, square, and semisubterranean, about 50 cm to 1 m into the ground; with one large room with a central hearth and wood posts along the walls, with four additional posts near the center of the room (Giddings and Anderson 1986). Along the coast, construction relied heavily on driftwood. The house walls were 4-5 m in length with side entrances, all facing the same direction, just above the level of the main floor (Dumond 2000), although the evidence for the entryway in some houses is missing, hinting at access through the roof of the house (Giddings and Anderson 1986).

Subsistence strategies of the Ipiutak show a reliance on sea mammals on the coast, and on caribou in the interior. However, caribou is present even at Ipiutak coastal sites. Point Hope may have served as a winter and spring residence, with smaller logistical groups venturing far inland during fall for caribou hunting, trade, or warfare (Harritt 1994a; Lutz 1982). Coastal Ipiutak people relied heavily on seal and walrus harvests and possibly conducted seasonal rounds or traded dried seal, seal oil, iron, and ivory with interior Ipiutak in exchange for caribou meat, antler, and furs, as well as fish and possibly birch bark (Larsen and Rainey 1948; Mason 1998, 2006, 2009; Shinkwin 1977). Seasonal aggregations may have included feasting and shamanic performances in larger specialized community structures that occur at several predictable locations across the landscape (Deering, Feniak Lake, Cape Krusenstern, and Point Hope. Most Ipiutak villages contain sizable numbers of burials, further evidence of sedentism. Dog remains were also recovered in many coastal Ipiutak sites, hinting at various uses in hunting, safety, and travel (Mason 1998).

Old Bering Sea Culture

Intensive whale hunting in the Old Bering Sea (OBS) culture begins the Northern Maritime Tradition. It developed around 2,250 to 2,000 BP, adjacent several resource hot spots clustered around Bering Strait from St Lawrence Island to East Cape in modern day Russia. While initially encountered on the Diomede Island, the fullest expression of OBS occurs in the cemeteries at Uelen and Ekven, on either side of Cape Dezhneva, the nearest points of modern, mainland Russia to Alaska. The two cemeteries contained several dozen graves out of 600, with massive, elaborately-carved toggling harpoon heads bearing distinctive iron-carved motifs (Arutiunov and Sergeev 2006). Motifs were first noted to have a sequence by Collins (1937), with the sparsest being Okvik, considered the earliest phase. The Hillside site near Gambell is a nearly pure Okvik site and is well dated to AD 200-400 (Dumond 2000). However, on the Chukotkan coast, “it is not so simple to isolate those of the Okvik culture” (Arutiunov et al. 1964:144).

OBS, first noted and named by Jenness (1928) in the Diomede Islands, can be found along all Chukotka coasts, Saint Lawrence Island, Punuk Islands, and in isolated finds at Point Hope, but possibly in a more significant fashion at Barrow (Carter 1966; Mason 2009). A couple of OBS-like objects are known from Norton Sound and Cape Espenberg (Mason et al. 2007), but otherwise most center around Kotzebue Sound. OBS culture appeared first on the west side of the Chukchi Sea and Saint Lawrence Island, though disappearing earlier on Saint Lawrence around AD 800, possibly incorporated into another culture, whereas in Chukotka, the culture persists until AD 1300 (Mason 2009). On mainland Alaska the culture appeared around 1675 BP and continued until 825 BP (Gerlach and Mason 1992).

As mentioned, walrus, seal, and whale huting were presumably the primary sources of OBS subsistence (Collins 1937; Hill 2011); no OBS sites or artifacts are found beyond 5 km of the Chukchi Sea (Mason 1998). Aside from harpoons, other recovered tools included a wide variety of wood and bone objects, ceramics, more crudely-worked stone tools, lamps, and anthropomorphic and animalistic figurines, as well as iron for engraving, imported from Yakutia, the upper Aldan, or ultimately, Korea via down-the-line trade (Mason 1998). Distinctively decorated with iconographic imagery, counterweights ("winged objects") for atlatl darts were also mortuary offerings (Mason 2009). Driftwood and stone walled house, often slab floors, with lengthy entryways were grouped in small clusters of eight to 15 depressions (Jenness 1928; Mason 2009).

Birnirk Culture

The Birnirk culture is on the northernmost Chukotkan and Alaskan coast. It first appeared around AD 600 and lasted until AD 1300. Its origins are contested; some argue for an origin in Ipiutak, due to shared characteristics in lithic technology (Anderson 1984), with some support through harpoon head types (Giddings 1961). However, others use harpoon head types to show Birnirk as a subset of OBS (Collins 1937; Ford 1959; Mason 2009; Maxwell 1980). Stratified successions of OBS capped by Birnirk are known at the Uelen cemetery, as well as the Birnirk type site near Barrow and several other Chukotka localities (Dikov 1979). Occupations are restricted to shores along the Chukchi Sea, especially on the north shore of the Chukotsk Peninsula (Dikov 1979), south of its first discovery far to the west near the Kolyma River (Mason 2009); Birnirk's highest density is clustered from approximately Wainwright to Barrow (Mason and Bowers 2009), and also occurring in low frequency at Point Hope, Cape Krusenstern, Cape Espenberg, but problematically at St. Lawrence Island, Wales, and Cape Nome, and across the Bering Strait at Ekven and much of the north shore of the Chukotka Peninsula (Mason 2009). Several locations are in close proximity to Ipiutak settlements and could even hint at instances of warfare, although a temporal gap of several decades to centuries often separates the two cultures (Gerlach and Mason 1992; Mason 1998, 2009).

The tool typology of Birnirk includes endblades, sideblades, chipped stone knives, burins, and a specific harpoon head with spare linear motifs (Carter 1966; Ford 1959; Mason 2009). Unlike Ipiutak, ulus made of ground slate along with usually curvilinear-impressed pottery were prevalent (Harritt 1994a) and organic tools were also well preserved in Birnirk assemblages (Ford 1959). Tools were made of ivory and baleen, with some burials revealing occasional open work carvings, also indicating interaction with Ipiutak (Larsen 1968). Birnirk is the first Alaskan coastal culture in which the watercraft is not simply inferred from the archaeological record (Ford 1959); kayak and umiaq parts were recently dated to AD 1000 by Anichenko (2012).

Architecture and mortuary patterns for Birnirk are distinctive and often co-occur, as most famously at Kugusguruk, near Barrow, where several dozen burials were interred in three large driftwood structures whose cultural logic remains uncertain. Birnirk houses from Cape Krusenstern were small with excavated entryways, and had a distinctive separate room resembling a kitchen that is either an alcove from the entry tunnel or separated from the main room by a wall (Giddings and Anderson 1986). These are thought to resemble houses known from the preceding cultures of Norton and Near Ipiutak (Harritt 1994a). The houses were generally constructed from wood and whale bone, although some without whale bone do exist, hinting that the resource may not have been available (McCartney 1980).

Punuk Culture

By 1,200 BP another incarnation of whaling culture appears around the Bering Strait region. This culture is noted first by Collins (1937) on Saint Lawrence Island. Since then, twelve other sites have been discovered with nearly half of them containing underlying OBS occupations (Mason 2009). Among these, there is only one area which can offer reliable dates. This is at the northwest tip of St. Lawrence Island at the sites Seveokok, Ayveghaget, and Mayughaaq. Together these show time of occupations as late as 500 BP and are thought to be contemporaneous and overlying with OBS, perhaps interacting with Birnirk, and maybe even warring with the Ipiutak culture during its waning years (Gerlach and Mason 1992; Mason 1998, 2009). Punuk is thought to have originated on St. Lawrence (Collins 1937; Mason 2009) but is found at other localities around the Bering Strait, including the southern coast of the Chukotka Peninsula, eastern Norton Sound, Kurigitavik near Wales, and Nunagiak near Barrow (Gerlach and Mason 1992). Crockford (2008) surmised that Punuk may have appeared on Saint Lawrence Island in response to the receding seasonal ice shelf, stating that in order to keep in line with ice-fringe hunting traditions, whalers were inclined to follow their prey to different territories.

Punuk maintained stylized harpoons like that of the rest of the whaling cultures, although with its own unique curvilinear design (Collins 1937). The harpoons of this culture were also more commonly inset with slate rather than chipped stone, while the harpoon itself was often made from bone or antler rather than ivory, and some had counterweights as seen in the OBS culture (Dumond 1987b; Mason 1998, 2009).

Ceramics remained in the toolkit, although they lacked decoration (Dumond 1987b). Iron used for engraving was also seen with this culture, although this is something that may have been present in past cultures including OBS and Ipiutak, stemming from trade with northern Chinese and Siberian cultures (Mason 1998). Punuk also showed advancements in body armor, wrist guards, and the bow-and-arrow, including Asian-influenced wrist guards, hinting at increased warfare (Collins 1937; Mason 1998).

Early Punuk houses mimicked those of OBS, although they were slightly larger. Later Punuk houses turned to a rectangular, semisubterranean form with several side rooms. Most contained a log floor with whale jaw bones and driftwood for walls and/or roof beams. The entryway was long and narrow. This house style lasted up to the contact period (Dumond 1987b). There were also some communal structures comprised of 80-plus beluga skulls creating a 200 m^2 footprint with a 14 m long entryway (Mason 1998).

Aside from whaling, Punuk also had specialized tools that rounded out their subsistence technology. Darts were barbed rather than toggled for sealing, blunts and bolas were made for birding, and leisters and other spear forms were made for fishing (Dumond 1987b). Umiaks, kayaks, and sleds rounded out the Punuk transportation systems for obtaining their harvest (Dumond 1987b; Mason 1998).

Thule Culture

Within the whaling villages, spread around the Chukchi Sea at AD 1000, is the final culture of the Northern Maritime tradition. Thule is found across an expansive area and is thought to have covered it with a speed not otherwise witnessed in the three millennia since ASTt. This pan-Arctic migration of the Inuit people in North America, as first noted by Mathiassen (1927), radiated from the Bering Strait to the east coast of Greenland, where the Thule culture is thought in some instances to have persisted as late as AD 1400, when the whaling tradition declined, most notably at Cape Krusenstern (Giddings and Anderson 1986).

Various taxonomic distinctions are employed for the Thule culture, including the Arctic Whale Hunting culture (Larsen and Rainey 1948), and the Northern Maritime tradition (Collins 1964). This latter grouping includes Birnirk, Punuk, and Western Thule, and incorporates only an Alaskan demographic. The origins of the Western Thule culture are contested, although many researchers place its origin the greater Bering Strait region (Collins 1943; Giddings 1967; Gulløv and McGhee 2006; Mason 2009; Morrison 2001). The relationship of Thule to other tenth century cultures, especially Punuk, is complex, as evident from the rival settlements from Ekven to Cape Lisburne (Bandi 1995; Collins 1937; Rudenko 1961). Birnirk offers the most plausible technological and aesthetic source (Mason and Bowers 2009) for Thule, based on harpoon typology and trait comparisons from the Birnirk sites, Nunagiak near Wainwright (Ford 1959) Walakpa near Barrow, (Stanford 1976), or at Cape Krusenstern (Harritt 1994a; Mason and Bowers 2009), or anywhere from Cape Nome to Barrow to the Mackenzie River (Bockstoce 1973). Mason (2009) proposes a widespread an interaction sphere among OBS, Ipiutak, Birnirk, and Punuk, which created the platform for social and technological innovation and warfare.

Beyond the enigmatic origins of Thule, another paradox involves its widespread expansion. Thule, from its likely Bering Strait origin, spread southward as far as Kodiak Island and east across the entire North American Arctic to eastern Greenland (Dumond 1987b). Long considered to date to AD 1000 (Dumond 1987b; MeGhee 1984; Mathiassen 1927; Morrison 2001), recently Friesen and Arnold (2008) established that the spread of Thule out of Alaska and into the Amundsen Gulf to likely be no earlier than AD 1200.

The impetus for the push across the Arctic is still highly conjectural. A long-standing view (Harritt 1994a; Larsen and Rainey 1948; Mason 1998; McCartney 1980; McGhee 1969/70; Morrison 1999) is that Thule people followed the bowhead whale retreat northward as the extent of open water increased during the Medieval Warm Period. Local over-hunting of ringed seal was an explanation favored by Stanford (1976), while Whitridge (1999) proposed that increased population from successful whaling hunts led less successful whaling crews to migrate east. A completely different scenario is offered by McGhee (1984, 2009): the acquisition of meteoric iron in Greenland was a major motivator. McGhee (2009) points out that, regardless of the reason for the push, between the Amundsen Gulf to Baffin Bay most early Thule sites are within 50 years of each other.

The Thule imagination continued to elaborate on the harpoon heads, with the Sicco type diagnostic of the early Thule culture, along with other open socket harpoons, especially the Thule type 2 (Ford 1959; Standford 1976). Other implements included ground slate, inset blades and knives, soapstone lamps, small ivory figurines, needlecases, sand/gravel-tempered pottery, and, especially, dog sleds and harnesses, the later increasing mobility and long-distance Thule travel (Collins 1937; Crockford 2008; Giddings 1952). House forms of Early Western Thule modified that of Birnirk, but were still constructed from wood or whalebone, reducing the number of rooms, but with a secondary kitchen alcove off a long entryway (Harritt 1994a; Morrison 2001). The succession of Thule structures is best documented from Cape Krusenstern, although not well-dated (Giddings and Anderson 1986).

Kotzebue Period

The Kotzebue period marks the last, regional, phase of the Thule culture within Kotzebue Sound, persisting from AD 1400 to approximately AD 1825, the onset of sustained contact with Europeans and Americans (Giddings and Anderson 1986; McClenahan 1993). Although an intensive whaling economy had never succeeded in Kotzebue Sound, the Kotzebue period witnessed an increasingly “broad spectrum” economy based on ringed and bearded seal, caribou, birds, and fish (Giddings and Anderson 1986). The Kotzebue period was restricted to Kotzebue Sound, at Cape Krusenstern, the village of Kotzebue, up the

Noatak and Kobuk rivers, and the northwest portion of the Seward Peninsula (Jordan 1989; Schaaf 1988). Two settlements at Kotzebue served as type sites for the Kotzebue period, both excavated in the late 1940s (Giddings 1952, VanStone 1955) as described in Chapter 3.

The Kotzebue period originated within the Birnirk and Western Thule cultures, the final phases of the Northern Maritime tradition (Collins 1964; Giddings and Anderson 1986). However, within Kotzebue Sound, people were less invested in whaling and more effort was placed on fishing (Giddings 1952; Jordan 1989). Increased use of dog traction is also noted (Dumond 1987b; Giddings 1952; Giddings and Anderson 1986; Harritt 1994a; Jordan 1989; McClenahan 1993). The Kotzebue period may be considered the coastal manifestation of the Arctic Woodland culture (Giddings 1952) which represented an upriver migration after AD 1200. Employing dendrochronology, Giddings (1952) defined the culture's history up the Kobuk River and its tributaries. The technological sequence of the Arctic Woodland culture remains the yardstick for the later period in northwest Alaska. The oldest settlement was located at Ahteut on the middle Kobuk River, dating to AD 1200. By the fifteenth century, settlements were established at Ekseavik on the Squirrel River tributary and at Kotzebue. By AD 1550, a cultural transformation, especially marked by intensification of fishing produced the more widespread Intermediate Kotzebue period (Giddings 1952; Giddings and Anderson 1986). The final period, Ambler Island, defined from an upriver site dated to AD 1700, before Captain Cook's expedition into the Chukchi Sea. The eighteenth century settlement pattern around Kotzebue Sound from this period likely resembled the territorial boundaries among the Iñupiat during historic times (Jordan 1989; Burch 1998).

With the waning whaling tradition, it has been noted that housing settlements during the Kotzebue period start to hold fewer people, going from clusters of dozens of houses two just one or a pair in a given area (McClenahan 1993; VanStone 1955). Houses became smaller as well, retaining their rectangular and semisubterranean patterns, but reduced to only a single-room, being dug about 60 cm into the ground. The houses contained a central, stone-lined hearth and often had a four-post supporting structure built exclusively with timber, a trait going back to Ipiutak times, while floors had hard-packed gravel. Entryways were noticeably shorter than those seen with the Western Thule culture and were lined with horizontal timber (VanStone 1955).

As the Kotzebue period was seen to have an interior riverine push by its people, the biggest resource focus was fish. Salmon were caught during the summer, while sheefish were harvested through the ice during the winter (VanStone 1955). Whitefish were also taken from the brackish lagoons, as were pickerel from the small lakes surrounding the Kotzebue area. In terms of procurement, there is evidence of nets through bone and antler sinkers, net spreaders, net gauges and net shuttles. There are also various types of fish spears and arrows, leisters, gorges, and hooks (Giddings 1952; VanStone 1955). With these advancements, it is thought that sealing and land mammal hunting still provided as much of the resource base as was garnered in the past (Jordan 1989).

During the Kotzebue period there were a variety of tools available for daily use. By the Intermediate Kotzebue period (400 BP) trade items such as iron and blue glass beads were also available (Giddings 1952). Jadeite seemed to be the stone of choice for scraping hides and wood, as well as for making knives, adzes, chisels, and gouges. Antler wedges were common for splitting wood and antler ice picks were made for ice fishing (Giddings 1952). Chipped stone remained common during this time period and extended well into historic and modern times (McClenahan 1993).

Early European Contact Period

Although several voyages entered the Bering Sea during the eighteenth century, making landfalls along the Chukotka and Alaskan coasts, it was not until August 1816 that Otto Von Kotzebue, led the *Rurik* into Kotzebue Sound (Kotzebue 1967). Within Kotzebue Sound, Von Kotzebue named Cape Espenberg, Cape Krusenstern, Deering, Chamisso Island and Choris Peninsula in Eschscholtz Bay, as well as the area named for himself, Kotzebue. In 1833, the Russian-American Company, a fur trading operation based out of Saint Petersburg under commission of the Czar established a post at St. Michael, followed by another at Unalakleet in 1837. The Hudson's Bay Company, the British counterpart to the Russian traders, began pushing west through Canada, establishing their own post that same year at Point Barrow (Bockstoce 1977). The following year in 1838, the Russian-American Company sent its own fleet, headed by Alexander Kashevarov through the Bering Strait where he was able to reach Barrow.

American interests in the Bering straits began in the 1840s. Within a few years, up to 150 whaling vessels were operating in the Arctic Ocean each season (Bockstoce 1977). Captain Thomas Roys of the *Superior*, employed by the Grinnell Minturn Company, allowed him to head into virtually unchartered territory (Bockstoce 1986). Roys captured bowhead whales with baleen up to 4 m long, and produced 23 kg (120 barrels), amounts more common in right whales (Bockstoce 1986). By the end of the season the *Superior* was fully loaded and headed back to Hawaii. This success spawned an overall run of 2,700 whaling voyages to the Bering Straits, intensifying commercial interest in Alaska beyond that of the fur trade.

Qikiqtaġruŋmiut Historic Period

European contact and trade was infrequent in Kotzebue Sound in the early nineteenth century. While Kotzebue's party had possibly been some of the first to introduce firearms to the area (Gregg 2000; Von Kotzebue 1967; Ray 1975), by the 1820s these trade items, among others such as "trinkets," beads, and scrap iron, became more popular through strict regulation by the Russians. In 1838, the inhabitants of northern Kotzebue Sound and the northern Baldwin Peninsula as a cohesive group were first noted by the term, *Qikiqtaġruŋmiut* ("peninsula people"), by the Russian-Aleut Captain Aleksandr Filippovich Kashevarov, who visited the north shore of Kotzebue Sound (VanStone 1977). By 1850, with the wintering of the British captain Thomas E.L. Moore at Chamisso Island, it is said that the early years of the contact period had come to a close (Burch 1998).

As Western whalers and traders visited northwest Alaska more frequently bringing diseases and an economy that forced labor and a dependence upon certain goods, the Native populations adjusted their seasonal round in order to obtain better access to trade goods (Bockstoce 2009). Point Hope residents began heading north to Barrow, an active whaling station, rather than south, within Kotzebue Sound to Sisualik, which had for several generations, served as a trading rendezvous point for the people of Kotzebue Sound, due to its proximity to the Noatak, Kobuk, and Selawik rivers. By 1885, the spring rendezvous had moved across Hotham Inlet to Baldwin Peninsula at *Qikiqtaġruk*, the present location of Kotzebue village. This relocation was probably due to the deeper waters off the coast that permitted easier access for larger vessels (Bockstoce 2009).

Leading up to this change, the early 1880s saw a famine following from a crash in caribou populations, likely precipitated by the introduction of a large number of firearms in the Kotzebue Sound area 15 years prior (Morseth 1997). This also led to a greater dependence by the Natives on goods coming from Western traders and also forced some people to move. In response to this decline, and attempts to revitalize and "civilize" the area, Sheldon Jackson, the Commissioner of Education in Alaska, in 1892 brought reindeer from Siberia to northwest Alaska (Ellanna and Sherrod 2005).

Along with the privatization of reindeer herding, missionaries came to northwest Alaska to instill a Western education and impose religious doctrine into Natives in the area, and a mission was established at *Qikiqtaġruq* in 1897 (Burch 1998; Ellanna and Sherrod 2005). The goal of the Christian teachers at the boarding schools also pushed to transform the Iñupiaq culture by replacing its Native language (Ellanna and Sherrod 2005). Effects of this federal institutional policy to bring the Native populations into the Western world affected the local material culture so that by the late 1890s Stoney (1899) noted a changing trend in fewer labrets among the men of Kotzebue Sound. By 1900 a census of Kotzebue Sound led by John W. Kelly noted only 196 Native inhabitants. The *Qikiqtaġruŋmiut* had become so few that according to Burch (1998) this depopulation marked the end of the *Qikiqtaġruŋmiut* as an independent "nation."

Chapter 2: Landscape and Subsistence

Geography

The community of Kotzebue is located in the northwestern portion of Alaska, 42 km north of the Arctic Circle at 66°53′50″N 162°35′8″W. This is located on Mapsheet Kotzebue D-2 at the Meridian Township, Range, and Sections K017N018W01-03, W09-10, W16, and W21. Kotzebue is found 884 air km northwest of Anchorage along the eastern reaches of Kotzebue Sound, a body of water which runs 160 km east to west and 112 km north to south. Within Kotzebue Sound is Baldwin Peninsula, a 72 km long piece of land at the head of the sound stretching to the northwest from the mainland. It is bounded to the north by Hotham Inlet and to the south by Eschscholtz Bay.

The Baldwin Peninsula is a push moraine formation with middle Pleistocene origins, created by a dynamic system of glacial, fluvial, and marine sedimentation. This peninsula was once the terminus of three ice lobes formed the Noatak, Kobuk, and Selawik rivers. These lobes were all a part of the Anaktuvuk River glaciation that took place between 500,000 and 600,000 years ago (Huston et al. 1990).

Today the Baldwin Peninsula terminates in Kotzebue Sound as a small, 5 km long spit consisting of multiple, parallel gravel and sand beach ridges. Along the coastal face of the Kotzebue spit is where the village of Kotzebue was founded in 1899. This is situated 11 km south of the mouth of the Noatak River where an underwater channel extending from the river's delta passes south along the shorefront of Kotzebue, creating a southward-flowing current (Figure 1).

Terrain

The Baldwin Peninsula and areas around Cape Espenberg, the Kobuk River mouth, and Selawik Lake fall within an ecoregion known as the sub-Arctic coastal plains, which is comprised of poorly-drained coastal plains with a shallow permafrost table. The landscape generally rises from sea level to less than 120m and is comprised of basalt hills with a gently sloping gradient. Much of the sediment is stratified alluvial and marine in origin, overlying a Cretaceous intermediate volcanic rock. Streams in the area are often meandering, with common thaw lakes and thaw sinks (Gallant et al. 1995).

Climate

Kotzebue Sound exists within the transitional climatic zone which offers long, severe winters and wet summers. Average summer temperatures range from 30ºF to 60ºF (-1ºC to 15ºC). Cooler temperatures are more common for the coastal regions during the summer. During the winter, temperatures in the Kotzebue Sound region range from -20ºF and 20ºF (-29ºC to -7ºC), with interior regions experiencing the harsher side of the extreme. The average annual precipitation in the Kotzebue Sound region is fewer than 50 cm, with most precipitation occurring in the form of 150 cm of snow per year. Coastal areas receive the most wind, up to 10 to 15 knots. Fog, rain, snow, and high winds are all common on the open water (Stern 1982).

Flora

Vegetation of Northwest Alaska varies significantly with slight geographic changes. Along riparian environments, willow and alder are found, directly bordered by black spruce forests. These forests are commonly found on poorly drained, north-facing lowlands. Also present is white spruce, which is located in areas of good drainage and little permafrost. Preferring a similar environment, cottonwoods can be mixed with white spruce near streams. Birch trees can be present but require sunny, sloped locations with moist soil and are good secondary growth after wildfires (Burch 1998; Stern 1982).

Tundra covers most of the landscape and can be divided into three categories: alpine tundra, moist tundra, and wet tundra. Alpine tundra is a blanket-vegetation that is joined in sparsely vegetated areas by lichens and low shrubs such as willow, dwarf birch, and sedges. It is found on high, exposed ridges. Moist tundra occurs along foothills and in well-drained soils and is often represented by tussocks. Tundra grass and mosses can be accompanied by willow and dwarf birch. Wet tundra is found in meadows and marshes where the soils are often saturated with water, due to their proximity to ponds, small lakes, and bogs. Sphagnum moss and sedges are the common foliage groundcover of wet tundra (Burch 1998).

Berries are found on the tundra landscape with salmonberries, blueberries, cranberries, and crowberries as the prominent species. Willow, fireweed, sourdock, wild celery, Labrador tea, and Eskimo potato are edible resources found around Kotzebue Sound (Georgette and Loon 1993). Baldwin peninsula is largely treeless, although areas around Kotzebue Sound provide a habitat for spruce, cottonwood, and birch. As a resource, these trees can be found around Baldwin Peninsula as driftwood with most of the resource drifting north from the mouth of the Yukon River (Giddings 1967).

Fauna

Within the tundra and forested environments of northwest Alaska there is a high diversity of Arctic animals. Caribou of the western Arctic caribou herd is the predominant large land mammal on the northwestern Alaskan landscape in this region. The range of this herd extends from west along the North Slope near Prudhoe Bay, south and west through Atigun Pass in the Brooks Range, west of the Koyukuk River to its confluence with the Yukon River where the herd remains west and north of the river (Trans Alaska Pipeline System Owners [TAPS] 2001). Caribou from this herd are often in the Kotzebue area around late fall through winter, and before Kotzebue became the large hub it is today, there was once a caribou trail through the center of town (Burch 1972, 1998).

Other large land mammals found in northwest Alaska include brown bear, black bear, Dall sheep, moose, and musk oxen. Small land mammals and furbearers in northwestern Alaska are martin, mink, weasel, muskrat, ground squirrel, marmot, hare, river otter, beaver, porcupine, red fox, wolverine, lynx, and wolf. Moose, musk oxen, and beaver arrived in the area at the end of end of the twentieth century (Burch 1998; Georgette and Loon 1993).

Twelve species of marine mammals are common in the Kotzebue Sound. These include orca, minke whale, harbor porpoise, and ribbon seal; however, Kotzebue Sound is generally outside the range for these animals. Marine mammals such as polar bear, gray whale, bowhead whale, and walrus tend to inhabit only the western portion of Kotzebue Sound, as they migrate north through the Chukchi Sea during the spring and south during fall migrations. Occasionally these animals will enter Kotzebue Sound, but sightings along the Baldwin Peninsula are uncommon (Burch 1998; Fall and Utermohle 1995; Georgette and Loon 1993).

More common marine mammals found in Kotzebue Sound include beluga whale, bearded seal, ringed seal, and spotted seal. Beluga whales commonly appear today in Kotzebue Sound between the end of May and August, peaking during the middle of July. They enter near Cape Krusenstern, pass Sheshalik and Cape Blossom, and enter Eschscholtz Bay before passing Cape Espenberg to go back out to the Chukchi Sea in the fall, preferring shallow estuaries during the summer to feed and protect young. Beluga whale once came into a shallow lagoon along the Koztebue Peninsula, however this is no longer a viable option, as the lagoon was infilled in the 1940s (Burch 1998; Bureau of Ocean Energy Management [BOEM] 2011).

Bearded seals are found in the sound during late winter and in the spring until April. Ringed seals can be found as soon as ice forms on the sound in the fall and will remain in the area throughout the winter until the ice disappears in the spring. Spotted seals enter the sound during the summer through early fall (Burch 1998).

All species of Alaskan salmon are present in Kotzebue Sound. By a large percentage, chum salmon is the most common salmon species found in Kotzebue Sound. Non-salmon fish known to inhabit Kotzebue Sound are sheefish, whitefish, Pacific herring, rainbow smelt, Arctic cod, saffron cod, longnose sucker, sculpin, and Arctic flounder. Dolly Varden are found in Kotzebue Sound after migrating to larger rivers in the Kotzebue Sound area. Freshwater fish found in ponds and streams around the Kotzebue Sound area include northern pike, Arctic grayling, Alaska blackfish, nine-spine stickleback, and burbot (Georgette and Loon 1993). Marine invertebrate numbers are limited due to the muddy environments of Kotzebue Sound; however; clams, mussels, and crab inhabit the area.

Migratory waterfowl are first present around Kotzebue Sound beginning in late April with the birds remaining in the area until the fall. The first of the migratory waterfowl to arrive are geese, including white-fronted geese, Canada geese, snow geese, and other brants. Snow geese do not settle in the Kotzebue Sound region but pass through to breeding grounds farther to the north (Georgette and Loon 1993). Large migratory birds found in the Kotzebue Sound area from spring to fall include sandhill cranes and tundra swans arriving in late April.

Other species of other migratory birds found within Kotzebue Sound include loons, murres, glaucous gulls, whimbrels, gyrfalcons, and peregrine falcons. Many of these bird species make their nests in marshy areas around the Krusenstern Lagoon, Noatak Delta, Sheshalik, and the northern portion of Baldwin Peninsula; however, the gyrfalcon will hunt on sea ice while peregrine falcons prefer mountainous or shrubby areas along riverine environments (Georgette and Loon 1993).

There are several year-round or wintering species of birds in the Kotzebue Sound area as well. The most prolific are willow ptarmigan, ravens, grosbeaks, buntings, and redpolls. In more forested areas are gray jays, chickadees, goshawks, grouse, woodpeckers, dippers, crossbills, and snowy owls. Snowy owls will live on the open tundra and are most common in the Kotzebue Sound area, especially in the west, around October and November.

Northwest Alaska Socioterritories

Northwest Alaska is traditionally inhabited by Iñupiat people. “Northwest Alaska” has been defined by Burch (1998:4) as the area of land from Cape Thompson in the north to Cape Espenberg in the south, east to the Kotzebue Basin which encompasses rivers valleys such as those of the Noatak and Kobuk Rivers (Figure 1). Burch (1998:9) also explained through ethnographic evidence that the land around Kotzebue Sound is divided into socioterritorial “nations.” These nations are defined by the extent of seasonal rounds and territorial claims among various related groups.

Within the Kotzebue Sound area, Burch (1998:9) defines the eleven nations of Northwest Alaska. These nations extend from an area near modern-day Ambler in the interior, west to Cape Espenberg, and north along Cape Krusenstern to modern-day Kivalina (Figure 2). The focus of this thesis will be the people of the nation of *Qikiqtaġruŋmiut.* This area is comprised of the northwestern half of the Baldwin Peninsula, continuing north onto the mainland area of the Noatak River drainage delta, extending into the Agashashok River into the foothills of the Baird Mountains. The *Qikiqtaġruŋmiut* boundary continues west to include the entirety of Cape Krusenstern.

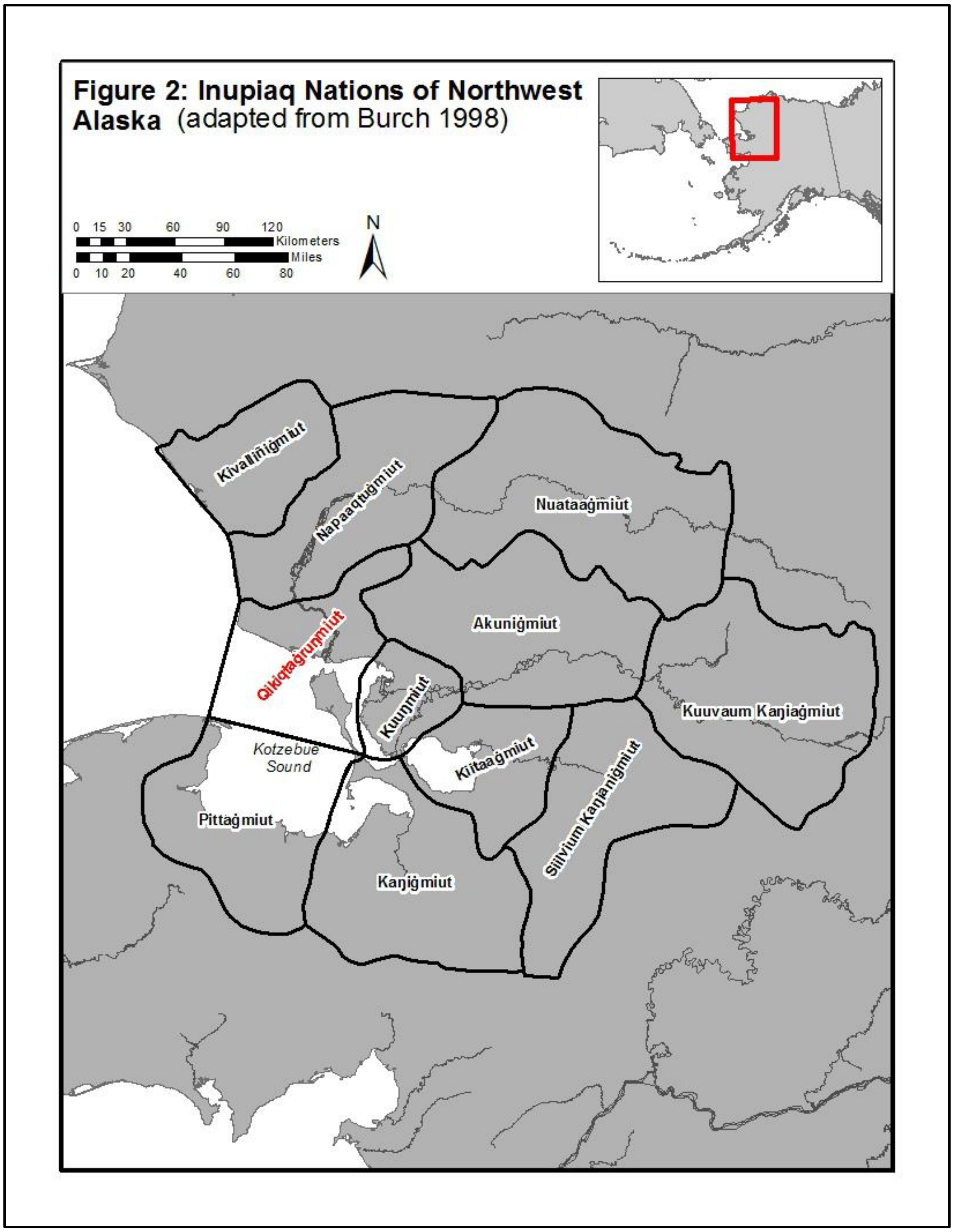

Figure 2: Iñupiaq nations of Northwest Alaska (adapted from Burch [1998:9]).

Kotzebue Village

The location of the village of Kotzebue is traditionally known as *Qikiqtagruk*. In the Iñupiaq language this means "almost an island" (NANA 2014). This refers to the thin, lagoon-pocked base of the spit that ephemerally connects the Kotzebue Peninsula to the rest of the Baldwin Peninsula The modern name, Kotzebue, refers to the Baltic-German explorer Otto Von Kotzebue, who explored Kotzebue Sound in attempts to discover a Northwest Passage in 1818 (Von Kotzebue 1821) . Though unsuccessful in his mission, this was one of the first recorded interactions between the Iñupiat of Kotzebue Sound and European explorers.

During the rest of the nineteenth century, European explorers began visiting Kotzebue Sound. This included voyages by Captain F. William Beechey of the H.M.S. *Blossom* in 1826 and an 1849-1850 voyage by T.E.L. Moore of the H.M.S. *Plover*. By the middle of the nineteenth century, commercial bowhead whaling In the Chukchi Sea, became popular, bringing up several hundred fleets of vessels (Bockstoce 1986). This increase in sailing traffic within the Chukchi Sea also affected the nearly Kotzebue Sound, affording some change. In previous years and generations, the *Qikiqtaġruŋmiut* had met at Sheshalik, a small strip of land with a lagoon near the mouth of the Noatak River, to trade goods and hunt beluga. By the 1880s, this long-standing tradition moved its location to the village of Kotzebue, likely as a means to allow for larger vessels to dock just offshore.

In 1897, a Quaker group, The Religious Society of Friends, sent missionaries to Kotzebue during the trade fair. Reaching upwards of 1,000 Inupiat traders at the event, this sparked enough interest to form a church in the village that year. This eliminated many Inupiat traditions such as viewing power within a shaman, traditional burial ceremonies, and polygamy (Burch 1994). That same year Episcopalian and Presbyterian churches were established around northwest Alaska. Since this time, the Catholic Church and Church of Jesus Christ of Latter Day Saints have also established congregations within Kotzebue. All of these religions exist today within the village of Kotzebue.

At the end of the nineteenth century, Kotzebue also saw gold miners come through the village from the Seward Peninsula towards claims along the Kobuk River. By 1938, Kotzebue received a hospital, but it was not until World War II when the government began constructing facilities such as communications towers and barge landing sites that Kotzebue began its position as the major hub of northwest Alaska (Burch 1998). In the 1960s, the Air Force made a presence in Kotzebue along with a bank, and Bureau of Indian Affairs high school. The early 1970s saw the passage of the Alaska Native Claims Settlement Act (ANCSA), including the creation of NANA Regional Corporation and the Kikiktagruk Inupiat Corporation within the city of Kotzebue. In the 1980s, the Alaska National Interest Lands Conservation Act (ANILCA) created lands near Kotzebue that are managed by the National Park Service (NPS) and the U.S. Fish and Wildlife Service. They include Cape Krusenstern National Monument, Noatak National Preserve, Kobuk Valley National Park, and Selawik National Wildlife Refuge.

Due to its location near the mouths of three major rivers and being one of the last deep water ports at the head of a large body of water near the interior of northwest Alaska, Kotzebue eventually found its place as the major hub of northwest Alaska , with an estimated population of 3,200 (DCCED 2010).

Kotzebue is still predominately Iñupiaq or other Alaska Native (74%), while much (16%) of the remaining population is made up of individuals of European descent (DCCED 2010).

Subsistence

The Alaska Department of Fish and Game conducted two studies for the years 1986 and 1991 to record subsistence activities for all resources harvested in the community of Kotzebue (Georgette and Loon 1993; Fall and Utermohle 1995). These studies provide information for the types and amounts of species harvested by Kotzebue residents, including amounts shared among the community and beyond. These data also provide an idea of the relative importance of these resources as well as the modern seasonal rounds for harvesting within the community.

Both the 1986 and 1991 study years show the importance of three major resources: fish, large land mammals, and marine mammals. Combined salmon and non-salmon fish accounts for roughly 40% of the overall harvest of Kotzebue residents. The next largest harvest is that of the large land mammals at 28 - 30% of the total harvest. The marine mammal harvest is almost as prevalent as the large land mammals at 27 - 28% of the total harvest. Outside of these top three resource groups, only roughly 4% of the total harvest is made up of the remaining species (Table 1).

Table 1: Harvest data by resource for the community of Kotzebue, 1986 and 1991.

Study Year	Resource	Percent Using	Estimated Harvest (#)	Estimated Pounds Harvested	Average Lbs Harvested per Household	Per Capita Lbs Harvested	% of Total Harvest
1986	All Resources	100	-	1,067,280	1,395	398	100.0%
	Salmon	85	32,128	195,981	256	73	18.4%
	Non-Salmon Fish	86	206,250	236,479	309	88	22.2%
	Large Land Mammals	88	2,027	299,709	392	112	28.1%
	Small Land Mammals	45	1,994	3,643	5	1	0.3%
	Marine Mammals	64	1,231	293,114	383	109	27.5%
	Migratory Birds	52	6,259	13,869	18	5	1.3%
	Upland Game Birds	41	3,097	2,168	3	1	0.2%
	Bird Eggs	16	6,577	1,250	2	0	0.1%
	Marine Invertebrates	13	1,248	315	0	0	0.0%
	Vegetation	81	-	20,739	27	8	1.9%
1991	All Resources	99	-	2,163,033	2,674	593	100.0%
	Salmon	90	45,489	274,202	339	75	12.7%
	Non-Salmon Fish	96	593,153	593,152	733	163	27.4%
	Large Land Mammals	94	4,065	644,967	797	177	29.8%
	Small Land Mammals	28	2,273	2,511	3	1	0.1%
	Marine Mammals	77	-	575,419	711	158	26.6%
	Migratory Birds	50	5,501	6,371	8	2	0.3%
	Upland Game Birds	54	7,977	5,584	7	2	0.3%
	Bird Eggs	24	5,275	852	1	0	0.0%
	Marine Invertebrates	27	723	722	1	0	0.0%
	Vegetation	92	-	59,207	73	16	2.7%

Sources: Georgette and Loon 1993:62-64 (1986); Fall and Utermohle 1995:XIX36-39 (1991).

When harvested resources in Kotzebue are considered by species, the top four harvested species remained the same between the 1986 and 1991 study years. In both study years caribou was the top-harvested resource, and salmon was the second highest harvested resource. In both 1986 and 1991, bearded seal was the third most harvested species. The two top fish species switched importance between the two study years (Table 2).

Table 2: Harvest data by species for the community of Kotzebue, 1986 and 1991.

Study Year	Resource	Percent Using	Estimated Harvest (#)	Estimated Pounds Harvested	Average Lbs Harvested per Household	Per Capita Lbs Harvested	% of Total Harvest
1986	Caribou	88	1,917	260,645	341	97	24.4%
	Salmon	85	32,128	195,981	256	73	18.4%
	Bearded Seal	47	443	185,871	243	69	17.4%
	Sheefish	76	23,742	130,580	171	49	12.2%
	Moose	42	65	34,721	45	13	3.3%
	Ringed Seal	17	440	32,580	43	12	3.1%
	Trout	59	7,503	24,759	32	9	2.3%
	Belukha	19	20	20,165	26	8	1.9%
	Spotted Seal	9	201	19,737	26	7	1.8%
	Berries	81	-	19,139	25	7	1.8%
	Pike	43	5,750	18,976	25	7	1.8%
	Whitefish	55	9,594	16,789	22	6	1.6%
	Young Bearded Seal	8	94	16,556	22	6	1.6%
	Saffron Cod	43	67,233	14,119	18	5	1.3%
	Walrus	5	15	11,807	15	4	1.1%
	Flounder	10	10,678	11,746	15	4	1.1%
1991	Caribou	93	3,782	514,362	636	141	23.8%
	Sheefish	85	77,571	426,642	527	117	19.7%
	Bearded Seal	63	963	404,338	500	111	18.7%
	Chum Salmon	86	44,283	266,586	330	73	12.3%
	Moose	62	235	126,220	156	35	5.8%
	Ringed Seal	28	914	67,649	84	19	3.1%
	Dolly Varden	79	20,165	66,543	82	18	3.1%
	Berries	92	8,664	56,319	70	15	2.6%
	Young Bearded Seal	18	316	55,530	69	15	2.6%
	Spotted Seal	12	251	24,577	30	7	1.1%
	Saffron Cod	66	101,900	21,399	26	6	1.0%
	Herring	45	3,562	21,371	26	6	1.0%

Sources: Georgette and Loon 1993:62-64 (1986), Fall and Utermohle 1995:XIX36-39 (1991)
* This figure provides only those species contributing to more than 1% of the total harvest.

Overall, the subsistence practices recorded for the study years 1986 and 1991 show that four species, caribou, sheefish, chum salmon, and bearded seal, provided 72 - 75% of the total subsistence diet for the community of Kotzebue. The remaining percentage of the harvested resources is comprised of species that provide more than 1% of the total harvest. Additionally, moose, ringed seal, and freshwater fish (trout or Dolly Varden) provided 9- 12% of the total harvest (Table 2).

Chapter 3: Previous Investigations

Kotzebue Sound

Kotzebue Sound has a long history of human occupation and use. According to the Alaska Heritage Resource Survey (AHRS), areas immediately surrounding Kotzebue Sound contain roughly 750 recorded archaeological and historical sites. Within the traditional territory of the *Qikiqtaġruŋmiut* as identified by Burch (1998, Figure 2), 380 AHRS sites recorded. On the Baldwin Peninsula there are 129 AHRS sites; over half (n=69) are on the Kotzebue spit, the site of Kotzebue village. Another small cluster of 27 AHRS sites is 1.5 to 3 km from the base of the peninsula, and one is across the lagoon east of town. These are historic sites dating to World War II and immediately after (Hogan et al. 2006).

Districts

There are two recognized districts on the Kotzebue Peninsula. One is the Kotzebue Archaeological District (KTZ-036) (Gal 1986). This district encompasses the entirety of the Kotzebue spit and contains evidence for the earliest known prehistoric occupations of the northern half of Baldwin Peninsula. Most of the prehistoric sites recorded on the Kotzebue spit are subsumed under the initial archaeological discoveries made by Giddings (1952), KTZ-030, and VanStone (1955), KTZ-031, or within the archaeological district, KTZ-036 (Figure 3). Exceptions include KTZ-315, a proto- or prehistoric grave site; KTZ-346, a prehistoric kargi; KTZ-347, a housepit; KTZ-370, a site consisting of some lithic flakes; and KTZ-375, a site including a human femur, bone harpoon, and lithics (Alaska Department of Natural Resources, Office of History and Archaeology [ADNR, OHA] 2014). These are the only prehistoric sites listed on the AHRS for the Kotzebue Peninsula (Figure 3).

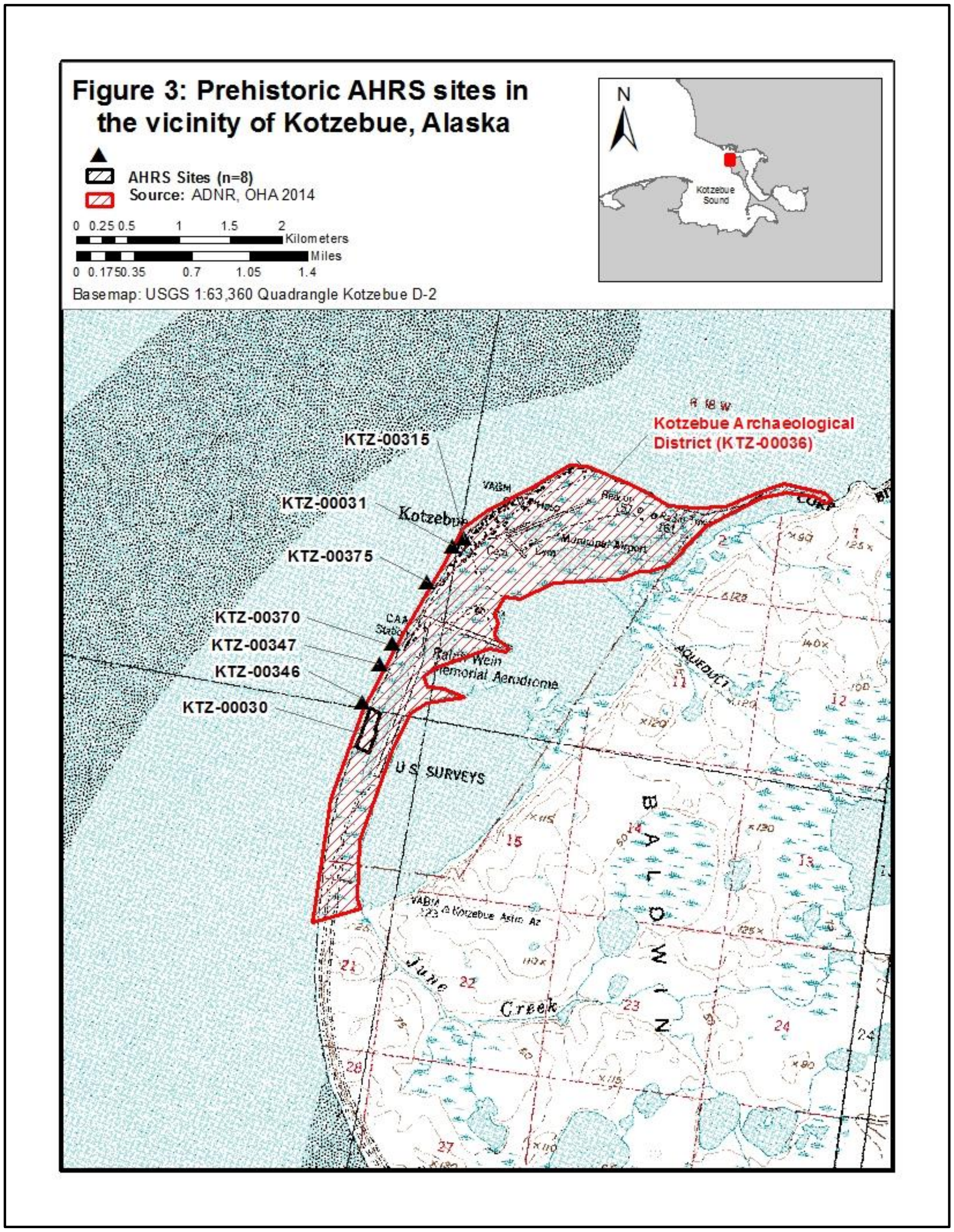

Figure 3: Prehistoric AHRS sites in the vicinity of Kotzebue, Alaska

There are two sites of questionable antiquity on the Kotzebue spit. The first site (KTZ-234) is a meat cache identified in 2002 at the base of the spit. This site features no description or citation on the AHRS card to determine an age. The other Kotzebue spit AHRS site of questionable age is listed as a historic site: the Kotzebue-Noatak Trail (KTZ-310) which is a linear feature leading from the north end of the Kotzebue Peninsula, across the mouth of the Hotham Inlet and terminating at Noatak. Historic trails are often developed over preexisting prehistoric pathways, and KTZ-310 is likely much older than its “historic” AHRS designation.

The second district on the Kotzebue Peninsula is the Kotzebue Front Street Historic District. This is a roughly 0.8 km section of Shore Avenue along the northwest waterfront of the peninsula from just west of Mission way at Tundra Way, to Turf Street which is near the northernmost reaches of the spit. The district delineates some of the earliest structures in the newly-formed town of Kotzebue constructed between 1897 and 1919. The creation of the historic district is the result of a 2001 study by historians Buzzell and Breiby (2003). The historians evaluated all structures along Shore Avenue for their age and integrity. Thirty of the 47 structures were found eligible for the National Register of Historic Places. The AHRS contains 16 other reported historic sites on the Kotzebue spit.

Early Archaeology of Kotzebue

As noted by the first archaeologist to visit Kotzebue in 1941, J.L. Giddings (1952:19), “Kotzebue was overlooked as an archaeological site of importance until 1941 because it boasted no obvious ruins – neither recent house pits in numbers nor the sort of mounds of accumulated refuse characteristic of coastal whaling points.” The earliest excavations in the village are by J. Louis Giddings who excavated two houses on a narrow series of beach ridges between Kotzebue Sound and an 800 m-long lake to the southwest of the modern village (Giddings 1952, 1967).

Giddings returned in 1947 and excavated three additional houses and defined the Intermediate Kotzebue phase of the Arctic Woodland sequence. In 1958, returning to Kotzebue, Giddings (1967) assessed the stability of the beach ridges and collected samples for tree ring dating. In 1951, James VanStone (1955) undertook his dissertation work in the village. He excavated eight house pits that were used to define the Old Kotzebue phase. At the close of Van Stone’s work, the focus of research in Kotzebue Sound turned away from Kotzebue for the next generation, as Giddings (1967) and then Douglas Anderson (Giddings and Anderson 1986) began a comprehensive survey and testing at numerous coastal locations.

Cultural Resource Management Investigations

By 1970, archaeological attention was renewed in Kotzebue following the passage of the National Historic Preservation Act of 1966 (NHPA), federal law 36 CFR Part 800. This law required that when federal money, lands, or permits are involved in projects, federal agencies are required to take into account the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on such undertakings. Historic properties are those historic or prehistoric districts, sites, buildings, structures, or objects included in, or eligible for inclusion in the National Register of Historic Places.

In Alaska, another law, ANCSA, passed in 1971. This granted 601,000 km^2 of land to twelve Native regional corporations, and increased the participation of Alaska Natives in the capitalist system. In Kotzebue Sound this created the NANA Regional Corporation, as well as the Kotzebue-local Kikiktagruk Inupiat Corporation (KIC). ANCSA settled most land disputes and enabled Natives to continue conserving or harvesting resources from their own land.

In the wake of the CRM legislation, over 64 excavation and monitoring projects occurred in the last 40 years. Of note, nearly 60% (n=38) of the surveys conducted within Kotzebue have concluded with negative results (Bacon 1977; Biddle 1999; Crozier 1985; DePew 1996, 2002; Desson 1985; DeVore 2001; Gannon 1987; Gilbert-Young 2005; Groethe 1993, 1994; Hoff and Thorsen 1990a, 1990b, 1990c; Hoff and Zimmerman 1991; Manchester and Sheehan 1994; NPS 2002a, 2004b; Navarre et al. 1988b, 1988c, 1988d, 1988e, Navarre et al. 1989a, 1989b; Pipkin 1995; Reynolds 1994; Schley 1984; H. Smith 1978; Tyler 1995; Weaver et al. 2003; Wiersum 1982, 1984a, 1984b; Wightman 2003; Williams and Reuther 2001; Williams and Slaughter 2005; Gannon and Wiersum 1986 in Yarborough 1994:3; Yarborough 1994; Zimmerman and Street 1998). A brief summary of positive investigations in Kotzebue are listed below, beginning with the work of Giddings in the 1940s and continuing through 2014 with the work of Territory Heritage Resource Consulting (THRC) and SWCA (Table 3).

Table 3: Previous archaeological investigations within Kotzebue

Year	Site/Area Investigated	Reference	Findings/Comments
1940, 1941, 1947, 1958	KTZ-030, 031	Giddings 1952, 1957, 1958,1961,1967	One house pit excavated at Giddings Site 38 (KTZ-031); 200 house pits (3 excavated)
1951	KTZ-031	VanStone 1953, 1955	Eight house pits excavated in areas adjacent to Giddings' work.
1976	KTZ-030, 031	Stern and Newell 1976	Two house pits by Rurik Way (KTZ-031); project was underway before monitoring began
1976	KTZ-030, 031	Scott 1976; Scott et al. 1978	Three house pits by Rurik Way (KTZ-031); one house pit may be from Stern and Newell 1976.
1976	KTZ-031	H. Smith, personal communication 2006	Burial exposed and removed while blading the east edge of 3rd Avenue (see Stern 1982:141).
1981	KTZ-001, 030, and 031	Stern 1982	Survey for various street improvements around town. No subsurface testing but extensive interviews; human remains exposed at Fourth and Mission.
1986	KTZ-031	Gal 1986:15	Housepit near Hanson's Store entrance observed during foundation excavation.
1988	KTZ-031	Navarre et al. 1988a	Possible historically significant cabin on Front Street; not present in 2001.
1989	KTZ-031	Gal 1989, 1991	Four possible positive test units.
1989, 1990	KTZ-031	T. Smith 1989, 1990a, 1990b	Cache and room of house pit excavated; the rest of the housepit is under the street.
1992	KTZ-038 (KTZ-031)	BIA n.d. (ca. 1992)	Included in KTZ-031.
1994	KTZ-031	Harritt 1994b, 1994c	Positive results at House 2601 and 2616.
2000	KTZ-031	McIntosh and Bowers 2000	Two positive results at House 723 and 726, one negative at House 210.
2001	KTZ-031	DePew and Buzzell 2002	Positive survey along Front Street.
2001	KTZ-250 (KTZ-001)	Buzzell and Breiby 2003	Proposed KTZ-250, Historic District along Front Street.
2002	KTZ-031	NPS 2002b (Chris Young, personal communication with Catherine Williams of NLUR, 2006)	Survey on First and Second Avenues, positive testing on NANA Museum property; human remains and artifacts recovered.

Table 3: Previous archaeological investigations within Kotzebue (continued)

Year	Site/Area Investigated	Reference	Findings/Comments
2003	KTZ-031	Reuther 2003	Survey of House 725; artifacts recovered 30-60cm below surface.
2004	KTZ-031	NPS 2004a (Chris Young, personal communication with Catherine Williams of NLUR, 2006)	Water line repair at Second Avenue and Lake Street; positive survey
2004	KTZ-031	Brown 2004	Monitoring water trench at 112 Second Avenue; prehistoric cache, 2 posts, and artifacts recorded.
2005	KTZ-031	NPS 2005a (Chris Young, personal communication with Catherine Williams of NLUR, 2006)	Testing on Building 152 lot on Second Avenue; one housepit side room, the rest remains under the street.
2005	KTZ-031	NPS 2005b (Chris Young, personal communication with Catherine Williams of NLUR, 2006)	Monitoring of NANA Museum demolition on First and Second Avenues; artifacts recovered from secondary context.
2006	KTZ-001; KTZ-031	Williams and Cassell 2007	Monitoring ground disturbances; cultural deposits discovered beneath road fill.
2007	KTZ-001; KTZ-031	Williams 2007	Monitoring ground disturbances in three areas; cultural deposits observed beneath road fill.
2007, 2008	Shore Avenue; KTZ-250 (KTZ-001); KTZ-031	DePew, personal communication 2008	Data recovery for the Shore Avenue Reconstruction Project; house pit identified and artifacts recovered.
2008	KTZ-001; KTZ-031	Charles M. Mobley & Associates 2008	Monitoring of sewer and water line replacement on Front Street, replacement of Lift Station 2, and line replacement for Lift Station 3.
2009	KTZ-036	Cassell et al. 2010	Monitoring of water line; positive results.
2010	KTZ-036	Carlson et al. 2013	Monitoring of Shore Avenue Reconstruction Project
2011-2012	KTZ-036	Corbin and Tedor 2013	Monitioring water line; several instances of human remains
2013	KTZ-030, 036, 346, 347	Cassell et al. 2013	Monitoring of airport gravel source at Isaac Lake
2014	KTZ-030, 346, 347, 375	SWCA (forthcoming)	Monitoring an airport material source; cultural materials identified
Modified from Carlson et al. (2013:21-26).			

Chapter 4: Methods

Field Background

Shore Avenue is one of the main streets in Kotzebue. In June 2010, and continuing into 2011, renovations began on this road with funding assistance by the Federal Highway Administration (FHWA) under the direction of the Alaska Department of Transportation and Public Facilities (DOT&PF hereafter referred to as DOT). This was an effort both to improve road conditions and to create a shoreline structure that would prevent future beach erosion. Prior to ground-breaking activities, DOT conducted extensive consultation with the Federal Aviation Administration, the State Historic Preservation Officer (SHPO), and other interested parties regarding the project and its potential to adversely affect archaeological deposits.

In compliance with federal regulations under Section 106 of the NHPA, consultation between the three agencies and interested parties resulted in a Memorandum of Agreement (MOA) for mitigating adverse effects that included a combination of data recovery and monitoring during construction. Parties concurred on this strategy as the best method for mitigating the effects of the project, after a 2001 investigation showed intact archaeological deposits occurring throughout the project area (DePew 2002). Because construction activity had the potential to destroy subsurface cultural materials, the MOA called for the archaeological excavation of trenches at locations along Shore Avenue to characterize the cultural resources that would be affected by construction. Better understanding of the nature of the archaeological deposits would provide important information for planning the archaeological monitoring during construction, and would also contribute to increasing the foundation of knowledge about the culture history of the city of Kotzebue and of the Kotzebue Sound region at large, and potentially provide information for the development of interpretive displays called for in the MOA.

OHA approached Native townsite lot owner, Lillian Lewis, to gain permission to excavate in her front yard. The excavation would extend into Shore Avenue. Her Native townsite lot, originally owned by Johnny Coppock, was selected due to its central location within the project area. As the Native townsite was in federally restricted status, an Archaeological Resources Protection Act (ARPA) permit was obtained by OHA from the Bureau of Indian Affairs (BIA) to conduct the excavations. Following Lewis' approval, excavation began in 2007.

Field Methods

OHA implemented a systematic checkerboard-pattern excavation grid designed to maximize the area sampled on Lillian Lewis' property. This also maintained a continuous stratigraphic profile, effectively displaying each beach ridge and cultural event that formed over time along the tested section of Kotzebue Sound (Locality A, Figure 4).

Figure 4: KTZ-036 2007 and 2008 excavations of Locality A and Locality B

Excavations in 2007 consisted of six 1x1-m test units. Each test unit was dug by hand with a trowel, with rock and sandy matrix placed into 5-gallon buckets. OHA screened all sediment and gravel through nested ¼ and ⅛ in mesh screens so that artifacts not found *in situ* were likely recovered (Figure 5).

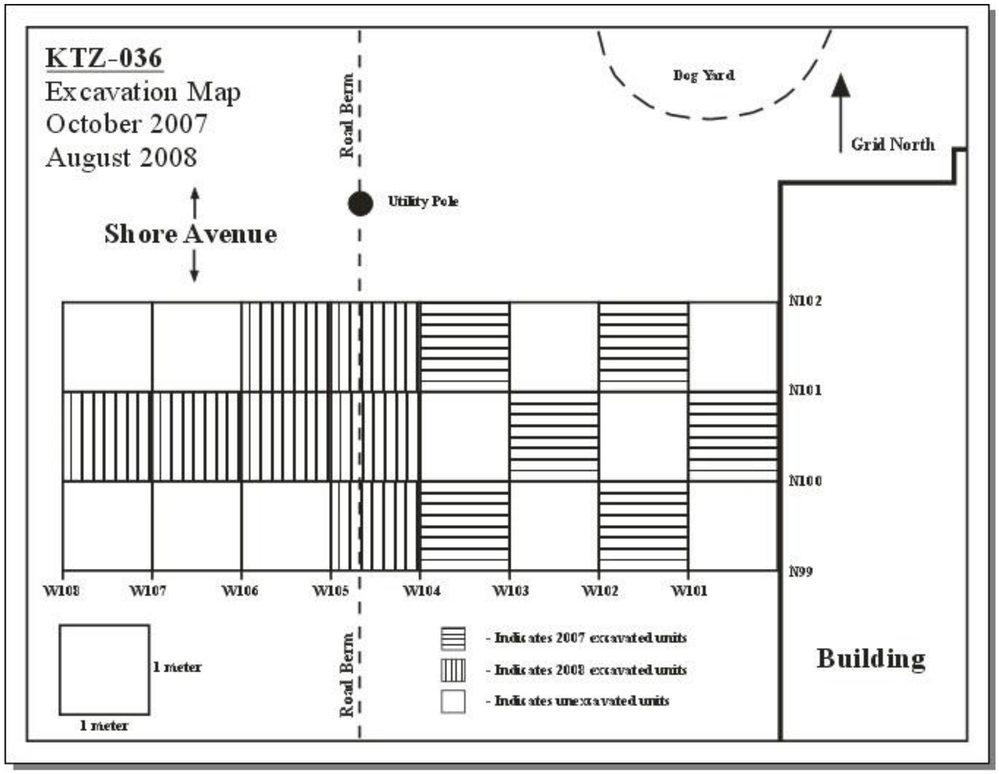

Figure 5: Excavation map of Locality A.

The units were excavated in arbitrary 10 cm layers with attention given to natural layers within the arbitrary levels. Most units were excavated to a depth of 140 cm below the ground surface. Some artifacts or features discovered *in situ* were photographed and documented. Large features such as structural wood or whale vertebrae were left *in situ*, as these pieces typically were found to penetrate into the next unit.

Artifacts recovered from the test units included faunal remains, formal stone tools and lithic debitage, and organic tools and assorted debitage made from antler, bone, ivory, and wood. Some sediments excavated from the upper levels of the test units contained historic era materials such as metal, glass, wood, and even plastic items. OHA collected all of the lower level cultural materials and a selected amount of the upper level materials. Cultural items were collected by level. For levels with large amounts of cultural material, some classes of artifacts, such as faunal remains and lithic debitage, were bagged together in a level bag. At the end of the excavation, the KTZ-036 collection was taken to the OHA lab to be cleaned, sorted, and cataloged in an Excel spreadsheet.

The project area for the 2008 season consisted of two locations, each with its own separate excavation. The first excavation was in the form of a 4x1 m trench that extended from the Lewis townsite lot (Locality A) westward toward the coast from the previous year's excavation into the Right of Way

(ROW) for Shore Avenue on Alaska state land. This trench included a 2x1 m lobe to the grid north on the east end of the trench, and another 1x1 m unit to the grid south of the main trench, also lying on the east end. This excavation exposed 15 m^2 of deposits (Figure 4).

OHA conducted the second 2008 excavation approximately two blocks south (425 m) of Lewis allotment at 508 Front Street (Locality B). This second trench was confined between two houses and ran 7x1 m on an east-to-west grid with just 1 m^2 expansion to grid south near the east end. This excavation exposed 8 m^2 of deposits (Figure 4 and Figure 6).

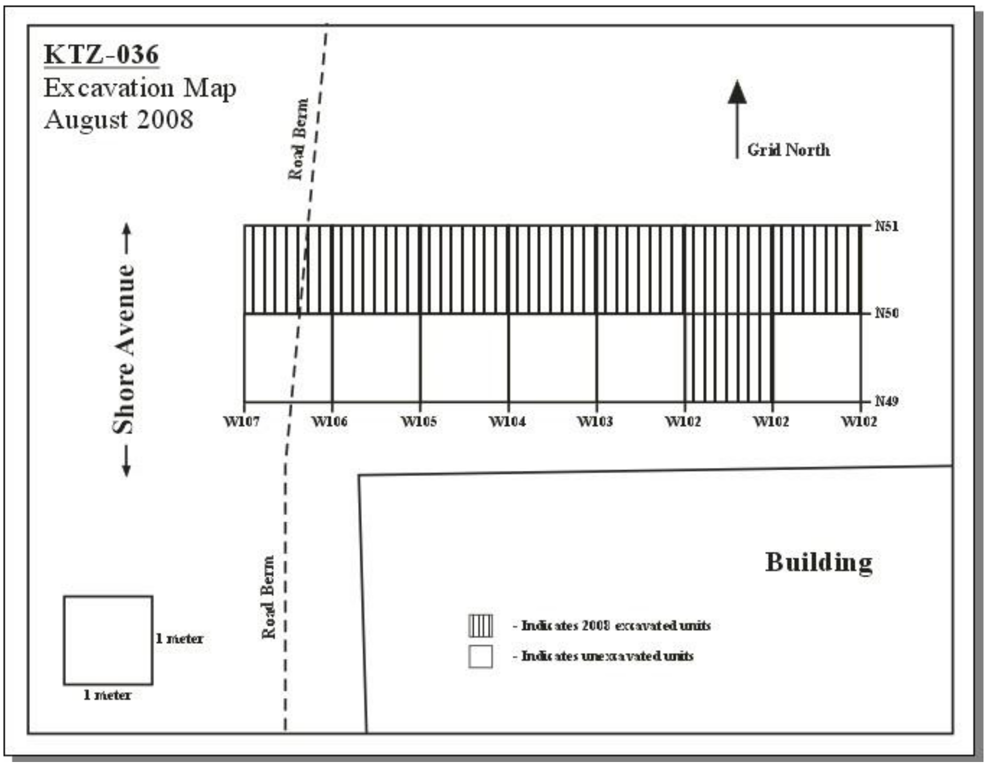

Figure 6: Excavation map at Locality B

Initial excavation of the northern 2008 trench began with a backhoe removing approximately 1 meter of overburden along Shore Avenue. Below the removed sterile layer, each trench was excavated using trowels. The sediment was passed through ¼- and ⅛-in nested screens. The second excavation did not require the removal of overburden and was dug completely by trowel to the lower levels. Each of the 2008 excavation units were screened and photographed in a similar manner. The 2008 excavated units resulted in the recovery of similar types of materials to the 2007 material.

Laboratory Methods

Collected materials were taken from the 2007 and 2008 excavations to the OHA lab for cleaning, processing, labeling, stabilization, and curation. The 2007 materials were removed from their field bags and cleaned with a paintbrush. Water was only used on lithic artifacts and glass. Once cleaned, artifacts were placed in appropriately-sized, 5 mm resealable sample bags and labeled with the corresponding three-point provenience, date, excavator, level, contents, quantity, and lab accession number. All diagnostic artifacts were photographed. Each piece of the collection was then separated by material type. Diagnostic tools made of either osseous or lithic materials were separated into their own sample bags. Historic materials, i.e., metal, glass, plastic, or ceramic, were kept bagged together as a lot. Since the faunal remains are the focus of this thesis, these remains were separated by taxonomic class: Mammalia (mammals), Aves (birds), or Actinopterygii (ray-finned fish).

In addition to the above curatorial methods, the 2008 material was treated with polymers to conserve the organic artifacts. The techniques used for conserving the osseous artifacts are outlined in Smith (2003). The initial step required dry-brushing the sediment from the artifacts. Once the surface was cleaned, the artifacts were submerged in 100% acetone for two months to remove any moisture from the pores of the osseous materials. This also prepared the artifacts for later absorption of the polymer (Figure 7).

Figure 7: KTZ-036 artifacts extracted from acetone in preparation for a polymer bath.

Upon removal from the acetone, the artifacts were placed on a drying rack. During this time a viscous solution consisting of 80% PR-10 and 20% CR-20 polymers was created (Figure 8). PR-10 is a dimethyl siloxane, hydroxyl-terminated polymer, an odorless oil with a small molecular size resulting in deep penetration of the pores of the artifacts to create a rigid product. CR-20 is a water soluble additive which reacts to join two or more polymers. This is known as a cross-linker.

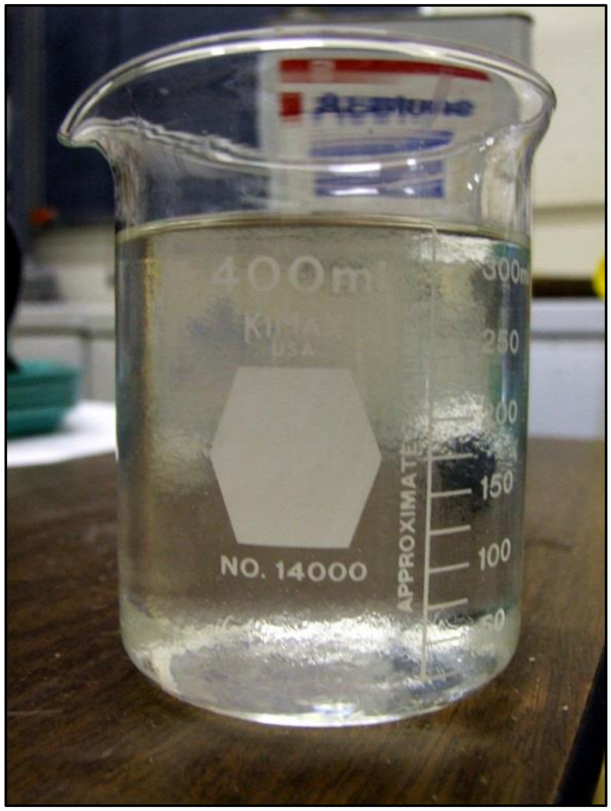

Figure 8: The 80% PR-10 and 20% CR-20 polymer solution.

The artifacts were left in the cross-linker polymer solution for four weeks, upon which they were removed and brushed six times with 100% CR-20 as a bulking agent (Figure 9). This step is done to promote adherence of the pure cross-linker to the surface of the artifact before the artifacts are put in contact with the catalyst to harden the silicone (Smith 2003). The catalyst is CT-34, which is a tin-based polymer that reacts with the PR-10 and CR-20 polymers by solidifying the solution that has completely permeated the artifact.

Figure 9: The artifacts are brushed with 100% CR-20 polymer to promote crystallization.

This final procedure is done by placing a small Dixie cup with 5-7 ml of the CT-34 catalyst in a closed environment next to the polymer-saturated artifacts for 24 hours (Figure 10). A small paper towel is placed in the cup, which acts as a wick to promote the evaporation of the catalyst. In a gaseous state, the catalyst then bonds with the polymers on the artifact. The resulting product is a silicon-sealed artifact which can be brushed dry of any flaky powder left as a result of the hardening catalyst. The artifact is then in a state in which it can be labeled and curated for perpetuity.

Figure 10: Dixie Cups are placed in with the artifacts with a CT-34 catalyst to harden the silicone.

Methods of Analysis

This thesis involved two types of analysis. The first was an analysis of the faunal remains. The second was an analysis of the osseous tools. The faunal analysis included identifying the quantity and types of large land mammals, sea mammals, fur bearers, and birds harvested at the site. The osseous tool analysis included identifying the raw material of each artifact and inferring the artifact's function, if possible.

Faunal Analysis

Faunal analysis for KTZ-036 consisted of the identification of the mammal and bird bone from the 2008 excavation. The 2007 material was required to be returned to the owner of the Lewis townsite lot and was not included in the analysis. The fish bone was also excluded from analysis. Fish bones are rarely used for bone tool making, which is the focus of the thesis.

The identification of faunal remains was conducted at the University of Alaska Anchorage. The primary comparative collection used is managed by the Alaska Consortium of Zooarchaeologists and the Department of Anthropology at the University of Alaska Anchorage. Additional materials, including a variety of seal and axial portions of a beluga (*Delphinapterus leucas*) were temporarily donated by the Department of Mammalogy at the University of Alaska Museum of the North. Professors Diane Hanson and David Yesner provided considerable assistance in identification. Manuals created by Post (2003, 2004) were also of significant help, especially with the identification of metapodials and phalanges.

Data Collection

The faunal analysis process began with sorting and identifying bird bones, followed by mammal bones. Each bag from site KTZ-036 consisted of unmodified bones found in relative proximity to each other, collected from specific arbitrary levels. After identification, the bones were re-bagged in their original lot bags. Because multiple bones remained in one bag, the greatest length of every bone was measured and recorded in centimeters to allow for replicable methods in the identification process.

The collected data were recorded on a Microsoft Excel spreadsheet. Categories of information present on the spreadsheet for each element found included provenience data such as the unit number, quadrant, level, and centimeters below surface (cmbs). Also included were multi-component catalog numbers, which included the AHRS number followed by the year the artifact was collected, the bag number, and the artifact number. Subsequent data collection included class separations between mammal, bird, and fish.

This catalog number is then tied to the element name, the side of the body from which it originated, the portion of the element present (i.e., complete, proximal, distal), and the identification of the element as close as possible to the species level. Crockford's (1998) confidence codes were included in the faunal identification to express the level of surety in the identification. Often birds were only identified with high confidence to family or genus. Terrestrial mammals were often identified to the species level, whereas sea mammals were often only identified to the genus level with much certainty.

Also included in the spreadsheet were any notable modifications made to the bone; these include butchery marks, bashing, burning, and gnawing. The age and sex were noted for each element. Sex was rarely noted and only juveniles were identified to age. The quantity of bones was also recorded. Fragmentary bones were often not listed individually on the spreadsheet but grouped together as a lot, as no identification was possible. This number is indicated in the quantity column of the spreadsheet. There was also a comments column to allow for the noting of any significant features or anomalies that would aid in a bone's subsequent identification, any discussion of refits or articular associations with other bones in the collection, and any tentative identifications in the case of highly fragmentary materials.

Data Analysis

Once the identification stage was completed, the Number of Indentified Specimen (NISP) along with the Minimum Number of Individuals (MNI) were calculated for each species or grouped genera (Lyman 2008). Both counts were used, as each can contribute to an understanding of the overall size of the collection. NISP is the overall tally of bones recovered from the site. Unfortunately, this number can lead to a misrepresentation in the data. For instance, a single fragmentary bone can be counted repeatedly, greatly increasing the NISP. However, it also informs on the complete number of bones being analyzed (O'Connor 2000).

MNI, on the other hand, creates a more conservative number. It quantifies the number of similar elements, including the side of the body from which it came, in order to determine the limiting number of animals, or harvested animal parts, that are contained within the collection (Lyman 2008). This number can considerably diminish or increase the actual number of complete individuals present at a site as due to unknown factors such as site-formation processes or harvesting techniques, or this could also be due to recovery techniques and laboratory protocol (Reitz and Wing 2008). For this reason, MNI should only be used as a general estimate of the species found at the site. However, this number does help illuminate whether any species are more important in the overall diet.

The comparison of the NISP to MNI can dictate whether certain elements were repeatedly discovered from the site or if most of the elements of a single individual were recovered. This can be done through the use of relative frequencies calculated by dividing the number of an individual type element by both the number identified from that species and the NISP itself. This can also help with identifying elements that were harvested and collected more often than others (Reitz and Wing 2008). After MNI and NISP were calculated, a cross-species comparison was conducted. Within the archaeological record, this comparison can show relative affinities toward one species over another and, if a detailed stratigraphic record is present, can show a preferential change over time.

Artifact Analysis

A systematic classification of the osseous tools was attempted. This was done to identify the known or supposed function of each tool in order to understand the impact forces and bending stresses applied to these tools. Archaeological and ethnographic literature was used to determine much of the intended functions (Bandi 1969; Bockstoce 1977; Dumond 1998; Ford 1959; Giddings 1961, 1964; Giddings and Anderson 1986; Stanford 1976; VanStone 1955, 1980).

Materials Analysis

Each piece of modified osseous material was analyzed to identify its material type. Often this could be done with the naked eye. If material type identification was not possible at this level, then the piece was further analyzed with a dissecting microscope with 10x, 20x, and 40x magnification. Below are the characteristics noted for each material type and how they are used for identification purposes.

Bone

Bone is comprised of a highly complex protein called collagen. It has a hard compact cortex with a soft interior made of spongy trabecular bone (Morrison 1986). The long bones are often those used in artifact manufacture. These bones have a lamellar structure sheathed by periosteum, both of which are deposited longitudinally creating the length of the bone. A system of blood vessels runs parallel to the bone linking the living cells within the bone to the rest of the body. This is known as the Haversian System (O'Connor 1984).

When observing the exterior of a long bone, most of the surface is smooth except for the occasional pit or scratch. This is the observable portion of the Haversian System and allows for easy identification of the material as bone (Espinoza and Mann 1999). In broken, cross-sectioned, or worked bone with exposed trabecular bone, identification can be made through the observation of large longitudinal spaces across the entirety of the bone until it meets with the cortical bone (O'Connor 1984, Figure 11).

Figure 11: This is cut bone showing the outer cortex and internal trabecular bone.

Ivory

Ivory is the name for large teeth or tusks harvested from selected large mammals. In the Kotzebue area this is limited to walrus and the extinct woolly mammoth; however, sperm whale, killer whale, and narwhal might also be included.

Ivory is made up of two major components. The first is the dentine, which is found in the interior of the tooth in young animals and is soon worn off with use. This is surrounded by the outermost layer, cementum, which is capped only at the occlusal surface of the tooth by enamel. Dentine can be broken up into primary and secondary dentine layers. The primary dentine encapsulates the secondary which is found at the center of the ivory (Espinoza and Mann 1999). In cross-section the secondary dentine in walrus ivory can be identified as having a globular or "grapey" appearance (Figure 12). The primary dentine is less distinct but can be differentiated from the brighter cementum.

Figure 12: A thin outer layer of cementum with the primary and "grapey" secondary dentine of walrus (left) and Schrager lines on the dentine of mammoth ivory (right).

In mammoths, dentine makes up nearly 95% of the tooth with little differentiation between the primary and secondary dentine, though between the primary dentine and the cementum, the difference is quite clear. In cross-section the cementum is not patterned but is shown as a thick outer layer. The dentine of mammoths or other proboscids has an overlapping "v" pattern known as Schreger lines, which open up toward the center of the cross section of the tusk. With this pattern, mammoths can be distinguished from modern elephants when the Schreger lines are fewer than 100 degrees, as modern elephants show a much wider angle of the cross-hatch pattern, over 100 degrees (Espinoza and Mann 1999; see Figure 12).

Antler

Antler is a specialized bone that develops on the frontal bone of Artiodactyla such as caribou and moose. Like the rest of the skeleton, antler is bone made of collagen. Unlike the lamellar long bones, antler is comprised of woven bone that does not contain a highly regimented structure, which is suitable for rapid growth, in some cases up to 2 cm per day (MacGregor 1985).

Similar to skeletal bone, antler contains outer cortical bone along with the spongy, inner trabecular bone. However, due to antler being much more highly vascularized than skeletal bone, the cortical bone of antler can be identified by being less smooth than skeletal bone and containing pits and irregularities (O'Connor 1984). In cross-section, antler has a similar morphology to porous trabecular bone. The noticeable difference is that the cortical bone in antler is generally thicker and less defined in regard to the transition to trabecular bone. The length of the spaces with the trabecular bone of antler is often less than that seen in bone (Figure 13).

Figure 13: Split antler shows the outer cortex and internal trabecular bone.

Data Collection and Artifact Classification

In order to better analyze the artifacts found in Kotzebue, an Excel spreadsheet was created listing the osseous tools found at KTZ-036 from 2007 and 2008, along with a small collection recovered during preliminary excavations undertaken by OHA in 2001. This contains columns expressing the AHRS number for the artifacts; the catalog number, including the specific OHA accession number; the date collected; the excavator's initials; a three-point provenience, when available; and the level and quadrant from which the artifact came. The spreadsheet also informs of the material type, the number of artifacts, the greatest length of the artifact, the suggested function or label for the artifact, and a detailed description of the artifact in a comments field. Each artifact was photographed individually on its dorsal and ventral faces. Where possible, each artifact was also photographed on at least one lateral face Photographs of grouped artifact classifications were taken of the dorsal and ventral surfaces.

Three initial categories were created to classify the artifacts based upon their known or suggested function. The three categories are broken down by their ability to best describe the function of the artifacts. The first category is "Functional," which is organic artifacts with a known function. These can be labeled through comparisons from ethnographic accounts and archaeological literature (Bandi 1969; Beechey 1831; Bockstoce 1977; Dumond 1998; Ford 1959; Giddings 1961, 1964; Nelson 1899; Stanford 1976; VanStone 1980; VonKotzebue 1821). In instances where several artifacts were given the same name and attributed function, a qualifier was used to designate the relative size and the thickness of the artifact, such as large, small, thick, or thin.

The second category is "Intermediate." This category is defined by artifacts where a functional attribution could not be assigned. Instead, the artifacts in this category are described based on their morphological characteristics. These artifacts are thought to be in an intermediate stage of manufacture or to have been broken during manufacture, or the use-life of the tool. This classification attempts to explore the forces and stresses that were used against the material as a tool. This was helpful when attempting to understand the reasoning behind the selection of the material type of the created tool.

The third category is "Debitage," which is the byproduct of making an osseous tool. This category is grouped by material type but also is broken into types of debitage, for instance, whether the pieces were created as a product of shaving or hacking off a large chunk of the raw material.

Faunal Remains and Artifact Comparison

The faunal analysis conducted for this thesis identified the types and amounts of animals harvested at the site (Chapter 5). The artifact analysis identified the material types used for tools. The latter analysis also identified the forces and stresses applied to the completed artifacts in their functional form as a tool (Chapter 5). A cross-comparison between these two analyses was then undertaken to show the general amounts of raw osseous materials available from local resources compared to the percentages of observed material types within the collection of artifacts (Chapter 6). This is followed by a discussion of structural and mechanical properties of each osseous material type, showing why given materials were selected over others for particular functions. This discussion also covers aesthetics of the material types (Chapter 6). These findings for KTZ-036 are then compared with findings from eight other previously documented archaeological sites from northwest Alaska, Kodiak, and the Canadian Arctic to show whether the preference for material type selection at KTZ-036 when creating osseous tools is also found at other sites.

Literature Reviews

Structural and Mechanical Properties of Osseous Materials

To determine whether osseous materials were selected beyond their ease in accessibility, a literature review was conducted to identify the chemical structure of bone, ivory, and antler. This illustrated how the structure of the osseous materials limits or enhances their use as a potential tool. Further research into mechanical properties of osseous materials showed how the materials react with forces applied to them. This showed possible reasons for one osseous material type to be selected over another given a certain intended function for the material.

Cross-site Comparisons

An examination of the percentage of materials used for osseous tools recovered from sites other than KTZ-036 was undertaken. This was done to determine whether the material type of an osseous tool was selected because of its accessibility or for its functional performance. This helped establish a possible material type bias for osseous tools of a given function. The comparisons involves eight Arctic or sub-Arctic sites from Alaska and Canada. Each site is compared to the osseous tools recovered from KTZ-036.

Cultural Influences

Spencer (1873) and Durkheim (1982), thought of societies as systems, where division of labor and religion helped maintain social order. They were proponents of structural functionalism, a theory which focuses on the study of the entirety of society rather than the individual. This allows for a collective consciousness, where a cultural system can override an individual's need by dictating something as cultural law.

To determine whether cultural ideologies could influence the selection of osseous materials for the manufacture of tools, a study of four Canadian Thule sites contributed by McGhee (1977) was referenced. McGhee aimed to relate contemporary Inuit ideology with respect to their use of certain material sources as a correlate for Thule cultural practices, as the Inuit culture is thought to have derived from their Thule ancestors. This review noted division of labor with and beliefs on how different osseous materials should be used in everyday life.

This information was then used to determine whether these cultural laws for osseous material use could be identified within the archaeological record. The sites listed in McGhee (1977) considered for his analysis were also considered for this thesis. These included the same four Canadian Thule sites and Walakpa near Barrow used by McGhee, along with the Ipiutak site near Point Hope (Larsen and Rainey 1948), KTZ-030 in Kotzebue (VanStone 1955), the Karluk One site on Kodiak (Margaris 2006), and the KTZ-036 osseous tools. This analysis helped determine whether cultural influences could explain any deviations from what might be expected for specific tools recovered within an Ipiutak or Thule archaeological context.

Chapter 5: Results

Excavations at KTZ-036

Locality A was excavated over two seasons of fieldwork in 2007 and 2008. The 2007 excavations were undertaken in a checkerboard pattern adjacent to the Lewis house and extending toward Kotzebue Sound. The 2008 excavations created a linear trench which continued from the center of the previous excavations toward the ocean. Also excavated were 3 m^2 to the north and south of the eastern end of the 2008 excavations (Figure 4 and Figure 5). Locality B was excavated in 2008 on the 500 block of Front Street. The excavation was a 7 m linear trench running perpendicular to the shoreline of Kotzebue Sound about 425 m south of the Lewis townsite lot. Here, 1 m^2 was excavated on the south side of the trench near its eastern end (Figure 6).

In total, the 2007 and 2008 excavation in Locality A created an 8 m long profile along the N100 line (Appendix A, Figure A-1). Because of the checkerboard pattern of the 2007 excavations, the two north wall profiles on the N100 line at W104-W103 and W102-W101 were inverted to match the south wall profiles along the rest of the N100 line. The N101 line was treated similarly, with the southern walls of the W104-W103 and W102-W101 profiles being inverted to match the northern walls of the rest of the profiles (Figure A-2). The N101 profile, however, is discontinuous at W104-W105. Instead, the N99 line had only one profile recorded at W104-W105 (Figure A-3).

Other profiles recorded within Locality A include north-south running exposures. In the 2007 excavations, the W101, W102, and W103 lines each had a 3 m exposure from N99 to N102 (Figure A-4, Figure A-5, and Figure A-6). On the W101 and W103 lines, both the N99-W100 profiles were inverted to create a cohesive, singular profile, while the W102 line inverted the N100-N101 profile for a similar effect. Within the 2008 excavations of Locality A, only the eastern wall of the 2008 excavations was profiled at the W014 line (Figure A-7).

Each unit in Locality A was excavated to at least 100 cmbs with the maximum depth at 140 cmbs. The average depth of Locality A excavation was between 110 and 120 cmbs. The profiles represent beach ridge formation activity consisting of overlapping and repetitive layers containing various combinations of compact and loose gravels, sands and silts of varying colors, and peats. Often the gravel layers were more substantial, with layers exclusively of sands or silts being relatively ephemeral.

To best identify and understand archaeological components within the profiles, those profiles running perpendicular to the shoreline and with the greatest length were analyzed. This resulted in the close examination of the south wall of the N101 line and the north wall of the N100 line (Figure A-1, Figure A-2, and Figure A-3).

The upper layers were composed of gravels and silts followed by loose gravels. Beneath these layers at W105 - W108 was a thick peat layer from approximately 30 to 50 cmbs. Within the peat layer along the north N101 wall were closely-aligned horizontally wood pieces throughout most of the W106 - W107 unit. In the N100 south wall is also a peat layer around 50 cmbs. Within the W105 - W106 unit, the peat layer dips down 30 cm, where it steadily becomes shallower for 2 m into W104, where it then levels out at 60 to 70 cmbs and continues along the profile until it tapers into gravels at W101.

Within the N101 south wall profile between W105 - W106 were two vertical pieces of wood (Figure A-1). Farther east, between W100 - W103, were two clusters of wood, lying horizontal, and three vertical pieces of wood, one immediately below the surface. Most of the mid-level horizontal pieces of wood lie within peat and gravel layers, and were bordered to the east and west by thick gravel layers, which indicate ground disturbance or a purposefully excavated pit cut into the surface when these wood pieces were deposited. To clarify these features, the profiles of N101 and N100 between W105 - W108 and W100 - W104 have been combined (Figure A-8 and Figure A-9). These form a schematic depiction of both the thick peat layer and the horizontal and vertical pieces of wood. This appears to be a heavily-used occupation level.

Beneath the upper occupation level at Locality A is a layer of loose and compacted gravels from 50 - 70 cmbs ranging from 2 - 20cm in thickness. This layer caps another from 70 - 100cmbs that is comprised of peat and sand (Figure A-1 and Figure A-2). One piece of horizontal wood was excavated near the south wall of Locality A at N100 between W102 - W103 (100 - 110 cmbs). This layer also contained isolated peat beds at W100 - W101 and W103 - W105, and could be an occupation level.

Locality B produced a 7 x 1 m^2 east – west trench, which resulted in two complete profiles of the south face of the N51 line and north face of the N50 line (Figure A-10 and Figure A-11). Profiles were also recorded on the eastern and western bounding walls of the trench between N50 - N51 on the W100 - W 107 line (Figure A-12 and Figure A-13). Profiles were not recorded for the square unit excavated to the N49 line between W101 - W102, aside from the northern wall that is a part of the overall N50 profile.

Each unit in Locality B was excavated to a minimum of 100 cmbs with the deepest units excavated to 120 cmbs. Both profiles showed a thick deposit of several compact gravel beds interspersed with discontinuous sand and silt beds. This alternation marks a shift from a hiatus in storms, eolian deposition of the sand to the presence of large storms. The southern N50 profile showed a disturbance from 30 - 60 cmbs between W014 - W106. A similar pattern was seen on the northern N51 profile, with a deep depression on the eastern side of the W102 - W103 unit. This bed then persisted to the end of the eastern portion of the trench through W100. Beneath these culturally produced depressions lies a series of gravel beds, followed by a 5 cm thick layer of peat, more gravel, and various sand layers.

Peat beds occurred within the profiles differing in thickness and depth. On the north profile one peat was nearly indistinguishable between W105 to W106 at 30 cmbs (Figure A-12), while on the south wall profile at N50, the peat layer is thick, between 10 - 20cm thick from 30 - 70 cmbs extending from the eastern reaches of the trench at W100 running to W103. This could be an occupation level.

Six radiocarbon samples were collected (Table 4), two from each of the three excavation areas, four within Locality A and two in Locality B. These were submitted to Beta Analytic, Inc. for Accelerator Mass Spectrometry (AMS) radiocarbon dating. The sampling strategy included three samples from the middle level of the excavation and three from the lower levels (Figure A-15 through Figure A-18).

Table 4: Conventional radiocarbon dates for Locality A and Locality B

RCS#	**Beta #**	**Uncorrected ^{14}C Age**	**Unit**	**Locality**	**Level**	**cmbs**	**Material**
RCS#1	257762	660 ± 40 BP	N99, W104	A	6	58	Charcoal
RCS#2	257763	1420 ± 40 BP	N101, W104	A	11	103	Charcoal
RCS#3	257764	>44000 BP	N100, W106	A	5	98-110	Charcoal
RCS#4	257765	1430 ± 40 BP	N101, W105	A	10	108	Charcoal
RCS#5	257766	260 ± 40 BP	N49, W102	B	6	41-68	Charcoal
RCS#6	257767	1280 ± 40 BP	N50, W101	B	8	79	Charcoal

Calibrated dates corresponding to the uncorrected dates for the middle levels were RCS#1 at Cal BP 680 to 550 (Cal AD 1270 to 1400) and RCS#5 at Cal BP 330 to 280 (Cal AD 1620 to 1670). The lower level calibrated dates for the excavations were RCS#2 at Cal BP 1380 to 1280 (Cal AD 570 to 660), RCS#4 at Cal BP 1350 to 1300 (Cal AD 560 to 650), and RCS#6 at Cal BP 1290 to 1140 (Cal AD 660 to 810). RCS#3 did not produce viable dates (Figure A-19).

Artifacts

Cultural remains were recovered from Locality A and Locality B included items fabricated from a host of materials such as stone, clay, wood, bark, bone, antler, ivory, leather, metal, and glass. Owing to the focus on bone technology, prehistoric artifacts of stone, wood, and bark are discussed to establish a context for the osseous artifacts. The prehistoric ceramics were previously analyzed by Anderson (2013). Excluded from comprehensive analyses, the historic artifacts included pottery, iron nails, glass bottle and window fragments, glass and amber beads, a leather strap, and a single marble.

Faunal Analysis Recovered from Excavations at KTZ-036

Introduction

Material from the 2008 excavation was used to conduct the faunal analysis. Mammals and birds were examined from Localities A and B. In addition, the fish bones from Locality B were analyzed, but not further considered for this thesis, as fish bones are not usually made into osseous tools. Faunal remains from Locality A and Locality B are reported as autonomous features and as joint entities. The integrity of the stratigraphy within each Locality was maintained sufficiently well across the shoreline so the Number of Individual Specimens (NISP) can be reported together. However, the distance between the trenches of 425 m justifies using a Minimum Number of Individuals (MNI) quantification separately derived for each trench. Separating the assemblage in this way creates a larger MNI than does combining the assemblage from each Locality into a single MNI (Casteel and Grayson 1977). Only vertebrates were analyzed: mammals, birds, and fish. Invertebrates such as shellfish were recovered from the site, but since none of these elements were observed to have been used to create tools, no identification was made. The total NISP of the overall examined faunal assemblage from 2008 including Localities A and B (excluding the fish bones from Locality A) is 4,174.

Mammals

The overall mammal NISP is 2,085 which is 49.3% of the overall faunal assemblage from 2008 including Localities A and B (excluding the fish bones from Locality A). Modification to the mammal bones was recorded during analysis. Taphonomic attributes identified the presence or absence of butchery marks, bashing, burning, and gnawing. Within analysis, butchery marks, or thin marks in the bone likely created by a knife, were identified as possible on 42 and positively identified on 82 mammal remains. When combined (n=124), a total of 5.9% of the 2008 mammal collection exhibited cut marks, identified most commonly on caribou remains (n=23; 18.5%) and seal (n=18; 14.5%). Fifty of the butchered remains (40.3%) were unidentified beyond land or sea mammal. One hundred sixteen mammalian remains showed possible evidence of bashing, and 54 mammalian remains showed definitive bashing marks for a total of 170 remains exhibiting modification. With Locality A and Locality B combined, there are bashing marks present on 8.2% of the 2008 mammal collection. These marks are mostly on the unidentified bones (n=48; 28.2%), followed by caribou remains (n=43; 25.3%) and seal remains (n=21; 12.4%).

Burning was identified by dark staining on the bones, evidence of low-temperature heating or the chemical alteration into whitish, vitreous “calcined” bone due to high-temperature heating. Only five mammal bones, or 0.2% of the mammal collection, and were calcined and was seen exclusively on seal bone. Gnawing was identified by deep parallel grooves of rodent incisors or puncture marks from large carnivore premolars. This taphonomic feature was tentatively identified on 21 mammal bones and positively identified on 89 remains for a total of 110 bones. Gnawing was found on a total of 5.3% of the

2008 mammal assemblage, with the most gnawing observed on seal bones (n=36; 32.7%); there were also a large number of unidentified gnawed bones (n=50; 45.5%).

Age of death was determined for a portion of the identified mammal remains using the degree of epiphyseal fusion categorize elements as belonging to adult or juvenile individuals. Nineteen specimens were adult mammals at the time of death, representing a mere 0.9% of the 2008 mammal assemblage. The majority (n=8; 42.1%) of these adult remains were attributed to Canidae, followed by Cervidae (n=6; 31.6%) and Phocidae (n=5; 26.3%). By contrast, identified juveniles included 59 mammal remains, comprising 2.8% of the total 2008 mammal assemblage. Nearly three quarters of the juveniles were seal (n=43; 72.9%). This is probably a low estimate as sea mammal epiphyseal fusion may be delayed relative to terrestrial mammals until well into adulthood, and the individuals may even be sexually mature while the epiphyses are still unfused (Storå 2002).

Land Mammals

The total land mammal NISP is 535 with an MNI of 18. Land mammal is 25.7% of the mammal NISP and 12.8% of the total NISP of the overall faunal assemblage from 2008 including Localities A and B (excluding the fish bones from Locality A). The land mammal category consists of five genera and one order. The species identified were caribou (*Rangifer tarandus*), wolf (*Canis lupus*), lynx (*Lynx canadensis*), fox (*Vulpes vulpes/Vulpes lagopus*), and hare (*Lepus* sp.). Often the Canidae species (*Canis lupus, Vulpes vulpes* and *Vulpes lagopus)* were only differentiated by size. Special attention was taken with the identification of these two genera, but it should be noted that these could be misidentified as one or the other. In the assemblage, the order Rodentia is represented by a consolidation of one identified family of rodents, voles (Cricetidae (voles), and two species, muskrat (*Ondatra zibethicus*) and ground squirrel (*Spermophilus parryii*). Some of these animals may have been intentionally trapped, and others could have been later additions to the midden through burrowing. The overall rodent NISP did not warrant a clear separation among species.

Within Locality A, the largest NISP was for fox (n=222). Caribou and wolf had the next two highest totals with their respective NISPs of 20 and 19. Hare followed with eight NISP, and the total NISP for rodent was five. Lynx was represented by a single bone. When considering MNI for Locality A, the high number of fox remains becomes one. This is the same MNI for the rest of the Locality A land mammals, all expressing the MNI as one. The apparent disparity between the high number of fox bones and the MNI of one is because a nearly complete, articulated fox was recovered *in situ*. Within the lab setting, the only elements noted to be missing from the fox were the main portion of the skull, three cervical vertebrae, fragments of ribs, an ulna and radius, a tibia and fibula, a set of metacarpals, and four phalanges. The remains included all of the sterna, most of the carpals and tarsals, and many of the sesamoids.

Within Locality B, caribou had the highest NISP (n=157), followed by the NISP of hare (n=33), fox (n=28), and wolf (n=26). Rodents were represented by all taxa for this category with an NISP of 15, and lynx was again represented by only a single bone. The MNI of caribou was also the highest within Locality B at three. Hare and wolf both had an MNI of two. Fox and lynx only had an MNI of one. Because the rodent category is represented by each of the family and species within that list, the MNI is three.

Combining the Localities, fox had the highest NISP (n=250). This shows how complete specimen skew NISP when compared to an MNI of two for this genus. The second highest NISP is caribou at 177 which has an MNI of four. Wolf had an NISP of 45 with an MNI of three, followed closely by hare which had an NISP of 41 and an MNI of three. Rodent had an NISP of 20 with an MNI of four due to three different families or species being represented. Lynx has an NISP of two and also an MNI of two (Figure 14 and Figure 15).

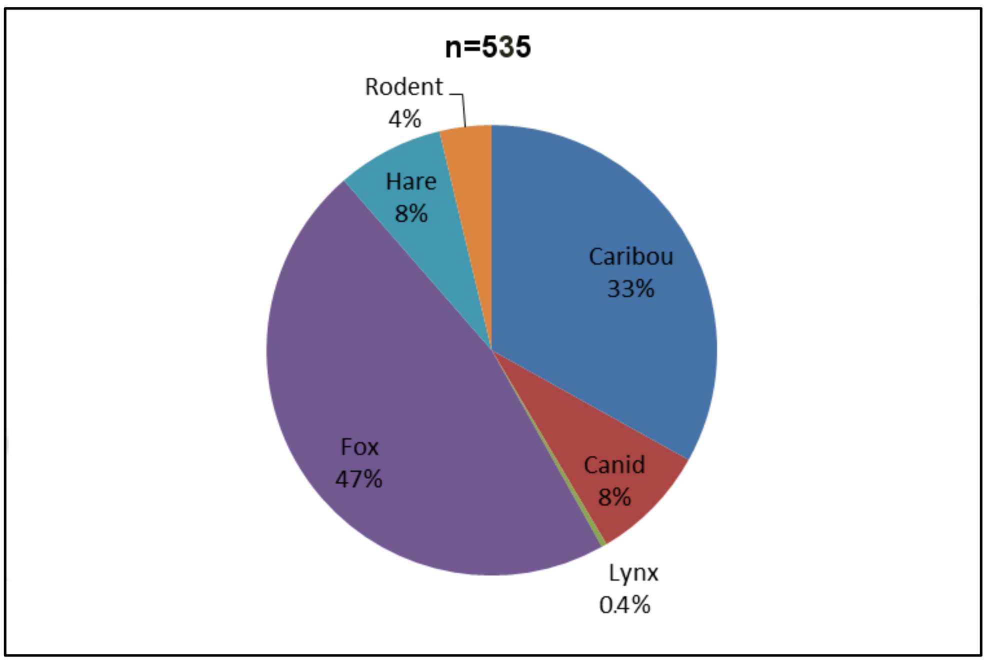

Figure 14: Land mammal NISP

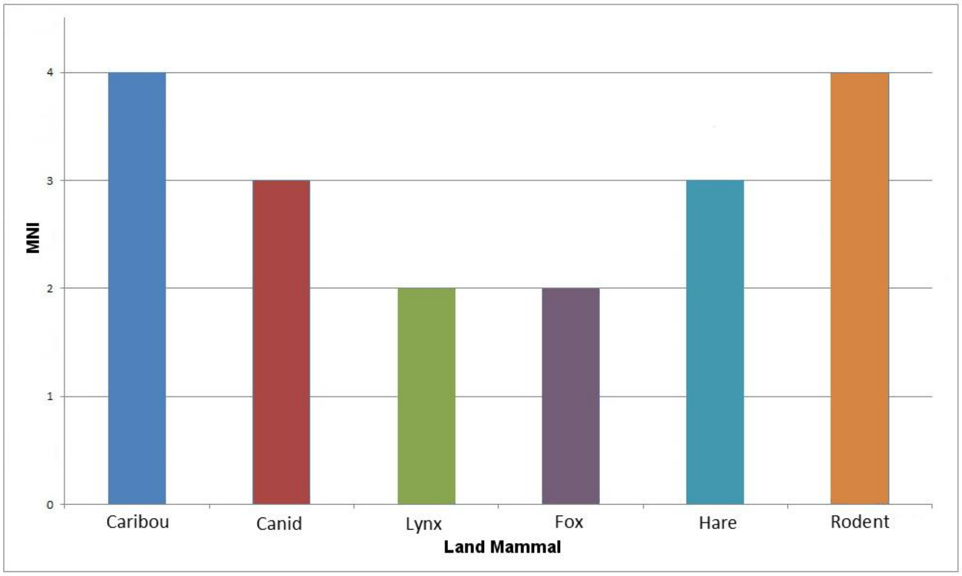

Figure 15: Land mammal MNI by taxon

Sea Mammals

The total sea mammal NISP is 573, which is 13.7% of the total NISP and 27.5% of the mammal NISP. The MNI is 19, which is 21.1% of the overall MNI. Sea mammals are represented by two species, one genus, and one order. The species include the two large sea mammals, walrus (*Odobenus rosmarus*) and bearded seal (*Erignathus barbatus*), followed by seal represented by the genus *Phoca* which includes harbor seal (*P. vitulina*), spotted seal (*P. largha*), ringed seal (*P. hispida*) and ribbon seal (*P. fasciata*). The order included in the sea mammal category is whale (Cetacea). Many of the whale remains are likely beluga whale (*Delphinapterus leucas*).

Within Locality A, the largest NISP is from *Phoca* spp. at 125. The next closest is bearded seal with an NISP of 26. Walrus and whale had a small contribution to Locality A, each with an NISP of three and two respectively. The MNI for Locality A sea mammal is four for seal, two for bearded seal, and one for both walrus and whale.

Locality B had similar results as Locality A, with seal having an NISP of 361, followed distantly by bearded seal with an NISP of 28. Walrus and whale again had low NISPs at 19 and nine, respectively. The MNI for seal is eight, followed by the rest of the sea mammals, bearded seal, walrus, and whale each with an MNI of one.

Combining Locality A and Locality B, the highest NISP belongs to seal at 486 with an MNI of 12. This is followed by bearded seal with an NISP of 54 and MNI of three. Walrus and whale have respective

NISPs of 22 and 11, each with an MNI of two as remains were found in each of Localities A and B (Figure 16 and Figure 17).

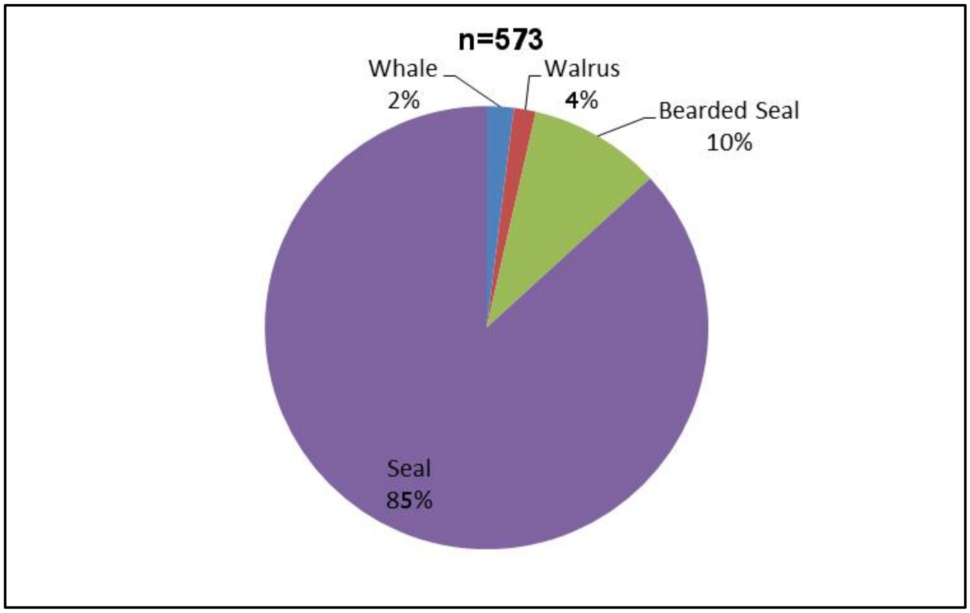

Figure 16: Sea mammal NISP

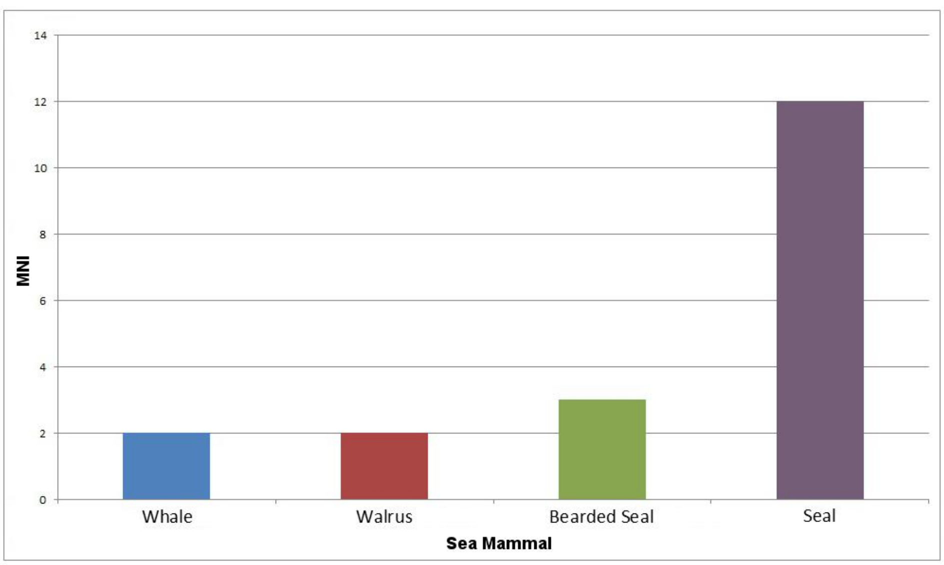

Figure 17: Sea mammal MNI by taxon

Unidentified Mammal

The unidentified mammal is 23.4% of the total NISP and 46.7% of the mammal NISP from 2008 including Localities A and B (excluding the fish bones from Locality A). MNI cannot be calculated for unidentified fragments. Within Locality A, 327 bones were unidentified. . Locality B contained 650 unidentified mammal remains.

Birds

The total bird NISP is 731 is 17.5% of the overall faunal assemblage from 2008 including Localities A and B (excluding the fish bones from Locality A). Two groups within the bird category were created to distinguish between aquatic birds and non-aquatic birds that were likely year-round residents of northwest Alaska.

Butchery marks were tentatively identified on 25 bird bones found in the 2008 assemblage and eight bird remains definitely showing butchery marks for a total of 33 bones. Combined, this represented 4.5% of the total bird assemblage for 2008. Remains showing butchery marks were mostly limb elements from ptarmigan (n=4; 12.1%) or ducks (n=5; 15.2%), and to a lesser degree, the lower extremities of geese (n=2; 6.1%) and of many unidentified birds (n=17; 51.5%).

Bird remains with bashing marks were tentatively found in 53 bones, and definitively in two bones, for a total of 55 bones. These were mostly on unidentified long bone fragments (n=45; 81.8%), but some were on the remains of demonstrably larger species such as swan and geese (n=7; 12.7%). Overall, bashing was observed in 7.5% of the 2008 bird bone assemblage.

Burning was evident in a very low number among the bird remains. Only four bird bones had identifiable evidence of burning, representing only 0.5% of the 2008 bird bone assemblage. Gnawing occurred on three bones (0.4% of the 2008 bird assemblage) which were a gull, duck, and unidentified specimen. Since bird bones ends ossify without the fusion of epiphyses, an age determination for birds was not attempted.

Aquatic Birds

The aquatic birds category consisted of five families. The family Anatidae dominated the bird remains, further subdivided into birds represented by three genera, swan (*Cygnus* spp.), goose (*Branta* spp.), and dabbling duck (*Anas* spp.), along with the subfamily, sea duck (Merginae), which includes golden eye (*Bucephala* spp.), harlequin duck (*Histrionicus histrionicus*), red-breasted merganser (*Mergus serrator*), and common eider (*Somateria mollissima*). The other four aquatic bird families were loon (Gaviidae); grebe (Podicipedidae); gull (Laridae), represented by glaucous-winged gulls (*Larus glaucescens*), glaucous gull (*Larus hyperboreus*), and black-legged kittiwakes (*Rissa tridactyla*); and auk (Alcidae). The total aquatic bird NISP is 148, which is 3.5% of the of total NISP and 20.2% of the bird NISP The aquatic bird MNI was 28 or 31.1% of the total MNI for Locality A and Locality B collections.

Within Locality A the highest NISP of 20 is contributed by the genus dabbling duck. This is followed by gull with an NISP of 13. The sea ducks with a combined NISP of seven, which is followed by auk with an NISP of six. Loon had an NISP of four. Swan and grebe were each represented only by a single bone. There were also eight bones that were not identified beyond the family Anatidae which includes all geese, swan, and duck. The MNI for dabbling duck is also the highest in Locality A at an MNI of five. Again it was followed by gulls with an MNI of two. Swan, auk, loon, and grebe each had an MNI of one, while sea ducks had an MNI of three with three of the four species represented. The high NISP of dabbling duck in Locality A is due to six sternal fragments which were refitted, reducing the MNI to five. There were also two furcula which could have been from the same animal.

The aquatic bird reflected by the highest NISP within Locality B was swan at 23. This was followed by geese and gulls with NISPs of 15 and 13, respectively. Sea ducks had an NISP of nine, while dabbling ducks had an NISP of eight. Auks and loons both had a low NISP of three and two, respectively. There were 15 aquatic bird remains that were unidentified beyond the Anatidae family (goose, swan, and ducks) level and were not counted for the purpose of calculating an MNI. The MNI for swan, geese, dabbling ducks, and gulls were two each. Sea ducks have an MNI of three, with three species being represented. Auks and loons each had an MNI of one. The difference between the NISP of 23 for swan compared to its low MNI of two because at least six or more of the identified faunal remains were likely to come from the leg and foot of the same aquatic bird.

When the Localities were combined, dabbling ducks had the highest NISP at 28 with an MNI of seven. This was followed by gulls with an NISP of 26 and MNI of four, and swan with an NISP of 24 and MNI also of four. Geese and the sea ducks each had an NISP of 16, although geese only had an MNI of two, while the sea ducks, being represented by four species, has an MNI of six. Auks have a total NISP of 9 with an MNI of two, while loons, with a total NISP of six, also have an MNI of two. Grebes are only represented by a single bone, for a total NISP and MNI of one (Figure 18 and Figure 19).

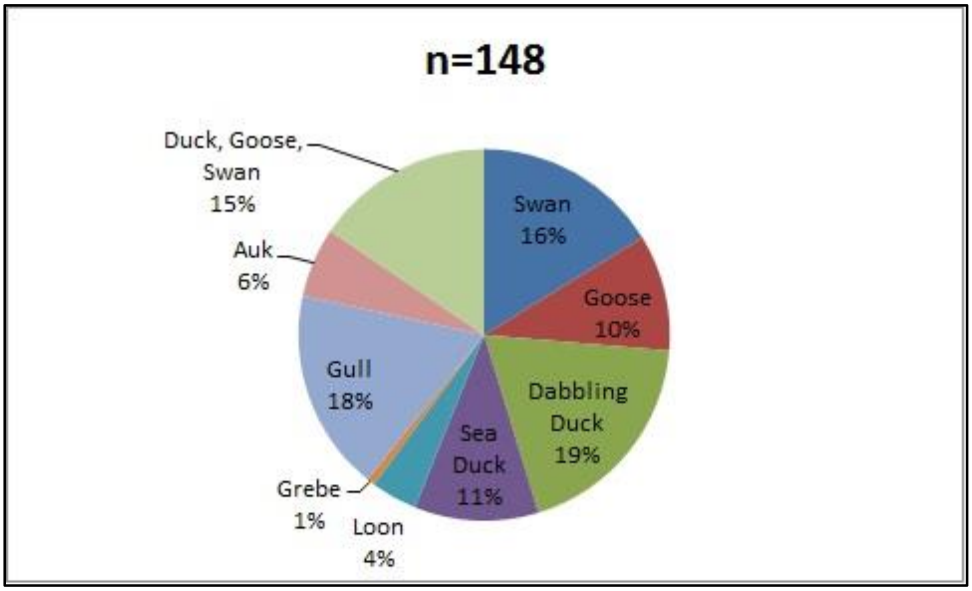

Figure 18: Aquatic bird NISP

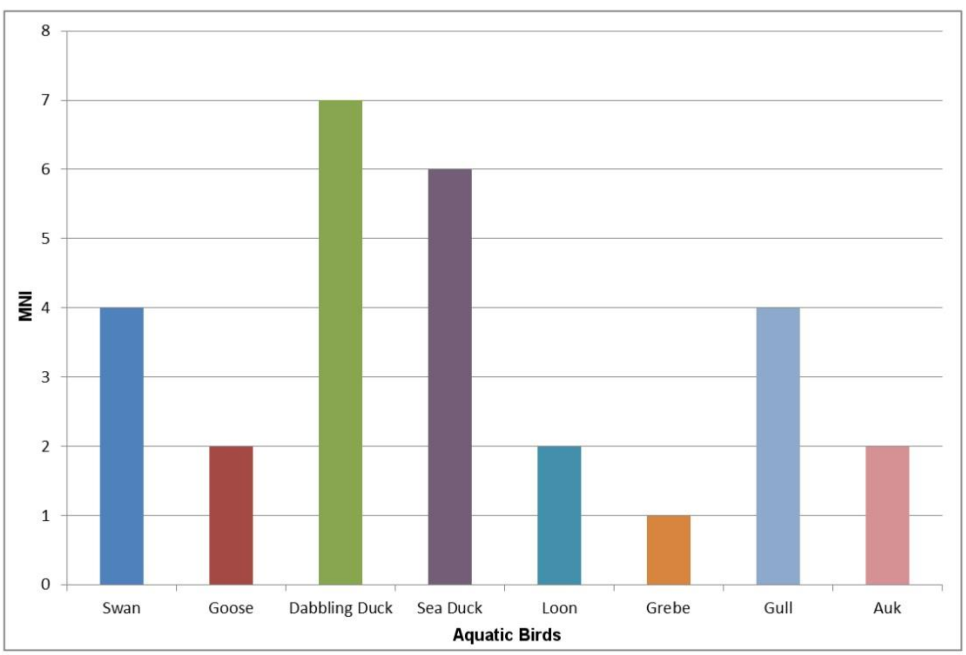

Figure 19: Aquatic bird MNI by taxon

Non-aquatic Birds

The total non-aquatic bird NISP is 147, which is 3.5% of the total NISP and 20.1% of the bird NISP. The non-aquatic birds category consists of two families of birds and one subfamily of birds. The families are represented by falcons (Falconidae) and passerines including raven and crow (Corvidae), with the subfamily for grouse (Tetraoninae), which includes both ptarmigan (*Lagopus* sp.) and spruce grouse (*Falcipennis canadensis*). These two birds can be identified to the genus level but only with difficulty for partial specimens, so the two were combined during analysis.

In Locality A, grouse contributed most of the non-aquatic bird remains with an NISP of 41. The only other family represented in this group by passerines, with an NISP of one. The MNI for the grouse in Locality A is six. The single raven bone provided an MNI of one. The similar element within the grouse were eight sternal fragments, however four pieces refitted reducing the MNI to six.

Locality B, like Locality A, had the most birds represented by grouse, with an NISP of 103. Again, only one other family was represented within the non-aquatic bird group, falcons, with an NISP of two. The MNI for grouse was 10, while falcons had an MNI of one. The MNI for grouse was calculated from 10 right humeri. Most of the bones for the identified grouse in Locality B were wing elements (n=55; 53.4%).

If Locality A and Locality B are combined, grouse dominates the group with an NISP of 144 and an MNI of 16. Falcons had an NISP of two and an MNI of one. Passerines are represented by a single bone, giving raven an NISP and MNI of one (Figure 20 and Figure 21).

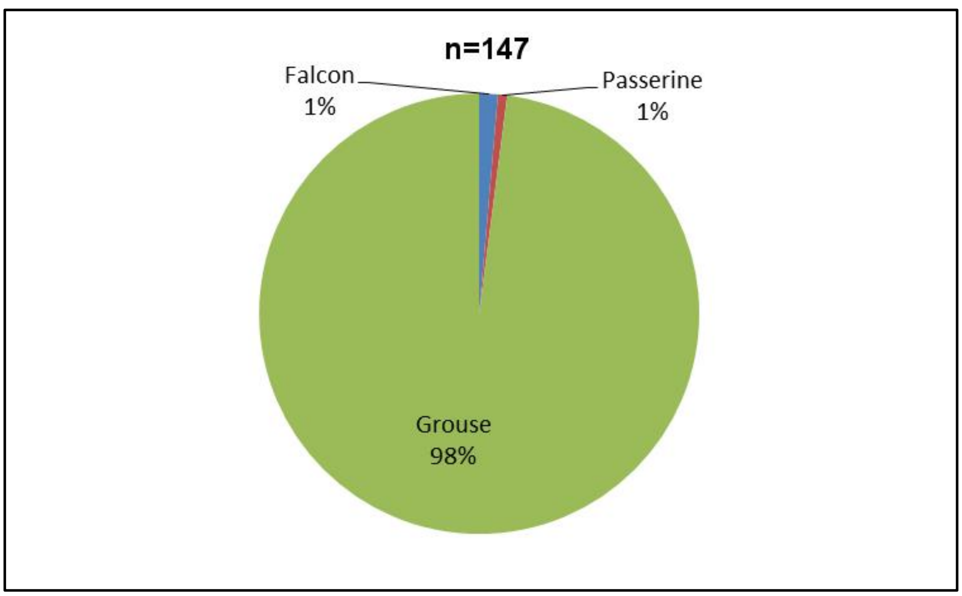

Figure 20: Non-aquatic bird NISP

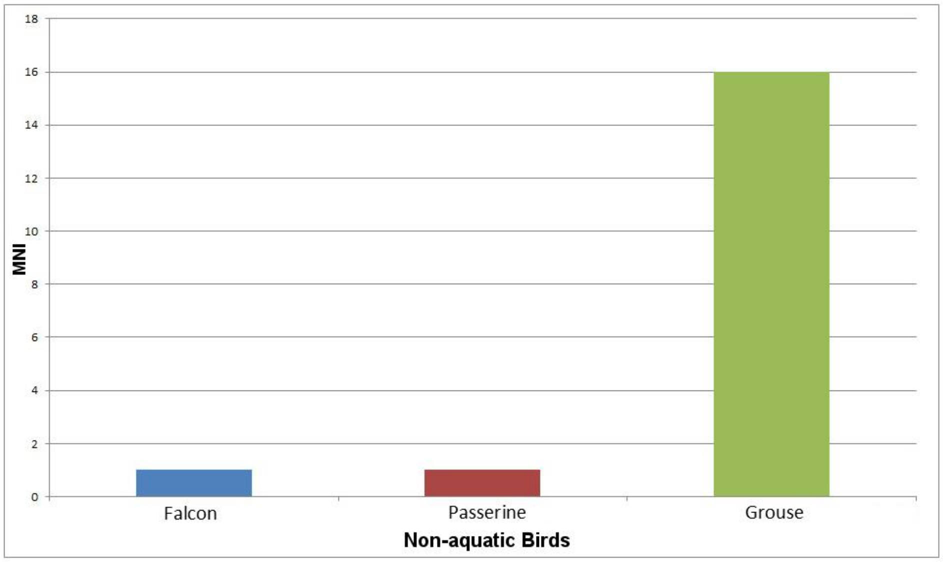

Figure 21: Non-aquatic bird MNI by taxon

Unidentified Bird

The total unidentified bird NISP is 436, which is 10.4% of the total NISP, and 59.6% of the bird NISP. Within Locality A, 226 bird bones remained unidentified by taxon. Many of these were fragmented and had no identifiable features. Locality B contains an NISP of 210 unidentified bird remains

Fish

The total fish NISP is 1,358 which is 32.5% of the overall faunal assemblage from 2008 including Localities A and B (excluding the fish bones from Locality A). The total identified fish NISP is 120, which is 2.8% of the overall NISP and 8.8% of the fish NISP. The total unidentified fish is 1,238 which is 29.7% of the overall NISP and 91.1% of the fish NISP. No taphonomic alterations were recorded for the fish bone, although a single sculpin dentary bone was eroded possibly from passing through the digestion tract of a person or animal. Within Locality B, four fish families were identified. These were sculpin (Cottidae), cod (Gadidae), flatfish (Pleuronectidae), and salmon or whitefish (Salmonidae).

In Locality B the overall identified NISP was 120 which is 1.8% of the total NISP. The highest NISP was salmon and whitefish with an NISP of 89, followed by cod with an NISP of 16, and flatfish with an NISP of 11. Sculpin had an NISP of four. Without considering vertebrae or rays, salmon and whitefish had an MNI of three due to three pairs of right and left cleithra. Sculpin have an MNI of two and cod and flatfish each have an MNI of one (Figure 22 and Figure 23).

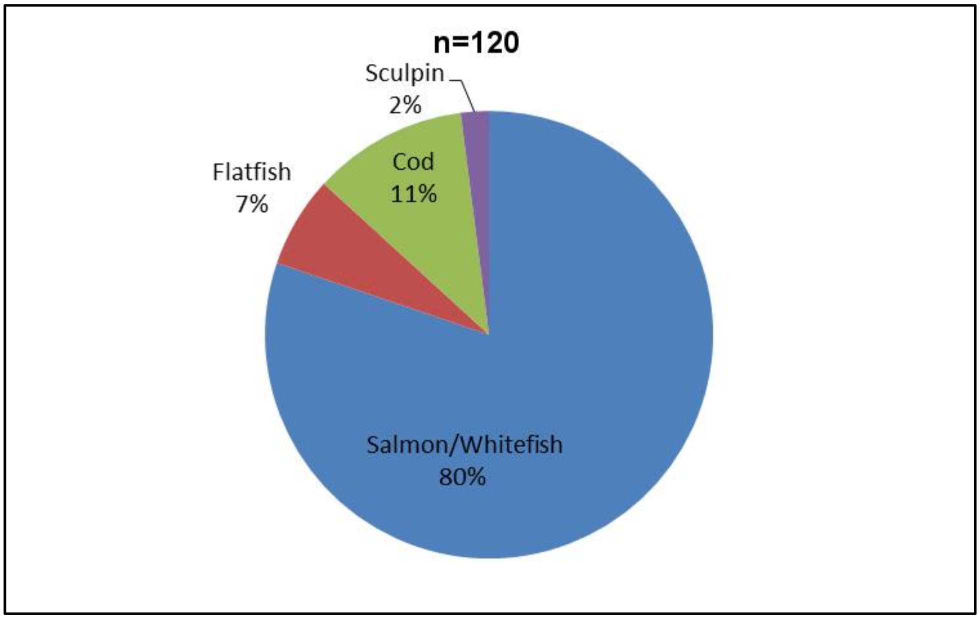

Figure 22: Locality B fish NISP

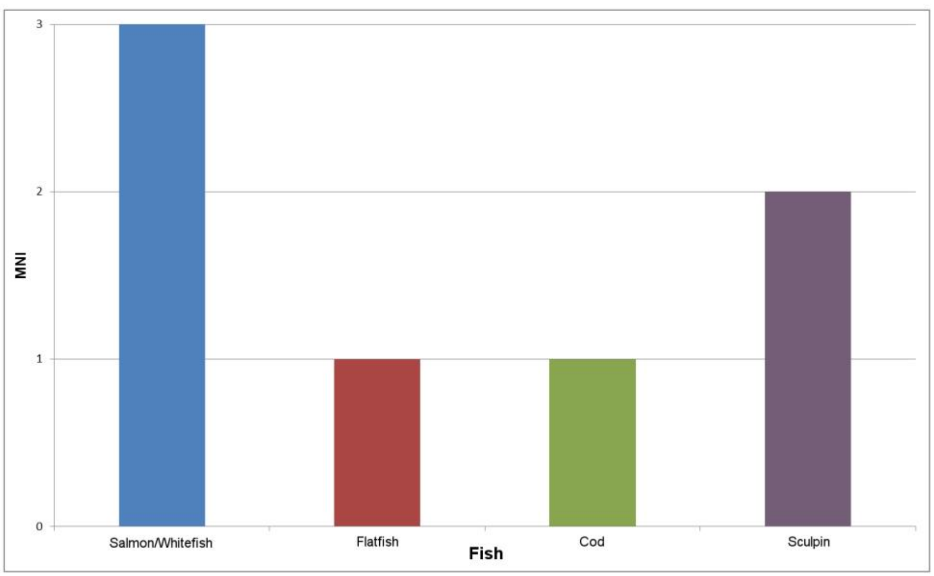

Figure 23: Locality B fish MNI by taxon

Faunal Overview

Within the 2008 assemblage with a total NISP of 4,174, there remained 2,771 unidentified faunal remains for an identified NISP of 1,523. Excluding these unknown remains, land mammal and sea mammal were the largest harvested groups. Land mammal is 35.1% of the adjusted NISP. Sea mammal is 37.6% of the adjusted NISP. The remaining aquatic birds (9.7%), non-aquatic birds (9.7%), and fish (7.9%) represented less than a third of the identified remains from the 2008 excavation

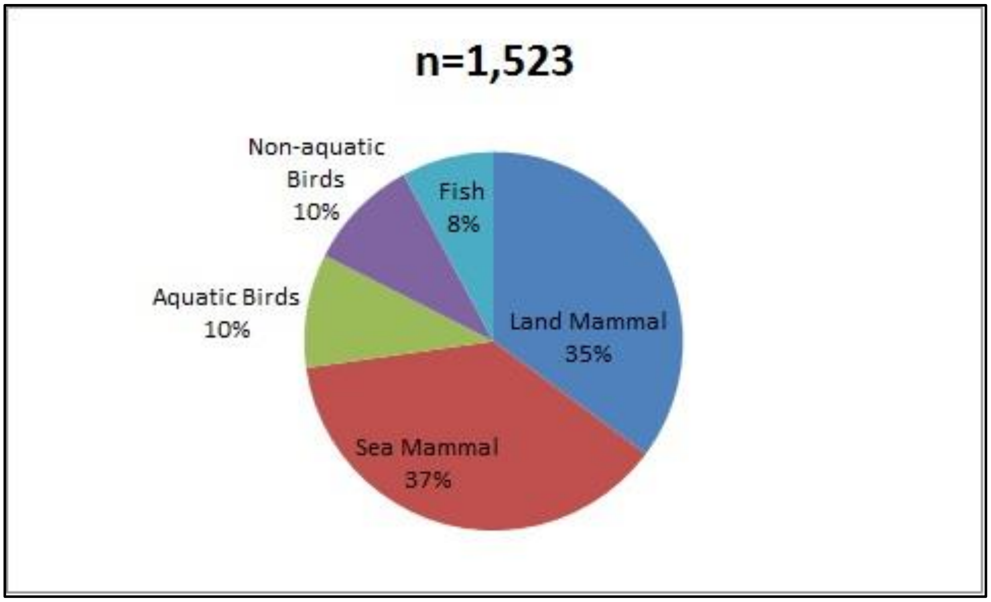

Figure 24: Total adjusted faunal assemblage NISP

The species that provided most of the material for manufacturing osseous tools included caribou with antler and bone, cetaceans with bone, walrus ivory, and avian species with bone. The NISP of osseous tool material present in the faunal collection is 505. This number is comprised of the NISPs for animals whose hard tissues are frequently used for osseous tool manufacture (Figure 25). These include caribou (NISP=177, 35% of the osseous tool material); whale (NISP=11, 2.2% of the osseous tool material); walrus (NISP=22, 4.4% of the osseous tool material); and bird (NISP=295, 58.4% of the osseous tool material). This graph also does not represent selective pressures for individual elements that are preferred in the creation of osseous tools.

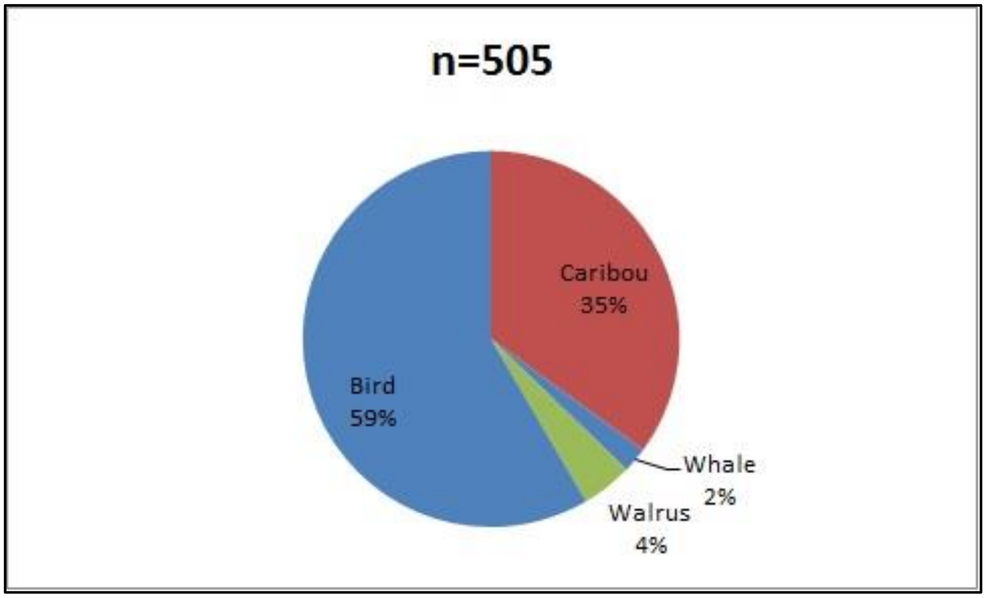

Figure 25: Osseous tool material present in the faunal assemblage.

Lithics

Though lithics are not the focus of this thesis, the formal tools are discussed to provide adequate context to the archaeological recovery at the site and to delineate the site's placement within the regional archaeological taxonomy. The lithic assemblage recovered within Locality A included bifaces, mostly projectiles and scrapers, as well as angular cores, unifaces, notched stones, ground stone, large blades, and flakes.

Most worked lithic artifacts were made of red-brown, light gray, or black chert. Large sedimentary stones were modified with notches or grooves. Slate and pumice were ground to create edges or grooves in the material. Debitage included obsidian and jade. Not included in the analysis was various amounts of chert debitage.

Points

Within Locality A, two projectile points were recovered within unit N100-N101, W105-W106. In Level 6, a nearly complete stemmed gray chert point was recovered in a shallow context with its abrupt shouldering and rounded base (KTZ-036-08-047.05). The point is complete at nearly 4 cm long and slightly over 0.5 mm thick (Figure 26). The stemmed point was recovered in Level 6 of the unit excavation and most closely resembles Intermediate Kotzebue forms recovered by Giddings (1952:44).

Figure 26: Intermediate Kotzebue projectile point (KTZ-036-08-047.05), Ipiutak side blade (KTZ-036-08-053.12), water-worn biface (KTZ-036-08-101.04), diagonal-break biface (KTZ-036-08-074.12), lateral-break biface (KTZ-036-01-018.01), biface (KTZ-036-08-055.02)

Another complete biface recovered considerably below the stemmed point in Locality A was in Level 11 at 101cmbs. The biface was of green-gray chert, finely flaked, and triangular in profile with a flat base. One edge is longer and is angled with the apex near the midpoint of the tool, producing asymmetry (KTZ-036-08-053.12). This point is 4.5 cm long and 0.25 cm thick (Figure 26). Limited comparisons, discussed below, lead to classify the biface as a side blade similar to Ipiutak (Larsen and Rainey 1948:Plate 2).

Within Locality B, three projectile points were recovered, the first from unit N49, W102, Level 2. This is a thick lanceolate biface of greenish-gray chert (KTZ-036-08-055.02) with the widest point one-third distally from the base and edge grinding for hafting. Also recovered from Level 2 was a second biface in unit N50, W105. This is a reddish-brown chert piece (KTZ-036-08-101.04) that has been water worn. It is larger than the previously mentioned biface but has a similar morphology with both possibly of Ekseavik or Ahteut form (Giddings 1952:48, 49). The third projectile point, recovered from Level 4 at 35 cmbd in unit N50, W101, is a greenish-gray chert biface (KTZ-036-08-074.12) with a diagonal break near the distal end. At the base of the projectile is some waisting, possibly for insetting the piece (Figure 26). Also recovered during preliminary surface testing in 2001 was a thick green-gray chert biface (KTZ-036-01-018.01) with edge grinding that is laterally snapped with slight shouldering part way up the base.

Scrapers

Locality A contained eight scrapers, all from within the 2007 excavations from N99 to N101 and W101 to W104. Both endscrapers and sidescrapers were recovered. This included four endscrapers. Three are discoidal in shape, and the fourth has a long, shouldered body with a rounded distal end. The three material types include greenish-gray chert used for manufacturing both a discoidal scraper and the longer endscraper, a reddish-brown chert, and a dark gray or black chert (KTZ-036-07-291.01, KTZ-036-07-250.01, KTZ-036-07-251.01, and KTZ-036-07-203.01, respectively). All four endscrapers were recorded between Levels 7 and 11 at 63 - 110 cmbs (Figure 27 and Figure 28).

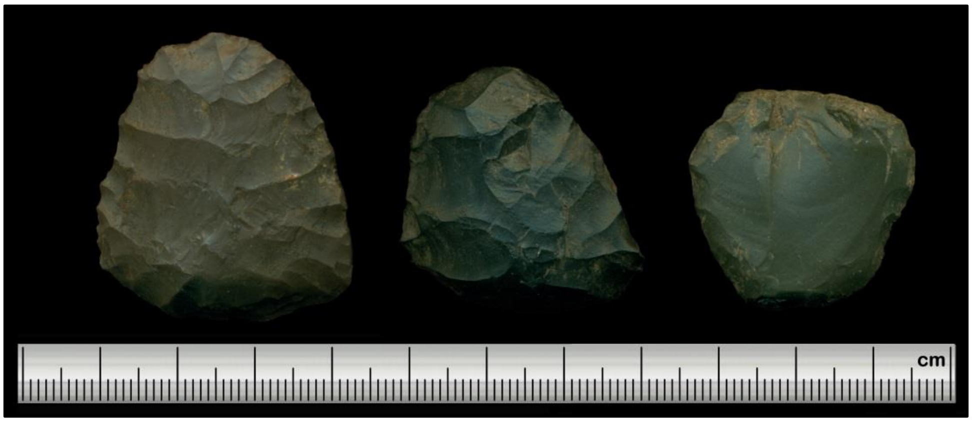

Figure 27: Endscrapers (KTZ-036-07-251.01, KTZ-036-07-203.01, and KTZ-036-07-291.01)

Figure 28: Endscraper (KTZ-036-07-250.01), sidescraper (KTZ-036-07-191.01)

Four sidescrapers were identified within Locality A. These were also only recovered within the 2007 excavations and from the same units as the endscrapers at N99 - N101, W101 - W104. Of the four sidescrapers recovered, three have one long, concave edge which has unifacial retouch (KTZ-036-07-300.01, KTZ-036-07-279.01, and KTZ-036-07-248.01). The fourth is a long biface, lanceolate in appearance with parallel edges and a thick, diamond-shaped cross-section (KTZ-036-07-191.01). There are three different material types represented by the sidescrapers. Two are made of black chert, one with one face nearly covered in cortex. The other side scraper with a concave edge is made of a gray chert. The large lanceolate is made of a gray banded chert or argillite (Figure 28 and Figure 29).

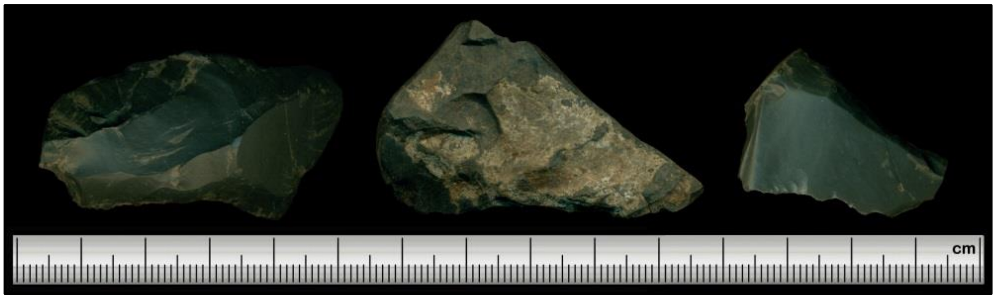

Figure 29: Sidescrapers (KTZ-036-07-300.01, KTZ-036-07-279.01, and KTZ-036-07-248.01)

Cores

Locality A contained two cores, both recovered within the 2007 excavations at N99-N100, W103-W104 and N101-N102, W102-W103. Both are angular, multi-directional cores with no obvious systematic method for platform preparation to extract flakes. One core is made of black chert and was recovered near the surface in Level 1 at 9 cmbs (KTZ-036-07-003.01). The other angular core is greenish-gray chert and was recovered at Level 7 at 60 to 70 cmbs (KTZ-036-07-212.01, Figure 30).

Figure 30: Angular cores (KTZ-036-07-003.01 and KTZ-036-07-212.01)

Flakes

Locality A contained lithic debitage, most of which will not be discussed. However, four flakes are worthy of mention. These flakes were recovered from the eastern portion of Locality A between N99 - N102 and W103 - W105, three of which are from the 2007 excavation and one of which was recovered from the 2008 excavation. The first piece is a unifacial flake made of greenish-gray chert in Level 5 at 47 cmbs (KTZ-036-07-147.01). This flake has marginal retouch and is possibly a sidescraper. The second flake is the only obsidian in all of the 2007 and 2008 excavations (KTZ-036-07-290.01). It was recovered in Level 11 at 100 to 110 cmbs and appears to have a polished or abraided edge. The third flake is a greenish-gray chert and blade-like, with a single dorsal ridge and is over 5 cm long and 1.7 cm wide (KTZ-036-07-293.01). It was recovered in Level 11 at 102 cmbs. The fourth piece is from the 2008 excavations and is a dark gray chert flake found in Level 10 at 105 cmbs (KTZ-036-08-041.18). It contains fluting on the dorsal face but is likely just the result of termination flaking (Figure 31).

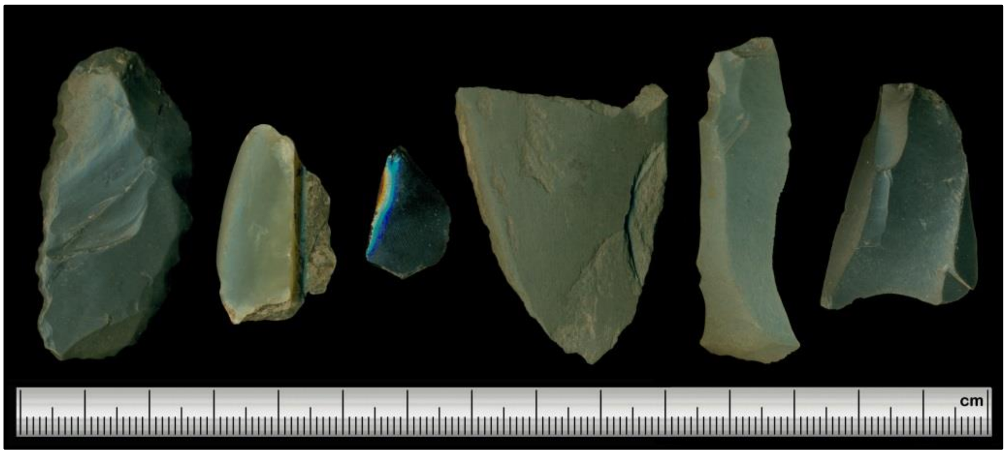

Figure 31: Uniface (KTZ-036-07-147.01), worked jade (KTZ-036-08-112.04), obsidian flake (KTZ-036-07-290.01), ground stone (KTZ-036-08-074.10), blade-like flake (KTZ-036-07-293.01), channeled flake (KTZ-036-08-041.18)

Locality B contained two modified flakes. These vary from the others in their unique material type. The first is a jade fragment found in Level 5 of N50, W106 (KTZ-036-08-112.04). This piece has a ground face with a step termination, appearing to have been purposefully snapped. The second piece was recovered from Level 4 of unit N50, W101. It is a piece of slate which has been broken along its thickest edge (KTZ-036-08-074.10). The longest unchipped face is ground (Figure 31).

Modified Flakes and Fragments

Locality A contained four other artifacts that were modified or fragmented. All were recovered during the 2007 excavation between N99 to N101 and W101 to W103. The first is a jade piece that has ground facets on the dorsal face (KTZ-036-07-107.01). This is one of two jade pieces found within the 2007 and 2008 excavations. It was recovered in Level 4 at 33-43 cmbs. Directly adjacent to the jade was an angular lithic of dark gray chert that has a point at one end (KTZ-036-07-107.02). This is may be a broken biface or intended to be a perforator. The third piece is a greenish-gray chert biface fragment broken diagonally along the latitudinal plane (KTZ-036-07-285.01). The biface fragment was recovered in Level 11 at 100 to 110 cmbs. The fourth artifact is dark gray chert and has a flat base with a point at the other end (KTZ-036-07-261.01). It is minimally modified on one face but may have been used as a small projectile point or drill. This modified piece was from Level 10 at 94 cmbs (Figure 32).

Figure 32: Jade (KTZ-036-07-107.01), biface fragments (KTZ-036-07-107.02 and KTZ-036-07-285.01), retouched uniface (KTZ-036-07-261.01)

Ground Stone

The 2008 collection contained three ground stone artifacts. The first and largest was from Locality B within unit N50 W101. This is a large, flat, slate piece (KTZ-036-07-107.02), which was likely once an ulu. Locality A contained two ground stone pieces. These were in units N100-100, W103-W104 and W105 to W108. The first, from Level 4, is a planar igneous stone with two unilateral notches next to each other (KTZ-036-08-020.06). These notches were ground rather than pecked. This may have been used as a handle or as a net sinker. The second ground stone is made of a coarse, soft material (KTZ-036-08-032.03). It is long and nearly cylindrical with finger divots and a point at one end. The point appears to have been ground to this shape due to the soft nature of the tool. This was located in Level 4 of the excavation (Figure 33). The purpose of this tool may have been as an abraider for slate or possibly other organic tools.

Figure 33: Ground slate knife (KTZ-036-08-075.07), unilaterally-notched stone (KTZ-036-08-020.06), ground/abraided stone (KTZ-036-08.032.03)

The two ground stone pieces from the 2007 excavation are made of different materials. The first piece (KTZ-036-07-228.01) is broken into four large fragments, but all refit into what would have been a rectangular prism with a nearly square cross-section. The outer faces are smoothed or have incisions that run nearly the length of the longest edge. This may be a whetstone and is likely shale from Level 8 at 70 - 80 cmbs. The second ground stone is a small piece of pumice deeply grooved along one face (KTZ-036-07-266.01), possibly for forming and straightening arrow shafts. The pumice tool (Figure 34) was from Level 10 at 90 - 100 cmbs.

Figure 34: Whetstone with incised lines (KTZ-036-07-228.01), grooved pumice (KTZ-036-07-266.01)

Locality B contained a single piece of ground stone. This piece of slate was from Level 5 of N50, W101 at 46 cmbd (KTZ-036-08-75.07). It is a large piece at nearly 11 cm long and had one edge that shows ground wear patterns. It appears that some of the stone may have broken, leading to its discard (Figure 33).

Notched Stone

Locality A contained notched stones. Both notched stones are from the 2007 excavation and are large, nearly 10 - 14 cm in length. The smaller notched stone is nearly round and made of an igneous material; the other is metamorphic. The first piece has two notches pecked opposite each other on the longitudinal edges (KTZ-036-07-149.01). Each notch is over 1 cm in depth. The smaller notched stone was recovered from Level 5 at 50 cmbs (Figure 35). The second notched stone is longer than wide and has pecked or ground notches at two points on each thick edge, making a total of 4 notches (KTZ-036-07-230.01). This notched stone was recovered from Level 8 at 80 cmbs (Figure 36). Both notched stones are likely net sinkers.

Figure 35: Bilaterally-notched stone (KTZ-036-07-149.01)

Figure 36: Bilaterally-grooved or notched stone (KTZ-036-07-230.01)

Ceramic

The KTZ-036 2007 and 2008 excavation collection contained 107 ceramic sherds. No complete ceramic pieces were found. Ornamentation on ceramics included thick rims, textile-impressions, and linear or striated surface treatments on artifacts (KTZ-036-07-84.04, KTZ-036-07-024.01, KTZ-036-08-093.09, and KTZ-036-08-022.02, respectively; Figure 37). This ceramic assemblage style is within the range of other known ceramics from Kotzebue and the broader northwest Alaskan region (Anderson 2013).

Figure 37: Ceramics: Sherd with rim, obverse and Profile (KTZ-036-08-84.04), sherd with textile-impression (KTZ-036-07-024.01), sherd with linear surface treatment (KTZ-036-08-093.09), sherd with striated surface treatment (KTZ-036-07-220.02) (Image modified from Shelby Anderson)

Also within the collection is a clay sphere (KTZ-036-07-139.01) which has purple splotches on the exposed face. This was the only of its kind recovered within the excavations (Figure 38). The artifact is likely a clay marble.

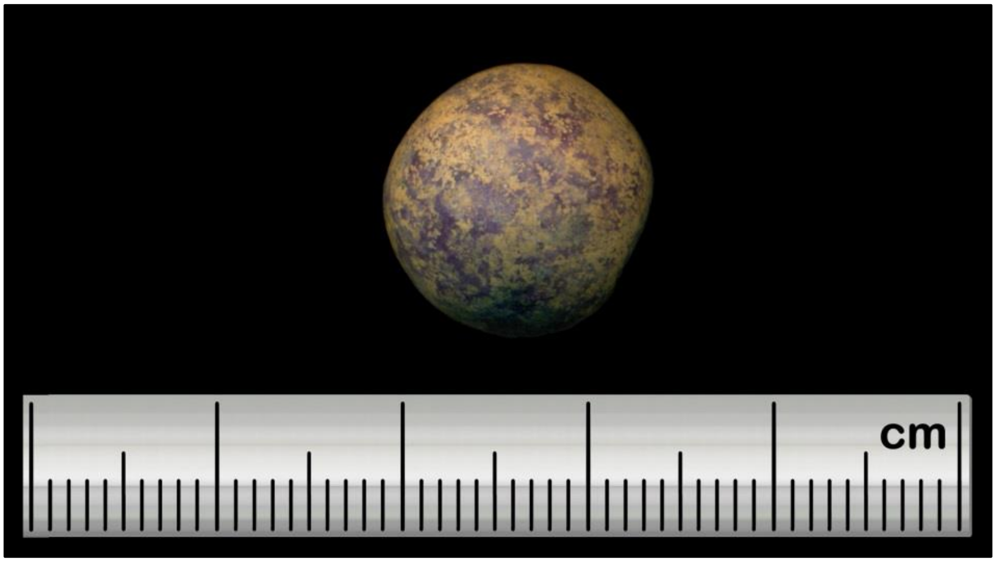

Figure 38: Clay marble (KTZ-036-07-139.01)

Glass

As many as 423 glass pieces were collected in the KTZ-036 2007 and 2008 excavations. This includes glass in the form of vessels, windows, and a single trade bead. In the 2007 excavation, all glass recovered from Level 5 or higher was considered historic. Within the 2008 excavations, historic glass was recovered as deeply as Level 8, but only as three specimens in a single unit (N49 W102) that may have experienced some disturbance. Here, only the glass bead will be briefly considered: it is a round, wound, Early Contact Village site Type 11 bead, from Level 1 (KTZ-036-07-007.01, Figure 39). The bead is made from blue glass, and appears to have been intentionally halved with the groove down the center of the bead as was common practice for their use in ceremonial materials (Eagle 2010).

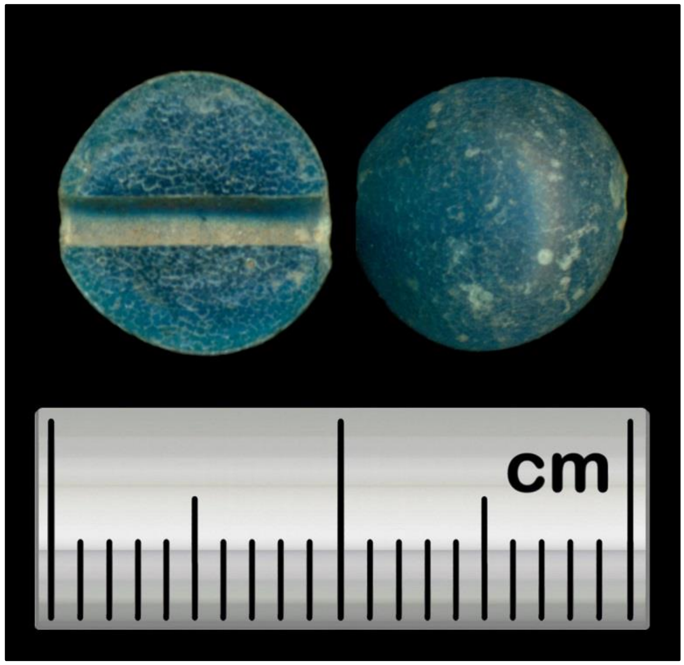

Figure 39: Glass: Wound halved blue bead (KTZ-036-07-007.01)

Amber

One small amber bead was recovered during the 2008 excavation (KTZ-036-08-085.05). The bead is somewhat cylindrical but not completely circular with two flat faces. It has a hole bored through the middle and is complete. The bead was recovered from Level 5 of the 2008 excavations (Figure 40).

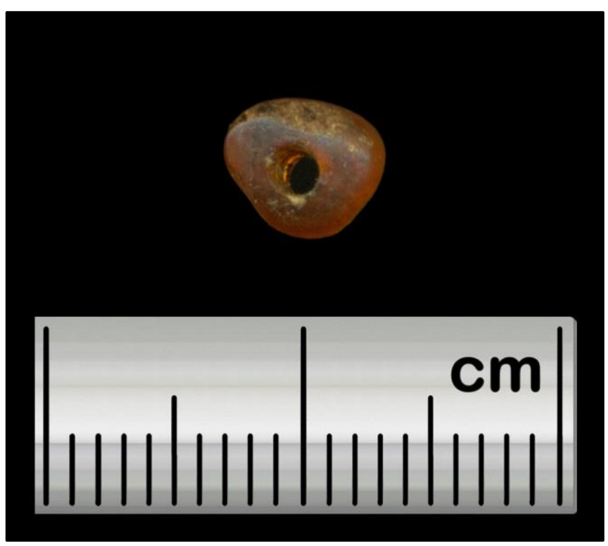

Figure 40: Amber: Bead (KTZ-036-08-085.05)

Wood

Wood was recovered throughout the Locality A excavation as unmodified, large branches or logs arranged horizontally or vertically (Figure 41, Figure 42, Figure A-8, and Figure A-9). Smaller modified wood pieces were discovered during excavation. This included one artifact from a 2001 test unit, two wood pieces from Locality A, and one artifact from Locality B. Some wood pieces found together in a horizontal context are considered to be planks for a wood floor of a house.

Figure 41: Unit N100 W103 showing horizontal wood pieces.

Figure 42: Unit N101 W102 showing horizontal pieces of wood around large rocks.

The 2001 wood piece is thick with a tapered end (KTZ-036-01-025.01). This appears to be a broken end of a handle. The second piece is thin with abrupt shouldering at one end, from Level 5 of the 2007 excavation of N100, W101 at 43 - 53 cmbs (KTZ-036-07-150.01). Also from Locality A in unit N99, W105 from Level 2 is a short, cylindrical piece of wood that is cut on one face and possibly charred or burned (KTZ-036-08-002-09). This is followed by a long, thin piece which was recovered from N101, W 102 from Level 7 around 60 to 70 cmbs (KTZ-036-07-210.01, Figure 43).

Figure 43: Wood: handle (KTZ-036-01-025.01.02), bow end (KTZ-036-07-150.01), cylinder (KTZ-036-08-002.09), slat (KTZ-036-07-210.01)

Other Organics

Non-osseous, organic tools recovered from the excavations include materials made from grass, fibers, bark, and leather. There were two examples of woven beach grass, each from N100, W101; one sample from Level 2 at 17 cmbs; and another from Level 4 at 33 - 43 cmbs (KTZ-036-07-054.01 and KTZ-036-07-116.01). Also recovered from this unit were several small strands of rope (KTZ-036-07-114.01). This cordage was recovered at the same depth as the weaving within Level 4 at a depth of 33 to 43 cmbs (Figure 44, Figure 45, and Figure 46).

Figure 44: Woven beach grass (KTZ-036-07-054.01)

Figure 45: Woven beach grass (KTZ-036-07-116.01)

Figure 46: Cordage or rope (KTZ-036-07-114.01)

Other organic artifacts from Locality A included a small piece of tree bark (KTZ-036-08-038.04) found in N101, W105 in Level 7 (Figure 47), and a leather strap (KTZ-036-07-126.01) in N100, W102 in Level 4 at 30 - 40 cmbs. The leather appears to be factory tanned, with two strands coming from a metal loop attached by metal rivets. The two leather strands extend from the ring, terminating in loops at the opposite end. This is likely the leather portion from one of the three ends of button suspenders (Figure 48).

Figure 47: Tree bark (KTZ-036-08-038.04)

Figure 48: Connective end of button suspenders (KTZ-036-07-126.01)

Osseous Tools

The osseous tools – those tools made of bone, antler, or ivory – are the focus of the thesis. These materials do not preserve well in acidic environments where decomposition rates tend to be higher than in anaerobic environments, created by quick deposition (Nielsen-Marsh 2000). In Kotzebue, preservation was good throughout most of the excavation units. One hundred seventy five artifacts suitable for osseous tool analysis were recovered from the excavations in 2001, 2007, and 2008. The Functional osseous tool classification is made up of 68 artifacts, or 38.9% of the total assemblage. The Intermediate osseous tool classification contains 51 modified pieces, or 29.1% of the osseous tool collection. The Debitage osseous tool classification consists of 56 debitage pieces, representing 32.0% of the osseous tool collection. When considered by material type, bone represents the smallest portion of the artifacts (14.9%), ivory is the second numerous (26.3%), and antler makes up 58.9% of the modified osseous collection (Figure 49).

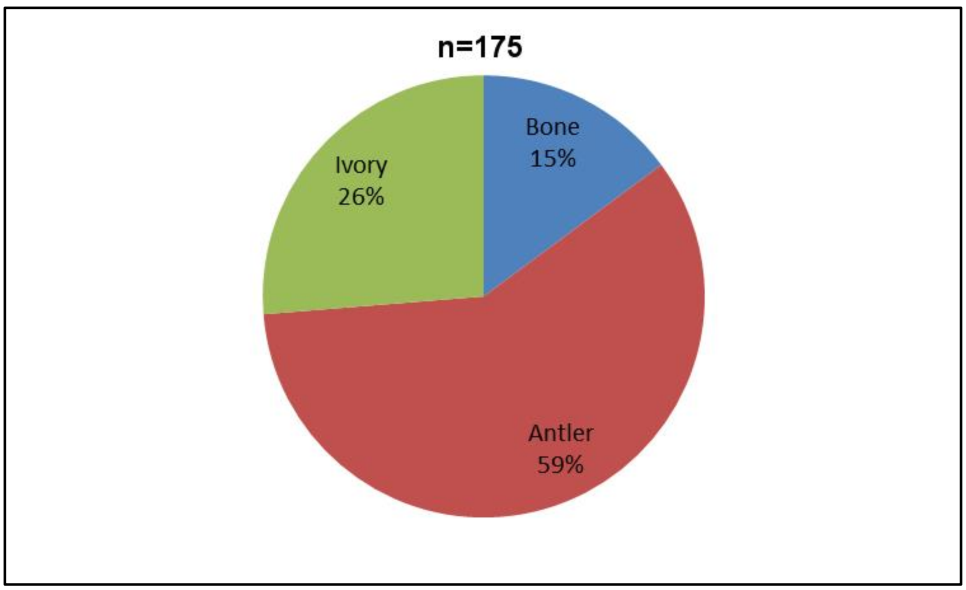

Figure 49: Overall modified osseous pieces by material type

Functional Classification

This portion of the collection has 68 artifacts; the majority being antler (61.8%, or 42 artifacts). This is followed by 20.6%, or 14, of the tools manufactured from ivory. Worked bone comprises 17.6% of the formal tool collection or 12 artifacts (Figure 50).

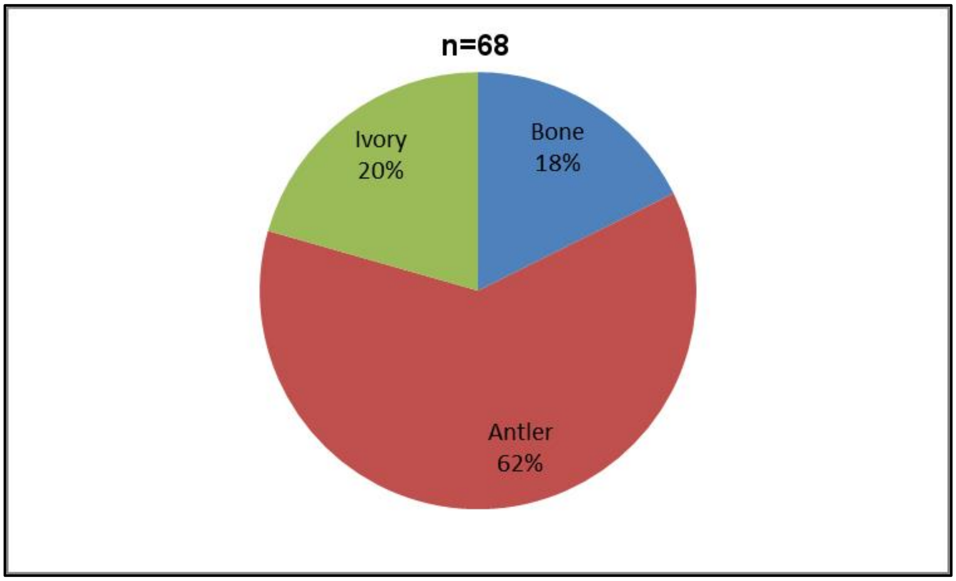

Figure 50: Formal tools by material type

Antler is the only material type found in all levels where formal tools were recovered (Figure 51). Antler peaks at Level 2 with nine artifacts and steadily declines through Level 5 with three artifacts until a second peak at Level 6 with eight artifacts. The numbers drop again after Level 6 to three antler artifacts in Level 7, with fewer in each level to the base of the excavation.

Ivory tools were recovered throughout most of the excavation levels with the highest frequency occurring in Level 2 with five ivory artifacts. From Level 2 to Level 9, two ivory artifacts are found within each level, aside from Level 6 which does not contain ivory tools. Bone peaks in Level 2 at six artifacts, and bone tools are found only between Levels 1, 3, 4, and 5 which only have one or two bone artifacts each. There are no bone artifacts deeper than level five. Most of the bone artifacts are made from sea mammal bone.

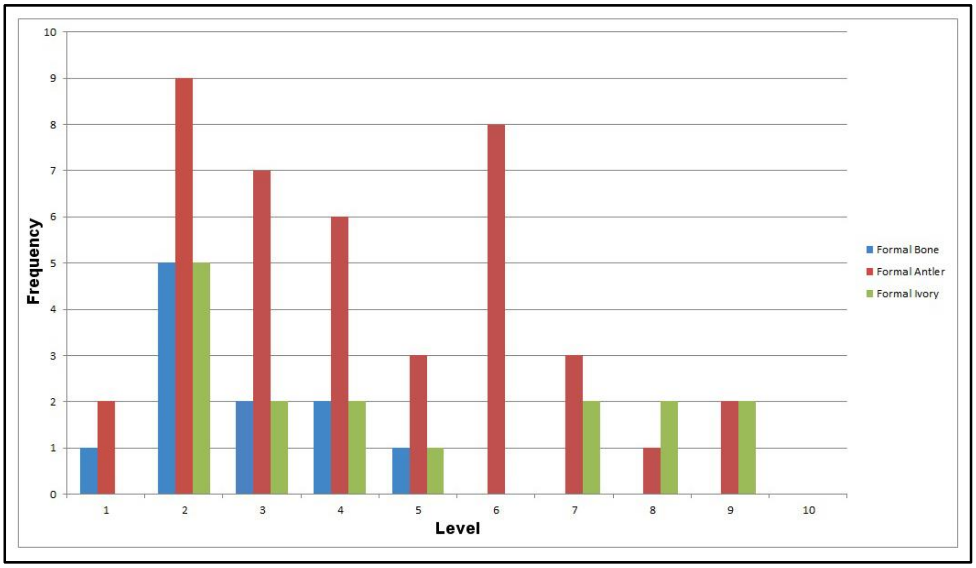

Figure 51: Formal tools by material type and level

Within the functional classification, four large groups were created to express how the tools were used during their use-life. These four groups included subsistence items, (hunting and fishing gear); manufacturing items (tools used to create other products); domestic items (items kept on the person or used within daily household life); and transportation items (pieces that increased the speed and mobility of the user).

Antler had the highest occurrence among each of the four groups. Antler was the most commonly used raw material within the subsistence (89.3% of the sample) and manufacturing (51.7% of the sample) groups. Antler represented a smaller percentage of the domestic group (25% of the sample), and was not present in the transportation items group. Ivory was the dominant material among domestic items (62.5%). Ivory artifacts made up 10.7% of the subsistence items group and 20.7% of the manufacturing items group. Bone was the only material type represented in the transportation items at 100%. Bone is also represented in the manufacturing items at 27.6% and within the domestic items at 12.5%. These data can be seen in Figure 52.

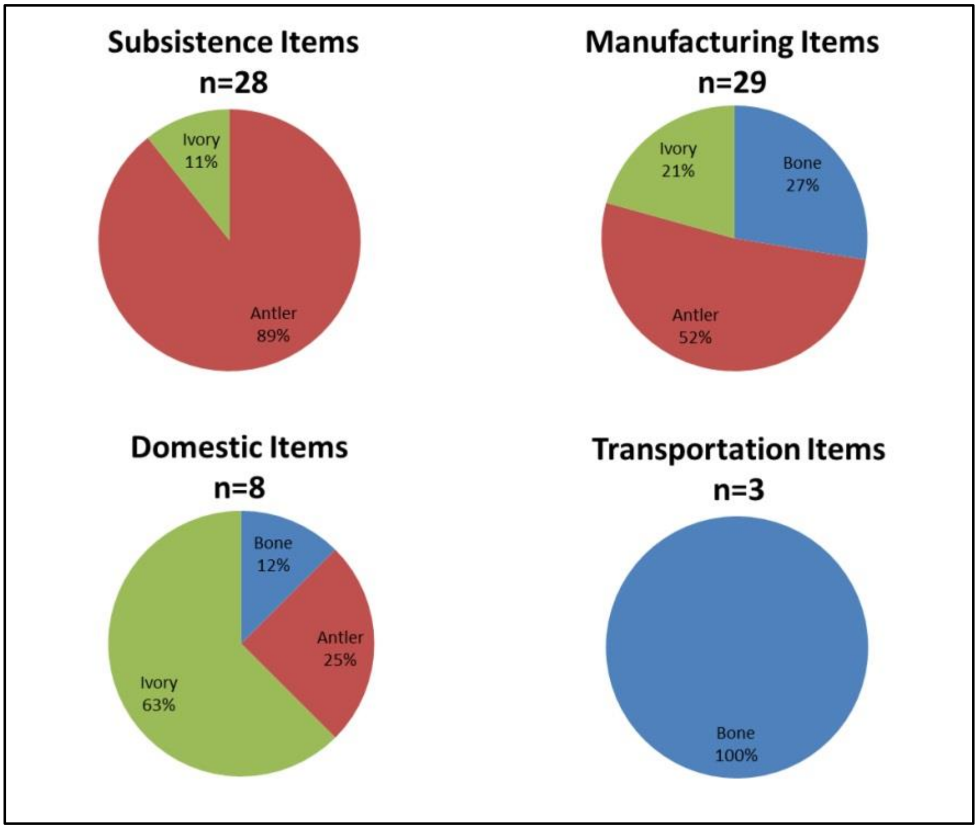

Figure 52: Formal tools by group and material type

Among these four groups, 20 categories were created to describe each tool's function within each larger group. These categories reflect the specific use of the tool, listing the general functional groups which are separated into specific categories. This is followed by a short description of the characteristics of each of the osseous tools within those groups (Table 5).

Table 5: Functional groups among osseous tools of KTZ-036

Classification	Artifact	Description
Subsistence Items	Bird Blunts	Short, blunt pieces with a deep concavity to fit on the end of a foreshaft or arrow
	Arrowheads	Long pieces with a thin edge for hunting terrestrial mammals
	Leister Points	Long, slender, multi-barbed pieces used to hunt bird or fish
	Foreshafts	A small piece with a line hole used to hold a harpoon head
	Harpoons	Pointed pieces, often with inset blades used to hunt aquatic animals
	Finger Rests	Triangular pieces with a line hole that are attached to the shaft of a harpoon
	Lures	Tear-drop shaped pieces intended to lure fish to the hook
	Hook Shanks	Small, slender pieces used secure a line and a hook for fishing
	Handles	Thick handheld beams attached to nets used for their manipulation during fishing or sealing
Manufacturing Items	Wedges	Beams with one blunt end and a tapered end often used for splitting wood
	Snowshoe Needles	Thin but wide pieces with a line hole at one end for stringing snow shoes
	Weaving Tools	Slender pieces with a blunt end used for weaving or sewing
	Drills	Long, cylindrical pieces with a sharp, pointed end for penetrating durable materials
	Awls or Bodkins	Thick pieces with points intended to puncture softer materials such as leather
	Flakers	Thick pieces with a rounded and blunt end that are intended to remove flakes from stone tools
Domestic Items	Brackets	Thin pieces with drilled holes for the intent of being lashed to another object
	Combs	Thin pieces with a row of teeth intended to comb through human or caribou hair
	Blades	Pieces with one long, thin edge and one blunt edge intended to cut or saw materials
	Fasteners	Circular pieces with holes intended to hold a line or affix to another material
	Thimble Holders	Pieces with two arms tucked within a surrounding section of the pieces to pinch material
Transportation Items	Sled Runners	Long, thin rectangular pieces with drilled holes intended to decrease sled friction with snow
	Harness Swivels	L-shaped pieces with two arms and large holes at one end for keeping dog harnesses from tangling

Subsistence Items

There are nine categories within the subsistence items group of the KTZ-036 osseous tool collection. Many of these are the tools propelled from the user to capture prey (Oswalt 1976). This includes the piece that punctures the animal, but can include a portion of the composite tool that is a part of the overall propulsion system. Also within this group are tools used for trapping or snagging animals for harvest, such as parts for nets and fishing equipment.

Among these tools were two main types of gear: terrestrial and maritime projectiles. Terrestrial hunting equipment includes the two main projectiles noted in the collection. These terrestrial projectiles include bird blunts and arrowheads, and aquatic-oriented tools which include projectiles such as harpoons, foreshafts, and leister points. Other items associated with harpoons such as finger rests, and items used for singular or group harvesting of fish such as lures, hook shanks, and fish net handles are included in this category. All of these tools were made of antler with the exception of one foreshaft from the aquatic projectile collection and the two lures. These three pieces are made from ivory.

Bird Blunts

The first blunt (Figure 53) is hollow at the base with three notches carved into the distal end to localize but slightly disperse the blow (KTZ-036-08-092.08a). There was a small piece of wood inside the blunt (KTZ-036-08-092.08b). There was a second bird blunt (KTZ-036-07-252.01) recovered from the excavations. This piece is a cylinder with a concavity extending from the proximal end to nearly half way up the blunt. The distal end is not perforated nor does it have a concavity. These tools were used to target birds and bring them down with the force of the blunt attached to an arrow and launched at the animal but preserve the skin without puncture (Nelson 1899).

Figure 53: Terrestrial projectiles: (left to right, top to bottom) bird blunts (KTZ-036-08-092.08a and b and KTZ-036-07-252.01) and arrowheads (KTZ-036-08-081.04, KTZ-036-08-096.04, and KTZ-036-01-008.01.01)

Arrowheads

The "terrestrial projectiles" in the collection were used to harvest large land mammals (Figure 53). Although broken distally, the first piece consists of much of the projectile head (KTZ-036-08-081.04). The distal end comes to a point with no slot for inserting a lithic or metal projectile point. The piece is lenticular in cross-section and has a blood line paralleling one edge that terminates at a small notch. It is at this notch that the piece is broken laterally. The second terrestrial projectile point is a long cylinder with a proximal end that has a completely shouldered tang that is slightly broken on the conical tip (KTZ-036-08-096.04). The distal end of the tool has a pointed tip with a flat, raised section. There is a small projection below the raised section that is partially broken. The third terrestrial antler projectile has long offset barbs with a deep slit in each ending in a proximal tip that does not have a slot for a lithic or metal projectile point to make a composite tool (KTZ-036-01-008.01.01). The base of the projectile has a well-defined shoulder around the entirety of the cylinder and has a rounded conical tang.

Leister Points

Four antler leister points are found in the osseous tool collection (Figure 54). Although they differ drastically in length and width, each is unilaterally barbed, beveled on the proximal end, and has a rounded tip on the distal end. The smallest of the leister points has eight barbs and several grooves at the proximal base to allow for addition friction with hafting (KTZ-036-08-067.04). The second shortest leister point has four equidistant barbs and a proximal end with a slight lip at the very tip to help with lashing (KTZ-036-07-

086.04). The second longest leister point has four barbs which group in pairs of two. The proximal base of the point is more robust near the tip for just under 1 cm and allows for a divot with which to lash the point to a shaft (KTZ-036-08-025.08). The longest leister point has nine barbs and is somewhat exfoliated (KTZ-036-07-179.01). The proximal base shows a roughed edge opposite the barb that would have aided in increasing friction for hafting purposes.

Figure 54: Maritime projectiles: (left to right, top to bottom) leister points (KTZ-036-08-067.04, KTZ-036-08-086.04, KTZ-036-08-025.08, and KTZ-036-07-179.01), foreshafts (KTZ-036-07-233.01 and KTZ-036-07-238.01), and harpoons (KTZ-036-07-034.01 and KTZ-036-08-103.05.02)

Foreshafts

There are two foreshafts in the collection, one of which is the only ivory piece in among the projectiles (KTZ-036-07-233.01). This piece is broken distally with a jagged fracture. Its base has shouldering and is flat and rectangular in shape and contains some lateral striations for increased friction. Near the center, the piece contains an elongated line hole. The second foreshaft is made of antler and has a similar flat, rectangular base to the ivory piece (KTZ-036-07-238.01). The proximal end comes to a fine point and near the center of the piece is a finely-drilled, small line hole. The foreshafts are illustrated in Figure 54.

Harpoons

There are two harpoons in the osseous tool collection (Figure 54). One harpoon is 7 cm long, and the larger harpoon is 13 cm long (KTZ-036-07-034.01 and KTZ-036-08-103.05.02, respectively). Both harpoons are made from antler. The smaller harpoon has decoration and a line hole. There is an appearance of an open socket, but this is just a product of breakage. The harpoon has a simple point with a single tang and does not have a slot for insetting a lithic or metal point. The larger harpoon has a line hole drilled into it, with obvious beginnings of the drilled hole on each face of the tool. At the proximal end there is a tang and an entry point for a foreshaft. On the distal end there is a suggestion of a slit for the fitting of lithic or metal projectile.

Finger Rests

There are two finger rests in the osseous collection (Figure 55), each made from antler (KTZ-036-08-082.13 and KTZ-036-08-025.07). These pieces are small, hooked items with a slightly curved edges and a thick, flat base that abuts a harpoon shaft with a rounded distal end. A line hole is bored through the center to attach the piece to the shaft of the harpoon.

Figure 55: Finger rests (left to right) (KTZ-036-08-082.13 and KTZ-036-08-025.07)

Lures

Fish lures were items attached to a line to lure fish to a hook. Two of these were located in the KTZ-036 collection (Figure 56), both made from ivory. The first lure is an elongated tear-drop shaped item which is broken proximally where a line hole may have existed (KTZ-036-08-104.02.02). It is only worked on one face to thin the piece. The second ivory lure is broken along a line hole with much of the piece missing (KTZ-036-01-018.02). The end still present is somewhat rounded.

Figure 56: Fishing gear: (left to right, top to bottom) Lures (KTZ-036-08-104.02.02, KTZ-036-01-018.02), and fishhook shanks (KTZ-036008-003.03, KTZ-036-07-254.01, KTZ-036-07-178.01, and KTZ-036-01.008.02)

Fishhook Shanks

Fishhook shanks (Figure 56) are used to connect the fishhook barb to the line through a linehole at the proximal end of the shank. The four fishhook shanks in the osseous tool collection are made of antler and vary slightly in morphology, though all are long and slender with line holes present at the proximal end. The smallest piece has a curved cylindrical shape with a hole drilled diagonally into its thicker end and two grooved notches going around the circumference of the thinner end for a line attachment (KTZ-036-08-003.03). The second smallest fishhook shank has two line holes, with an elongated lower hole (KTZ-036-07-254.01). The piece curves in the same direction that the line holes face, with the distal end thinned and flattened, for the hafting of a fishhook barb. The third fishhook shank is more robust and circular in cross-section (KTZ-036-07-178.01). The line hole is elongated and on the same plane as the curvature of the piece. On the distal end within the curved portion is a notched groove that likely contained a fishhook barb. The largest fishhook shank is has angled edges and a circular line hole near the proximal end (KTZ-036-01-008.02). The distal end is beveled and, from where the beveling begins, the piece is scored to increase the surface area for tension when hafting to it a fishhook barb.

Handles

There are seven tools classified as handles (Figure 57). Handles are long beams which can be used to support work on other items. They can be attached to nets for set-netting, or as the portion of a composite tool which allows for the handling and manipulation of the tool. These can be separated further into three categories: net handles, broken handles, and composite handles.

Figure 57: Handles (left to right, top to bottom) (KTZ-036-08-092.07, KTZ-036-01-004.01, KTZ-036-08-076.08, KTZ-036-07-208.01, KTZ-036-07-124.01, KTZ-036-08-103.05.01, and KTZ-036-08-104.01)

There are three net handles in the collection (Figure 57), all of which are made of antler. Each of these pieces is complete, and allows for a hand to grip the length of the tool. Holes are drilled through the handle on both ends to allow for a line attachment. These holes can be made by first notching the antler near the ends and then drilling through the softer trabecular bone. The two larger handles (KTZ-036-07-0208.01 and KTZ-036-08-103.05.01) are largely unmodified aside from the ends which have been hacked, smoothed, and where the line holes have been made. The smaller net handle (KTZ-036-08-092.07) has been hacked on either end and split longitudinally. The piece has also been modified along the entirety of its dorsal face to allow for a better handheld fit. The line holes were not created by notching, but the cortex of the antler was thinned to allow for easier drilling.

The broken handles are in partial form. There are three of these in the osseous tool collection. Like the larger, complete handles, these handles have at least one rounded end with notching and a drilled line hole. It is difficult in any of these pieces to determine how the body of the artifact was modified. Two of the pieces (KTZ-036-08-076.08 and KTZ-036-07-124.01) are long, but have been split and broken. The third broken handle (KTZ-036-01-004.01) has the primary characteristics of a net handle, but also has the secondary characteristics of appearing to have purposefully shortened.

There is one composite tool handle in the osseous collection (KTZ-036-08-104.01). This antler piece has been planed on either face and has a notched protuberance at one end. The other end has a jagged break. The edge with the protuberance has been sheared. The other edge has been scored, possibly to create friction.

Subsistence Items Overview

Seven of the nine tool categories in the subsistence group were 100% antler. This is 25 of the 28 (89.3%) subsistence-related pieces. The only other material type represented within the subsistence items group was ivory, which comprised all of the lures and 50% of the foreshafts (Figure 58). When considered by depth, no discernible pattern can be made aside from a higher frequency of tools in the upper levels. Antler and ivory, when present, are distributed throughout the excavation levels (Figure 59).

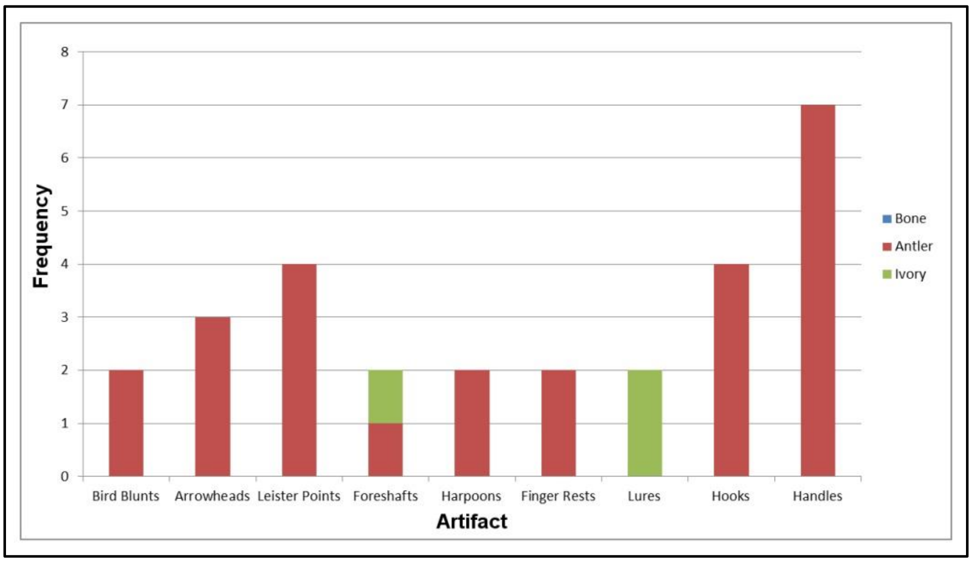

Figure 58: Subsistence items by artifact and frequency of material type

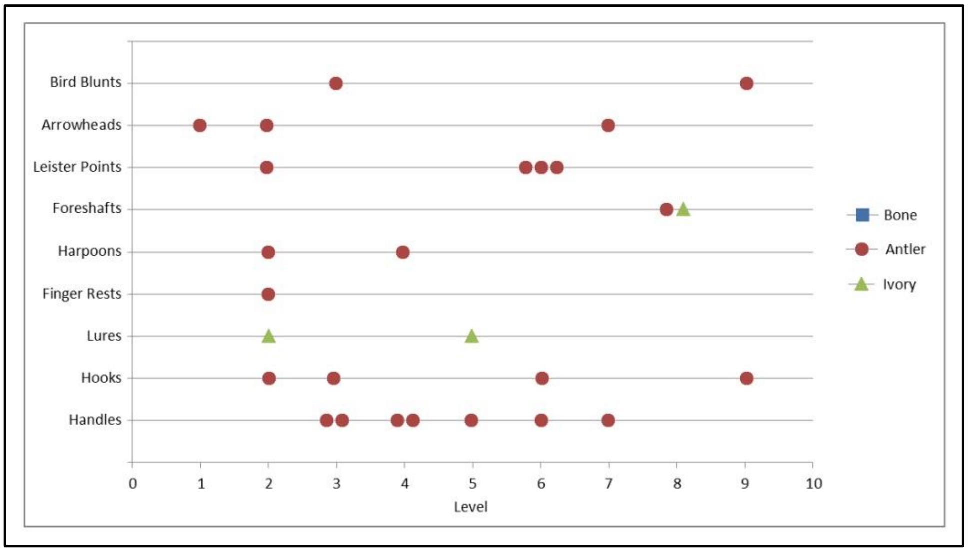

Figure 59: Subsistence items artifact frequency by material type and level

Manufacturing Items

Manufacturing items include wedges, perforators, and flakers. Wedges were used for splitting wood or other organic materials by placing the beveled end of the tool between cracks in the material intended to be split, and applying a force with a hammer or hammerstone with enough pressure to split the material. Perforators include a variety of tools such as snowshoe needles, weaving tools, drills, and awls or bodkins. These tools push through another medium for sewing, weaving, or piercing hides. Also in the manufacturing items group are flakers used in pressure flaking in flintknapping. Most of the wedges and flakers in this osseous collection are antler. Bone and ivory are the much more prevalent material type among perforators.

Wedges

Thirteen tools are categorized as wedges (Figure 60). This classification is divided into three categories: small wedges, thick wedges, and large wedges. Ten of the wedges are made from antler and three are made from bone.

Figure 60: Wedges: (left to right, top to bottom) Small wedges (KTZ-036-07-144.01, KTZ-036-08-076.07, KTZ-036-08-095.08.01, KTZ-036-01-024.01, KTZ-036-01-022.01, and KTZ-036-07-074.01) and large wedges (KTZ-036-01.010.01, KTZ-036-08-074.05, KTZ-036-08-032.01, KTZ-036-08-027.06, KTZ-036-08-082.09, KTZ-036-07-095.01, and KTZ-036-07-042.01)

Six small antler wedges are thin and less than 2 cm wide are tapered at one end with a thin, blunt edge. Most of these small wedges appear to be broken. One artifact is only a wedge base (KTZ-036-07-144.01). One of the artifacts was broken at the tapered edge, leaving an asymmetrical appearance (KTZ-036-08-076.07). Two of the small wedges are mostly complete with a blunt end slimming to a tapered end (KTZ-036-08-095.08.01 and KTZ-036-01-024.01), the latter being more robust. The fifth small wedge is the longest of the group whose original uniform girth is represented by the thickest portion of the piece, but is split (KTZ-036-01-022.01). The final small wedge piece is the widest of this subgroup and has abundant scarring on its dorsal face (KTZ-036-07-074.01).

The collection contains a single thick wedge made of bone, likely from a sea mammal. It appears to have been sawn on four faces, the only face not modified is the outer curved face (KTZ-036-01-010.01). The modified surfaces create an object with two large faces that look like half of a semicircle.

Six large wedges appear in the osseous tool collection. All are broken and in one instance a large wedge piece is shorter than the small wedges. The classification for the large wedge category is based on the suspected original width of the tool which is estimated to be greater than 2 cm. This standard points at an overall longer and larger original wedge.

Two of the large wedges are made from dense, likely sea mammal, bone. The remaining five are antler. The first of the large wedges (KTZ-036-08-074.05) is bone. This is a long slender piece that has a sharp, smooth edge that was broken and tapers at one end. The following four large wedges are all antler and broken, although each has an apparent beveled end. In each case, the original width of the tool is not thought to be represented. One of the large antler wedges (KTZ-036-08-032.01) is relatively short because it is broken, showing a jagged break. It is compressed on the beveled end and has a serrated break where torqueing may have led to breakage. One large antler wedge (KTZ-036-08-027.06) shows fracturing on the beveled end and possible use-wear polish. The thick end is also broken, with a large portion removed from the tapered end. This piece also has a divot on the dorsal face which suggests the piece may have had another function. Another artifact (KTZ-036-08-082.09) is made of antler and at one point may have been a complete cylinder from an antler beam. There are signs of compression on the tool that show that it was used after much of the trabecular bone was exposed. There is a small scar on the dorsal face with polishing on the beveled end, while the blunt end shows signs of compression.

There are two large wedges (KTZ-036-07-095.01 and KTZ-036-07-042.01) that are largely intact although there is some damage. The largest wedge is made of antler and has both a beveled end with polish and a thick end with compression damage. The beveled end broke along one edge to nearly the midline. It may have originally been an entire cylinder of an antler beam, but the compression patterns show that it was used after it was halved longitudinally. The second largest wedge in the collection is made from bone and has at least one thick, smooth edge and an end that tapers flat. It is broken longitudinally but maintains, in part, its original width.

Snowshoe needles

Snowshoe needles (Figure 61) are for weaving snowshoes. Two snowshoe needles (KTZ-036-07-256.01 and KTZ-036-07-198.01) are each made from ivory and broken. Each end of the needles has a notch that would have been a complete linehole; more ivory could have extended beyond the piece, leaving the line hole about one-quarter of the way into the tool. The other end of the flat artifact is rounded and shows some polish.

Figure 61: Perforators: (left to right, top to bottom) snowshoe needles (KTZ-036-07-256.01 and KTZ-036-07-198.01), weaving tools or needles (KTZ-036-08-049.12 and KTZ-036-08-002.07), drills (KTZ-036-08-017.01.02, KTZ-036-08-030.06, and KTZ-036-08-117.07), and awls/bodkins (KTZ-036-07-185.01, KTZ-036-08-094.08, KTZ-036-08-082.05, and KTZ-036-07-049.01)

Weaving or Sewing Tools

There are two osseous tools identified as weaving tools or needles (Figure 61). The first piece (KTZ-036-08-049.12) is made from ivory and has a flat, rounded end. The proximal end is broken. The second piece is bone and is almost a small cylinder that has a blunted, polished distal end with a proximal end that is snapped although the edges show considerable wear with a few observable grooves (KTZ-036-08-002.07).

Drills

The osseous tool collection has three artifacts identified as drills (Figure 61). Two are made from ivory while the third is bone. These have a relatively sharp, or heavily polished, tip. The drill made of bone has a sharp tip but is broken proximally (KTZ-036-08-017.01.02). The smaller of the ivory drills has a rounded, polished distal end and is thickest at its midline. It is broken distally (KTZ-036-08-030.06). The longer ivory drill is complete and has a polished distal end. The proximal end has a flat, shouldered tang that is only apparent on one face (KTZ-036-08-117.07). This may have been inset into a shaft as part of a composite tool for drilling.

Bodkins/Awls

There is one bodkin in the collection (Figure 61). This is a puncturing tool with a curved distal tip (KTZ-036-07-185.01). This is the only perforating tool that is made of antler. The proximal end has grooves on either face, and may have been hafted to a larger handle.

The osseous tool collection also contains three awls (Figure 61). These are tools that are used to perforate harder materials such as hides. All three awls are bone. The first piece (KTZ-036-08-094.08) is from the epiphysis of a bone that has been broken off the main shaft with a tapered end that has signs of polish. The smallest awl (KTZ-036-08-082.05) is an expedient bone fragment that is also pointed at the distal end with polish. This awl may be water worn. The longest awl (KTZ-036-07-049.01) is a snowshoe hare radius and is weathered on both distal and proximal ends. The pointed end has evidence of polish and the proximal end is broken.

Flakers

Five flakers came from the KTZ-036 site (Figure 62). They are large enough to be handheld and have at least one rounded tip that could have aided in pressure flaking lithic tools. The opposite end of the flakers is broader and thicker, likely to allow for a greater surface area with which to apply a greater force, removing larger flakes from the stone. Four of these flakers were made of antler. The fifth was made from ivory.

Figure 62: Flakers (top to bottom) (KTZ-036-07-211.01, KTZ-036-01-017.01, KTZ-036-01-004.01.03, KTZ-036-08-117.06, and KTZ-036-08-111.03)

The smallest antler flaker (KTZ-036-07-211.01) has a thick body with a whittled, polished point at one end that is offset to one edge. The other end is blunt but also possibly worked to a rounded end. The second smallest antler flaker (KTZ-036-01-017.01) has each end terminating at a point along one edge, although one end is dramatically thinner than the other end. Both ends are modified with the apparent intent for use.

One ivory flaker (KTZ-036-01-004.01.03) has the finest point of all the flakers, and is polished along one offset edge. It is broken proximally and is placed in the flaker category rather than in the perforator or drill categories because of its size. The largest complete drill, which is approximately 8 cm in length, is as long as the ivory flaker. It may be that length and overall size are not determinant factors for drills.

One of the larger antler flakers (KTZ-036-08-117.06) has a pointed end following offset along one of the edges, and is more robust than the other flakers. The proximal end is blocky which suggests the piece may have been hafted to form a composite tool for flaking. The largest piece (KTZ-036-08-111.03) is rounded on both ends. It is relatively thin, and uniquely conforms to the right hand with an indentation for each finger, including a concavity that receives the thumb.

Manufacturing Items Overview

Within the manufacturing items group most materials are antler (15 of 29 pieces). However, this material type only dominates the wedges and flakers at 77% (n=11) and 20% (n=4) respectively. Antler is only present in one other category, awls and bodkins, where it represents 25% of material type in that category. Bone is otherwise dominant; represented in four of the six categories, it comprises 75% (n=4) of the awls and bodkins group, 50% (n=2) of the weaving tools, 33% (n=3) of the drills, and 30% (n=2) of the wedges. Ivory is also represented in four categories. It is the only material type that completely dominates a category, snowshoe needles. Ivory comprises 67% (n=2) of the drills, half (n=1) of the weaving tools and 20% (n=1) of the flakers (Figure 63). When considering depth, it can be seen that all bone artifacts are in Levels 5 and above. Antler is present from Level 7 and above, while ivory is present in the deepest and most shallow levels (Figure 64).

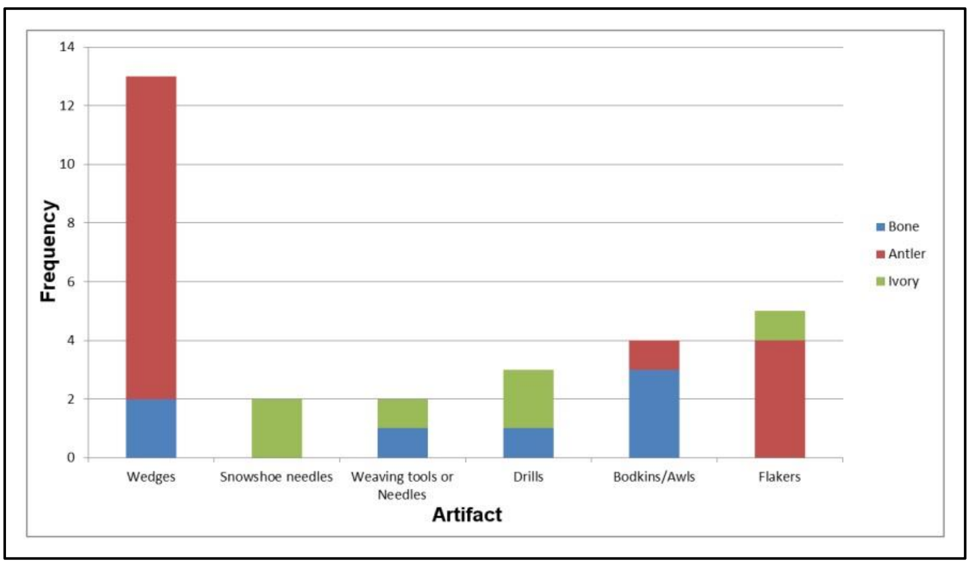

Figure 63: Manufacturing items by artifact and frequency of material type

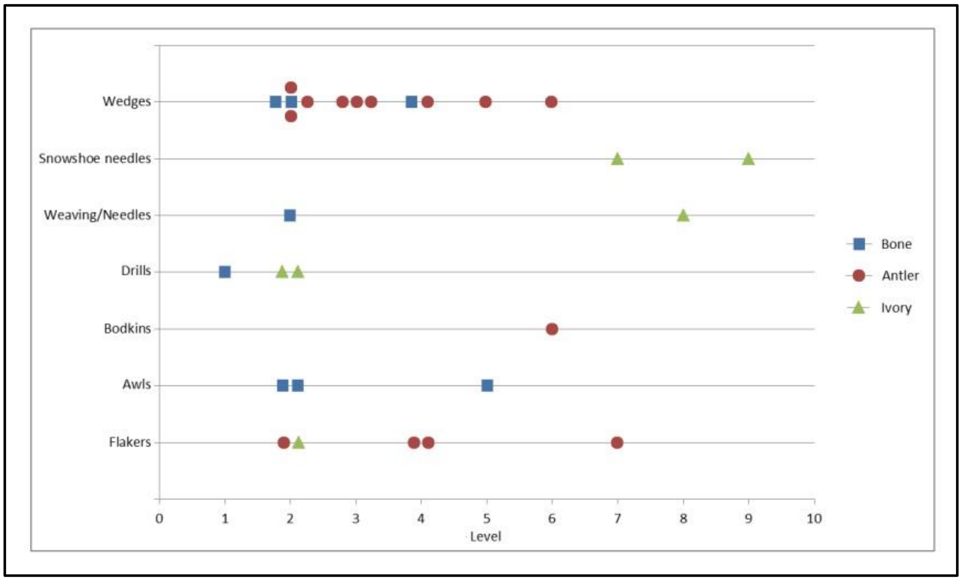

Figure 64: Manufacturing items artifact frequency by material type and level

Domestic Items

There are five categories within the domestic items group of the KTZ-036 osseous tool collection. These items are those that were found in the home, including blades, brackets for containers, combs, fasteners for clothing, and thimble holders. These pieces are made from bone, antler, and ivory, with ivory being the most prevalent material type in the group.

Brackets

Two brackets were recovered within the KTZ-036 2001 and 2007 excavations. Each has drilled holes and was likely lashed to another object. One piece (KTZ-036-01-011.01) is ivory and is curved across its length, with a raised middle portion. It has three drilled holes, two offset to one edge, and the middle hole is offset to the other edge. The outer portion of the piece has two parallel etched lines connecting each of the holes. This may be a brow band.

The second bracket (KTZ-036-07-142.01) is made of antler. It is long with a shallow groove down its length. Within the groove are sets of two drilled holes, each drilled at an angle away from its paired hole. There are seven pairs of drilled holes. Three of the outer holes are broken (Figure 65).

Figure 65: Brackets (top to bottom) (KTZ-036-01-011.01 and KTZ-036-07-142.01)

Combs

Two combs, one ivory, the other antler are present in the collection (Figure 66). The ivory comb (KTZ-036-08-119.04) is broken parallel to its teeth, four of which remain. Along the edge are two parallel engraved lines on the handle leading to the teeth. The antler comb (KTZ-036-08-054.02) is complete. It has six teeth and is undecorated. The edges of the comb are thin and parallel, ending in a flat base.

Figure 66: Combs (top to bottom) (KTZ-036-08-119.04 and KTZ-036-08-054.02)

Blades

Two ivory blades (Figure 67) came from the 2007 excavation at KTZ-036. The first blade (KTZ-036-07-253.01) has a triangular cross-section and a serrated blade. The distal end of the blade is polished and the proximal end is snapped and broken.

Figure 67: Blades (Top to Bottom) (KTZ-036-07-253.01and KTZ-036-07-205.01)

The second ivory blade (KTZ-036-07-205.01, Figure 67) is in the shape of a miniature knife. Something of this size would not appear to be functional; however, the tip of the knife is polished, and has signs of use wear. Following Nelson (1889:Plate XLIV, Figure 49), the object appears to be a boot sole creaser. This piece does have the appearance of a story knife; however, these tools are typically much longer than this 9-cm artifact, and are more close to 25 to 30 cm in length and curved (Giddings 1967).

The proximal end has a hole drilled near the end of the handle. The blade itself has "ownership" marks. This includes the same pattern on both faces with an etched line across the entire long edge of the blade. Extending from the line toward the center of the blade are two sets of short, parallel lines etched at a diagonal. One set is near the center of the blade, the other is one-third of the way from the tip. Another line is etched along the lower portion of the handle that does not extend onto the blade. A third set of paired parallel lines exists along the center of the lower portion of the handle of the blade. At the lower portion of the shoe creaser's neck near the edge of the blade, extending onto the blade, appears to be an engraving of the foot of a bird represented by a long back talon and three lines extending away from the same point at 45-degree intervals making up the forward-facing phalanges.

Fastener

A circular fastener which looks like a modern-day washer made of sea mammal bone (KTZ-036-07-087.01) came from the 2007 excavations. The piece (Figure 68) is thin with a 1-cm diameter hole in the center. A line of leather could have passed through the hole and attached the piece to other items.

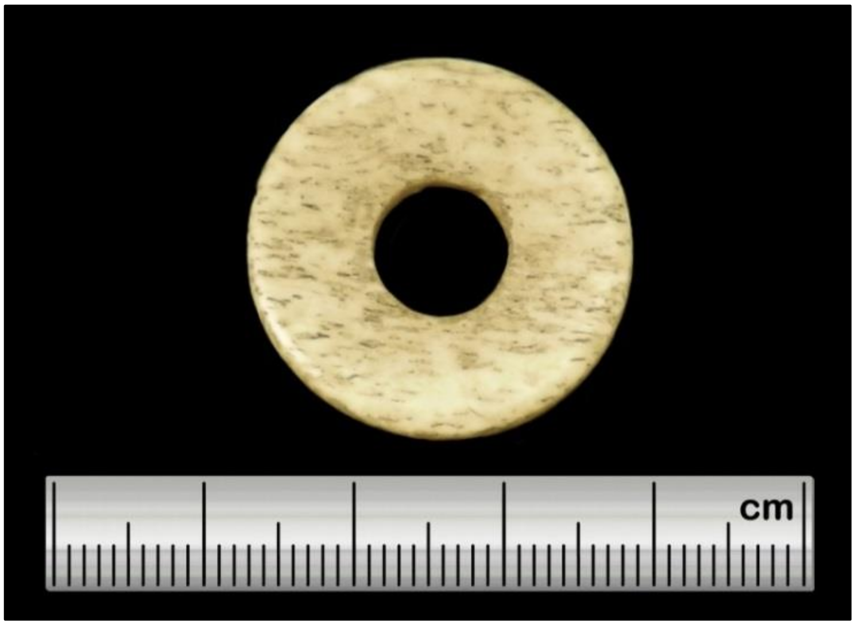

Figure 68: Fastener (KTZ-036-07-087.01)

Thimble Holder

A partial ivory thimble holder (KTZ-036-08-102.06, Figure 69) was also recovered from excavations. This is one of the interior arms that would hold a thimble. A similar thimble holder is in Nelson (1899:Plate XLIV, Figure 17).

Figure 69: Thimble holder (KTZ-036-08-102.06)

Domestic Items Overview

Among domestic items, ivory is the dominant material type (62.5%). Ivory is present in four of the five categories at 100% in blades (n=2) and thimble holders (n=1), and 50% in both brackets (n=1) and combs (n=1). Antler is the next dominant material type, used to make the brackets (n=1) and combs (n=1), at 50.0%. Bone is only present in a single category – fasteners – and the one piece represents 100% of that category (Figure 70). Ivory is the only osseous material type present in lower levels, but is also present in the upper levels along with bone and antler (Figure 71).

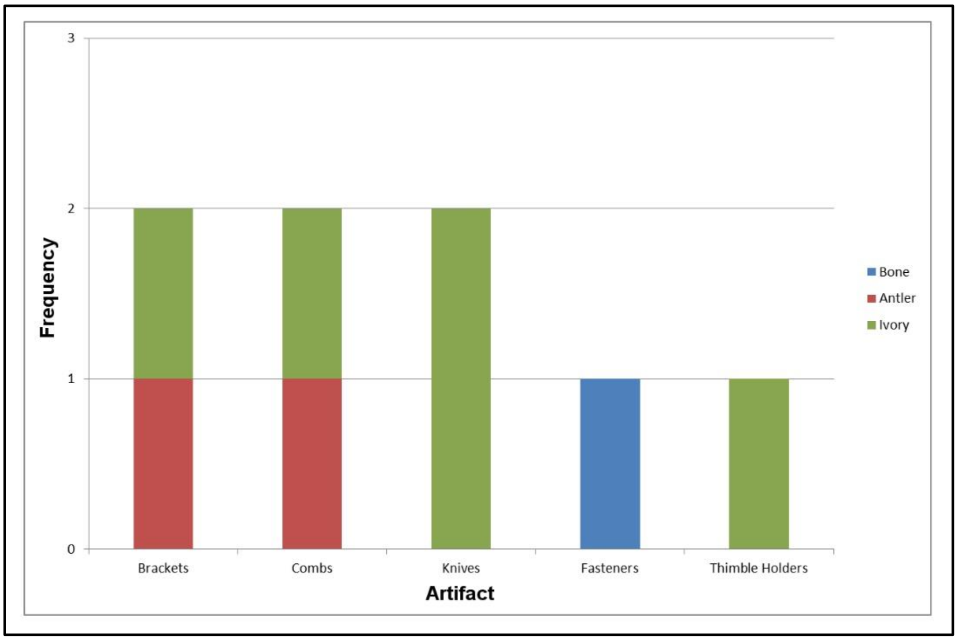

Figure 70: Domestic items by artifact and frequency of material type

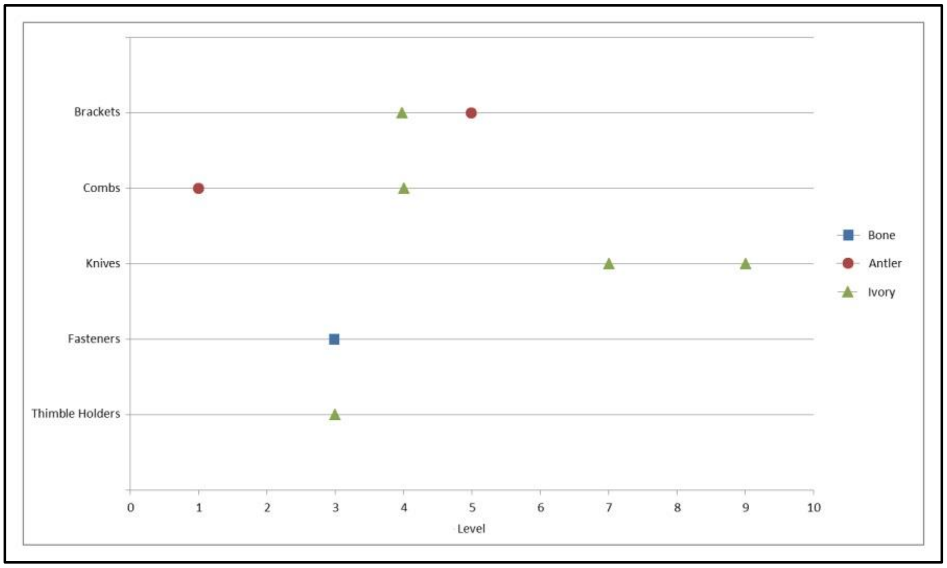

Figure 71: Domestic items artifact frequency by material type and level

Transportation Items

There are two categories within the transportation items group. These are associated with dog sledding, and include sled runners and dog harness swivels for keeping dog lines from tangling. All artifacts within this group are made from bone.

Sled Runner

Two sled runner pieces (Figure 72) are made of sea mammal bone and would have been long, rectangular pieces, but both are broken. The first artifact (KTZ-036-01-013.01) is broken on both ends. One end contains remnants of a drilled hole and another complete hole is closer to the other end near the center of the runner. One long edge has a lip but the piece is flat overall. The second, longer runner (KTZ-036-08.004.01) is broken at one end. There is one hole drilled along the center line, approximately 5 cm from the complete end. The piece is almost entirely covered in a black pitch or resin which almost completely fills the drilled hole.

Figure 72: Sled runners (top to bottom) (KTZ-036-01-013.01 and KTZ-036-08-004.01)

Dog Harness Swivel

A dog harness swivel (KTZ-036-08-035.06) came from the 2008 excavation at KTZ-036. It is made from bone and is L-shaped with a large hole drilled through the smaller projection (Figure 73). The longer portion of the piece has two arms with a space carved between the two. One piece ends beyond the other, with a robust end. The shorter arm may be broken and does not contain a thick end.

Figure 73: Dog harness swivel (KTZ-036-08-035.06)

Transportation Items Overview

The transportation items are represented by three pieces split between two categories. Each of these categories, harness swivel and sled runners, are represented exclusively by bone (Figure 74). All artifacts were recovered from the upper levels (Figure 64).

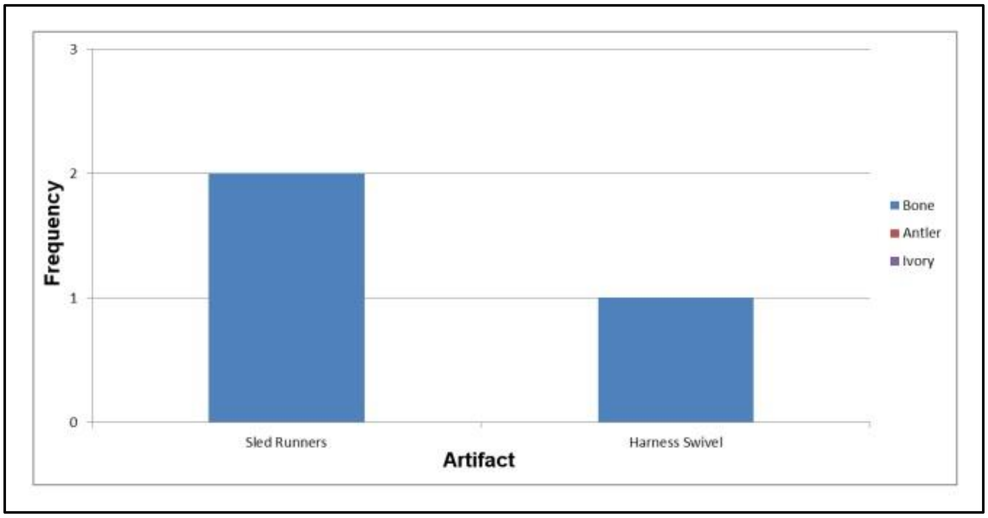

Figure 74: Transportation items by artifact and frequency of material type

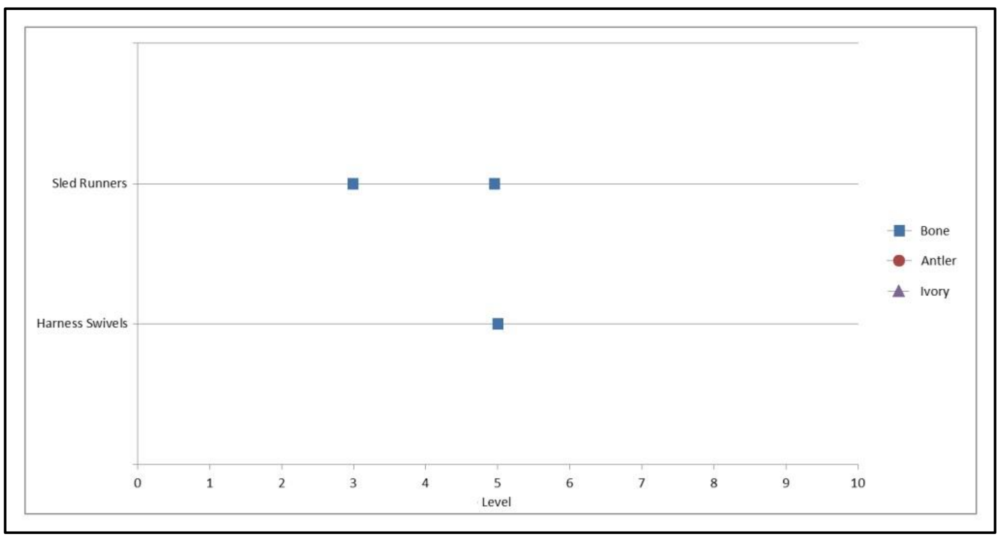

Figure 75: Transportation items artifact frequency by material type and level

Intermediate Classification

Fifty one tools from KTZ-036 were determined to be in an "intermediate" state. Most of these tools are antler. This represents 74.5% of the intermediate tool collection (n=38) (Figure 76). Ivory is the second-most common material type, comprising 17.6% (n=9) of the intermediate collection. Four pieces are made of bone, representing 7.8% of the collection.

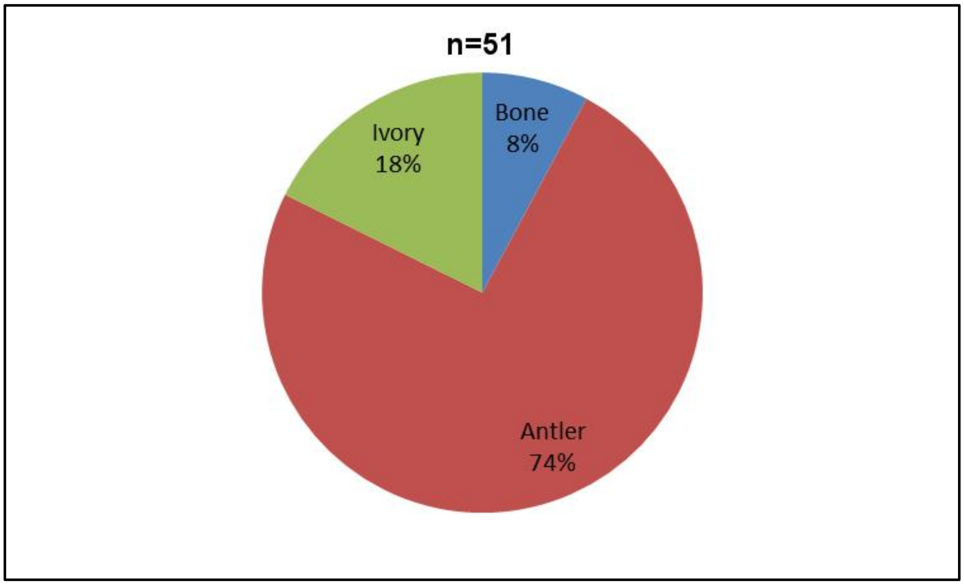

Figure 76: Intermediate tools by material type

Antler is the only material type present in all layers that contain intermediate tools. Intermediate antler tools are most common in Level 2 (n=14) and less so in Level 5 (n=8, Figure 77). Aside from Level 2, the intermediate antler artifacts are spread throughout the levels in frequencies that resemble a bell curve centered on Level 5. Three ivory artifacts are in Level 2, and Levels 3 and 4 contain two ivory artifacts each. There are two intermediate ivory artifacts in the lower layers, with one each located in Levels 8 and 9. Intermediate bone tools are spread in depth throughout the excavation with only a single bone artifact each were represented from Levels 1, 2, 5, and 8 (Figure 77).

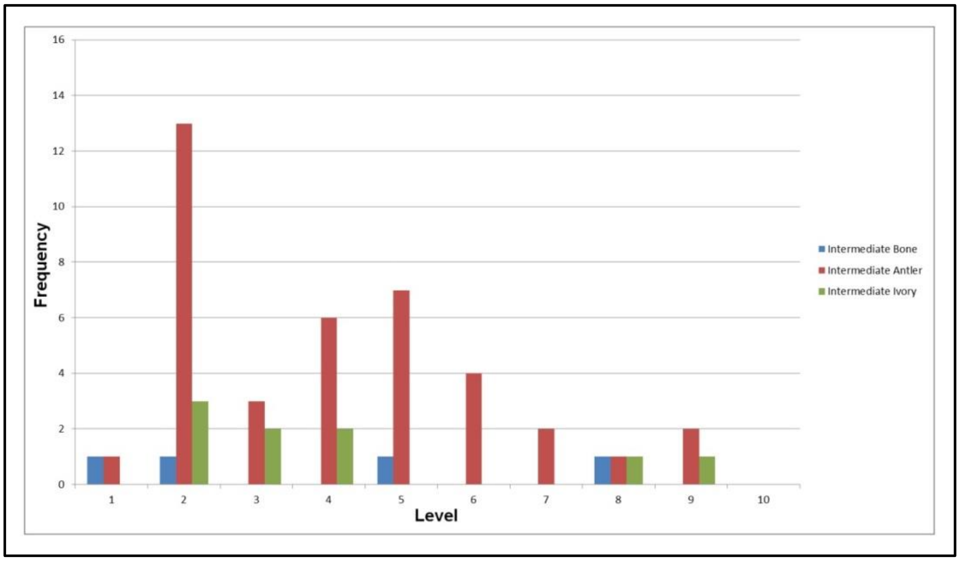

Figure 77: Intermediate tools by material type and level

The intermediate osseous tools from the KTZ-036 collection are classified into five groups based on their manufacturing technique. These groups are: hacked artifacts, planed artifacts, pointed artifacts, scored artifacts, and tanged artifacts. Some of these groups are incomplete artifacts, while others likely contain fragmentary artifacts. Hacked artifacts have crude cuts to reduce the piece into manageable portions for artifact manufacturing. Planed artifacts are sheered to a flat plane and are either whole or broken. Pointed artifacts are likely broken projectile points or are preforms of projectile points. Scored artifacts are likely created to be hafted to another object. Tanged artifacts are likely the broken proximal ends of formal projectile points or other similar tools.

Hacked Artifacts

Antler is often reduced to manageable units by hacking at a full rack and removing sections for the creation of functional tools (Corbin 1975). This process results in the creation of preforms or pieces to discard. In a group of 15 artifacts, further divisions were made, creating four categories, to identify morphological differences including: beams hacked on a single end, large hacked beams, beams hacked and halved, and beams hack and planed.

Three antler beams at the site are hacked on a single end (Figure 78). These are split on the other end giving a beveled appearance (KTZ-036-07-017.01.01 and KTZ-036-07-188.01). This could imply an intended use as wedges. One artifact may have been a handle and has a groove down the face, although it is too fragmentary to determine its function (KTZ-036-08-063.08.01).

Figure 78: Hacked ends: (left to right, top to bottom) Single end worked beam (KTZ-036-08-017.01.01, KTZ-036-07-188.01, and KTZ-036-08-063.08.01) and large beam (KTZ-036-08-092.04, KTZ-036-07-232.01, KTZ-036-08-064.01.02, and KTZ-036-07-189.01)

Four large hacked beams in the osseous tool collection are antler, with the majority including the entire thickness of the antler beam. In two instances, both ends of the antler are completely hacked (KTZ-036-08-092.04 and KTZ-036-08-064.01.02). These may be handle preforms or a hammering utensil. The other two antler pieces have least one end that is battered with flakes removed (KTZ-036-07-232.01 and KTZ-036-07-189.01). The opposite ends of these beams do not have as many prominent marks but show evidence of breakage. These pieces may have been used as wedges and could have been broken from use.

Three hacked pieces were also subsequently planed (Figure 79). One piece of bone in this category is small and planed on all four edges to be relatively smooth (KTZ-036-08-024.02.03). The other two planed, hacked pieces are made of antler (KTZ-036-07-080.01 and KTZ-036-07-048.01). These are planed along the edges, possibly as a means to remove them from the rest of the antler beam.

Figure 79: Hacked ends: (left to right, top to bottom) Hacked and planed beams (KTZ-036-08-024.02.03, KTZ-036-07-080.01, and KTZ-036-07-048.01) and hacked and halved Beams (KTZ-036-07-244.01, KTZ-036-08-075.01, KTZ-036-08-111.07.02, KTZ-036-07-243.01, and KTZ-036-08-087.10)

Five pieces are hacked at both ends and also halved longitudinally (Figure 79). The smallest (KTZ-036-07-244.01) is ivory with the breakage possibly due to the structural mechanics of the tooth. The remaining four pieces (KTZ-036-08-075.01, KTZ-036-08-111.07.02, KTZ-036-07-243.01, and KTZ-036-08-087.10) are made from antler and are hacked on both ends and the pieces halved longitudinally. These antler artifacts may be discard pieces.

Planed Artifacts

There are 12 artifacts that are planed or smoothed. Most of the pieces are made of antler but ivory and bone are also found in this category. Within this group there are three other categories: planed pieces with rounded ends; planed, flat pieces; and planed pieces with a drilled hole (Figure 80).

Figure 80: Planed artifacts: (left to right, top to bottom) Rounded ends (KTZ-036-08-025.01, KTZ-036-07-033.01, and KTZ-036-07-043.01), flat, planed pieces (KTZ-036-01-008.01.03, KTZ-036-08-113.04, and KTZ-036-07-117.01), and planed pieces with hole (KTZ-036-07-118.01, KTZ-036-01-004.02, KTZ-036-08-072.04.01, KTZ-036-07-156.01, KTZ-036-01-010.02, and KTZ-036-08-117.05)

There are three planed pieces with rounded ends. Two are made of antler and are tabular shaped. The shorter piece (KTZ-036-08-025.10) may be a flaker, while the longer piece (KTZ-036-07-033.01) could be a sinew twister. The third piece (KTZ-036-07-043.01) is slightly concave being rounded on one end and having two small projections on the other. This may be a labret or a preform for a labret.

There are three flat, planed artifacts: Two pieces are made from antler and the third from ivory (KTZ-036-01-008.01.03, KTZ-036-08-113.04, and KTZ-036-07-117.01 respectively). The first two antler pieces are thin and could both be a projectile tang. The larger ivory piece, a tabular slab with rounded ends, is likely a preform.

Six planed pieces have drilled holes. One (KTZ-036-07-118.01) is tabular ivory and looks much like the flat piece from the previous group. Also recovered was another small piece of ivory that is cut on both ends with rounded edges resulting in a small protuberance (KTZ-036-01-004.02). The hole drilled into the piece does not penetrate through both sides. Two of the planed pieces with lineholes (KTZ-036-08-072.04.01 and KTZ-036-07-156.01) are made from sea mammal bone. Each of these has a drilled hole at which the piece was broken. The smaller piece contains one broken end with the remnants of a linehole. The second piece is long with one edge tapering medially to where the piece broke at the linehole. This piece may be a sled runner (see Figure 72), but is too fragmentary for definitive identification. The final two artifacts with lineholes are made from antler (KTZ-036-01-010.02 and KTZ-036-08-117.05). The smaller piece is broken at the drilled hole and has one end that is rounded. The larger piece has three drilled holes in the center representing a triangular pattern. On each end this piece has at least two drilled holes where the antler was broken, leaving two protuberances at the center.

Pointed Artifacts

Eight antler artifacts are pointed but cannot be assigned a function. These pointed pieces (Figure 81) are separated into four groups including a bipointed piece, broken points, biconvex points, and point preforms.

Figure 81: Pointed artifacts: (left to right, top to bottom) bipointed pieces (KTZ-036-08-112.05), broken points (KTZ-036-07-161.01, KTZ-036-08-025.09, and KTZ-036-07-141.01), biconvex points (KTZ-036-07-020.01 and KTZ-036-08-095.017), and preform points (KTZ-036-07-204.01 and KTZ-036-08-104.02.01)

The bipointed piece (KTZ-036-08-112.05) is weathered but worked to a point on either side. This could be a bodkin or awl (see Figure 61). There are three broken points in the osseous tool collection. One of these (KTZ-036-07-161.01) has a slight curve. This may be a broken leister (see Figure 54). The other two broken pointed artifacts (KTZ-036-08-025.09 and KTZ-036-07-141.01) are conical, coming to a rather fine point on one end and snapped on the other.

Two of the points are biconvex and lenticular in cross-section. One of these pieces (KTZ-036-07-020.01) comes to a fine point on one end and, like the conical broken points, is snapped on the other end. The second biconvex piece may be complete but is in a weathered state (KTZ-036-08-095.17). There are two preform points in the osseous collection. One piece (KTZ-036-08-104.02.01) has a rather pointed end with a curved body and a flat base. This may be an incomplete leister point (see Figure 53). The final preform piece is relatively long at 25 cm (KTZ-036-07-204.01). This has a conical tip with the other end being blunt and rounded. The piece is cylindrical with no markings. This is likely a preform, but its use may have been intended as a stake or drill (see Figure 61).

Scored Artifacts

Five artifacts are distinguished by being laterally scored (Figure 82). All artifacts within this category are antler. Two of the smaller artifacts (KTZ-036-07-249.01 and KTZ-036-08-082.02) are fragmentary and only partially scored on the dorsal face. These may be from a handle or socket piece. There are two larger artifacts which are broken on both ends with one end having an obvious shouldering that is scored (KTZ-036-08-074.08 and KTZ-036-01-026.02). These may be from a socket piece. The largest of the scored artifacts (KTZ-036-08-084.09) is a halved piece of caribou antler beam. It contains deep scoring on both faces with a divot on the flat, ventral face. Two pieces resembling this artifact may have been hafted together as a socket piece or to cause friction against ice or other materials.

Figure 82: Scored artifacts: (left to right, top to bottom) Partially scored (KTZ-036-07-249.01, KTZ-036-08-082.02, KTZ-036-08-074.08, and KTZ-036-01-026.02) and completely scored (KTZ-036-08-084.09)

Tanged Artifacts

Eleven artifacts have tangs, or tangs with partial shafts. “Tangs” are at the base of a projectile or other tool that is inset into a socket piece for added stability; the two pieces can then be hafted together. The material type differs for these artifacts. There is one bone piece, six made from antler, and four from ivory. This classification is further separated into five groups, including: shouldered tangs, flat tangs, pointed tangs, scored tangs, and tangs with partial shafts (Figure 83).

Figure 83: Tangs: (left to right, top to bottom) Shouldered KTZ-036-07-221.01 and KTZ-036-07-157.01), flat (KTZ-036-08-082.11), conical (KTZ-036-08-074.011, KTZ-036-08-085.09, and KTZ-036-08-025.05), scored (KTZ-036-01-018.01 and KTZ-036-07-229.01), and shafted (KTZ-036-07-088.01, KTZ-036-08-002.05, and KTZ-036-01-019.01)

Within the collection there are two shouldered tangs. One of these artifacts (KTZ-036-07-221.01) is made from bone and has a nippled appearance on one end and is broken on the other. The second piece (KTZ-036-07-157.01) is made of antler and has offset projections near the halfway point of the tang that do not ring the entire piece. This tang is broken presumably where the tang would meet the main body of the tool. There is one flat tang made of antler that appears to be a small wedge (KTZ-036-08-082.11). It is broken on the thick end and tapers to a thin end.

There are three pointed tangs. Two of these pointed tangs are created from antler and the third is ivory. The first antler tang (KTZ-036-08-074.11) is long and slender, coming to a fine point on one end, and was purposefully hacked on the broken end. The following two pointed tangs, one being antler (KTZ-036-08-085.09), the other ivory (KTZ-036-08-025.05), are more conical with the end being hacked or broken shortly after the cone reaches its fullest extent. The two scored tangs are each made of ivory. One is thin and conical (KTZ-036-01-018.01) while the other is blunt and robust (KTZ-036-07-229.01).

The final group of tangs has partial shafts. The first of these pieces is ivory. The other two are antler. The ivory piece (KTZ-036-07-088.01) has a beveled tang connected to a shaft piece that mushrooms out but is split along one face. This may be the full length of the original artifact, and if this is the case, this may be a fragmentary bird blunt. The other two antler pieces have shafts that are cylindrical. One of the artifacts (KTZ-036-08-002.05) has a shouldered tang that is beveled, which keeps the shouldering from going around the entire piece. The distal end is broken. The other antler piece (KTZ-036-01-019.01) has complete shouldering and a slightly scored tang with at least one dimple near the apex of the pointed cone. The distal end is neatly snapped.

Intermediate Tools Overview

Among the 51 intermediate tools (Figure 84), antler is the dominate material within each of the five categories. The presence of antler material ranges from 50 to 100% in all groups. It is exclusively present in the pointed and scored artifact groups. Antler artifacts are 86.7% of the hacked group. Fifty percent of the tanged artifacts are made of antler, and 54.4% of the tanged artifacts.

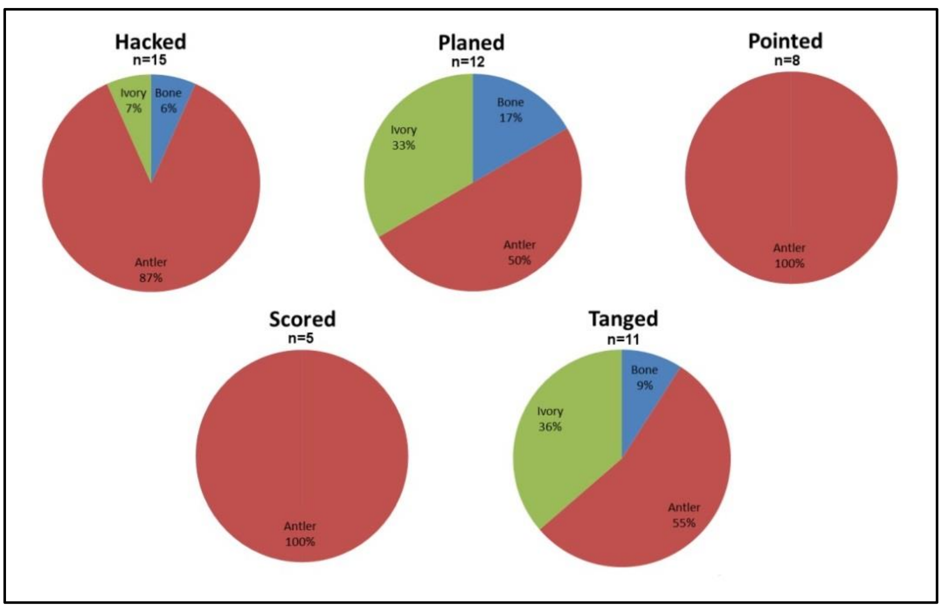

Figure 84: Intermediate tools by classification and material type

Ivory is represented in three of the five intermediate osseous tool groups. This material type is found among the planed, tanged, and hacked artifacts. Ivory does not dominate in any of these groups but is most prevalent in the tanged group (36.4%). Among the planed artifacts, 33.3% of the pieces are ivory. In the hacked ends group 6.7% of the artifacts are made of ivory (see Figure 71).

Among the intermediate osseous tools, bone is the least common material type. It is used in three of the groups. As a material type, bone is most prevalent among the planed artifacts (16.7%). Bone is represented in both the tanged and hacked artifacts groups each by a single artifact (9.1% and 6.7%, respectively) of the group (see Figure 71).

Debitage Classification

Fifty-six pieces of debitage were recovered. This includes 10 pieces of bone (17.8%), 23 pieces of antler (41.1%), and 23 pieces of ivory (41.1%). (Figure 85). Antler and Ivory are most present in Level 4, with the frequency of both material types waning in either direction from these levels (Figure 86). Ivory and antler are matched by level, aside from Level 4 where antler outnumbers ivory and in Level 5 where antler is present with one artifact compared to a relatively greater number of ivory artifacts. Bone debitage was only recovered in Level 1 through 6, where each occurrence was in a level that contained no more than three artifacts.

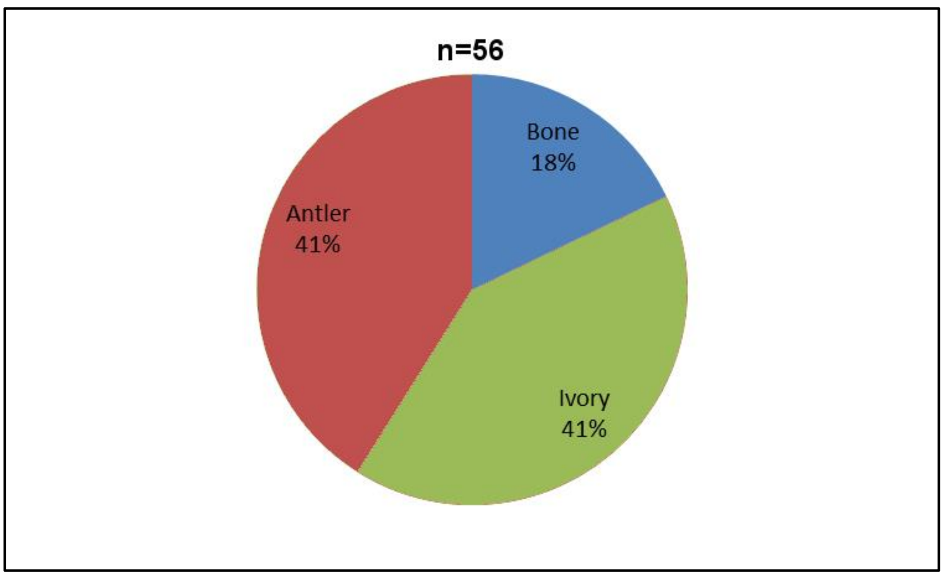

Figure 85: Debitage by material type

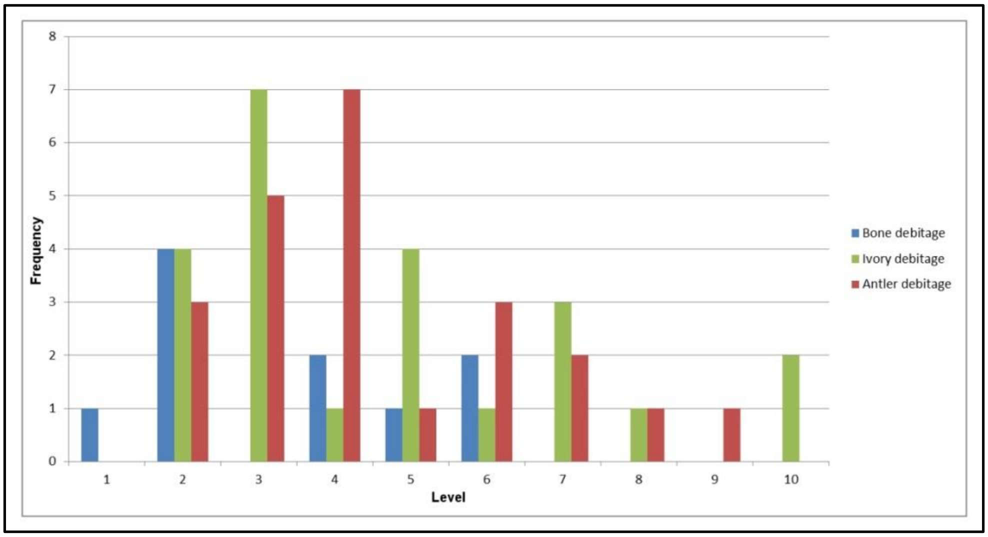

Figure 86: Debitage by material type and level

Bone Debitage

The 10 pieces of bone debitage were classified into three groups. These are bone flakes, cut bone, and long bone fragments (Figure 87). The three bone flakes (KTZ-036-08-101.01, KTZ-036-08-095.08.02, and KTZ-036-07-155.01) were small compared to the other bone debitage and each ends in a feathered termination, likely as a product of a forceful strike.

Figure 87: Bone debitage: (left to right, top to bottom) Bone flakes (KTZ-036-08-101.01, KTZ-036-08-095.08.02, and KTZ-036-07-155.01), cut bone (KTZ-036-08-002.06, KTZ-036-08-054.01.02, KTZ-036-07-047.01, and KTZ-036-01-025.01.01), and long bone fragments (KTZ-036-08-111.03, KTZ-036-07-190.01, and KTZ-036-08-064.01.01)

Most cut bone is slightly larger than the bone flakes, with sheer cuts on one of two ends. The smallest piece (KTZ-036-08-002.06) is cut on both ends and has one thick edge tapering to a thin edge on the opposite side. This thin edge may have use wear, and this could have been an expedient tool, possibly a scraper. The second smallest cut artifact (KTZ-036-08-054.01.02) may be a section of a large rib. The third cut artifact (KTZ-036-07-047.01) is removed from the rest of the bone at an angle, leaving a beveled appearance similar to a wedge. The largest piece (KTZ-036-01-025.01.01) is nearly conical with a flat cut on one end. Based on the exposed trabecular bone and exterior texture of the bone, this bone is identified as the distal end of a walrus baculum.

The final three pieces of debitage are discarded long bone fragments. Each is the product of striking the bone with the force by another object. One piece (KTZ-036-08-111.03) is a long, thin flake that is water worn. The second long bone fragment (KTZ-036-07-190.01) is thick but broken on either end. The third piece (KTZ-036-08-064.01.01) is a bone broken on either end with a long groove incised down the face.

Ivory Debitage

Ivory debitage includes 23 pieces (Figure 88), although four of these pieces refit into two larger pieces (KTZ-036-07-076.04.01 with KTZ-036-07-076.04.02 and KTZ-036-07-076.04.03 with KTZ-036-07-076.04.04). This category is further broken into six groups, including feathered termination flakes, thick flakes, pointed flakes, chunks, enamel, and halved.

Figure 88: Ivory debitage: (left to right, top to bottom) Feathered termination flakes (KTZ-036-01-025.02.01, KTZ-036-07-225.01, KTZ-036-08-041.05.01, KTZ-036-08-056.13, KTZ-036-08-056.12, and KTZ-036-08-074.02.05), thick flakes (KTZ-036-01.008.01.02, KTZ-036-08-075.04.01, KTZ-036-08-075.04.02, and KTZ-036-08-087.09.02), pointed flakes (KTZ-036-07-032.01, KTZ-036-08-087.09.01, KTZ-036-08-063.05, and KTZ-036-07-181.01), ivory chunks (KTZ-036-08-041.05.02 and KTZ-036-08-087.11.02), and enamel (KTZ-036-08-104.02.03, KTZ-036-08-075.04.03, KTZ-036-07-076.04.01, KTZ-036-07-076.04.02, KTZ-036-07-076.04.03, and KTZ-036-07-076.04.04)

The ivory flakes with feathered terminations are thin at one end and thicker at the other, with some having been struck on this thick end (KTZ-036-01-025.02.01, KTZ-036-07-225.01, KTZ-036-08-

041.05.01, KTZ-036-08-056.13, KTZ-036-08-056.12, and KTZ-036-08-074.02.05). These are followed by thick flakes which are byproducts of the flaking process but do not have an obvious striking platform (KTZ-036-01-008.01.02, KTZ-036-08-075.04.01, KTZ-036-08-075.04.02, and KTZ-036-08-087.09.02). The final piece in this group may have been broken from a larger formal tool in a rejuvenation process. This piece has diagonal notches on one edge with cut marks and polishing.

There are four pointed flakes that do not have many identifying marks but are products of ivory reduction (KTZ-036-07-032.01, KTZ-036-08-087.09.01, KTZ-036-08-063.05, and KTZ-036-07-181.01). There are two ivory chunks, one of which (KTZ-036-08-041.05.02) is small and rounded and may have been worked but then snapped from the larger piece. The second piece (KTZ-036-08-087.11.02) is a portion of the base of a walrus tusk that has been worked on its outer edge and split longitudinally. There are six ivory enamel pieces, two of which (KTZ-036-08-104.02.03 and KTZ-036-08-075.04.03) are water worn. The remaining four enamel pieces refit and were probably stripped to gain access to the more easily-carved cementum of the tusk. These are the two refits: KTZ-036-07-076.04.01, KTZ-036-07-076.04.02, KTZ-036-07-076.04.03, and KTZ-036-07-076.04.04.

There is a large mammoth tusk fragment in the collection (KTZ-036-08-091.09) that is considered debitage (Figure 89). This piece was halved longitudinally and has a portion of the wider proximal end cut, leaving a large 90-degree notch. The rest of the ends are weathered and deteriorating. Within the tusk concavity, a piece of charcoal with a black chert flake was recovered *in situ*.

Figure 89: Ivory debitage: Tusk half (KTZ-036-08-091.09)

Antler Debitage

The antler debitage collection (Figure 90) consists of 23 pieces, two of which (KTZ-036-07-168.01.01 and KTZ-036-07-168.01.02) are refits giving the appearance of containing only 22 pieces of antler debitage. This classification is further separated into groups of thin flakes, thick flakes, large flakes, chunks, and shaved pieces. The thin flake group consists of two pieces, one is long and slender (KTZ-036-07-202.01), and the other almost square (KTZ-036-08-074.02.02). There are three thick flakes (KTZ-036-08-074.02.03, KTZ-036-08-063.07.02, and KTZ-036-08-074.02.04) that are long and possibly notched, taken from a larger beam.

Figure 90: Antler debitage: (left to right, top to bottom) Thin flakes (KTZ-036-07-202.01 and KTZ-036-08-074.02.02), thick flakes (KTZ-036-08-074.02.03, KTZ-036-08-063.07.02, and KTZ-036-08-074.02.04), large flakes (KTZ-036-08-093.08.02, KTZ-036-08-073.01.02, KTZ-036-08-073.01.03, KTZ-036-08-093.08.01, KTZ-036-01-026.03, KTZ-036-08-082.10, KTZ-036-07-168.01.01, and KTZ-036-07-168.01.02), and antler chunks (KTZ-036-07-257.01, KTZ-036-08-073.01.01, KTZ-036-01-025.01.01, KTZ-036-08-063.07.01, KTZ-036-07-175.01, and KTZ-036-08-104.04)

Nine large flakes (KTZ-036-08-093.08.02, KTZ-036-08-093.08.03, KTZ-036-08-073.01.02, KTZ-036-08-073.01.03, KTZ-036-08-093.08.01, KTZ-036-01-026.03, KTZ-036-08-082.10, KTZ-036-07-168.01.01, and KTZ-036-07-168.01.02) have no platform but are part of the reduction process; the final two of these large flakes are the two refits (Figure 90). This is followed by antler chunks which have angular edges and no obvious striking platform, the largest antler chunk (KTZ-036-01-025.01.01) is the pedicel, or where the antler attaches to the skull. Additional antler chunks (KTZ-036-07-257.01, KTZ-036-08-073.01.01, KTZ-036-08-063.07.01, and KTZ-036-07-175.01) are small but angular. There is one long antler piece which is cut on either end but has since been worn (KTZ-036-08-104.04).

There are three shaved flakes of antler (Figure 91). Each flake has a portion that shows a row of curling. One piece (KTZ-036-07-119.01) has some thinning on the dorsal face which may have been part of a larger tool. Two other flakes (KTZ-036-08-088.08.03 and KTZ-036-07-202.03) are curled on one end and chopped on the other. These may be primary reduction of antler flakes from a larger core, and may have been made through the use of an adze.

Figure 91: Antler debitage: (left to right) Shaved flakes (KTZ-036-07-119.01, KTZ-036-08-088.08.03, **and** KTZ-036-07-202.02)

Chapter 6: Discussions and Conclusions

This thesis employs inferences on the faunal resources locally available in Kotzebue during its prehistoric occupation, as a comparison to the osseous tools recovered from the site to determine whether prehistoric inhabitants relied strictly on locally available osseous materials. To achieve this goal, both the faunal remains and osseous tools recovered from the KTZ-036 excavations were analyzed along with a review of structural and mechanical properties of osseous materials. Supplemental ethnographic data were used to identify specific cultural use of a given material type within the regional cultural chronology for northwest Alaska and across the North American Arctic. Modern subsistence practices were incorporated into the ecological expectations, as these data may be evidence of long-term trends in harvesting activities.

Cultural Components

The KTZ-036 excavations revealed a well-stratified sequence with clearly separated cultural components (Figure A-14 to Figure A- 18). This context includes a consistent suite of radiocarbon dates and artifacts (Figure A-14 to Figure A- 18). The radiocarbon samples and artifacts associated with the strata provide absolute ages, as well as a relative chronology, of two principal occupation periods at the site: Ipiutak and Western Thule or Kotzebue period. The Ipiutak component lies at the base of the excavation while the Thule levels are 30 – 70 cm above in the middle of the strata.

Ipiutak

The radiocarbon samples collected from the lowest occupation levels provided dates ranging from 1470 to 1240 BP (Table 4). These dates fall within the range of the Ipiutak culture defined by Giddings and Anderson (1986), between AD 1 and AD 1000 (Figure 92, Figure A-19) and are within the range common among coastal Ipiutak occupations (Gerlach and Mason 1992). The Ipiutak culture has a distinctive lithic technology (Larsen and Rainey 1948, Giddings and Anderson 1986). Two diagnostic lithic artifacts within the KTZ-036 collection include a finely-worked side blade (KTZ-036-08-053.12) and three discoidal end scrapers (KTZ-036-07-251.01, KTZ-036-07-203.01, and KTZ-036-07-291.01; Figure 26 and Figure 27). The side blade was recovered at 101 cmbs (Figure A-16) and is similar to Ipiutak pieces at Point Hope (Larsen and Rainey 1948: Plate 36). The discoidal scrapers also resemble those from Point Hope (Larsen and Rainey 1948:104), with one scraper from the lower component at KTZ-036 adjacent to ^{14}C samples RCS #2 and #4 (

Figure A-15). The faunal assemblage shows a small number of caribou in the lower levels and a higher number of seal. This is consistent with known coastal Ipiutak practices (Larsen and Rainey 1948).

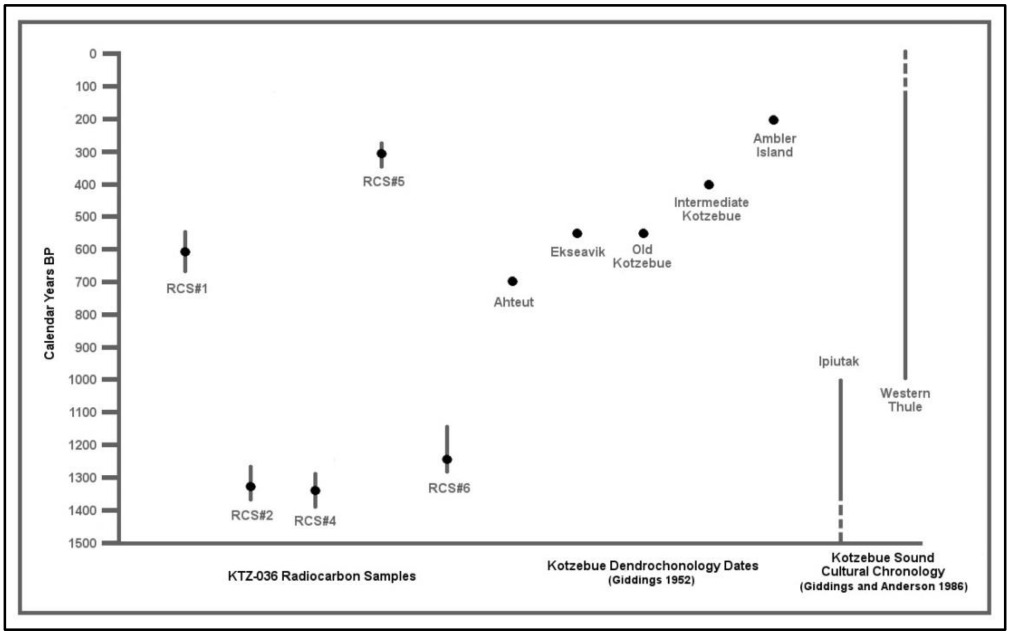

Figure 92: KTZ-036 radiocarbon samples compared to the standard chronologies of Kotzebue Sound (Giddings 1952, Giddings and Anderson 1986, VanStone 1955)

The definition of the Ipuitak culture is typically marked by the absence of ceramics. Within Locality A, ceramics were present from 10 cmbs to 100 cmbs. Six of the seven sherds were recovered from level bags within N99, W102 and N101, W104 at Level 10 at 90 to 100 cmbs (KTZ-036-07-0262.01, KTZ-036-07-0262.02, KTZ-036-07-263.01, KTZ-036-07-263.02, KTZ-036-07-263.03, and KTZ-036-07-264.01). Although the sample size is low, the presence of any ceramics, renders it difficult to consider the use of the term Ipiutak to define the lower component.

As for the context of the associated radiocarbon ages relative to the ceramics: RCS #2 was obtained at 103 cmbs, 2 m to the north, and 2 m to the west in N101, W104. Another sample, RCS #4 was in N101, W105 at 108 cmbs (Table 4). Both samples produced nearly identical age assignments: 1420 ±40 and 1430 ± 40 BP. Between the two radiocarbon samples, a green-gray chert discoidal scraper (KTZ-036-07-291.01) was recovered at 108 cmbs which is typologically similar to the Ipiutak technology. The proximity of the ceramics to the radiocarbon samples leaves room for the ceramics to be associated with these lower occupation levels. Locality B RCS# 6 returned an age range of 1320 to 1240 BP (AD 630 to 710, Table 4) which also falls within the Ipiutak range.

The attribution of all these pieces to the same component is somewhat speculative. However, the thick peat layer that is suggestive of a house depression within the Western Thule tradition is at its lowest 80 cmbs. RCS #1 was collected 2 m west of the ceramic cluster in N99, W102 in Level 6 at 58 cmbs. This sample returned a date of 660± 40 BP. The data are not conclusive, with a wide range of radiocarbon dates and possible taphonomic forces at work, the presence of pottery in what appears to be an Ipiutak setting should elicit further investigation as to whether the Ipiutak technology present in Kotzebue also had ceramic vessels in their tool kit.

Kotzebue Period

Through dendrochronology, Giddings (1952) and VanStone (1955) defined the Kotzebue Period as part of the Arctic Woodland Culture with occupation in the Kobuk River valley beginning at the Ahteut site (AD 1250) and ending with the Ambler Island site (AD 1760). Between these bounding cultures exist Ekseavik (AD 1400), Old Kotzebue (AD 1400), and Intermediate Kotzebue (AD 1550), although VanStone (1955:115) suggests the Old and Intermediate Kotzebue periods are representative of a singular culture (Figure 92).

Both upper component radiocarbon samples (RCS #1 and #5) fall within the accepted range of the Western Thule or Arctic Woodland Culture chronology. Locality A's RCS #1 provides dates from 700 to 620 BP (AD 1250 to 1330) which coincides with the oldest occupation at Ahteut. The Locality B RCS#5 ranges from 300 to 220 BP (AD 1650 to 1730) falls between the Intermediate Kotzebue period and Ambler Island occupation dates (Giddings and Anderson 1986; see Figure 92 and Figure A-19 for visual detail).

In the upper components of the KTZ-036 excavations is a wood layer at approximately 40 to 80 cmbs (Figure A-1 and Figure A-2). Much of the wood is parallel, horizontal planking (Figure 41 and Figure 42). Along with the horizontal wood pieces, this feature also contains two vertical posts in the south wall profile of N100, W106 (Figure A-1). This arrangement of wood is suggestive of house remains similar to Western Thule hoses excavated at Deering (Bowers 2009).

Found in proximity to the wood layer in Level 6 is a lithic stemmed projectile point (KTZ-036-08-047.05, Figure 26) with prominent shoulders similar to the morphology of the Intermediate Kotzebue points recovered by Giddings (1952:44). The location of this point is illustrated in the profile in Figure A-16. Also found in the wood layer is a small ivory blade (KTZ-036-07-205.01, Figure 67 and Figure 93). This piece has ownership marks, one with a long line extending from the basal crook of the artifact where the blade begins. From here two short offshoots are present near the far terminus. Each short line extends at a 45-degree angle from the main line, ending roughly when the main line ends. Other marks on the tool include two short, parallel diagonal lines, one set on the lower portion of the handle and two on the opposite edge of the blade. This pattern is seen on both faces. The two ownership marks visible on the ivory blade recovered from the KTZ-036 excavations are similar to those on artifacts recovered from the Intermediate Kotzebue House 12 and the Old Kotzebue Houses 5, 6, and 6A of the Giddings (1952:46) excavations and Kotzebue House 2 from the VanStone (1955:96) excavations (Figure 94).

Figure 93: North wall of Unit N100, W101 showing the ivory blade (KTZ-036-07-205.01) and antler projectile preform (KTZ-036-08-104.02.01) in juxtaposition to a horizontal wood beam.

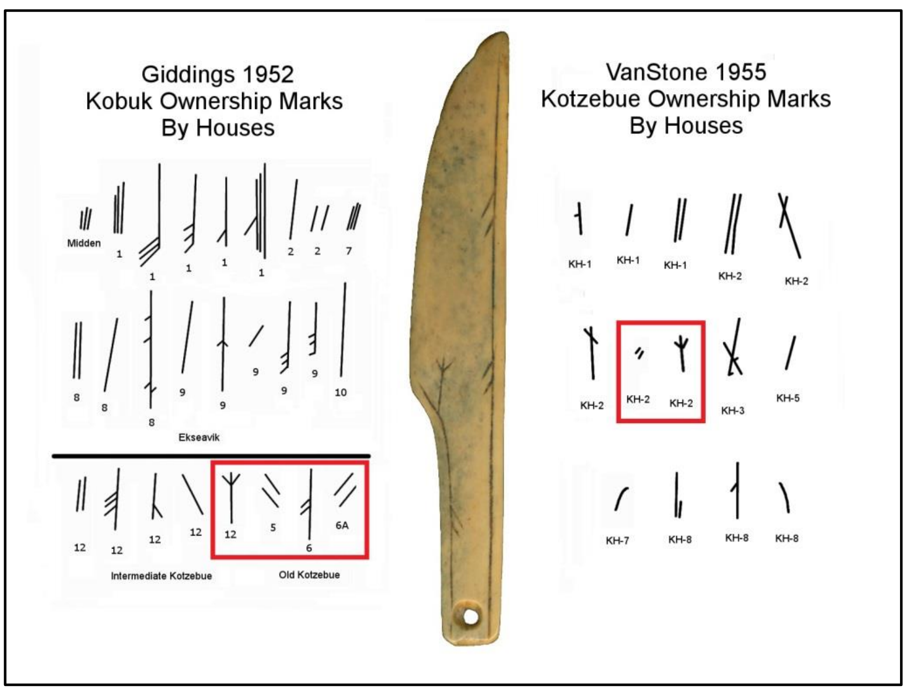

Figure 94: Ivory blade (KTZ-036-07-205.01) exhibiting ownership marks shared with artifacts from the Giddings and VanStone excavations.

Using the end rings on six structural timbers, Giddings (1952:108) reconstructed six tree ring estimates from House 12 that ranged from AD 1500 to 1529, falling in the Intermediate Kotzebue Period. The wood from Houses 5, 6, and 6A was too degraded to reliably observe tree rings from the outer surface, making dendrochronology impossible. Based on typology, Giddings placed these houses in the Old Kotzebue Period at AD 1400, based on correlations with other tree ring dated Kobuk houses upriver.

VanStone (1955:127) conducted a dendrochronological study in his Kotzebue excavations, obtaining four end ring dates from the wood recovered at House 2 ranging from AD 1315 to 1442. The radiocarbon-derived ages from this project are close to, or slightly younger than, the dendrochronological data produced by the 1950s excavations. For example, RCS#1 falls at AD 1250 to 1330, while the Giddings House 12 dates are substantially younger. However, there are 15 years of overlap with the VanStone House 2 dates possibly indicating a contemporaneous occupation of the KTZ-036 and House 2 structures.

Since VanStone's Kotzebue House 2 contained artifacts with similar ownership marks as the house partially recovered from the KTZ-036 excavations, and since the two excavations had overlapping dates, House 2 (Figure 95) may offer the closest analogue for a floor plan for the KTZ-036 house. The floor plan for Kotzebue House 2 discussed in VanStone (1955:79).

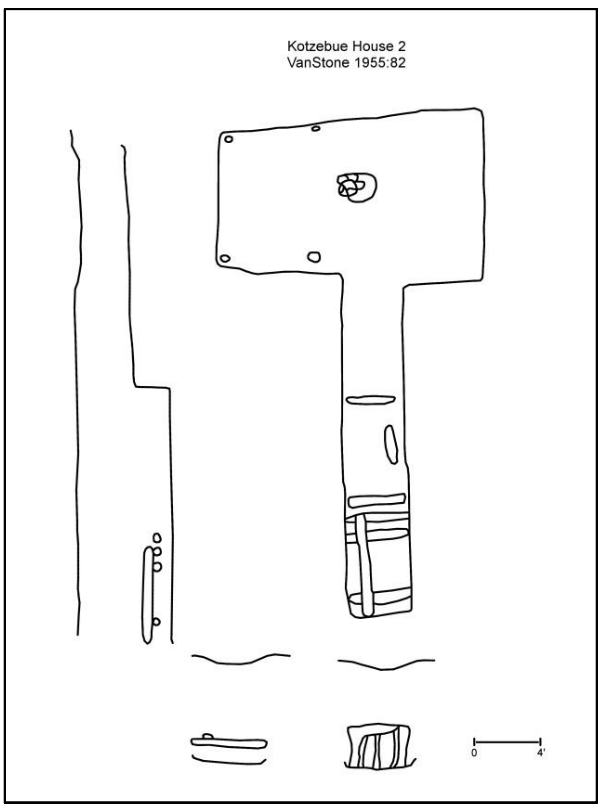

Figure 95: Profile and floor plan of Kotzebue House 2 from the VanStone excavations.

All houses excavated by VanStone (1955) have a long Arctic entry that is set lower than the both the ground level outside and inside the house, acting as a cold trap. This Arctic entry leads to a large rectangular main room with a central hearth. This suggests that the large stones uncovered in a semicircular pattern in the KTZ-036 excavation of Locality A, Unit N101, W102 may be a central hearth (Figure 42).

The Intermediate Kotzebue stemmed point, artifacts with ownership marks matching to other artifacts from the Intermediate and Old Kotzebue periods, and site dates that overlap with the lower extreme of Old Kotzebue, all fit with the chronology of the Ahteut site to the Intermediate Kotzebue period (AD 1200 to 1400). This information suggests that the occupation at KTZ-036 may span much of what is known as the Kotzebue Period. Additionally, a lower component exists that extends further back in time the known occupation of Kotzebue spit. To a degree, VanStone (1955) had already suggested a deeper timeline for Kotzebue spit, though many of his dates fall within the timeline of the proposed AD1400 dates for the Old Kotzebue Period. Radiocarbon dates from the 2007 and 2008 excavations provide earlier occupation dates for Kotzebue from those reported by Giddings (1952) by nearly 750 years (Figure 92).

Faunal Remains, Modern Subsistence, and Available Osseous Materials

The fauna identified from the KTZ-036 excavations show the relative importance of certain species to the early inhabitants of the Kotzebue Spit. Caribou is the most prevalent land mammal species (Figure 14). Caribou has a high MNI as well as a large NISP (Figure 15). The fox remains from Levels 8 and 9 number 184 elements, 177 elements with refits (Figure 14). This is suggestive of many fox being recovered at the site, but the MNI show there to be only two individuals represented (Figure 15). This is due to a nearly complete articulated fox whose lower section was recovered from Levels 6 through 8 of Unit N101, W106 (Figure 96) and whose upper section was recovered from Level 9 of the same unit (Figure 97). Aside from the missing cranium and mandible, one ulna and radius, one tibia and fibula, a set of metacarpals and some podials, this animal was nearly complete, including even the sternum and sesamiod bones (Figure 98).

Figure 96: Looking north in Levels 6-8 of Unit N101, W106 with a lower articulated section of a fox adjacent to structural debris.

Figure 97: Looking east in Levels 9 of Unit N101, W106 with the upper articulated section of a fox adjacent to structural debris.

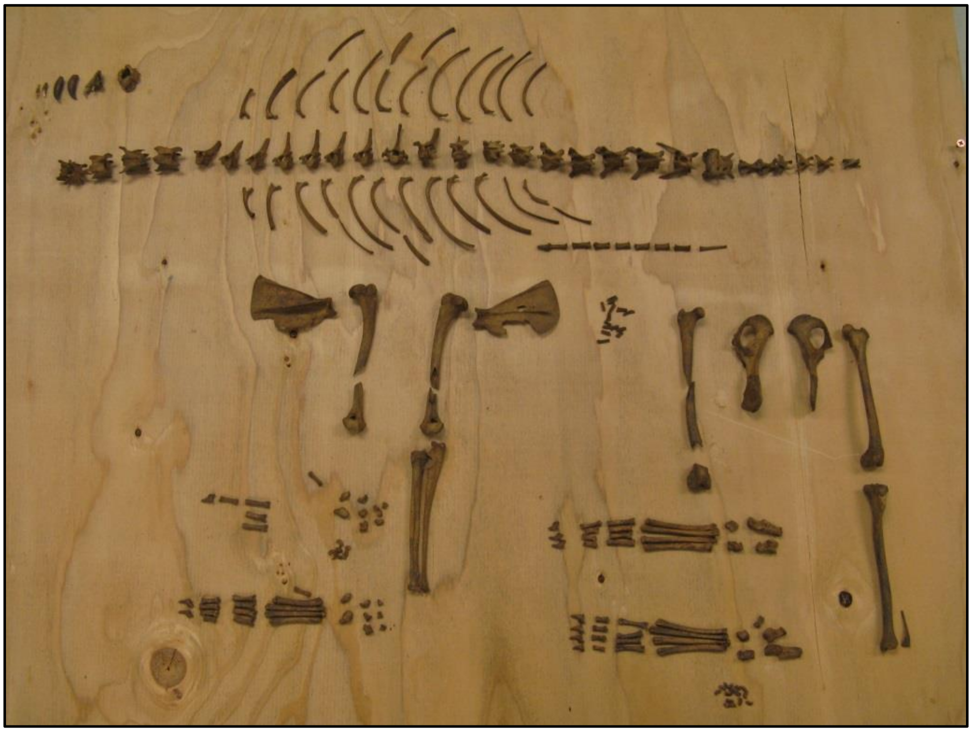

Figure 98: Nearly complete skeleton of a fox recovered from Levels 6-9 of Unit N101, W106.

Seal are the most frequently represented sea mammal in the faunal collection, with 283 remains present between Levels 3 to 5, which is almost four times the amount of the rest of the sea mammal remains combined (Figure 16). There is also a large spike in Level 10 with 50 identified seal remains. Comparing the NISP of the sea mammals to that of the MNI shows that seal still vastly outnumber the rest of the sea mammals with an MNI of 12, while the rest combined make up an MNI of only seven individuals (Figure 17).

Among whale and walrus there were only 33 remains identified in the excavation with a combined MNI of 4, though much of the 17.6% of formal bone tools recovered from the excavation were determined to be of sea mammal origin. The low numbers of recovered remains from whale (nine vertebrae, two ribs) and walrus (20 ivory or tooth fragments, one metatarsal, one rib) may point to a harvesting site with the unwanted, larger remains left behind at the processing location. Whale and walrus are also high-yield species, both in terms of raw material for tool manufacture and subsistence harvest. Walrus contributed 22 identifiable remains spread between Levels 2 and 8, where ivory represents 20.6% of the tools. This small number of walrus remains demonstrates that walrus harvest was done elsewhere or that the ivory was traded in from elsewhere, likely the outer coast along the Chukchi Sea (Figure 24). In a modern setting, walrus contribute approximately 1.1% of the overall harvest among the residents of Kotzebue (Table 2).

Both land mammals and sea mammals remains show high representation above the middle components of Level 5 but also have a small peak in Level 10. This is particularly true of the seal remains. Excluding taphonomic interference from degradation or disposal patterns, this may represent an early focus on sealing in the lower component that shifted later to harvest patterns that included large numbers of caribou. This could be a difference in seasonal site use, where the landscape was once only used during the winter for seal hunting and later used year-round for harvesting both seal and caribou, or the variation may be from natural population cycles of animals around Kotzebue Sound. Determining seasonality is outside the scope of this thesis and would require a larger sample size (see Figure 14 and Figure 16) to address this issue. Though it should be noted that a high number of migratory birds were recovered from the middle component (a summer occupation indicator), whereas below Level 7, only six migratory birds elements are present.

Harvest data from studies undertaken in 1986 and 1991 show that caribou is the top harvested species providing under one quarter of the total harvest. Ringed and spotted seal in at just under 5% in modern harvests, do not represent their numbers in the past. Bearded seal, the largest taxon, is the most harvested sea mammal, represented by nearly 20% of the total harvest for the two study years (Table 2). This shows a continued reliance on caribou but a shift in sea mammal harvesting strategies. Outside of taphonomic or sample size issues, this change could be due to a simple preference shift or it could be due to differences in sea ice formation in Kotzebue Sound over the years or a change in technology (i.e., snow machines). This is outside of the scope of this thesis.

Bird remains provide the lowest numbers of the three vertebrate classes. There are 270 identified remains with 126 belonging to aquatic birds. From Level 8 to Level 11 aquatic bird remains are mostly absent (Figure 18). This may be a taphonomic effect, as the thin, hollow bird bones are susceptible to decomposition. This could indicate a winter occupation, where aquatic, migratory birds were not harvested during the early occupation due to their lack of presence in the area. Above Level 7, dabbling duck, sea duck, swan, and gull have the highest NISP as well as an MNI of four or greater (Figure 18 and Figure 19).

Among non-aquatic birds, grouse (a group including grouse and ptarmigan) represent all but three of the 144 remains recovered from this bird group. Much like the aquatic birds, there are few terrestrial bird remains below Level 8, with only two remains recorded in Level 8. This again could be from bone degradation in lower levels or a lack of harvest of these animals during this time frame.

For the residents of Kotzebue during 1986 and 1991, Georgette and Loon (1993:125) noted that the harvest of ducks was incidental to moose or caribou hunts. Birds during these study years account for between 0.6 and 1.5% of the total harvest for each year (Table 1). Bird eggs from these study years only provide between 0 and 0.1% of the total harvest. However, since the wing bones were used to make formal bird bone tools identified from the excavations (20.6% of tools made from bone), using wing bones to estimate an MNI from the site might yield misleading results (Figure 25).

Osseous Tools and Materials

Among the 175 modified osseous artifacts from KTZ-036, roughly 15% are made from bone, 26% from ivory, and 59% antler (Figure 24). Bone is obviously the most ubiquitous material of the three, as it is present in every animal; however, it is used the least. Ivory represents around one-quarter of the recovered osseous tool kit and debitage. Considering that walrus represented under 2% (n=9) of the remains identified among the sea mammal remains alone (Figure 16), and in modern times represents around 1% of the total harvest within Kotzebue (Table 2), even where there is access to powerful engines and boats, the overall use of ivory exceeding bone by 10% deserves deeper consideration. It would appear that this material would have limited availability and would require long-distance travel or trade to the outer Chukchi coast to obtain enough ivory for tool manufacture.

Antler from KTZ-036 is assumed to have exclusively originated from caribou, as no moose remains were identified in the collection. Caribou (Figure 16) is the third most represented species in the faunal collection, after seal and fox. With a relatively high site MNI (Figure 17), caribou could feasibly result in large quantities of meat and antler.

Structural and Mechanical Properties of Osseous Materials

Scheinsohn (1999:711) postulated, “It can be supposed that raw material variability depends on two factors: (1) the availability of a given raw material in the area, and (2) the suitability of its mechanical properties when used to make a tool designed to fulfill a certain function.” The previous section established the likelihood of availability for each type of osseous material at the site in Kotzebue. This section will focus on the mechanical structure of bone, ivory, and antler. The outcome will be compared to each functional category presented in Chapter 5. This will demonstrate if there were any apparent selective pressures for the manufacture of osseous tools.

While part of a living system, bone, ivory, and antler experience different environmental stresses. These stresses include varying levels of compression and bending associated with their function, which affects the strength, stiffness, and fracture resistance of each material. While transforming the skeletal materials from their natural to technological forms, the same stressors affect how the material will react in its newly-defined function. To best understand the reaction to stressors, the chemical makeup of the osseous materials will be examined, followed by assessment of the potential forces applied to the materials.

Bone

Bone contains four main components. The majority of bone is comprised of calcium hydroxyapatite, the mineral portion that provides bone with its hard, crystalline structure for strength and rigidity and makes up 65% of bone. Collagen, a protein polypeptide that provides elasticity, comprises 25 to 30% of the bone. Fat is a component which disappears relatively quickly after burial, while the remaining 10% in living bone is water (Margaris 2006; O'Connor 1984).

When combined, these molecules form offset chains comprised of the mineral component, deposited by osteoblasts, creating a triple-helix structure that runs the length of the bone surrounding a central, somewhat linear column of collagen, with water filling in the gaps. From this structure, two different types of tissues are created: trabecular and cortical bone. The trabecular bone forms quickly with collagen fibrils growing in haphazardly, leaving a porous space within the center of the bone. This type of bone acts as a shock absorber and is surrounded by the compact cortical bone which constitutes the outer walls of the bone. Cortical bone provides stiffness and strength in the form of osteoblasts that run parallel to the length of the bone (Margaris 2006, O'Connor 1984). It is this dense cortical bone which is predominately used to create bone artifacts (MacGregor 1985).

Cortical bone is an anisotropic material, meaning that forces applied to different parts of the bone will illicit varying results based on its structural characteristics. Long bones of terrestrial animals are continually faced with compressional forces from either end of the bone as a result of the weight of the body being forced against the ground surface through gravity.

However, cortical bone can appear differently within animal species, usually based on the regular activities of the animal. Variations are most apparent among terrestrial mammals, birds, and sea mammals. For example, in studies testing the durability of a bovine tibia, it is was observed that forces applied to the ends of the bone pressing inward with the grain of the bone were twice as stiff, three times as strong, and six times more fracture resistant than when forces were applied transversely to the bone against the grain (MacGregor and Currey 1983; MacGregor 1985).

Bird long bones are tubular, with a thin cortical layer. The trabecular bone is almost non-apparent, and a central cavity containing both gases and marrow decreased the bird's weight to aid in flying (MacGregor 1985). The long bones also have supporting struts which increase the stiffness of the bone when force is applied longitudinally to either end. This allows for thin bone to hold up to large amounts of pressure (Margaris 2006).

Sea mammals, in contrast to birds, require greater bone weight and density to both maintain neutral buoyancy in the water or aid in diving, and as a result have dense trabecular bone and no medullary cavity (Margaris 2006). This allows for much of the bone in sea mammals, especially cetaceans, to be useful for tool-making, while in terrestrial mammals and birds, the porous trabecular bone limits its use in creating a viable tool.

Implications of these studies and observations show the advantages and limitations of the natural rigidity of bone. Bone can withstand a relatively high amount of directional force from either end, but not laterally. Bending stresses are the most common forms of structural failure. Translating this to human use, it is not only something to be considered when the material is being used as a tool, but also of note when the bone is being modified to become a tool.

This is especially important when considering the limitations of the cortical bone which is only best used when creating something with slender, linear characteristics such as projectiles or needles. Bird bones are also unique in that they "maintain sharp points with diameters sized appropriately for creating holes in skins and hides" (Margaris 2006:39). The exception to the normal limitation of bone due to the relatively thin cortical bone is whale bone. In this case, much more of the bone including the trabecular bone can be utilized. A benefit of whale bone, noted by Margaris (2006:198), is that it can withstand an intermediate amount of applied force with a blunt but sustained stress.

Ivory

Ivory is the name for the material found in teeth which have become over-developed and greatly enlarged in certain animals relative to the rest of their dentition. These sizable teeth are commonly referred to as tusks. For the purposes of the Arctic, and specifically around Kotzebue, the presence of ivory is found in two animals, walruses and mammoths. Mammoth tusks are recovered from the earth, as this species is now extinct. Among walrus, the tusks are enlarged maxillary canines which can reach lengths of one meter and five kilograms (LeMoine and Darwent 1998). In mammoths, these are over-developed incisors which can reach up to four meters in length and weigh up to 400 kilograms (Heckel 2009; O'Connor 1984).

The chemical makeup of ivory is the same as bone, but its mineral structure is proportionally smaller, making a tighter, stronger system than bone. Ivory also contains roughly a similar percentage of each of the aforementioned chemical components that make up the tusk. The mineral hydroxyapatite is 70% of the ivory which creates a rigid prismatic structure. The elastic collagen is only is between 15 and 20% and the remaining 10% consists of water (Heckel 2009; O'Connor 1984).

In this form up to 95% of the tusk is made of a material known as *dentine* (Espinoza and Mann 1999). Dentine involves both primary and the inner secondary dentine. The primary dentine is the portion of the tusk from which most ivory tools are made. In cross-section, primary dentine surrounds the secondary dentine which in walruses has a bubbly appearance due to it being a tightly packed system of tubes. This offers less stability when being carved due to its fracture pattern being less predictable (Margaris 2013; O'Connor 1984). In proboscideans (elephants) the dentine is constructed of a system of overlapping "V"s which are called Schreger Lines. This is a product of cone after cone growing from the pulp cavity outward (Espinoza and Mann 1999; O'Connor 1984). The transition from the primary to secondary layers of dentine in proboscideans is not easily observable.

Surrounding the dentine is a thin, dense layer of *cementum* which is around 50% mineralized and 50% collagen and water (Chandra et al. 2004). Enamel is only found at the tips of the tusks of animals. This material is approximately 95% mineralized, with the remainder consisting of collagen. This material protects the tooth when the animal is young and wears away through use after around five years (Heckel 2009).

Dentine is the workable material of the tusk or tooth and in many instances, the working surface can be all but the outer cementum. This offers a lot of material that can be carved or engraved, especially when compared to the small, outer cortical portion of the bone (Heckel 2009). Ivory also has rigidity and strength mixed with elasticity that makes it a resilient material that will keep from fracturing even with large amounts of applied stress (Heckel 2009). However, ivory does not fare well in subfreezing temperatures. As noted by Nunavut hunter, Noah Piugaattuk, "In winter, harpoon heads of antler were better than ivory harpoon heads. Antler was stronger in winter as ivory would freeze and would shatter" (Bennett 2004:265). During experiments by Guthrie (1983) and Pawlik (1994), wet and dry ivory was difficult to work when compared with other osseous materials, although the result leaves a clean, more defined etching.

Aside from its great mechanical properties, ivory also has the advantage of having a sheen or luster which can offer aesthetic properties. This can give objects intended to be ornate more allure than other material types (Heckel 2009). This sheen could also have practical purposes when considering the material's use as a tool if the function is to catch the eye.

Antler

Antler is a paired bony growth projecting from the skulls of cervids. During rut, this feature is used by males competing over females. It should be noted that among caribou, the female of the species grow antler. This is an anomaly among cervids which essentially doubles the availability of the resource to every caribou that reaches maturity (although female caribou produce smaller antler, depending on age). With respect to KTZ-036, only caribou antler was recovered and will be the only type of antler discussed.

Antler has the same chemical components as bone and ivory but is less mineralized. Antler is approximately 55% hydroxyapatite with the remaining 45% comprised of collagen and water (Guthrie

1983). Due to its lower mineral content, antler is not as stiff as bone, but because of its higher collagen content, antler is more elastic and less prone to fracture from bending or impact. This serves the animal well for collisions with the antlers of other caribou during rut. Antler is 30% more flexible than bone when tested against the grain, allowing for antler to have 2.7 times more force applied to it before losing its structural integrity (Guthrie 1983; MacGregor and Curry 1983; Knecht 1997; Wainwright et al. 1982).

Antler is a quick-growing material, which increasingly grows from the tip of the antler, or pedicle, outward. Its growth creates a cortical bone sheath with a trabecular interior, somewhat like bone, although the trabecular space is more dense and vascular. During growth, the antler grows velvet, a vascularized "skin" that covers the antlers to keep them from drying out. Arteries run the length of the antler, and after the velvet has sloughed off in time for rut a grooved appearance is left on the exterior of the cortical bone (MacGregor 1985). At this time the antler is considered dead tissue.

While covered in velvet and alive on the caribou's skull, it can withstand a slightly less force applied with its grain of growth as compared to the same forces applied against bone. When dry, bone can withstand one-and-a-half times more force before fracture, whereas dry antler elasticity is increased by two times its wet bending strength. With transverse forces applied against the grain of both bone and antler, bone strength remains roughly the same, while dry antler increases by one-and-a-half times (MacGregor 1985:27).

Through experimentation, both Guthrie (1983) and Knecht (1997) corroborate this notion that antler is much more easily worked when wet than dry. Guthrie (1983) and Knecht (1997) also note that antler makes a much more durable tool and is easier to work than other osseous materials. Antler is also less prone to breakage and is superior to bone as a material for tool-making in that the trabecular bone, although less preferred than the cortical bone, can still be used as it is much less porous than bone. Unlike bone and ivory, which are more mineralized, antler does not have the ability to hold a sharp edge as well as its counterparts (Guthrie 1983; Knecht 1997). Overall, antler appears to be the material of choice for a projectile that is absorbs the shock of a sharp impact, in fact Guthrie (1983:277) states that "Caribou antler has qualities which make it superior to virtually every other type of raw material, with the exception of metal."

Overview of Functional Osseous Tools

Considering the relative frequency of each osseous material type at KTZ-036, along with the chemical and physical structure of each material type can lead to an understanding of their individual advantages and disadvantages for durability and strength within a manufactured tool. Each functional group can then be used to determine whether a conscious decision was made to use the given material type for its function. It should be noted that the collection of these tools is small, so the association of a certain material type with a functional tool type does not exclude the potential for another possible function, but suggests the observed material type may be the most prevalent for the tool type it is representing. Certain trends became apparent from this analysis. Among the subsistence items, if the tool was intended to be used as a projectile it was most likely to be made from antler. An exception to this trend is the ivory piece (KTZ-036-07-233.01, Figure 54). It may be a broken harpoon, which provides a good suggestion for why antler is chosen as material for projectiles over ivory. Where impact was not of much concern, for instance with foreshafts or finger rests, ivory or antler was sufficient for use. For fishing gear, antler was the material of choice unless the item was a lure, in which case ivory was likely considered possibly due to its sheen.

Manufacturing items had much more diversity in the material types used than the subsistence items. Wedges and flakers are items that receive stress but require flexibility. This may be why most are made from antler. Tools used to apply sustained pressure to another object benefit from a durable material. Since the mineral content in bone and ivory are higher than antler, this could explain why the snowshoe needles, weaving tools, and especially awls and drills were made from ivory and bone. Aside from their functional use of creating or mending snowshoes, these pieces were often worn as pendants, with an attached carved ivory chain or similar linear piece used to tie it around the neck (McGhee 1977). Ivory is an attractive material choice for this type of artifact, because its durability and aesthetic properties serve both uses of snowshoe needles.

Domestic items were largely used within the home, on clothing, or as accessories. Ivory is depicted as more ornamental than the other osseous materials due to its sheen and was sought after to be displayed within a domestic setting. In the KTZ-036 collection 62.5% of these domestic items were ivory. The boot sole creaser, the two brackets, the thimble holder, and the ivory comb, all represent items where the need for durability and aesthetic value intersect. Ivory's luster, ability to maintain detailed etched designs, as well as its durability and flexibility make it the perfect material for domestic artifacts.

Sea mammal bone was exclusively used for transportation items. Sled runners are best when they are able to sustain a moderate amount of pressure over a long period, but also require long, straight sections of bone, something not possible with antler. Sled runners frequently needed to be replaced. Bone is an "inexpensive" raw material because it is present in every harvested animal. The harness swivel is somewhat cylindrical, with much of the trabecular bone in the center removed. This allows the piece to not be limited by the cortical bone.

Comparative Sites

The first four sites analyzed are in Alaska. The first of these sites, excavated by VanStone (1955), is KTZ-031 (Figure 99). Second is the Ipiutak site (XPH-003) at Point Hope, the type site for the Ipuitak culture (Larsen and Rainey 1948). This analysis illuminates how an ivory-rich location used the available materials for the creation of osseous tools. This is also true for the third analyzed site, Walakpa, a Western Thule site near Barrow (BAR-013), which also has easy access to ivory. The fourth site analyzed is Karluk One (KAR-001), a Koniag village dating from AD 1000 to 1100, located on the northwest coast of Kodiak Island. This outlier has undergone a detailed analysis by Margaris (2006) but is from a much different geographic landscape than KTZ-036. This site in helps to illustrate the preferred use of certain material types over others where both ivory and antler are uncommon (Table 6).

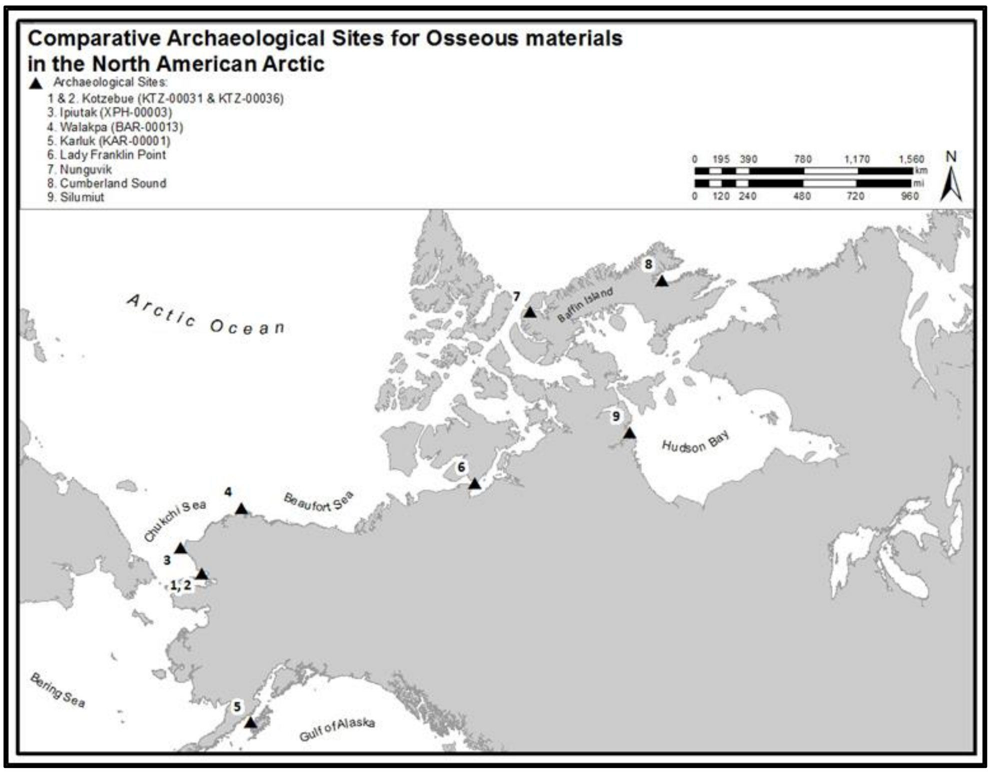

Figure 99: Comparative archaeological sites for osseous materials in the North American Arctic.

Table 6: Comparison of material types from KTZ-036 with osseous tools from sites across Alaska

	KTZ-036				KTZ-031				Ipiutak				Walakpa				Karluk			
Tool	**#**	**B**	**I**	**A**	**#**	**B**	**I**	**A**	**#**	**B**	**I**	**A**	**#**	**B**	**I**	**A**	**#**	**B**	**I**	**A**
Bird Blunts	2	-	-	100	10	-	-	100	43	-	-	-	-	-	-	-	-	-	-	-
Arrowheads	3	-	-	100	49	-	14	86	1172	-	2	98	400	-	-	100	28	64	-	36
Leisters	4	-	-	100	17	-	-	100	11	-	-	-	?	-	-	100	-	-	-	-
Foreshafts	2	-	50	50	-	-	-	-	-	-	-	-	10	-	100	-	-	-	-	-
Harpoons	2	-	-	100	3	-		100	159	-	**E	**L	52	2	40	58	38	16	-	84
Finger Rests	2	-	-	100	1	-	100	-	-	-	-	-	0	0	0	0	-	-	-	-
Lures	2	-	100	-	4	50	50	-	-	-	-	-	-	-	-	-	-	-	-	-
Handles	7	-	-	100	46	28	-	72	-	-	-	-	-	-	-	-	-	-	-	-
Wedges	13	23	-	77	26	31	-	69	47	<3	<3	97	-	-	-	-	35	91	-	9
Snowshoe Needles	2	-	100	-	-	-	-	-	-	-	-	-	1	-	100	-	-	-	-	-
Needles	1	100	-	-	-	-	-	-	148	100	-	-	-	-	-	-	-	-	-	-
Bodkins, Awls	4	75	-	25	26	23	15	62	338	0.3	<99.7	<99.7	-	-	-	-	30	74	3	23
Combs	2	-	50	50	2	-	100	-	-	-	-	-	0	0	0	0	-	-	-	-
Thimble Holders	1	-	100	-	-	-	-	-	-	-	-	-	1	-	100	-	-	-	-	-
Sled Runners	2	100	-	-	11	91	-	9	-	-	-	-	1	100	-	-	-	-	-	-
Harness Swivels	1	100	-	-	-	-	-	-	-	-	-	-	1	-	100	-	-	-	-	-

*# = Number of total tools, B = Percent of bone tools, I = percent of ivory tools, A = percent of antler tools
**E = more tools early in the period were of that material type, ** L = more tools late in the period were of that material type

Between the two Kotzebue sites, there are few noticeable differences. For the projectiles, antler is still the most common material used. Only14% of the arrowheads are made of ivory. VanStone (1955:96) notes that 11 of the 49 arrowheads have ownership marks. It is not explicitly stated if these are the ivory pieces. The single finger rest, recovered by VanStone (1955), is ivory, where both KTZ-036 finger rests were antler.

Fishing tools show a slight disparity, with some bone present among both the lures and net handles. Wedges still show a mix of bone and antler, leaning more heavily toward antler with no ivory being present. Among the wedges, VanStone (1955:106) notes that whale bone wedges tend to be larger than antler wedges. The greatest difference is among bodkins and awls where most within the KTZ-031 assemblage are antler instead of bone. The combs in the KTZ-031 excavation are made exclusively of ivory and bone dominates the material type of the sled runners.

Ipiutak at Point Hope has dates ranging from the 200 BC to AD 900 (Mason 2006). Among the arrowheads, 1,172 were collected by Larsen and Rainey (1948) and 98% of these were antler. The remaining 2% were ivory. Ipiutak at Point Hope is a hotspot for walrus and their ivory, yet antler dominates this category. Within the fauna recovered from the Ipiutak site, 53% of the bones were seal, 23% were walrus, 12% came from bearded seal, and only 10% were caribou. The remaining 2% came from birds, fox, squirrel polar bear, whale, wolf, and beluga.

With walrus contributing nearly a quarter of the estimated harvest and caribou representing 10%, it is likely that tusks outnumbered caribou antlers (Larsen and Rainey 1948:68). However, the disparity between the more than 1,100 projectiles points of antler and the 23 ivory arrowheads indicates antler is the preferred material for making projectile points. Larsen and Rainey (1948:63) noted that all 23 ivory arrowheads had incised lines. These lines could represent ownership marks, giving a reason as to why ivory is more likely used in this type of hunting scenario over antler. There is evidence of a substantial amount of ivory at Point Hope. From Larsen and Rainey's (1948) account, Plates 58 to 71 show 227 openwork carvings and chains. Of these, only one is antler and one is made from jet; the remaining 225 are made from ivory. This shows that ivory was harvested in large quantities but seemingly used for purposes other than hunting.

Larsen and Rainey (1948) also note a change over time for using ivory as the preferred material for harpoons. Later in the occupation, antler became the preferred material for harpoons. Antler remained the preferred material for wedges, with antler contributing 97% of the material for wedges. Bone was the preferred material for needles in the Ipiutak culture, and equally so in the other two Kotzebue excavations. Larsen and Rainey (1948) also noted antler and ivory to be the primary materials for bodkins and awls, which is different from both Kotzebue excavations, in which bone was either the first or second most utilized material.

Near Barrow at Walakpa is a Birnirk and Western Thule site excavated by Stanford (1976). At this excavation antler was the only material from which both arrowheads and leisters were made. All foreshafts at Walakpa were ivory. Most harpoons were made of antler (58%), but ivory made up 40% of the harpoons. Bone was used for only 2% of the harpoons. The one snowshoe needle was ivory, keeping with the trend at KTZ-036. This is the same for the single thimble holder at Walakpa that is also made from ivory, like the one recovered from KTZ-036. The sled runner is bone, like those from both Kotzebue excavations and unlike at KTZ-036, the dog harness swivel is made from ivory rather than bone.

The site at Karluk (KAR-001) on the southwest coast of Kodiak Island is an area known for its absence of both ivory and antler. Neither walrus nor caribou frequented the island until modern times (Margaris 2006). The site at Karluk dates to the Early Koniag Period which is between AD 1200 and AD 1400 (Partlow 2000:74). Margaris (2006) noted arrowhead composition to be 36% antler and 64% bone. Harpoons were even more commonly made from antler (84%) and only 16% were made from bone. Antler could come from trade or harvesting by the residents of western Kodiak across the Shelikof Strait before European contact. Margaris (2006:192-193) describes ethnographic accounts from Russians living in Kodiak during the early nineteenth century about trade with people of the Alaska Peninsula for antler. Among wedges, bodkins, and awls, bone is the main material type (91% in wedges and 74% in bodkins and awls). The remaining percentage of both tool types is made from antler, with the exception of bodkins and awls where 3% (n=1) of the tools was made from ivory. This was likely a product of transport or trade from the mainland or beyond.

The fifth through eighth sites were analyzed by McGhee (1977) for their osseous material use in coastal Canadian Thule sites across the North American Arctic. These sites extend from Victoria Island in western Nunavut to the eastern coast of Baffin Island. They are Lady Franklin Point, Nunguvik, Cumberland Sound, and Silumiut (Figure 99; Table 7). The data for the percentages of material types among osseous tools recovered at these sites were synthesized by McGhee (1977), with the Cumberland Sound data from Schledermann (1975) and the artifacts from the other three sites from the collections of the Archaeological Survey of Canada cited within McGhee (1977) (Table 7).

Table 7: Comparison of material types from KTZ-036 with osseous tools from Western Thule sites across Canada

	KTZ-036				Lady Franklin Point				Nunguvik				Cumberland Sound				Silumiut			
Tool	**#**	**B**	**I**	**A**	**#**	**B**	**I**	**A**	**#**	**B**	**I**	**A**	**#**	**B**	**I**	**A**	**#**	**B**	**I**	**A**
Bird Blunts	2	-	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arrowheads	3	-	-	100	87	-	-	100	29	-	-	100	2	-	-	100	10	-	-	100
Leisters	4	-	-	100	2	-	-	100	2	-	50	50	6	66	17	17	5	-	20	80
Foreshafts	2	-	50	50	3	-	-	100	4	75	25	-	12	100	-	-	2	-	100	-
Harpoons	2	-	-	100	35	10	-	90	21	52	5	43	51	41	26	33	64	39	33	28
Finger Rests	2	-	-	100	0	0	0	0	2	-	50	50	4	25	50	25	3	-	100	-
Snowshoe Needles	2	-	100	-	0	0	0	0	2	-	100	-	8		100	-	3	-	100	-
Combs	2	-	50	50	1	-	100	-	3	-	100	-	2		100	-	2	-	100	-
Thimble Holders	1	-	100	-	0	0	0	0	0	0	0	0	0	0	0	0	1	-	100	-
Sled Runners	2	100	-	-	2	50	-	50	8	100	-	-	50	96	4	-	8	100	-	-
Harness Swivels	1	100	-	-	1	100	-	-	9	45	45	10	22	95	5	-	1	-	100	-

*# = number of total tools, B = percent of bone tools, I = percent of ivory tools, A = percent of antler tools

At the middle Thule site on Lady Franklin Point of southwestern Victoria Island, the main industry practiced in this area is antler-working, with caribou and ringed seals are the staple of those living at the site (McGhee 1977). Among arrowheads, leisters, and foreshafts, antler is the exclusive material used for the creation of these tools. The harpoons artifacts are nearly completely made from antler (90%) with bone being the remaining 10%. Among domestic items, artifacts at Lady Franklin Point, such as combs, were commonly made from ivory. In transportation items, sled runners were 50% antler and 50% bone with the harness swivel also created from bone.Nunguvik, on the north shore of Baffin Island, is an early-to-middle Thule site that focuses heavily on antler-working with respect to arrowheads, All 29 tools were made from antler. There we only two recovered leisters; one is antler, the other ivory, and among foreshafts, three were ivory while one was antler. What is notable about the harpoons (n=21) is the heavy use of bone for these tools at Nunguvik, with 52% made from bone, 43% from antler, and 5% ivory. The finger rests are represented by two examples; one is antler, the other ivory.

Two snowshoe needles recovered at Nunguvik are ivory, which is consistent with the other sites. This is also true for the three combs which are more commonly not made from ivory. All sled runners (n=8) are made from bone, while the harness swivels (n=9) are at their most diverse in Nunguvik with 45% made of bone, 45% ivory, and 10% antler. There are very few harness swivels recovered in archaeological assemblages. Generally this tool is made from either bone or ivory. There are nine harness swivels from Nunguvik, displaying some diversity in material type. Ten percent of these tools are made of antler, and the remaining 90% split evenly between bone and ivory.

The Cumberland Sound site on the southeast shore of Baffin Island is a middle-to-late Thule site. Like the other Thule sites, antler is the exclusive material type choice for arrowheads at the Cumberland South site (n=2). The leister points (n=6) at Cumberland Sound are unique in that most (66%) are bone. This is the only site analyzed where antler is not the most utilized material for leisters. At Cumberland Sound one antler and one ivory leister each represent 17% of the material type for that tool. Nunguvik and the Cumberland Sound Site both use bone as the major material type choice for foreshafts (n=12). This is unlike any other site included in this comparison. Like at Nunguvik, bone is the most commonly observed material type for harpoons at the Cumberland Sound site at 41%, followed by antler (33%) and ivory (26%). The finger rests at Cumberland Sound are the most diverse of any other site where it is the only site in the analysis with a finger rest made from bone (n=1), while the other three finger rests are made from antler (n=1) and ivory (n=2).

With the largest collection of snowshoe needles (n=8), all are made from ivory, keeping in common with the other analyzed sites. The same is true for combs, where both recovered pieces are ivory. Again, most of the sled runners are bone (96%), although 4% are made from ivory. Cumberland Sound is the only site in which ivory is used for sled runners. Among harness swivels at the site 95% are bone and 5% are ivory, similar to other sites with this tool type.

Silumiut is an early-to-middle Thule site on the inner northwest coast of Hudson Bay. The 10 arrowheads from the site are all antler. Like other sites, antler makes up the majority of the Leister points (n=5, 80%). Ivory is twenty percent of the Leister points. Both recovered foreshafts are ivory.

The harpoons (n=64) recovered from Silumiut, like those from Cumberland Sound, represent almost an equal split between the three material types although bone is still the most recovered material for harpoons (39%) followed by ivory (33%) and antler (28%). This is the only site among those analyzed where antler is the least used material type for harpoons. The finger rests at Silmiut are all ivory, as are the snowshoe needles. The combs and thimble holder are all ivory as well. The sled runners, however, are all made exclusively of bone, which is the general trend for these tools. The harness swivel recovered from Silmiut is made from ivory which is consistent among the other sites within the comparison.

Cultural Influences

McGhee (1977) observed that among four Canadian sites, Lady Franklin Point, Nunguvik, Cumberland Sound, and Silumiut, and the Alaskan site, Walakpa, all arrowheads used for terrestrial hunting were made from antler, but varying frequencies of bone, ivory, and antler were used across the Arctic to make harpoons. At Walakpa and Lady Franklin Point, antler is dominant. At Nunguvik, Cumberland Sound, and Silumiut, bone is most prevalent followed by antler, except for at Silumiut, where ivory supersedes antler (Table 7).

McGhee (1977:145) proposes that the apparent lack of a functional explanation for material type selection among harpoons is due to symbolism culturally imposed on the osseous materials. Since the current Inuit culture is the direct descendant of the Thule culture, it may be possible to draw analogies from what is known of the modern culture. When reviewing the record of ethnographic pioneers among the Inuit people (Brower 1994, Jenness 1991, Maus 1906, Murdoch 1892, Rassmussen 1925, 1929, 1930) it is evident that there is a strict set of cultural rules involving hunting, treatment of the animal after the harvest, and gendered division of labor in processing the harvest. Infused in the culture are also charms or traditions that help in the hunt, and in some instances these traditions dictate which osseous materials are used for specific tools. An Amitturmiut man of Nunavut, Noah Piugaattuk, notes of his harpoon that the "foreshaft was made of ivory for the walrus harpoon; this is in connection to the fact that the walrus used their tusks as their own hunting implements" (Bennett 2004).

McGhee (1977:145) then postulates, "ivory was linked symbolically by the Thule craftsman with a set of mutually associated concepts: sea mammals, women, birds, and winter life on the sea ice" and that antler “may have been linked with a set of concepts opposed to these: land mammals, particularly the caribou, men and summer life on the land.” This is presumed to stem from the dichotomy in Inuit culture of treatments between the land versus the sea (Mauss 1906) and maintaining separate cooking pots for animals from land versus sea and many other activities where mixing the two types of activities involving the two types of animals should not overlap. This includes sewing caribou skins while on open ice or wearing walrus skins on a caribou hunt (Rasmussen 1929:193, 1930:48). McGhee (1977) cautiously concludes that this ideology can also be extended to hunting weapons.

There may be some merit to this claim, but McGhee’s (1977) short article does not delve into the mechanics of the materials. The analyses performed in this thesis identify subsistence, structural, and mechanical considerations for osseous tool material type choice that McGhee does not consider, which could provide insight into the degree of influence ideology has on tool making material selection.

Consider once again antler’s properties as a flexible material expressed earlier in the chapter. Arrowheads (e.g., Figure 53) recovered around the Arctic during the Thule culture occupation are commonly slender and thin, and the ability of the material type to absorb the shock of impact is important. The shock cannot be distributed well throughout the entirety of the piece given its morphology. This is why antler is an important material for use with these tools. In harpoons, the length-to-width ratios of these tools is smaller than that of arrowheads, and they are often more robust. Any of the materials use for harpoons are durable enough to withstand an impact. The energy will be absorbed throughout the thickness of the piece. So, whether or not there was a cultural tradition of keeping material types separate, it was fortuitous at the least that the slender pieces were allowed to be created from the most suitable material.

The results presented in Table 7 show that an abundance of ivory does not affect the percentage of harpoons made from ivory. One interpretation may be that areas with less access to walrus could use ivory as a prestige item, making even their harpoon heads from the material. Regardless, as bone is the top material type for harpoons at three of these Thule sites, the number of faunal remains for whale at each site should be considered.

Other considerations not mentioned by McGhee (1977) could be seasonality or style of hunting at each occupation site where open water hunting from kayaks and ice floe hunting would benefit from the use of different materials. For instance, traditional knowledge from Nunavut notes that ivory is not a good material for hunting on ice as it is rather brittle when frozen (Bennett 2004:269). This would mean that bone or antler could prove more advantageous in ice floe hunting. In open water, having an ownership marks on tools may be an important consideration. Ivory is known to hold an etching better than the other osseous materials (Lucier and VanStone 1995:118).

This does not diminish the fact that cultural tradition could have solidified the use of a specific osseous material for a designated tool, as repeated use of that material type would have proved to be superior over another osseous material. This should only be considered for tools in which function is predicated upon ability to hold up to the applied forces. Besides tools like arrowheads and harpoons, where the tool has to stand up to a hard impact, items like awls, bodkins, and needles (where great amounts of pressure are applied to puncture other durable materials), or items such as wedges (that have an intense force applied to them), the selection of a given material type would then only be restricted by the material's ability to meet the dimensional requirements of the tool being created. This could indicate why many domestic items are created from ivory, as the aesthetics rather than structural and mechanical properties could outweigh the ability of the material to stand up to mechanical forces leading to structural failure. In this regard, for tools without structural or mechanical requirements, cultural values separating the land from sea could easily dictate what osseous materials were used for certain items without being overtly impractical.

Conclusion

Conclusions, Limitations, and Future Research

The hypothesis that a faunal collection present at a site can dictate items found within an osseous toolkit is partially supported by the KTZ-036 archaeological collection. The idea that osseous material choice is based exclusively on resource availability predicted through the faunal assemblage at KTZ-036 was not entirely supported. The antler, harvested from caribou (n=177), is the most commonly represented osseous material at KTZ-036. This could feasibly support the creation of a large toolkit, where antler represents 58.9% (n=103) of the overall modified osseous material collection (Figure 49). However, more ivory is present in the collection than would be predicted from the faunal collection. Walrus represented 1.5% (n=22) of the elements thought to contribute to the use of osseous material manufacture, but the modified collection of ivory is 26.3% (n=46) of the tools recovered at KTZ-036 (Figure 25). The explanation for the high number of ivory artifacts may be that the material was a prestige item for the culture. It is also be possible that the harvest of walrus was elsewhere, leaving most bones, but not the ivory, at the kill site. Whale (n=11) and bird (n=720) are also represented in the faunal collection, but as bone tools only represented only 14.9% (n=26) of the modified osseous materials.

What is to be taken from this exercise is that caribou antler was fortuitously present and available around Kotzebue spit for the manufacture of various tools. Coincidentally abundant at the site, when considering structural and mechanical properties, antler outperforms other osseous materials when used for specific functions. Ivory and bone also have characteristics that promote their selection over other materials for specific functions.

Tools with high impact potential are more frequently made from antler. These include projectile points, arrowheads, and possibly harpoons. Tools that require durability with applied pressure on a limited surface, such as drills, are more likely to be made from ivory. Tools under direct pressure with the intent to maintain a point and puncture another material, such as awls, will likely be made from bird bone. Tools that sustain an intermediate and uniform pressure along their length, like sled runners, are more likely to be made from sea mammal bone. Tools that have no discernible forces applied to them, such as finger rests or dog harness swivels, are more likely to not be made of a specific material.

Aesthetics should also be considered in the use of ivory. Personal or domestic items are more likely to be made from this material, as shown where 62.5% of domestic tools from the KTZ-036 collection were made from this material. Ivory could have been a highly sought after commodity in Kotzebue and interior Alaska, as walrus do not frequent the inner coast of Kotzebue Sound.

Limitations of this research include the small sample size of both the faunal remains and the osseous tools recovered at the KTZ-036 site. Further studies could include supplementing this small collection with the materials from the recent excavations in Kotzebue over the past five years. This includes the collection recovered by Northern Land Use Resources Alaska (NLURA) while conducting the monitoring portion of this project (Carlson et al. 2013), as well as THRC (Cassell et al. 2010; Corbin and Tedor 2013) or SWCA (forthcoming) that recovered items from the Intermediate Kotzebue period.

One additional avenue of study could be observing what the tools could reveal about artifact rejuvenation. Some of the osseous tools appear to have been broken and reworked. Creating methods for observing the *chaîne opératoire* could be a thesis in itself. Another avenue of study leading from this thesis could entail a more systematic analysis of the origination of the osseous material types recovered from the site. For antler, this could include identifying the herd through stable isotope analysis. For ivory, a similar sourcing could be attempted which could possibly identify hunting or trading practices from the outer coast. Experimental archaeology for showing break patterns, use wear, and rejuvenation of tools is another possible research avenue.

Kotzebue and the surrounding area was a great hub for trade as it was easily accessible from the outer coast, a source of the highly prized ivory. It also has three major rivers reaching from the interior, offering all the caribou one would require for food, clothing, and tools. Beluga, birds, and fish seem also to have been plentiful, rounding out almost any resource need.

The prehistoric inhabitants of Kotzebue were fortunate to live in an area that provided them with enough animals to harvest for subsistence needs. This includes caribou which not only provided food but also antler for most of their osseous tool needs. When necessary, it seems through trade or long distance travel that ivory or whale bone were also obtained. Where bone has its strengths, and ivory has its aesthetics and the medium for masterful engraving, antler is really the best osseous material to have at one's disposal for tool-making. Again quoting Guthrie (1983:277), "Caribou antler has qualities which make it superior to virtually every other type of raw material, with the exception of metal."

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Appendix

Excavation Profiles

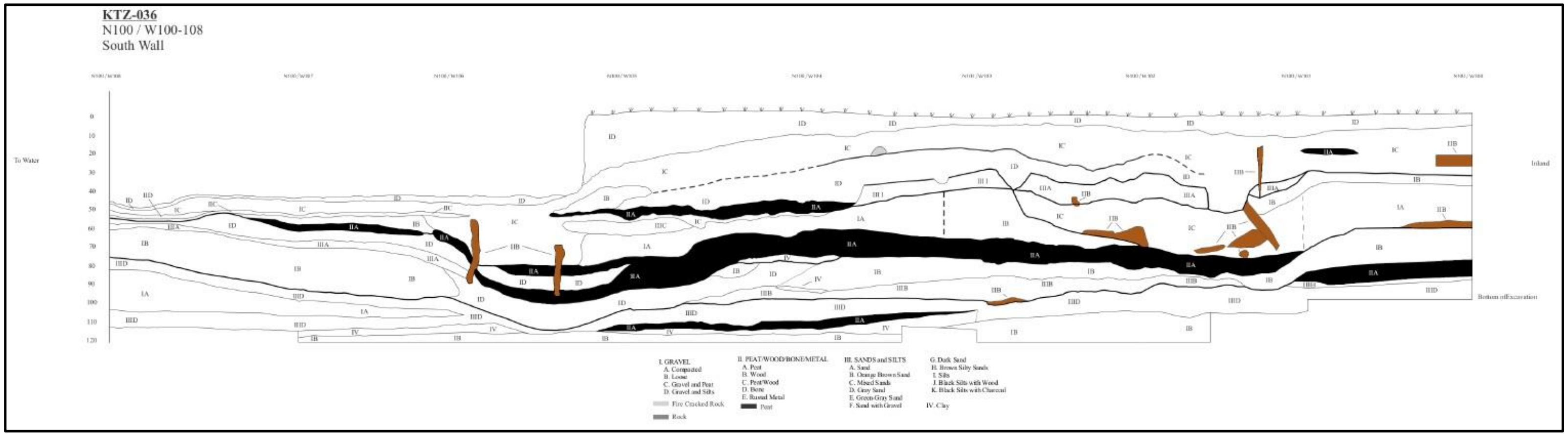


Figure A-1: N100/W100-108

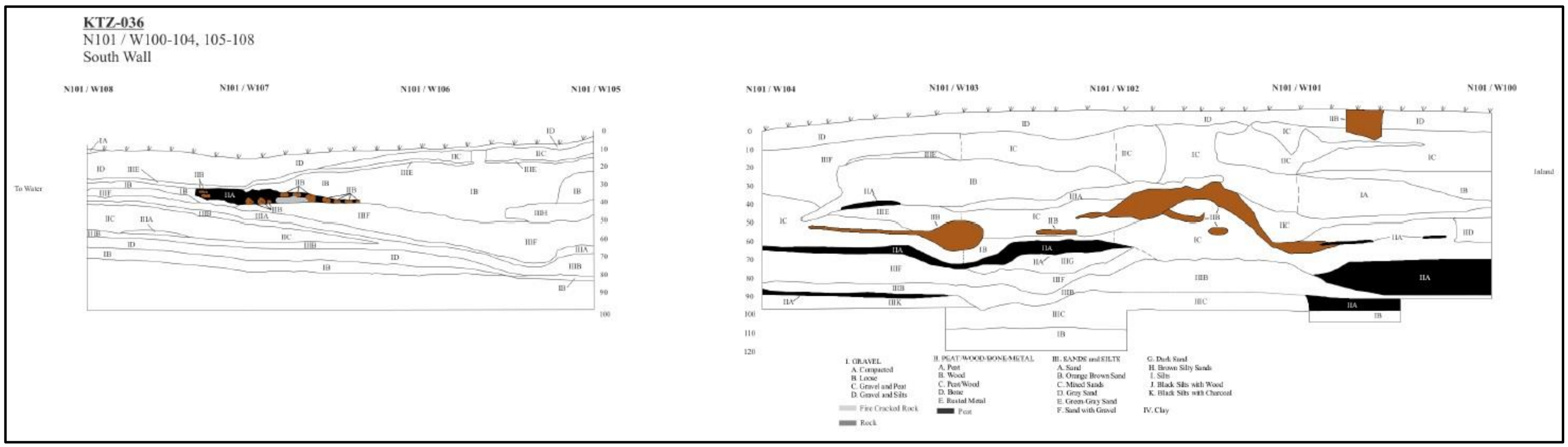
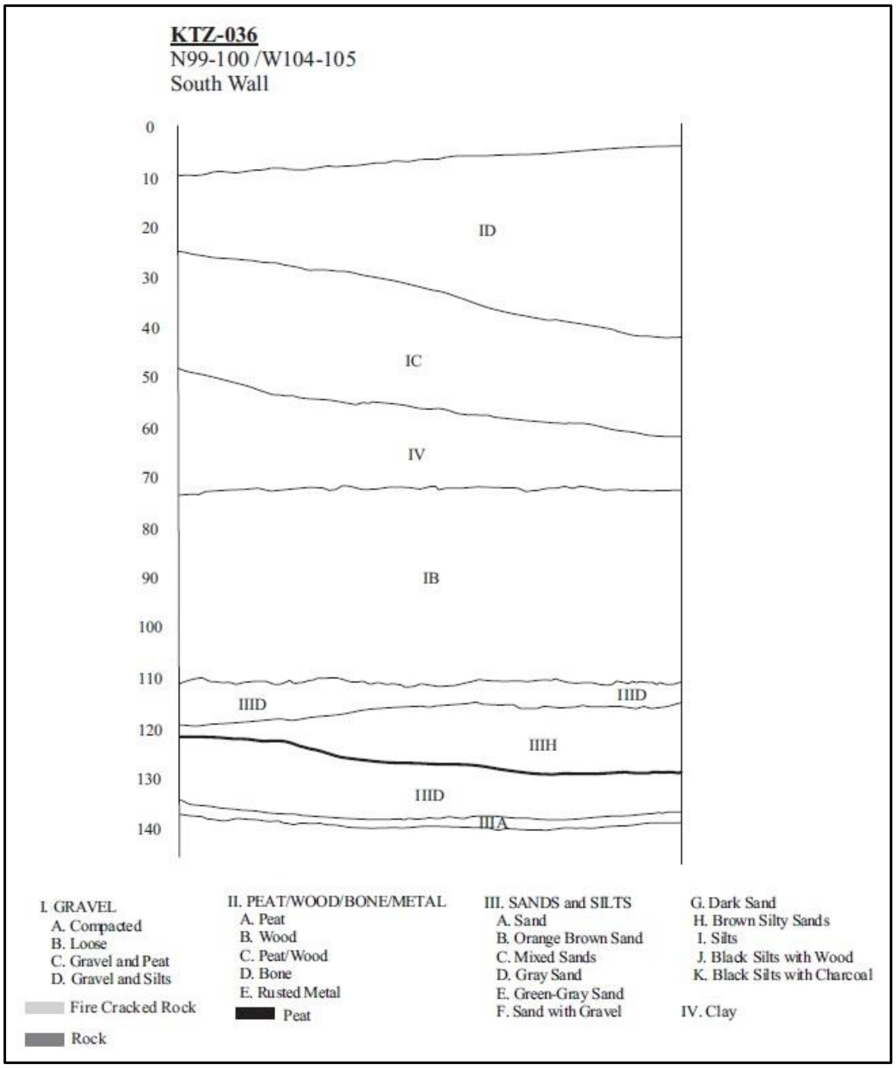


Figure A-2: N101/W100-104, 105-108



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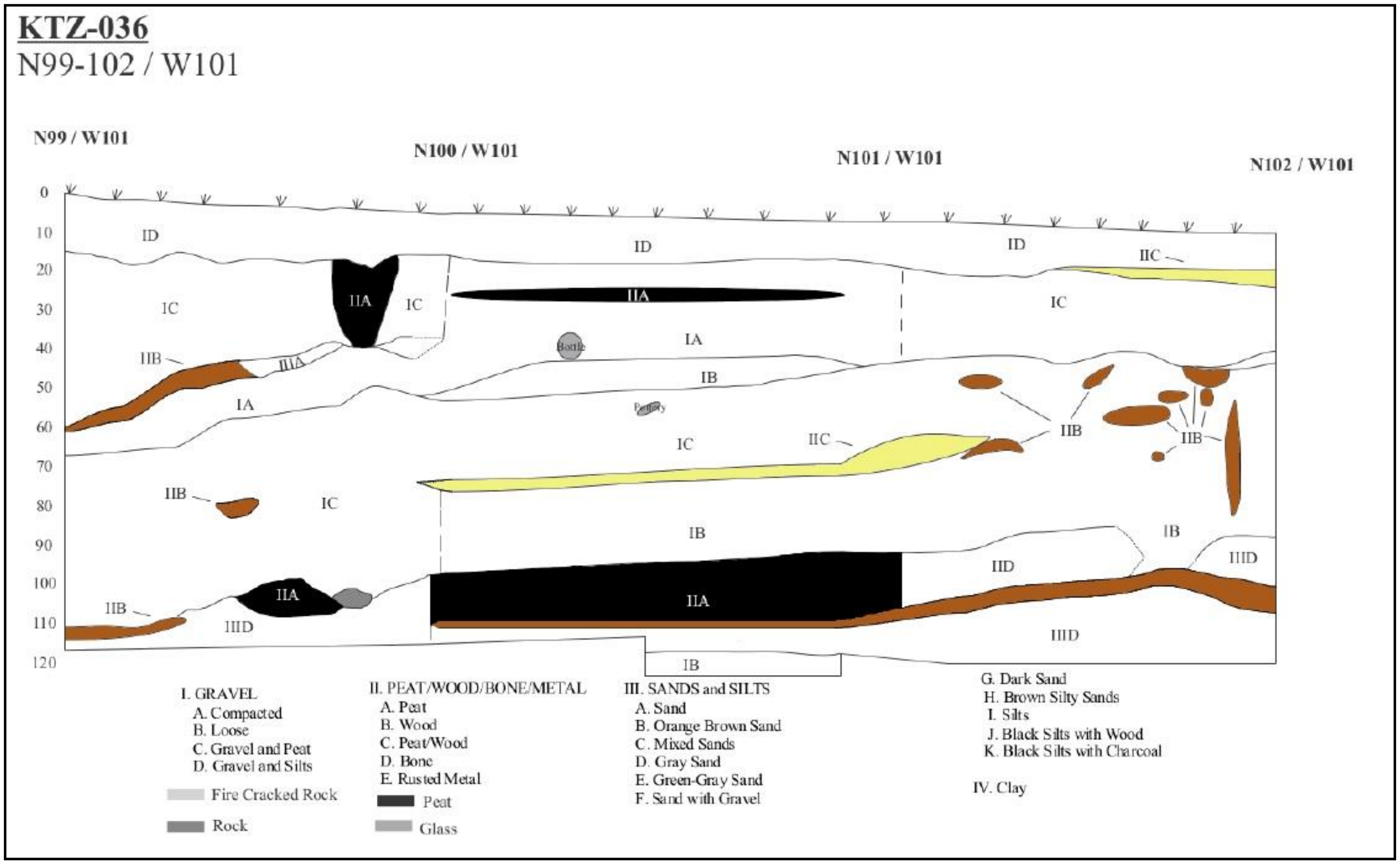

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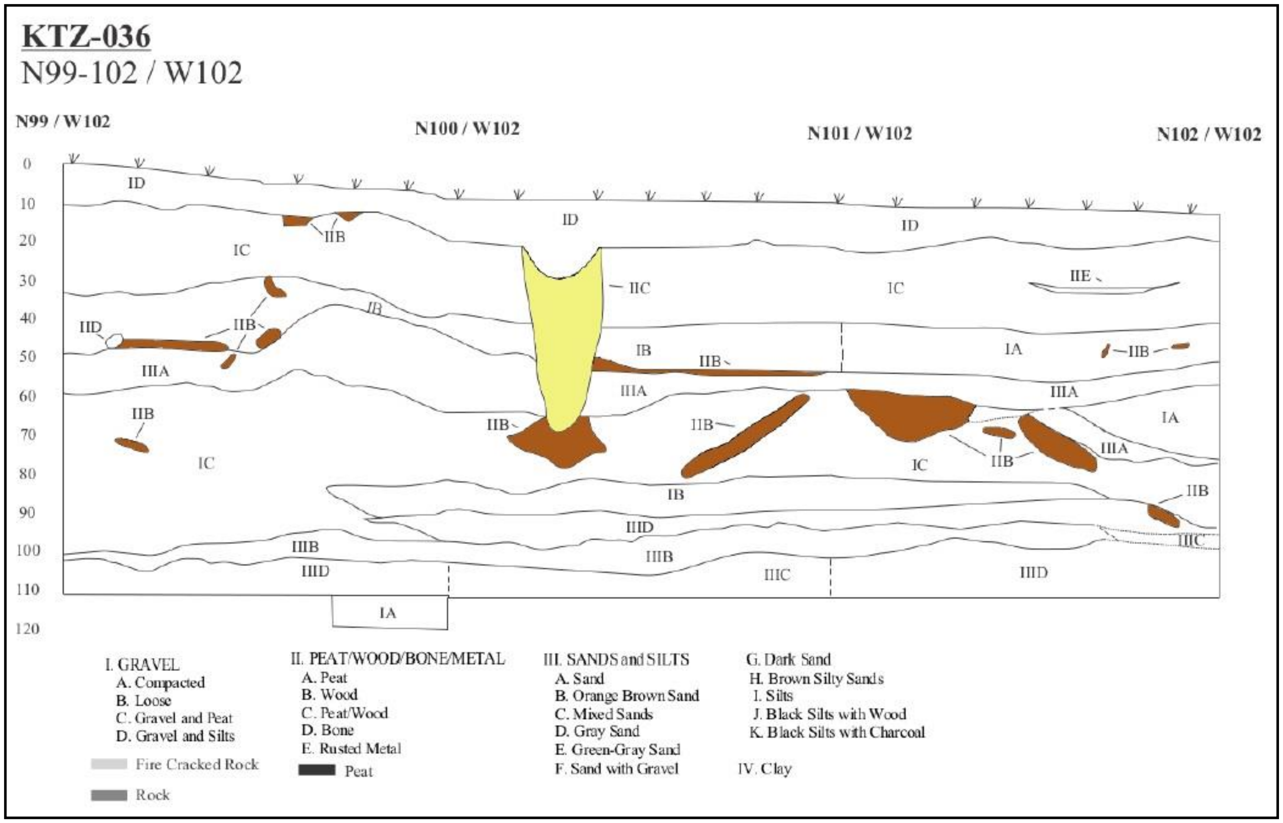

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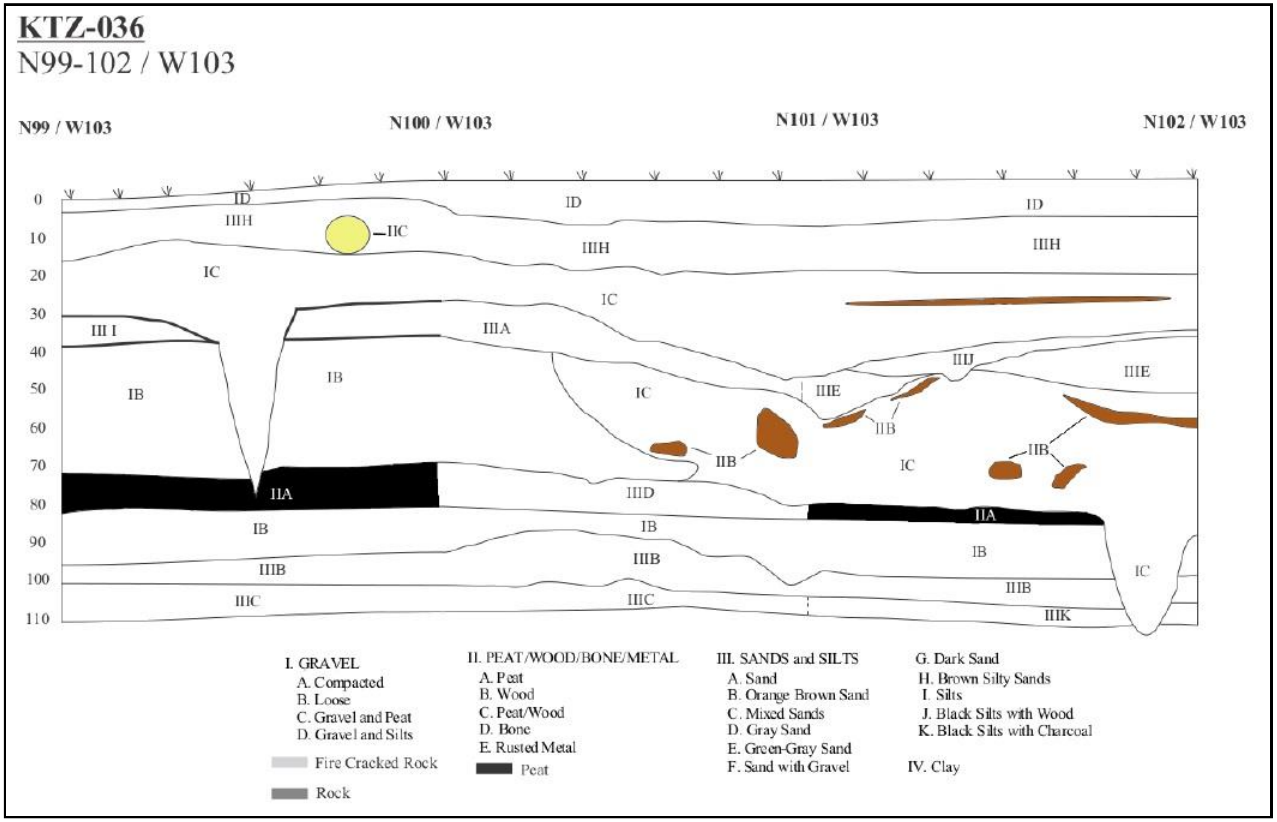

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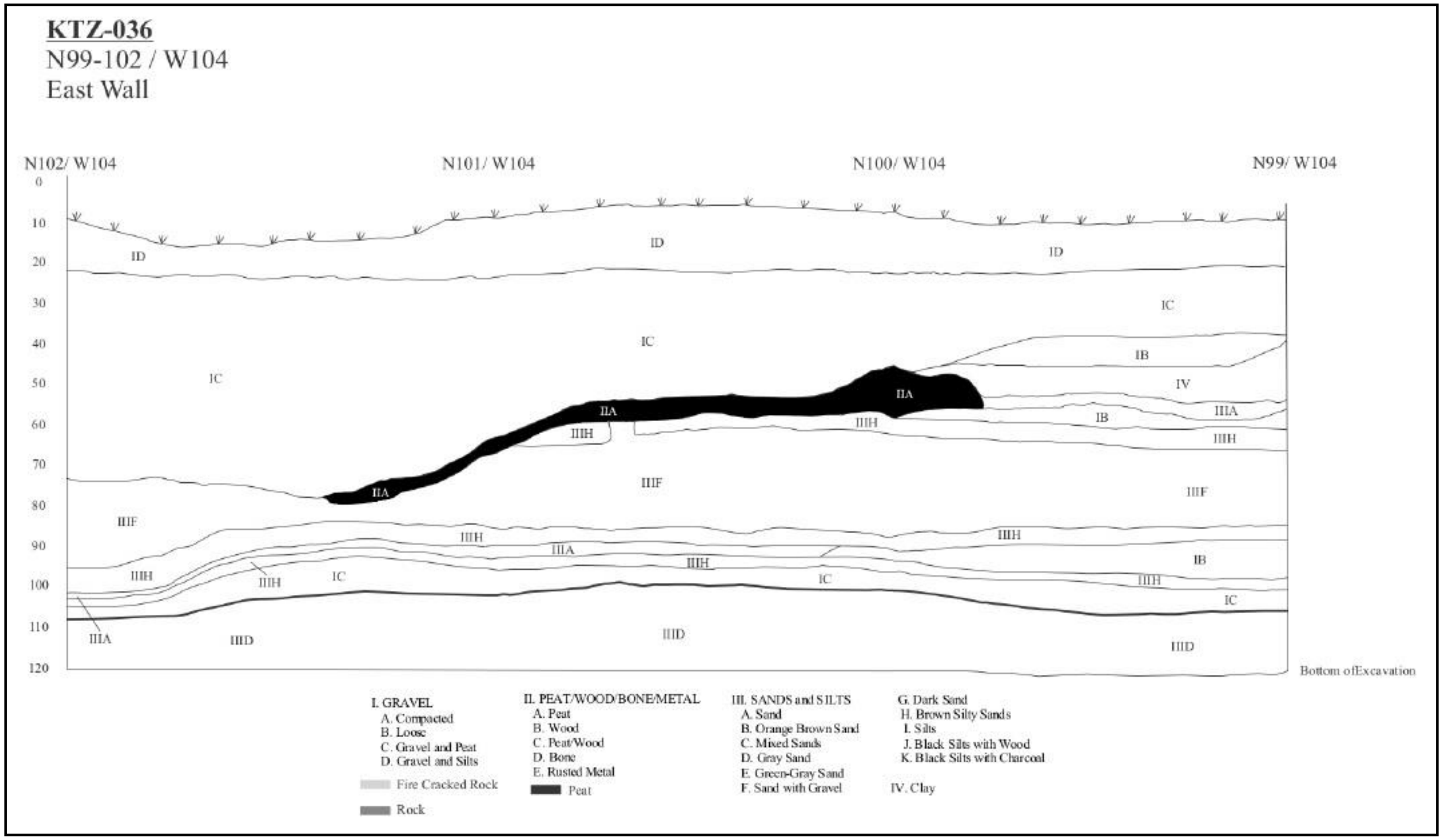

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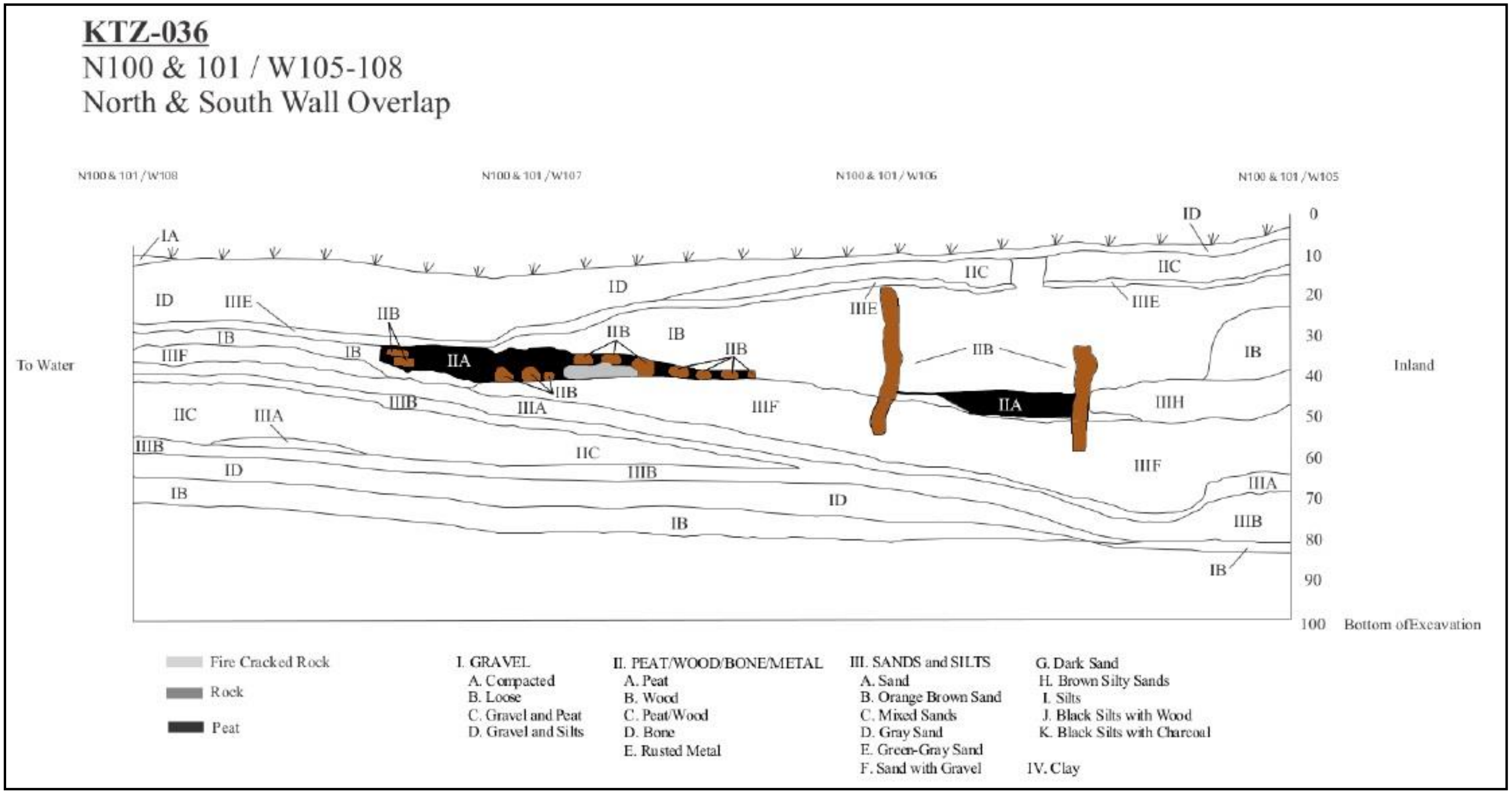


Figure A-8: N100&101/W105-108

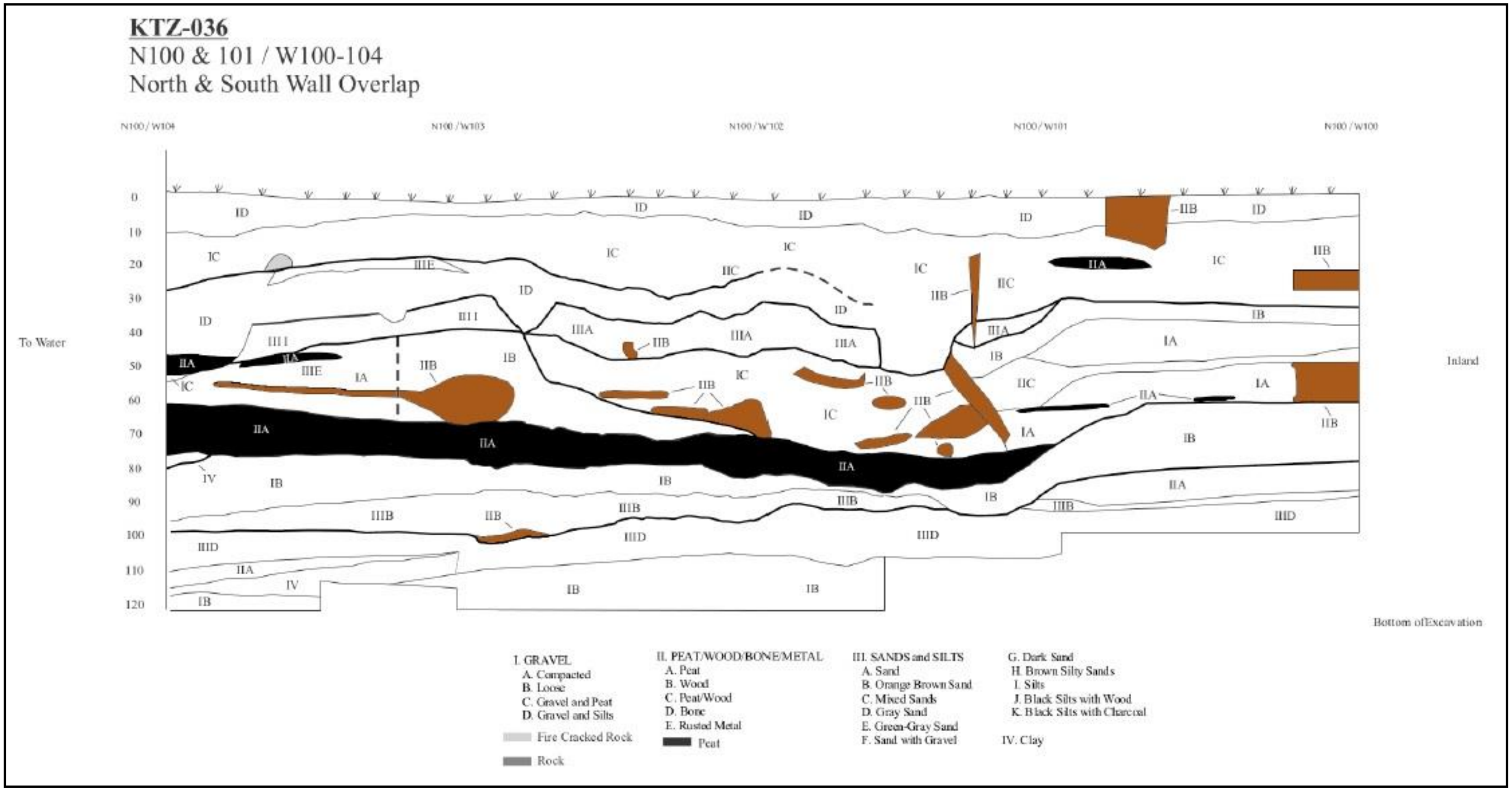
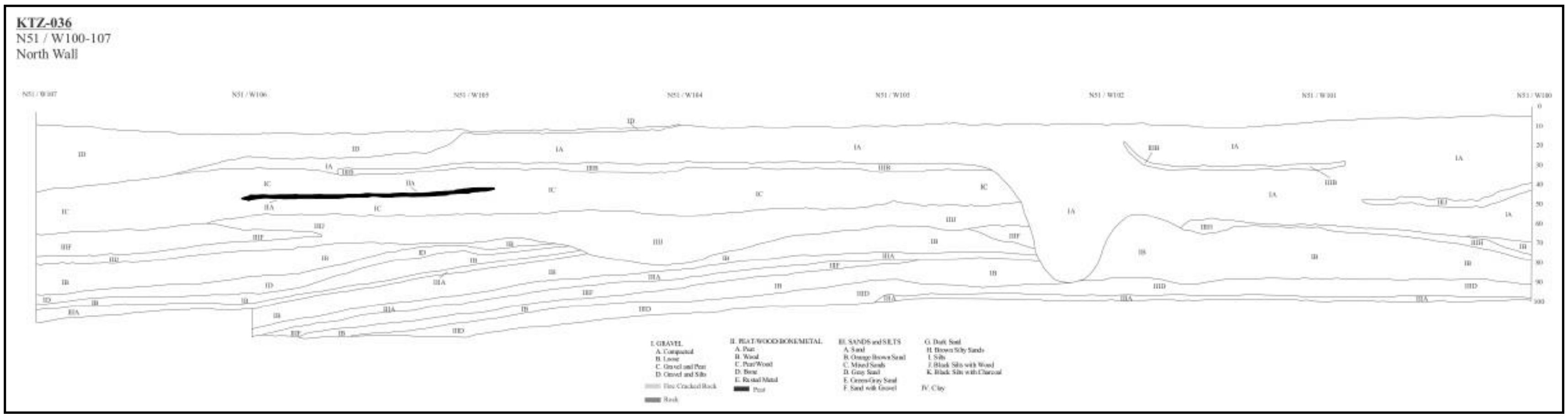


Figure A-9: N100&101/W100-104



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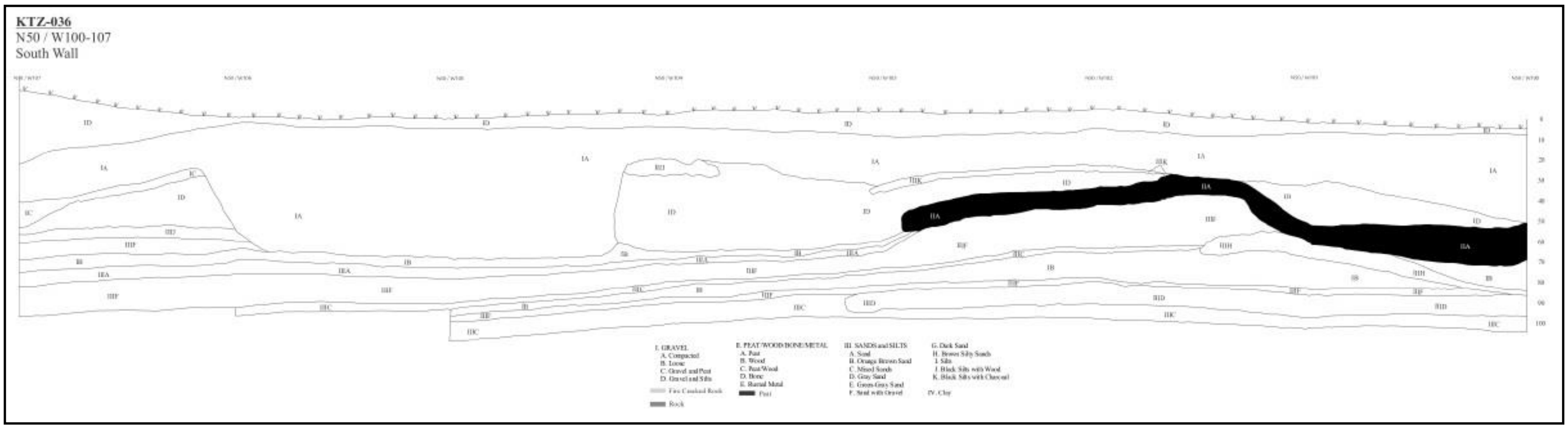

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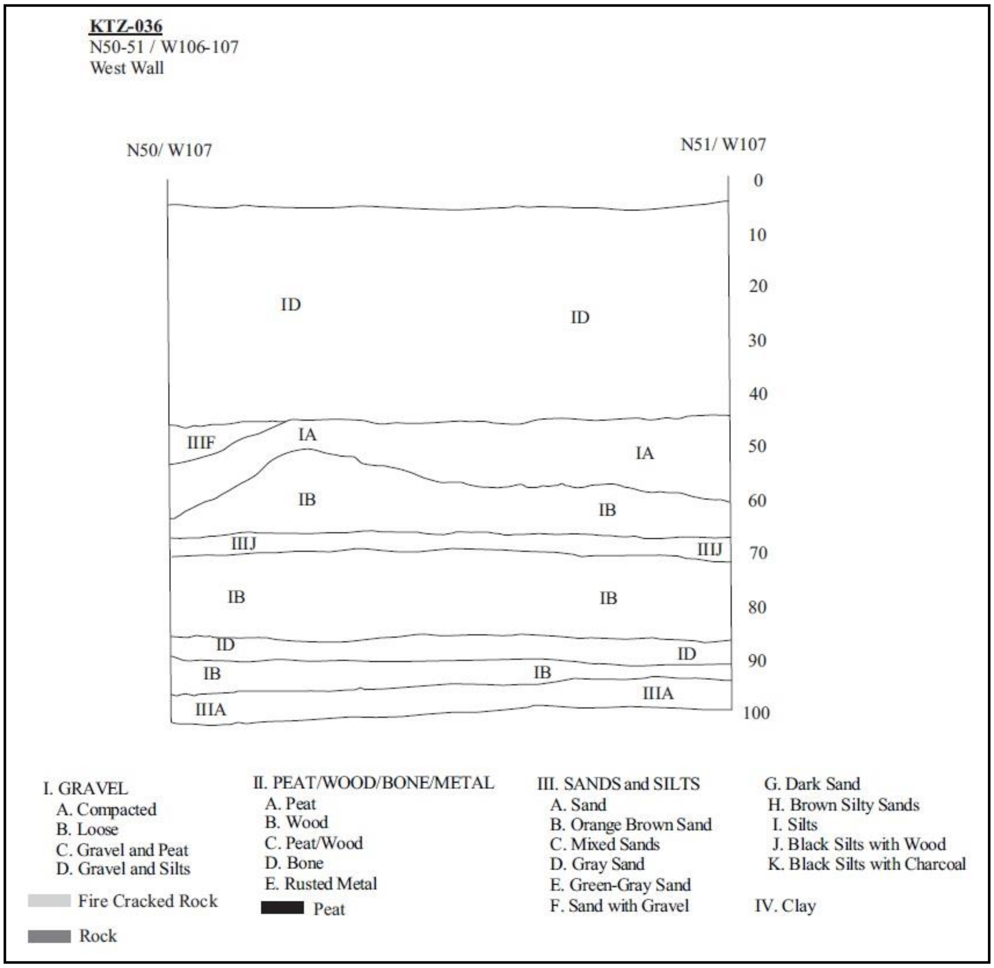

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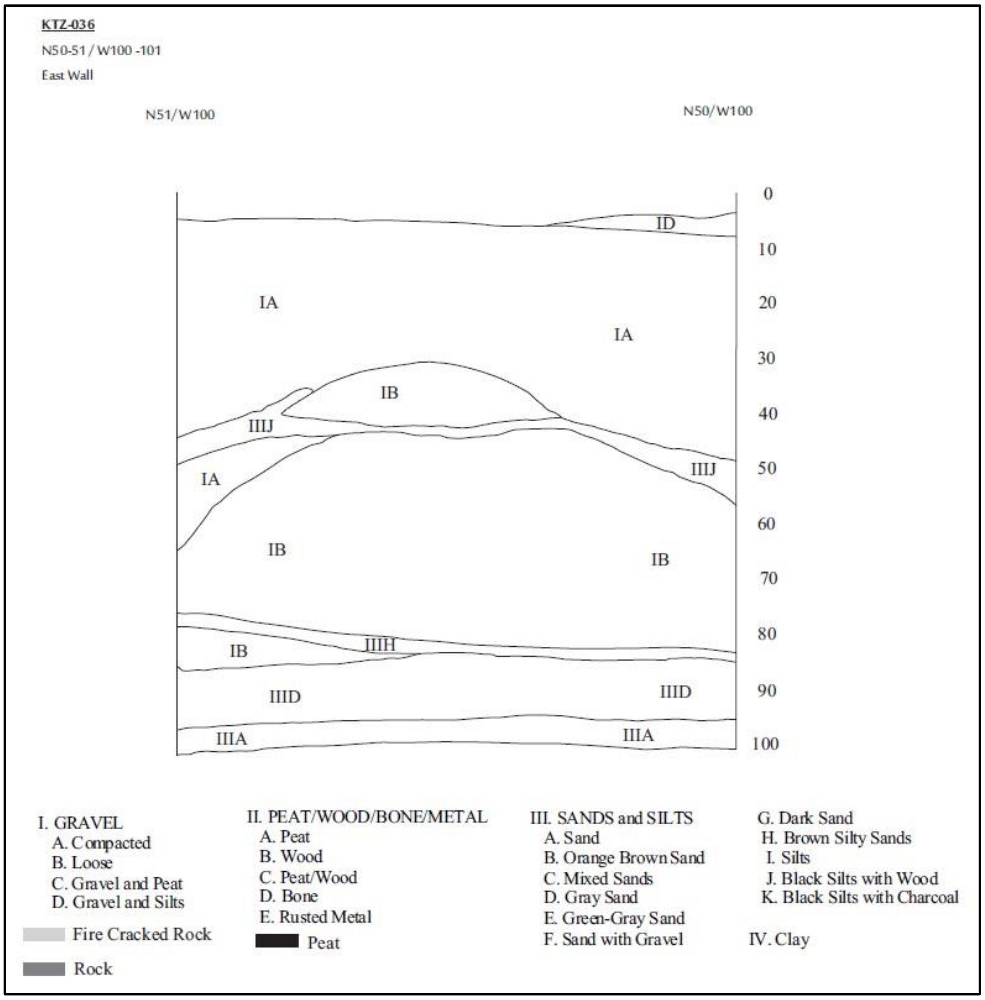

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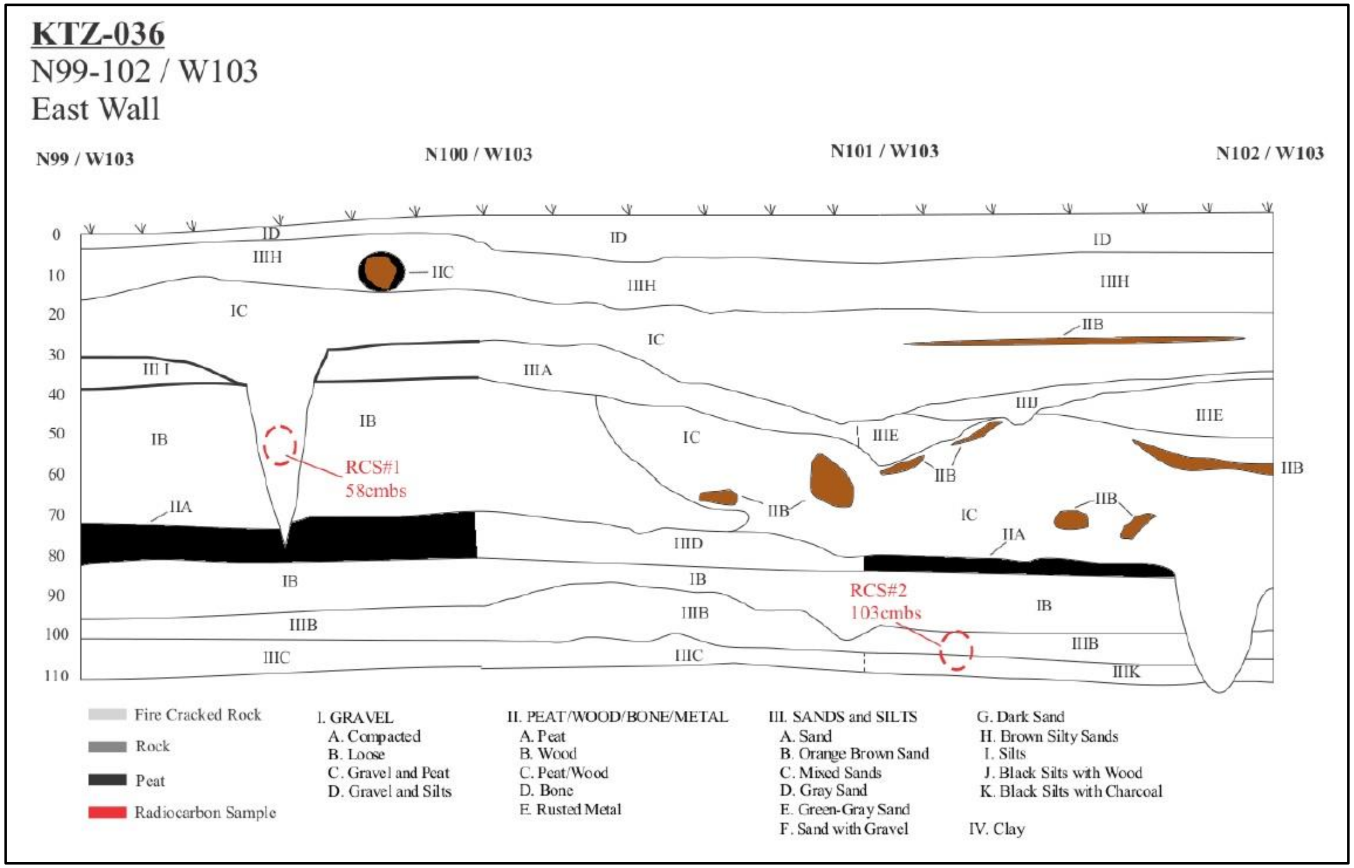

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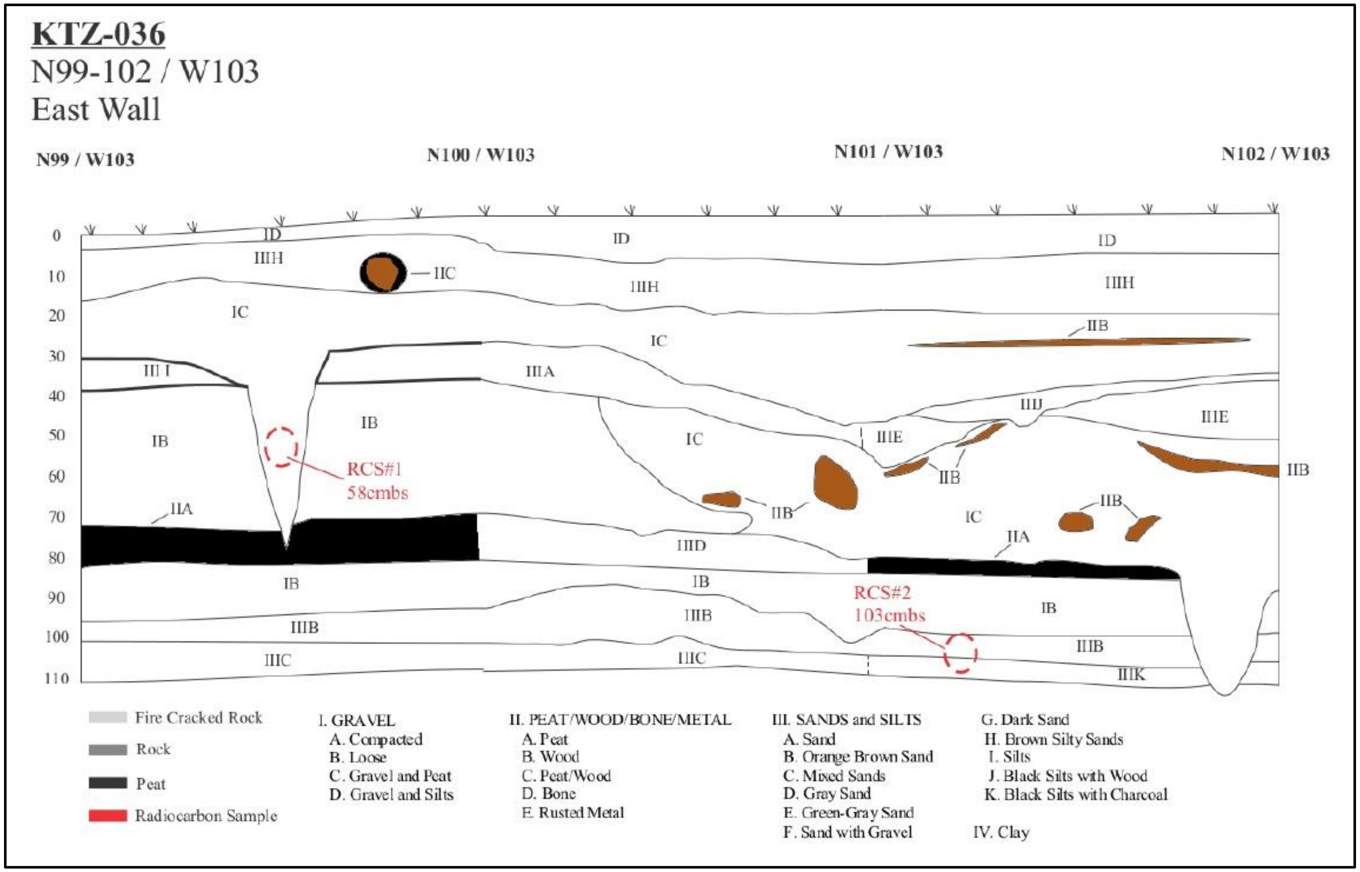

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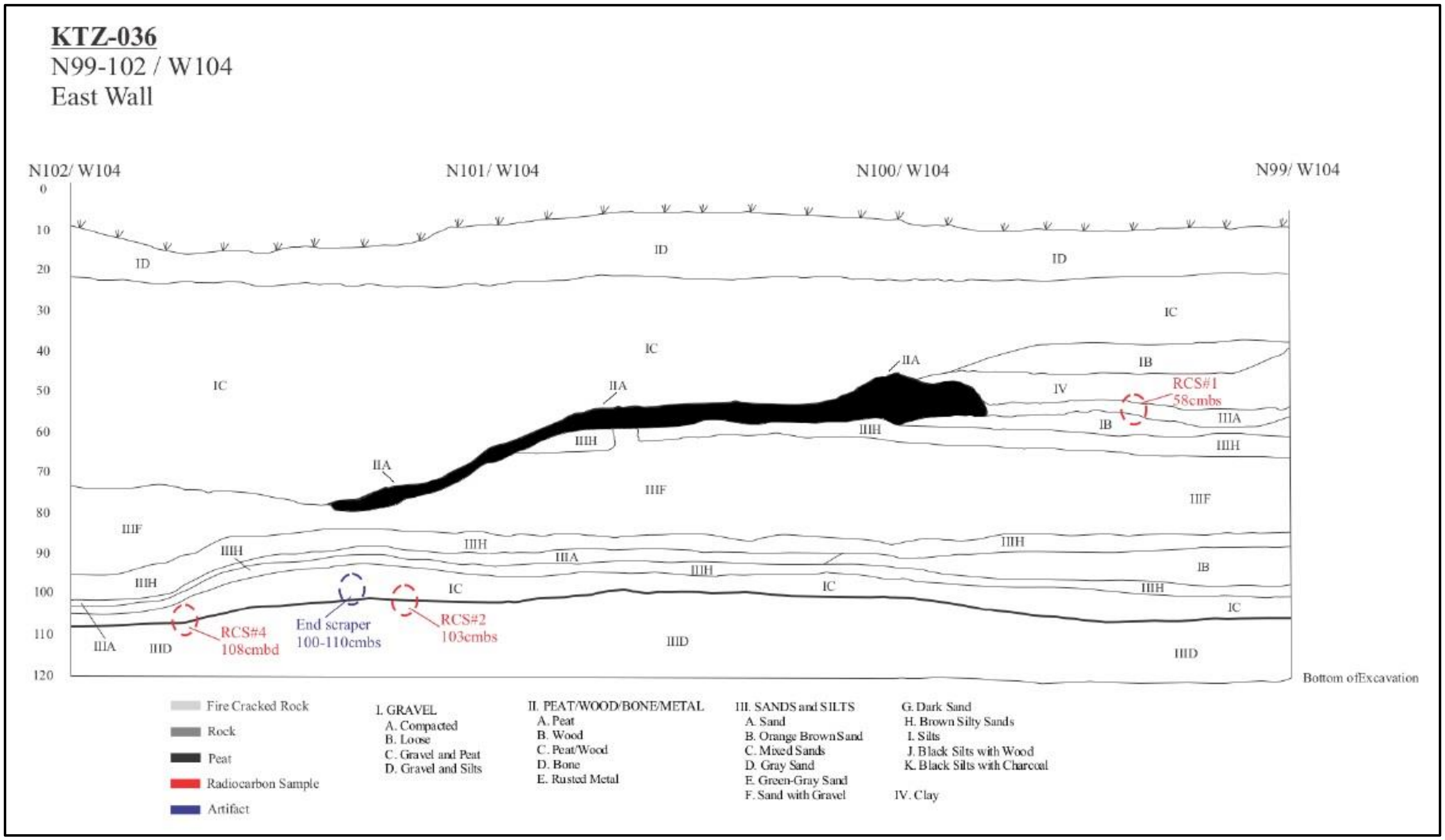

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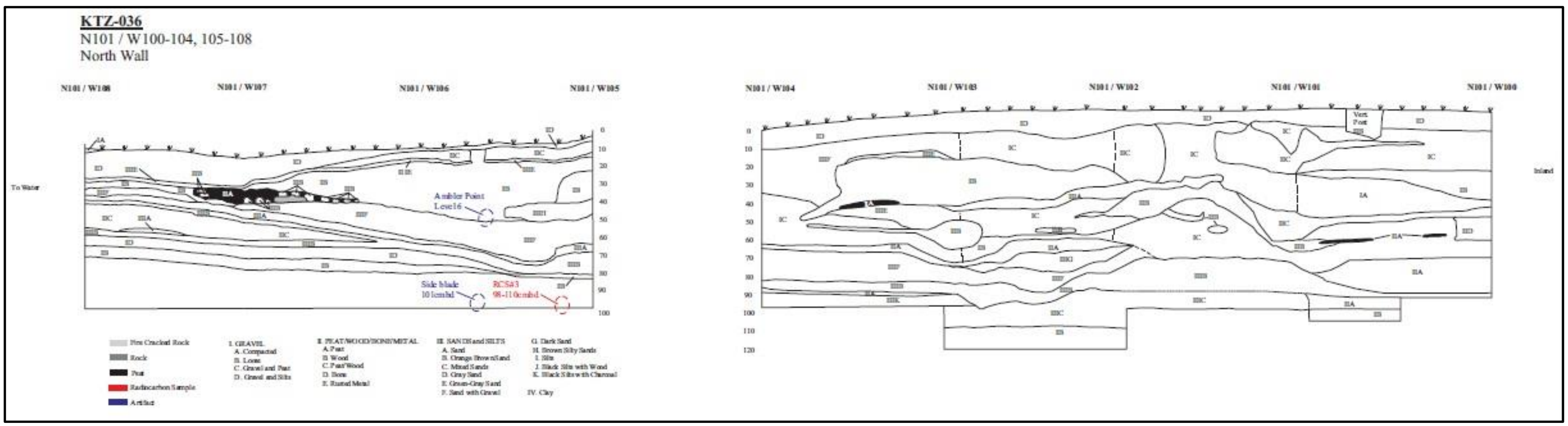
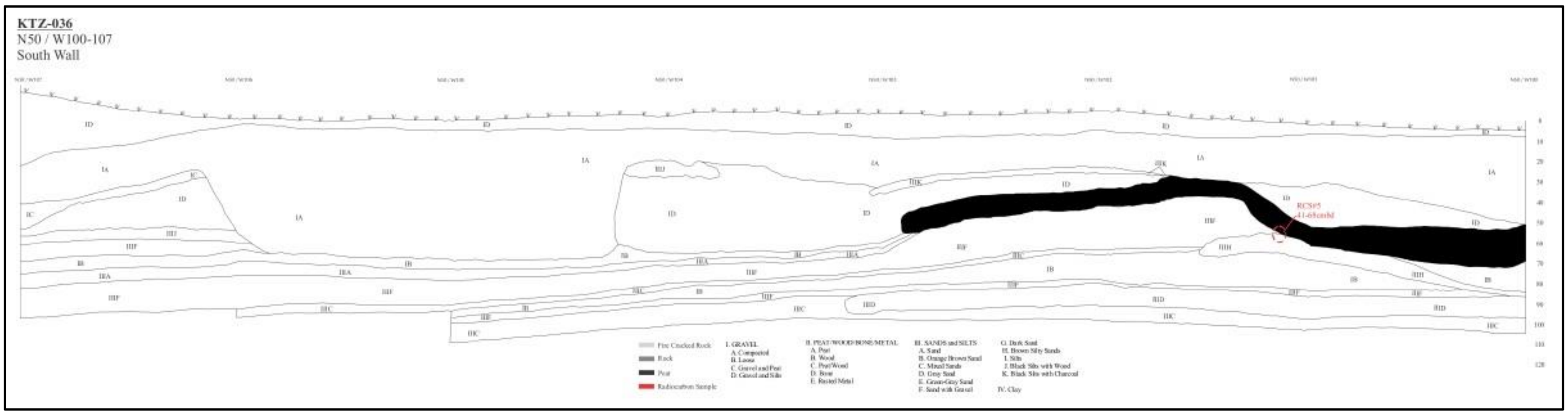


Figure A-17: N101/W100-104, 105-108



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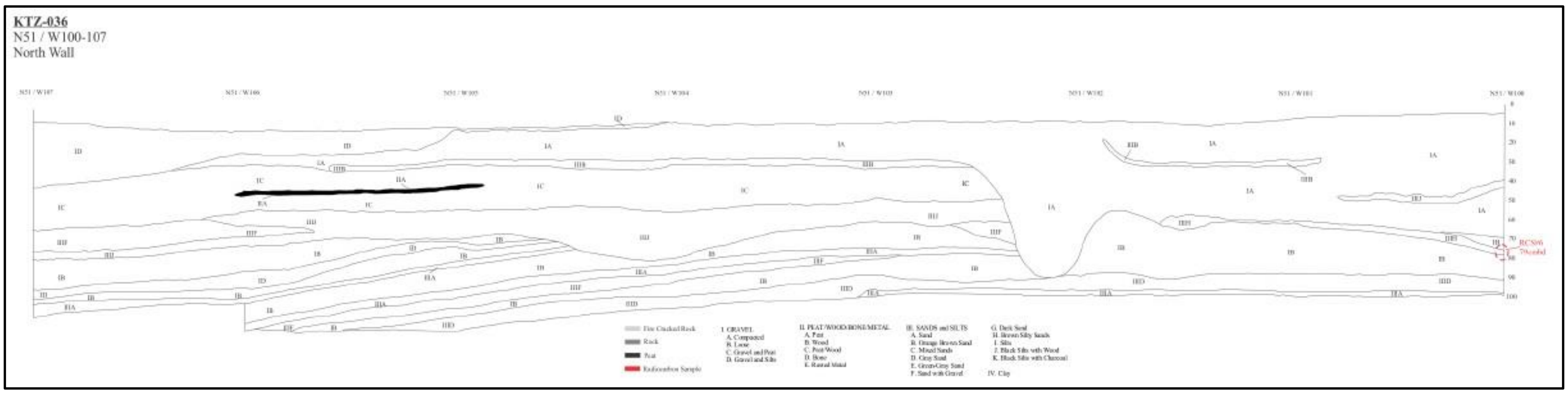

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