Bone and antler tools from the Victoria Day site (Manitoba): building bridges with First Nation communities through experimental archaeology

BY

KEVIN BROWNLEE

A Thesis submitted to
the Faculty of Graduate Studies
In Partial Fulfillment of the Requirements for the Degree of

MASTER OF ARTS

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Bone and antler tools from the Victoria Day site (Manitoba): building bridges with First Nation communities through experimental archaeology

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Abstract

Archaeological research in the province of Manitoba is shifting towards collaborative projects with First Nation communities. The aim of this project was to establish a collaborative model for Indigenous research through the involvement of the First Nation community and the use of experimental archaeology. Members of the Nisichawayasihk Cree Nation were involved throughout the entire research process, from excavation to analysis.

Recent archaeological work in northern Manitoba has recovered several human burials in a remarkable state of preservation. Individuals interred with bone and antler tools provide us a rare glimpse into the use of perishable materials. This research project focuses on the bone and antler tools associated with burial of an adolescent male, dating to 4,000 BP from the Victoria Day site (GkLr-61, feature 2) on Threepoint Lake. The tools were studied following an 'operational sequence' or 'chaîne opératoire' method of analysis, focusing on the entire "life cycle" including the acquisition of raw materials, the manufacturing process, use and re-use of the tool and final deposition. Interviews were conducted with members of the Nisichawayasihk Cree Nation and their insights guided the use of experimental archaeology to evaluate tool performance. The results of this project provide important insights into the culture of the people who lived in the Boreal Forest of Manitoba 4,000 years ago and are presented in a format that is meaningful to both the Indigenous community and archaeologists.

Acknowledgements

This research was made possible by the support and assistance of numerous people. First, I would like to thank the ancestor whose human remains and associated tools were the basis of my thesis. I hope I have done your tools justice. I would also like to thank the chief and council of Nisichawayasihk Cree Nation who allowed and encouraged the research completed on this burial. Special thanks goes to councillor Darcy Linklater who has been a very strong supporter of archaeology. Without the support of the community, the information we have learned about this individual could have never been documented and shared.

I was very fortunate to be on the crew when the burial was identified and recovered. I owe a great deal to my fellow crewmembers that assisted in the recovery. David K. Riddle led the excavation and adapted excavation techniques to allow for a very thorough recovery of this burial. David is by far the best field archaeologist I have ever worked with. I owe a great deal to you. Felix Spence, Elmer Spence, and Ron Francois were great co-workers and always went above and beyond the call of duty during the excavation and should be commended.

I owe a great deal to my uncle Don McMaster who sparked my interest in experimental archaeology twenty five years ago. Thanks to Mireille Lamontange who was my sounding board when choosing the thesis topic. The advice from Heidi Katz on experimental archaeology and bone and antler technology was greatly appreciated. David Finch offered his advice freely by answering my many questions related to human osteology. Thanks to Kate Peach who completed an extensive summary report on all the bone and antler tools that became the basis of my faunal analysis. Thanks to Dr. Rob

Hoppa for giving me access to the equipment in BDIAL for my research. My sister Dr. Meredith "M" Brownlee assisted in the creation of dental stone casts from the vinyl moulds using her dental supplies. Without your help I would still be trying to get the bubbles out of the casts. The difficulty of working full time and working on a Masters degree was a challenge. I must thank my managers Pat Badertscher (Historic Resources Branch) and Nancy Noble (The Manitoba Museum) for their support, without which I would be out of a job or still working on my thesis.

In order to replicate these tools, I needed fresh bone and antler. During the fall of 2002, I travelled to Leaf Rapids, Manitoba for a hunting trip to obtain the raw materials for my thesis. With the help of George Dysart, I shot the moose that was used for this research. The moose was shot on my last day of three weeks trip and was truly a gift. Keith Anderson and George Dysart both kept reassuring me that a moose would show up when the time was right, and it did. Other items that were required for this research project were supplied by Keith Anderson and William Dumas.

The suggestions by community members on tool use were essential to this research. By sharing your knowledge, you continued to inspire me during my research. I overcame my lack of understanding of Cree by relying on Charlene Spence (my little sister) as my interpreter while in Nelson House. The patience of those interviewed was much appreciated. The curious looks I received when I showed them my replicated bone and antler tools and then being told I can purchase metal ones at the local store always brought humour to the interviews.

I have to thank Keith Anderson and wife Bertha "Mom" for their generosity and opening up their home and the Rusty River Camp as my home away from home. I also owe a great deal to all my brothers in northern Manitoba. Keith Anderson you have always been there to answer my questions and share your knowledge and opinions on both my research and life for this I am grateful. Thanks to Burnell Anderson who assisted me as photographer and consultant. To my big brother William Dumas, your unwavering support of archaeology and this project were vital, thanks for always looking out for me. Leslie Baker your insights into the Cree language, resources of the land and how people used these resources was truly an eye-opening experience. Thanks for everything. Bruce Tait, your visits to the Rusty River camp to chat were always welcome, and next time I won't boil the coffee. The unwavering support of archaeology by all people from northern Manitoba demonstrates the growing acceptance of this area of study among First Nation people.

Thanks to my advisor Dr. Ariane Burke, for believing in my project and taking me on as a Masters student. Your advice on bone and antler tools, theory, and the design of the research project were invaluable. Thanks for sticking with me over the course of this degree and for your editorial work. I couldn't have gotten through this without you. I owe a great deal to Dr. E. Leigh Syms as a committee member and an archaeologist. This research was made possible by the foresight of Leigh through his belief that detailed documentation of the tools from this burial was required prior to reburial, including photographs, illustrations, replication, faunal analysis, and vinyl moulds. Without Leigh's dedication and passion for heritage, a study of this kind could not have been possible since the items were reburied before this thesis research began. In the eighteen years that I've known him, Leigh has always shared his passion and enthusiasm for archaeology and anthropology. You have been mentor and good friend, thank you for everything.

Thanks to Dr. Greg Monks who provided me with a solid foundation of theory and shared his expertise freely. Your patience through this whole process was much appreciated. Finally, I would like to thank my external Dr. Jill Oakes. I have learned so much from you. Most importantly, on how to create a research project that honours, respects, and validates the perspectives of Indigenous people while remaining relevant to the academic community.

During my Masters I worked full time, which put a huge strain on my friends and family. Barely enough time for work and research my family and friends have stuck with me. Thanks to my grandmother Helen Riesberry, my dads Clark Brownlee and Terry Mowatt and my moms Eleanor Brownlee and Cheryl Burton. Thanks for all your love and support.

Thanks to those funding agencies that believed in me and my project including: the National Aboriginal Achievement Foundation, Faculty of Arts J. G. Fletcher Award for Graduate Students Research and the Thomas C. Shay Scholarship.

I could not have made it through this project without the love and support of Myra Sitchon. Thanks for everything, particularly discussing archaeology theory at midnight, your technical advice, and creating the amazing maps used in the thesis. You have made everything bearable even when the light at the end of the tunnel was small.

Dedication

I am dedicating this thesis to the memory of Felix Spence. Felix was an amazing field archaeologist who had no formal training. He was a crewmember during the identification and recovery of the Victoria Day site burial (feature 2). Unfortunately, he passed away before the analysis was complete and never saw the end result.

Felix, you are missed brother.

I would also like to dedicate the thesis to First Nation youth of today and tomorrow.

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1. Introduction

Recent archaeological investigation in northern Manitoba has resulted in the identification of hundreds of archaeological sites and thousands of artifacts. These sites are predominately located on the eroding shorelines of the Churchill, Rat, Burntwood and Footprint Rivers and the artifacts are mainly from surface collections. While the materials document the complex and rich history of the boreal forest of Manitoba contextual information is often lacking. The repeated use of preferred sites over thousands of years and collapsed stratigraphy make it difficult to interpret these assemblages. Since 1990, a number of human burials have been recovered from the eroded shorelines that provide an exceptional opportunity to research a single time period and the material culture of a single cultural group. The recovery and analysis of human remains and associated artifacts has been conducted with full permission from the local First Nation communities.

Various researchers have examined the materials from these burials (Brownlee and Syms 1999; Finch 2003, Meiklejohn 1995; Molto 1996; 1997; Peach 1995; 1998; 1999; Smith 2001; Syms 2001; 2003; 2004). Upon requests from local communities, archaeologists from the Manitoba Museum developed display cases and non-technical reports (Brownlee and Syms 1999; Syms 1997; 2001). Through working cooperatively the results of research are shared in a format that is socially relevant to First Nation people and the general pubic. Social relevance is a topic being discussed by both archaeologists and social scientists (Wallerstein *et al* 1996; Nicholas and Andrews 1996; Syms 1997; Zimmerman 1997). The danger of conducting internally focused research is that the social sciences will lose research funding acquired through public support. As a result, academic researchers have recently begun to reexamine their disciplines and the relevance of their work to the general public.

This thesis explores the use of experimental archaeology and ethnoarchaeology in producing results that are both academically sound and socially and culturally relevant. One of the main premises behind experimental archaeology is to replicate tools and thoroughly examine their possible functions. Experimental archaeology also provided a means of understanding the process of tool production and use. In order to conduct experimental archaeology a number of criteria must be met. Ideally, both manufacturing tools and finished tools are present in the archaeological sample. Artifacts from a single burial feature are excellent candidates for experimental archaeology, if manufacturing tools and finished tools are represented, because a burial represents the cultural expression of a single group. This study concentrates on the burial assemblages from the Victoria Day Site Feature 2 (GkLr-61) which meets the criteria noted above.

The diversity and number of bone and antler tools from the Victoria Day Site - Feature 2 makes this an excellent source of data on bone and antler tool technology. Osseous material is often poorly preserved in the western boreal forest of Canada (Wright 1995:268). Many of the tools represented in the Victoria Day sample have never been encountered from archaeological sites in the region. Ethnoarchaeology was incorporated into this study through interviews with members from the Rock Cree communities of Nisichawayasihk Cree Nation (NCN), Granville Lake and O-Pipon-Na-Pipwin Cree Nation (OPCN or South Indian Lake) (Chapter 6-14).

1.2 Objectives

The objectives of this thesis are as follows:

1. To establish the production sequence (raw material selection, production techniques, use, and reuse) of eighteen tools recovered from the Victoria Day Site – feature 2.
2. To place archaeologically recovered material into a human frame of reference through experimental archaeology and ethnoarchaeology, thus making this study both socially and culturally relevant.
3. To demonstrate that scientifically based research can be conducted on casts enabling archaeologists to work on repatriated material.

This thesis uses Gould's (1977: 360) proposition that an archaeological perspective can be used in conjunction with ethnographic material, resulting in a valid cultural explanation of excavated data. Significant social, economic, and political changes have occurred within First Nations groups since the arrival of Europeans to North America. In addition to these changes their material culture has undergone significant modification with the arrival of Europeans and the adoption of their goods. While material culture has changed, many of the activities that were practiced by First Nations groups continue.

Unfortunately, most of the material culture used by people living in the boreal forest has not preserved over time, resulting in the loss of these items from the archaeological record. Artifacts recovered from an archaeological site are not representative of the totality of a past society's material culture. By focusing strictly on items recovered from archaeological sites, the past becomes dehumanized and removed from the cultural context resulting in discussion of "bones and stone". This study has addressed this issue by including ethnoarchaeological research and applying agency theory to the interpretation of the production sequences used to make the Victoria Day tools.

Participatory Action Research (PAR) is a relatively new concept used extensively in Sociology and Native Studies. PAR involves the study group as an integral part of the research process (Hoare *et. al.* 1993; Robinson 1996; Ryan and Robinson 1990; St. Denis 1992; Simonson and Bushaw 1993). A central tenet of PAR is that research respects and validates a community's perspective by addressing their specific problems and issues. PAR is applicable to this thesis since Elders from the Nisichawayasihk Cree Nation (in the study region) have eloquently stated that a major issue facing their community is that the youth are losing touch with their past and heritage. The Elders have indicated that archaeology can be used to teach First Nation youth about the past, thereby addressing their concerns (Brownlee and Syms 1999). This research has achieved both social and cultural relevance by addressing the concerns of the Nisichawayasihk Cree Nation. Participatory action research provides a useful method of integrating the Aboriginal community's knowledge into archaeological interpretations.

Archeological research has undergone significant changes in the last fifty years. Advances in physical and biological sciences have proven extremely useful in archaeological interpretation including radiocarbon dating, stable isotope analysis, trace element analysis, and DNA research. In the process of becoming more scientific, archaeologists have adopted many technical terms. The use of jargon has contributed to the lack of interest in archaeology from the general public, and as a result there is a decrease in public funds worldwide to conduct research, as outlined by the Gulbenkian Commission (Wallerstein *et al* 1996). This concern will be addressed in this study by making a conscious decision to eliminate technical terms or placing them in parenthesis.

A challenge facing archaeologists involves gaining access to archaeological materials that are in the process of repatriation or that have been repatriated. Many First Nation groups are demanding the return of both archaeological and ethnographical material. Of concern to some archaeologists is the repatriation of human remains and associated grave goods, which may be perceived as having scientific value. Archaeologists must recognize and respect the inherent rights and interests of First Nation people in any archaeological investigation of their past, particularly with regards to burials. The Canadian Archaeological Association (CAA) has addressed this concern by developing a statement of *Principles for Ethical Conduct*, which this research will follow (CAA 2002).

In addition to First Nations concerns, the *Principles for Ethical Conduct* indicates that researchers must actively communicate the results of their research to a wide audience (CAA 2002). The CAA believes that this approach will rectify the issues facing archaeologists with regards to public support and address the concerns of members of the First Nations. Within Manitoba, recent research on human remains has occurred in full partnership with a number of First Nation communities. The Victoria Day Site (GkLr-61) feature-2 is one such example of these cooperative initiatives.

LeMoine has criticized fellow archaeologists for their cursory examination of organic tools (bone, antler, teeth and ivory) recovered from archaeological sites

(1994:316). LeMoine (1994) demonstrates how wear pattern analysis can benefit archaeological interpretation. This research addresses Lemoine's critique directly.

Finally, the recent recovery of bone and antler tools in northern Manitoba has resulted in a questioning of existing cultural chronologies that are primarily based on stone projectile point and ceramic typologies (Syms 2001). This research will contribute to the betterment of existing chrono-typological schemes by providing the first detailed documentation of an organic tool assemblage from northern Manitoba.

2. Background to the Study

2.1 Source of Data

A number of unique and significant archaeological discoveries have been made in northern Manitoba since the early 1990's, notably collections of bone and antler tools associated with eroded burials from the Churchill, Rat, Burntwood and Footprint Rivers (Peach 1995, 1998, 1999; Syms 2001). The Churchill River Diversion Archaeological Project (CRDAP) is a partnership with Nisichawayasihk Cree Nation (NCN), O-Pipon-Na-Pipwin Cree Nation (OPCN or South Indian Lake), Manitoba Hydro, Historic Resources Branch, The Manitoba Museum and The University of Winnipeg. The CRDAP is designed to mitigate the impact of flooding caused by hydro-electric dams to heritage resources through the recovery of archaeological material and human remains from affected rivers and lakeshores. Analysis of material serves two purposes; first it benefits the local Cree communities by sharing information on local history and secondly it contributes academically to the understanding of the archaeology of the area. The Victoria Day Site, feature 2, is one such example.

The burial identified as feature 2 from the Victoria Day Burial Site (GkLr-61) was recovered from the shores of Threepoint Lake in 1995 as part of the Churchill River Diversion Archaeological Project (CRDAP) (Figure 2.1) (Brownlee 1995a; Riddle 1996). Flooding of the area by hydroelectric dams constructed in 1975 has altered the local environment, resulting in higher water levels that exposed the burial (Figure 2.2). During the summer of 1995, a Cree crew worked under the direction of David K. Riddle on the CRDAP. The crew consisted of Kevin Brownlee, Ron Francios, Felix Spence and Elmer Spence (Riddle 1996). The Victoria Day site was visited on July 14^{th}, 1995

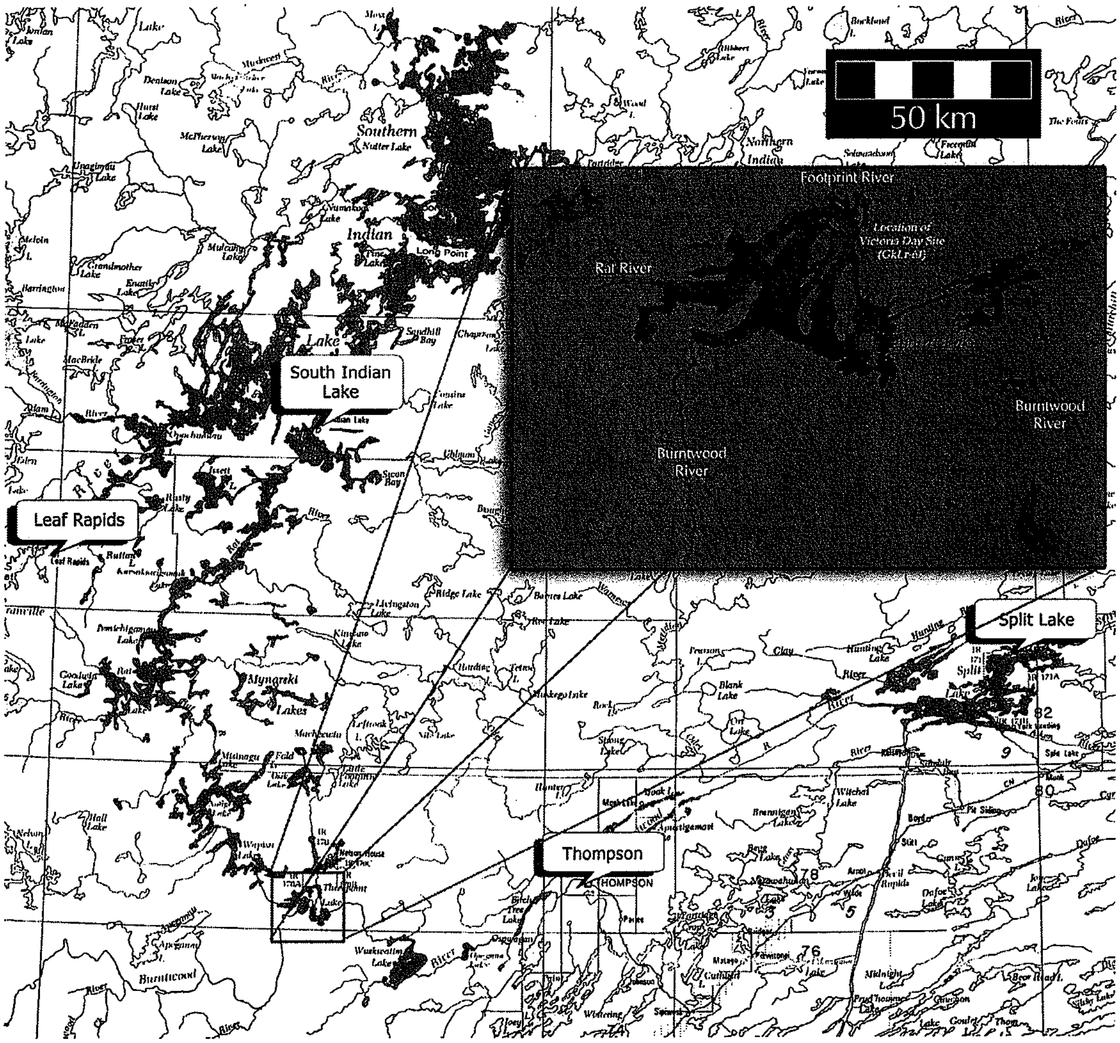


FIGURE 2.1: Map showing the location of Threepoint Lake.

during which a scatter of human remains were identified. As the survey neared the southern edge of the site, a number of human bones were located *in situ* protruding from the clay beach. All members of the crew placed tobacco at the burial and left it untouched until a ceremony could be conducted, as Elders from the community of Nisichawayasihk Cree Nation had requested.

On July 15, 1995 David K. Riddle traveled to Nisichawayasihk Cree Nation, Nelson House, to consult with local Elders. The local community granted permission to excavate the burial and preparations for a ceremony were made. Elders and spiritual leaders from the community arranged for a ceremony and feast to take place on July 16th 1995. All five crew members attended the ceremony, which was conducted by Andrew Wood. Nine other members of Nisichawayasihk Cree Nation attended the ceremony including Dolly Hart, Joshua Spence, Eveline Spence, Nelson Heart, Leonard Linklater, Milly Young, Shirley Linklater, Jody Linklater and Charlene Spence. The ceremony was conducted entirely in Cree by Andrew Wood and was initiated with prayers, drumming and a song. Following the song, a pipe ceremony was conducted involving everyone around the circle. A plate of food was prepared for the individual whose remains had been disturbed. This ceremony brought Elders, community members and archaeologists together for a common goal the preservation of Cree cultural heritage. The ceremony strengthened the archaeologist's commitment to the Cree community and the resolve that the wishes of the community would be respected during analysis of the remains. The ceremony also taught the young people of Nisichawayasihk Cree Nation (NCN) to respect the past, and demonstrated the strong connection that First Nations people have to their history. Once the ceremony and feast were completed, the food offering for the buried individual was placed into the water.

The involvement of the local First Nation community in the project from the time the human remains were identified demonstrates the commitment of the archaeologists involved to ensuring that the research conducted be ethically responsible. The conditions outlined by the local community for the excavation, subsequent research and presentation of results ensure that the First Nations community is a full partner in the research. This approach fulfills the tenants of Participatory Action Research (PAR) (Hoare and Robinson 1993).

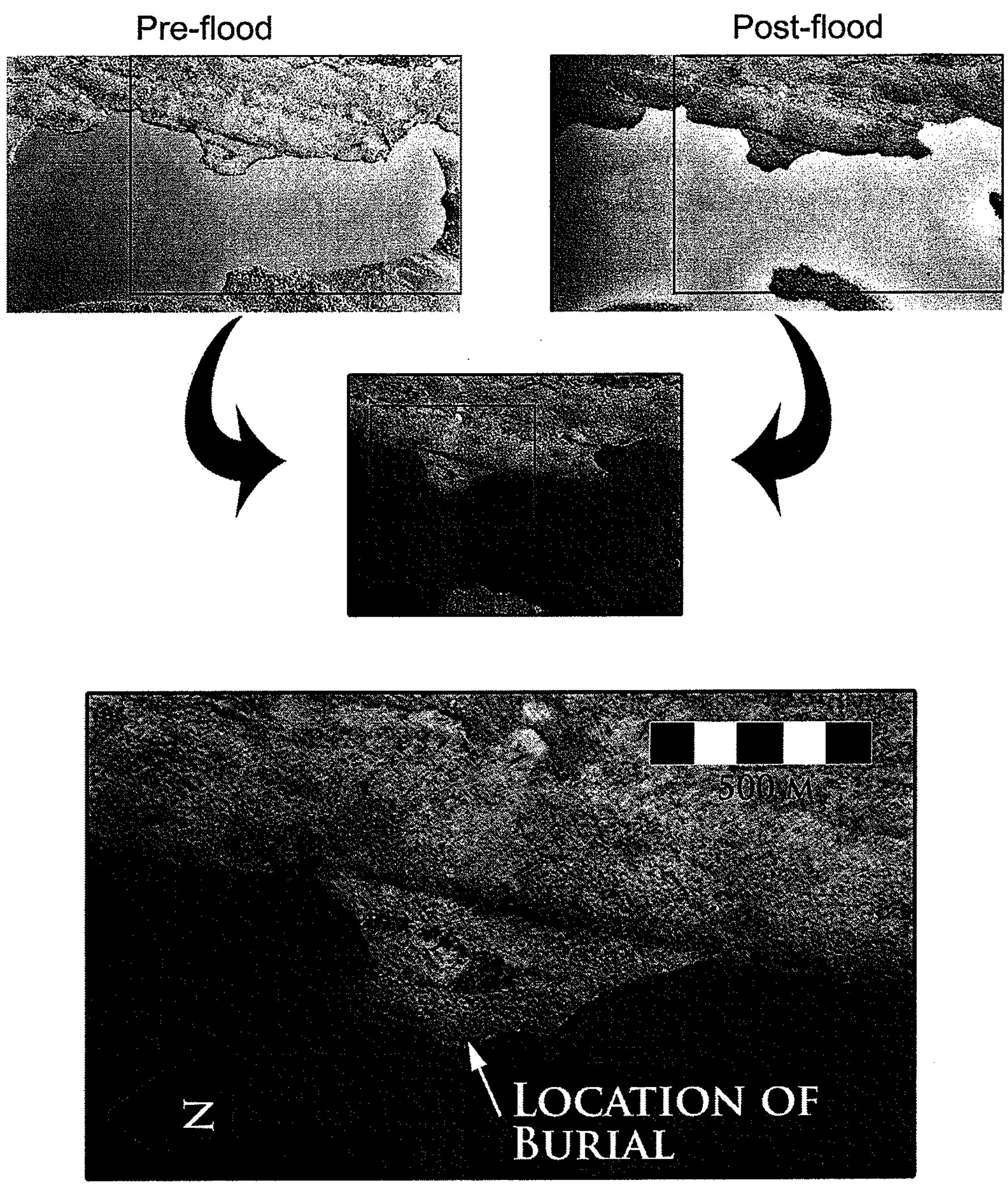


FIGURE 2.2: Modified Aerial Photographs showing the pre and post-flood shoreline at the Victoria Day site, the line in the water (lower photo) represents the larger preflood shoreline. (Photographs supplied by Historic Resources Branch, Province of Manitoba)

2.2 The Excavation

Following the ceremony, the burial was excavated. Since spiritual leaders requested that no photographs be taken of the human bones detailed drawings of the burial were made in the field (Brownlee 1995a). Despite water and ice erosion that had occurred, it was possible to determine that the burial was a primary context and the individual had been buried in a tightly flexed position on his right side, oriented with his head towards the west with the face towards the south and feet towards the east (Figure 2.3).

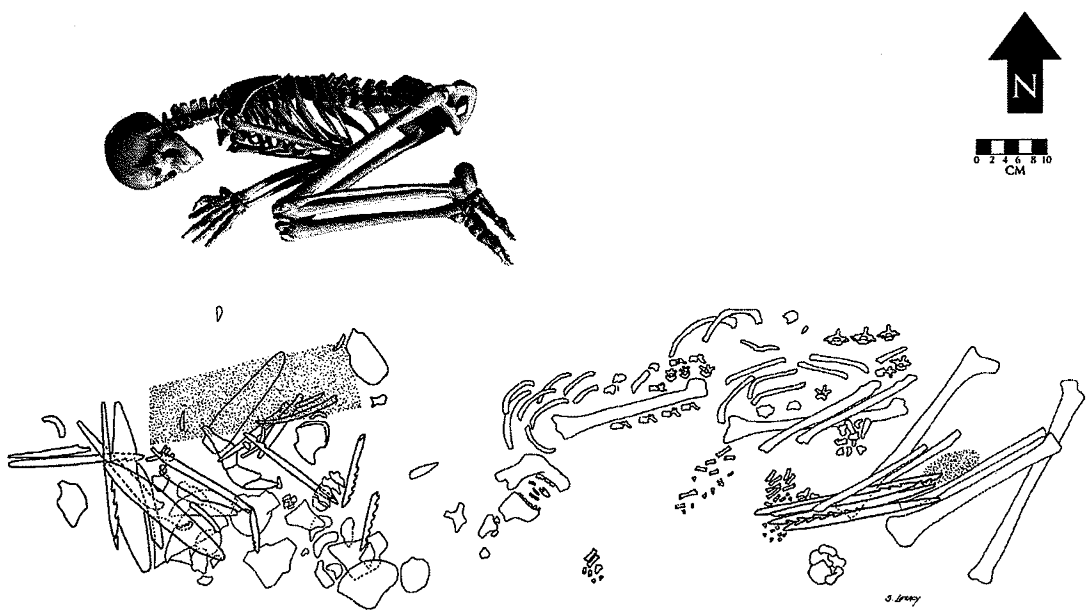


FIGURE 2.3: Reconstructed burial position for individual (above), field drawing below.

2.3 The Tool Sample

A total of forty-seven tools were found in association with the Victoria Day Burial, Feature 2. Of these tools, 39 were produced from bone and antler (appendix 1); the remaining items were made of stone. This assemblage represents the largest and oldest known cache of bone and antler tools from the western boreal forest of Canada.

In the spring of 1999, the human remains from the Victoria Day site feature 2 and associated artifacts were returned to Nisichawayasihk Cree Nation for reburial. In anticipation of future research, an initial report on the faunal tools was produced by Peach (1998) and Syms (The Manitoba Museum) produced moulds of the functional edges of the bone and antler tools using 3M Express Vinyl Polysiloxane Impression Material prior to reburial. In addition to the moulds, the tools were fully documented (measurements were recorded and scientific illustrations and photographs were produced). The research focused on eighteen tools that have never (or rarely) been recorded archaeologically or ethnographically in the study region (Table 2.1). Items omitted from this research are presented in appendix 1.

TABLE 2.1: Original artifacts examined during thesis with faunal identification.

Tool	Artifact Number	Material	Species	Element	Side	Portion	Sex	Age
Harpoon Head	67A	Bone	*Alces alces*	Metatarsal	?	Lateral/Medial	Male	Old Adult
Harpoon Head	67C	Bone	*Alces alces*	Metatarsal	?	Lateral/Medial	Male	Old Adult
Harpoon Head	7	Bone	*Alces alces*	Metatarsal	?	Lateral/Medial	Female?	Adult
Harpoon Head	67D	Bone	*Alces alces*	Metatarsal	?	Lateral/Medial	Undetermined	Adult
Harpoon Head	30; 36	Antler	*Rangifer tarandus*	Beam	?	Lateral/Medial	Male	Adult
Fish Spear Point	67B	Bone	*Alces alces or Rangifer tarandus*	Metatarsal	?	Lateral/Medial	Undetermined	Adult
Fish Spear Point	51	Bone	*Rangifer tarandus*	Long bone	?	?	Undetermined	Adult
Fish Spear Point	18	Bone	*Rangifer tarandus*	Long bone	?	?	Undetermined	?
Fish Spear Point	79	Bone	*Rangifer tarandus*	Long bone	?	?	Undetermined	?
Adze	24	Antler	*Alces alces*	Palmate	?	Upper and Lower	Male	Old Adult
Chisel	6	Antler	*Alces alces*	Palmate/Tine	?	Lower/Ventral	Male	Old Adult
Pick	43	Antler	*Alces alces*	Palmate/Tine	?	Lower/Ventral	Male	Old Adult
Birchbark Peeling Tool	11	Antler	*Alces alces or Rangifer tarandus*	Tine	?	Complete	Male	Young Adult (Alces alces) Old Adult (Rangifer tarandus)
Bone Chisel	25	Bone	*Alces alces or Rangifer tarandus*	Long bone	?	?	Undetermined	?
Awl	23	Bone	*Alces alces*	Vestigial Metatarsal	?	Complete	Undetermined	Adult
Awl	12;19a;22	Bone	*Alces alces*	Vestigial Metatarsal	?	Complete	Undetermined	Young Adult
Knife	47	Bone	*Alces alces or Rangifer tarandus*	Rib	Left	?	Undetermined	Adult
Ladle	27	Antler	*Alces alces*	Palmate/Tine	?	Ventral	Male	Young Adult

2.4 Dating

It was important to obtain precise dates from the burial in order to verify that the materials recovered from the Victoria Day Burial Feature 2 represent a single event. Two samples were selected for AMS dating. The first was taken from the moose or caribou antler birchbark peeling tool (Field No.11), identified as sample GkLr-61-F2A.

The second was taken from a modified ulna from the common loon (Field No. 28) identified as sample GkLr-61-F2B. The uncorrected date obtained from Isotrace Laboratory for sample GkLr-61-F2A is: 3700 +/- 60 radiocarbon years BP (TO-6031); sample GkLr-61-F2B is dated: 3920 +/- 60 radiocarbon years BP (TO-6032). The Calib Rev 4.4.2 program was used to calibrate the dates yielding ages of: 4160 – 3870 BP at two σ (95.4% c.i; 94.6% probability) and 4450 – 4220 BP at two σ (95.4% c.i.; 84.6% probability). The dates obtained are approximately 60 years apart (Figure 2.4), which was initially problematic, since they would indicate that the items recovered are not contemporaneous. A number of AMS dates from northern Manitoba have resulted in similar discrepancies, however, and may be attributed to a phenomenon known as the fresh water reservoir effect (Syms 2003; 2004). A high marine diet or a fresh water diet based on fish affects bone chemistry and can result in older dates. Because of the potential impact of the reservoir effect on the loon bone, the date obtained from this sample was re-calibrated using calibration curves for a mixed marine/terrestrial diet (Marine/INTCAL98). The common loon is a migratory bird that spends the winter in marine environments in Florida and the Gulf of Mexico (Kenow *et al* 2002:453). The summer diet of the common loon consists of fish, crayfish, frogs, snails, salamanders, and leeches. Adult loons prefer fish to other food, and seem to favour perch, suckers, catfish, sunfish, smelt, and minnows, while in northern environments. The winter diet includes small fish, crustaceans, mollusks, and aquatic insects (Bent 1919:53). The time spent in marine environments ranges between 182 and 146 days (Bent 1919; Kenow *et al* 2002).

VICTORIA DAY BURIAL (GkLr-61) FEATURE 2 DATES

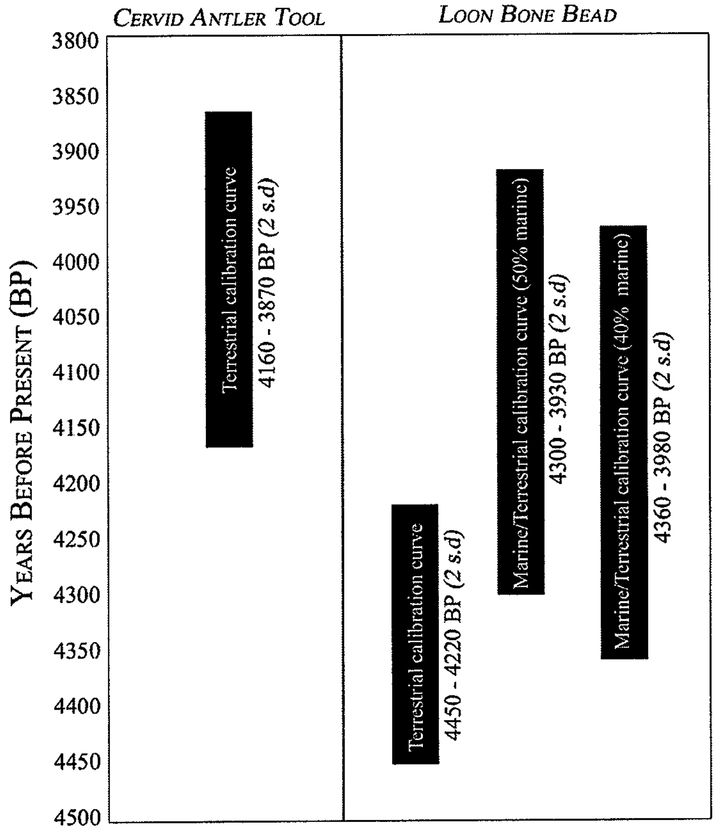


FIGURE 2.4: Plotting AMS date ranges for the Victoria Day burial with different calibration curves.

A calibration curve has been created for species that have a mixed marine/ terrestrial diet in the Radiocarbon Calibration Program Calib Rev 4.4.2 (Marine/ INTCAL98). Imputing a 50% marine diet into the program resulted in a calibrated date for the loon bone sample of 4300 - 3930 BP at 2 σ (98.1% probability distribution). The overlap between this date and the antler birchbark peeling tool is 230 years. After entering a 40% marine diet into the program, the date changed to 4360 -3980 BP at 2 σ (95.4% c.i.; 99.9% probability) and overlapped with the antler birchbark peeling tool age by 180 years. The tools, therefore, likely represent a single deposition event (Figure 2.4).

2.5 Human Osteology

2.5.1 Biological Profile

Bone preservation for Victoria Day, feature 2, is excellent and nearly ninety percent of the individual was recovered. Dr. J.E. Molto conducted the analysis of the human remains at Lakehead University (1996; 1997). Based on tooth eruption and epiphyseal fusion, the individual was determined to be between the age of 14 and 16 years (Molto 1997:3; Finch 1998). Molto (1997:3) suggests the individual is male based on the relatively large size of the skull and teeth and the presence of a mylohyoid bridge. It is recognized that sex is impossible to positively identify at this young age and both Meiklejohn (1998) and Finch (1998) suggest the sex was undetermined for the individual after examining the remains. A number of morphological traits indicate that the individual was of First Nation descent (Molto 1997:2). The individual was in relatively good health, although cribra orbitalia was present in both orbits suggesting that the individual had suffered anemia during childhood (Molto 1997:4). Enamel hypoplasia on the incisors identified by Meiklejohn (1998) and Finch (1998) suggest the individual suffered from disease and/or nutritional stress during childhood. No cavities were present suggesting a low starch (carbohydrate) diet, which is expected from groups following a hunting and gathering subsistence strategy (Molto 1997:4).

2.5.2 Stable Isotope Results

Analysis on bone collagen for stable isotope values is important for determining diet. A small rib fragment was submitted to the stable isotopic laboratory at Laurentian University for processing and analyzed at McMaster University. The results indicate that the Victoria Day individual had the lowest level of $\delta^{13}C$ (-24.047) and the highest enrichment of $\delta^{15}N$ (15.48) recorded for a sample of 27 individuals from northern-western Ontario and southeastern Manitoba on file at Lakehead University (Molto 1997: 4). A Carbon/Nitrogen ratio of 3.116 confirms that the sample was not contaminated.

It is possible to offer broad generalizations about diet from these results based on comparison with results from southern Manitoba (Ens 1998). The results suggest that individual 2 from the Victoria Day Burial site (GkLr-61) had a high fish diet. Low carbon and high nitrogen values have been obtained for 11 individuals tested from northern Manitoba (Figure 2.5), which date between 6,500 BP and 100 BP, indicating a relatively stable subsistence pattern over thousands of years. The unusually low carbon value from the Victoria Day burial Feature 2 may be related to the anemia indicated by the presence of cribra orbitalia (see above). The hypothesis of a high fish diet is supported the high polish and minimal wear present on the teeth (Molto 1997) and also the nine harpoon heads and fish spear points associated with the burial.

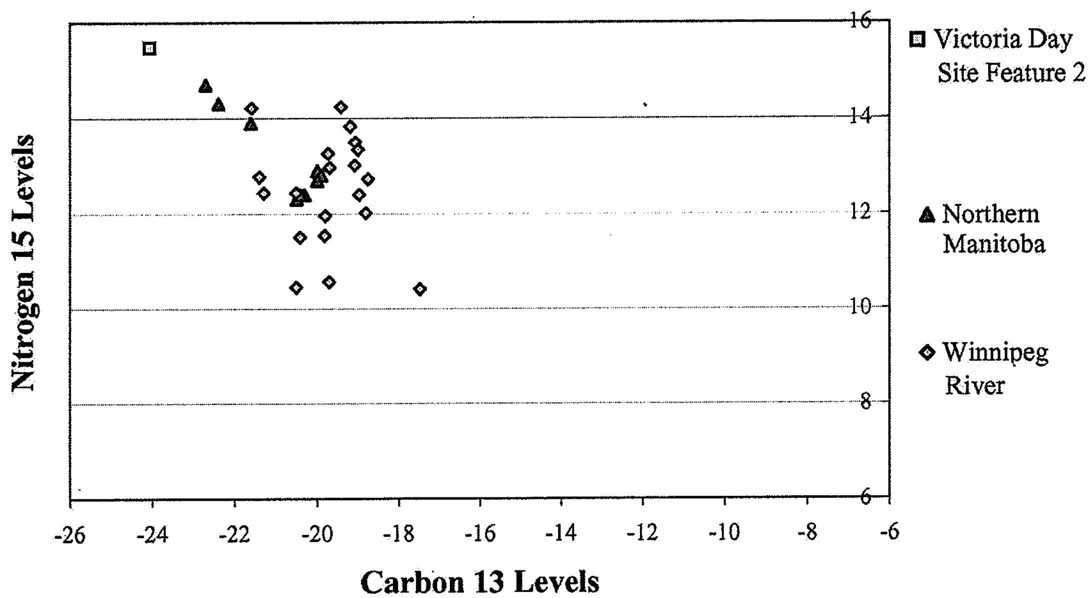


FIGURE 2.5: Scatter plot of $\delta^{13}C$ and $\delta^{15}N$ values from human bone collagen from northern Manitoba and the Winnipeg River region (modified from Ens 1998).

2.6 The Paleoenvironment of Northern Manitoba

It is generally agreed that the environment influences patterns of subsistence and mobility. Therefore, it is important to establish the physical environment of an area in order to provide insights into the cultural history of the people living there. Ethnological and archival documents suggest that hunting and gathering groups have a profound and intimate knowledge of seasonal and yearly variations in their environment (Brightman 1993; Brumbach and Jarvenpa 1997; Ridington 1999; Thompson 1962). This knowledge comes from paying close attention to the world around them and making decisions based on these observations (Ridington 1999:171). Ancestral knowledge records how best to utilize available resources and is shared from one generation to the next. This knowledge establishes a common understanding among people of both long and short term environmental conditions (Ridington 1999:172). The target region for this research is Canada's boreal forest zone, which is mostly underlain by the Canadian Shield (Johnson *et al* 1995). The boreal forest extends from Alaska to Newfoundland (Figure 2.6). Vegetation succession following deglaciation progressed differently in each region depending on temperature, precipitation and proximity to forest refugia (Löve 1959). Unfortunately, the vegetation communities that developed immediately following deglaciation between 8500 and 6500 years BP have no modern analogs. Modern vegetation communities are the product of thousands of years of Holocene development and each region is unique. While the boreal forest is often presented as a homogeneous biome, variation occurs across the region.

In order to properly reconstruct the physical environment in the vicinity of Threepoint Lake 4000 years before present, botanical, geological, and climatological

FIGURE 2.6: Western boreal forest shown in white (Modified from Johnson et al 1995).

data (Clarke *et al.* 2004; Klassen 1983; Löve 1959; Perkins 2002; Ritchie 1987; Ritchie and Yarranton 1978; Shay 1984) were reviewed. Only a general environmental reconstruction is possible due to the low resolution available from studies of this region. Most environmental reconstructions for the study region are based on pollen data (Ritchie 1987; Ritchie and Yarranton 1978). Ideally, multiple proxies should be used for environmental reconstructions including macrofossil, pollen, diatom, and insect data (Lowe and Walker 1997).

By 6,500 BP the vegetation communities in the region of Threepoint Lake of northern Manitoba began to have a distinctively modern appearance (Shay 1984; Ritchie 1987). The main drainage systems of northern Manitoba were established by this time

(Klassen 1983). Threepoint Lake refers to the three bays created by the rivers that flow into the lake and these would have existed by 4,000 BP. In Cree this lake is called *Nisto Tawaw Sakahikan* or Three Bay Lake (William Dumas *pers. comm.*).

A relatively warm, dry climate interval persisted in Northern Manitoba until 6000 years BP, during which time the forest/tundra margin extended 250 km north of its present location (Shay 1984). The climate probably affected northern hunting and fishing groups in Manitoba since it is likely that the range of barren ground caribou extended further north during this time and may even have moved beyond their territory in which case people would have had to travel further north than at present to hunt these animals or shift to other prey resources. Climatic variations likely forced the barren ground caribou into the region periodically when severe conditions such as high snowfall on the tundra occurred in conjunction with an early freeze up (Bergerud 2000; Kelsall 1968:62). Unfortunately, bone and antler is rarely recovered from archaeological sites and cannot be used to refute or substantiate these hypotheses.

After 6000 years BP the average yearly temperature decreased slightly with an increase in precipitation (Ritchie 1983). Under these climatic conditions the forest/ tundra boundary gradually moved south. Barren ground caribou would have become more common in the Threepoint Lake region as deeper snow and earlier freeze up of the lakes and rivers would have forced the herds further south into during the winter months. The cooling trend continued until 4000 years BP when climate stabilized, resembling today in both precipitation and temperature (Ritchie 1987).

During the period of interest for this research, the study region would have been in a boreal forest zone. Contrary to popular belief, the boreal forest is very mixed, supporting both coniferous and deciduous vegetation and many ecosystems. Well-drained soils support birch, white spruce, aspen, balsam fir and jack pine (Ritchie 1987; Shay 1980). Poorly drained areas develop fens, marshes, and muskeg supporting black spruce and tamarack. The boreal forest is characterized by thousands of lakes and rivers, which connect these various ecosystems together; as a result the area around Threepoint Lake supports a diversity of plant and animal life.

Trees in the area include black and white spruce, jack pine, white birch, balsam fir, balsam poplar, trembling aspen and tamarack. Shrubs include alder, hazel, and many types of willows. Fruit bearing vegetation include strawberries, raspberries, bearberries, gooseberries, cloud berries, pin cherries, saskatoons, crowberries, dewberry, blueberries, wild rose, moss berries, high bush cranberries, and juniper. Other plant life includes various mosses, rock trip, lichens and horsetails. In addition, a number of mushrooms and tree fungi also grow in the region (Marles *et al.* 2000, Johnson *et al* 1995).

The large game animals that use this region include black bears, moose, barren ground and woodland caribou. Smaller game includes beaver, muskrat, porcupine, rabbit, otter, lynx, martin, fisher, mink, ermine, wolf, and wolverine (Brightman 1993; Thompson 1963). A wide variety of fish can be found in the waters, including sturgeon, whitefish, northern pike, red and black suckers, pickerel, perch, mariah, and tulabee (Maher 1995: 49; Thompson 1962).

Today, spring sees the arrival of many species of bird including many types of ducks, geese, mergansers, seagulls, terns, cranes and loons, swans, pelicans, and other waterfowl. Many types of songbirds also migrate seasonally into the area. Grouse, gray jays, ravens, chickadees and a few species of owl and woodpecker inhabit the area year round. During the winter ptarmigan move south into the boreal forest from the northern tundra. A wide range of hawks, falcons, eagles and owls use the area during various times of the year (Bortolotti 1995: 33-48).

2.7 Site Location

Threepoint Lake is the meeting place of three major river systems (Figure 2.7). Waterways were main transportation routes during the past. Because the confluence of major rivers systems connects various regions together they become favoured camping sites both recently and in the distant past. As a result, Threepoint Lake has a total of 27 sites spanning 6,000 years. This lake also was the location of numerous Fur Trade posts established by both the NWC and HBC beginning in 1789 (Smith 1998).

A slow flowing channel exists southwest of the burial site, a short, one kilometer paddle from the site (Figure 2.8). The location was a favorite stopping place for ducks and geese during the spring migration and the stream is sheltered from the predominant northern and western winds (Linklater 1994). The environment adjacent to the channel is a low marshy area not suitable for camping, although it was prime moose habitat. Camping near this location would provide easy access to migrating ducks and geese in the spring, as well as being in close proximity to an ideal moose hunting area and a prime fishing location. A weir could easily be constructed across the shallow channel. The low water flow would allow fish to be speared easily either with or without the use of a weir at this location. The area also yields many species of berries and medicinal plants. Just behind (east) the burial site is a large granite ridge that runs parallel to the eastern side of the Threepoint Lake, which is still a favorite blueberry picking area. The local forest cover at the site is a mix of coniferous and deciduous trees today. Of note is the large number of paper birch trees in the area (see discussion chapter 15).

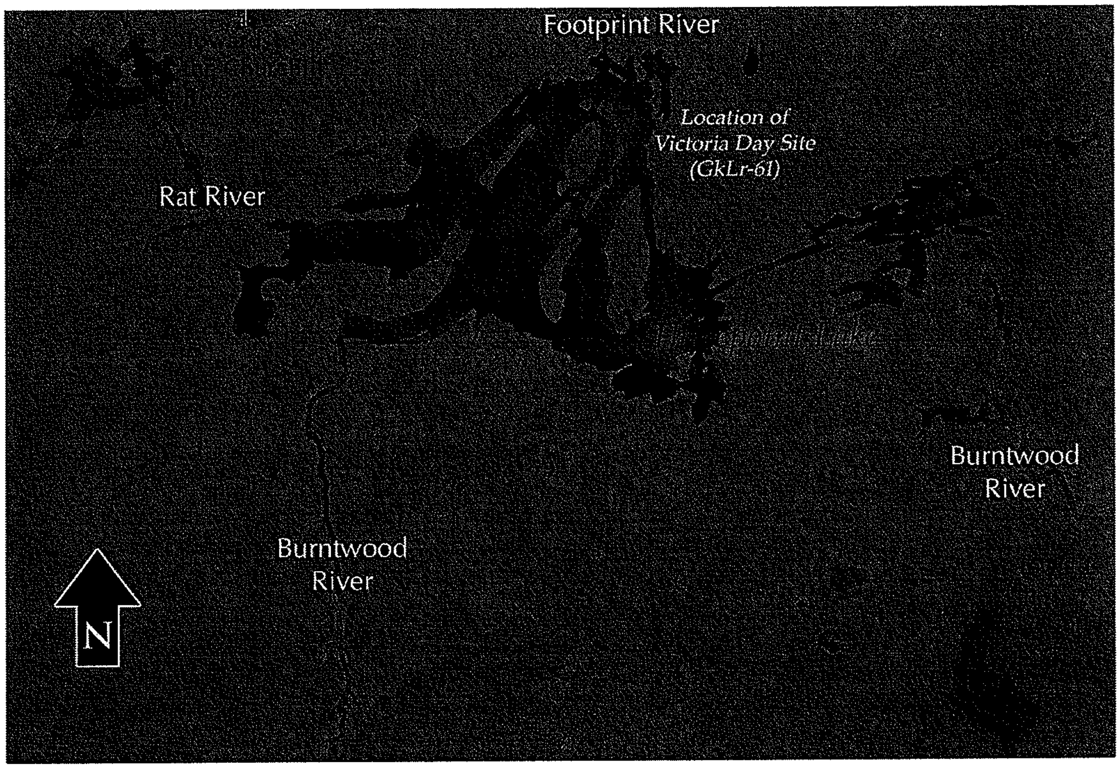


FIGURE 2.7: Three main rivers converging on Threepoint Lake, post flood map.

The Victoria Day site is located on the eastern shore of Threepoint Lake on a small point of land that faces west, now impacted by flooding (Figure 2.2; 2.7; 2.8). The burial site is located at the center of a rich microenvironment (see above). The site would ideally be occupied from just spring break-up until freeze-up (April – October) as it is too exposed for a winter campsite. Arriving at this location in early spring would allow people to harvest large number of migratory birds. The locally available paper birch could be used to mend and build canoes. The group would also be camping adjacent to a prime fishing location before the spawn began, giving them time to create and repair fishing equipment and build a weir if necessary. While berries would not be

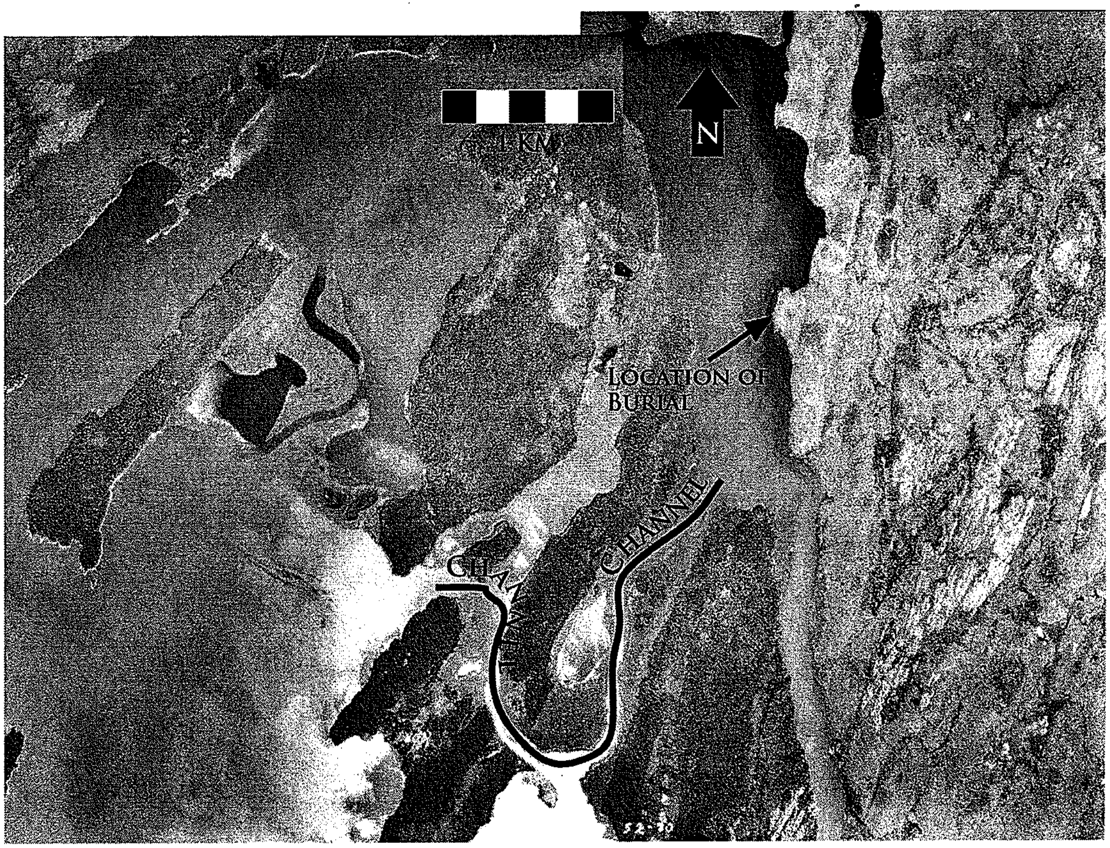


FIGURE 2.8: Modified aerial photograph of Threepoint Lake, note channel in the centre of the photograph. (Photograph supplied by Historic Resources Branch, Province of Manitoba).

available during the spring, a camp at this location could be sustained on other resources including ducks, geese and fish.

2.8 The Intensive Diversification Period (Archaic)

The period between 6500 and 2000 BP in the Canadian Shield is known broadly as the Shield Archaic (Wright 1995) and more recently, the Intensive Diversification Period (Syms 2001). This period remains relatively poorly understood. The difficulties of conducting research in the boreal forest outlined by Wright (1972) are still relevant today. Access to many locations is difficult, as few roads exist in the area. Flying field crews into the area is also prohibitively expensive. Boat travel is the most cost effective method of transportation but restricts research to river and lakeshore areas. Boreal forest archaeologists recognize these practical limitations. Even when these constraints are overcome, archaeologists are often faced with sites that have compressed/collapsed stratigraphy, acidic soils (and therefore poor faunal preservation), slow soil accumulation rates and dense forest cover.

The Victoria Day burial offers a rare glimpse into the cultural record of the Middle phase of the Shield Archaic (*aka*, Middle Intensive Diversification Period). The Intensive Diversification Period (Shield Archaic) is currently defined primarily on the basis of what is absent. By default, if lanceolate points and ceramics are lacking in an assemblage it is identified as representing the Intensive Diversification Period (Wright 1972; 1995:261). Wright sub divided the Shield Archaic into early, middle and late phases. Technology of the Shield Archaic is based on chipped stone and is lacking in ground stone tools (1995:261, 265). The recent recovery of burials from the Churchill River Diversion Archaeological Project has called attention to the well-developed bone and antler technology also possessed by people inhabiting the boreal forest during the Intensive Diversification Period (Peach 1998; 1999; Syms 2001).

Chronologies developed for the boreal forest tend to focus on projectile point typologies or ceramic wares (Wright 1995:265). Diagnostic artifacts are used exclusively to develop chronologies, creating a disjointed narrative of the past. Material recovered in association with the Victoria Day burials provides a rare occasion to study other materials, such as bone and antler tools, which are otherwise ignored or under valued.

The Victoria Day burial and others like it discredit the claim that the Shield Archaic had a poorly developed bone and antler technology (Mason 1981:136-139). Groups using the boreal forest during the Shield Archaic or Intensive Diversification period have been portrayed as marginal in the literature (Mason 1981; Clark 1991; Wright 1995). "The oldest of the projectile-point styles of the Shield Archaic … are suggestive of a deteriorated Late Paleo-Indian or Plano cultural pattern extended into and forced to come to terms with impoverished prospects. Mainly lacking ground and polished stone tools, the Shield Archaic looks ancient."(Mason 1981:136). By extension, the boreal forest region has been characterized as "a social and cultural backwater" (Mason 1981:138). It is argued here that these conclusions are inaccurate and based on incomplete data. Additional research, such as presented here, is required in order to understand this complex period when groups were diversifying both their technology and subsistence base.

Faunal reports for materials associated with the burials exist, including a preliminary study of the bone and antler tools (Peach 1995; 1998; 1999; Syms 2001). The research presented in this thesis, however, is the first intensive study of bone and antler tools that included research into the production sequence and wear pattern analysis; and the first to apply experimental archaeology and ethnoarchaeology to research in the region.

3. Foundations of Research – Theory

3.1 Introduction

Theory is the foundation of archaeological interpretation and directs research design. The following is a summary of the objectives established for the present research:

1. To establish the production sequence (operational sequence) of archaeologically recovered material.
2. To place archaeologically recovered material into a human frame of reference, thus making this study both socially and culturally relevant.
3. To demonstrate that scientifically based research can be conducted on repatriated artifacts.

It is of paramount importance that this research address the concerns of First Nation people, since without their support research on the Victoria Day site burial Feature 2 could not have occurred. Historically, archaeology has been linked to assimilation policies and the disenfranchisement of Aboriginal people from their past (Deloria 1970, 1985, 1992; Churchill 1997). A number of recent authors have examined the historical link between archaeology, colonialism, and Aboriginal people (Trigger 1984; McGuire 1992; Ferguson 1996; Zimmerman 1997). Yet there have been few attempts to become socially relevant or validate Aboriginal perspectives in archaeological theory. This research attempts to construct a theoretical framework that is relevant to the public, involves First Nation people in the interpretation of their heritage, and is academically sound.

3.2 Conceptualizing a Holistic Approach

John Ewers, in 1961, developed a holistic framework for ethnohistorical research that integrates historical documents, archaeology (artifact analysis, and fieldwork), ethnology, sociocultural anthropology, and linguistics. Each sub-discipline of anthropology provides a unique perspective for the interpretation of present and past groups within this framework. Despite the fact that it was developed over 40 years ago, a holistic framework continues to be applicable for anthropological research since it recognises the value of each sub-discipline of anthropology. Within a holistic framework, each sub-field provides a unique view of the past and the more approaches incorporated the better. Charles (1992:905), for example, advocates choosing several theoretical frameworks in order to increase our understanding of past events. Each theoretical framework illuminates a different aspect of past life ways. This flexible approach recognises that each theory has its own benefits and drawbacks, compared to a single-model perspective. Though Ewers (1961) recognises that his model is time consuming, the potential benefits far out weigh the time investment.

Archaeologists should always examine new ways to broaden the scope of their research. New developments within the field of archaeology and in the so-called hard sciences and social sciences should be examined and evaluated to determine if they may be applied to archaeological research. A holistic approach recognizes that no single method, methodology, or theory can be used exclusively in the interpretation of the past. In other words, a holistic approach requires that researchers employ not only multiple methodologies but also multiple theories, integrating these into their interpretation. This approach ensures that the researcher rather than the theoretical approach being applied guides research.

The over arching theoretical framework applied in this research, therefore, is interdisciplinary and holistic, focusing on the study of technology through agency theory and processual archaeology. Agency theory is a particularly fruitful approach to the study of technology and one that is in keeping with the concern of this research to enfranchise First Nation groups (see below).

3.3. Agency Theory

3.3.1 Defining Agency Theory

Little consensus exists as to how agency theory is actually defined and applied by current researchers (Dobres and Robb 2000). It has been applied to interpret the individual; the cognitive structure of an individual; the resistance to social norms; the resistance to power inequalities; the capacity for skilful social practice and the freedom from social constraints (Dornan 2002). In principle, however, agency theory employs methodological individualism, focusing on people or groups of people as agents of the past. This is not to say that archaeologists are searching for the identification of real people, traced archaeologically (Johnson 1989). Rather, artifacts are examined as the product of an idealized "individual" or the product of a group of individuals who made a series of cultural choices when producing tools. The main terms used in agency theory are agent, agency, and structure (Dobres 2000). The term *Agent* is a comprehensive one that includes not only individuals but also groups of individuals or bounded collectives. The term agent, therefore, should not be considered synonymous with an individual.

Structure encompasses many things, both tangible and intangible, including the conditions, context, rules, and environment in which people and groups of people exist. Some structure has physical form (such as environment, architecture, and food), while some does not (such as ideology and symbols). Structure both constrains and enables individuals. *Agency* is defined as the dynamic process of action between individuals and structure (Dobres 2000:133). Agency can be played out at both the micro-scale (individual to individual) or at the macro-scale (individual to structure).

In agency theory, societal institutions become structures through the agency (actions) of individuals and collectives (agents), at the same time that agents (individuals and collectives) are structured by and exist within societal institutions (Dobres 2000:141). In other words while one person may act alone when producing a tool, he or she remains part of a larger social community where they learned and developed their technical skill (Dobres 2000: 128).

Attesting to the value of an agent based approach, numerous archaeologists have begun to apply this theoretical model (Brumfiel 2000; Dorbes 2000, 2001; Dobres and Hoffman 1999; Dobres and Rob 2000; Dornan 2002; Hodder 2000; Ingold 2001; Sassaman 2000; Schiffer 2001, Sinclair 2000). The recent popularity of agent-based research, in both archaeology and socio-cultural anthropology, is proof of its ability to reunite subfields of anthropology.

3.3.2 History of Agency Theory

The focus of agent based research is not new, in fact individualism extends back to Greek philosophy. The concept of self-determination has been common throughout the eighteenth and nineteenth century. Sociocultural anthropologists were adopting the concept of the methodological individual in the 1950s (Dobres and Robb 2000: 4). Archaeologists who embraced sociocultural anthropology were conceptualizing and writing about groups of "agents" well before it became common in archaeological circles (Sinclair 2000: 210).

Agency theory developed by integrating concepts drawn from processualism and structuralism to examine the interplay between social institutions and self-determination. From this perspective, society and the individual are integral components driving social reproduction. Many of the founding principles of agency theory are borrowed from theorists such as Bourdieu (1977) and Giddens (1979). Agency theorists also adopt some of Marx` (Marx 1963; Marx and Engels 1970) concepts relating to structuralism (Dobres and Robb 2000), such as a concern for the relationship between the individual and the social structure within which they function.

3.3.3 Archaeological Application of Agency Theory

Archaeologists study the material culture of past groups, borrowing many theories from social anthropology (Binford 1962). The application of agency theory in archaeology requires some modification from its original use in sociocultural anthropology. Archaeologists cannot have a conversation with individuals in the past or ask questions about their society. Therefore, archaeologists must adapt the concepts of agency theory and relate them to archaeological data such as artifacts, spatial analysis, and experimental archaeology to help interpret the actions of individuals in the past.

Four distinct lines of inquiry using agency theory emerged in archaeology during the 1980s and 1990s. The first area was in gender research (e.g., Conkey and Spector 1984; Gero 2000). The second area examines structuralism, i.e., how agents are in a continual negotiation with long term social structures (Sassaman 2000). The third area agency theory is used in is the study of emerging inequalities (Silverblatt 1988). Finally, agency is used in the study of variation in material culture as expressed in the style and form of artifacts (Hegmon 1992) and more recently, agency theory has focused on technological analyses (Aronson 2001; Dorbes 2000, 2001; Dobres and Hoffman 1999; Dobres and Rob 2000; Dornan 2002; Hodder 2000; Ingold 2001; Sassaman 2000; Sinclair 2000).

3.4 Technology and Agency Theory in Archaeology

Technology has long been a focus of archaeological research. In the past, anthropologists established cultural stages of human development, from savage to civilized, largely based on technological developments (Haller 1971). In the 19th century model the "human race" moved through successive orders of complexity, each stage defined primarily by the technology utilized by each group (Haller 1971). While we no longer accept these inherently evolutionist perspectives, technology is still the focus of much archaeological research since archaeologists must rely on the interpretation of material culture to inform us about the past.

Recent archaeological research into technology is informed by agency theory and the notion that agents play a central role in weaving the material, social and symbolic together (Dobres 2000). In this way, technology is viewed as the interaction of humans and the physical world (Ridington 1999); material culture is a source of information about this interaction.

Hoffman and Dobres (1999:211) recognize that technology is tied to "social relations, knowledge, skill, and contexts of learning; and the construction of, interpretation, and contestation of symbols and power." Indeed, within hunting and gathering groups, the forces of production are deeply embedded in social relations (Ingold 1993: 438) and in the material and ecological conditions of the natural environment (Ridington 1999:169). The technology used by northern hunting groups, therefore, involves a sophisticated interaction between people and a complex ecosystem (Ridington 1999:172).

By highlighting the connections between culture and technology, archaeologists are moving beyond a materialist perspective on technology. Examining technology provides archaeologists with the option of pursuing many avenues of research, resulting in new insight into the cultural choices made in the past.

3.5 The Operational Sequence

Another important concept employed by archaeologists to study technology is the operational sequence or "*chaîne aine opératoire*". This concept incorporates a consideration of the cultural choices made during tool production and the complete sequence of events involving tool manufacture, use and discard (David and Kramer 2001; Dobres and Robb 2000; Ingold 2001; Skibo and Schiffer 2001; White 1992).

The concept of the "*chaîne opératoire*", or production sequence, as a framework for the analysis of artifacts was introduced by Leroi-Gourhan in 1964, though he did not fully integrate the social aspects of tool production (Graves 1994). Leroi-Gourhan's work was translated into English in 1993, after which English speaking archaeologists were exposed to this terminology. Other archaeologists used similar concepts to study the steps in manufacture, recording cultural choices in production (Syms 1977:59-63). By studying artifacts as they progress through an operational sequence, the social and technical activities involved in production become fused together (Gamble 1999:82). Since the nineties, the concept of the operational sequence has been refined in order to accommodate both tool production and a relationship with social structure. The utility of the operational sequence as a concept is demonstrated by various researchers (e.g., David and Kramer 2001; Dobres 1999, 2000, 2001; Hodder 2000).

The operational sequence includes all of the steps involved during artifact production as the item is transformed from raw material into a finished tool. This approach is now enriched by the recognition that some of the choices in tool production are cultural (Graves 1994; Dobres 2000). By examining the operational sequence, static archaeological remains can reveal information about the active mind of an ancient individual or individuals (Dobres 2000, 2001) without trying to relate the sequence to a particular, embodied individual (Hodder 2000: 26).

If one accepts that tool production is an interplay between the static physical properties of raw materials and the flexible cultural choices made during production (Dobres 2000: 155) then it seems natural to adopt a "*chaine opėratoire*" mode of analysis, establishing the production sequence of raw material selection, production techniques and sequences, use, reuse and discard. Before one can interpret the cultural influence expressed in a tool, one must begin with an understanding of the technological progression of the tool's life. By demonstrating the chain of events that take place when an artifact is made, the choices of past people can be determined, as these choices may reflect socially accepted methods of tool production. This approach changes the research emphasis from a focus on the finished product to focus on the whole process of production.

If the production sequence for similar tools varies between regions, new questions are raised as to why certain production sequences were chosen in favour of others. This leads archaeological interpretation far beyond the simple analysis of form, as well as drawing attention away from the function of a tool as an ultimate objective of research.

An understanding of the norms of tool production provides insights about individuals and also about value systems. Hoffman and Dobres (1999) recognize that the choices available to an individual are almost limitless and that culture ultimately plays a crucial role in deciding what choice the individual makes. If the method of tool production can be shown as culturally distinctive, then we can begin to understand the role culture played in the past.

3.6 Application of Agency Theory

3.6.1 Examining the Individual through Agency Theory

Agency theory presents individuals as forward-looking intentional and creative (Hodder 2000:23). For example, Hodder (2000) advocates using agency theory to present the "lives lived" of past people. The narrative that Hodder (2000) creates is an excellent model for the present research as it should help generate interest from the general public and more specifically, within First Nation communities. By incorporating a narrative element into research, the human scale is re-inserted into archaeological interpretation as a window for the non-specialist (Hodder 2000:31). Other examples of a narrative approach include research conducted by Fox and Molto (1994) and Brownlee and Syms (1999). By integrating archival and ethnographic data the narrative is enhanced, providing a better picture of social processes at work and their potential effect at the level of the individual (Dornan 2002).

3.7 Sources of Variation in Tool Form

Variation in tool shape can be the result of constraints imposed by the raw material, the type of tools used in production, the manufacturing techniques employed during manufacture, the mental construct of the end product before production begins, or the mental, physical, spiritual or emotional aspect of the toolmaker (Sinclair 2000; William Dumas *pers. comm.*). Archaeologists must remain mindful of this list when interpreting inter or intra site variability.

Archaeologists should conceptualize tools as the product of an individual, which represent the fusion of culture and technology (Hoffman and Dobres 1999). From a Cree perspective, each of the four components of an individual (spiritual, emotional, physical, and mental) must be balanced. During tool manufacture an individual with a broken arm will not create stone tools with the same skill as he or she did before the arm was broken. If a hunter becomes frustrated or upset, their ability to shoot accurately may be affected. Whether shooting a bow and arrow or a 270 rifle, a calm and balanced attitude is required to be successful in hunting. While these four components of an individual are difficult to interpret from the archaeological record they are relevant to understanding the potential sources of variation in the archaeological record.

Variation also occurs based on the experience level of the crafts person. If an individual is a novice or learning a technique, finished tools may not follow the mental image held by the individual producing an item. Over the course of a person's lifetime, they will move from novice to being proficient to expert and finally to teacher. The last stage occurs when the lack of physical strength, dexterity, or mobility begins to influence the end product.

Finally, the personality of the individual is also reflected in the final form of a tool through a process of embodiment, as Sinclair's (2000) research shows. Sinclair (2000) bases this idea on ethnographic accounts of Inuit soapstone carvers who, through the process of carving, embody traits such as boldness, exactitude, perseverance, and adaptability into their work (Sinclair 2000: 205). Boldness is embodied through the choice of a complicated design, exactitude through the details of the design, perseverance though difficulty of making an item and adaptability through the ability to modify an item if problems arise during manufacture. Sinclair (2000) uses the skills and character traits required to produce artifacts to reconstruct the social values of the toolmakers. By expressing these personality traits throughout their art, Inuit hunters try to establish balance in their lives and ensure successful hunting by showing respect for the items carved. The concept of embodiment can be used when examining archaeological material, for example, a well-executed, thin projectile point made out of poor quality material shows boldness, skill, perseverance, and exactitude.

3.8 First Nation Perspectives

Another feature of agency that is consistent with a First Nation perspective is that during the production of a tool, dialogue occurs between the maker and item being produced. Cree philosophy recognizes that every item, either animate or inanimate has a spirit (William Dumas *pers. comm.*). This concept may extend to a time when virtually every item had a use and dialogue occurred between the producer and the raw material. Perhaps through the manufacture process dialogue between the maker and the tool has become entrenched in Aboriginal philosophy. Further, if every item has a spirit it must be treated with respect to ensure that the item "works" well, is free from flaws, will be successful in its final use and ensures balance.

3.9 Combining *Chaîne Opératoire* and Agency:

The concept of the *chaine opératoire* is an important initial step in the analysis of artifacts from the perspective of Agency. For example, Robb (2001a) presents the following framework for the analysis of artifacts:

- Outline the operational sequence of producing an item including skill, choice, and implied knowledge (Dobres 1999, 2000, 2001).
- Determine the nature of technology (reductive, breakable, reworkable, and additive).
- Suggest techniques of embodiment (gesture, skill the senses) (Sinclair 2000)..
- Identify the material requirements for producing an item (chains of procurement, social relations).
- Establish the culture use-life or biography of an artifact (use, circulation, choices, changing meanings, deposition). (David and Kramer 2001).

- Recognize that an item moves through space as it is produced, used, and deposited.
- Outline the length of time a tool is functional, how a tool is used, and how projects and time is managed.
- Understand the symbolisms of a medium, the physical properties of raw material, the social associations of material, and the symbolic interdependence with other artifacts
- Identify social institutions and how tools were involved.
- Establish if a functional interdependence exists with other artifacts
- Determine if techniques are specific or applied to other artifacts.

When this framework is applied, artifacts can be used to reconstruct activities and their relationship to broad projects. It becomes the archaeologist's goal to link artifacts to activities, activities to projects, and projects to the ancient economy. By conceptualizing tools in terms of the projects they involve, static items are seen as active. Robb (2001a) discusses the goals, objectives, motives, and intentions that fuel projects. Traditional ecological knowledge, oral histories, and participant observation are excellent ways to establish motives, goals, objectives, and intentions of people in both recent and distant past. These techniques rely on the expertise of indigenous people to help establish projects conducted in both the recent and distant past. It is within this intellectual framework, combining analysis of the *chaîne opératoire* with concepts of agency and embodiment that this research has evolved.

3.10 Becoming an Agent of the Past

Ethnoarchaeology is the ethnographic study of living cultures using an archaeological perspective (David and Kramer 2001: 2). Since it is a way of acquiring knowledge, it is neither a method nor a theory, rather it is a research strategy that cross-cuts theoretical perspectives (David and Kramer 2001). In this research, I have conducted ethnoarchaeological research and have used both participant observation and interviews as a means of broadening my knowledge of activities conducted in the past. Archaeologists often have preconceived ideas regarding the activities conducted in ancient times and focus on the ones that have archaeological visibility (Dobres 2000; Brumbach and Jarvenpa 1997; Conkey and Gero, 1991; Conkey and Spector 1984; Gero 1991; 2000; Moore 1994; Spector 1993). By including ethnoarchaeological data into the analysis, the potential for this kind of bias is reduced.

First Nation people who live off the land have a remarkable reverence and respect for the land and animals and the knowledge held by current individuals of the land is extensive (Brightman 1993; Brumbach and Jarvenpa 1989; 1997; Linklater 1994; Keith Anderson *pers. comm.*; Leslie Baker *pers. comm.*; William Dumas *pers. comm.*). Since one of the goals of archaeology is to understand movement on the landscape and use of the resources, what better way to engage First Nation people than by incorporating their knowledge and expertise of land and resource use (Malasiuk 1999)?

Being an agent of the past requires that archaeologists utilize traditional knowledge, ethnoarchaeology, ethnology, participant observation, and historical documents to broaden their interpretive approaches. Indigenous people are integral in the interpretation process, providing an alternate worldview. When interpreting artifacts the researcher attempts to situate himself in *Kayas* (long ago), to become an "agent" of the past. In doing so, the researcher examines tools to see what activities or tasks they may have been involved in and how they may have been used. In northern Manitoba, interviews and oral history are particularly useful methods for understanding resource use and seasonal movements over the landscape. In addition, they can assist us in defining past activities, which extend beyond current memory and help us "look outside the box", as advocated by Hodder (1984).

3.11 Theoretical Summary

Over the last few decades archaeology has shifted from a culture-historical perspective, based on the descriptive study of artifacts and a focus on large-scale processes, to an attention to the individual as well as the society they lived in. A new focus on individuals as active agents and constructing societies, has emerged in the form of agency theory. While the focus of attention in agent-based research is on individuals (real or idealized) within a larger society, there is a recognition that detailed descriptive examination of artifacts is still fundamental to archaeological research. The examination of technology and artifacts has also been improved with the introduction of the concept of the operational sequence, where an artifact is seen as the expression of individual choices. As argued in the introduction to this chapter, a holistic approach is a required to properly interpret technology (Charles 1992; Ewers 1961; Hoffman and Dobres 1999). This research adopts just such an approach, incorporating agency, the concept of the *chaîne opératoire* and a First Nation perspective.

4. Methods

4.1 Background Summary

Following the recovery of burial feature 2 from the Victoria Day Site and prior to this research, the associated artifacts underwent conservation and were documented at the Manitoba Museum. All items were cleaned using distilled water and a soft brush, and all broken items were re-fitted and glued under the direction of the conservation department at the Manitoba Museum. Black and white, colour print and colour slide photographs were taken during and following the cleaning process to document the artifacts thoroughly. Shirley Levacy (contractor for the Archaeology Department at The Manitoba Museum) illustrated each item. Thirty-eight of the forty-six tools recovered in feature 2 were replicated. Linda Pearce (contractor for the Archaeology Department at The Manitoba Museum) produced four exact replicas for each of the thirty-eight tools chosen by Syms for future research and display purposes. The decision to produce casts was also based on an assessment of which items could be replicated, as some items were too fragile (some incisors, ochre); flakes of unknown function and/or association with the burial were not reproduced. Casts were produced from rubber moulds using Ultracal 30 casting compound. The Ultracal 30 replicas were hand painted to match the original tools and used to create display cases for the community of Nisichawayasihk Cree Nation and Manitoba Hydro; two copies of each tool was also retained for research at the Archaeology Department at the Manitoba Museum.

The faunal material from Victoria Day was examined by Kate Peach, who identified the tools from feature 2 to species and element, whenever possible (Peach 1998). Dr. Heidi Katz (formerly Knecht) was contacted by Dr. Leigh Syms to assist in documenting the original tool surface for future wear pattern analysis. Katz has extensive experience in both wear pattern analysis and experimental archaeology on bone and antler tools (Knecht 1993a, 1993b, 1994, 1997a, 1997b). Katz suggested the use of 3M Express Vinyl Polysiloxane Impression Material to produce a high quality, permanent record of wear patterns and manufacturing marks that would facilitate wear pattern analysis of the tools once the originals were reburied. Leigh Syms produced the vinyl moulds of functional edges and manufacturing marks present on all of the bone and antler tools studied in this research. The original tools from the Victoria Day site feature 2 were reburied in the community of Nisichawayasihk Cree Nation prior to this research. The Manitoba Museum's replicas, vinyl moulds, illustrations and photographs were utilized to produce the archaeological replicas using authentic raw materials (below).

4.2 Museum replicas

Creating a positive copy of the surface of the original tools is required to facilitate the examination of wear patterns. Dental stone casts were made from the vinyl moulds that recorded the functional edges of the original tools. Green Jade Stone (High Strength Die Stone) was used to produce the casts. Pre-weighed packages of jade stone powder weighing 70 grams were mixed with 15.5 ml of water (10-15 seconds). A vacuum mixer was used to blend the powder and water into an even consistency removing many air bubbles (20-30 seconds). A dental vibrator was used to remove any final bubbles remaining in the liquid jade stone before pouring (30-60 seconds). Small batches of dental stone were mixed at a single time as the material sets within 4 to 6 minutes.

Each dental stone cast was photographed using the same standards set for documenting the replicated tools using an Olympus C3030 Zoom (1/1.8" CCD and 3,340,000 pixels resolution). The camera was attached to an Olympus SZX12 stereoscope used to record the surface of the cast at 7x magnification. Small pencil marks were made on the casts allowing the images to be stitched together to produce a continuous image of the tool surface captured by the vinyl molds. A data recording sheet was completed for each tool to record the results of stereoscope and macroscopic observation. The recording sheets allow the researcher to compare images from the original tools (dental stone casts) and the replicated tools.

4.3 Archaeological Replicas (Experimental Replication Process)

Faithful reproductions of the tools were essential to assess the function of the Victoria Day tools during the interview process, which took place after reburial of the originals, and in order to test the proposed function of the tools during the experimental phase of research (results Chapters 6-14). What may seem insignificant to an archaeologist may be an essential part of tool during use. The interview process was designed to help identify the function of tools and the locations of functional edges. Files and handsaws were used exclusively to shape and finish the replicas. Different grades of files were used, depending on the stage of manufacture. Coarse wood rasps were used to rough out the tools, followed by finer grain files to finish them. Water was used initially to soften the antler tools but this reduced the effectiveness of files as they were quickly clogged. Following this discovery, files were used on dry antler and bone.

Water does not soften bone unless the bone is boiled (Lahren 1974:149) and this was not attempted since it was expected to clog the files. The last stage of manufacture was polishing the surface of the bone and antler tools to eliminate manufacturing marks. Polishing was done using 600 grit waterproof sandpaper. No power tools were used in the replication process as the speed of these tools can burn the material being cut or ground, possibly influencing their utility.

4.4. Ethnographic Methods

The goal of this stage of the research was to identify a list of potential activities for the tools from Victoria Day site, feature 2. Dobres (2000) suggests researchers use alternate intellectual frameworks to enhance research. One means of developing an alternate framework for interpreting the past in northern Manitoba is to engage members of First Nations to participate in the research. This principle guided the choice of ethnographic methods used here.

4.4.1 Participatory Action Research

Participatory Action Research, or PAR, involves the integration of the study group as part of the research process from start to finish (Hoare *et al.* 1993; Maguire 1987; Robinson 1996; Ryan and Robinson 1990; Simonson and Bushaw 1993). PAR involves three levels (Maguire 1987). In the first level, PAR acts as a method to investigate social problems such as youth loosing touch with their heritage and history. The next level ensures that the nature of the work is educational, teaching both the researcher and participants. The final level involves use of the research results to solve the problems initially outlined in the first level.

Participant observation research for this project is based on the author's eleven years of experience working with northern communities (Nisichawayasihk Cree Nation, South Indian Lake, and Leaf Rapids). During this time, the researcher has attempted to familiarize himself with the Rock Cree culture, language (Algonquian language), the boreal forest environment and its resources. This learning process contributes to his understanding of past life-ways and assisted in the interpretation of archaeologically recovered materials.

4.4.2 Interview Process

Before interviews could be conducted ethics approval for the project was sought from the Joint Faculty Research Ethics board at the University of Manitoba. The application was approved in May of 2002, for the duration of one year.

Brightman (1993: 23) notes that the most fruitful method of interviewing within the Rock Cree community of Granville Lake was through informal conversation. A formal interviewing process is less informative, as direct questions are not culturally appropriate. Furthermore, formal questions lead to answers that are consciously formulated by those interviewed based on their assessment of what they think the researcher wants. Therefore, informal conversations were used in this research. The method of recording selected was written notes during and immediately following the conversations (during the evening or the following day). Tape recorders were not used they create a formal atmosphere (Brightman 1993).

The replicas produced by the author were brought to the interviews to assist in the identification of potential activities associated with them. Un-hafted tools were used to ensure the entire tool could be examined. In this way, information regarding possible hafting methods and the types of wood best suited for hafting the tools could be elicited. A drawback of this approach was that some consultants interpreted the tools as complete (not requiring handles), thus limiting the types of activities suggested. Three antler tools with different morphologies were identified by many of the older consultants as hide fleshers. Hide fleshers do not require hafts and are still used by northern residents in preparing hides. During the experimental stage, however (see Results) it was determined that antler functions very poorly as a hide fleshing tool. The interview process began in June of 2002 with community members from Nisichawayasihk Cree Nation. Many of the older individuals interviewed only spoke Cree, requiring the assistance of an interpreter, Charlene Spence of Nisichawayasihk Cree Nation. At the time, Spence had worked as an archaeologist for three years and was well acquainted with the author. Seven Elders were interviewed in Nisichawayasihk Cree Nation (Nelson House) including: Lottie Moore (aged approximately 110 years old), Alvin Moodie (in his late 90s), Marie Hartie (aged in her late 80s), Moses Moore (aged in her mid 80s), Leda McDonald (age 83), Joshua Spence (age 82), and Jonson Donkey (age 55) the exact age of some individuals is not known due to incomplete birth records. The interviews were conducted during one day. Interviews lasted from 15 minutes to 1 hour, and in some cases more than one Elder was present during the interview process.

Many ethnologists experience hesitation within the community when they first conduct research (Brightman 1993; Brumbach and Jarvenpa 1989). Residents of Nisichawayasihk Cree Nation were acquainted with the author, however, since he had spent 11 years working as an archaeologist within this community and a level of trust had been previously established. All of the people interviewed knew of the archaeological work conducted in their traditional territory and the presence of Charlene Spence as interpreter also provided a level of trust between the author and those interviewed.

The second set of interviews was conducted in Leaf Rapids and adjacent Rusty River Camp, owned by Keith Anderson. These interviews were conducted between the author and his long time friends and "adopted" family. Again, established trust within these social circles provided exceptional insights into the lifestyle and activities conducted by northern trappers and fishers. Those interviewed included Keith Anderson, Burnell Anderson, and Leslie Baker. Visitors to the Rusty River Camp also provided insights into the tools, including Bruce Tait, Paul Bird, and John John Baker. Many hours were spent discussing the function of the tools in camp at Rusty River. Telephone conversations continued this dialogue once the field component was complete, mainly between Keith Anderson and the author. During the informal interviews the replicated tools became the focus of conversation. Unfortunately, none of the people interviewed had ever made bone or antler tools, except for hide fleshers made of moose metatarsals. Conversations soon moved to the types of activities the tools may have been used for. This direct historical approach identified current activities or activities within the memory of individuals that were projected onto the tools. Numerous hypothetical activities that could have been associated with the tools were suggested and these activities were evaluated during the experimental component of the project (see below). Many Elders thought it was strange that I would reproduce bone and antler tools, since metal tools could be purchased and used in place of bone and antler ones.

The complete set of replicated tools was shown to the people during interviews and types of activities suggested by those interviewed were recorded. It was hoped that some of the tools would be interpreted as representing "tool kits" rather than viewed in isolation. For the experimental stage of the research, after the interviews at the Rusty River camp (where appropriate types of wood could be collected, based on the information provided during the interviews) the replica tools were hafted.

4.4.3 Oral Histories

During the interview process oral histories were collected. The author distinguishes interviews relating to the tools (ethnoarchaeological data) from conversations recording oral histories. Conversations about the replicated tools involve asking individuals what the tools may have been used for - a hypothetical situation. Oral histories discuss actual events and real situation. These tend to focus on resource use and subsistence practices. The oral histories (recorded from Nisichawayasihk Cree Nation, South Indian Lake and Granville Lake communities) provide information about potential contexts of use of the Victoria Day tools that might otherwise be archaeologically invisible.

Few archaeologists use oral histories or community knowledge for developing activities to be tested using experimental archaeology. Dornan (2002) and Hodder (2000), touch on the subject of incorporating other voices although not specifically with regards to experimental archaeology. Dornan (2002:311), in her evaluation of agency theory, states that if archival and ethnohistorical material is available for the group being studied it must be incorporated into the analysis. This statement should be expanded to include other forms of knowledge from the Aboriginal community such as oral histories and other forms of traditional knowledge. There are obvious ethical and moral reasons for doing this, as well as practical ones, since incorporating other voices or perspectives can identify significant historical events, subsistence practices and activities not recovered in the archaeological record. I would argue that adding the dimension of ethnography, oral history, and traditional knowledge enhances the application of agency theory in archaeology. In this research, oral histories are used in conjunction with informal interviews to propose possible tool functions. The interviews conducted during this research focused on resource use and subsistence strategies. Since these oral histories record the personal experience of the consultants interviewed little critical evaluation was required.

4.4.4 Ethnographic and Historical Documents

Ethnographic, archival, and historical documents are also used in this research to identify activities, projects, and goals potentially associated with the Victoria Day Feature 2 artifacts (see chapter 3). Recent economic and environmental changes in the study region have had a negative impact upon the lives of its people. Hydroelectric dams, logging, federal and provincial legislation, mining, residential schools and the creation of reserves have affected the normal movements of people over the landscape. By severing the tie between First Nations and the land, the connection these people have to their past and history has been broken (Linklater 1994). Currently, a number of individuals, including two of my consultants, continue to have an intimate tie to the land for subsistence and economic livelihood, although the number of these people continues to be reduced. This fact reiterates the importance to teaching the youth about their past, a major concern identified by the community. Ethnology and historical documents can help to establish a meaningful connection to the past.

The ethnographies used in this research include Brightman (Rock Cree) (1993) and Brumbach and Jarvenpa (Dene) (1989). Brightman's (1993) study focuses on the Rock Cree from the Churchill River, who speak the same dialect as Nisichawayasihk Cree Nation. These sources provide information about land use, population movements, and activities. Archival and historical documents provide additional information for activities conducted in the boreal forest and transition zone. Historical sources include the journals of James Knight 1717 (1932), Drege 1748 (Pettipas 1982) David Thompson 1806 (1962), and Andrew Graham 1815 (Lister 1988).

A review of the ethnologies and historical documents was conducted to examine the role of different animal resources in the diets of past people. Particular attention was paid to reference to fish weirs and fishing strategies recorded in these sources as numerous fishing tools were recovered with the Victoria Day Burial, Feature 2. The information obtained from the archival and historical documents was used to supplement information recorded during the interview process. When inconsistencies were identified between oral interviews and archival information, the archival data were evaluated to establish whether ethnocentric and/or androcentric views may account for the discrepancies. Likewise, oral interviews were evaluated against the knowledge that recent activity, resulting from contact with Europeans rather than an ancient pattern of activity, is being recorded. It should be noted that neither of these sources has precedence over the other.

4.5 Experimental Archaeology

As an analytical tool, experimental archaeology is an important means of establishing the operational sequence of a tool as well as its' use. A scientifically based testing program was developed to evaluate the suggested functions of each tool, using experimental archaeology. The replicas produced for this research were used in a series of activities, as suggested by ethnographic and historic data. The surface of the replicas was examined under the microscope both before and after the experiments (see below), and compared with the surface patterns on the casts of the original tools.

4.5.1 Development of a Key

A limitation faced by the present study is the lack of standardization in the recording of wear patterns and manufacturing marks. Further complicating the issue is the lack of standardized terminology or vocabulary when describing these wear patterns. This issue is particularly noticeable in North American archaeology. The Committee of Nomenclature of Prehistoric Bone Industry has been active since 1974 to help establish standards across the discipline, although the publications of this committee are exclusively in French (Marylene Patou-Mathis, *pers. comm.*). Unfortunately, this research has not been translated into English.

To ensure reproducibility of results, a standard form was developed for this research to record the wear patterns and manufacturing marks on the tools (appendix 2). A key was developed to establish consistency in recording procedures (appendix 2). The key is flexible, to allow the addition of new terms and fields to describe patterns not accounted for in the original recording form. No new fields were added during this the course of this project, however.

A form was completed for each tool, recording both wear patterns visible with the naked eye and using a stereomicroscope at 7x magnification, the information provided in the original report on the faunal material (Peach 1998) and photographs of the tool. This information was supplemented with an examination of dental stone replicas cast from the 3M Express Vinyl Polysiloxane moulds taken from the original Victoria Day site Feature 2 tools (see above). The bone and antler replicas were observed macroscopically and using the stereomicroscope prior to testing. These observations could then be compared with the wear patterns produced during the experiments. After experimental use, the tools were again observed under the stereomicroscope and details of wear were recorded.

4.5.2 Faunal Analysis

Faunal analysis was an important aspect of this research. Identification of species, element and bone portion is useful for illuminating the production sequence. Furthermore, this analysis provides insight into the value of non-meat products obtained from animals. The original faunal report for Victoria Day Site feature 2 (Peach 1998) described the morphology of the tools, their measurements and identified element and species when possible. This original report was the basis of the faunal identification component of this research. Since the original tools had been reburied, the replicas and photographic records of the original tools were used to assist in the identification process. The replication process itself provided refinements to the faunal identifications. The shape and dimensions of the original tools were used to help identify the element, or portion, used in the production of the tool (Chapters 6-14).

To further assist in the faunal analysis, comparative collections at both the Manitoba Museum and the University of Manitoba were consulted. Modern moose and caribou bones at the author's disposal were cut to determine the thickness of bone and location of cancellous bone. Cancellous bone is porous or spongy and often removed during the manufacture of tools to expose the compact (dense) cortical bone. It is located at the proximal and distal ends of long bones reducing the maximum usable length of an element when manufacturing tools (Reitz and Wing 1999: 58).

4.5.3 Experimental Archaeology

Interviews with Elders and community members provided information about traditional activities and the tools associated with them. The interviews also helped devise a list of activities with which the tools could have been associated (see results chapters). Experimentation involves the use of replicated tools in actual situations. Tests were conducted on the Churchill River, near the town of Leaf Rapids (Manitoba). Many of the tools were interpreted as relating to a spring/early summer season such as birchbark peeling and spearing fish during the spring spawn. For this reason the majority of tests were conducted during the month of June 2003. The suggestion that the antler pick was used to chop a hole in the ice required a trip to Lake Winnipeg in March, 2004. Other activities were conducted in Winnipeg between June 2003 and March 2004.

One of the goals of this research was to bring static tools to life through experimental archaeology. A better appreciation of the skill required to use these items can be obtained by testing the tools in a field setting (Schiffer 2003:171). As discussed below, however, the application of wear pattern analysis was limited by the sample and this research focuses instead on the efficiency with which the tools performed in test situations. Furthermore, while this project highlights the activities being carried out during the experimental component, other reports (LeMoine 1994, 1997) only briefly describe the activities themselves. Most published material relating to wear pattern analysis only show images of the wear patterns and rarely show the activities that are under examination.

To appeal to a wide audience many photographs were taken to record the experimental stage. Colour slide (Kodak E200 Ektachrome), black and white print (Kodak TMAX 100) and digital imaging were used to document the experiments.

During the field testing program, examination of the wear patterns occurred at predetermined intervals. These intervals were devised separately for each tool and activity. When a tool began to show considerable wear before the task was completed the experiment was halted.

Schiffer (2003:170) advocates the evaluation of tool performance during experimental archaeology. For this project, a four tiered system was devised to rank the performance of each tool as inadequate, adequate, proficient or exceptional for any given function This scale can be applied to tools regardless of whether wear patterns were present or not.

4.5.4 Wear Pattern Analysis

Wear patterns can be observed under low magnification, high magnification or through the use of Scanning Electronic Microscopy (SEM) (LeMoine 1997). The higher the magnification the more difficult it becomes to ensure the wear pattern is the result of use rather than manufacture in both archaeological and replicated items.

Wear pattern analysis involved the comparison of wear present on the original tools from the Victoria Day site feature 2 (recorded in the Museum casts) with the wear patterns produced on replica tools used in activities suggested by the consultants (see chapters 6-14). Tests were judged positive when a specific activity produced a distinct wear pattern on a replicated tool and the same pattern is identified on an archaeological tool.

Digital images taken under the stereoscope (7 x magnification) were used to make the comparisons. Sets of three digital images were examined and compared for each tool type including: 1) a pre-experiment photo of the replicated tool; 2) a post-experiment photo of the replicated tool; and 3) the dental stone cast (recording the wear surfaces of the original tool). High-resolution digital images were taken to permit magnification of the images during the wear pattern analysis. Imaging software (Photoshop 7.0) was used to magnify the surface of the tools.

5. Results

In this chapter, the operational sequences of the tools, as reconstructed using ethnographic information and experimental replication, is described, followed by results of wear pattern comparison. Description of the tools follows Osgood's (1970) study of Ingalik material culture. This presentation style was chosen due to the large amount of data relating to each tool. For purposes of continuity each tool is discussed in turn. The following is a break down of the sections used to present the results of this research:

Chapter number.1. Original tool

- Chapter number.1.1 Material – identification of raw material(s) used
- Chapter number.1.2 Morphological Description
- Chapter number.1.3 Wear & Manufacture Patterns – description of marks visible on the tool surface
- Chapter number.1.4 Production sequence

Chapter number.2. Comparative Research

- Chapter number.2 Comparative Research– similar or identical tools from other regions or sites identified archaeologically or ethnographically.

Chapter number.3. Interviews

- Chapter number.3 Suggested tool function as identified by community members – the activity and season.

Chapter number.4. Replicated tools

- Chapter number.4.1 Material – raw material(s) used
- Chapter number.4.2 Morphological Description
- Chapter number.4.3 Production sequence (Appendix 4)

- Chapter number.4.4 Manufacture patterns – describe manufacture marks on the tool surface

Chapter number.5. Experimentation

- Chapter number.5.1 Test of tool functions using replica tools.
- Chapter number.5.2 Performance – assessment of tool function (inadequate, adequate, proficient, exceptional).
- Chapter number.5.3 Comparison study – comparison of wear patterns visible on original and patterns produced experimentally on the replicated tools.

5.1 Properties of Raw Material

Central to the analysis of bone and antler tools is an understanding the properties of raw material (Schiffer 2003:170). Raw material selection is based on the material's properties (as they affect tool function) as well as cultural influences on the toolmaker. The tools studied here are made of bone or antler. A short description of the properties of these raw materials is presented in a separate section (below) as it applies for all tools. The author made observations from modern comparative collections at The Manitoba Museum and University of Manitoba (anthropology department), unless otherwise noted.

Three cervids present in the study region are used as sources of raw material for tool making, as evidenced by the tools associated with Victoria Day feature 2. The largest animal is moose (*Alces alces*) occupying the area year round. Two sub species of Caribou (*Rangifer tarandus*) are found within the study region. Woodland caribou are found in the area year round. Barren ground caribou migrate south into the region during early winter intermittently depending on snowfall and ice formation (Kelsall 1968:Map1).

Woodland caribou are larger than barren ground caribou, averaging 395 lbs for males and 291 lbs for females. Barren ground caribou average 238 lbs for males and 171 lbs for females (Kelsall 1968:29). The reverse is true for the antler of these sub species: barren ground caribou have larger antlers than woodland caribou. (Boone and Crocket Club 2004).

5.1.1 Cervid Bones

Moose (*Alces alces*) possess the longest and most dense bones available to northern boreal forest groups for tool production. The longest elements are the metatarsals. These elements have straight lateral and medial sides, ideal for producing long items such as harpoon heads and fish spear points where maximum straight length is important. Dense cortical bone, suitable for tool making, comes from the diaphysis (shaft).

Caribou bones are relatively smaller than moose in both maximum length and thickness. Caribou metatarsals are straight, although much shorter and thinner than moose metatarsals. The tibia of caribou is another bone that provides a useable surface that is both dense and straight. Woodland caribou generally have slightly larger bones, while barren ground caribou have larger antlers (Kelsall 1968).

Bone has certain properties that must be carefully considered when selecting raw materials for tool use. Green-bone fracture is concoidal, producing sharp edges when bone is freshly broken. Bone can also be ground to produce a very thin sharp cutting edge. Bone has low tensile strength, however, meaning it will break under pressure such as twisting or bending or if struck against a hard object such as a prey animal's skeleton (Knecht 1994, 1997a). Bone does not soften in water and can therefore be used for tasks carried out in water.

5.1.2 Cervid Antler

Cervid antlers vary significantly in morphology and properties between species and within a species. Antler size depends on age and health of the animal. Antler chosen for tools tends to be mature, meaning growth has stopped and the velvet has been shed prior to the rutting season. Antlers from the three cervids studied here mature at similar times, between the end of August and mid September.

Caribou are the only cervid species where both males and females posses antlers. Female caribou have smaller antlers than males of similar age. Brow tines are palmate on one side and often much reduced on the opposite side. A large single beam extends caudally with small tines protruding from the main beam terminating with a slightly palmate portion. Caribou antlers are oval to bi-convex in cross-section. Males shed their antlers in November or December, while the females retain the antlers until late winter or early spring (Kelsell 1968:35).

Only male moose possess antlers, generally developing them after the first summer of life. The antlers of moose are symmetrical, with a large palmate brow tine extending in front of the animal and a palmate portion extending caudally. Tines extend from the palmate section, with larger tines on the lateral and anterior side of the palmate and small "button" tines on the posterior portion. Moose shed their antlers by February. In cross section, tines have a small porous interior compared to the thick dense cortex. A cross section of the palmate section has a thin, dense outer cortex covering a thick porous centre. Tines from moose tend to be round to slightly oval and the palmate sections are slightly concave on the dorsal (upper) surface and convex on the ventral (lower) surface. It appears that during tool production antlers are chosen on the basis of their shape and size as appropriate for each tool type (Antler ladle Chapter 14; antler harpoon head Chapter 6).

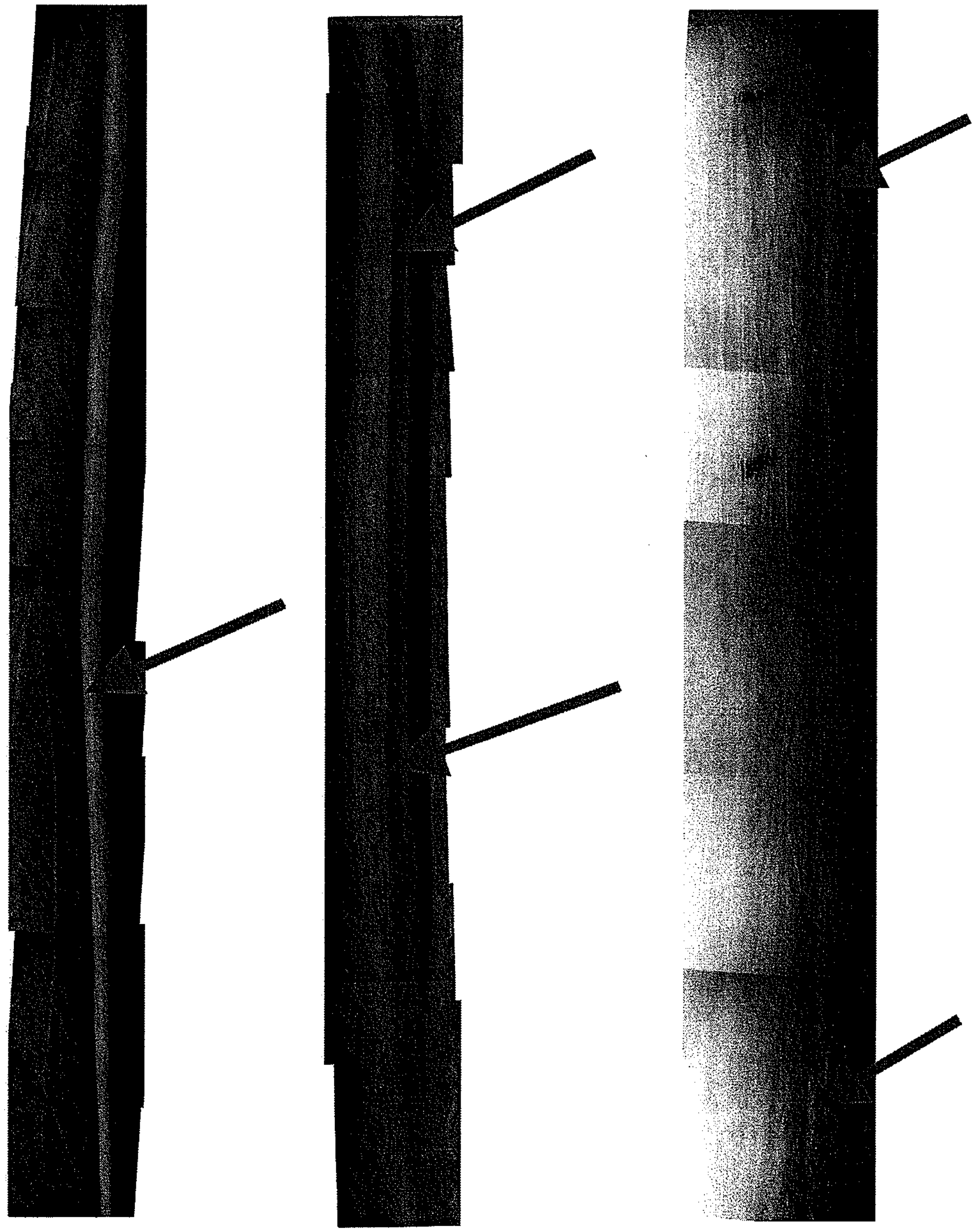
Antler, an osseous material similar to bone, possesses different properties. Antler does not hold a thin, sharp edge well and is easily blunted. To maintain a sharp edge tools must be given a steep edge (for example, the antler adze, peeling tool, chisel and pick studied here). Antler has higher tensile strength than bone, and will crush under pressure rather than chipping or snapping. Experimental testing of antler projectile points on animal carcasses showed the points becoming soft and bending rather than breaking (Knecht 1994; 1997a; Nuzhnyi 1998).

5.2 Testing Manufacturing Tools on Bone and Antler

Three experimental tests were performed with two different manufacturing tools to assist in the identification of manufacturing marks located on the original tools. The first two experiments involved testing the utility of rodent incisors as gouging tools. Nine modified rodent incisors were recovered in association with the Victoria Day burial feature 2, and were identified as carving tools (Peach 1998). One lower beaver incisor was used to gouge the surface of a caribou antler beam. The surface of the antler was dampened with saliva, a strategy used by the Netsilik to soften antler (Brown 1967). It took 45 minutes to produce a groove on the surface 135 mm long, 1.0-2.5 mm wide and 2 mm depth. The groove had a smooth inner surface and was "U" shaped in cross section. A few slight parallel striations were present within the groove when viewed using a stereomicroscope at 7x magnification (Figure 5.1a).

The second test involved the use of an upper beaver incisor to carve caribou antler beam. The surface of the antler was dampened with saliva, as above. The upper incisor was wider and produced a much larger groove. It took 30 minutes to produce a groove 121 mm long, 3.9 - 6.2 mm wide and 5mm depth. The inner surface of the "U" shaped groove had parallel grooves when viewed as above (Figure 5.1b). The repetitive gouging created parallel grooves within the gouge.

The third experiment involved carving a fresh moose metatarsal with a stone flake. The unretouched flake was made from Swan River Chert, a poor quality chert (grading towards a quartzite) with quartz vugs (Campling 1980; Grasby 2002; Syms 1980). This type of chert is commonly found west of Lake Manitoba and occurs in small quantities in northern Manitoba. This material was chosen because it would perform similar to quartzite, which is locally available in northern Manitoba. The fresh bone was a cut longitudinally; the bone was not boiled or soaked before or during the experiment. The experiment lasted 10 minutes, until the surface of the bone was modified through carving. Channeled striations were clearly visible within the grooves made by the tool (Figure 5.1c). The orientation of these manufacture marks were generally parallel. Subsequent carving obliterated earlier manufacture marks.



A B C

Figure 5.1 Experiments with various manufacturing tools. A. Narrow groove left by an upper beaver incisor when used to carve a caribou antler. B. Wide groove left by an upper beaver incisor used to carve a caribou antler. C. Shallow striations created from a stone flake when used to carve the surface of a moose bone.

5.3 Tool Orientation

The orientation of each tool is described using standard terminology used to describe lithic artifacts: distal, proximal, dorsal, ventral, right lateral and left lateral. The terms do not correspond to the orientation of the original bone or antler element. The working edge or functional edge is always the distal end of the tool; the proximal end represents the side opposite to the working edge. Dorsal is a term that usually refers to the top of the artifact although this distinction is sometimes arbitrary. Left and right edges are identified with the tool placed on its ventral surface with the working edge away from the observer.

5.4 Experimentation

The experimental component was designed to test the activities suggested by those community members interviewed and historical documents. Multiple copies of tools were produced in anticipation of having multiple functions. The interviews suggested a number of activities that could not be tested based on legal issues, for example the antler pick used to spear large game. Based on the interviews numerous antler tools were interpreted as hide fleshing tools. Due to time constraints, insufficient numbers of tools were replicated to allow all of the suggested uses to be tested for each category of tool. For example, since only two replicas of the antler pick and one antler chisel were manufactured it was decided that the antler chisel be used to flesh a hide while the antler pick would test chopping a hole through the ice and chop a hole into a beaver lodge.

5.5 Tool Performance

The experiments conducted during this research were designed to produce wear and evaluate performance. Ideally multiple tools would be tested and observations made until tool exhaustion. While this would better reflect wear patterns from heavily worn tools none of the tools from Victoria Day Site feature 2 had extensive wear patterns and tools were not tested to exhaustion in this study.

The performance of the replicated tool types was ranked following each experiment. The time required to complete a task was not used to evaluate tool performance because experience speeds the process. The experiment with the bone awl used to drill a hole through a birch stave (Chapter 12) was the only exception made regarding time required to complete a task. A significant amount of time was required to produce the hole due primarily to the mechanical property of bone. To ensure the tool did not break a significant amount of time was required to complete the task. It is not expected that experience would have significantly reduced the amount of time required to drill the hole through the birch stave.

The following definitions were created to evaluate tool performance:

INADEQUATE
The tool broke or was completely unsuitable for the activity.

ADEQUATE
The tool performed the task poorly. The tool was difficult to use and/or handle. The working edge chipped or blunted quickly, negatively impacting performance.

PROFICIENT
The tool performed satisfactorily during the activity. Tool performance was consistent despite minor blunting or chipping of the working edge.

EXCEPTIONAL
The tool performs the task efficiently. Minimal wear occurred on the working edge and exceptional performance was maintained throughout the activity.

6. Results – Barbed Fishing Tools

A total of nine barbed fishing tools were recovered with the remains of the young individual from the Victoria Day Site Burial, feature 2. Harpoon heads will often have a hole near the base to attach a line to, although this is not always the case. Other methods of attaching a cord include carving a groove or leaving a ridge near the base that prevents the line from slipping off the harpoon head (Stewart 1996:104-105). None of the barbed fishing tools from the Victoria Day burial have a ridge or groove at the proximal end of the tool for attaching a line. Fish spears are firmly attached to a pole and do not require a line hole near the base.

Barbs are numbered from distal to proximal in sequential numbers. Ventral surface is the flatter surface of the tool and, when identifiable, the ventral surface corresponds to the inner portion of the original antler element. The dorsal surface is the rounder side and when distinguishable is the outer, cortical surface of the bone element.

6A Original Tools (Bone Harpoon Heads)

6A.1.1 Material – Harpoon heads 67A, 67C, were produced from a large adult male moose (Alces alces) metatarsal. Harpoon head 7 was produced from an adult moose (Alces alces) metatarsal likely from a female or younger male based on size. Harpoon head 67D was manufactured from a mature moose (Alces alces), sex undetermined.

6A.1.2 Morphological Description – All four bone harpoon heads are unilaterally barbed on the right lateral edge (Figure 6.1; 6.2; 6.3; 6.4) (Table 6.1). The line hole is located on the right lateral edge between 40 and 48 mm (average 42 mm) from the

TABLE 6.1: Comparison of measurements between original and replicated Harpoon Heads.

Artifact Number	***67A***	***67C***	***67D***	***7***	***30, 36***	**Replica 1**
Length	337 mm	298 mm	287 mm	276 mm	220 mm*	282 mm
Width Barb 1	12.3 mm	13.5 mm	11.6 mm	11.0 mm *	12.7 mm	16.9 mm
Width Barb 2	14.1 mm	15.0 mm	13.4 mm	13.0 mm	14.8 mm	18.4 mm
Width Barb 3	15.4 mm	15.7 mm	13.8 mm	13.2 mm	15.5 mm	18.6 mm
Width Barb 4	15.7 mm	15.9 mm	14.4 mm	13.2 mm	15.5 mm	18.0 mm
Width Barb 5	16.2 mm	16.5 mm	15.1 mm	12.8 mm	15.7 mm	17.8 mm
Width Barb 6	16.0 mm	16.9 mm	15.2 mm	13.6 mm	15.7 mm	17.5 mm
Width Barb 7	16.4 mm	16.2 mm		13.0 mm	16.7 mm	17.6 mm
Width Barb 8	16.6 mm				15.5 mm	17.8 mm
Width Barb 9	15.3 mm *				16.5 mm	17.5 mm
Width Barb 10					16.6 mm	
Width Barb 11					16.9 mm	
Width Before first Barb	14.4 mm	13.9 mm	13.5 mm	12.7 mm	13.8 mm	15.3 mm
Thickness at line hole	8.9 mm	7.0 mm	7.2 mm	7.9 mm	8.6 mm	5.5 mm
Width at Line hole	13.8 mm	12.0 mm	12.6 mm	12.9 mm	13.4 mm	16.9 mm
Distance between proximal end and line hole	40 mm	40 mm	40 mm	48 mm	?	40 mm
Greatest Width	16.6 mm	16.9 mm	15.2 mm	13.6 mm	17.5 mm	18.6 mm
Greatest Thickness	11.3 mm	10.8 mm	9.8 mm	8.7 mm	9.6 mm	5.6 mm
last barb and below last barb	N/A	2.3 mm	1.7 mm	0.3 mm	3.1 mm	2.2 mm
Cancellous material proximal end	Yes	Yes	Yes	Yes	N/A	No
Cancellous material distal end end	Yes	No	No	Yes	N/A	No
Decoration	Yes	Yes	No	Yes	No	No
* Broken artifact						

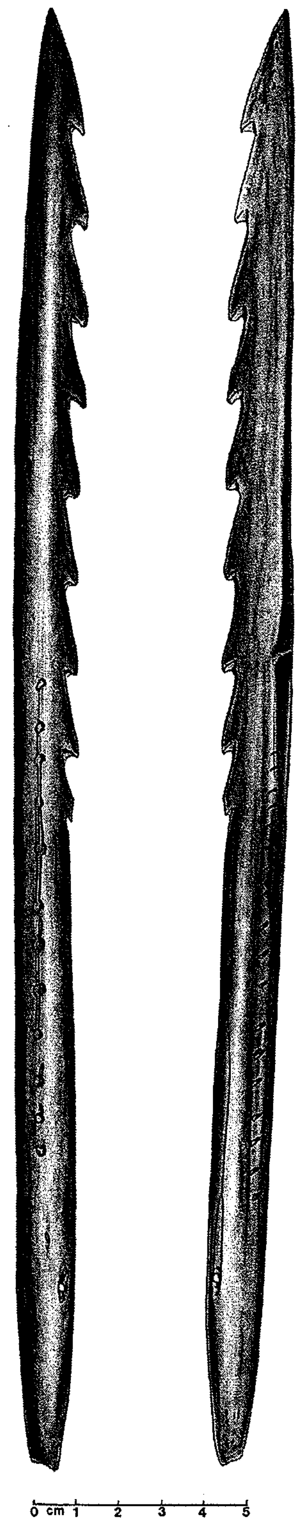


FIGURE 6.1: Drawing of original harpoon head (67A).

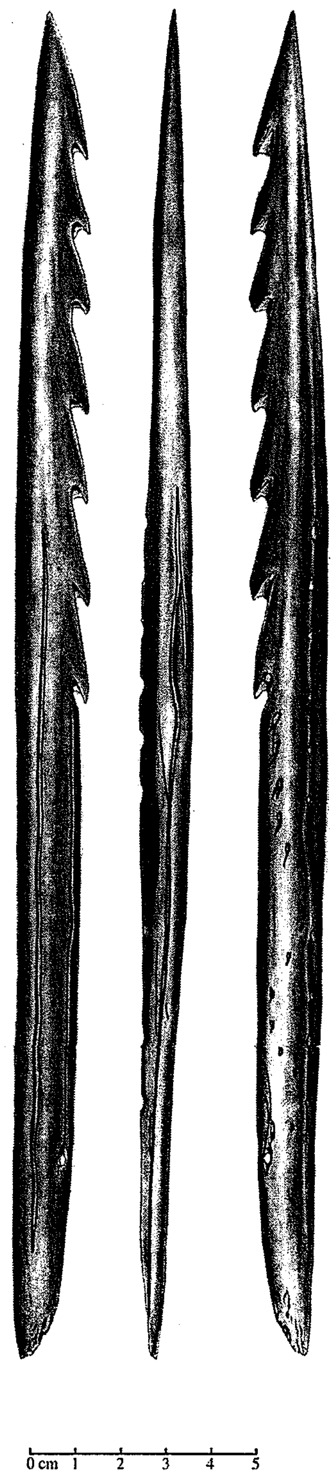


FIGURE 6.2: Drawing of original harpoon head (67C).

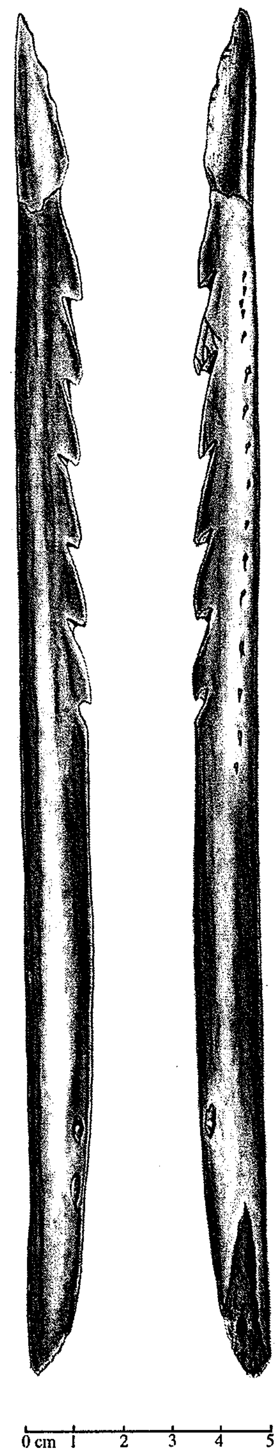


FIGURE 6.3: Drawing of original harpoon head (7).

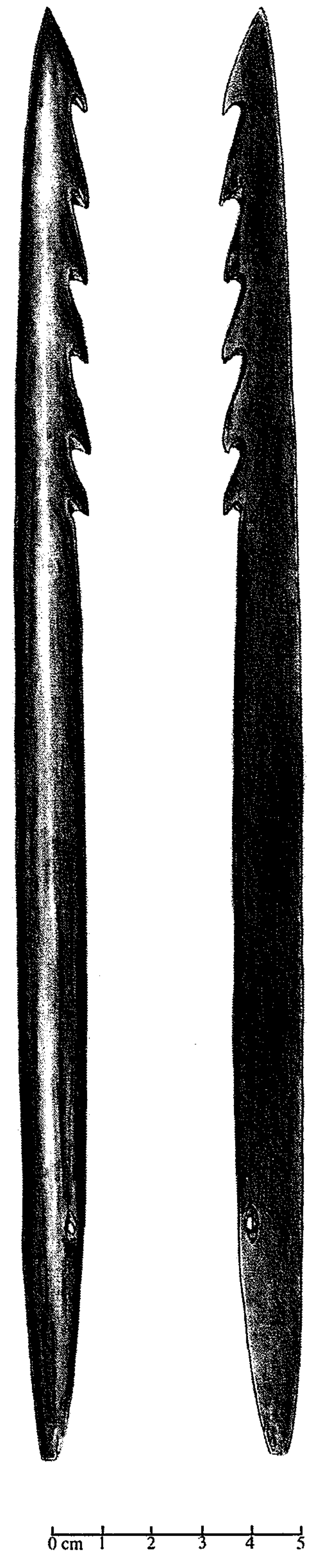


FIGURE 6.4: Drawing of original harpoon head (67D).

proximal end. Maximum width ranges between 13.6 to 16.9 mm. The ventral surface is relatively flat with the dorsal surface rounded, plano-convex in cross section. The ventral surface represents the interior of surface of the bone, with the dorsal surface representing the exterior surface of the original bone.

The harpoon heads have an average of 7 barbs (range 6 – 9 barbs). The difference between the width of the harpoon head at the most proximal barb and just proximal to this barb averages 1.0 mm (range of 0.3 – 2.3 mm). One harpoon head was not included in the average and range, because the first barb was broken. The maximum barb width averages 15.5 mm (range 13.6 – 16.9 mm). The average length of harpoon heads from the sample is 299.5mm (range 276 – 337 mm). The average diameter of the line hole is 2.2 (range 2.1 – 2.6 mm).

Decoration was present on three of four harpoon heads. The decoration on harpoon head 67A is composed on a series of twelve round notches connected by a discontinuous single smooth groove on the dorsal surface oriented in a straight line (Figure 6.5). The ventral decoration of harpoon head 67A is comprised of a series of 18 short linear oblique lines at a 40° to 50° angle to the axis of the harpoon head oriented in a straight line. A number of these short lines were created with two strokes, the second partly obliterating the first line.

Decoration on ventral surface of harpoon head 67C consists of fifteen oblique notches, beginning at the line hole and arranged in an undulating pattern, terminating at the first barb (Figure 6.6). One to four strokes were used to produce the notches, each subsequent stroke partly obliterating the earlier ones. Parallel to this wavy line is a series of twelve notches oriented in a straight line close to the left lateral edge (Figure 6.2).

These begin at the line hole and end between the fifth and sixth barb. Decoration on the dorsal and left lateral surface consists of three narrow "U" shaped lines. The first line on the dorsal surface begins at the line hole and extends to the first barb. The second line on the dorsal surface begins 17 mm proximal of the line hole and ends between barbs five and six. The left lateral line decoration extends from near the proximal end to the fifth barb. The line branches just proximal of the seventh barb, extending only 10mm.

Decoration on harpoon head 7 consists of sixteen shallow notches oriented roughly in a straight line on the ventral surface. The notches begin 11 mm proximally from the seventh barb and end at the second barb (Figure 6.3).

6A.1.3 Wear and Manufacturing Patterns

Manufacturing marks on the dorsal and ventral surfaces consist of channeled striations oriented proximo-distally (Figure 6.7, 6.8, 6.9; 6.10). Experimentation with potential manufacturing tools (Figure 5.1 A, above) shows that the harpoon head blanks were probably carved with unmodified stone flakes creating channeled striations on all surfaces. The harpoon head preform was given a plano-convex cross section. The under cut surfaces of the barbs do not have channeled striations which is consistent with experimental data produced with a narrow rodent incisor (Porcupine or Muskrat) (Figure 5.1 A) (Figure 6.9; 6.10). The line hole cross cuts the channeled striations on the dorsal and ventral surfaces indicating it was added after the tool was shaped (Figure 6.7, 6.10). Some channeled striations are present around the line holes and it cannot be determined if the holes were produced with a rodent incisor or a narrow flake or lithic tool. The undercut surfaces of the barbs are "U" shaped in cross section suggesting a rodent incising tool rather than a lithic tool.

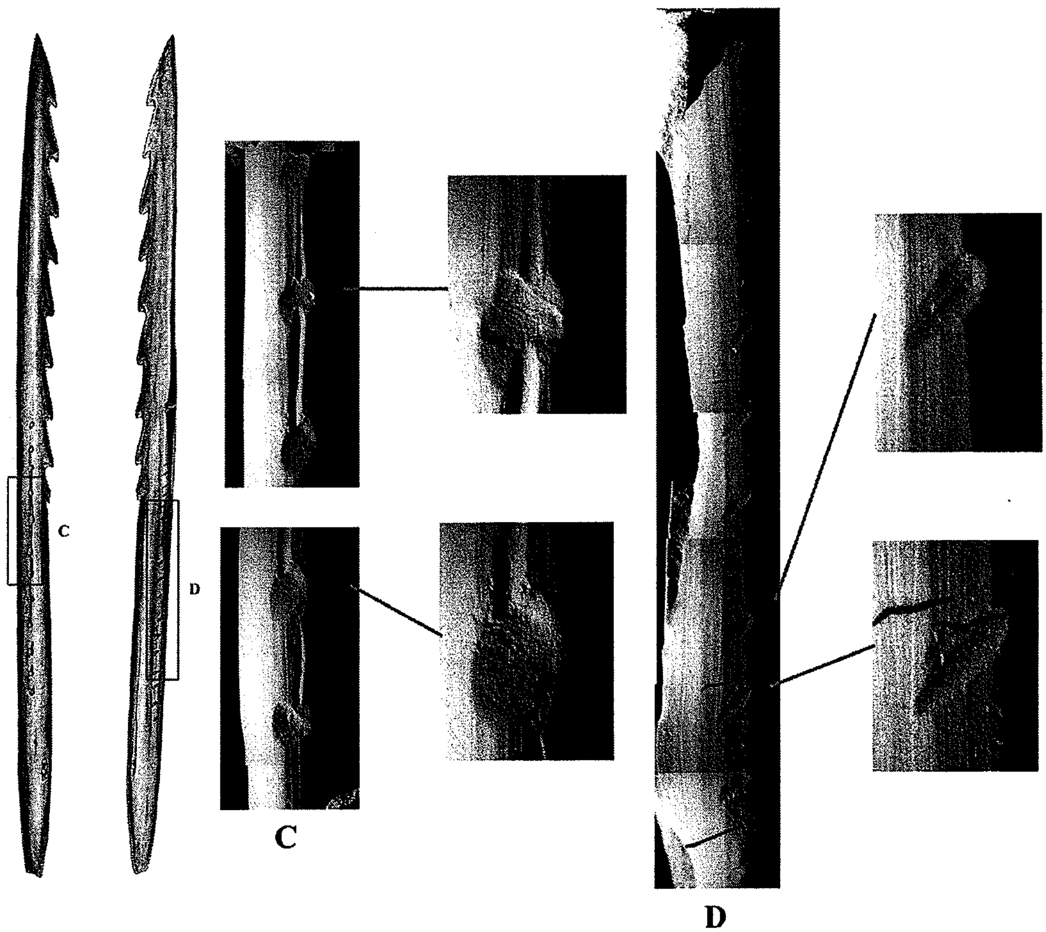


FIGURE 6.5: Decoration on surface of harpoon head 67A, dental stone cast.

The decorative marks cross cut the channeled striations caused by manufacture (Figure 6.5; 6.6). It is suggested that rodent incisors were employed to decorate the harpoon heads, as the surface lacks the channeled striations typical of flakes and are "U" shaped in cross section. Based on the width and the smooth interior surface of the groove it is suggested that a muskrat incising tool was used to create the line. The notches are slightly wider and were likely produced using a small lower beaver incising tool or either a lower or upper porcupine incising tool. Experimentation further supports these claims (see testing manufacture tools Chapter 5).

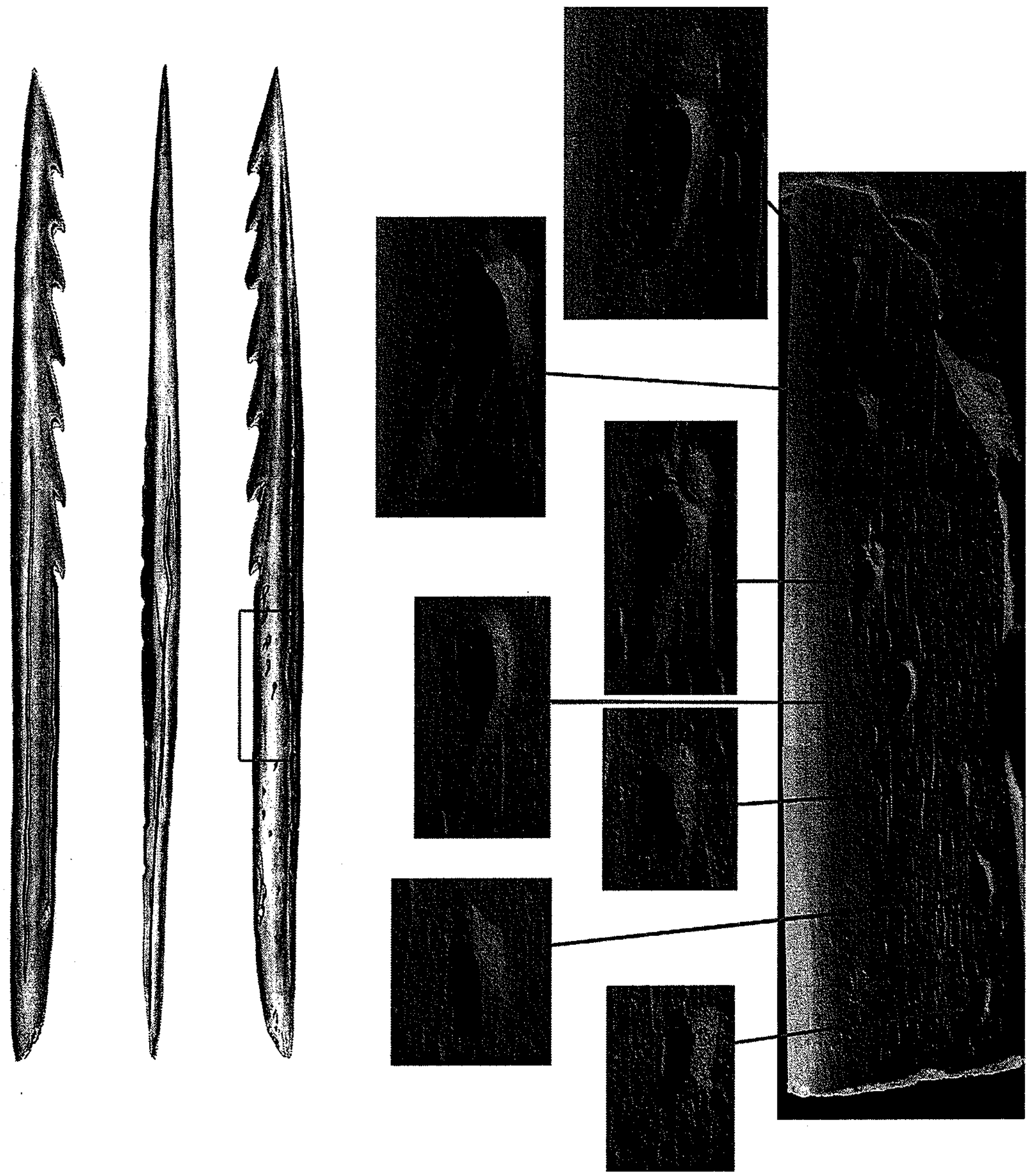


FIGURE 6.6: Decoration on surface of harpoon head 67C, dental stone cast.

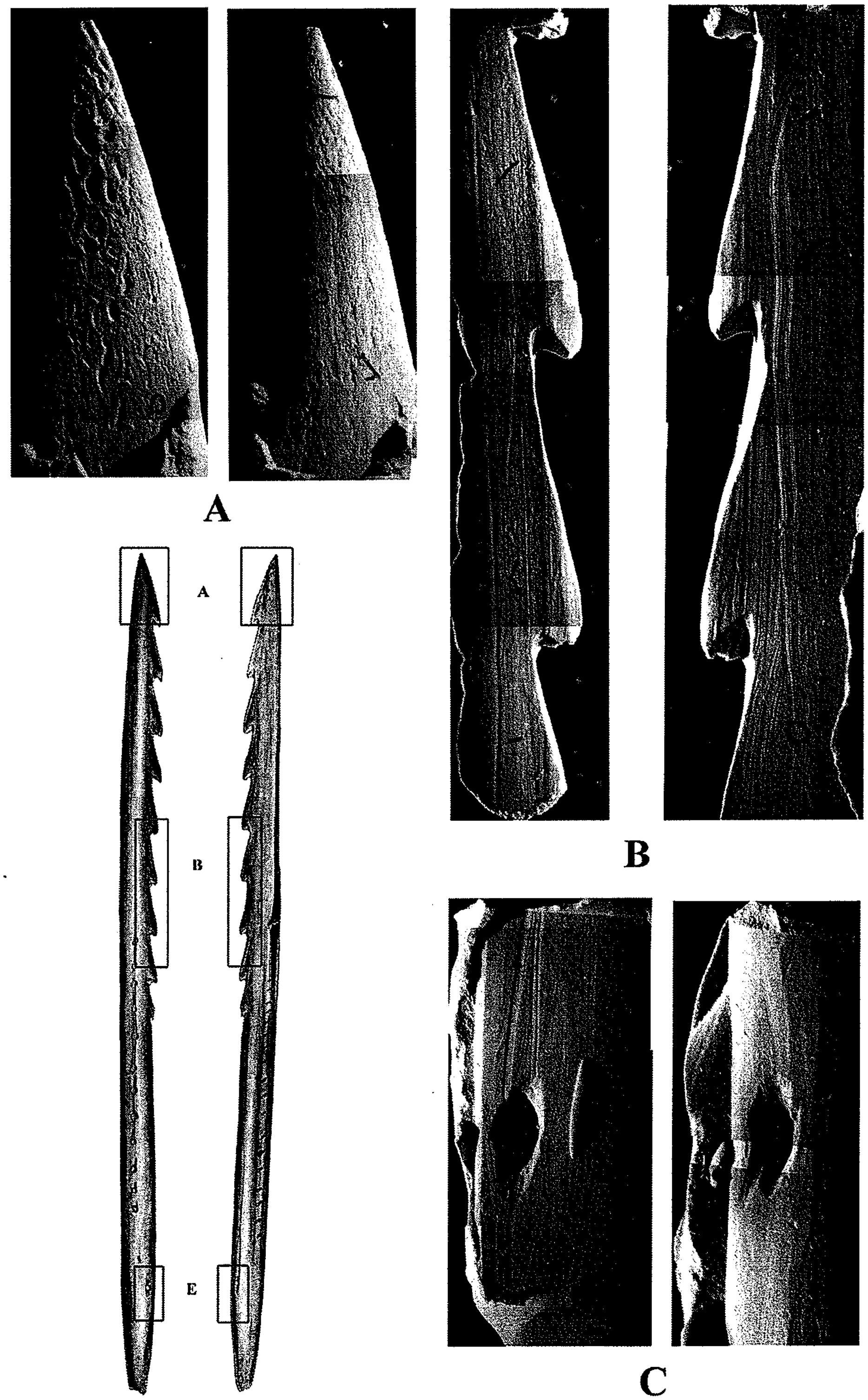


FIGURE 6.7: Surface of harpoon head 67A as recorded on the dental stone cast. Images taken with a stereoscope under 7x magnification.

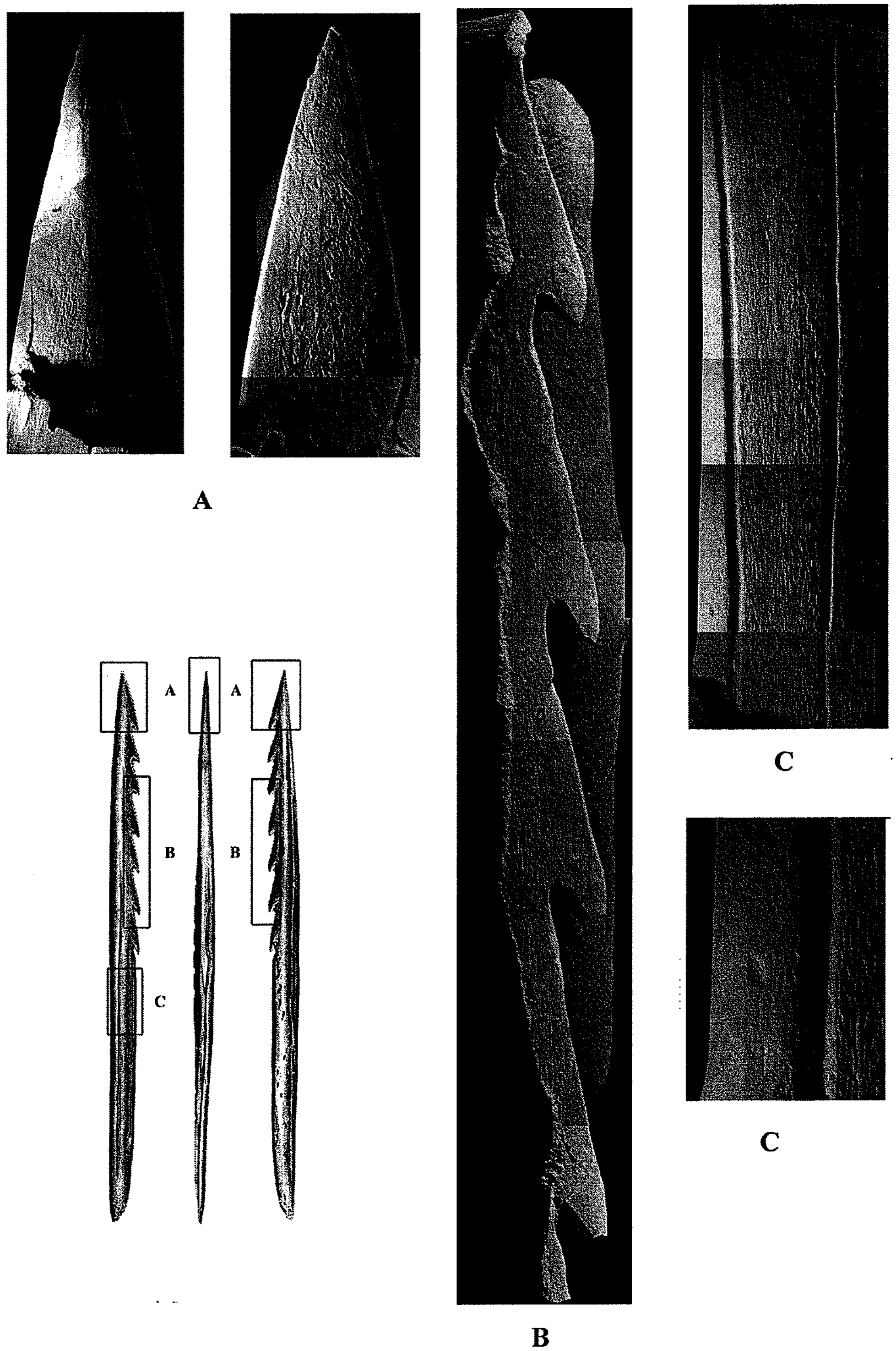


FIGURE 6.8: Surface of harpoon head 67C, as recorded on the dental stone cast. Images taken with a stereoscope under 7x magnification.

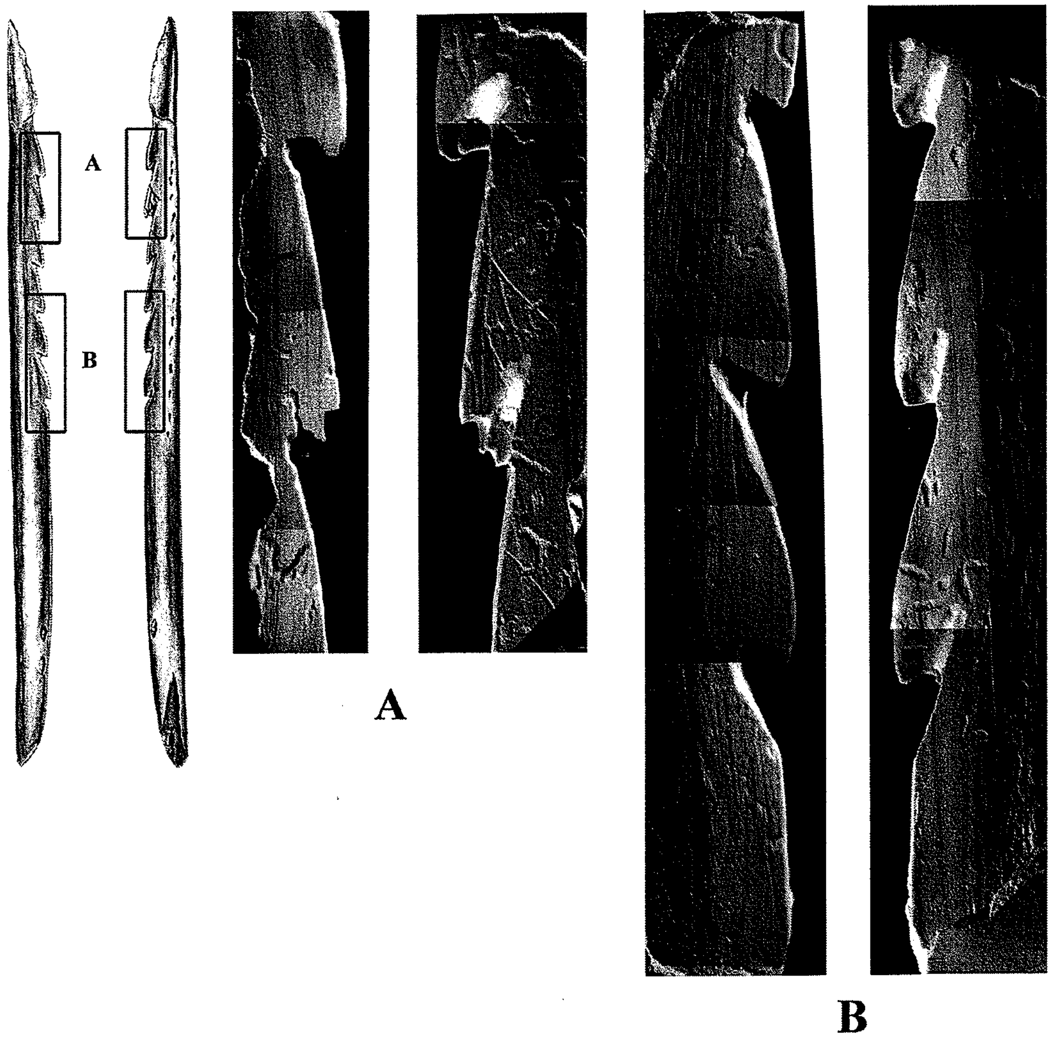


FIGURE 6.9: Surface of harpoon head 7, as recorded on the dental stone cast. Images taken with a stereoscope under 7x magnification.

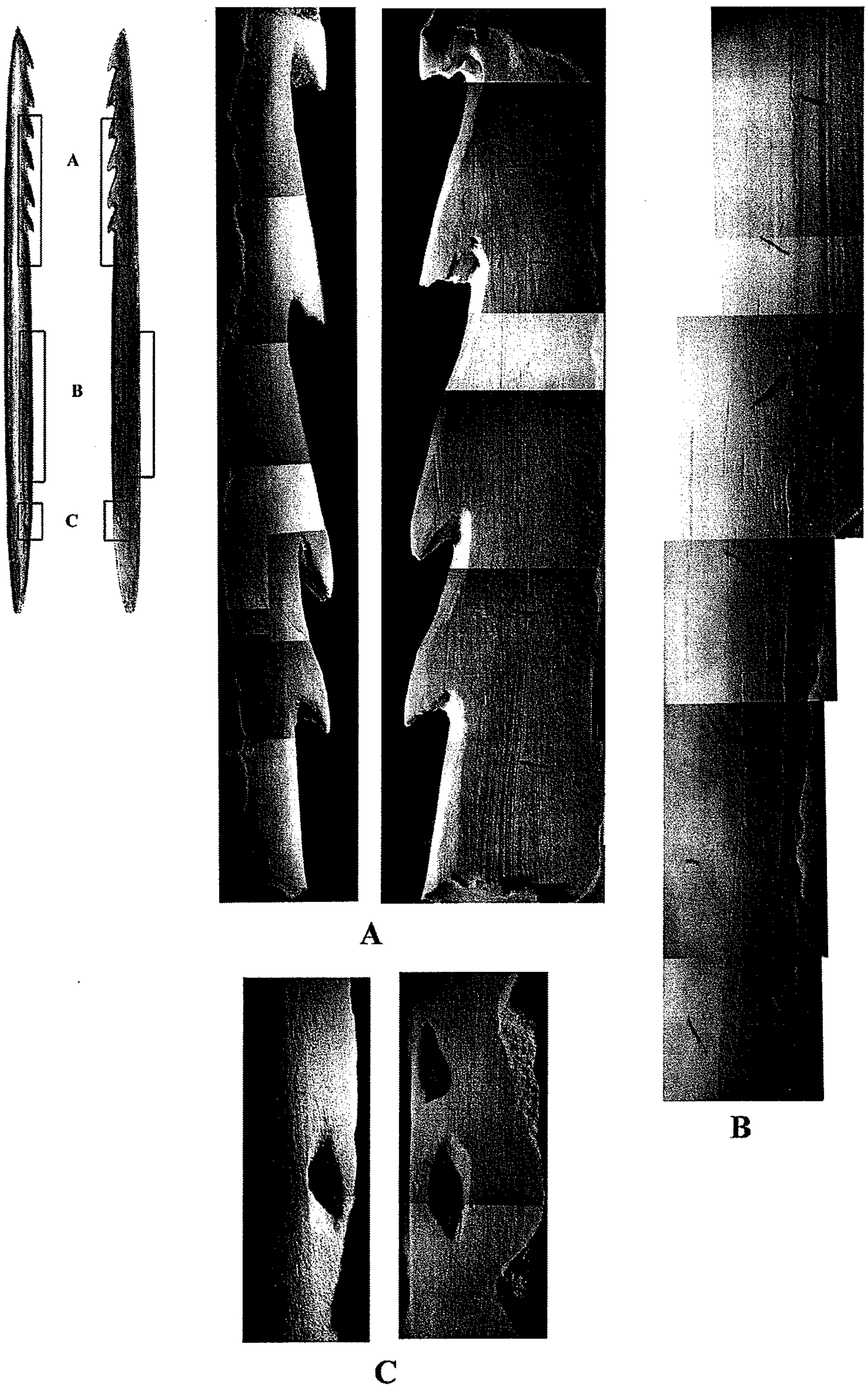


FIGURE 6.10: Surface of harpoon head 67D, as recorded on the dental stone cast. Images taken with a stereoscope under 7x magnification.

No wear patterns resulting from use were observed on the surfaces of the bone harpoon heads. It is concluded that the all bone harpoon heads were manufactured and never used.

6A.1.4 Production Sequence – The four bone harpoon heads were produced following the same production sequence and are discussed together. In each case a metatarsal from a fully grown moose (with epiphyses fused) was chosen to produce the tool. The medial and lateral surfaces of the metatarsals are flat and straight and were chosen to maximizing the total length of the tool.

The first step in manufacture was to remove the epipheseal ends. Harpoon heads 67A and 7 had cancellous material present on both the proximal and distal ends of the finished tool, indicating that the maximum length of the shaft was being utilized. Harpoon heads 67C, and 67D had cancellous material present only on the proximal end of the tool. The surface of the element was scored longitudinally to remove a bone blank. The interior of the bone was carved flat. The exterior surface of the bone was carved to a round surface representing the dorsal side of the tools. The harpoon head blanks are plano-convex in cross section and appear tear dropped shaped.

Barbs were added on the right edge of the harpoon head. Based on the replication stage of this thesis the researcher suggests barbs were added beginning at the distal end to ensure even spacing. The barbs were carved on both dorsal and ventral surfaces, slightly under-cutting the sharp right lateral edge. The final modification to the harpoon heads was the addition of a line hole (Figure 6.7; 6.9). The hole was placed near the right lateral edge and between 40 and 48 mm from the proximal end of the harpoon head. The line hole was not drilled, rather gouging of the dorsal and ventral surfaces produced the line hole. The line holes are hourglass shaped in cross section.

Decoration on harpoon head 67A, 67B and 7 was applied once the dorsal and ventral surfaces were shaped (Figure 6.5; 6.6). The decorative notches on harpoon head 67A cross cut the decorative grooved line, where present indicating the notches were applied after the line was carved. The gouges begin on the proximal end and increase in depth distally. The eighteen lines that decorate the ventral surface fade distally, progressively becoming fainter.

6A.2 Comparative Research

Ethnographers and archaeologists record different types of barbed fishing tools (Osgood 1970; Stewart 1996). Harpoon heads are identified as barbed points that detach from a wooden shaft once they are embedded in a fish. A line is fastened to the harpoon head so the harpoon head and fish are not lost. The wood shaft acts as a float and is attached to a line, which the person fishing holds. Pulling the line will retrieve the fish once it has tired out. Many wide barbs are required to prevent the fish from escaping once it has been harpooned.

Harpoon heads have been recovered from a number of sites in northern Manitoba including the Victoria Day burial site GkLr-61 (feature 1) (4740 – 4405 cal. yrs BP), Oxford House harpoon head (5290 – 4970 cal. yrs BP), and HeLw-20 (not dated). All harpoon heads have line holes near the proximal end. A number of unilaterally barbed bone points were recovered from Laurel occupation at the Pas site (FkMh-5) dating to approximately 2000 BP. These points are different from the other three sites; they are wider, more massive and lack a line hole. More research is required on this collection to determine if the barbed points are harpoon heads or fish spear points.

Thompson recorded various sacred locations identified by his guides between 1784 and 1812 when he traveled in northern Manitoba. One common sacred location was at falls and rapids, where fish spawn. Spears are left at the "Manito Stone" near the falls as an offering to the spirit of the falls for the fish caught (Thompson 1962:76). Are the spears he refers to fish spears or harpoons? If so, this activity may be partly responsible for the lack of barbed fishing tools recovered at campsites. Another factor influencing the recovery of bone and antler harpoon heads and fish spear points is preservation of these materials, which is generally poor in the boreal forest.

Lister (1988) documented the use of fish resources in the Hudson Bay Lowland area during early contact. The importance of fish weirs was documented in early archival sources for the region. Based on historic and ethnographic data Lister located archaeological evidence of fish weirs and associated campsites during his survey.

According to Lister (1988:80) the occupation of the Hudson Bay Lowland area relied upon the use of fish weirs for food. While no direct evidence was recovered indicating fish weirs were utilized during pre-European times, it can reasonably be concluded that they were in use (Lister 1988:80).

6A.3 Interviews

Eight people identified the barbed tools as fishing equipment during the interviews. Johnson Donkey illustrated how the harpoon heads and fish spear points would be attached to a pole by placing the tools into a drilled socket.

Keith Anderson shared information on the habits of jackfish. Jackfish migrate to shallow bays during the late winter to feed. Angling through holes in the ice can easily catch these fish. By attracting fish to a hole in the ice using a lure (possibly a shiny shell), a fisher could harpoon the fish as they attacked the lure. This fishing technique would require a structure to be built over the hole to eliminate light from above (Kohl 1985:328-329). All light would be coming from under the ice, allowing the fisher to see the fish.

During the early summer, Jackfish can be found in very shallow calm water sunning themselves. When Keith Anderson was young he remembered relatives standing on the shore spearing jackfish using an ice pick as the jackfish were sunning themselves in shallow, weedy water. Using this technique, fishers could spear/harpoon many large jackfish in a short period of time.

Leslie Baker remembers traveling to a rapids on the Footprint River north of Nelson House in the 1950's when he was young and witnessing the use of fish weirs. Spruce poles were stuck in the silty river bottom at an angle creating a ramp. Fish would swim up stream during the spring spawn over the ramp and get trapped in a pen also created with branches stuck into the silty river bottom. The Cree term for fish weir is *Pichipothagan* meaning "to draw in" and "plate". When asked why plate Baker indicated that fish weirs were the plate of mother earth.

Fish weirs produced a reliable source of food for northern groups both recently and in the past and their importance are recorded in the language. He does not remember seeing fish weirs after this time.

I asked everyone (following Leslie Baker's account) if they remember fish weirs in use. Bruce Tait indicated that during low water rows of poles can be seen sticking from the water in the Shallow Lakes area (North west of Southern Indian Lake), he believes these are part of an old fish weir. Fish weirs have never been mentioned in northern Manitoba and appear to be an old tradition that is no longer maintained. This research is the first to identify the presence and location of fish weirs for the Nelson House/Southern Indian Lake area.

6A.4 Replication

6A.4.1 Bone Harpoon Head Material – The lateral portion of a metatarsal from an adult female moose (*Alces alces*). Other materials included tamarack pole, metal cable, 1/16 inch nylon line and moose rawhide.

6A.4.2 Morphological Description – This tool is a unilaterally barbed fish spear point with nine pronounced barbs, located on the right lateral edge (Table 6.1).

6A.4.3 Production Sequence – See appendix 4.

6A.5 Harpoon Experimentation

6A.5.1 Test 1 – Harpooning one pickerel

6A.5.2 Test Tool Function – The fisher held the extra nylon line that attached to the wood handle and harpoon head. The harpoon was used from inside a boat. A two pound pickerel was caught using a rod and reel, humanely killed and placed back in the water, and attached to the fishing line to prevent loss of the tool if it broke during the experiment. The floating pickerel was brought close to the boat to test the harpoon. The pole was firmly grasped by the fisher and thrust at the fish. The harpoon head easily penetrated the fish although it broke in the process into a number of pieces. The main break occurred at the line hole, the location where the harpoon head was socketed. The proximal end broke into two pieces; the base remained in the socket while the fragment was lost. The largest section (distal end) was retained once the fish was retrieved with the rod and reel. The barbs on this tool held the fish extremely tightly and much force was required to remove the harpoon head from the fish (Figure 6.11).

6A.5.3 Performance – This tool performed poorly during the activity as it broke during the experiment and it was given a rating of inadequate. The force used to spear the fish broke the harpoon head. Based on this experiment it is suggested that a wood foreshaft may have been added to the harpoon head to prevent stress on the bone tool. The hole was 40 mm from the proximal end of the tool and this does not appear adequate to withstand the pressure of use without the addition of a wood foreshaft. The flat ventral surface of the proximal ends of the harpoon head may have been used to haft onto a wood foreshaft. This would increase the distance between the line hole and the proximal end of the tool and add tensile strength to the tool during use. The performance of the tool was rated as inadequate as the harpoon head broke during experimentation while the wide barbs held the fish very tightly.

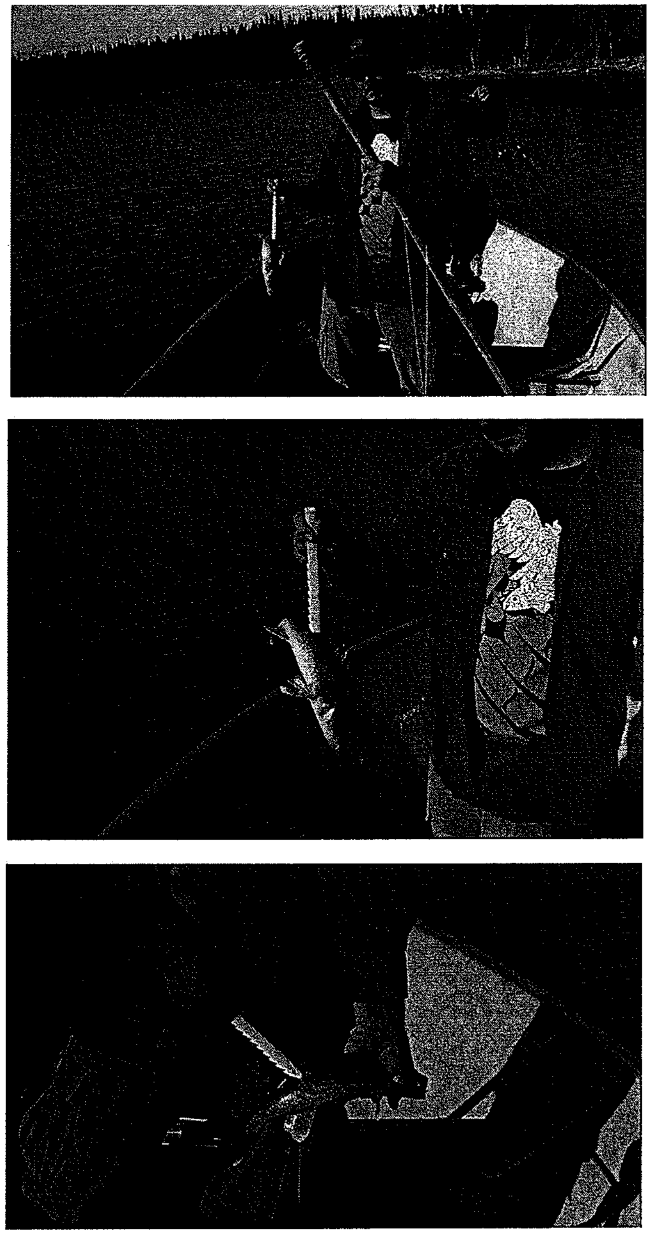


FIGURE 6.11: Harpoon experiment with pickerel.

6A.5.4 Comparison Study – This tool exhibited no wear patterns, as the tool had not been utilized enough to create any patterns. No comparison was possible as neither the replicated tool nor the originals had evidence of wear patterns. If any of the original harpoon heads had been used it was minimally as manufacturing marks on their surfaces were sharp and clearly defined.

6B Original Tool (Antler Harpoon Head)

6B.1.1 Material – Barren ground caribou (*Rangifer tarandus*) antler, from the main beam that extends caudally. The antler was from an adult male, likely over 5 years old.

6B.1.2 Morphological Description – This tool is identified as a unilaterally barbed harpoon head, with eleven barbs on the left lateral edge (Figure 6.12). This tool is broken in three pieces, the first break occurs between barb 6 and 7 the second break occurred at the line hole and the proximal end of the tool was not recovered during the excavation. The line hole is located near the left lateral edge. The dorsal surface is dense antler, with the ventral surface composed of spongy antler material, except on the left lateral edge (barbs). The ventral surface is generally flat with a rounded dorsal surface, plano-convex in cross section. The barbs are located on the left lateral surface, the opposite edge compared to the bone harpoon heads from this burial. Barb 8 is broken and exhibited some polish over the broken surface.

The maximum length of this tool is 220mm, and estimated to have been between 260 – 248 mm when complete (the measure measurement between the line hole and the proximal end ranges between 40 and 48 mm for the other harpoon heads). The maximum thickness is 9.6 mm near the center. The width just proximal of the eleventh barb is 13.8 mm and on the eleventh barb is 16.9 mm (also the maximum width) (Table 6.1).

6B.1.3 Wear and Manufacture Patterns – The antler harpoon head retained the channeled striations from manufacture or re-sharpening (Figure 6.13). The caribou antler harpoon head did not have wear patterns from use. The polish located on the broken 8th barb may have been caused by use, although the tool was subsequently re-

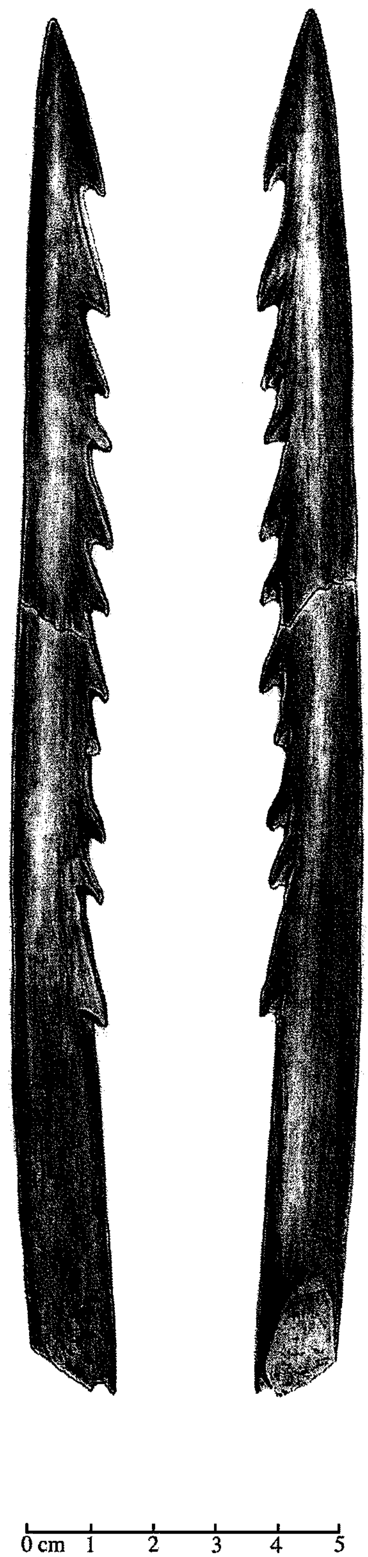


FIGURE 6.12: Drawing of original harpoon head (30/36).

sharpened prior to burial. The missing proximal end of the harpoon head probably occurred after burial. If the tool broke during use, one would expect that the proximal end of the tool might be brought back to a campsite but the distal end of the tool would be either in the fish that was speared and lost (swam away) or at the bottom of the lake, river or stream.

6B.1.4 Production Sequence – A large bull barren ground caribou antler was chosen to produce the tool. The main caudal beam was cut to the desired length. The blank was carved longitudinally on the medial and lateral surfaces to split the piece into two equal halves, one of which was chosen to manufacture this harpoon head.

The ventral surface is carved flat. Dorsally the antler was carved to create a round shape (Figure 6.12). In cross section the harpoon head is "tear dropped", flatter on the ventral surface and round on the dorsal surface. The left lateral surface terminates in a sharp edge and the right lateral edge is rounded.

The barbs were added during the final stage of manufacture (Figure 6.13) using the same procedure as the bone harpoon heads (see section 6A.1.2). The barbs were unevenly spaced, ranging between 19mm to 9mm apart although most are closely spaced. While the barbs appear crude in comparison to the barbs on the bone harpoon heads the purpose of this is unclear. Possibly, the tensile strength of antler allows close spacing of the barbs, unlike bone, which could be susceptible to breakage if the same spacing were employed. The addition of a line hole, approximately 1.1 mm in diameter near the left lateral edge was made during the final stages of manufacture.

No antler replica was produced (see the section on bone harpoon head replication and experimentation (Section 6A.4 and 6A.5)).

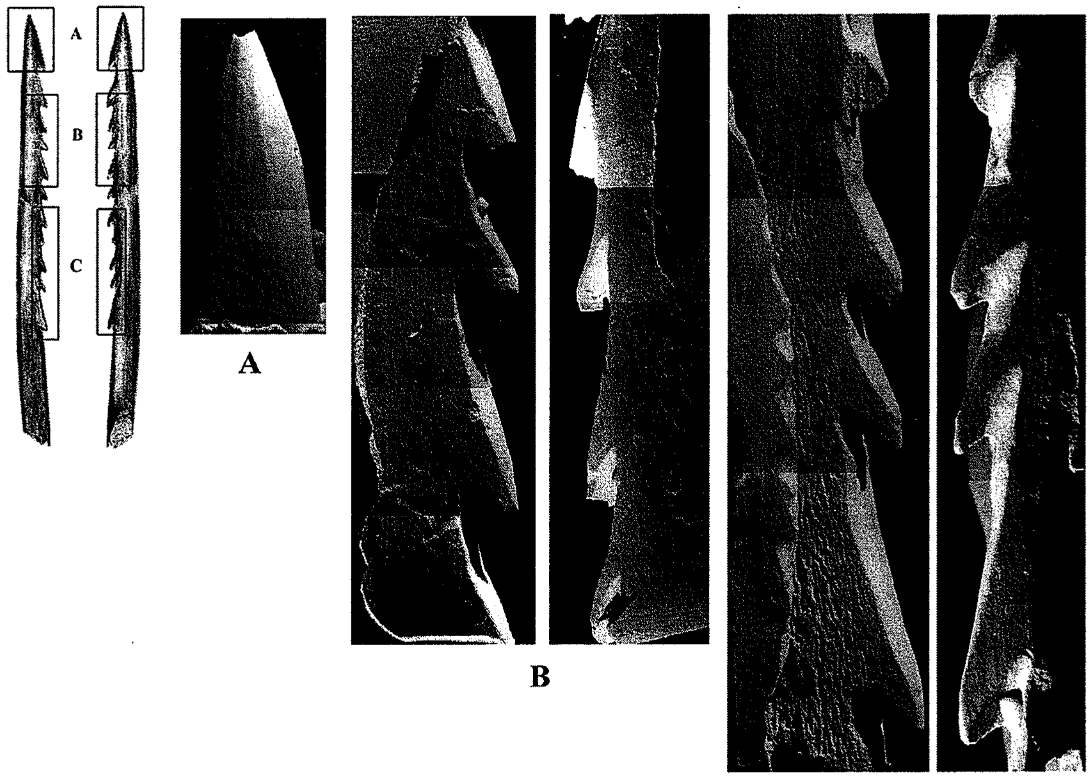


Figure 6.13: Surface of harpoon head 30/36, as recorded on the dental stone cast. Images taken with a stereoscope under 7x magnification.

6C Original Tool (Fish Spear Points)

6C.1.1 Material - Fish spear point 67B was manufactured from a metatarsal from an adult cervid, sex undetermined. Fish spear points 51, 18 and 79 were likely manufactured from caribou long bones. Identification was based on the maximum thickness of the fish spear points.

6C.1.2 Morphological Description – All fish spear points are manufactured from bone and are unilaterally barbed on the left lateral edge (Figure 6.14; 6.15; 6.16; 6.17) (Table 6.2). Barbs are shallow and evenly spaced distally to proximally. None of the fish spear points have a line hole near the base. They have an average of 3 barbs per spear point (range 2-4). The difference between the width of the harpoon head at the most proximal barb and just proximal to this barb averages 0.7 mm (range 0.4 – 1.0 mm). The maximum barb width averages 12.3 mm (range 9.0 – 15.2 mm), which is also the maximum width of the fish spear points, except for fish spear point 79. The average length of fish spear points from the sample is 221.3 mm (range 190 – 258 mm); one fish spear point was broken and not included in the average.

TABLE 6.2: Comparison of measurements between original and replicated fish spear points.

Tool number	**67B**	**51**	**18**	**79**	**Replica 1**	**Replica 2**
Length	258 mm	216 mm	190 mm	97 mm*	230 mm	236 mm
Width Barb 1	11.9 mm	10.6 mm	9.3 mm	8.0 mm	12.4 mm	14.9 mm
Width Barb 2	13.9 mm	13.2 mm	10.0 mm	8.5 mm	14.1 mm	16.5 mm
Width Barb 3	14.8 mm	14.6 mm		9.0 mm	14.9 mm	16.2 mm
Width Barb 4	15.2 mm	15.1 mm			15.5 mm	15.9 mm
Width below final barb	14.2 mm	14.1 mm	9.6 mm	8.5 mm	15.4 mm	15.7 mm
Maximum thickness	8.4 mm	8.8 mm	6.7 mm	5.6 mm	8.1 mm	7.9 mm
Location of Greatest Width	Barb 4	Barb 4	Barb 2	Not at barb 9.3 mm	Barb 4	Barb 3
* Tool Broken						

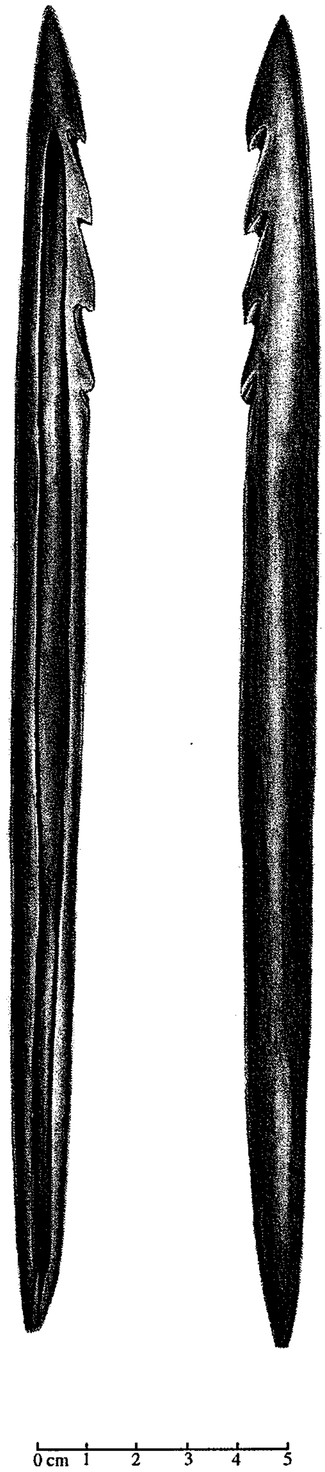


FIGURE 6.14: Drawing of original fish spear point 67B.

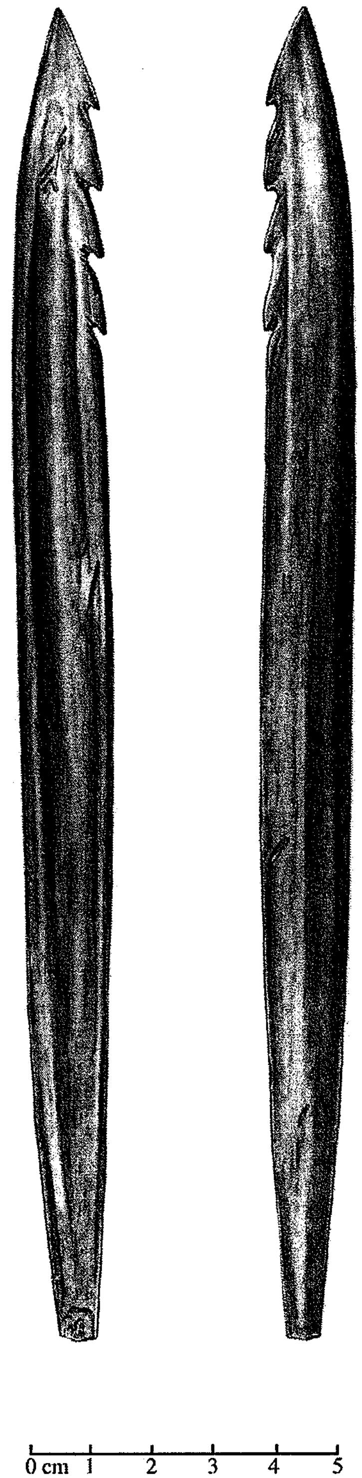


FIGURE 6.15: Drawing of fish spear point 51.

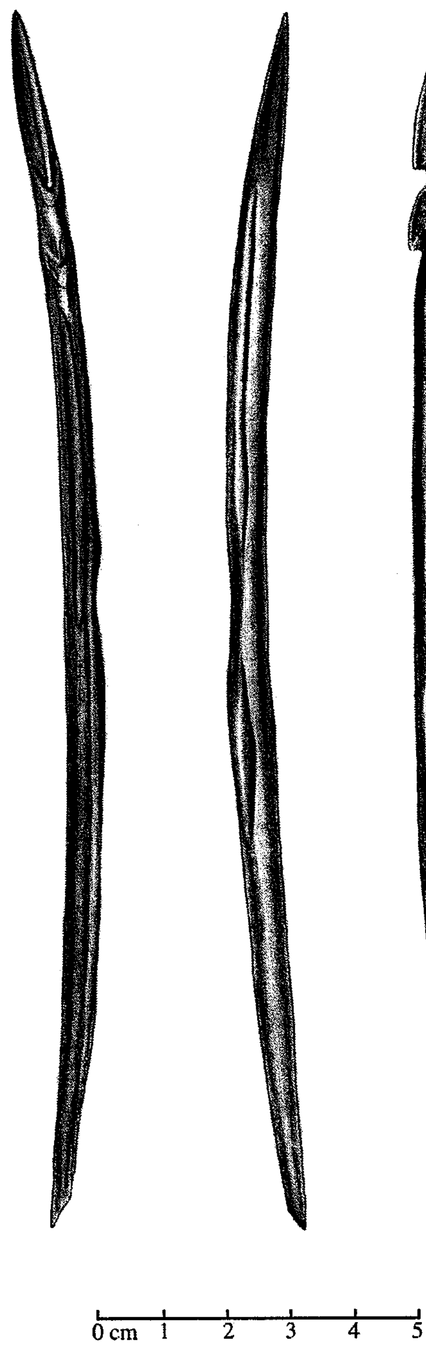


FIGURE 6.16: Drawing of fish spear point 18.

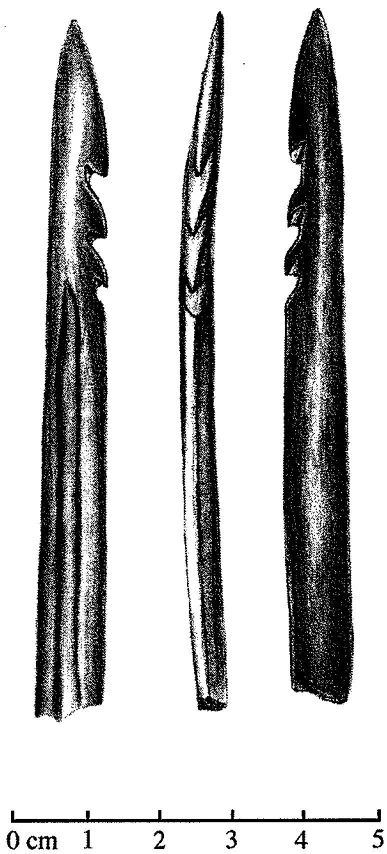


FIGURE 6.17: Drawing of fish spear point 79.

Fish spear points 67B, 51, and 79 have a concave ventral surface, representing the inner portion of the element. Fish spear point18 is highly modified with a flat ventral surface. The dorsal surfaces of all of the fish spear points are rounded, representing the outer surface of the original element. The left lateral edge is sharp and the right lateral edge is rounded. The proximal end of all fish spear points is pointed, although not sharp. The proximal ends of fish spear point 51 and 18 have exposed cancellous material. Fish spear point 67B and 51 are straight in lateral profile. Fish spear point 79 is slightly curved and fish spear point 18 is highly curved in lateral profile. The dorsal surface of fish spear point 18 is irregular with wide grooves and ridges. The main ridge is natural although carving on the left and right side of the ridge increases the prominence of the ridge.

6C.1.3 Wear and Manufacturing Patterns – The surfaces of the fish spear points were carved with a stone tool creating channeled striations in the dorsal surface and edges of the ventral surface (Figure 6.18; 6.19; 6.20). The under-cut surfaces of the barbs are smooth, lack channeled striations and are "U" shaped in cross section. None of the fish spear points had wear patterns resulting from use based on the clearly defined striations from manufacture (Figure 6.18, 6.19, 6.20). Fish spear point 79 is broken, the proximal end missing (see section 6B.1.3 description).

6C.1.4 Production Sequence – The fish spear points were manufactured from smaller elements than the harpoon heads, and caribou appears to have been the preferred raw material. Fish spear points 67B and 51 were produced from straight bone blanks likely from the lateral or medial portion of a caribou metatarsal. The ventral surface is concave representing the inner portion of the original element. Care was taken in manufacture of these two tools (67B and 51) as the lateral profile is straight and the barbs evenly spaced. In comparison fish spear points 18 and 79 appear to have been made expediently. The bone blanks used to produce these tools were curved (18 heavily curved; 79 slightly curved) in lateral profile and few barbs were added. Based on these characteristics I would suggest less care was taken during the manufacture process of these two tools. In

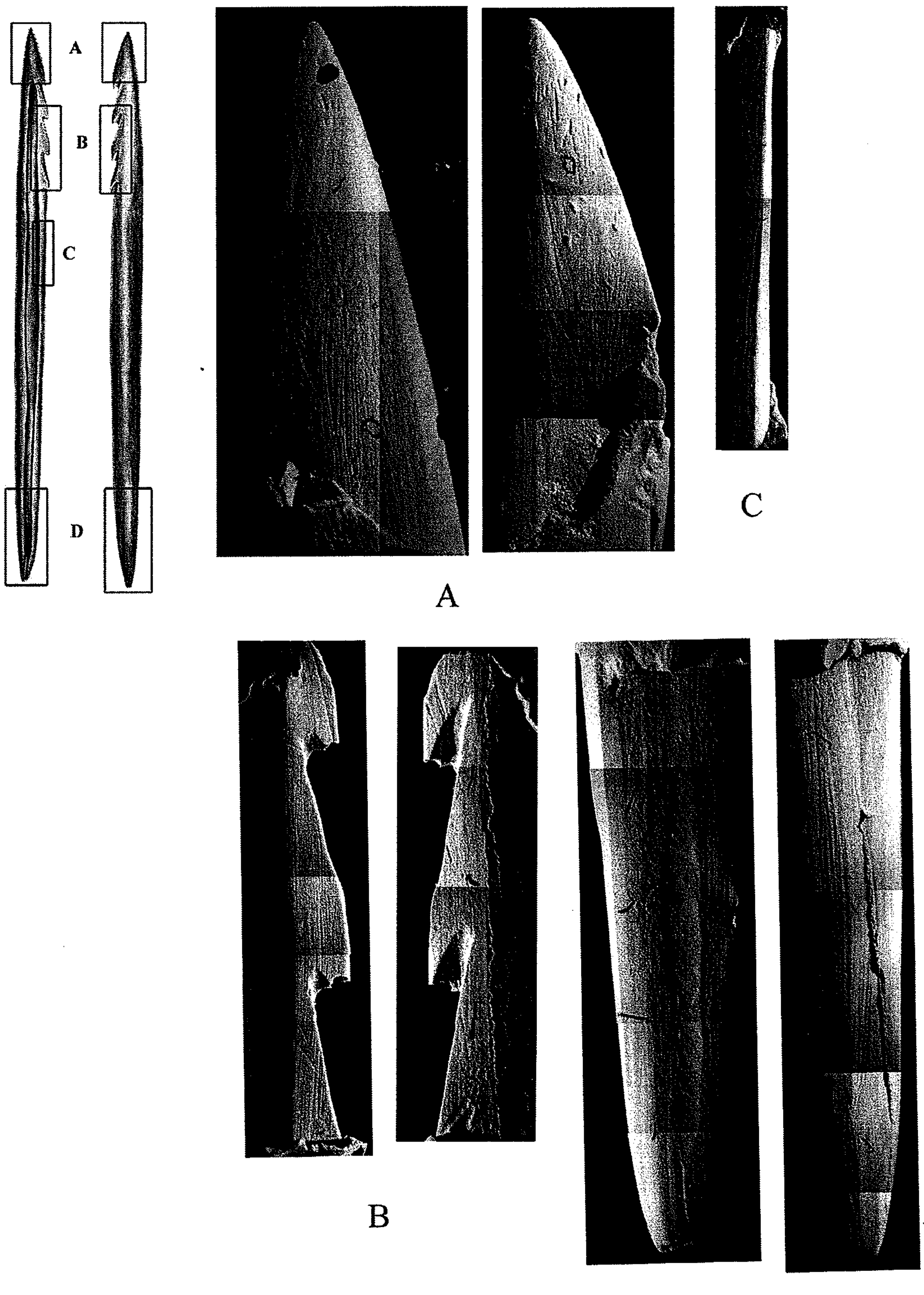


FIGURE 6.18: Surface of fish spear point (67D), as recorded on the dental stone cast. Images taken with a stereoscope under 7x magnification.

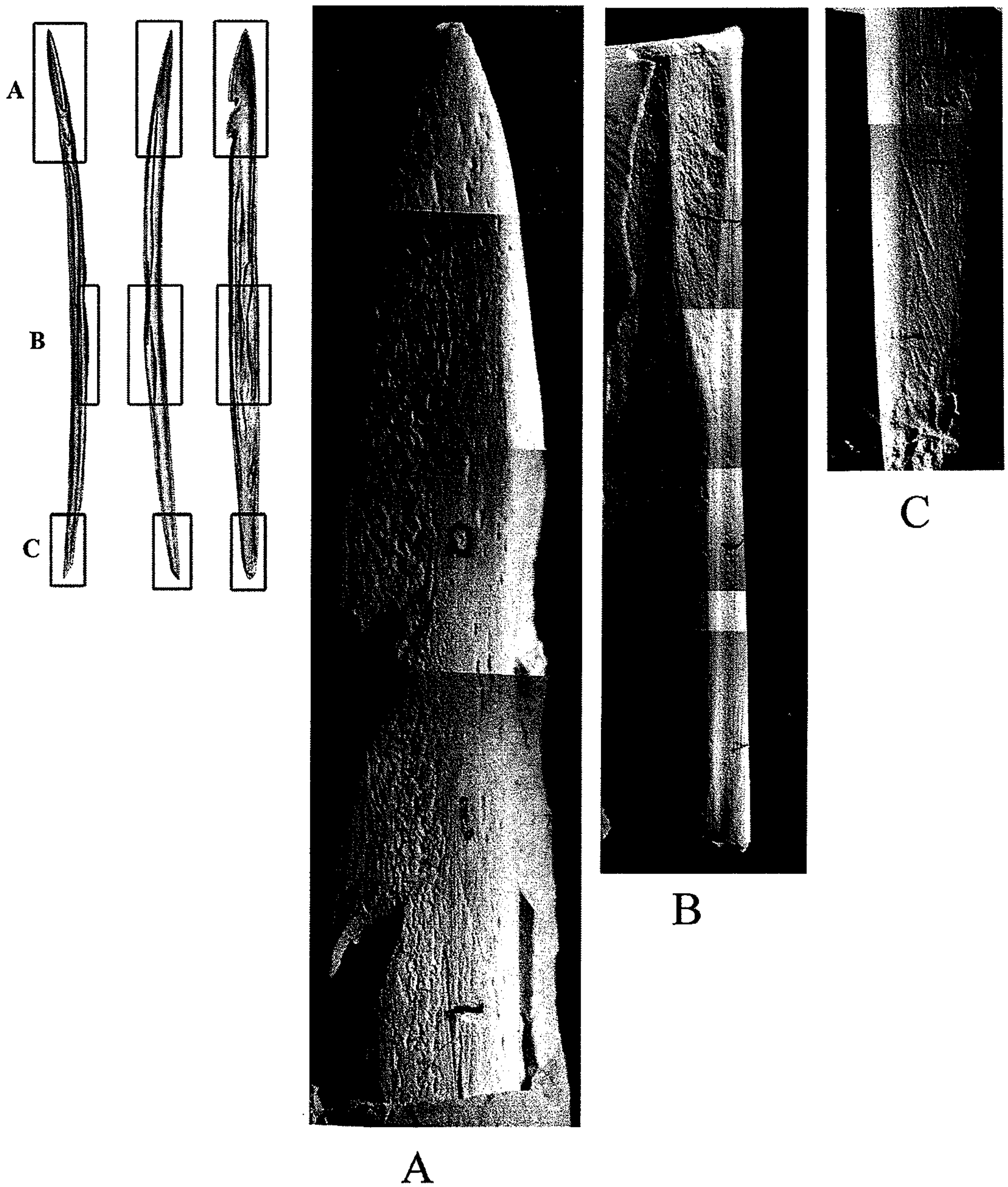


FIGURE 6.19: Surface of fish spear point 18, as recorded on the dental stone cast. Images taken with a stereoscope under 7x magnification.

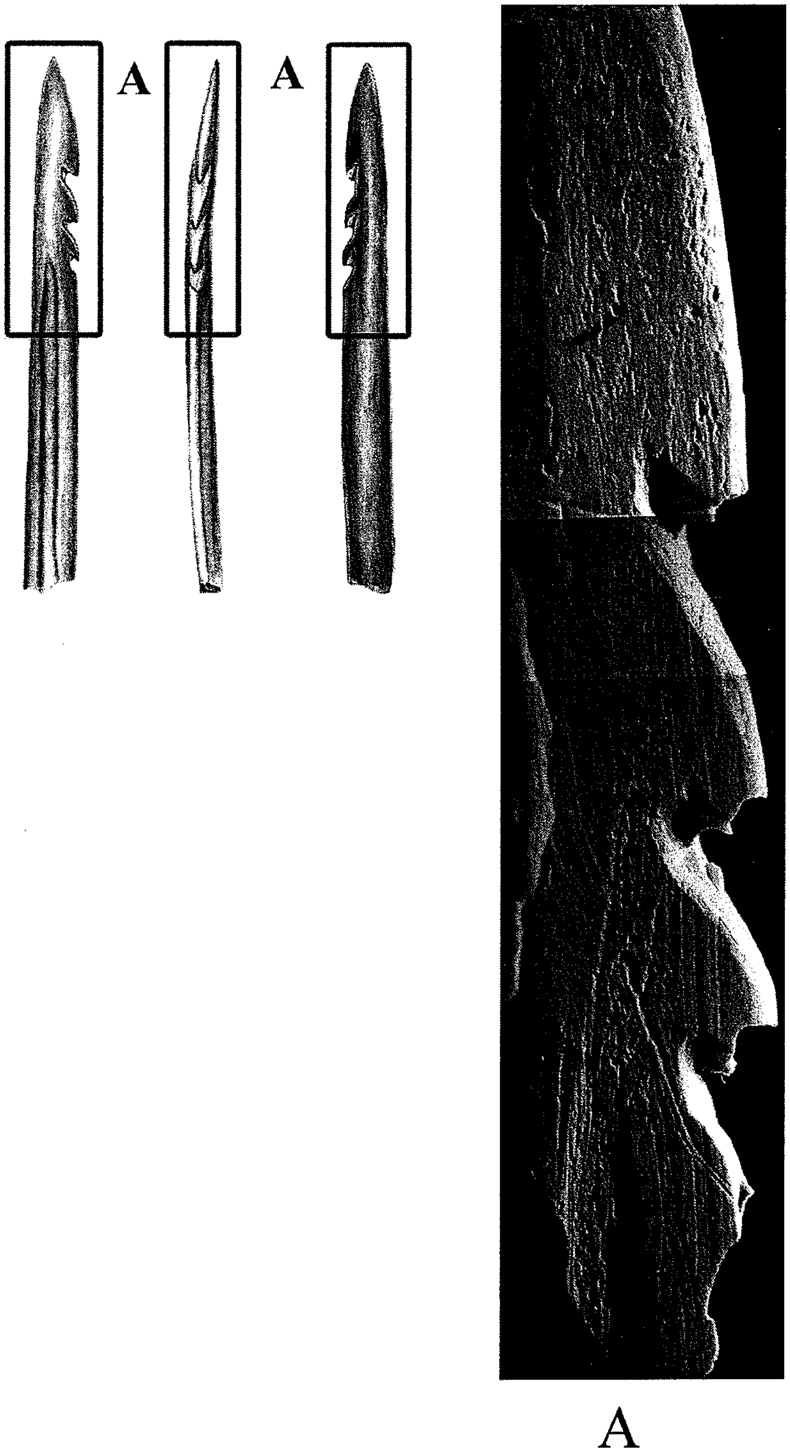


FIGURE 6.20 Surface of fish spear point 79, as recorded on the dental stone cast. Images taken with a stereoscope under 7x magnification.

comparison to bone harpoon heads there is significant variation in shape and lateral profile suggesting a lack of standardization in the manufacturing process of fish spear points.

Despite variation in final form, the fish spear points all appear to have been manufactured from long bone shafts of cervids (likely caribou) using roughly the same production sequence. The left lateral edge was sharpened to prepare for the addition of barbs. The barbs were created by slightly undercutting the left lateral edge. Barbs were added from the distal end first, to ensure even spacing. None of the fish spear points were decorated and no line was added to the proximal end of the tools.

6C.2 Comparisons – Fish spear points lack a line hole and are firmly attached to their shafts (Osgood 1970; Stewart 1996). These tools are used to spear fish and toss them onto shore or into a canoe, much like a pitchfork, and as a result, they require fewer and less pronounced barbs. Many wide barbs on a fish spear point would make it difficult to take the fish from the spear, as it would be held too securely. In this case, each fish would have to be pulled off by hand before another could be speared, rather than being shaken off. Fish spear points have been recovered from two sites in northern Manitoba: HhLp-16 and GjLp-14. Poor preservation of bone and antler hampers the recovery of these tools. See section 6A.2.1 for additional ethnographic information on fishing techniques.

6C.3 Interviews – Keith Anderson indicated that Lake Whitefish would be easy to spear in June when they feed at the surface of the water on Mayflies. The water will churn with hundreds of whitefish in areas where mayflies land on the water surface.

Keith Anderson and Leslie Baker commented that fish spears could be used to obtain many fish during the spring and fall spawn on small rivers, where fish are found in large numbers. They also suggested that fish could be removed from a weir pen (part of the fish weir) with a fish spear, net, or gaff. See section 6A.3.1 for additional information on fishing techniques.

6C.4 Replicated Tools

6C.4.1 Material - The bone used to replicate fish spear point (replica 1) was the medial portion of a metatarsal from an adult female moose (*Alces alces*). Replica 2 was manufactured from a lateral portion of a metatarsal from a two year old male moose (*Alces alces*). Tamarack poles, and moose rawhide was used to haft both fish spear points.

6C.4.2a Morphological Description Replica 1 – This tool is a unilaterally barbed fish spear point with four shallow barbs, located on the left lateral edge (Table 6.2).

6C.4.2b Morphological Description Replica 2 – This tool is a unilaterally barbed fish spear point with four shallow barbs, located on the right lateral edge (Table 6.2).

6C.4.3 Production Sequence – See Appendix 3

6C.4.4 Manufacture Patterns – Photographs taken under the stereoscope pre-experiment indicated that many file marks were present on the surface of replica 1 and absent (except for the barbs) on replica 2 (Figure 6.21). Based on this observation, replica 1 was used as a test tool, and considered disposable for the experimental stage since wear patterns could not be adequately identified on the surface.

6C.5 Fish Spear Experimentation

6C.5a.1 Activity Replica 1 – Spear two Jackfish

6C.5a.2 Test Tool function Replica 1 – The tool was used to spear fish from a beaver dam located on the Rusty River. Burnell Anderson caught a small two pound Jackfish with a rod and reel; he humanely killed the fish and placed it back in the water. The dead, floating fish was brought near the researcher to spear. The fish was kept on the line to ensure that if the spear point broke during the experiment (while in the fish) the distal end would not be lost. The pole was grasped with both hands and thrust at the fish with a quick motion, never leaving the hands. The first attempt missed the fish and the second attempt hit a rock, breaking the tip off the fish spear point. The break occurred on the distal side of the first barb. The experiment was continued and the fish was speared on the fourth attempt (Figure 6.22). A second small jackfish (two and one half pounds) was speared in a similar fashion to the first.

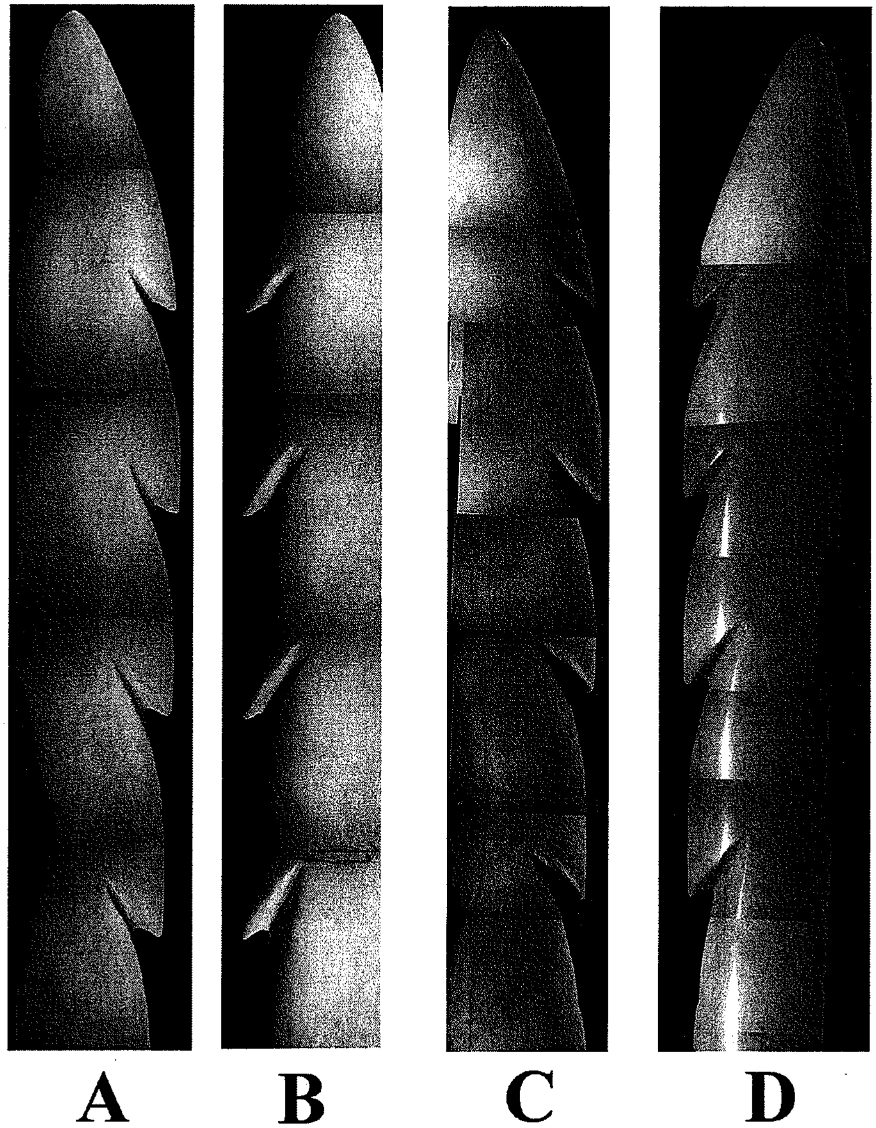


FIGURE 6.21: Surface of fish spear point replica 2. A and B show the surface of the pre-experiment fish spear point (A-Dorsal, B-Ventral). C and D are both post experiment surface of the tools showing wear patterns (C-Dorsal, D-Ventral). Images taken under 7 x magnifications using a stereoscope.

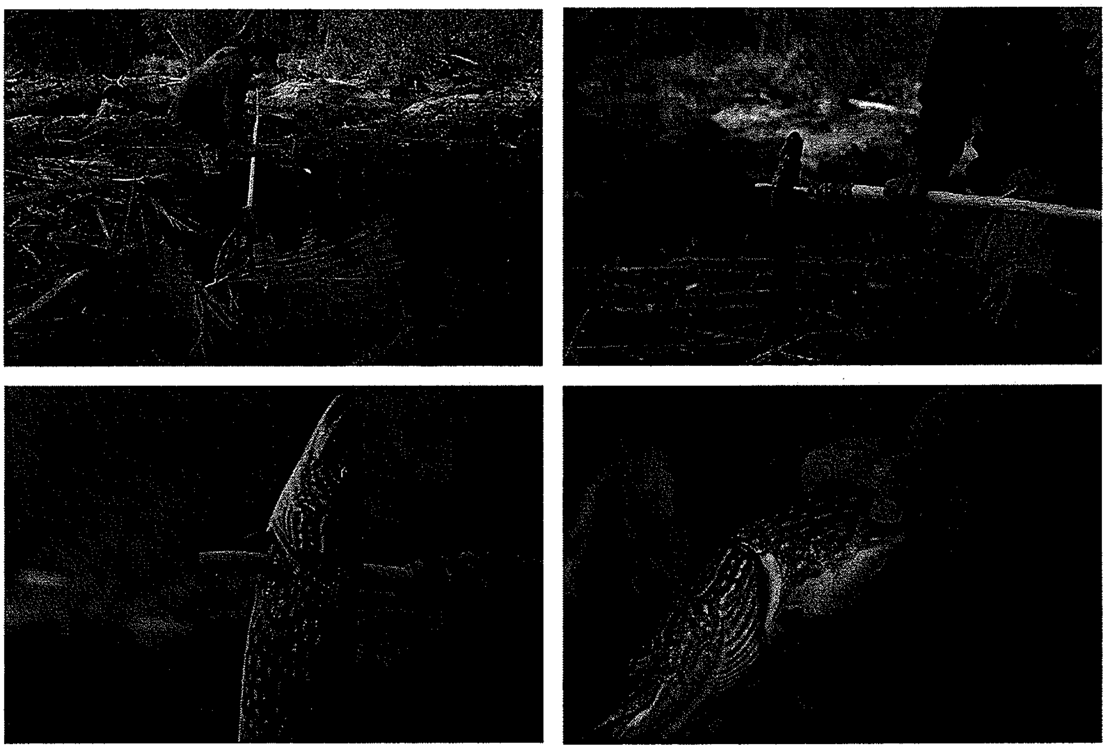


FIGURE 6.22: Experimenting with a fish spear (replica 1) on a jackfish.

6C.5a.3 Performance – Exceptional. The spear easily secured the fish and supported its weight until it was shaken off. The inexperience/inability of the researcher to handle the tool caused the breakage. Hand-eye coordination and experience is required to properly handle the tool. A longer pole would have assisted in the experiment.

6C.5b.1 Activity Replica 2 – Spear three Lake Whitefish and one White Sucker.

6C.5b.2 Test Tool Function Replica 2 – Local commercial fishermen donated three Lake Whitefish (four pounds each) and one White Sucker (two pounds) for the experiment, caught the night or morning before the experiment in commercial fish nets. The dead fish were placed into a plastic fish tub and repeatedly stabbed with the fish spear (Figure 6.23). Each fish was stabbed twenty times with the fish spear, for a total of 80 punctures.

6C.5b.3 Performance – Exceptional. The fish spear point easily pierced the scales and skin of the fish, and each fish was lifted from the tub without the fish spear point breaking.

6C.5.4 Comparison (Replica 1 and 2) – Replica 1 had too many file marks on the surface due to manufacture and was not examined for wear patterns. Replica 2 was highly polished after use. The tip was slightly blunted. Small cracks appeared in the fish spear point after 24 thrusts. These increased in length during the experiment although the tool did not break (Figure 6.24). No other wear scars were visible (Figure 6.21). No comparison was possible since the original tools had been re-sharpened prior to burial, eliminating any wear patterns.

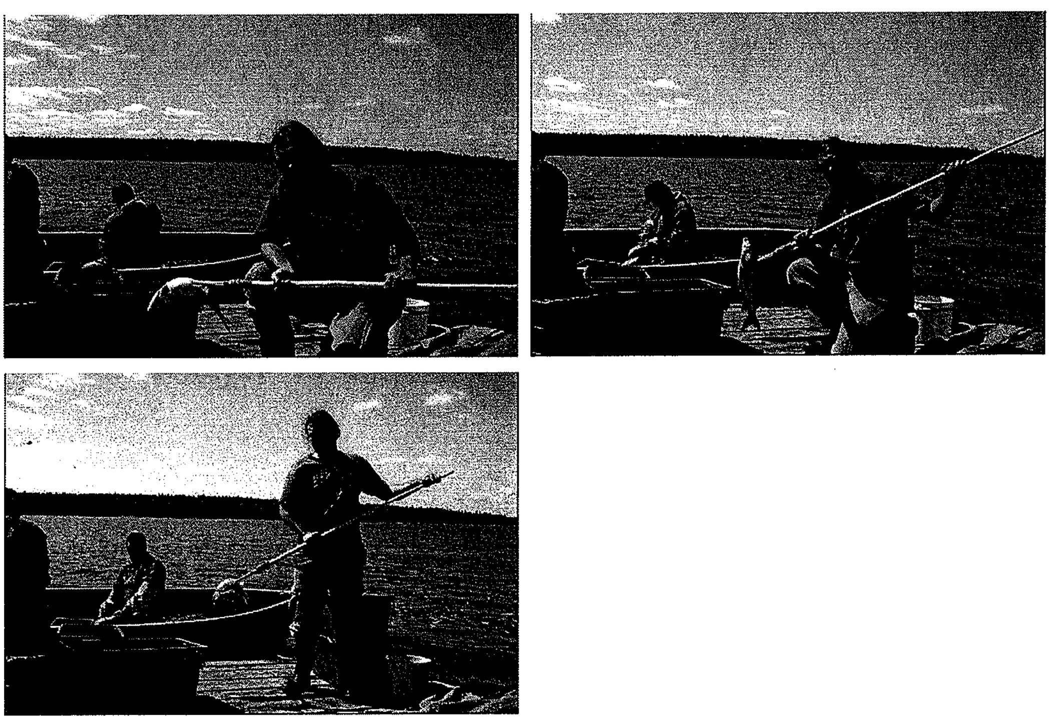


Figure 6.23: Experimenting with a fish spear (replica 2) on suckers in a fish tub.

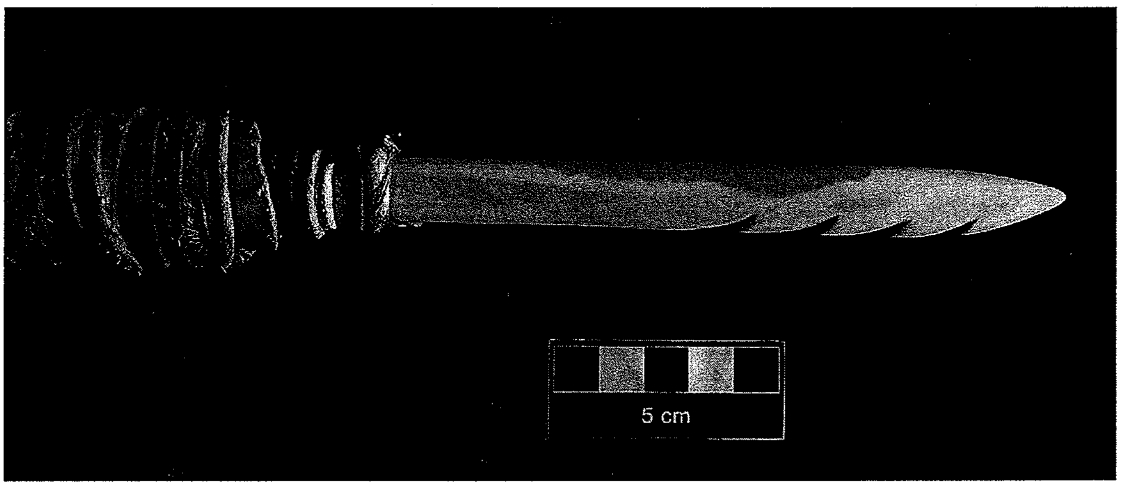


FIGURE 6.24: Hafted fish spear (replica 2) post experiment.

7. Results – Antler Adze

7.1 Original Tool (Antler Adze 24)

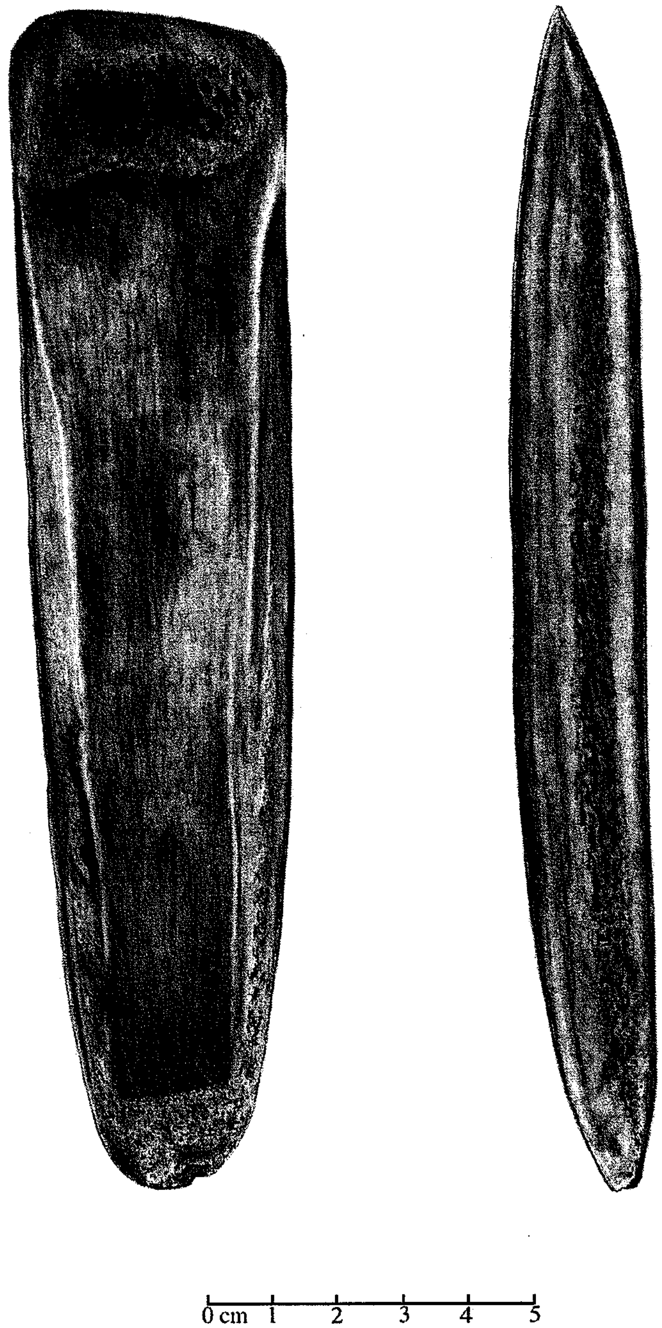
7.1.1 Material – Moose (*Alces alces*) antler fully developed, Bull Moose palmate section from a three year old or older.

7.1.2 Morphological Description – The general morphology is slightly convex on the dorsal surface and slightly concave on the ventral surface in lateral profile (Figure 7.1). In ventral/dorsal profile the tool narrows at the proximal end and expand to the distal (working) edge to a width of 40.4 mm. Both lateral surfaces are exposed spongy cancellous material with dense antler on both the ventral and dorsal surfaces. The dorsal surface of the working edge is slightly modified, with the ventral surface carved away to produce a steep beveled sharp edge. The maximum length is 180mm, and the maximum thickness is 20.3mm, located 37.5 mm from the distal tip just before the beveling begins on the ventral surface to produce the sharp working edge (Table 7.1).

7.1.3 Wear and Manufacture Patterns – The ventral surface has no evidence of manufacturing marks and is smooth with high polish. The dorsal surface has a few random striations but is relatively smooth with high polish. The upper and lower lateral edges exhibits random cut or chop marks roughly perpendicular to the tool (Figure 7.2). Striations and channeled striations are present on the lateral edge running parallel to the tool on both the dorsal and ventral edge.

The dorsal edge has pitting on the right side of the bit edge. The corresponding edge on the ventral surface is blunted and has some crushing (Figure 7.2).

7.1.4 Production Sequence – A relatively flat portion of the palmate section of a large moose antler was chosen to produce this tool. The dorsal surface of the tool is slightly



FUGURE 7.1: Drawing of original Antler adze (24).

convex representing the ventral (lower) surface of the original antler. The ventral surface is slightly concave representing the dorsal (upper) surface of the antler. The thickness of this tool indicates it was made from a large moose antler.

TABLE 7.1: Comparison of measurements between orignal and replicated antler adzes.

Antler Adze		
Description	**Replica 1**	**Original**
Length	181 mm	180 mm
Working edge width	40.7 mm	40.4 mm
Thickness 30mm from distal end	17.4 mm	17.8 mm
Width 30mm from distal end	43.9 mm	40.8 mm

The dense, palmate antler was cut or scored to produce a blank, to the approximate dimensions of the final tool. The blank was then chopped on the lateral edge to taper the tool towards the proximal end and an expanding bit edge, giving the tool its final form. The ventral surface was carved to produce the steep working edge.

7.2 Comparative Research

Osgood (1970:100) identified an antler adze made from caribou horn (antler), the blade measuring 25.4 mm in width and hafted to a wood handle. The tool is used for rough trimming of wood, intermediate between a stone adze and beaver incisors (Osgood 1970:100). Clusters of adze cut stumps help identify sites in the interior of the Yukon that are associated with the Gwichin (Jean-Luc Pilon, *pers. comm.* 1996). Antler adzes were used to cut the trees based on archaeological recoveries. Lemoine (1997:52) identified a similar adze tool made from whale bone recovered at the Gupuk site. Schledermann and McCullough (2003:87-88) identify 12 adze heads and blades from Ellesmere Island manufactured from osseous material including bone, antler, ivory and horn.

Adzes are typically manufactured from stone in the boreal forest. In 1995, 160 adzes had been recovered and identified (Brownlee 1995b). It is estimated that an

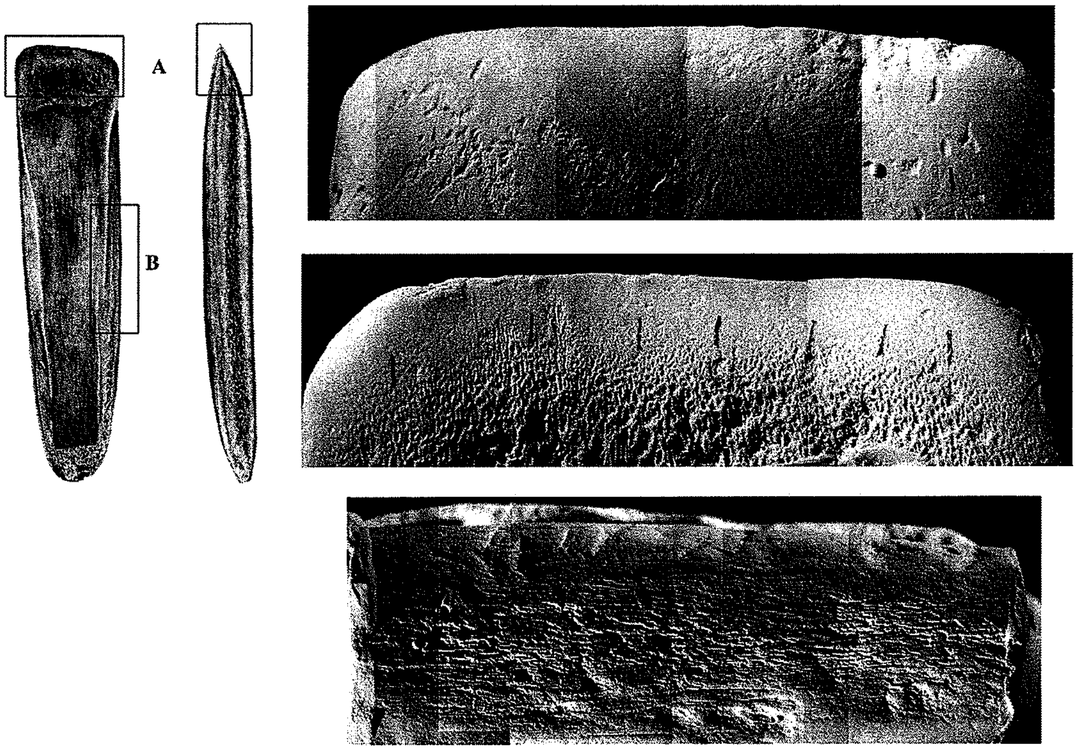


FIGURE 7.2: Surface of original antler adze (24) as recorded on the dental stone casts. Images taken using a stereoscope under 7x magnification.

additional 50-70 adzes have been recovered since 1995 when the study was conducted for a total of 210-230. David Meyer (1978:39) identified two antler celts (or wedges) from Saskatchewan, the first from the Nipowiwinihk (FhNa-1) in a Selkirk layer (Pehonan complex). The second was recovered near the Old Cumberland House (1774-1794) (FlMn-4) (David Meyer *pers. comm.* 1996; Meyer 1978:39). MacNeish (1958:133) identifies an antler adze 106 mm in length from the Selkirk site EaLf-1on the Red River. The final archaeologically recovered antler adze from EfKv-61/W8 (University of Winnipeg collection) from the Winnipeg River area of southeastern Manitoba 120 mm long.

Thompson identifies the main tree species used by the Cree. The wood from paper birch (*Betula papyrifera)* was very strong and often used for canoes, dishes, sleds, and axe handles. Tamarak (*Larix laricina)* was an extremely strong, elastic wood, the best for making sleds. Trembling Aspen (*Populus tremuloides*) were used for smoking fish and meat and often used for firewood. Boughs of black spruce (*Picea mariana)* were often used for making beds and lying out fish and meat and the wood was used as poles for tent frames and canoes (Thompson 1962:58).

7.3 Interviews

Lottie Moore, Alvin Moodie and Johnson Donkey identified the tool as a hide fleshing tool. Keith Anderson suggested an axe or adze. Those interviewed indicated the importance of wood, when asked. Some of the items made from wood include poles for tents, hide frames and smoking racks. Finer work included making snowshoe frames, ribs and gunwales for canoes, sleds, dishes and utensils and handles for various tools.

7.4 Replicated Tools

7.4.1 Material – Shed moose antler, large 4 years old or older. Paper Birch wood handle and moose rawhide lacing.

7.4.2 Morphological Description – The working edge of this tool was faithfully reproduced with the working edge measuring 40.7mm. Thickness of the tool 30mm from the working edge was 17.4mm and width at this point was 43.9 mm (Table 7.1). The replicated tool was rectangular in shape, rather than constricted at the proximal end. The decision to diverge from the original tools dimensions was based on ease of production and assist in hafting the tool. Reproducing the working edge of the original

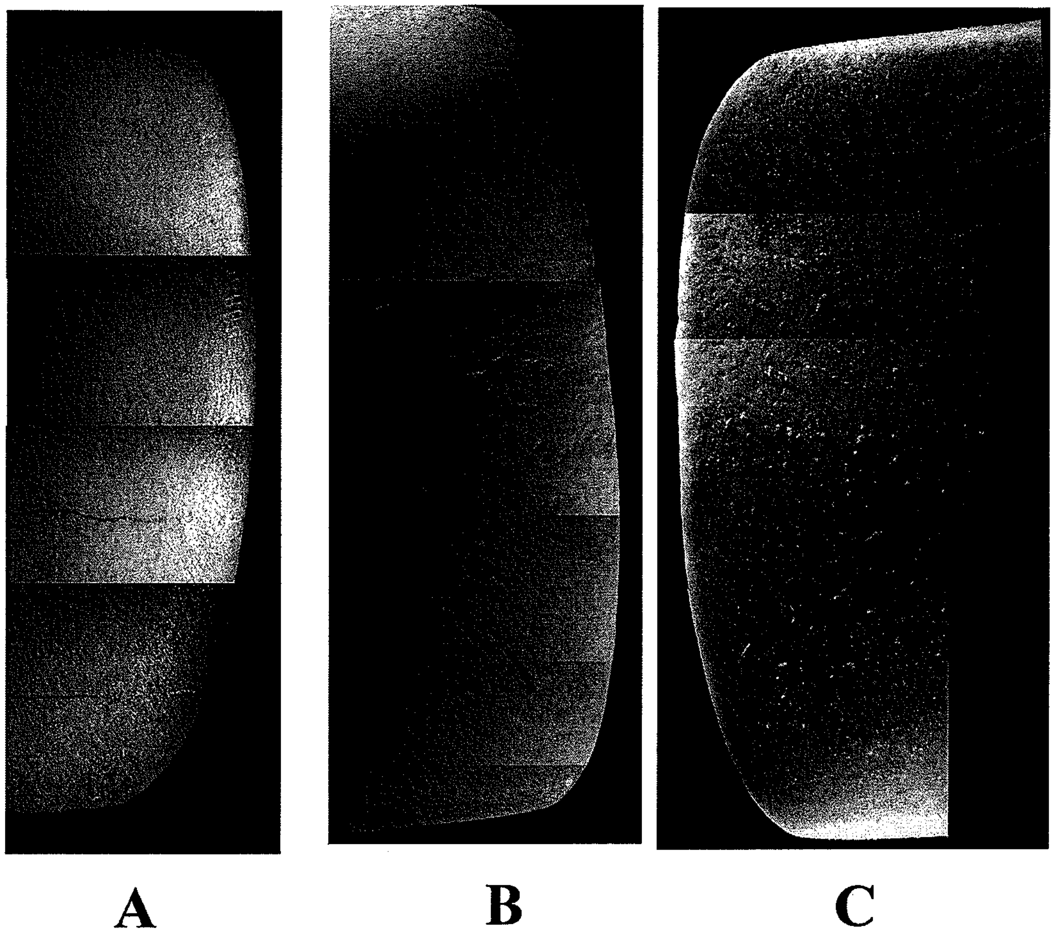


FIGURE 7.3: Surface of antler adze (replica 1), images taken using a stereoscope at 7x magnification. A. pre-experiment dorsal surface, note file marks. B. and C. show the post-experiment tool surface with pitting on the dorsal surface.

tool accurately was seen as critical for testing, while the morphology and shape of the proximal end of the tool was of secondary importance.

7.4.3 Production Sequence – See Appendix 4

7.4.4 Manufacture Patterns – The working edge of the tool was smoothed using 600 grit sandpaper, eliminating most manufacture marks. Light file marks were identified under 7x magnification on the dorsal distal end of the tool (Figure 7.3).

7.5 Experimentation

7.5.1 Activity – Chop a living trembling aspen (*Populus tremuloides*).

7.5.2 Test Tool Function – The handle is held parallel to the tree with the blade of the antler adze perpendicular to the tree (Figure 7.4). A small living poplar tree was selected to test the performance. Small limbs from the tree were quickly removed using the adze. The adze was then used to chop a section from the tree. The blade easily cut through the bark and into the trunk of the tree. The tool was held in the right hand, while the left hand held the trunk. The blade hit the trunk of the tree at a 30° angle. The adze was used to cut the trunk of the poplar 1.2 meters from the ground producing a cut about 35 cm long, 8 cm wide and 2 cm deep. Glancing blows were only possible due to the angle at which the antler blade was hafted. The experiment was halted after 10 minutes, once wear was present on the antler adze.

7.5.3 Performance – Adequate. This rating is based on the experiment itself. The 30° angle that the adze was hafted at was inadequate for cutting into the trunk of the tree. The tool performed exceptionally well at removing small limbs from the tree as the handle did not interfere with the activity. It is suggested an angle of 60 – 80° would substantially improve performance when chopping a tree. The antler adze cut the tree well and sustained minimal wear/damage. Despite the adequate performance the antler adze remained tightly bound to the handle.

7.5.4 Comparison – The working edge of the adze became dulled over the entire surface, with concentrated wear on the left side of the working edge. Both the dorsal and ventral surfaces had pitting and crushing on the left side of the working edge (Figure 7.3). When compared to the original tool, a similar pattern of crushing was noted on the

FIGURE 7.4: Experimenting with the antler adze (replica 1), chopping a small poplar tree.

right portion of the bit edge. Depending on the handedness of the user it appears that one side of the tool is unintentionally favoured. During use, one area will sustain the most damage, where the brunt of the chopping takes place. It is concluded that the original tool was used as a woodworking adze. The minimal wear on the original tool suggests it was not used extensively before deposit in the burial.

8. Results – Antler Chisel

8.1 Original Tool (Antler Chisel 6)

8.1.1 Material – Male moose (*Alces alces*) antler fully developed, three years old or older. The identification of moose was based on the following observations:

- The distal one third of the tool has a round cross section, common to moose antlers and unlike the oval cross section of a caribou antler.
- The proximal two-thirds of the tool is flatter, and represents the palmate section of a moose antler.
- The maximum width of the tool is 37.4mm and it is estimated the original tine was at least 42mm in diameter, too large for a caribou antler.

8.1.2 Morphological Description – The ventral surface is predominantly spongy, from the inner portion of the antler (Figure 8.1). Dense antler is visible on the outer edge of the ventral surface, except for 87.3mm on the proximal end of the left lateral side, which was entirely spongy. The antler used to produce this tool has a gentle curve, slightly concave on the left lateral side and slightly convex on the right lateral side. The dorsal surface of the tool is the ventral (lower) portion of the antler and round in cross section over the entire length. The dorsal surface of the tool is comprised of dense, compact antler. The tool has a maximum width of 37.5mm near the center (Table 8.1). The maximum thickness of the tool is 16.2mm, located 49.4mm from the working edge. The working edge narrows slightly to a width of 29.9mm. Proximally the tool terminates in a point, although the end is not sharp.

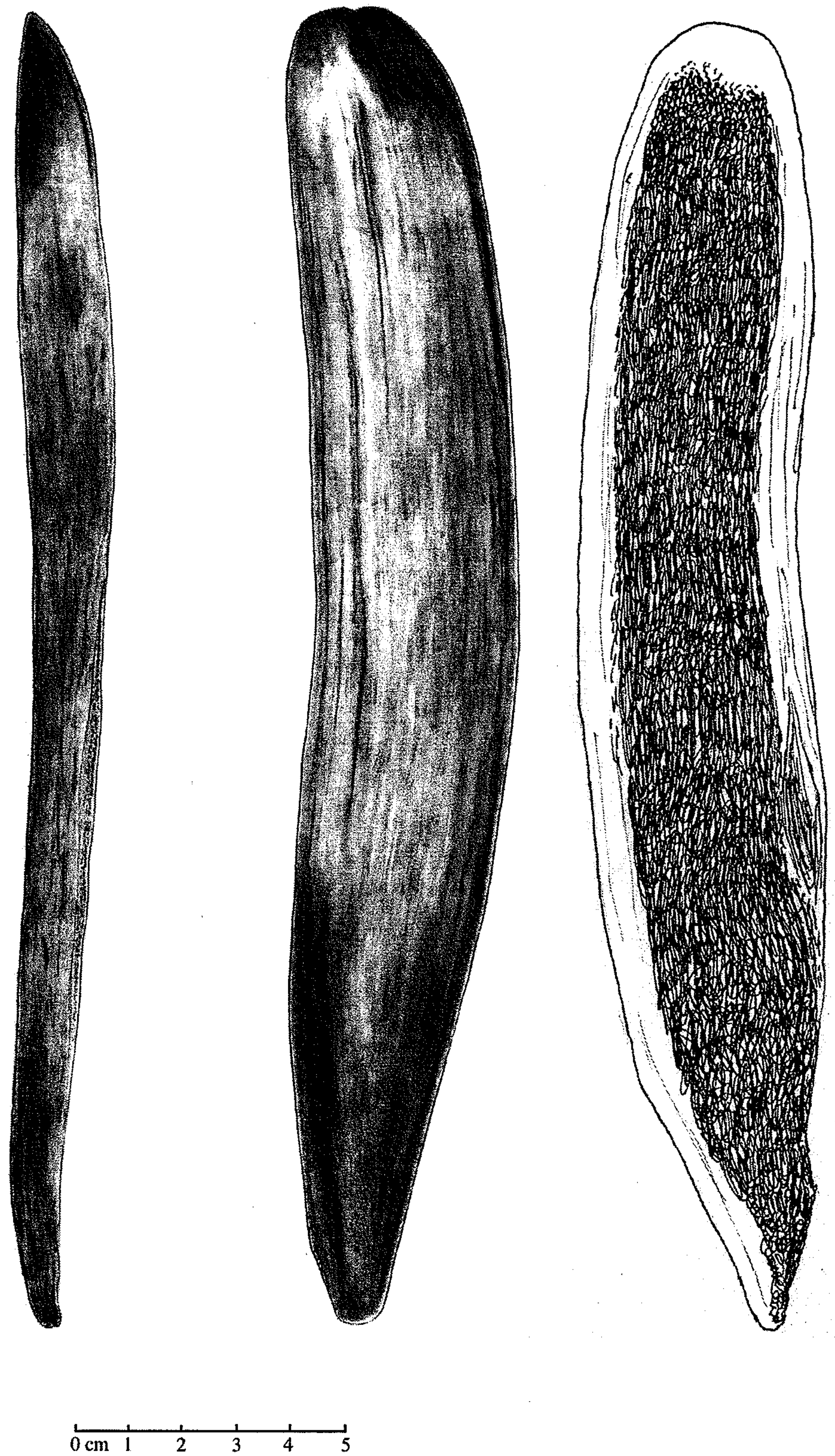


FIGURE 8.1: Drawing of original antler chisel (6).

TABLE 8.1: Comparison of measurements between original and replicated antler chisels.

Tool Number	**6**	**Replica 1**
Length	242 mm	239 mm
Working edge	20.5 mm	22.3 mm
Thickness 10mm from distal end	8.9 mm	9.0 mm
Thickness 20mm from distal end	12.5 mm	13.2 mm
Thickness 30mm from distal end	14.5 mm	15.9 mm
Width 10mm from distal end	25.1 mm	29.8 mm
Width 20mm from distal end	32.5 mm	30.1 mm
Width 30mm from distal end	33.4 mm	36.5 mm

While the tool terminates in a gouge/chisel working edge with a convex dorsal surface and slightly concave ventral surface in cross section the body of the tool is plano-convex in cross section. Polish is visible on the distal end of the tool (ventral and dorsal) and on the proximal end both dorsally and laterally.

8.1.3 Wear and Manufacturing Patterns – Channeled striations, representing manufacture marks, are located on the distal working edge although they become obliterated by smoothing and exhibit high polish on both the dorsal and ventral surface. The channeled striations disappear on the dorsal surface approximately 19.6 mm from the working edge and are likely smoothed and polished from use. The middle of the working edge is blunted on the ventral surface with a slight depression on the dorsal surface, likely resulting from use (Figure 8.2). The ventral lateral edges have parallel grooves consistent with an upper beaver incising tool (see testing manufacture tools section).

8.1.4 Production Sequence – An antler from a mature adult moose was used to produce this tool. Based on the thickness of the dense antler it is likely from a fully mature moose. Alternatively, a shed antler could have also been used to produce this tool.

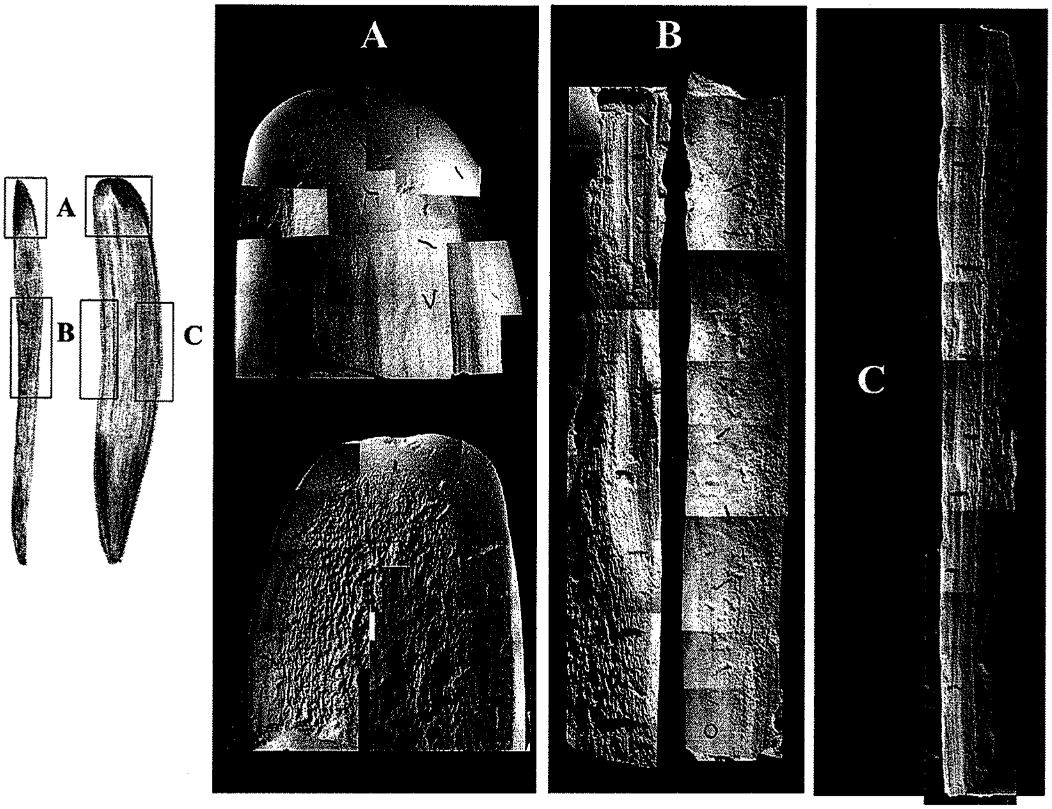


FIGURE 8.2: Original surface of the antler chisel (6), as recorded on the dental stone casts under 7x magnification.

The tool was manufactured from a large tine and palmate section of a moose antler. The first, second or third most anterior palmate tines from a left antler are large enough to produce a tool of this size. The ventral (lower) surface of the antler represents the dorsal side of the tool. The dorsal surface of the tool is round in cross section and the ventral surface is relatively flat. The gentle curve of the tool represents the natural morphology of the antler tine.

The outer dense antler material was scored on the lateral edges to expose the inner spongy portion (Figure 8.2). Once the dense material was scored the interior spongy area was pried apart. The scoring split the tine into two unequal sections - a one third (ventral), two thirds (dorsal) split. The ventral section was used to produce the tool. The right lateral side of the ventral surface bears evidence of scoring (parallel grooves) and a ridge of spongy material runs parallel to the long axis of the tool beside the dense antler and ending 92.1mm from the distal edge. The spongy interior increases in width from the distal (working edge) to the proximal end. This indicates the distal end of the tool was also the distal end of the original antler tine.

The ventral side of the antler used as the blank for the tool corresponds to the dorsal surface of the finished tool. The distal ventral surface slopes towards the dorsal surface creating the working edge. The working edge is slightly convex/concave in cross section approaching a gouge.

8.2 Comparative Research

Osgood identified an ice chisel (1970:221-222) used by the Ingalik of Alaska manufactured from caribou bone and resembling this tool. The bone chisel is 12 inches in length; although only 3 inches of the tool extend beyond the wood pole to which it is attached. The tool is used to chop holes in the ice although much care is required to ensure the bone does not break. Only small chips of ice are removed, the size of a fingernail and the pile of ice chips created look like snow (Osgood 1970:222). Thompson (1962:73) mentions ice chisels were used to pierce holes in the ice or through a beaver house. The antler chisel is a unique item, never recovered archaeologically before in the boreal forest of Manitoba.

8.3 Interviews

This tool was identified as a hide fleshing tool to scrape flesh and fat from moose hides by Lottie Moore, Leda McDonald, Marie Hartie, Johnson Donkey, and Alvin Moodie. Those individuals who still practice this activity use moose metatarsal bone fleshers. The sharp chisel edge of these tools often has "teeth" cut into the surface facilitating the removal of fat and flesh. Most of the people interviewed commented that the tool is missing the teeth and it is made from the wrong material (antler not bone). In addition, this tool would have required a leather or cloth loop attached to the proximal end of the tool. This loop can be twisted around the wrist to ensure the tool does not slip and allow additional pressure to be applied to the tool.

Keith Anderson and Leslie Baker suggested the tool might have been used to chop a hole in the ice if attached to a long pole.

8.4 Replicated Tool

8.4.1 Material – Shed moose antler, large 4 years old or older. No handle or lacing was attached to the tool.

8.4.2 Morphological Description – The tool was faithfully reproduced to match the dimensions of the original. The length of this tool is 23.9 cm. The width of the working edge is 2.2 cm (Table 8.1). The maximum width of the tool was 4.19 cm near the center of the tool. The tool was plano-convex in cross section.

8.4.3 Production Sequence – See appendix 4

8.4.4 Manufacture Patterns – The final step in the process was to smooth the surface using fine 600 grit sand paper to remove file marks left from the manufacture on the working edge of the tool (Figure 8.3). No manufacture marks were left on the working edge of the tool when viewed under 7x magnification.

8.5 Experimentation

8.5.1 Activity – The tool was used to flesh a moose hide.

8.5.2 Test Tool Function – A raw moose hide (adult female) was used to test the function of the tool in fleshing a hide (Figure 8.4). A large spruce tree was cut at about 4 feet from the ground with the top rounded off using an axe. The hide was placed over the tree stump and the antler "fleshing" tool was use to remove all the fat and flesh from the hide. The process took approximately 2 hours 15 minutes. The tool dulled during the experiment. The tool was not re-sharpened during the process. Fat and blood from the hide saturated the tool. Antler softens once it is wet and the tool dulled and became blunted after it was saturated. Bone is a far superior material for use, as the surface never softens with contact with the fat and blood from a hide.

8.5.3 Performance – Based on this experiment the tool is given an inadequate rating. Bone out performs antler as a raw material suitable for a fleshing tool.

8.5.4 Comparison – The tool appeared frayed under 7 power magnification. The entire working edge had become dulled (Figure 8.3). The wear patterns created from fleshing a moose hide are inconsistent with the wear observed on the original tool. The replicated tool was dulled and rounded on the working edge, and wear was concentrated at the bit edge. This differs from the original tool where smoothing extended approximately 19.6 mm from the working edge. The tool appears to have been inserted into a hard material to a depth of at least 19.6 mm.

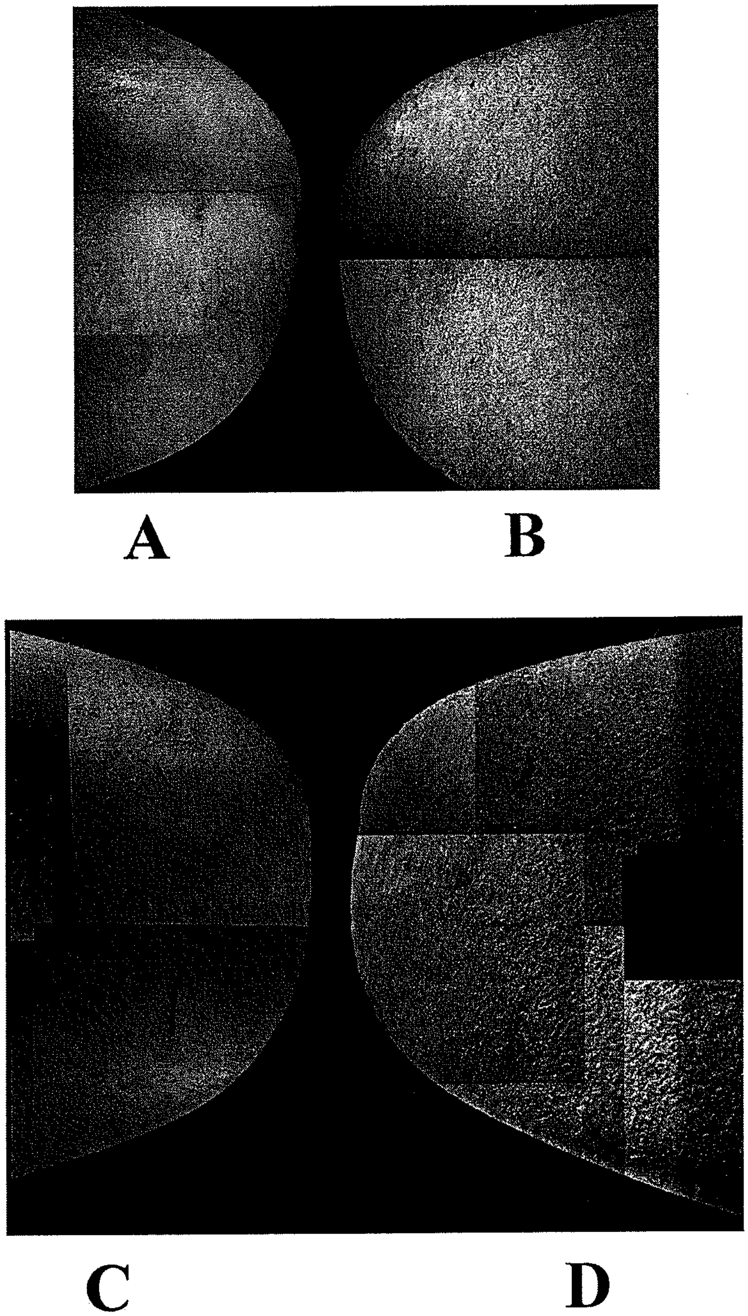


FIGURE 8.3: Surface of antler chisel (replica 1), A. and B.show the pre-experiment surface (A-Dorsal, B.-Ventral). C and D show the post experiment tool surface, under 7x magnification (C-Dorsal, D-Ventral).

FIGURE 8.4: Experiment with the antler chisel fleshing a moose hide.

When the wear pattern from the original tool was compared to other tools tested in this research it corresponded with the antler adze used in woodworking. It is proposed that the tool was used as a wedge for splitting wood. Since the proximal end of the tool shows no evidence of battering it is suggested that a haft of some type was applied to this tool although likely not very large. The process of splitting wood would smooth the working edge beyond the immediate sharp edge, obliterating the manufacture marks consistent with the pattern observed on the original tool. The ridge of spongy antler on the ventral surface ended 92.1 mm from the working edge may indicate a maximum depth the tool entered the wood being split. The maximum thickness of the original tool was 16.2 mm located at 49.4 mm from the working edge. The maximum thickness of a wedge should be close to the working edge. Antler, having high tensile strength, would be ideal for a wedge as it can withstand twisting without breaking.

It is concluded that the tool was used for woodworking. While no pitting was identified on the working edge, the sharp edge has minimal contact with the wood. The majority of pressure and wear would occur on the dorsal and ventral surface away from the working edge.

9. Results – Antler Pick

9.1 Original Tool (Antler Pick 43)

9.1.1 Material – Moose (*Alces alces*) antler, fully mature antler from a 3 year old or older moose.

9.1.2 Morphological Description – One side of the tool is compact antler and the other is spongy; the tool is plano-convex in shape (Figure 9.1). The total length of the tool is 22.5 cm. The compact surface is convex and follows the original outer shape of the antler tine used to produce the tool. In cross section, the distal third of the tool is round and the proximal end is flattened. Orienting the tool so that the compact surface is dorsal, the left lateral side of the working edge is thick, dense antler with a maximum width of 6.7mm. This tool differs from the other tools in the assemblage in that the compact surface has been gnawed by a rodent (Figure 9.2). The gnaw marks are polished, which raises the possibility that the tool may have been produced from a shed antler with gnaw marks. The lateral edges of the tool do not have gnaw marks indicating that the tool was not gnawed following production.

9.1.3 Wear and Manufacture Patterns – It is unclear if the smooth working edge was the product of manufacture or wear. No channeled striations are visible on the distal end. A couple of striations are present on the left lateral ventral surface although these are the exception, rather than the rule (Figure 9.2). Channeled striations are present on the lateral edges, primarily on the ventral surface running parallel to the long axis of the tool.

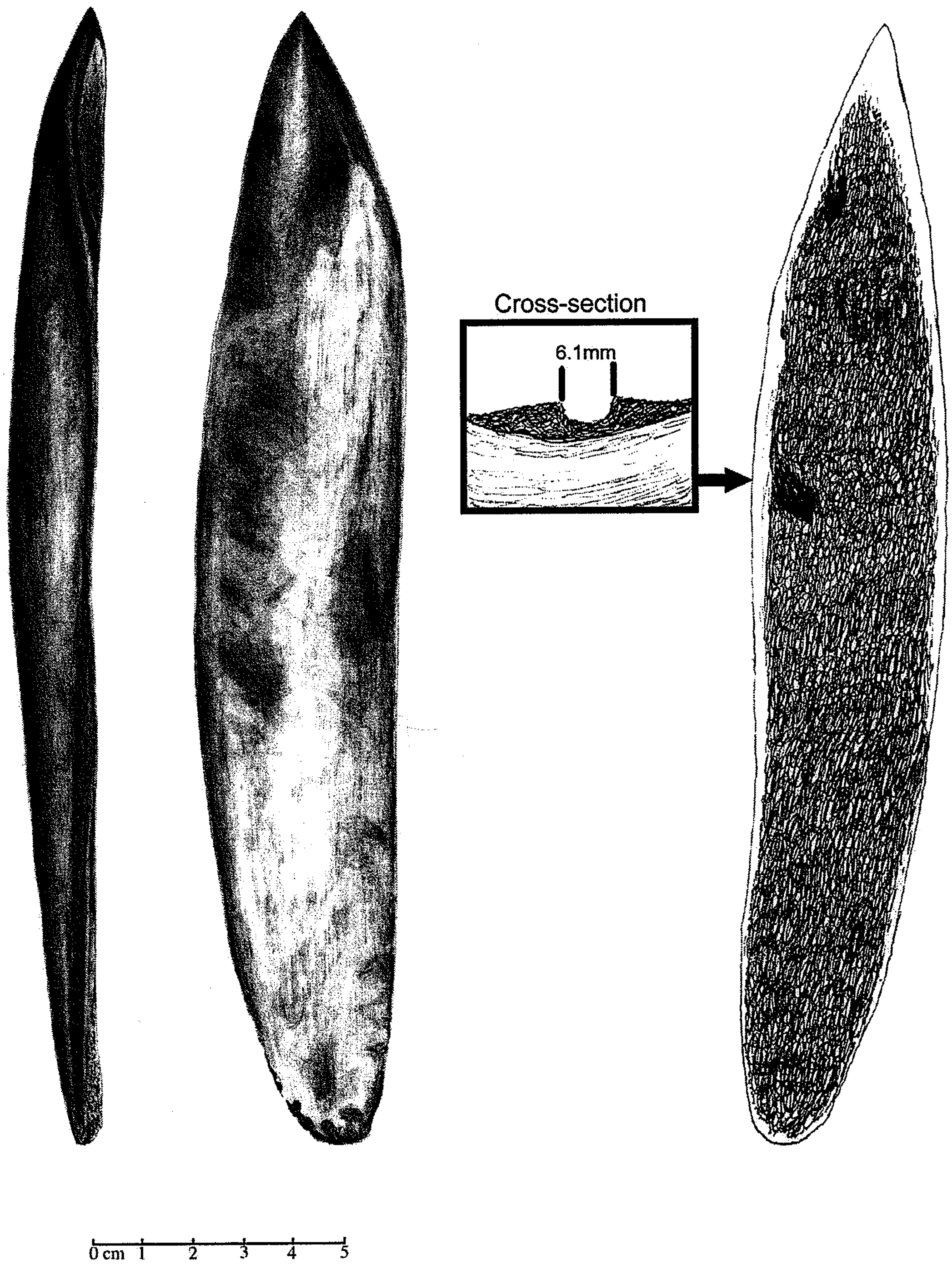


FIGURE 9.1: Drawing of original antler pick (43).

TABLE 9.1: Comparison of measurements between original and replicated antler picks.

Tool number	43	Replica 1	Replica 2
Length	225 mm	238 mm	231 mm
Width at 20mm from distal end	21.5 mm	21.8 mm	20.9 mm
Width at 30mm from distal end	27.1 mm	27.6 mm	27.0 mm
Width at 40mm from distal end	31.6 mm	31.9 mm	30.3 mm
Width at 50mm from distal end	34.7 mm	36.2 mm	33.6 mm
Thickness at 20mm from distal end	10.2 mm	10.4 mm	13.1 mm
Thickness at 30mm from distal end	12.3 mm	12.4 mm	15.3 mm
Thickness at 40mm from distal end	13.9 mm	13.6 mm	17.4 mm
Thickness at 50mm from distal end	15.5 mm	15.5 mm	19.4 mm

9.1.4 Production Sequence – This tool was produced from a large tine and palmate section of a moose antler. The distal end of the tool is also the distal end of the antler tine. To increase the maximum length of this tool the palmate section of the antler was also used, the more compact tine was used to make the working tip of the tool. To remove the tool blank, the palmate section of the antler was cut both dorsally and ventrally through the outer compact antler. The tine section was carved laterally, exposing the inner spongy portion of the antler. On the right lateral side, 83.3 mm from the distal end and 132 mm from the proximal end, there is a groove with parallel striations on its inner surface. The groove is 6.1 mm wide and 11.2 mm long, at an angle of 56° to the long axis of the tool. This groove cross cuts another lateral, "U" shaped groove, 51.6 mm long. The grooves are consistent with use of a round peg, forced into the spongy interior portion of the antler after it was scored in order to split the antler (Figure 9.1). Once the blank was removed the lateral surfaces were carved and the sharp working edge created. Since the tine may originally have extended much further than the end of the tool it is possible that it had been re-sharpened many times.

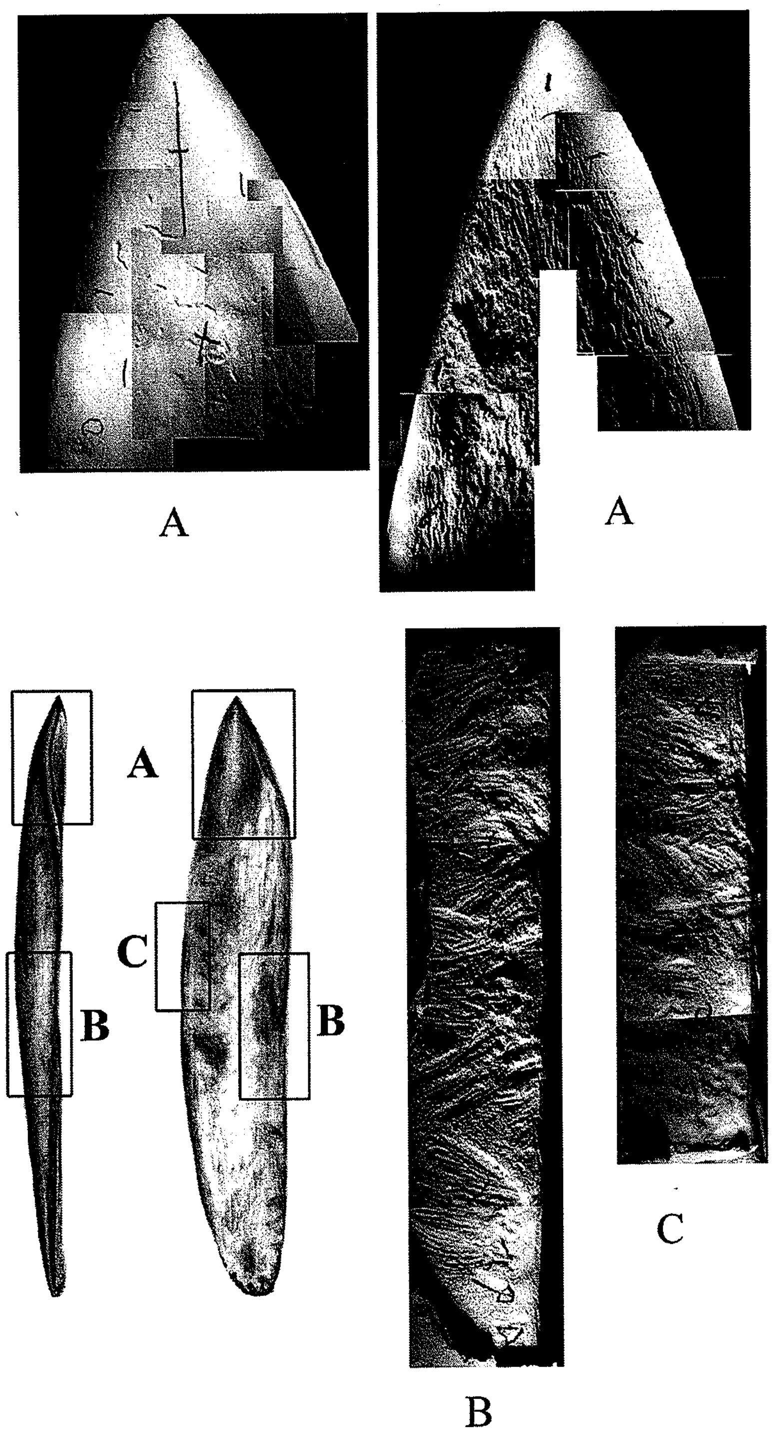


FIGURE 9.2: Original surface of antler pick (43) as recorded on the dental stone cast, images at 7x magnification.

9.2.Comparative Research

The antler pick shares similarities with a tool recovered from northern Manitoba, in another burial from site GkLs-20, on the shore of the Rat River (Syms 2001). Two samples were dated from this burial feature providing an age of approximately 1930 to 1725 yrs BP (Syms 2001). The tool recovered from GkLs-20 was made from a caribou antler rather than moose antler, shares a similar morphology but is significantly longer (38.1 cm versus 22.5 cm).

Lemoine (1997:52) identifies a number of caribou antler pick tools recovered from Gupuk an arctic site in the McKenzie River Delta. Wear pattern analysis revealed that these tools were utilized on ice and earth. Schledermann and McCullough (2003:75) identified ten ice picks from Ellesmere Island manufactured from both antler and ivory. They indicate that these tools were hafted to the butt (proximal end) of harpoon shafts.

The tool also superficially resembles a tool known as a lace point, recorded ethnographically, made from moose bone and 15- 20 cm long (Osgood 1970:200). The lance point was used for hunting bears and swimming caribou.

9.3 Interviews

Keith Anderson and Leslie Baker both drew comparisons with modern metal ice picks, used by trappers. These are often used in conjunction with metal ice chisels to chop holes through the ice at remote camps, when power augers are unavailable. The antler pick would be hafted onto a long pole, 6 to 8 feet in length, depending on the depth of the ice. The ability to chop a hole in the ice is extremely important for northern groups between freeze-up to the spring thaw (November to April), as open water is generally a long distance from camp. Fast moving water never freezes, and camping next to these areas is not advised since the air is humid and cold. Water required in camp is drawn from holes chopped through the ice, ***not*** by melting ice or snow, as too much fuel is required. Hunting groups may melt snow during a short hunting trip but this is for small amounts of water. A camp requires large quantities of water in the winter and holes in the ice are the best source. Holes in the ice would also be used to fishing, where a harpoon can be used to secure fish through a hole in the ice (see chapter 6).

Keith Anderson describes using water to create rabbit traps: a pile of snow is made using snowshoes and water is poured into the center of the pile. This melts the snow and creates a depression in the center. Poplars are cut and placed over top of the hole and when rabbits eat the poplar branches they may slip into the hole and become trapped. Trappers will visit the location the next day and collect the live rabbits, letting some go if they are too small. Melting snow or ice for this purpose would be an inefficient use of time and fuel.

The importance of holes in the ice cannot be stressed enough. To keep the water from freezing over during the night a hide, snow and spruce boughs are placed over the hole, to provide insulation. The following morning a thin layer of ice is easily chopped through. Ice can build up to great depths during the winter; over a meter of ice is not uncommon in Manitoba. Knowledge of the environment can assist in the placement of holes in the ice. The location of reefs and water currents reduces the depth of the ice and creates preferred locations to place a hole.

The other identified function for this tool came from Keith Anderson and Leslie

Baker who interpreted it as a spear tip. Both saw this as a tool to be used on swimming animals, particularly caribou or moose. The spear would never leave the hand and could be used repetitively on many animals. A heavy pole would be attached to the antler point and lashed with rawhide. Swimming moose and woodland caribou could be taken whenever they are found during open water (May – October). It is unlikely that barren ground caribou could be taken with these tools as the migration takes place after freeze-up.

Leslie Baker recounted a story told to him by his grandmother about caribou hunting techniques. When caribou swim across lakes and rivers hunters will approach the animals in canoes. Using spears the hunters stab the caribou in the heart and lung region (above the diaphragm). The caribou bleed to death and are hauled onto the shore. When the animal is eviscerated the diaphragm is not punctured and only the stomach, intestines and internal organs are removed. The stomach is cleaned and tied at one end. The diaphragm is then carefully cut and the blood that pooled above the diaphragm is collected in the stomach. A ladle is used to collect the remainder of the blood from the heart and lung cavity and place it into the stomach. The stomach, filled with blood, is then smoked over a fire, drying the blood. Once the process is complete the stomach is "rock hard" and the crystallized blood is chipped off and used to make a broth. This account demonstrates the resourcefulness of Cree people who would use parts of the animals they killed as the container to hold a valuable food source. Cree did not need to carry containers with them to collect the blood from the animals as parts of the animals provided the material for the containers. Traveling light with minimal possessions is an asset and the knowledge of animal physiology ensured that every part of the animal was used.

Keith Anderson relayed a third function for the tool based on stories he heard about people chopping holes into beaver lodges for trapping. Beaver lodges have a large interior chamber covered by sticks and mud. The entrance to the house is through a hole in the base of the interior chamber under the waterline. A hunter will chop through the outer portion of the beaver house, exposing the interior chamber. The chamber is about 3 feet in height and an adult can crouch inside the house. When the beaver return to the house through the floor the hunter blows on the nose of the beaver. The beaver will immediately turn around and try to escape down the entrance. The hunter will grab the hind limbs of the beaver and throw the animal out of the lodge. A second hunter will club the animal. If the hunter tries to grab the beaver when it is facing the hunter there is a danger that the hunter will be bitten. This activity could be conducted any time beaver meat was required. Beaver pelts are at their prime during the early winter (November – December). Keith Anderson and Leslie Baker both suggested the tool could be used for different functions (outlined above), with little or no modification to the hafting.

9.4 Replicated Tools

9.4a.1 Replica 1 Material – Shed moose (*Alces alces*) antler from an adult male (estimated 5-8 years old), Tamarack (*Larix laricina*) pole, moose rawhide.

9.4a.2 Morphological Description – The tool is 23.8 cm in length and is plano-convex in cross section along the entire length.

9.4a.3 Production Sequence – See Appendix 4

9.4a.4 Manufacture Patterns – All manufacture marks were removed from the working edge of the tool by smoothing the surface using 600 grit sandpaper (Figure 9.3).

9.4b.1 Replica 2 Material – Shed moose (*Alces alces*) antler from an adult male (estimated 5-8 years old), Tamarack pole, moose rawhide.

9.4b.2 Morphological Description – The tool is 23 cm long and plano-convex.

9.4b.3 Production Sequence – See Appendix 4

9.4b.4 Manufacture Patterns – All manufacture marks were removed from the working edge of the tool by smoothing the surface using 600 grit sandpaper (Figure 9.4).

9.5 Experimentation

9.5a.1 Replica 1 Activity – To chop a hole in a beaver lodge.

9.5a.2 Test Tool Function – An active beaver lodge was chosen for the experiment on the Churchill River. The pole was held by both hands and thrust into the edge of the beaver lodge. The antler tip easily entered into the lodge. A prying motion was used to move the sticks and mud away from the hole. The tool was used like a pitchfork, lifting and removing the stick from the hole. The thickness of the roof of the lodge was about 35 cm. A hole, approximately 30 cm in diameter was made into the top of the lodge (Figure 9.5). The hollow interior was 95 cm in height. The activity was halted after the hole was produced. Total length of time to open the hole was 20 minutes.

9.5a.3 Performance – Tool performance was identified as exceptional. The hafting was ineffective in securing the antler tip to the pole during the experiment.

9.5a.4 Comparison Study – The edges of the "ice pick" dulled during use. The tip, which bore the brunt of use, was blunted. Polish is evident on the dorsal (cortical)

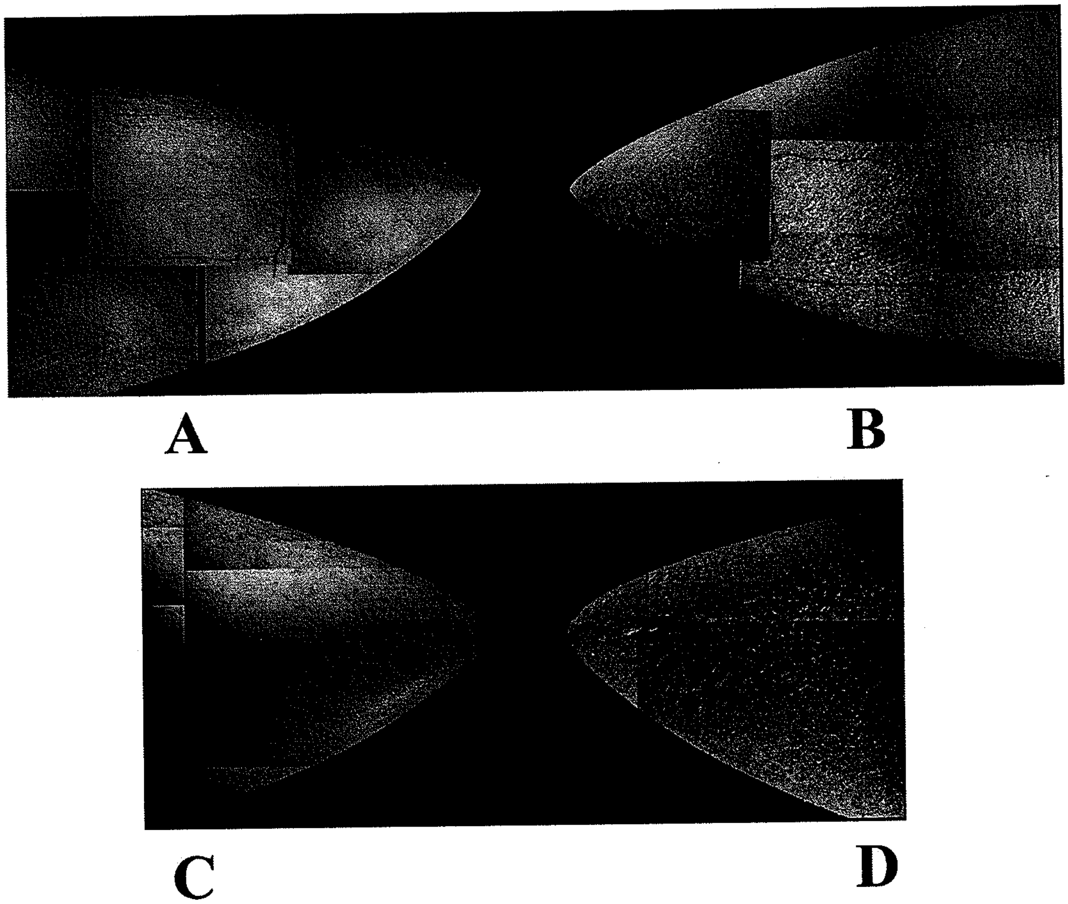


FIGURE 9.3: Surface of the antler pick (replica 1) as recorded under 7x magnification. A. and B. pre-experiment tool surface (A-dorsal, B-Ventral). C and D post-experiment tool surface (C-Dorsal, D-Ventral).

surface and the ventral, porous side roughened during use (Figure 9.3). Wear created from chopping into the beaver lodge is consistent with wear patterns observed on the original tool. No comparable wear patterns were created with the other antler tools tested in this thesis.

9.5b.1 Replica 2 Activity – Chop a hole in ice.

9.5b.2 Test Tool Function – The test was performed on Lake Manitoba on March 13, 2004. The temperature was –11° C with a wind-chill of –20° C. A location was chosen sixty meters from the shore, just beyond a pressure ridge. The snow was 38 cm deep and

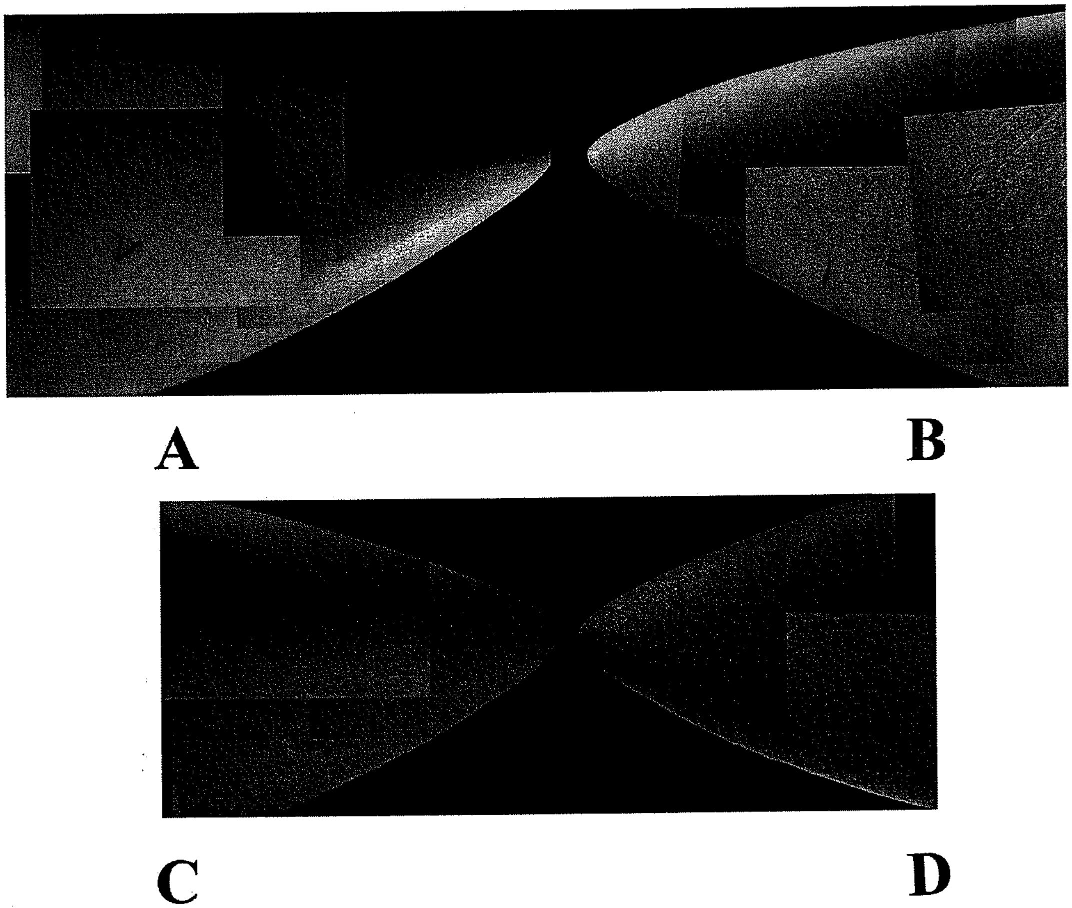


FIGURE 9.4: Surface of the antler pick (replica 2) recorded under 7x magnification. A. and B. pre-experiment tool surface (A-dorsal, B-Ventral). C and D post-experiment tool surface (C-Dorsal, D-Ventral).

was shoveled away to expose the ice surface. The pole was grasped with both hands and the tool was used to chip at the ice surface. Slanting blows removed large chunks of ice. The tensile strength of antler allows a large amount of force to be used in the process without breaking the tip. A hole, 50 cm in diameter was opened to a depth of 31 cm (Figure 9.6). The activity was halted at this point, as significant wear was present on the antler pick. The hafting technique proved effective and the antler pick remained solidly attached to the pole throughout the experiment.

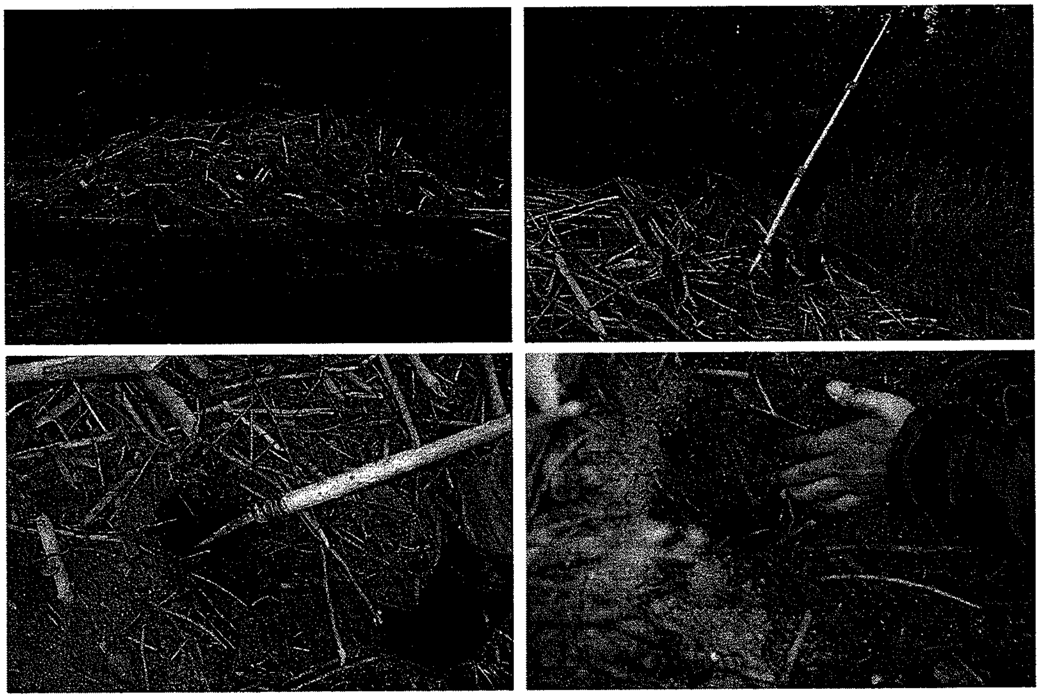


FIGURE 9.5: Experimenting with antler pick (replica 1) to open an active beaver lodge.

9.5b.3 Performance – Exceptional. The tool performed the task quickly and efficiently. The large amount of pressure used in the experiment demonstrates the high tensile strength of antler as a raw material, suitable for heavy work. Large chunks of ice were removed during the experiment up to 45mm in diameter, unlike the bone ice chisel documented by Osgood (1970:221-222). The tip of the tool was blunted during use, although performance was not negatively affected.

9.5b.4 Comparison Study – The wear patterns created during this experiment were unique. The distal surface of the tool was extensively pitted and blunted slightly (Figure 9.4). The original tool had no pitting on its distal surface indicating that it had not been used for this activity before it was deposited in the grave. The Victoria Day tool was clearly not used for this purpose.

FIGURE 9.6: Experimenting with antler pick (replica 2) to chop a hole in lake ice.

10. Results – Birchbark Peeling Tool

10.1 Original Tool (Birchbark Peeling Tool 11)

10.1.1 Material – Moose (*Alces alces*) antler tine or an extremely large barren ground caribou (*Rangifer tarandus*) antler tine, 8 years or older.

10.1.2 Morphological Description – The tool is curved in profile, following the natural shape of an antler. From tip to tip the tool is 19 cm long (Table 10.1). The maximum width of the tool is 23.6 mm, tapering to the proximal end. The maximum thickness is 14.9mm (60 mm from the distal end). The working edge (the distal end of the tool) is the proximal end of the tine. The ventral surface is the concave side of the antler while the dorsal surface is convex (Figure 10.1).

TABLE 10.1: Comparison of measurements between original and replicated birchbark pealing tools.

Tool number	11	Replica 1
Length straigh line	190 mm	190 mm
Length of tool	206 mm	209 mm
Working edge width	23.1 mm	23.5 mm
Maximum Width	23.6 mm	26.1 mm
Maximum Thickness	14.9 mm	23.8 mm
Width 10 mm from distal end	22.8 mm	24.5 mm
Width 20 mm from distal end	22.6 mm	26.0 mm
Width 30 mm from distal end	21.5 mm	26.0 mm
Width 40 mm from distal end	22.5 mm	25.8 mm
Thickness 10 mm from distal end	9.0 mm	9.1 mm
Thickness 20 mm from distal end	12.9 mm	16.2 mm
Thickness 30 mm from distal end	14.0 mm	20.0 mm
Thickness 40 mm from distal end	14.7 mm	20.6 mm

The working edge is beveled to produce a sharp edge on the dorsal surface 22 mm from the distal end of the tool and is 23.1 mm wide. Viewed dorsally or ventrally the working edge is rounded and asymmetrical, the left side extends further than the right side and is slightly flared on the left lateral side. Some porous antler is visible on the dorsal surface. This could indicate use of a moose antler rather than a caribou antler

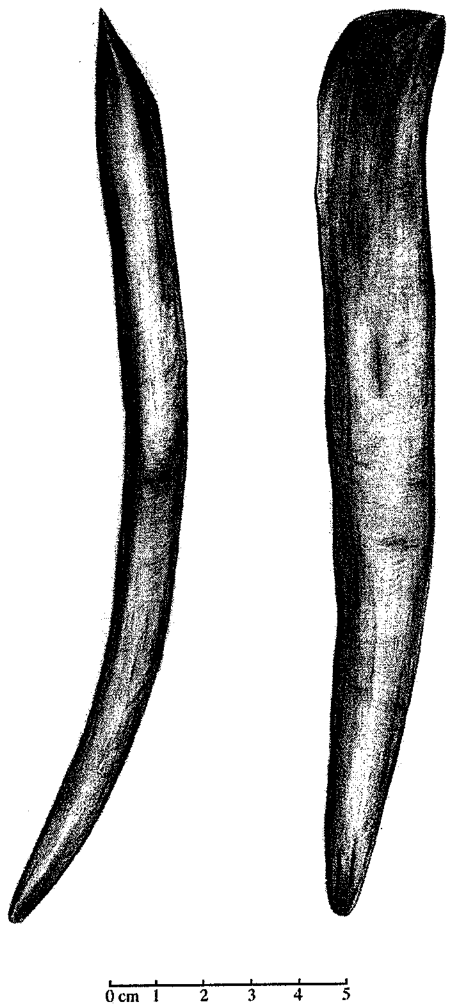


FIGURE 10.1: Drawing of original birchbark peeling tool (11).

(which has a larger spongy interior). However, the tine is oval in cross section, corresponding more with a caribou antler.

10.1.3 Wear and Manufacture Patterns – Oblique striations are visible on the distal dorsal surface, slanting towards the right side of the working edge. It is unclear if these are the result of use or manufacture. The ventral surface has channeled striations resulting from manufacture, parallel to the working edge. The proximal end of the tool has channeled striations running parallel to the long axis of the tool, particularly visible on the ventral surface. The proximal extremity of the tool is smoothed and highly polished, obliterating the manufacturing marks; this polish is likely a result of handling the tool during use (Figure 10.2).

10.1.4 Production Sequence – A tine of suitable length was chosen from a fully mature moose antler (two years or older) or a large barren ground caribou antler (old adult, over 8 years). Once the tine was removed from the antler the proximal end was beveled by carving. The ventral surface was only slightly modified to produce a flat surface (Figure 10.2).

10.2 Comparative Research

Osgood (1970:77-78) describes a bone birchbark remover in his summary of the material culture of the Ingalik. The tool has an asymmetrical edge and is used to pry birchbark from a tree, used in conjunction with a birchbark knife (a ground stone blade inserted into a caribou antler handle) to score the bark (Osgood 1970:89).

10.3 Interviews

The interviews conducted in Nelson House produced few proposed uses for this tool. Moses Moore, Alvin Moody and Johnson Donkey suggested it might have been used to scrape hides.

Keith Anderson suggested that the tool may have been used to peel birchbark. Today people peel birchbark by using a knife to score the bark and then use the tip of the knife to pry the bark from tree in difficult areas around small branches and healed wounds.

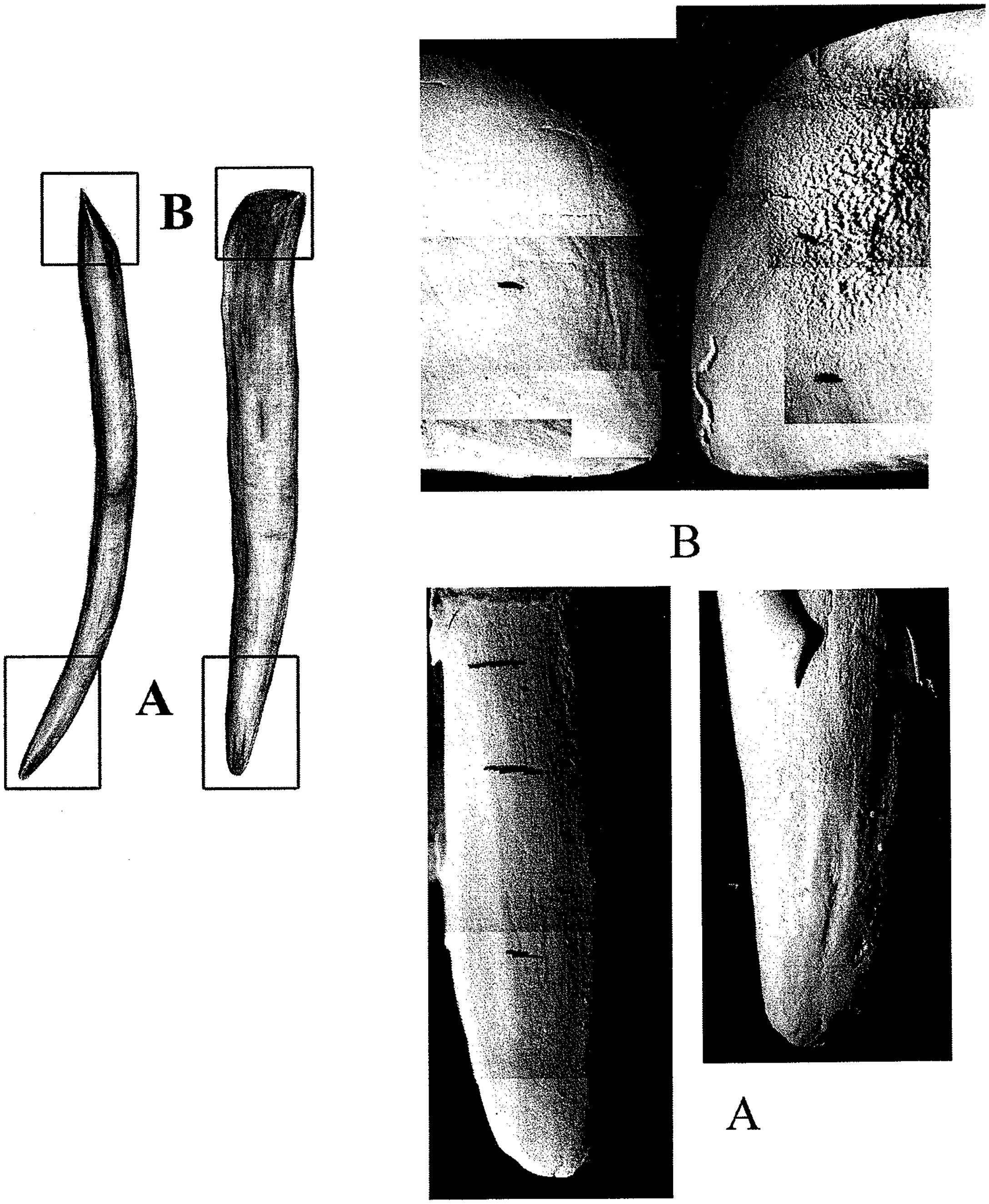


FIGURE 10.2: Original surface of Birchbark peeling tool (11) as recorded on the dental stone cast, image taken at 7x magnification.

10.4 Replicated tool

10.4.1 Material – A left tine from a two year old bull moose was used in the production of this tool. The moose was a spike bull with forked antlers (left side 2 points, right side 3 points). No caribou antlers large enough to produce this tool were available for this study.

10.4.2 Morphological Description – The tool is 19 cm long from tip to tip (Table 10.1).

10.4.3 Production Sequence – See Appendix 4

10.4.4 Manufacture Patterns – The sharp distal edge was finished with 600 grit sandpaper, smoothing the working edge and eliminating manufacture marks (Figure 10.3).

10.5 Experimentation

10.5.1 Activity – Peel birchbark and the inner bark of a paper birch (*Betula papyrifera*).

10.5.2 Test Tool Function – A location was large stand of paper birch trees on a small lake on the Island River system west of Leaf Rapids. The experiment took place on May 28th 2003 on a warm sunny afternoon. The base of a tree about 59 cm in diameter was selected because it was straight and free of large branches. A 70 cm long groove was scored down the surface of the birch tree near the base using the sharp edge of the tool (Figure 10.4). The sharp edge was held parallel to the tree and drawn down with the right side of the tool facing down. The rounded right lateral edge penetrated 3-4 mm through the bark. The tree was then scored around its diameter at both the top and bottom of the vertical groove. Once the tree was scored on all sides the tool was used to

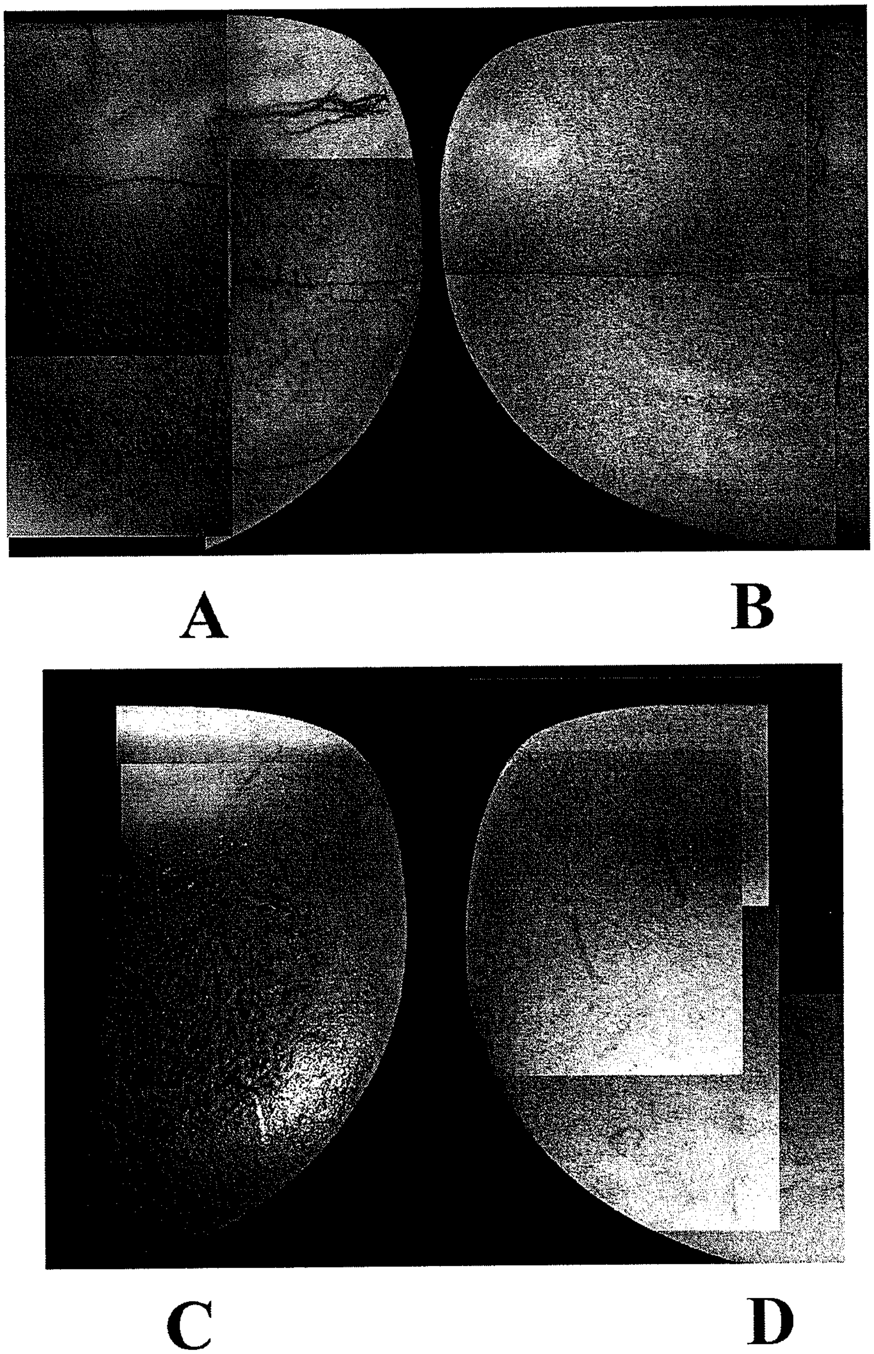


FIGURE 10.3: Surface of birchbark peeling tool (replica 1), under 7x magnification. A and B show the pre-experiment tool surface (A-Dorsal, B-Ventral). C and D show the post-experiment tool surface.

pry the outer bark from the tree. A large sheet of bark was removed (75 cm by 58 cm), and Keith Anderson and I stripped the inner bark. The inner bark is used as a medicine by northern groups and was collected in a similar fashion to the outer bark. The sap was still running at this time and once the inner bark was removed the sap was scraped off the trunk and eaten. The sap is sweet and nourishing (Marles et a 2000:145).

10.5.3 Performance – Exceptional. The importance of birchbark for northern groups may have resulted in the development of a specialized tool used for the sole purpose of scoring and peeling birchbark and the inner bark. This tool performs two activities, scoring and prying of birchbark. This is different from the Ingalik who had two separate tools one for scoring and another for prying (Osgood 1970:77-78, 89).

10.5.4 Comparison – The tool was slightly dulled during use along the working edge. High polish was evident, particularly on the dorsal surface (Figure 10.3). The original tool did not demonstrate the same polish (instead, it was striated) and may have been re-sharpened prior to burial eliminating wear polish. Polish located at the proximal end of the original tool suggests the tool had been used.

FIGURE 10.4: Experimenting with peeling birchbark with the birchbark peeling tool (replica1).

11. Results – Bone Chisel

11.1 Original Tool (Bone Chisel 25)

11.1.1 Material – This tool was produced from a long bone of a large mammal (probably cervid). Based on the thickness of the tool (maximal thickness: 7.2mm) it was likely produced from moose bone. A midshaft of a long bone was used; unfortunately manufacture marks have modified the surface, eliminating the possibility of identifying the element.

11.1.2 Morphological Description – The tool resembles a miniature stone adze in shape (Figure 11.1). The tool is pointed and flares distally to form a slightly plano-convex working edge. The pointed proximal end is the result of an oblique break. The distal or working edge has a width of 11.8 mm. Total length is 6.65 cm with a maximum thickness of 7.2mm (Table 11.1).

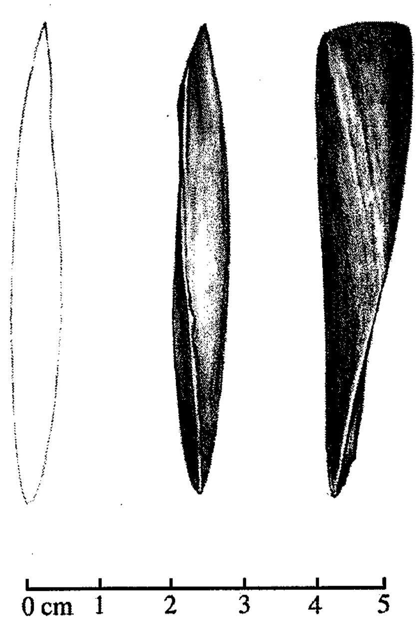


FIGURE 11.1: Drawing of bone chisel (25).

TABLE 11.1: Comparison of measurements between original and replicated Bone Chisels.

Tool number	Original 25	Replica 1	Replica 2	Replica 3	Replica 4
Working edge width	11.8 mm	12.7 mm	13.2 mm	14.3 mm	14.5 mm
Length	66.5 mm	61.3 mm	64.9 mm	64.3 mm	68.2 mm
Proximal end width	2.2 mm	18.4 mm	19.5 mm	20.2 mm	16.0 mm

11.1.3 Wear and Manufacture Patterns – Channeled striations associated with tool manufacture are common, oriented parallel to the long axis of the tool on the dorsal surface (Figure 11.2). The ventral surface has channeled striations on the distal end oriented parallel to the working edge. The striations extend over the entire surface of the tool indicating that the tool was re-sharpened prior to burial. It is suggested that the tool had been originally used and re-sharpened rather than manufactured specifically for burial since the broken edge exhibited high polish (proximal) that is interpreted as a product of handing during use (Figure 11.2).

11.1.4 Production Sequence – The bone fragment used for making this tool may have been a splinter of a long bone broken to extract marrow. It was produced on a spiral fracture. Alternatively, the bone may have been a by-product of harpoon head or fish spear point manufacture. The shaft from virtually any long bone of a moose has sections both thick and long enough to produce a tool of this shape. The tool was carved primarily on the dorsal surface and lateral edges to create the shape of this tool.

11.2 Comparative Research

No comparable items were identified during the literature review.

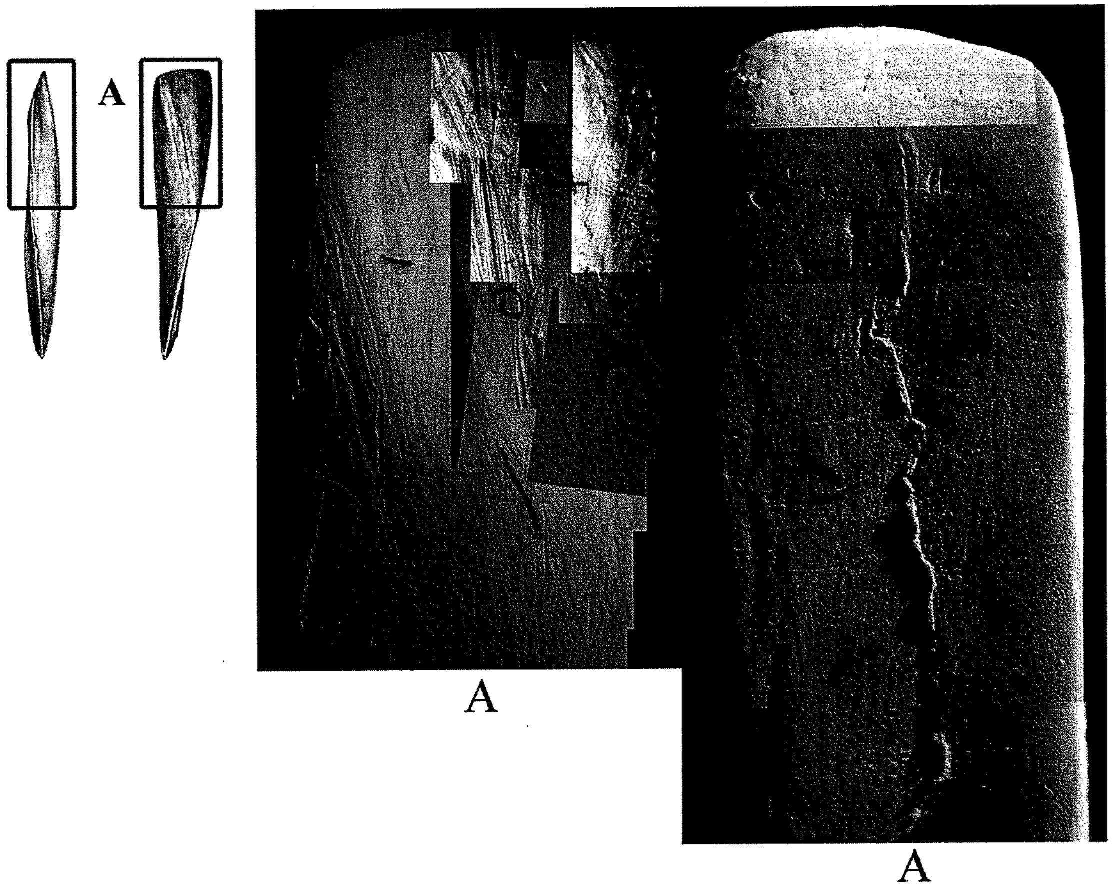


FIGURE 11.2: Surface of original bone chisel (25), recorded under 7x magnification.

11.3 Interviews

A number of possible functions were suggested, including chipping spruce gum from trees (Keith Anderson). Northern people use spruce gum as a chewing gum, medicine and a temporary patch for aluminum and canvas canoes. Keith Anderson suggested the sap could be used to seal birchbark canoes and baskets. Many ethnographic accounts document the use of spruce gum or spruce sap. It has medicinal uses both internal consumption and applied to cuts externally, used as a chewing gum, heated and mixed with charcoal and used as a glue for sealing birchbark canoes and baskets (Marles *et al* 2000:94-97).

Cleaning spruce roots was an activity suggested by Lottie Moore and Johnson

Donkey, a task now performed using a modern knife. Spruce roots are an important lashing material. As they are extremely flexible when wet and hard and brittle when dry, the use of spruce roots is limited to situations where no direct stress is placed on the lashing. Spruce roots are ideal for birchbark baskets, birchbark canoes in the lashing of birchbark sheets together and lashing these to the gunnels and lashing birchbark sheets together to cover a structure. Since spruce roots are not flexible and are unable to withstand stress when dry they are not used to tie poles together for hide frames, house structures, or to secure tools to handles.

The dominant species in northern Manitoba is Black Spruce (*Picea mariana*) and collecting spruce roots is an easy task. Lillian Hunter of Nelson House taught this activity to the researcher in 1996. Lillian was collecting spruce roots for making birchbark baskets. Spruce roots generally run just below the moss layer. A suitable location is chosen, often an open spruce forest, with little understory and thick moss. Moss is turned over to expose the roots, which are followed until the root becomes too thick or thin to be functional. The roots are often uniformly thick for many meters without branching. No tools are required during this process. In ideal situations, root length can reach 10 meters. The preparation of spruce roots involves peeling the roots. The next step in preparing the roots can be done immediately or the roots may be left to dry. Dry roots can be stored for long periods of time, requiring only soaking in water to soften. The next stage involves splitting the roots longitudinally. This reduces the thickness of the root and is required if sewing birchbark. Splitting spruce roots is done using a fingernail to start the split, followed by carefully pulling the sides apart. Splitting wood for constructing snowshoe frames was an activity suggested by Johnson.

Birch is the preferred wood for snowshoe frames. Woodworking within the boreal forest is an important skill, but rarely identified archaeologically. Many other tools were probably used in woodworking including spokeshaves, utilized and retouched flakes, stone wedges, in addition to beaver incisors (Osgood 1970:83-88).

Keith Anderson suggested the tool could be used to flesh furs (small to medium animals). Large bone fleshers are still used by northern residents when removing the flesh and fat from moose hides. These bone fleshers often have small teeth carved into the cutting edge to facilitate the removal of the flesh. The presence of two muskrat mandibles in the burial indicates the use of muskrats as a resource probably of both incisors and pelts as well as for food.

11.4 Replicated Tools

11.4.1 Material – All four replicas were produced from a single moose metatarsal from an adult female over two years old.

11.4.2 Morphological Description – All four tools were rectangular in shape with a slightly convex distal working edge. Length ranged from 6 to 6.8 cm. Working edge widths ranged from 12.7 mm to 14.5 mm (Table 11.1). The dorsal surface of all tools was exterior surface of the cortical bone.

11.4.3 Production Sequence – See Appendix 4

11.4.4 Manufacture Patterns - The working edge of the tools were smoothed with 600 grit sand paper, eliminating file marks from the working edge of the tool. Replica 1 and 4 were smooth, with no manufacturing marks on the distal surface (Figure 11.3, 11.6). Replica 2 (Figure 11.4) and 3 (Figure 11.5) had file marks remaining on both the dorsal.

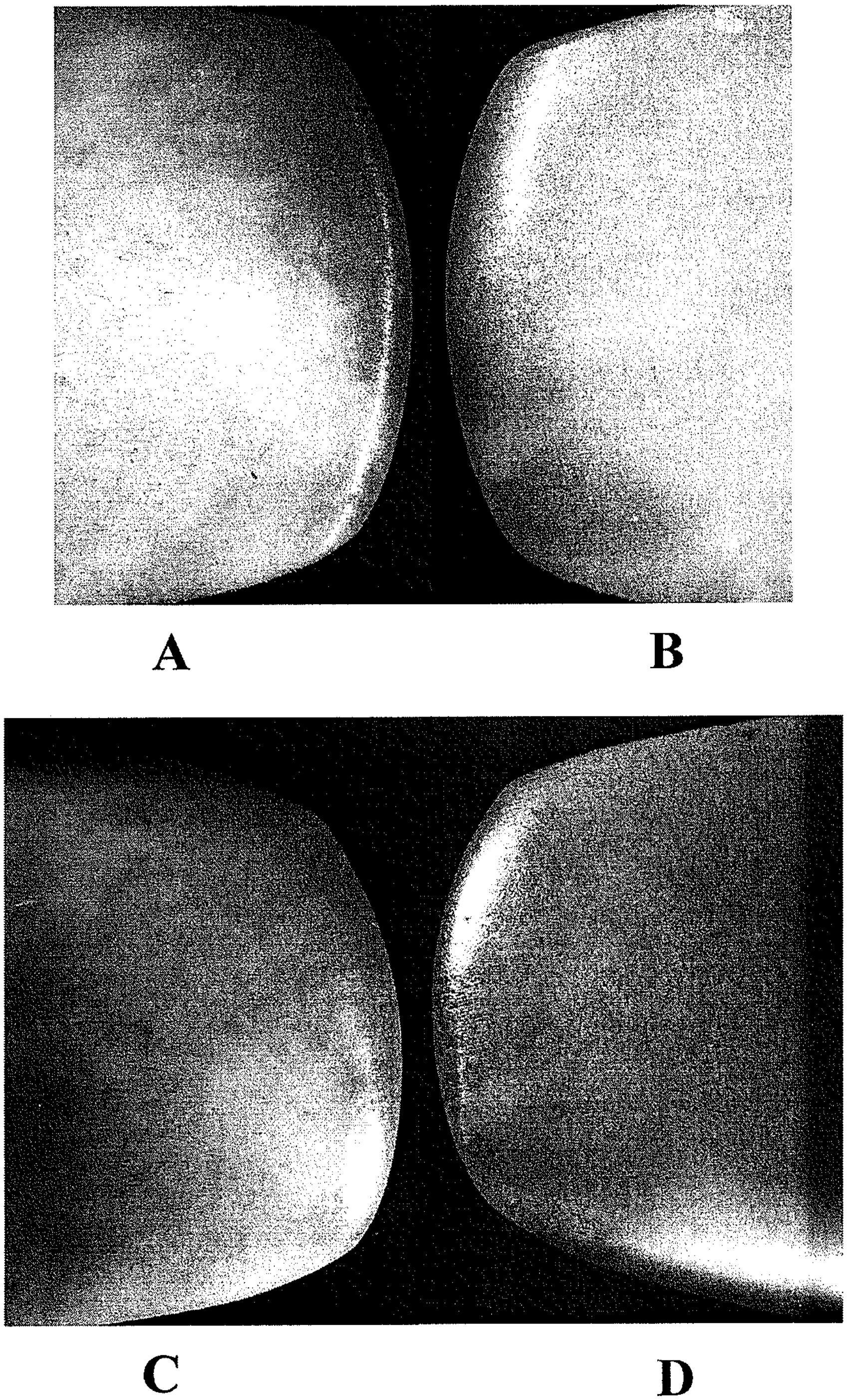


FIGURE 11.3: Surface of bone chisel (replica 1) as recorded under 7x magnification. A and B show the pre-experiment tool surface (A-Dorsal, B-Ventral). C and D show the post-experiment tool surface (C-Dorsal, D-Ventral).

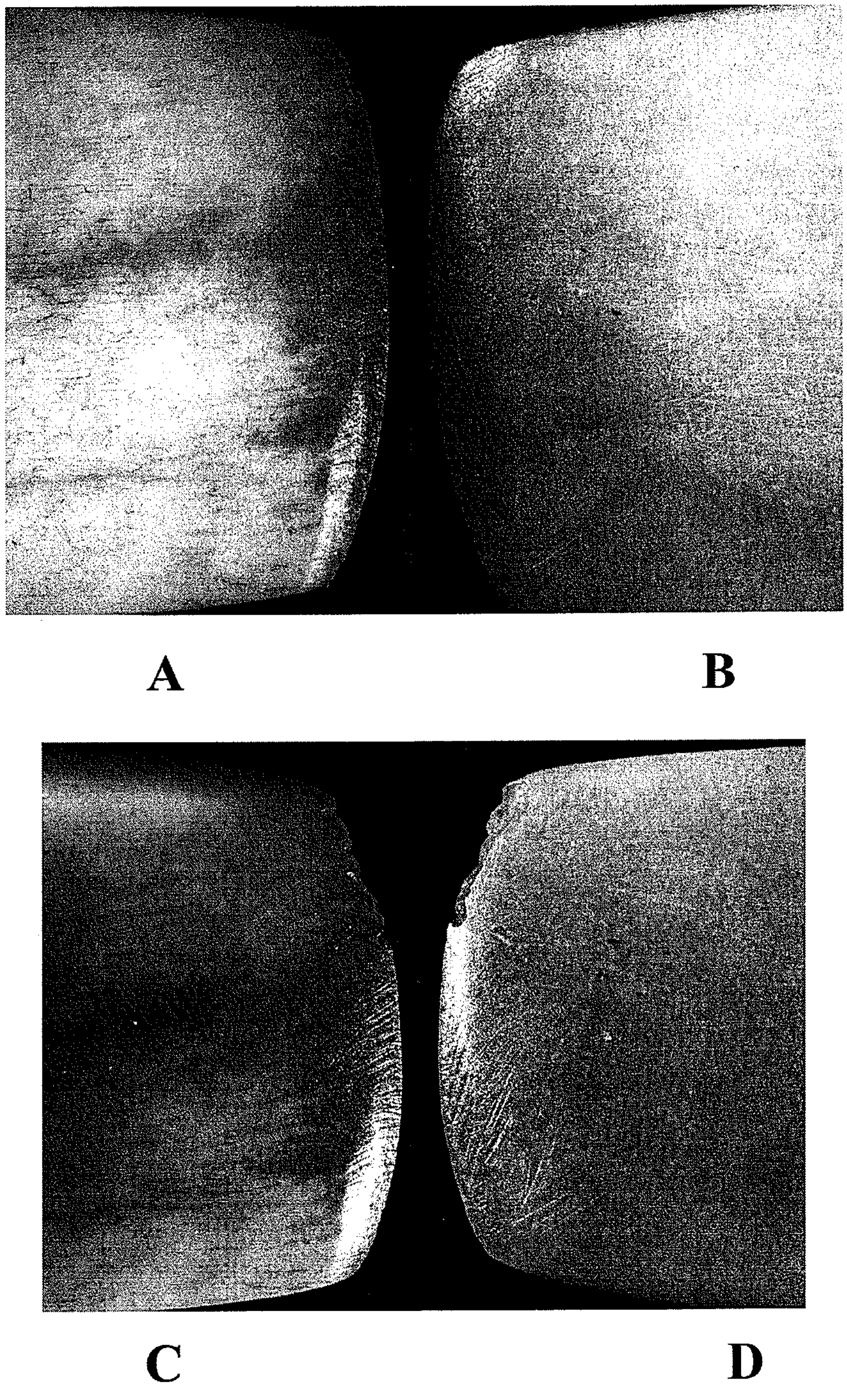


FIGURE 11.4: Surface of bone chisel (replica 2) as recorded under 7x magnification. A and B show the pre-experiment tool surface (A-Dorsal, B-Ventral). C and D show the post-experiment tool surface (C-Dorsal, D-Ventral).

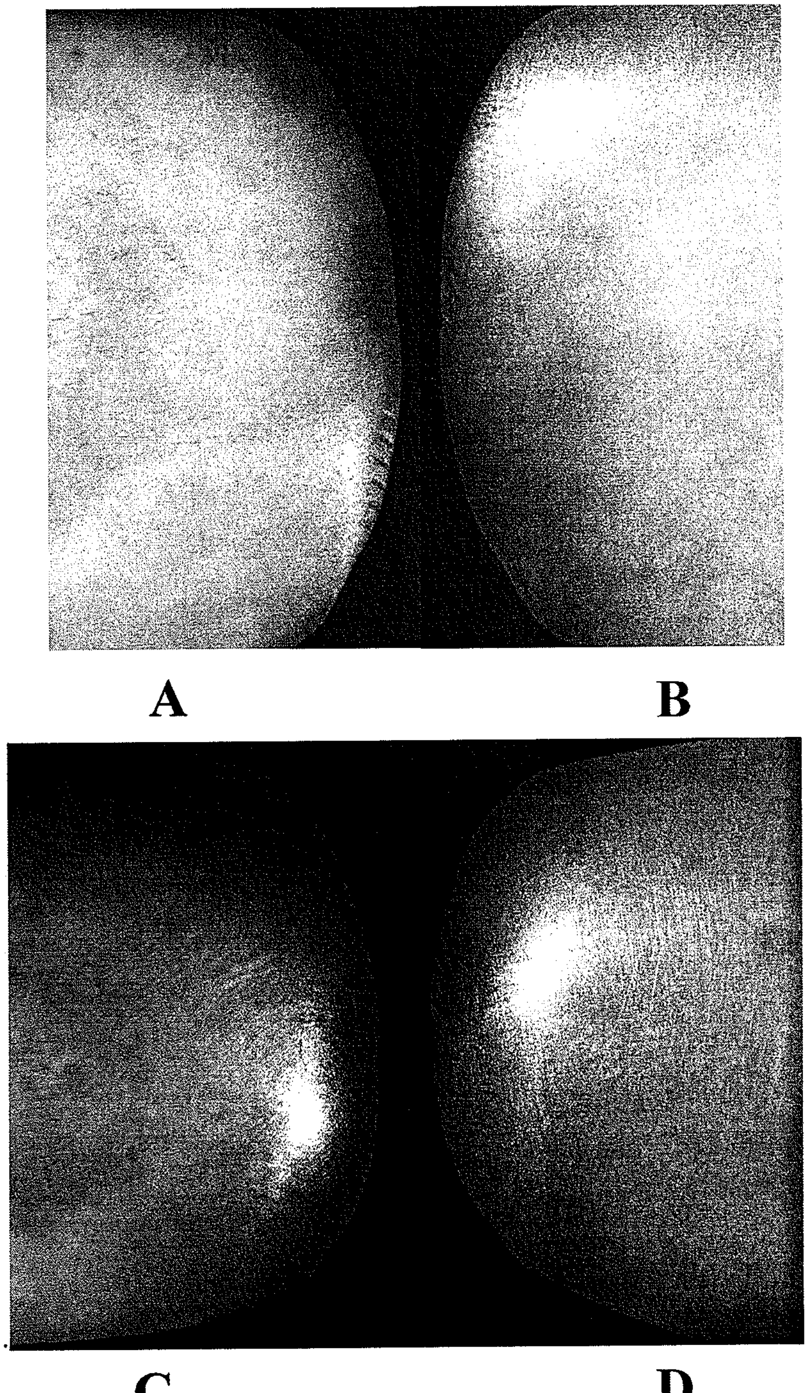


FIGURE 11.5: Surface of bone chisel (replica 3) as recorded under 7x magnification. A and B show the pre-experiment tool surface (A-Dorsal, B-Ventral). C and D show the post-experiment tool surface (C-Dorsal, D-Ventral).

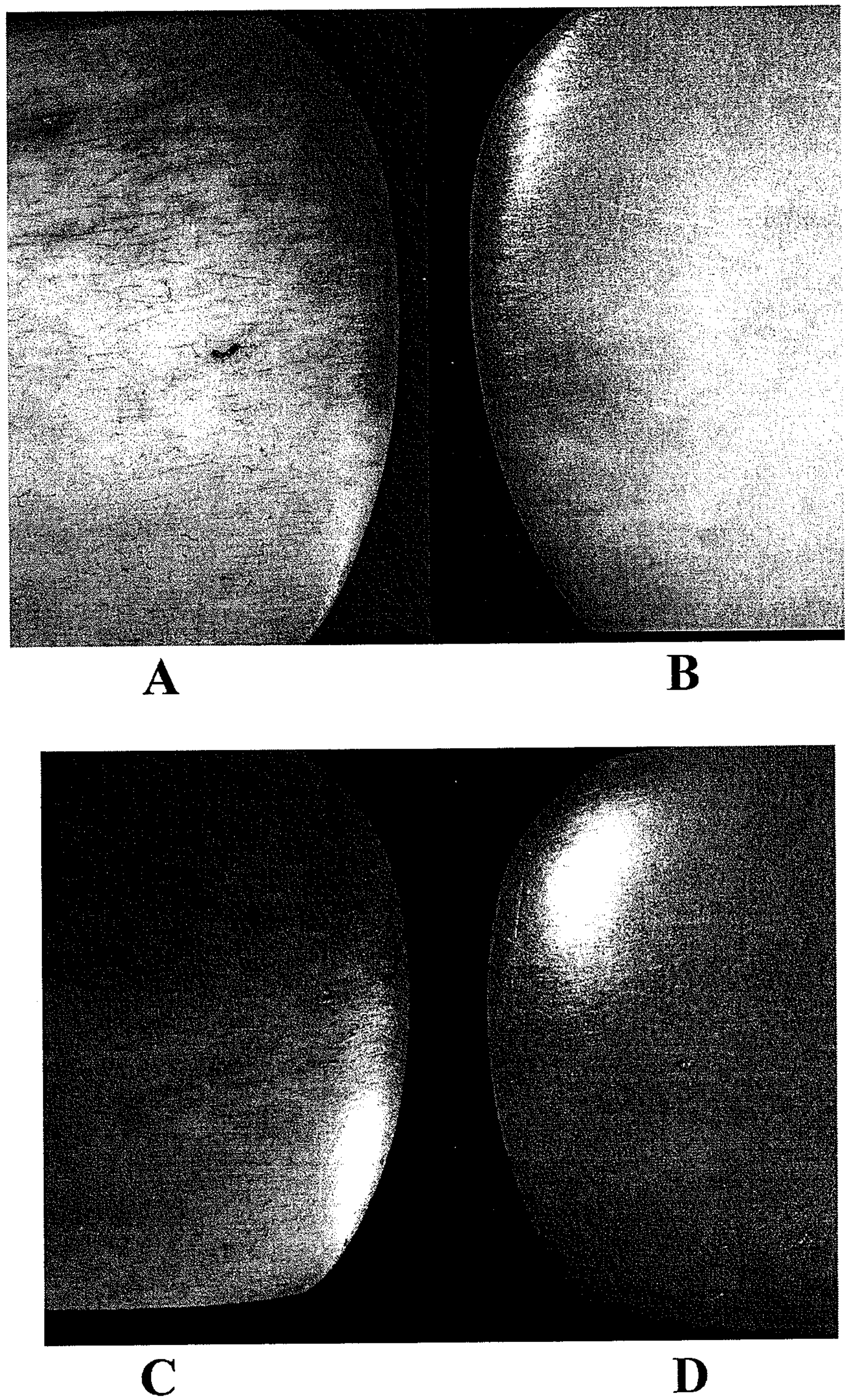


FIGURE 11.6: Surface of bone chisel (replica 4) as recorded under 7x magnification. A and B show the pre-experiment tool surface (A-Dorsal, B-Ventral). C and D show the and ventral surface of the working edges.

11.5 Experimentation

11.5a.1 Replica 1 Activity – Peel and prepare spruce roots for lacing.

11.5a.2 Test Tool Function – The tool was held at a 45° angle and drawn towards the user, peeling the outer bark off the spruce roots (Figure 11.7). The tool did not require hafting as it was large enough to handle. Once the roots were split longitudinally they were drawn between the lateral edge of this tool and a wood stump at a 90° angle to break down the fibers in the root to improve pliability for sewing. For this activity the left lateral edge of the tool was used rather than the working (distal) edge. The root ran smoothly under the bone tool producing slight wear along the tool edge.

post-experiment tool surface (C-Dorsal, D-Ventral).

11.5a.3 Performance - This tool performed exceptionally well in peeling spruce roots.

11.5a.4 Comparison – High polish resulted from this experiment on the distal end of the tool. In addition, light striations were produced on the ventral surface of the tool oblique to the working edge. The tool was slightly dulled during the experiment, although performance was not affected (Figure 11.3). Because the distal end of the original tool may have been re-sharpened prior to burial, it was impossible to compare the wear patterns.

11.5b.1 Replica 2 Activity – Splitting a birch stave.

11.5b.2 Test Tool Function – A birch tree 14 cm in diameter was collected from Leaf Rapids and hewn to a rough board 182 cm long using a metal axe. Once the birch board

FIGURE 11.7: Experimenting with bone chisel (replica 1) peeling spruce roots.

was fully dried the bone wedge was used to split it. Utilizing a bone wedge to split birch trees would be an efficient method of roughing out numerous tools.

The unhafted tool was driven into the flat surface of the birch board like a wedge, using a piece of wood like a mallet (Figure 11.8). The wedge easily split the board. The wooden tool used to drive the wedge did not crack, break or chip the proximal side of the bone tool. The smooth surface of the wedge easily penetrated the wood and did not catch or bind.

11.5b.3 Performance - While the replica tool performed exceptionally well for this task the original tool was deemed too short to have performed as well. Either the original tool had been broken during use (rendering it un-useable as a wedge for splitting wood) or it would have required hafting. The binding on the haft would have caught on the edges of the wood, however, preventing clean penetration. During use the wedge was in contact with the wood along both surfaces.

11.5b.4 Comparison – The tool was smoothed during use and only dulled along the working edge during the first few blows (Figure 11.4). Small chips were produced on the left side of the working edge. Polish was created on the surface of the tool smoothing over manufacturing marks (file ridges). Although the original tool could not have been used for splitting wood in its final form, the proximal end may have broken during use following which it was hafted and utilized for another activity. The polish present on the broken edge suggests use after the break occurred. The original function of the tool could not be verified during this test but its overall shape could suggest prior use as a bone wedge for splitting wood (as suggested during interview the process).

11.5c.1 Replica 3 Activity – Collect Spruce Sap (Spruce Gum).

11.5c.2 Test Tool Function – Replica 3 was used to collect spruce gum, the tool was used to chip and pry spruce gum that had seeped from a wound on a spruce tree (Figure

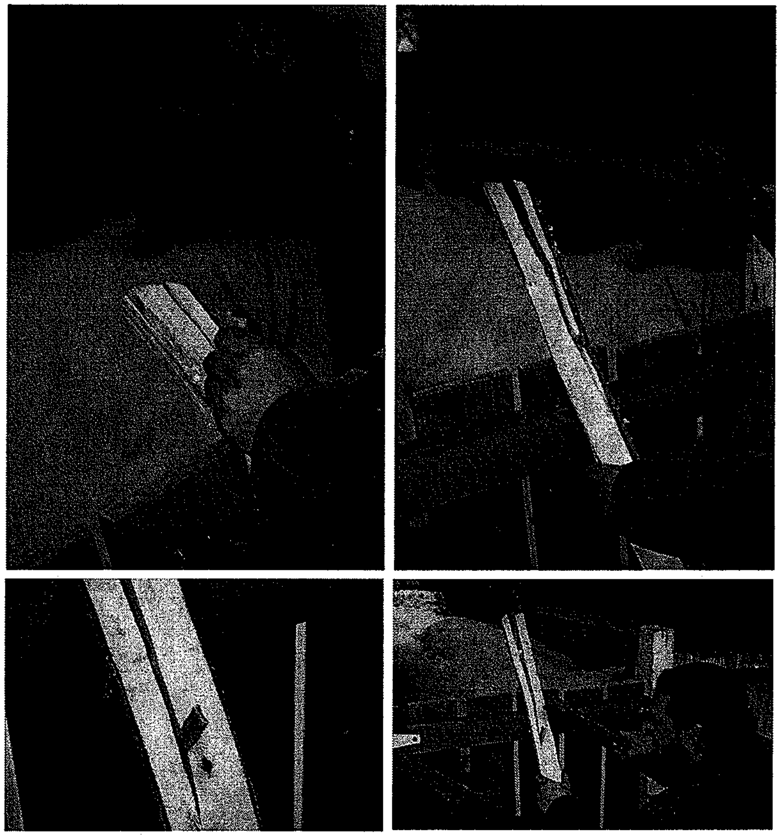


FIGURE 11.8: Experimenting with bone chisel (replica 2) splitting birch stave.

11.9). The weight of the sap collected was 272 grams. Experiment was halted after wear (chipping) was observed on the working edge. The tool performed adequately during the experiment. The addition of a handle would have improved the function of the tool.

11.5c.3 Performance – The tool performed this activity proficiently. The addition of a handle would have improved the use of this tool for the activity.

11.5c.4 Comparison – The distal end of the tool was chipped during the experiment. The chips were less than 1 mm wide and occurred on the entire distal surface. Polish was also created on the surface of the tool during use (Figure 11.5) obscuring manufacturing marks. These patterns do not match those observed on the original tool (see above).

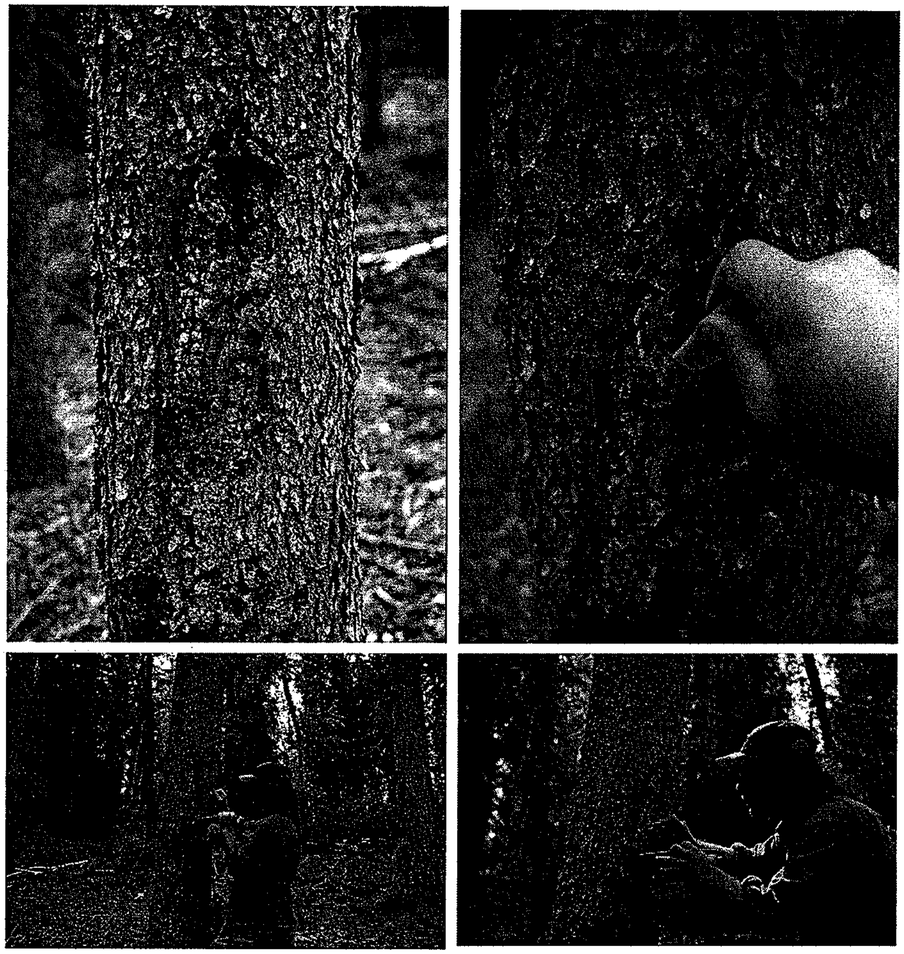


FIGURE 11.9: Experimenting with bone chisel (replica 3) collecting spruce sap.

11.5d.1 Replica 4 Activity – Fleshing three Muskrat Pelts.

11.5d.2 Test Tool Function – The author obtained three muskrats, weighing approximately 1 ½ pounds each, from a northern trapper. The bone tool could not cut through the skin of the muskrats and a metal knife was used. Incisions were made in the pelt of the muskrats from chin to tail on the ventral side and the pelt was cut just above the paws. The metacarpals were broken and the paws detached to allow the skin to be removed. The bone tool was used to remove the skin from the body. Once the pelts were removed they were placed on a flat surface and the bone tool was used to remove all fat

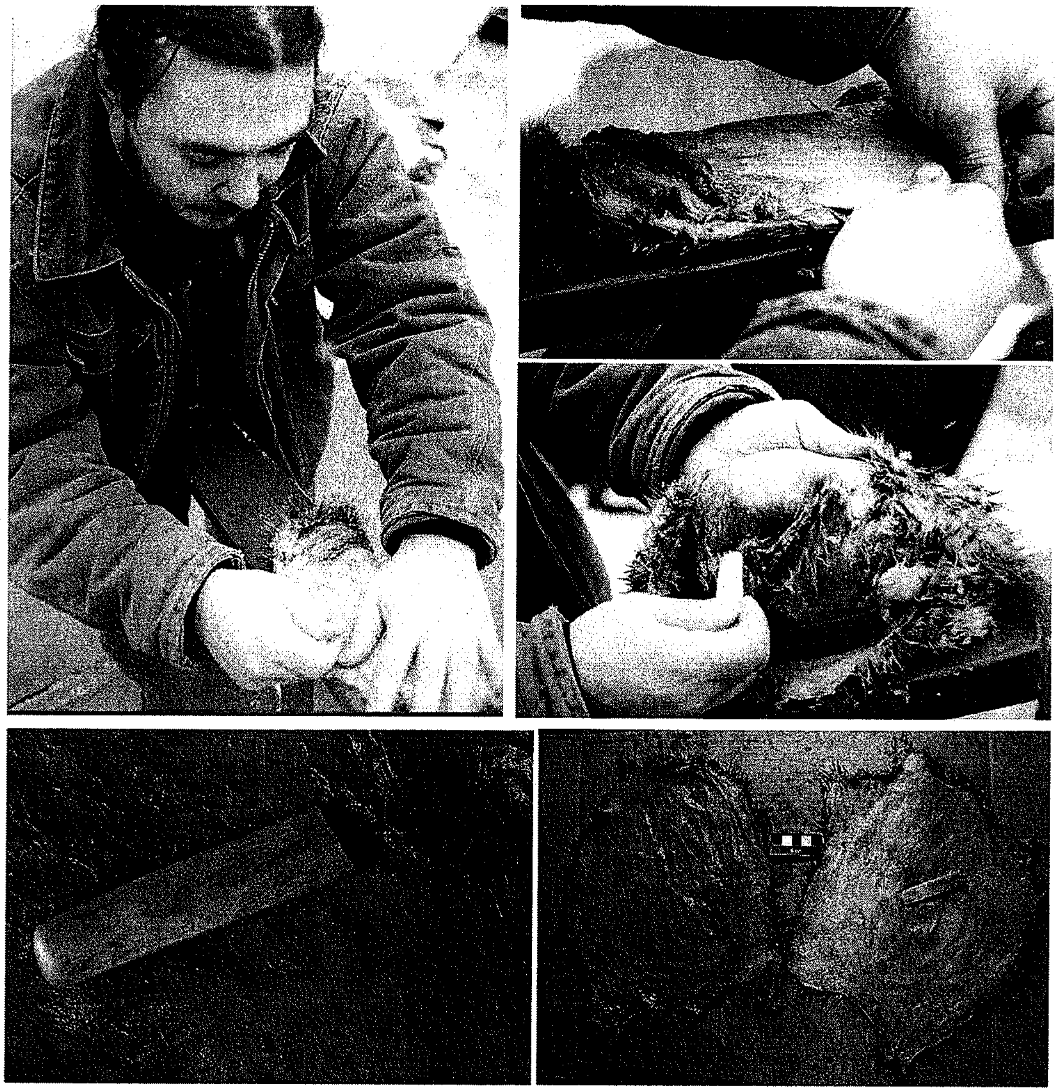


FIGURE 11.10: Experimenting with bone chisel (replica 4) fleshing muskrat pelt.

and flesh still attached to the pelt (Figure 11.10). The tool remained sharp throughout the skinning and fleshing process. The tool was held at an angle of less than 45° and pulled towards the user. Skinning the animals took 10 minutes and fleshing took approximately 20 minutes for each pelt. Within 90 minutes all three hides were complete.

11.5d.3 Performance - The tool performed proficiently but would require the use of a stone flake or knife to cut the hide. This tool was ideal for fleshing the pelts, however, since it did not cut into the hide the way a metal knife can. The addition of small notches on the working edge of the tool would have facilitated removal of the flesh. Upon completion of this activity it was apparent that the tool could also be used to soften the pelt. Unfortunately the tanning process utilized by groups living 4000 years ago is not known. Future research could include testing the utility of a tool such as this one during the softening of pelts, the final stage in preparing a fur.

11.5d.4 Comparison – The distal surface of the tool became highly polished during use. Light striations were also visible on the ventral surface (Figure 11.6). Because there were no wear patterns visible on the original tool it was impossible to determine if this was one of the functions the tool could have performed.

11.5.5 Comparison Summary

The lack of use-wear pattern on the original tool limited use-wear analysis. The effectiveness of the replica at performing suggested actions is the only guide to tool function. Of the three tests performed, the activity that best suited the shape of the original tool and the task at which it was most proficient was spruce bark peeling.

12. Results – Bone Awls

12.1 Original Tools (Awl 23 and 12, 19a, 22)

12.1.1 Material – A vestigial metacarpal of an adult moose (*Alces alces*) was used to create Awl (23). The broken awl (catalogue numbers 12, 19a and 22) was created from the vestigial metacarpal of a sub-adult moose (*Alces alces*).

12.1.2 Morphological Description – Awl (23) was manufactured from a mature moose vestigial metacarpal with the epiphysis fully fused (Figure 12.1). No lipping or bone growth was present on the distal articular end suggesting a young to middle aged adult. The tool is concave (Figure 12.1). The length of this tool is 14.17 cm (Table 12.1). Awl (12, 19a and 22) was recovered in three pieces during excavation and subsequently refitted. The distal epiphysis was not fused and likely attached by ligaments during use (Figure 12.2). The element is large and almost fully grown when compared to modern examples housed at the University of Manitoba and The Manitoba Museum. The length of the tool is 16.4 cm (Table 12.1).

TABLE 12.1: Comparison of measurements between original and replicated awls.

Artifact number	Original 12, 19a, 22	Original 23	Replica 1	Replica 2	Replica 3
Length	164 mm	141.7 mm	157 mm	143 mm	145.5 mm
Width 20 mm from distal end	4.5 mm	8.5 mm	5.2 mm	7.9 mm	7.6 mm
Thickness 20 mm from distal end	2.1 mm	3.3 mm	3.3 mm	3.7 mm	4.0 mm

12.1.3 Wear and Manufacture Patterns – Awl (23) has channeled striations on the entire distal end of the tool and these marks are not polished or obliterated, furthermore, the distal tip had been chipped and subsequently smoothed, over indicating the tool had

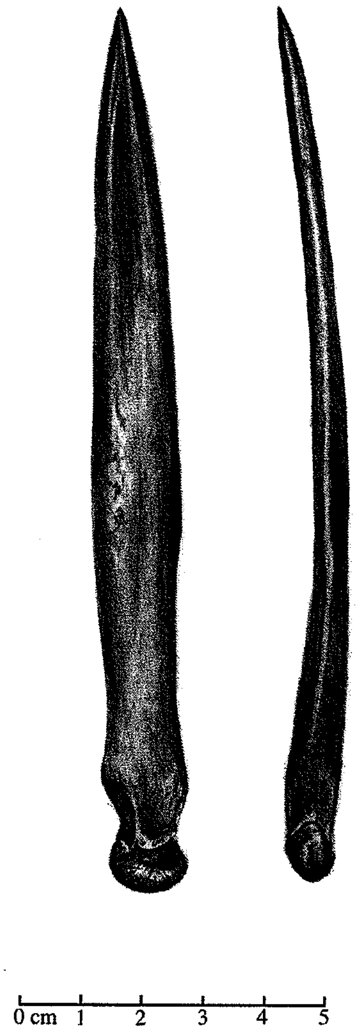


FIGURE 12.1: Drawing of original awl (23)

been used and then re-sharpened prior to burial (Figure 12.3). Awl (12, 19a and 22) only shows channeled striations on the lateral edges. The dorsal surface is minimally modified with slightly more modification on the ventral surface (channeled striations). The distal tip is chipped but subsequent re-sharpening has partially smoothed use-wear (Figure 12.4).

12.1.4 Production Sequence – Vestigial metacarpals are naturally pointed and need very little modification to produce an awl. Awl (23) has been re-sharpened numerous

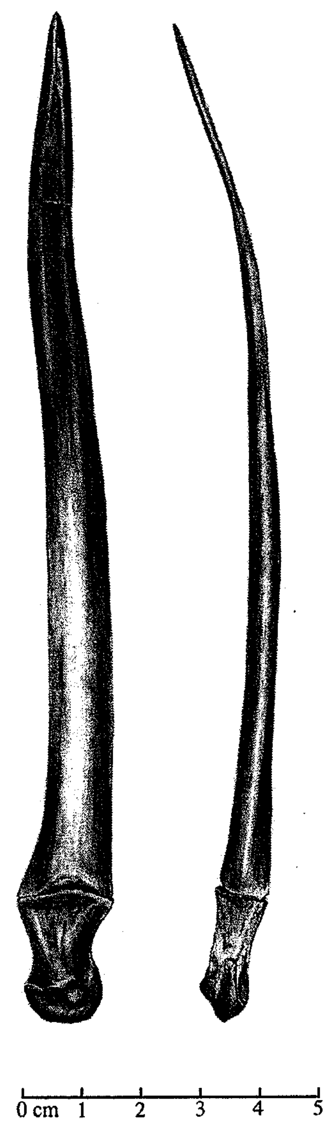


FIGURE 12.2: Drawing of original awl (12/19a/22).

times and is reduced in length compared to un-modified elements. Carving on the lateral and distal ends produced a broad sharp tip (figure 12.2). Awl (12, 19a and 22) has minimal modification in comparison, and is almost as long as un-modified elements. The convex exterior side of both elements is identified as the dorsal surface.

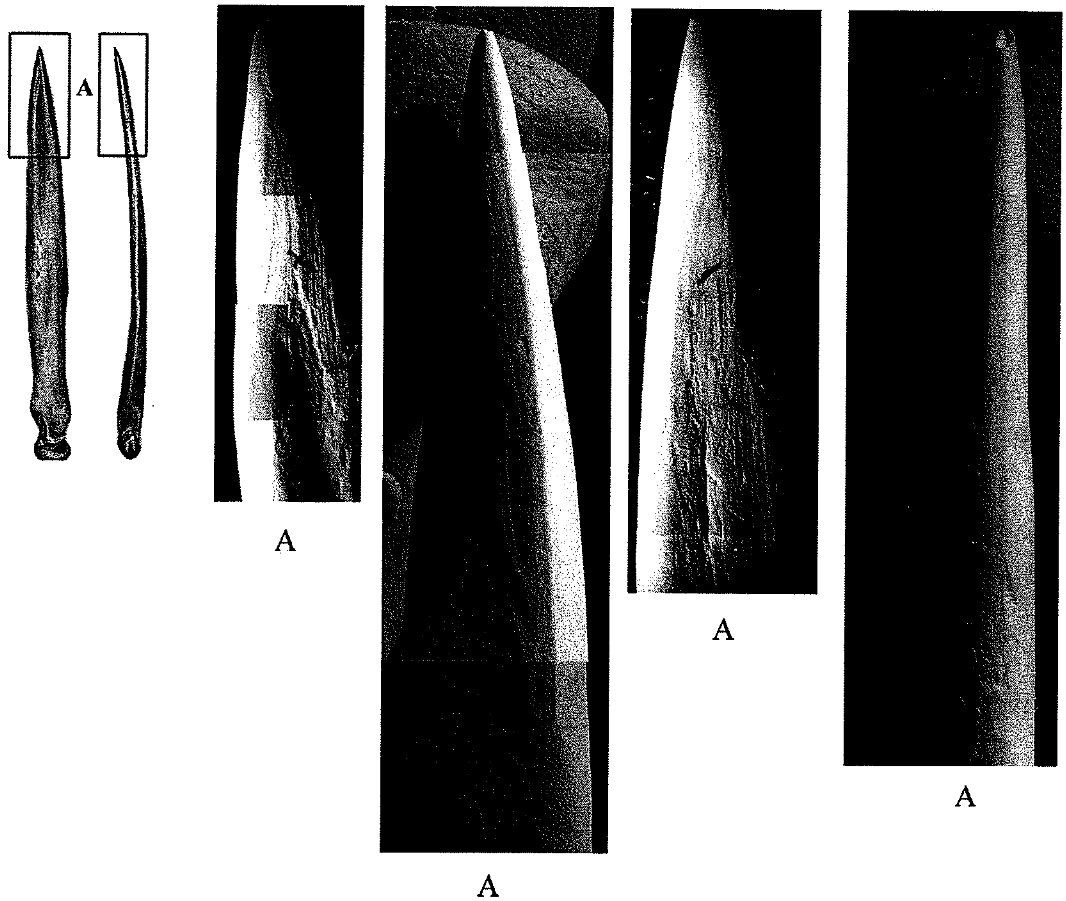


FIGURE 12.3: Surface of original awl (23) as recorded on the dental stone casts, images taken under 7x magnification.

12.2 Comparative Research

Awls are used to puncture holes in other materials. Osgood (1970:61-66, 70-75) identified many types of awls used for different purposes by the Ingalik. Based on Osgood's observations both element and species selection varies, although bone is the most common material employed. Most of the awls documented by Osgood are sharpened "bone slivers" hafted in handles.

The most common raw material for precontact awls in the northern boreal forest is the vestigial metacarpals of moose (Syms 2001; Brownlee and Syms 1999).

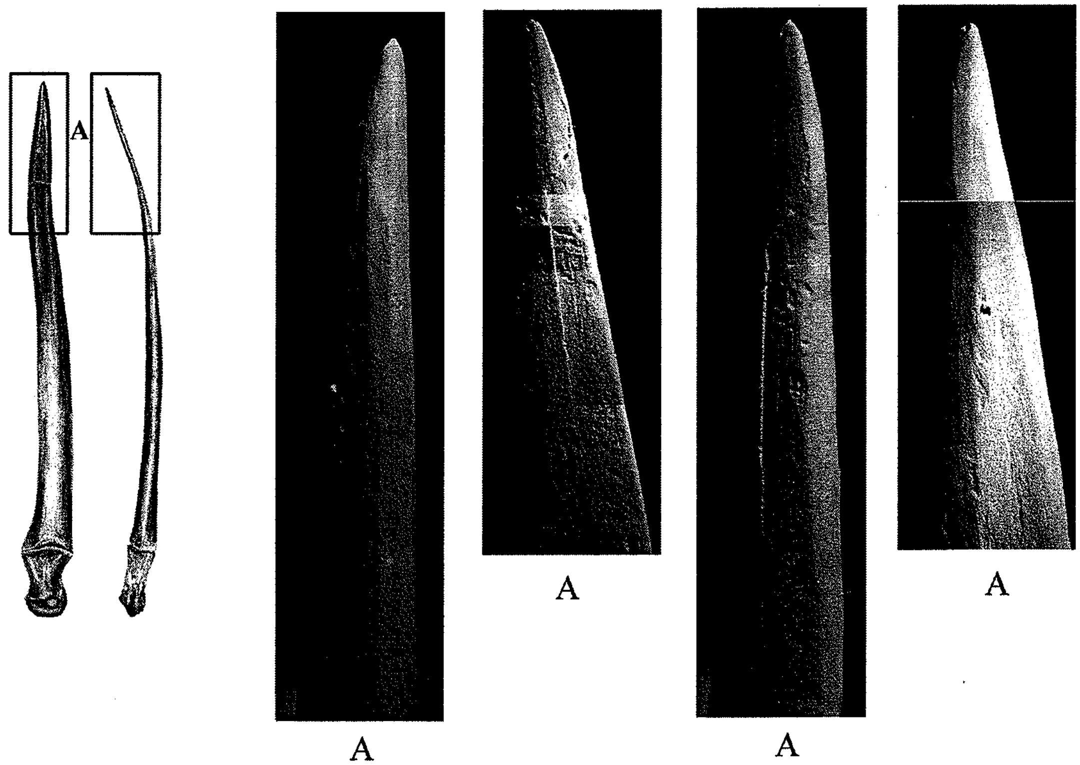


FIGURE 12.4: Surface of original awl (12/19a/22) as recorded on the dental stone casts, images taken under 7x magnification.

12.3 Interviews

Lottie Moore, Leda McDonald, Johnson Donkey, and Alvin Moodie suggested sewing hide for clothing and personal items (bags, moccasins). Another suggested use supplied by Lottie Moore and Alvin Moodie was to puncture birchbark during basket making. Johnson Donkey suggested the tool could be used for making holes in wood (paper birch) snowshoe frames in preparation for lacing. The middle section of the snowshoes is woven with rawhide lacing, strung through small holes through the wood frame. The toe and heel section are woven with the same material but lashed over the frame, not through it. Johnson Donkey suggested that the bone awls could be used to produce holes in the snowshoe frame. Keith Anderson commented that the broader awl could be used to make holes in rawhide, as the thinner one would break more easily.

12.4 Replicated tools

Two types of awls were produced. Replica 1 followed the dimensions of awl 12, 19a and 22 with a narrow/thin tip with minimal modification (Figure 12.5). Replicas 2 and 3 followed the dimensions of awl 23 with a wider and thicker distal tip (Table 12.1) (Figure 12.6, 12.7).

12.4.1 Material – All three awls were manufactured from vestigial metacarpals from an adult moose aged 3 years old. The articulating end was fully fused.

12.4.2 Morphological Description – All replicas were concave. Size and shape was dictated by the shape of the raw material (Table 12.1).

12.4.3 Production Sequence – See Appendix 4

12.4.4 Manufacture Patterns - The final stage involved smoothing the surface with 600 grit sandpaper, eliminating all file marks from the distal end.

12.5 Experimentation

12.5a.1 Replica 1 Activity - An awl with similar dimensions to original awls 12, 19a, and 22 was chosen to puncture holes in home tanned moose leather.

12.5a.2 Test Tool Function - A small piece of tanned moose hide (280 mm by 200 mm), produced by the researcher was used for experimenting with the bone awl. The awl was used to puncture 300 holes in the hide, just large enough to thread a piece of sinew through (Figure 12.8). Significant pressure was required to puncture the moose hide, with a twisting motion. The holes produced were approximately 3 mm long and 1 mm wide. The awl never entered the hide more than 10 mm.

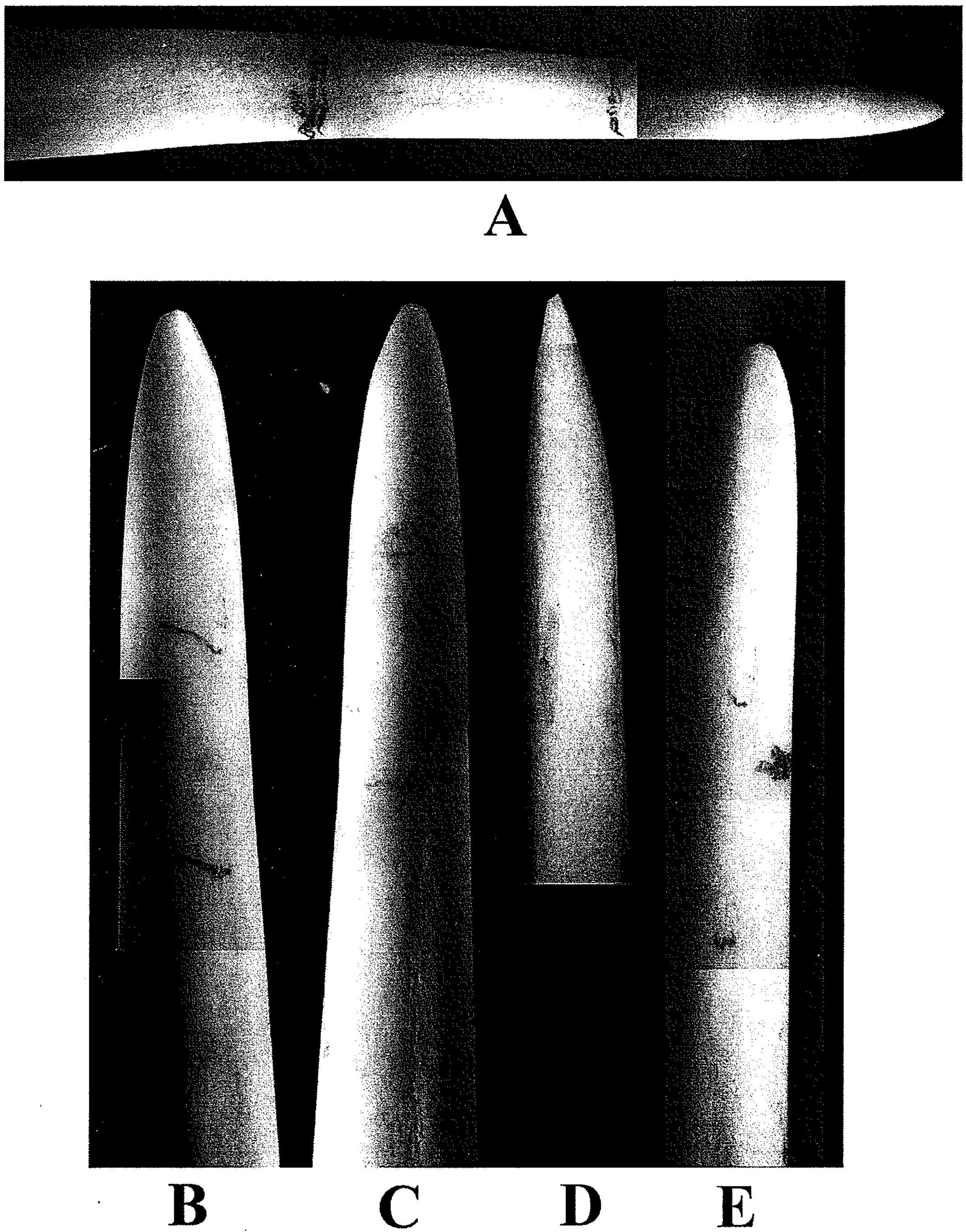


FIGURE 12.5: Surface of awl (replica 1), under 7x magnification. A. Pre-experiment ventral surface of awl. B to E Post-experiment surface of awl (B-Dorsal, C-Ventral, D-Left Lateral, E-Right Lateral).

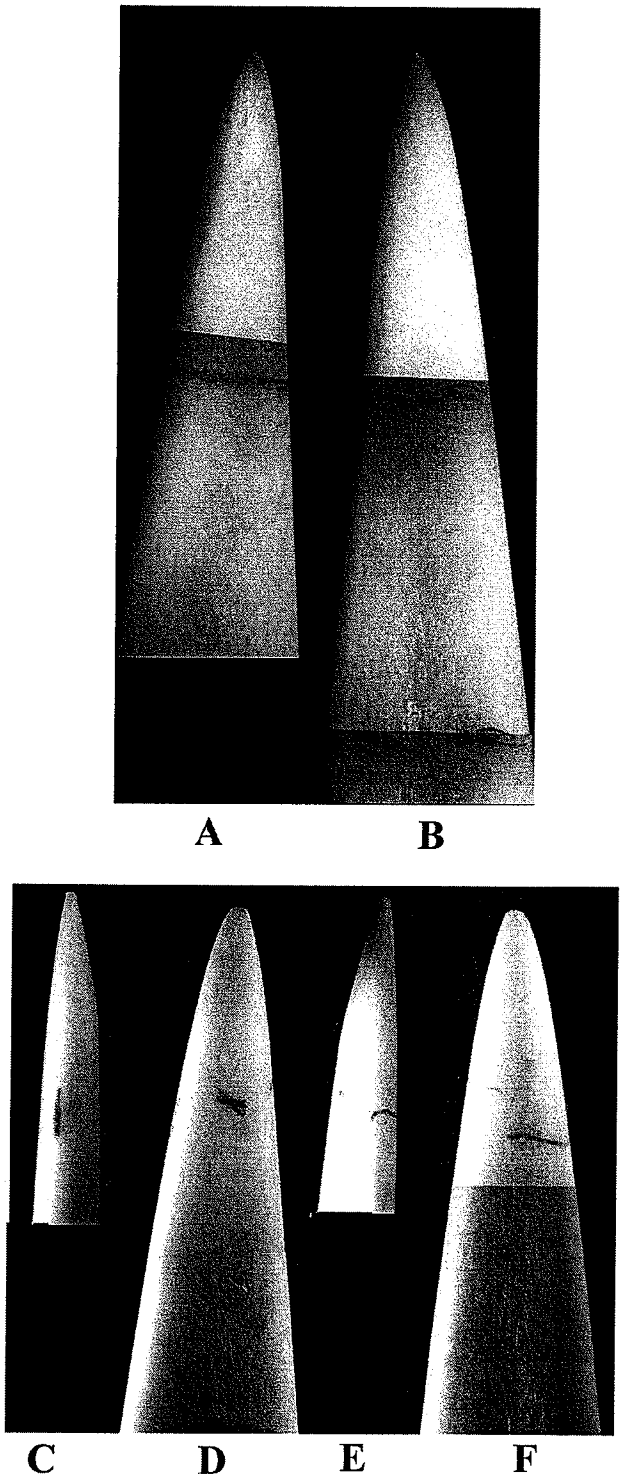


FIGURE 12.6: Surface of awl (replica 2), under 7x magnification. A. and B. Pre-experiment surface of awl (A-Dorsal, B-Ventral). C to F Post-experiment surface of awl (C-Left Lateral D-Dorsal, E-Right Lateral F-Ventral).

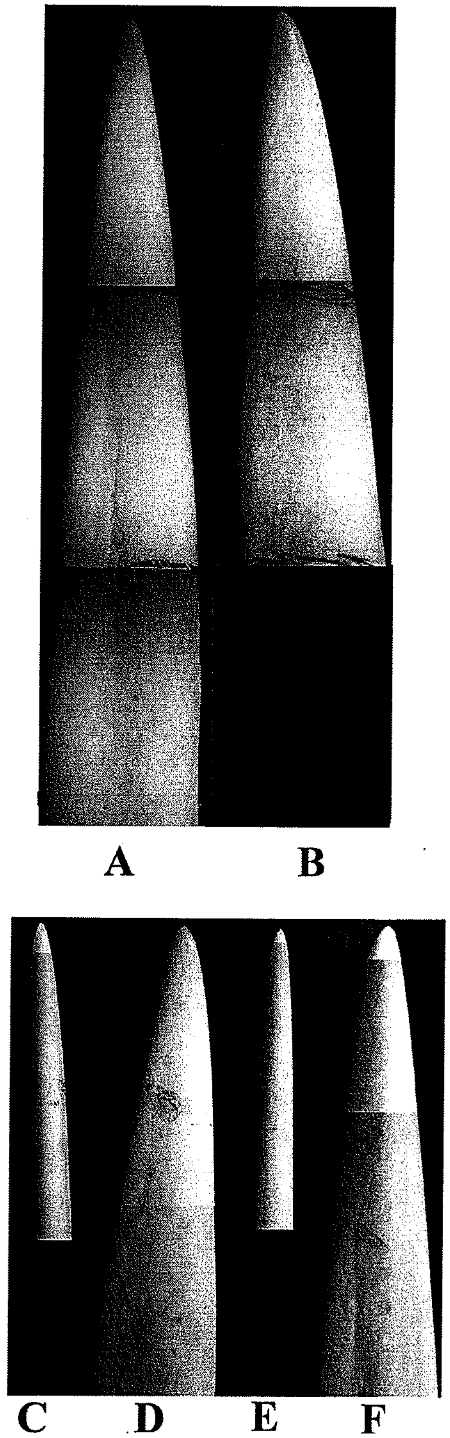


FIGURE 12.7: Surface of awl (replica 3), under 7x magnification. A. and B. Pre-experiment surface of awl (A-Ventral, B-Dorsal). C to F Post-experiment surface of awl (C-Left Lateral D-Dorsal, E-Right Lateral F-Ventral).

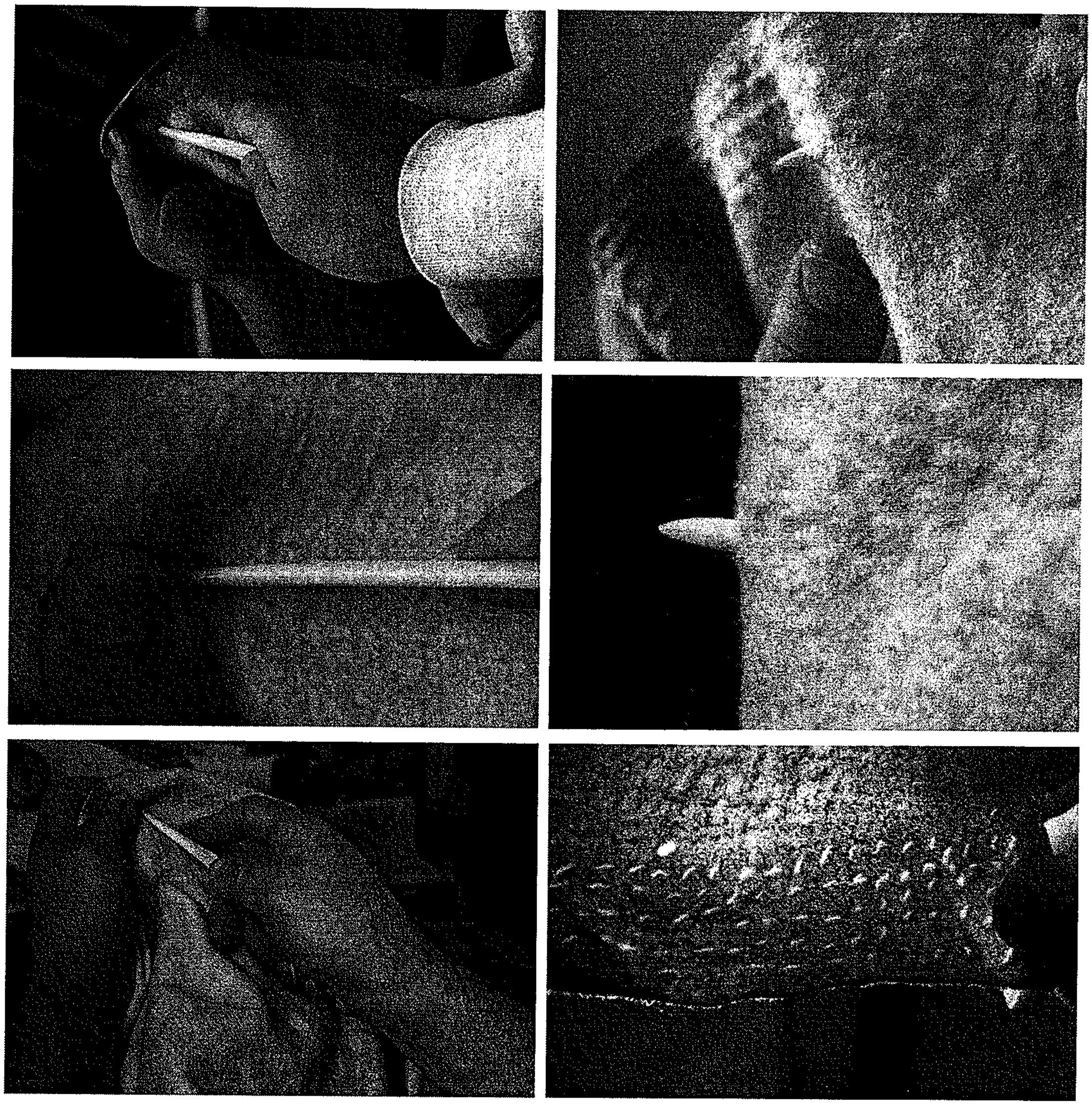


FIGURE 12.8: Experimenting with awl (replica 1) on home tanned moose leather.

12.5a.3 Performance – Exceptional. The awl perforated the hide cleanly. When the piece of hide is held up to the light no holes are visible but a rigid end of sinew would easily pass through the holes during sewing and the garment seams would have been tight.

12.5a.4 Comparison – The tip of the awl was slightly blunted during use, although this did not affect performance. High polish was created on all surfaces of the distal end of the tool. Small chips were produced on the distal end of the tool (less than 1 mm in width) visible on the ventral surface, and polish overlays the chipping (Figure 12.5).

12.5b.1 Replica 2 Activity – The awl was used to puncture birchbark. The awl had similar dimensions to original awl 23.

12.5b.2 Test Tool Function - Lillian Hunter (Nisichawayasihk Cree Nation) taught the researcher to make birchbark baskets in 1997. Traditional birchbark is sewn with spruce roots, which have been soaked in water to make pliable. Birchbark is perforated, and spruce roots are laced through the holes. Awls are used to create the perforations in the birchbark (Figure 12.9). Rather than perforate a piece of birchbark it was decided to create two baskets as a complete activity. The round proximal end of the tool fits well into the hand and does not require the addition of a handle. Minimal pressure is required during use. Holes are produced with a twisting motion, the awl rotating 180° once it enters the bark. This action creates a round hole, required for sewing. The spruce roots are plano-convex in cross section and very supple. Since no needle is used during sewing the soft spruce roots must fit into the hole created by an awl. The awl penetrated about 5 – 7 mm, creating a perforation approximately 2 mm wide. A total of 252 holes were produced using this tool.

manufacture.

12.5b.3 Performance – Exceptional. The awl was ideal at creating holes in birchbark. It entered the bark smoothly and did not split the bark during the process. The tip was dulled during the experiment although it did not significantly affect the performance of the tool.

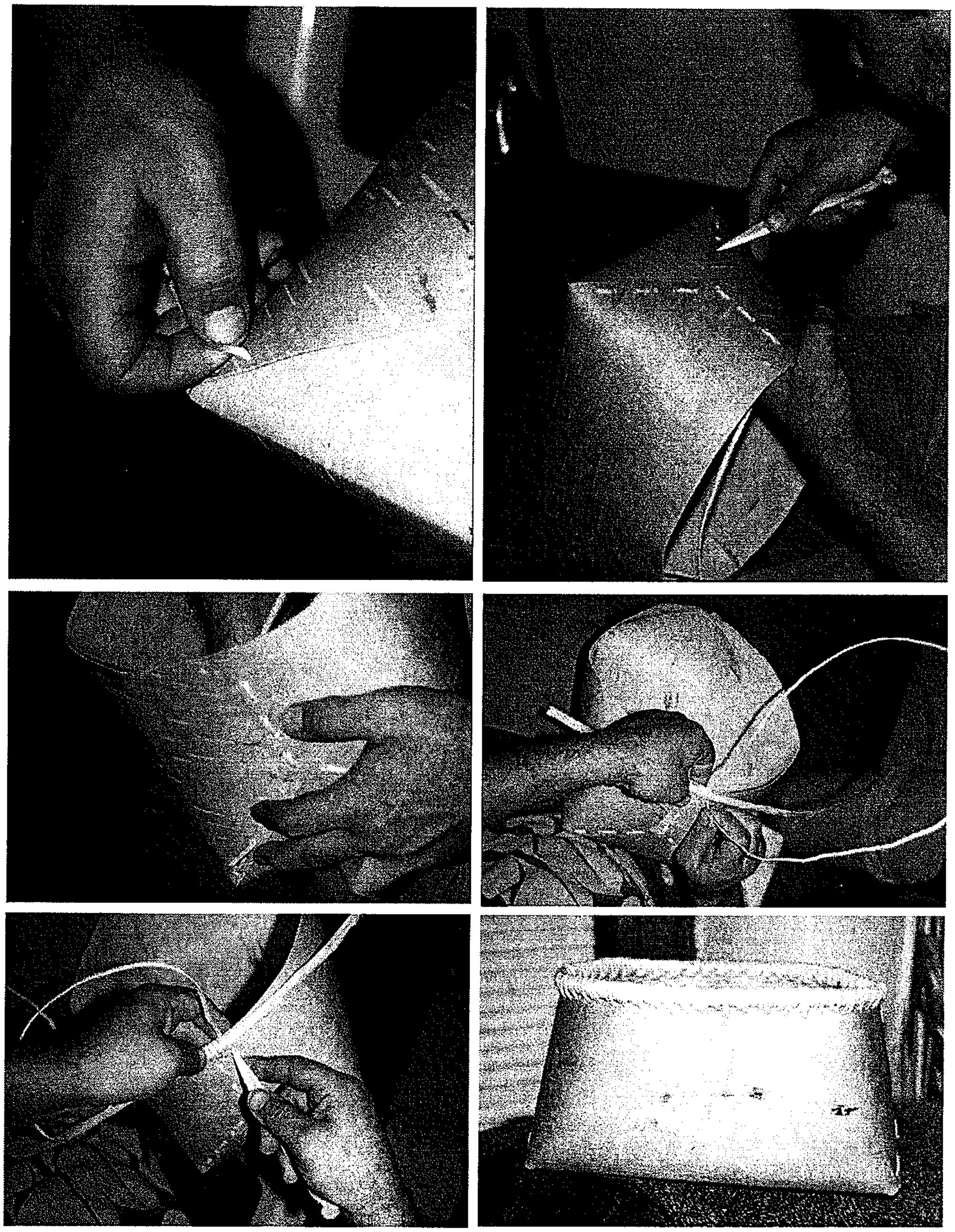


FIGURE 12.9: Experimenting with the awl (replica 2) during birchbark basket slightly

12.5b.4 Comparison – The tip of the tool was blunted from use and very small chips (less than 1mm) were visible on the distal end. The most significant change in the tool was high polish concentrated on the distal end extending approximately 7 mm from the distal end (the maximum depth the tool was inserted into the birchbark) (Figure 12.6).

The minor chipping present on the distal tip of the original tool and the replicated one may indicate a similar use but the degree of polish produced during testing is not observed on the original tool.

12.5c.1 Replica 3 Activity – The awl was used to make holes in a birch snowshoe frame. This awl had similar dimensions to original awl 23.

12.5c.2 Test Tool Function - The birch wood was approximately 18.3 mm thick and 35.2 mm wide following the dimensions of Swampy Cree snowshoe frames described by Drege (Pettipas 1982). The birch wood was soaked in cold water for 48 hours prior to testing to soften the wood. Holes were made 40 mm from the cut edge. The awl was held tightly in the right hand and twisted, drilling into the wood (Figure 12.10). The hole gradually expanded, without cracking the wood. After the awl entered to a depth of 16 mm, the wood was turned and a hole was placed on the opposite side to match up with the hole on the first side. After 27 minutes a hole (5.2 mm to 3.1 mm wide) was created through the wood. Care was taken to ensure the awl did not break.

12.5c.3 Performance – Inadequate. While the tool eventually created a hole through the frame a significant amount of time was required. Bone is fragile and brittle and much care was taken to ensure the relatively thin bone awl did not break. In this experiment time was a factor in assigning performance. In section 5.5, (Tool Performance), time was not considered in assessing performance. In this experiment, time became a factor due to the physical properties of bone (i.e. fragile and brittle). It is not expected that time would be reduced as one became proficient at the activity since the properties of bone do not change. Other tools would be better suited to drilling a hole in wood. The activity

FIGURE 12.10: Experimenting with awl (replica 3) on birch stave.

could not be rushed, as the tool likely would have broken.

12.5c.4 Comparison – The tool was polished during testing on the distal 16mm (Figure 12.7). Similar patterns were not observed on the original tool.

12.5.5 Comparison Summary

The tests showed that the awls were probably used to perforate hide and/or birch bark for the confection of baskets and clothes, based on their efficiency at these tasks. Use-wear visible on the original tool would confirm this hypothesis.

13. Results – Bone Knife

13.1 Original Tool (Bone Knife 47)

13.1.1 Material – Cervid rib: either Moose (*Alces alces*) left rib (10-12) or Caribou left rib anterior (2-6).

13.1.2 Morphological Description – The tool is 16.7 cm long, with a proximal width of 14.7 mm and a distal width of 21.4 mm (Figure 13.1) (Table 13.1). The tool is straight but slightly concave. The sharper working edge of the tool is located on the distal right lateral side. The proximal end was carved then broken leaving a jagged end.

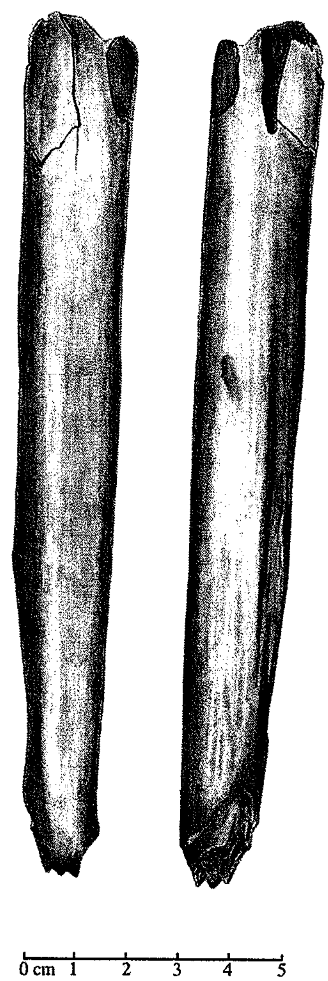


FIGURE 13.1: Drawing of bone knife (47).

TABLE 13.1: Comparison of measurments between the original and replicated bone knives.

Artifact number	Original 47	Replica 1
Length	167 mm	134.7 mm
Proximal Width	14.7 mm	21.8 mm
Distal Width	21.4 mm	25.7 mm
Proximal thickness	6.4 mm	12.6 mm
Distal Thickness	5.4 mm	10.8 mm

13.1.3 Wear and Manufacture Patterns – Manufacturing marks are visible on the ventral surface of the tool (channeled striations) (Figure 13.2). The dorsal surface is not modification, with the exception of the proximal end of the tool, where carving was used to score the dense cortical bone before it was broken. Since the vinyl mould was applied to the portion of the tool that was held rather than the sharp cutting edge detailed wear patterns could not be observed or documented for this tool.

13.1.4 Production Sequence – A large, relatively flat distal section of rib was chosen for the production of this tool. The rib was broken at the proximal end and subsequently carved and polished. The proximal surface may have been carved to improve handling of the tool. The distal end was intentionally broken at a desired length to allow the tool to be handled without the addition of a handle. The proximal half of the tool had no sharpened cutting edge supporting the suggestion that it was the handle of the tool. The tool appears to have been produced expediently as it is relatively un-modified.

13.2 Comparative Research

Evidence of similar tools from archaeological sites in the boreal forest is limited. The Nagami Bay Burial (HgLt-1) contained a moose rib modified in a similar fashion, although it was interpreted as a handle blank; two other modified ribs had metal blades

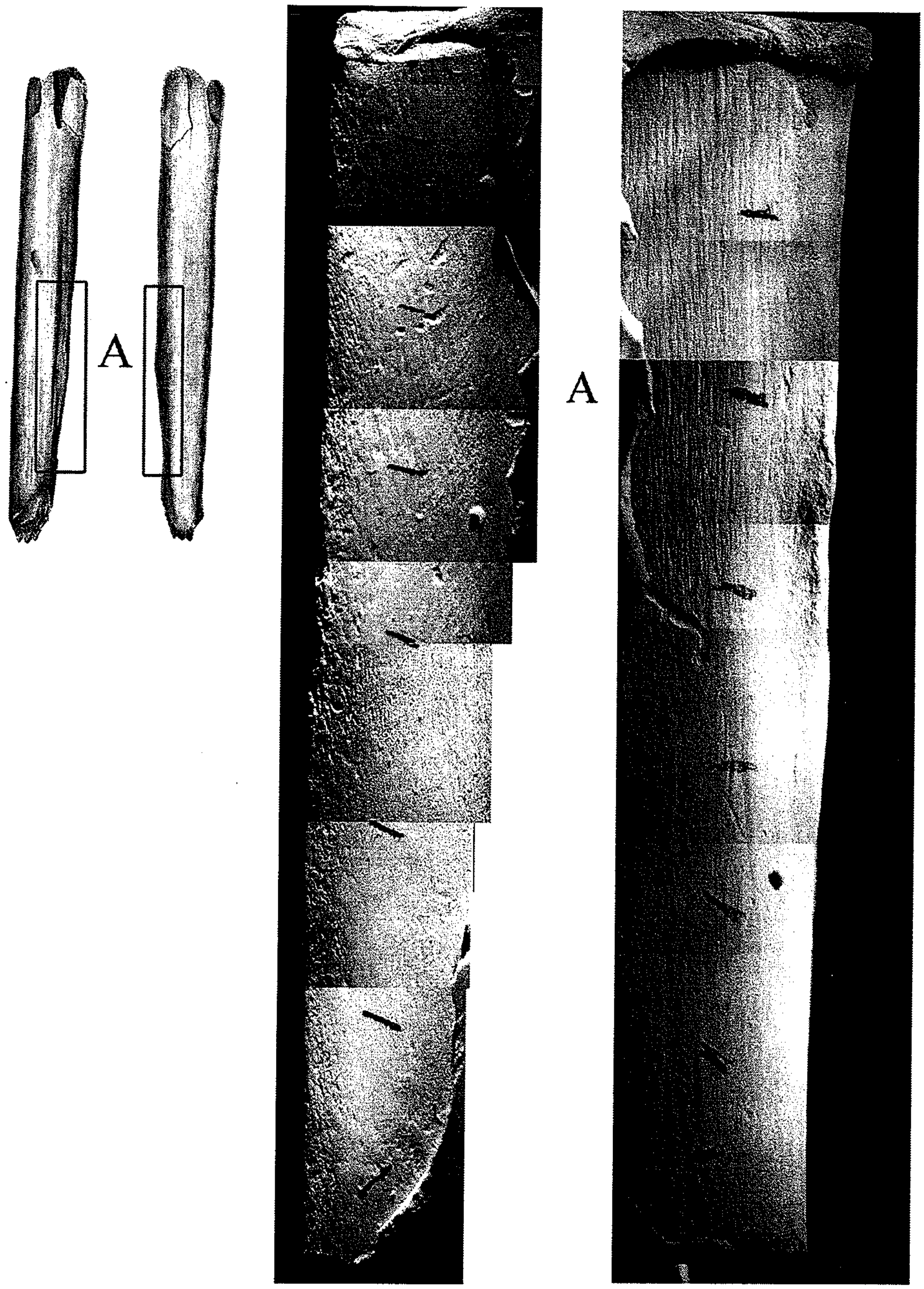


FIGURE 13.2: Surface of original bone knife (47) recorded in the dental stone cast, under 7x magnification.

inserted into them (Brownlee and Syms 1999:27). In addition, the interpretation of this tool as a handle blank is based on the un-modified and un-sharpened lateral edges of the tool. Another example comes from the Rivermouth site (EcKx-37) where an ungulate rib was modified to hold a chert biface. It is possible that rib knives are more common archaeological sites but are misidentified due to the limited modification required to the element. Compounding the problem is polish or smoothing of edges may be identified as taphonomic rather than functional. As a result ribs can be interpreted as faunal remains, tool blanks or handles, rather than finished tools. Interpreting the tool from the Victoria Day site feature 2 as a bone knife is based on the slight modification of the lateral edge to create a sharp "cutting" edge as opposed to the un-modified lateral edge of the bone handle found with the Nagami Bay burial (HgLt-1).

13.3 Interviews

During the Nelson House interviews few people could identify the rib as a tool. Johnson Donkey suggested a knife but did not know what it may have been used for. Leslie Baker and Keith Anderson indicated the tool was a likely used to scale fish in preparation of smoking.

13.4 Replicated Tool

13.4.1 Material – Moose ribs (number 9 to 12) from an adult male, three to four years old.

13.4.2 Morphological Description – The rib knife replica is 13.4 cm long (Table 13.1). The outer surface of the rib is designated as the dorsal surface. . The right lateral surface at the distal end of the tool was modified to a sharp working edge.

13.4.3 Production Sequence – See Appendix 4

13.4.4 Manufacture Patterns – The rib was cut to length and the lateral edge was sharpened using a file then subsequently sanded using 600 grit sandpaper to eliminate the manufacturing marks produced from the file (Figure 13.3).

13.5 Experimentation

13.5.1 Activity – Scale three Lake Whitefish (*Coregonus clupeaformis*) and one White Sucker (*Catostomus commersoni*)

13.5.2 Test Tool Function – No handle was added to the tool although it was much shorter than the original tool. A handle would have improved the handling of the tool, although it was not deemed crucial in the testing.

Three large white fish weighting approximately 3-4 pounds and one white sucker weighing 2-3 pounds were used in the experiment, donated by local fishermen. The tool was grasped at the proximal end with the distal right lateral edge used to remove the scales (Figure 13.4). The ventral surface of the knife was held almost flat against the body of the fish. The scales were easily removed using this tool.

Once all three fish were scaled one was gutted using the knife although it did not perform this activity very well.

13.5.3 Performance – The knife performed exceptionally well to scale fish. The tool did not dull during the experiment. The tool performed so well that those who witnessed the experiment indicated that they may take a rib from the next moose they shoot and use it to scale whitefish. According to Keith Anderson and Burnell Anderson the knife performed better than a modern metal knife since it did not catch on the skin of the fish rather it glided easily over the skin regardless of the angle or pressure applied to it.

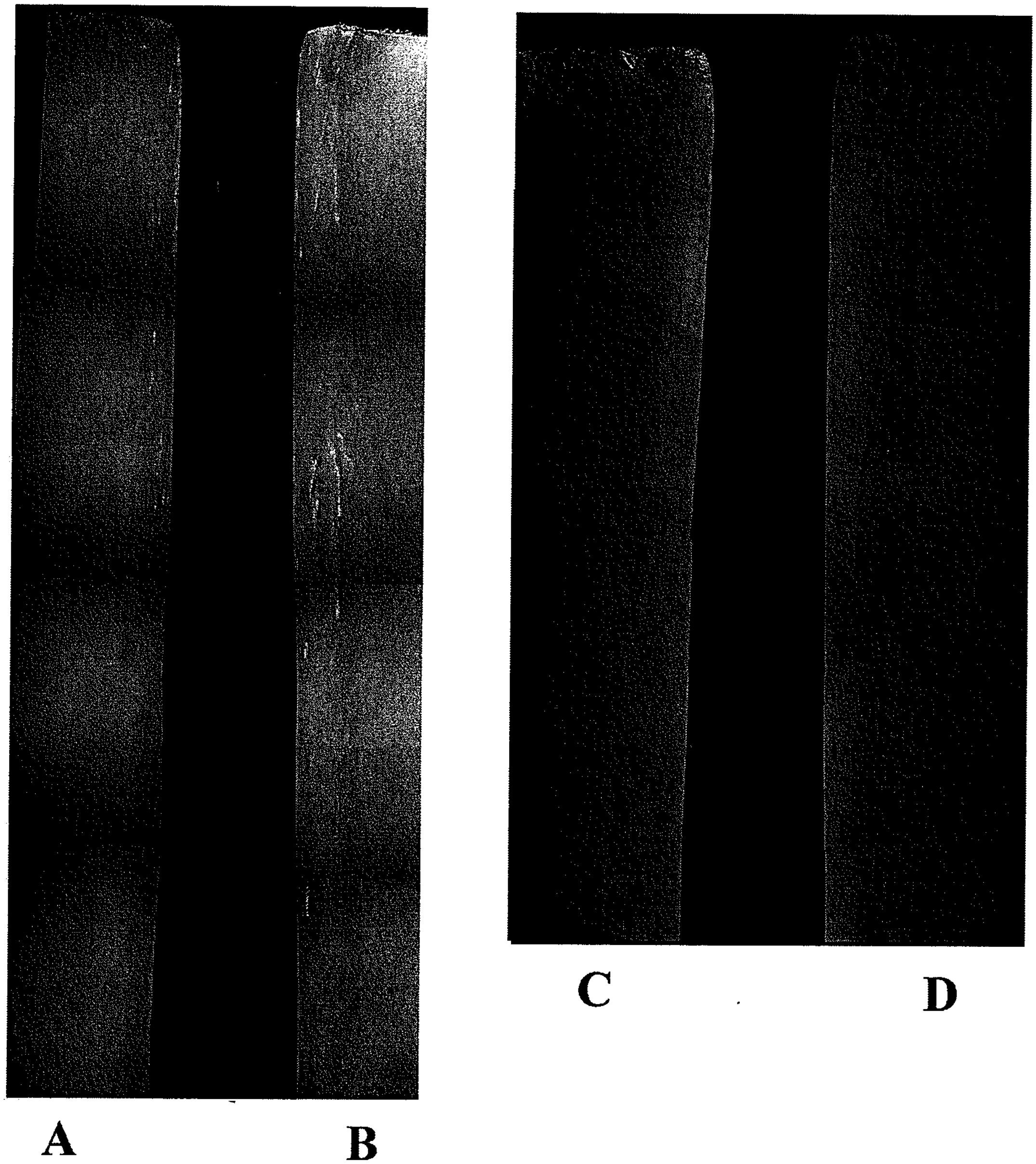


FIGURE 13.3: Surface of bone knife (replica 1), under 7x magnification. A and B show the surface of the knife before experimentation (A-Dorsal, B-Ventral). C and D show the surface of knife after experimentation (C-Dorsal, D-Ventral).

Scaling a fish can take three to four minutes (inexperienced individual) using a metal blade. In this experiment the fish were scaled in half the time (approximately 2 minutes, inexperienced individual).

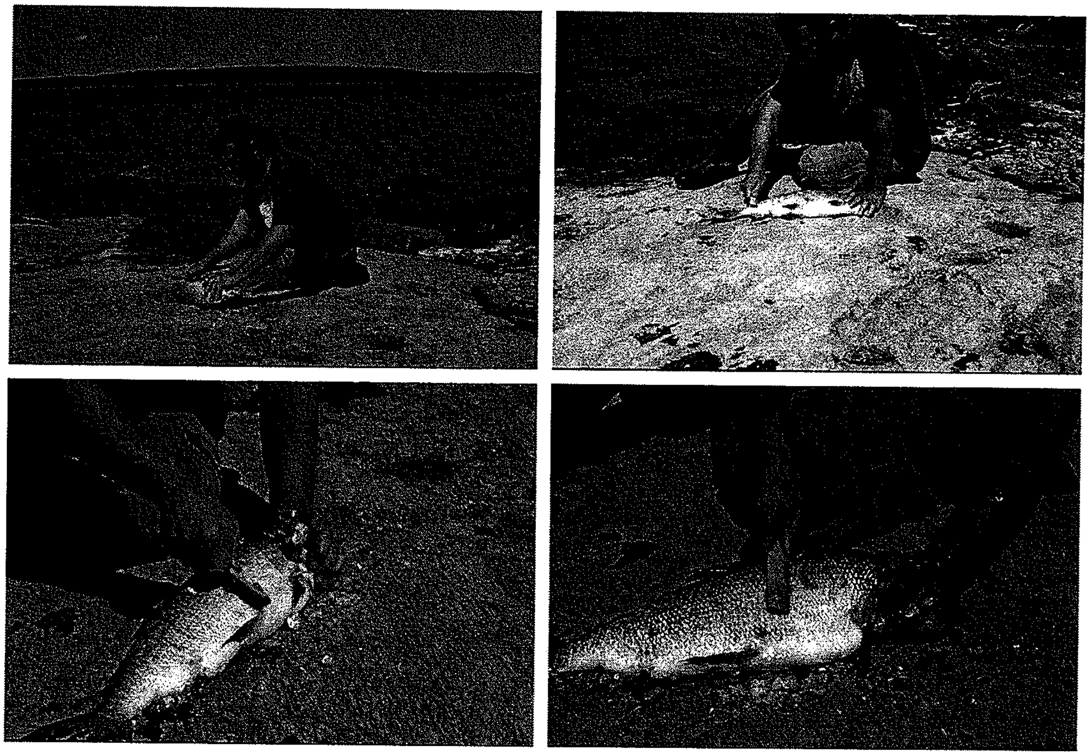


FIGURE 13.4: Experimenting with the bone knife (replica 1) to scale whitefish.

13.5.4 Comparison – Very light striations were produced on the dorsal surface with no observable wear on the ventral surface. The rough scales were in contact with the dorsal surface and created the wear patterns (Figure 13.3). A comparison of wear patterns could not be undertaken since the vinyl mould was not applied to the working edge of the tool. Based on performance the tool could well have been used for scaling fish.

14. Results – Antler Ladle

14.1 Original Tool (Antler Ladle 27)

14.1.1 Material – Moose (*Alces alces*) antler, fully mature antler from a three year old or older.

14.1.2 Morphological Description – The tool was recovered in five pieces during the excavation and subsequently refitted. The distal end of the tool was never recovered. The main portion of the tool has hollowed out and dish shaped in appearance (Figure 14.1). It is sub-triangular in shape when viewed dorsally, with rounded edges.

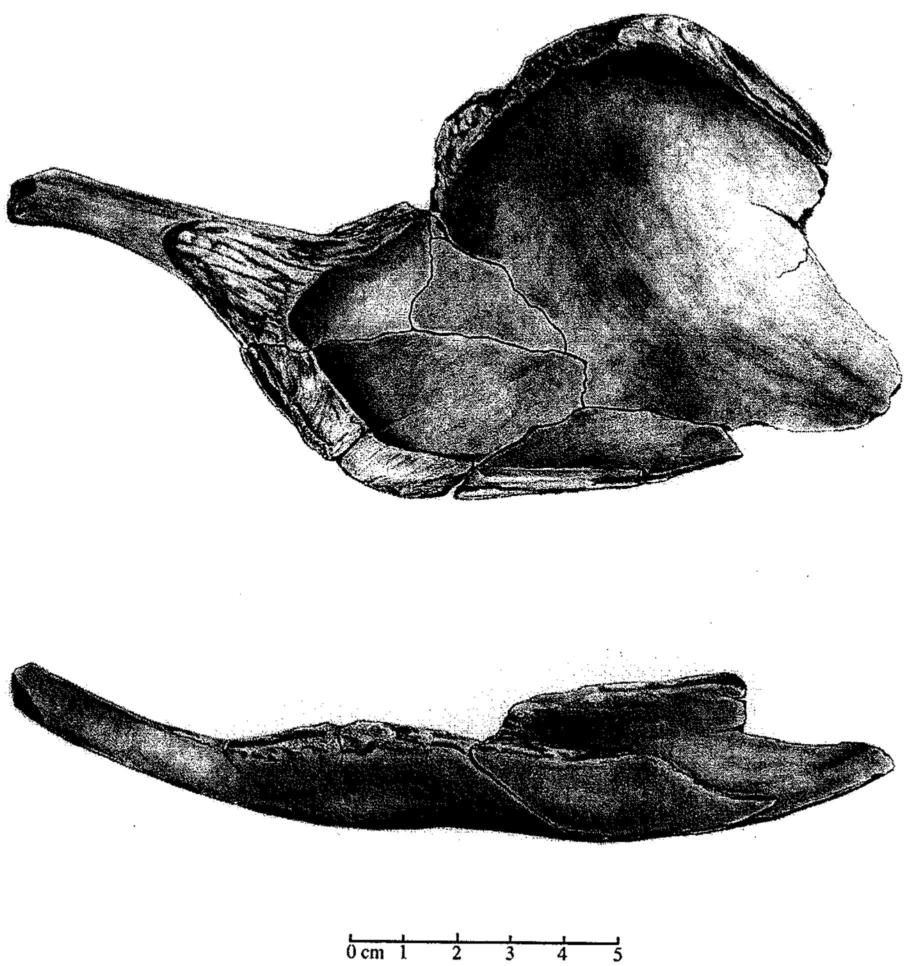


FIGURE 14.1: Drawing of original antler ladle (27).

The tool is concave; the concavity is very thin (2 mm thick). The edge of the scoop portion of the tool is naturally lipped over both the right and left edges. The lip has been removed on the distal end. Extending from the proximal end of the dish is a handle. The handle follows the curve and shape of the original antler. The width of the handle where it attaches to the ladle is 15.4 mm and it narrows to 11.3 on the proximal end. The handle ranges from 11.4 mm to 10.7 mm thick. The maximum width of the bowl is 90.2 mm. The total length of the scoop is 16.8 cm.

14.1.3 Wear and Manufacturing Patterns – The ventral, convex portion of the ladle was carved with a stone flake based on the presence of deep "V" shaped grooves similar to those produced experimentally. The dorsal surface of the tool has wide shallow "U" shaped channels occurring randomly and cross cutting each other (Figure 14.2). The shallow "U" shaped striations are the product of a rodent incisor tool. While the grooves on the interior are clearly the result of carving out the bowl, the marks on the ventral surface are more problematic. There does not appear to be any purpose for carving or incising the ventral surface of the ladle, which would suggest the patterns were caused by use. The deep "V" shaped marks on the ventral surface appear to have been caused by a sharp item, such as a stone flake. One possible explanation is that the tool was stored in a bag or pouch with stone tools, as tools were removed from the bag the surface became marked with the striations. Whether the carving on the ventral is the product of use, manufacture or wear and tear could not be conclusively determined.

14.1.4 Production Sequence – Antler from a young moose, three to four years old, was selected based on its shape. The morphology of the tool reflects the shape of the antler used in manufacture. The antler had a small tine protruding from the palmate section, which was carved into a handle. The blank for the tool was removed by carving into the palmate portion of the antler, removing a large section. Once the blank was removed the dorsal (upper) surface was heavily gouged using a beaver incisor (Figure 14.2). A large amount of antler was removed from the surface to create the scoop. A lip of antler was left on the right and left lateral edges. The bottom of the ladle was thinned to 2mm, primarily by carving the ventral surface creating the bowl of the ladle. The ventral surface has less modification, restricted to "v" shaped parallel grooves caused by a lithic tool although the purpose is not known. The handle was carved to fit comfortably in the hand, reducing the length of the antler tine slightly.

14.2 Comparative Research

Antler ladles are present in The Manitoba Museum's ethnographic and archaeological collection from across the arctic region but are absent in the boreal forest. Many of the ladles were manufactured from caribou antler and identified as ice scoops. Osgood (1970:222-223) describes Ingalik ice scoops made from spruce root.

14.3 Interviews

While everyone interviewed agreed that the tool was a ladle or spoon, different suggested uses were recorded. Johnson Donkey, Moses Moore, Lottie Moore and Alvin Moodie, Leda McDonald, Marie Hartie and Joshua Spence suggested a soup ladle. Keith Anderson suggested the tool was used for scooping ice chips from a hole in the ice. Leslie Baker suggested the ladle was used to scoop blood from the inner cavity of large

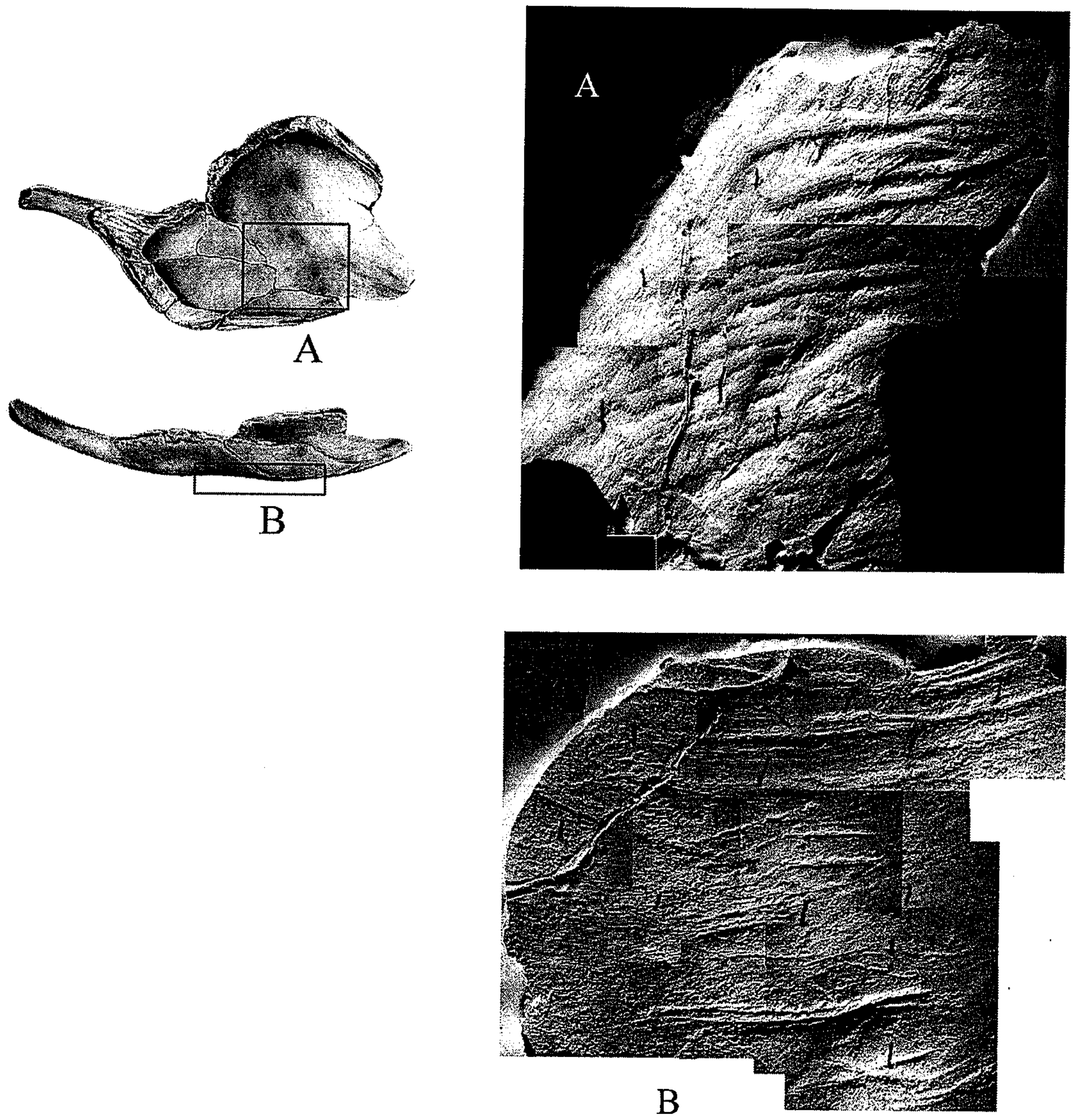


FIGURE 14.2: Surface of original antler ladle (27) recorded on the dental stone cast, under 7x magnification. Top showing the ventral surface of the ladle with "V" shaped parallel grooves (lithic tool), the bottom showing the dorsal surface of the ladle with wide shallow "U" shaped grooves (rodent incisors).

game (moose or caribou). The blood is collected and smoked and dried for later use (see antler pick interview section, above).

14.4 Replicated Tool

14.4.1 Material – Moose (*Alces alces*) antler from a three year old bull moose.

14.4.2 Morphological Description - The size and shape of this tool was reproduced faithfully. The maximum length was 172 mm from handle to distal end. The replica was slightly flatter than the original, with slightly more angular corners.

14.4.3 Production Sequence – See Appendix 4

14.5 Experimentation

14.5.1 Activity – Scoop ice chips from a hole being chopped into lake ice.

14.5.2 Test Tool Function - The tool was used to remove ice chips from the hole chipped into the surface of the lake (see antler pick replica 2 experiment section).

14.5.3 Performance – The tool performed the task exceptionally well. The shape and size was well suited to the activity. It should be noted, however, that the ladle would have worked as a scoop for any of the activities suggested during the interviews.

14.5.4 Comparison – No wear patterns were created during this activity. Loose ice chips were removed without creating wear on the surface of the tool. No wear patterns were observed the replica and a comparison could not be conducted.

15. Discussion

A primary objective of this research was to examine the tool function of bone and antler tools from the Victoria Day site (feature 2). Another objective was to reconstruct the production sequences to gain a better understanding of the interplay between tool production and use as well as other aspects of life. These approaches flesh out a narrative of the past that highlights the rich and dynamic history of life in the boreal forest.

15.1 The Production Sequence

Reconstructions of the production sequences of bone and antler tools at the Victoria Day site feature 2 are presented in Chapters 6 through 14. These reconstructions are based on experimental data supplemented by information from interviews and reviews of the archaeological and ethnographic literature. The identification of the manufacture process is difficult when tools exhibit extensive wear since the wear from use tends to obliterate the manufacture marks (Lemoine 1997:95). It was possible to identify the manufacture sequences of the tools from Victoria Day because the manufacture marks were clearly visible on many of the tools. The establishment of the production sequence helped identify tools used in the manufacturing process (such as utilized flakes) not included with the burial.

The reconstructions of the production sequences improved faunal identification of the tools. In most cases, it was possible to identify the elements used (e.g. antler and metapodials) and the species being exploited (e.g. moose and caribou). This outcome has implications for the identification of "waste" production resulting from the manufacture of bone and antler tools and should help refine the interpretation of faunal assemblages at campsites where tools were potentially manufactured. Deliberate choices were made during the production of blanks, which should make the early production stages more identifiable in the archaeological record. The results presented in Chapters 6 through 14 highlight how the production sequence provides information that extends beyond the function of a tool. The reconstruction of the production sequence of a tool can illuminate the choices made by past peoples. For example, it is possible to determine which materials should be used for certain tool types and what techniques to employ during the manufacture of a tool. This information can be further supplemented by documenting the properties of the various raw materials used which provides a further understanding of the choices made by the toolmaker(s), such as why one material was used rather than another (see discussion below, and relevant sections of Chapters 6 through 14).

Schiffer (2003:170) states that "an appreciation for material properties and formal properties (artifact morphology) helps us to frame questions about the effects of technical choices on the materiality of finished products". For example, it is clear that the toolmaker(s) sought to maximize the length of blanks destined for use in the manufacture of harpoon heads and fish spear points, which limited the choice of raw material to moose or caribou metapodials. Another observation is the lack of grinding or polishing during tool manufacture. Carving was commonly used to shape the tools. Since carving versus grinding does not affect the final form or function of a tool this choice likely has more to do with cultural influences.

Schiffer (2003:171) indicates that researchers must distinguish between material properties, artifact morphology (formal properties), and performance in order to understand variations in tool morphology. For example, some of the Victoria Day Site feature 2 tools, such as the rib knife and the bone chisel, exhibit a lack of formal modification, which suggests that they were expedient tools. Other tools, such as the fish spear points and the harpoon heads, required thoughtful and careful planning because they required a much longer production sequence. A full understanding of tool variation during the Intensive Diversification Period was impossible because of the small sample size examined in this thesis. However, the description of material properties outlined in Chapter 5 and the detailed descriptions of artifact morphologies discussed in Chapters 6 through 14 provides a foundation for future research focused on understanding variations in tool morphology.

15.2 Wear Patterns

Another objective of this research was to conduct wear pattern analysis of the bone and antler tools to assist in the determination of tool function. Casts of the Victoria Day site feature 2 artifacts were the only materials available for analysis since the tools themselves were reburied prior to this study. An examination of these casts revealed that all bone barbed fishing tools were never used (Table 15.1). Six tools were identified as re-sharpened, based on having clear striations on the distal working edge while polish was observed on the proximal end of the tools (Table 15.1). Four tools were used and not re-sharpened prior to burial and exhibited minor wear on the working edge (Table 15.1). Because fourteen of eighteen tools exhibited manufacture or re-sharpening marks on the surface a comprehensive study of wear-patterns was impossible. This led the researcher to develop an alternative methodology for the identification of potential uses of each tool. Since wear pattern analysis could not be conducted for many of the tools, this research follows Schiffer's (2003:171) recommendation that real world situations should be used to evaluate tool function. It is through experimentation in real world situations that researchers can begin to understand how tools were used in the past. Tool performance was therefore assessed (as an alternative to wear-pattern analysis) as means of testing the hypothetical uses of the Victoria Day site feature 2 tools suggested by the ethnoarchaeological research (see Chapter 4). Several tools were recognized as having multiple functions (Table 15.2). This suggestion is not unusual since multifunction tools are well suited to the mobile lifestyle practiced by boreal forest groups.

Table 15.1: Summary of wear patterns on all tool surfaces examined.

Tool (field number)	Wear Patterns/Manufacture Marks	Tool Evaluation
Harpoon head (67A)	Striations all surfaces	New
Harpoon head (67C)	Striations all surfaces	New
Harpoon head (67D)	Striations all surfaces	New
Harpoon (7)	Striations all surfaces	New
Harpoon (30/36)	Striations present with polish on broken barb	Re-sharpened
Fish Spear Point (67D)	Striations all surfaces	New
Fish Spear Point (51)	Striations all surfaces	New
Fish Spear Point (18)	Striations all surfaces	New
Fish Spear Point (79)	Striations all surfaces	New
Antler Adze (24)	Pitted, crushed and polished on distal surface	Used
Antler Chisel (6)	Blunted and polished on distal surface	Used
Antler Pick (43)	Smoothed and polished on distal surface	Used
Birchbark Peeling Tool (11)	Distal end has striations proximal end polished	Re-sharpened
Bone Chisel (25)	Distal end has striations proximal end polished	Re-sharpened
Awl (23)	Distal end has striations over chipping	Re-sharpened
Awl (12/19a/22)	Distal end has striations over chipping	Re-sharpened
Bone Knife (47)	Distal end has striations proximal end polished	Re-sharpened
Antler Ladle (27)	Polish and smoothing over distal surface and handle	Used

15.3 Technological Analysis

A full technological analysis would require an examination of faunal waste at this and other campsites, and a comparison of the tools from the Victoria Day site

TABLE 15.2: Summary of all suggested activities and performance rating for those activities tested.

Artifact Description	Artifact Number	Activity	Performance	Explanation	Tested
Harpoon	Replica 1	Harpoon Pickerel	Poor	Poor hafting	Yes
Fish Spear	Replica 1	Spear Jackfish	Not rated		Yes
Fish Spear	Replica 2	Spear Suckers and Whitefish	Excellent		Yes
Antler Adze	Replica 1	Chop living Poplar Tree	Adequate	Poor hafting	Yes
Antler Chisel	Replica 1	Flesh moose hide	Inadequate	Material not suitable	Yes
Antler Pick	Replica 1	Chop hole in beaver lodge	Exceptional		Yes
Antler Pick	Replica 2	Chop hole in lake ice	Exceptional		Yes
Antler Birchbark Pealing tool	Replica 1	Peal Birchbark	Exceptional		Yes
Bone Chisel	Replica 1	Peal Spruce Roots	Exceptional		Yes
Bone Chisel	Replica 2	Split Birch Stave	Exceptional	Unlikely use	Yes
Bone Chisel	Replica 3	Collect Spruce Sap	Proficient		Yes
Bone Chisel	Replica 4	Flesh four muskrat pelts	Exceptional		Yes
Awl	Replica 1	Pierce Moose Leather	Exceptional		Yes
Awl	Replica 2	Pierce Birchbark	Exceptional		Yes
Awl	Replica 3	Pierce Birch Stave	Inadequate	Time consuming	Yes
Bone Knife	Replica 1	Scale 3 whitefish	Excellent		Yes
Antler Ladle	Replica 1	Scoop Ice from hole	Excellent		Yes
Antler Adze	N/A	Hide Fleshing Tool	N/A	Not tested - see Antler chisel replica 1	No
Antler Chisel	N/A	Ice Chisel	N/A	Not tested - see Antler pick replica 2	No
Antler Pick	N/A	Spear Large Game	N/A	Not tested	No
Antler Birchbark Pealing tool	N/A	Hide Fleshing Tool	N/A	Not tested - see Anter Chisel replica 1	No
Antler Ladle	N/A	Soup Ladle	N/A	Not tested	No
Antler Ladle	N/A	Collect Blood from body cavity of large game	N/A	Not tested	No

feature 2 with those associated with other burial and from non-burial contexts. Finally, one would have to compare the tools from this region to others regions, searching for similarities and differences and trying to interpret why these occur. Only after a full technological analysis can tool variation and cultural influences on tool production be understood. This research is a first step in this direction.

15.4 Archaeological Implications of the Study

15.4.1 Understanding the utility of skeletal elements

The artifacts from the Victoria Day site (feature 2) shed light on the relative values of the different portions of the animal being exploited during the Intensive Diversification Period. Zooarchaeologists generally calculate the value of anatomical elements of large game based on meat weight, marrow weight, and other utilitarian indices of nutritional value (Binford 1978; Metcalfe & Jones 1988). However, the possibility that some elements of an animal's body may have spiritual and/or other economic value in addition to their nutritional value is recognized (Binford 1978; Brightman 1993).

The results of this study provide archaeologists with supplementary information on the economic value of moose and caribou beyond their nutritional worth. For example, the use of moose and caribou metatarsals and vestigial metacarpals in the production of the tools suggests that these elements had additional economic value as raw materials. Although the absence of metatarsals from kill-sites in the boreal forest could be caused by the transport of elements for consumption at another site, it is also possible that they were removed for use in bone tool production. This information should be considered by zooarchaeologists interpreting the proportional representation of skeletal elements of moose and caribou in boreal forest sites.

Tool replication experiments proved useful when determining the types of tools used during the manufacture process. These tools include:

- Rodent incisors were used to carve bone and antler tools such as the pick, the chisel, and the harpoon heads.
- Lithic flakes were used to shape the harpoon heads, fish spear points, pick, chisel, birchbark peeling tool and the bone chisel.
- Potentially, a stone adze was used on an antler tool (the antler adze).

Therefore, it is suggested that the presence of these manufacturing tools in an archaeological context could be indicative of the production of bone and antler tools.

It is also important to consider that bone and antler blanks may be produced in one location while the final shaping of the tool can occur at a different location. This mirrors the creation of blanks suitable for transport common for lithic materials. Similar efficiencies should operate in the production of bone and antler tools (e.g., carrying an antler or entire metatarsal is inefficient). If the bone breaks during manufacture and the intended use required a long blank, the piece being worked will either be turned into another tool or discarded. One example exists in northern Manitoba where a bone handle blank was identified in association with the Nagami Bay burial (HgLt-1) (Brownlee and Syms 1999:31). Poor bone and antler preservation in the boreal forest may account for the limited identification of tool blanks recovered at campsites.

15.5 Activities and Tasks: the toolkits

15.5.1 Fishing Tool Kits

A number of tools can be attributed to functional categories or "tool kits" based on the results presented in Chapters 6 through 14 (summarized in Table 15.2). Fishing is the dominant activity represented in the Victoria Day site (feature 2) tool assemblage based on the presence of five harpoon heads and four fish spear points. Ethnographic and ethnoarchaeological data collected during this research demonstrate the importance of fishing for boreal forest groups in the recent past (see Chapter 6). Based on the experiments conducted in this research with harpoons and fish spears it is suggested that large fish were procured with harpoons while small fish were obtained with fish spears. This conclusion is based on tool performance (primarily how securely the barbed points hold the fish, a direct reflection of the width of the barbs). Because bone fish spear points hold the entire weight of a fish, larger fish cannot be secured through this method. Harpoon heads detach from the shaft and are used to retrieve a fish rather than hold the entire weight of a fish, allowing larger fish to be secured with this method. It is also possible that these tools were used in conjunction with a fish weir. The processing of fish upon capture was indicated by the recovery of a bone fish-scaling knife and an antler ladle, which can be included in this functional category or "toolkit" based on its presumed function as an ice scoop (Table 15.3).

TABLE 15.3: Original tools divided into tool kits based on the results of research.

Activities	Use	Tool(s)	Tested
Food Procurement	Fishing	Harpoons Heads	Yes
Food Procurement	Fishing	Fish Spear Points	Yes
Food Procurement	Hunting	Antler Pick (open beaver lodge)	Yes
Food Processing	Fishing	Bone Fish scaling knife	Yes
Food Processing	Fishing	Ladle (ice scoop)	Yes
Manufacturing	Wood Working	Adze	Yes
Manufacturing	Wood Working	Antler Chisel (Wedge?)	No
Manufacturing	Processing Spruce Root	Bone Chisel	Yes
Manufacturing	Pierce Birchbark	Awl	Yes
Manufacturing	Pierce Leather	Awl	Yes
Manufacturing	Flesh Pelts	Bone Chisel	Yes
Procurement	Birchbark	Peeling tool	Yes
Procurement	Spruce Gum	Bone Chisel	Yes
Procurement	Chop hole in lake ice (water)	Antler Pick	Yes

15.5.2 Other Tool Kits

Another activity carried out by people living in the boreal forest during the Intensive Diversification Period was the gathering and processing of wood and bark. The woodworking toolkits comprised of tools for the processing of spruce gum, woodworking tools, and tools identified for the collection and processing of birchbark (Table 15.2).

Birchbark is a versatile material that can be used for many purposes such as a covering for house structures and for the construction of baskets, plates, and canoes. Therefore, birchbark was a very important raw material for groups living in the boreal forest. It is best to collect birchbark in early spring (April to May) when the sap begins to flow. At this time, the bark is pliable and resists splitting. Later in the year, birchbark splits more easily and becomes difficult to work with, especially when it is bent and folded during the manufacture of baskets and canoes. However, birchbark can be collected at any time if the material is being used in flat sheets to cover a wigwam or a house structure. In addition, small patches of birch bark can be collected during ice free periods of the year in order to repair holes in a canoe.

The antler birchbark peeling tool (Table 15.2) is the first archaeologically recovered tool identified for this function in Manitoba. The bone chisel tool may also indicate the use of birchbark as raw material. This tool performed exceptionally well in the action of peeling spruce roots. Since spruce roots were threaded through birchbark to create baskets, canoes, and wigwam structures, the presence of this tool may have been a part of a birchbark manufacturing "tool kit". The thick awl could have been used to pierce birchbark during the manufacturing process.

The presence of other woodworking tools such as the adze and the antler chisel (wedge) may be indicative of the construction of wood items such as poles. Poles were often used for house structures, smoking racks, traps for larger animals such as bears, hide frames, and for finer work such as carving the wood ribs and gunwales for birchbark canoes (Marles *et al* 2000; Osgood 1970; Pettipas 1982; Thompson 1962).

Many archaeologists have suggested that canoes were a requirement for inhabitants of the boreal forest of Canada (Clark 1991:99; Mason 1981:136; Wright 1995:265). Poor preservation likely explains why no watercrafts have been recovered from the Intensive Diversification period (Shield Archaic) from the boreal forest. The recovery of the birchbark peeling tool, the likely spruce root peeling tool, the awl and woodworking tools from the Victoria Day burial (feature 2) supports the notion that birchbark canoes and baskets were produced during this time.

Items that do not belong to a particular toolkit include an awl, an antler pick, and a ladle. The thin awl from the Victoria Day tool assemblage could have been used for sewing leather. It is the only manufacturing tool that cannot be associated with a toolkit (as defined above). The antler pick may have been used to spear large game while animals are swimming. The ladle, which we have attributed to function as an ice scoop, could have also been used to collect blood from the cavity of the animal during processing.

It is important to understand that tools may have served different purposes during different seasons. For example, the bone chisel could have served to flesh pelts (late fall and winter activity) and peel spruce roots (Spring activity). The pick could have been used to chop holes through the ice during winter and procure beavers by piercing an opening through their lodges (Fall activity). The adze and chisel may have been used to produce sleds and snowshoes (Winter activity), poles for harpoons and fish spears (all year), and gunwales for canoes (Spring activity). The harpoons and fish spears could have been used during all seasons.

The identification of distinct toolkits based on functional categories is an important contribution of this thesis. Though the actual function for many tools could not be properly identified since the tools were re-sharpened, newly manufactured or exhibited minor wear it was still possible to evaluate the tasks carried out by the peoples of the boreal forest from a thorough analysis of each tool. Fishing was a major activity based on numerous fishing-related tools. Woodworking activities are also well represented based on the number of woodworking tools in the assemblage. While it is suggested that birchbark was used as a raw material, definitive proof is lacking as none of the tools identified as used to procure and process birchbark exhibit wear patterns and birchbark itself was not preserved.

15.6 Post Repatriation Analysis

This research analysed dental stone casts of archaeological material that had been repatriated. The demonstration that scientific research can be conducted on casts is an important contribution of this project. Most burial material recovered in Manitoba faces repatriation. It is therefore essential that the discipline respond by developing scholarly standards that enable research to continue following repatriation. This research has shown that scientific research can continue after reburial, only if proper documentation of artifacts has been completed.

15.7 Cultural Influences on Tool Production

It is only possible to determine the cultural influences on tool production once the production sequence is understood. If tool production is culturally transmitted, the identification of choices made in the past will help to establish cultural norms and/or preferences. This yields potentially valuable cultural information since existing chronologies for the boreal forest are based on very few artifact classes (e.g. projectile points and ceramics). The results presented in this research will facilitate such studies in the near future as they provides a basis for comparison with other toolkits and help us to better understand patterns of formal tool variation.

15.8 Hunting Strategies and Selection

This study demonstrates that it is inappropriate to identify resource use by examining each tool in isolation. Since nine items were associated with fishing and no hunting or red meat processing tools were found, no direct evidence for the utilization of large game is present in this assemblage. For clues to large game procurement during the Intensive Diversification Period one must examine the raw material used to create the bone and antler tools found with the Victoria Day Site Burial feature 2. Both moose (*Alces alces*) and caribou (*Rangifer tarandus*) bones and antler were used in the production of tools. The sample is biased in favour of males due to the large number of antler tools (n=6). Furthermore, the size of three harpoon heads (67A, 67C and 7, see Chapter 6) indicates that they may have been made from the metapodials of large moose, likely males. These details suggest that the procurement of large game for raw materials might have focused on large moose. While it is possible to obtain bones of moose year round, the mature antlers used for the tools could have only been obtained between September and January. Therefore, people of the Intensive Diversification most likely procured the raw materials for the production of antler tools during this time. An unfused vestigial metacarpal awl belonging to a sub-adult moose supports the use of a younger animal.

Caribou is represented in this sample by at least one adult male. It is suggested that barren ground caribou (*Rangifer tarandus*) were obtained based on the dimensions of harpoon head (artifact number: 30/36 see Chapter 6). This assumes that the average body sizes of present-day populations can be used to infer the average body size of caribou from the past. In summary, of all of the tools examined, a total of ten tools were identified as moose, four were identified as caribou, and four were either moose or caribou. The minimum number of individuals represented is not in itself informative since few items were clearly identified to species, side, age, and sex. It is possible that male moose had greater utility values for the boreal forest people due to the usefulness of their antlers in tool production, even though they also used the bones of younger adults. It is clear, however, that metapodials were valued for the production of harpoon heads and fish spear points.

15.9 Interpreting the Burial

The local environment and tools associated with the burial suggest a late spring or early summer season. The tools suggest subsistence focused on fish at the time of burial although large game hunting was required to obtain raw materials for tool production. Fish spear points and harpoon heads were manufactured specifically for burial. All other tools were re-sharpened or exhibited minor wear suggesting previous use indicating the items were taken out of circulation from the group. The question arises: why were so many tools recovered in association with this young individual? Was he or she a fisher during life, were the tools part of their tool kit or were these gifted from other members of the group. Unfortunately we will never know the story behind the tools. The recovery of three harpoon heads and one fish spear point in a tight bundle by the legs and arms of this individual suggest the tools were not hafted at the time of burial. The items were likely included for future use in the afterlife. By the time an individual reached 14 to 16 years old they would be functioning as an adult in many respects. Activities such as hunting and fishing would be second nature. The individual would also be involved in the manufacture of various tools such as harpoons and fish spears, birchbark canoes, and in obtaining raw material such as plants (berries, bark, wood, fiber), stone, and water. Since the majority of tools were identified as re-sharpened or had minor wear (10 of 18) rather than manufactured specifically as a burial item the tools associated with the burial did not require the creation of a large cache of tools as burial inclusions after the death of the individual. The tools do provide an excellent opportunity to examine the activities occurring at the time of death and therefore assisting in the identification of seasonality of death and burial. By viewing the tools in this perspective associated burial items reflect current activities. Had the burial occurred six months later a different assemblage of tools would be expected that reflect the activities of a different season.

16. Conclusions

This thesis, while accomplishing many of the goals stated in the introduction, also raised many new questions. Questions such as: the prevalence of bone and antler tools in the boreal forest, the potential for change in manufacturing techniques over time and cultural differences in this change, and the relationship between tools from this burial and other bone and antler caches. Answers to these questions lie in further research in the area using this study as a baseline. One goal initially stated for this research was to compare wear patterns on the original tools with tools used in the experiments. While wear pattern analysis was conducted on the experimental tools, many of the original tools were either re-sharpened prior to burial or manufactured specifically for burial (14 of 18 tools), eliminating the possibility of comparing use patterns. The research strategy was modified to accommodate this discovery and tool performance was evaluated as a means of testing potential tool functions suggested by reviews of the ethnographic and historical record and interviews with members of Nisichawayasihk Cree Nation. Data on burial customs from the middle Intensive Diversification Period (Middle Shield Archaic) are scarce. In Wright's (1995:286-294) summary of the Middle Shield Archaic there is little reference to burial practices. Most burials from the boreal forest contain only decomposed bone and enamel tooth caps, with associated tools that include copper items, chipped stone tools and red ochre. The situation in northern Manitoba offers the best insight into burial practices, although most burials are disturbed from flooding and scattered on the shorelines. The only other burial that is contemporaneous with the Victoria Day Site burial feature 2 is feature 1 (dating approximately 700 years earlier) from the same site although it was completely destroyed from erosion and very little contextual information was available. The remains were that of an adult female with red ochre, one bone harpoon head, rodent incisors and a round medicine stone. Neither the orientation of the human remains nor the burial type (primary versus secondary) could be determined. Three additional burials from the area are dated significantly earlier (approximately 2500 years earlier) than the ones from the Victoria Day Site. All are primary, extended with very few tools including one rodent incisor.

One of the essential components of this research was the involvement of the First Nation community in the development and design of the experimental component. Cree consultants suggested a range of activities that the tools could have been associated. The tools were then tested experimentally. This enabled the researcher to suggest functions for tools that were not immediately apparent on the basis of morphology alone. Establishing the production sequence for the tools was another goal of the research and proved vital in confirming or refining the initial faunal analysis of the tools. Research design was guided by agency theory and a heightened awareness of the importance of the decision-making process on tool production. Experimental archaeology and ethnoarchaeology were also applied to the research design. This research calls attention to the value of proper artifact documentation prior to reburial.

The process of replicating tools provides a unique opportunity to understand the practical limitations of both raw material and manufacturing techniques. One realizes the skill and expertise required to produce tools from fragile material such as bone, especially when manufacturing tools such as stone and rodent incisors are employed. It is clear from this experience in replicating tools that careful planning and foresight was required on behalf of the original toolmaker. The harpoon heads demonstrate the skill of the artisan and potentially also embody social values such as industrious, boldness and exactitude. Even through working with modern raw materials and modern tools the researcher became involved in a dialogue with the raw materials and the tools being created. Careful planning ensured the maximum length of the raw material was utilized without breaking the tool in the process. When one considers that tools were essential for survival, breaking a tool during manufacture would impact the ability to provide for the camp. If only four long harpoon heads could be manufactured from one moose, breaking one or two during manufacture will have a major impact on the group.

16.1 Research Framework

The research framework developed during this project may be useful for other archaeologists and is reviewed here:

- Replication of tools in original materials
- Interviews with local community members able to provide insights into contexts of use and tool function (ethnoarchaeology)
- Literature reviews to determine if past activities and similar tools are documented.
- Experiments with tool use in "real" world situations (experimental archaeology) to test suggested tool functions and establish production sequences for the tools.
- Wear pattern analysis on original and replicated tools (wear pattern analysis) as an extension of the testing.
- Results of the research are shared with as broad an audience as possible, in formats culturally relevant to the communities involved in the research.

The focus of this research was on bone and antler tools from a burial context. This same approach may be applied to materials from other contexts such as campsites (both stratified and un-stratified). Future research into production sequences for bone and antler tools should include full faunal analyses in these contexts in order to identify waste products and all of the stages of blank production hypothesized here through experimentation.

16.2 Limitations and Recommendations

Researchers trying to apply the proposed research framework in the Boreal forest face a number of limitations, while some can be overcome others cannot. These limitations include:

16.2.1. Taphonomy

Taphonomic conditions in the boreal forest involve the destruction of tools through exposure, freeze-thaw cycles, forest fires, acidic soils, and root etching. Limited root etching and alkaline clays caused only slight destruction of the tools examined in this research. The sample was chosen for study because of excellent preservation of the tool surfaces. The same cannot be said of bone and antler tools from most habitation sites in the boreal forest. Slow soil accumulation in the boreal forest results in tools being exposed to forest fires, acidic humus layer, scavengers and fluctuations in temperature and humidity. These post depositional factors limit the recovery of tools from ancient campsites, further reducing the likelihood of comparison with bone and antler tools from burial sites.

16.2.2 Sample Size

An inherent limitation of this research is that it focused on a small selection of artifacts dating to a specific time period in the past during the Intensive Diversification Period or Shield Archaic. While excellent time resolution is possible with the Victoria Day site, feature 2, as the burial represents a single cultural group, the same cannot be said for most collections from boreal forest sites. Throughout this study activities conducted by this individual and the group to which he belonged were identified or suggested. A larger sample size is now required to test these suggestions and see if they apply to a broader time frame. If more burials could be studied and linked together, generalizations about Shield Archaic (Intensive Diversification Period) lifeways might be established. Unfortunately, the sample size for these materials remains small.

16.2.3 Wear Pattern Analysis

Another limitation with this research was inherent in the sample available for wear pattern analysis. The primary difficulty in this research was that many of the tools in the burial were either re-sharpened or newly created (14 of 18 tools) obscuring wear patterns. A second difficulty is that several tools may have had many different functions. Hunter gathering groups often have technology that is multifunctional, minimizing the quantity of tools that have to be transported. Because hours are sometimes spent creating a tool it is unlikely that it will be discarded when the season changes. A more likely situation is that the tool will be used for a different purpose. This creates difficulties for wear pattern analysis since multiple uses will produce conflicting patterns or obscure earlier ones. Not all tools, therefore, are amenable to this kind of research.

16.2.4 Vinyl Molds

Limitations of this research include the use of vinyl molds and dental stone casts rather than original tools. No casting medium will capture polish from an original tool. Fortunate for this research detailed photographs of the original tool surface were taken before reburial allowing polish associated with use to be identified. While this research indicates that research can be conducted after reburial, wear pattern analyses should be conducted on original tools prior to burial. This should not take away from the importance of casting the tools as a permanent reference.

16.2.5 Interviews and Ethnohistoric research

Interviews and ethnohistoric research were an important component of this research. Interviews were used to identify contexts of use and potential tool functions. General questions proved to be the most informative (with less emphasis on the tools being examined). Often this approach led back to the tools during the discussion and insights were provided as to the context of tool use. Researchers attempting to duplicate this study should be diligent in selecting expert consultants from the community. Those individuals who still live off the land or had experience in the past living off the land make excellent consultants. The limitation of both the ethnohistoric research and interviews during this research was that insufficient time was allocated for these components. What this project has demonstrated is the importance of both these methods for future studies, particularly in providing insights into past resource use and subsistence strategies.

16.3 Concluding Remarks

The Victoria Day Site feature 2 burial sheds light on the importance of fishing to boreal forest groups. Because perishable materials are rarely preserved including wood, bone and antler, which are used to manufacture fishing equipment, fishing is under-represented. This research confirms that fishing was a primary food source for several boreal forest groups, supplemented with big game, small game and gathering (Lister 1998). This finding is also borne out by recent isotopic bone analyses when compared to Ens (1998).

This research also calls attention to the importance of bone and antler tools for people living in the boreal forest. Earlier impressions that groups in the boreal forest had a poorly developed bone and antler technology based on analysis of campsites excavations are shown to be incorrect (Mason 1981:136-139). It appears to be a preservation issue rather than a true absence of tools. Future avenues of research into the production sequences of bone and antler tools include investigating boreal forest sites that have excellent bone and antler preservation in order to identify archaeologically the production sequences reconstructed here through experimentation.

Finally, it is demonstrated that scientific research can be conducted on repatriated items if proper documentation is conducted including vinyl molds of the surface of tools and/or high quality photographs using a stereo-microscope at 7x magnification. Use-wear analyses should also be conducted on the original tools prior to burial.

The sample of artifacts examined in this thesis is a first step in placing artifacts into action, interpreting the items as parts of tool kits linked to activities, rather than isolated items. This research also demonstrates that evaluations of tool performance under experimental conditions can be used to test their hypothesized function.

The main outcome of this research was the development of a research framework that is multi-faceted and incorporates the perspectives of First Nation people. One of the benefits of taking the approach adopted here is that by experimenting with raw materials and considering the contexts of their use, sets of tools or raw materials rarely or never found archaeologically can be suggested to have been used, including birchbark, spruce roots, raw pelts, moose hide (raw and tanned), wood, spruce gum, and plant fiber. Archaeologists cannot begin to properly interpret the archaeological record without consideration of perishable materials such as these.

The analysis conducted during this research provides insight into the potential uses and functions of the tools from the Victoria Day Site burial (feature 2) based on experimental archaeology, ethnoarchaeology and historical research. This research also provides a context for the manufacture and use of the tools (see discussion above). The over arching theory applied during this stage of research was agency theory (see Chapter 3). Agency, as applied in this thesis, uses artifacts as a catalyst to understand activities, goals, and strategies practiced in the past (Robb 2001a, 2001b). This approach places the artifacts into a human frame of reference creating a narrative of the past, which was greatly improved by the insights provided by the community members.

It is hoped that this research has achieved social and cultural relevance while contributing to the academic understanding of life in the boreal forest during the Shield Archaic. By identifying projects, goals and objectives of past people a narrative can be created, one that can be appreciated by people outside the discipline of archaeology. In today's atmosphere of cost cutting and CRM work a huge amount of "Grey Literature" is created. It is time to revisit the goals and objectives of our discipline and strive for a product that is both academically sound and culturally and socially relevant.

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Appendix 1

Burial material not examined in the thesis

Un-Examined Material

Faunal

A number of the faunal materials recovered in association with the burial were not examined. One antler pin was recovered and is interpreted as the tip of a pressure flaking tool. While rodent incisors were tested in the experimental stage of research little attention was paid to the items recovered. Seven rodent incisors and two muskrat mandibles were identified all were modified from use and interpreted as incising or carving tools. Based on the experimental stage of research it was determined that these tools were used to incise and carve the antler and bone tools. The modification on the distal edges of the incisors was used to divide the sample into two groups. The first category is those incisors used as gouges with wear concentrated on the distal end (Field numbers 26, 46, 50 and 21). One of the incisors is from the lower jaw of a beaver, two incisors are from the upper jaw of a beaver and one incisor comes from the upper jaw of a porcupine. The muskrat jaws were also used in the same manner with wear on the distal end of the incisor, although the incisors were attached to the mandible (Field number 10, 44 and 77). The second category includes those incisors, which have been used on the lateral edge of the incisor, producing a very steep edge. Three teeth are included in this second category and all vary in size (Field number 40, 4 and 20). One of these incisors is made from the lower jaw of a beaver, the next incisor comes from the lower jaw of a porcupine or beaver and the last incisor is made from the upper jaw of a porcupine.

One miniature harpoon was recovered manufactured from antler (field number 13, 37). Two small bones were recovered identified as loon ulna with the proximal and distal ends removed (Field number 78; 28). These may have been used as tube beads. Four bird beaks were recovered from the burial (Field numbers 57A, B, C and 82). Two of the bird beaks have been identified as merganser, a fish duck. The other two beaks are from a medium sized bird, possibly a merganser.

Three pieces of large mammal bone were recovered during the excavation, which do not seem to have been made into finished tools, all varying in degree of modification. The first was a fragment of a harpoon preform carved from a moose long bone (field number 52). The second bone was less modified and was interpreted as a bone blank, made from either a moose or caribou bone (Field number 48). The bone was modified initially by flaking or breaking this bone and finishing off by carving the edges (Peach 1997). The third bone was minimally modified, and was made from a splinter of bone from a moose tibia (Field number 45). The bone was broken and slightly carved (Peach 1997).

A single shell was recovered with this individual (Field number 8). It was only half of a clam shell or bivalve, identified as a Fat Mucket and is locally available from the lakes (Brian McKillop Personal communication 1997). This item was in very poor condition when recovered, broken and disintegrating. Because of the poor condition it was recovered it is impossible to determine if it was modified prior to the burial.

Lithics

None of the lithic tools were examined during the research. One tool was identified as a whetstone manufactured from Basalt. Its morphology is tear dropped shape in dorsal profile with the ventral surface ground and polished flat (203.1 grams).

The dorsal surface is flaked with slight polish on high areas. Because none of the bone or antler tools were ground during manufacture the whetstone may have been used to grind red ochre that it found in association with. Another stone item was identified as either a flake or an expedient anvil manufactured from basalt based on pecking present on the flat surface (95.9 grams). Two flakes were recovered, one quartz the other a gray chert neither was utilized. The last lithic item recovered was a piece of pyrite (29.2 grams).

Two other lithic samples were recovered; the first was a lens of crushed hematite (red ochre) near the skull of the individual measuring 1.5 cm thick and measured 32cm by 11cm (274.7 grams). Although the container it was placed in had long since deteriorated definite corners were identified during the excavation it was rectangular in form. The other sample was limonite (yellow ochre) recovered in a number of pieces, all under 20 mm in diameter (113.7 grams). The limonite was recovered between the legs of the individual. Both red ochre and yellow ocher are interpreted as pigment used for painting.

Appendix 2

Recording form and Key used in thesis

Artifact

Raw material type

Time Interval

Task

Polish Location

Striation Isolated Location

Striations Parallel Location

Striations Group Location

Micro Pitting Location

Flake Scar Location

Rodent Gnawing Location

Cracking Location

Battering or Crushing Location

Fracturing Location

Groove Location

Modern Manufacturing Marks

Key to recording form

Introduction

The following provides strict guidelines on how the data recording form will be completed. The data recording form was developed by Brownlee to ensure consistency when recording manufacturing marks and wear patterns on tools. Dr. Hedi Katz informed Brownlee that the greatest amount of information pertaining to wear patterns is observed under a stereoscope at the lower end of magnification (Hedi Katz pers. comm.). Therefore, no more than 15 times magnification will be used under the stereoscope in this study to examine the manufacturing marks and wear patterns produced on the tools.

A form will be completed on each original tool using Kate Peach's report on the faunal material and photographs. This information will be supplemented with an examination of dental stone casts taken from3M Express Vinyl Polysiloxane Impression Material moulds taken from the original tools. The stone dental casts will be photographed and examined using the Olympus SZX12 stereoscope (7 to 90 magnification).

Before the experimental component of this thesis begins each tool will be photographed using the Olympus C3030 Zoom, which has a 1/1.8" CCD and 3,340,000 pixels resolution. This camera will be attached to the Olympus SZX12 stereoscope (7 to 90 magnification) to record the surface of the replicated tools at 7 times magnification. A score sheet will be completed for each tool based on the results of macroscopic observation and analysis using the stereoscope at 7 to 15 times magnification. This will allow the researcher to distinguish between manufacturing marks and wear patterns produced in the experiments.

During the field testing program, examination of the wear patterns will occur at predetermined intervals. These intervals will be devised separately for each tool and activity. If a tool begins to wear considerably before the predetermined task is completed a new time period may be developed in the field.

Because experimentation of tools will occur in remote regions in northern Manitoba the stereoscope cannot be used. Only a macroscopic analysis will be conducted, with the aid of a magnifying glass. Once the experimental component of this thesis is completed another data sheet will be completed using the Olympus C3030 Zoom attached to the Olympus SZX12 stereoscope. Each replica will have multiple data sheets recording the results of manufacture and wear throughout the testing program.

Artifact

Record the artifact description (tool type) with the corresponding artifact or replica number (i.e. Harpoon replica 1). Describe the proximal, distal, lateral, medial, ventral and dorsal side of the tool to provide consistency when recording wears patterns, this will be facilitated through illustrations and photographs, labelled with the appropriate descriptor. Always use the orientation of the tool itself: the distal end refers to the working edge of a tool.

Raw material type

Record the raw material type used in replication or faunal identification of the original tool including element and species (e.g., harpoon made from a right moose metatarsal, medial side using the entire length of the diaphysis). Record the species, age and sex of the material used in the replication process, if known (i.e. metatarsal from a female moose two to four years old.

Time Interval

Record Not Applicable (N/A) if describing an original artifact. If recording wear patterns on a replica the time interval must be recorded from when the tool began to be used. Each time interval will be recorded on a separate data sheet.

Task

Record the action(s) performed with the artifact using a standard protocol. Each task will be thoroughly described before being performed, for example, recording the outside temperature, type of wood being chopped, date and season, and time of day. Record the type of action the task requires, (i.e., force will be applied through the longitudinal axis of the artifact, repetitive blows will be used to chop holes in the ice). Terms for describing the action: chopping motion, prying motion, wedging motion, drawing motion (drag across a surface), pushing motion, and circular motion. (E.g., to harpoon a fish a quick even thrust with significant force is required applied through the longitudinal axis of the harpoon and shaft).

Polish Location

Polish is present when the bone exhibits gloss, sheen or has a shiny appearance under indirect (angled) light viewed either macroscopically or microscopically. Record the location of polish on the tool relative to the proximal, distal, lateral, medial, ventral and dorsal side of the tool as defined above. Terminology:

No polish - matte surface

Slight polish - some smoothing of surface, little or no gloss

Medium polish - considerable surface smoothing; some gloss

Heavy polish - major surface modification; high gloss

Striation Type

There are two possible types of striation:

Deep Striae are defined as deep striations are clearly visible macroscopically.

Fine Striae are defined as shallow striations only visible under a stereoscope at 7 to 15 times magnification.

Striations may be the result of manufacture or wear/use. Striations are defined as thin or narrow scratches (very shallow) on the surface of the tool or on the walls of larger grooves. Record their orientation relative to the distal (working) surface(s) of the tool. Manufacturing striae will be recorded once at time interval – minute 0.

Striation Isolated Location

If an isolated striae is located on the tool record its presence under this heading. Record the location, direction and nature of the striae (either deep or fine), and length of the striation in relation to the proximal, distal, lateral, medial, ventral and dorsal side of the tool as defined above.

Striations Parallel Location

If more than one striation is identified parallel to one another then record their presence under this heading. Count and measure the maximum length of the striations. Record the location, direction and nature of the striae (either deep or fine), in relation to the proximal, distal, lateral, medial, ventral and dorsal side of the tool as defined above.

Striations Group Location

If numerous randomly oriented striae are present, record their presence under this heading. Record the location, direction and nature of the striae (either deep or fine), of striations in relation to the proximal, distal, lateral, medial, ventral and dorsal side of the tool as defined above and their varying orientations as well as maximum length.

Micro Pitting Location

Micro pitting is a weathering phenomenon and may be the result of gastric juices, root etching, or exfoliation form acidic soils. This heading will be used to describe micro pitting on original artifacts. The replicated tools are not expected to have this type of wear pattern since the tools will not be left in environments that will deteriorate the surface. Micro pitting may be visible macroscopically as rough areas on the surface of the tool. The micro pits are more clearly observed using a stereoscope. The micro pits will appear as an interruption of the normal surface finish of the tool. Micro pits have rounded corners and are randomly distributed on the tool. If this type of weathering occurs on the surface of the replicated tools the same recording procedure will be applied. Comparison of photographs taken before and after the experimental stage of this project will assist in identifying micro pitting. Record the location and orientation of micro pitting in relation to the proximal, distal, lateral, medial, ventral and dorsal side of the tool as defined above.

Flake Scar Location

A flake scar is defined as an area where a flake or chip has been removed from the tool either intentionally or unintentionally. Flake scars are expected at the edges of a tool a result of manufacture, use or of post-depositional damage. The negative impression of a bulb of percussion may be present depending on the properties of the raw material and will be noted. The direction of a flake scar denotes the direction from which a blow was applied to the material. Flake scars are different than crushing or battering that may be the result of steady pressure (see battering/crushing location section). The normal surface of the tool will be interrupted by a depression in which "ripple" scars may be visible. Record the location and number of flake scar(s) and their orientation (what direction did the blow come from in relation to the proximal, distal, lateral, medial, ventral and dorsal side of the tool as defined above.

Rodent Gnawing Location

Gnawing may be the result of either rodent or canid activity. None of the tools in this study have evidence of carnivore gnawing. Rodent gnawing is identified on some of the tools and is described as parallel grooves or striations, located on the edge of a tool, wavy in appearance.

N/A - no gnawing, intact surface

Light - light rodent gnaw marks (less than 1 cm in width)

Medium - medium rodent gnaw marks (1 – 2 cm in width)

Heavy - heavy rodent gnaw marks (2 + cm in width)

Record the location of rodent gnawing in relation to the proximal, distal, lateral, medial, ventral and dorsal side of the tool as defined above.

Cracking Location

If cracks appear in the tool during manufacture or use, or as a result of weathering action, record their presence under this heading. Cracks may appear although the tool remains intact. Record the location, length and orientation (esp. in relation to bone laminae) of the cracking in relation to the proximal, distal, lateral, medial, ventral and dorsal side of the tool as defined above. In addition to the location, note when these appear based on the time intervals and the speed and direction in which cracks propagate.

Battering or Crushing Location

If the tool receives trauma from use record the presence under this heading, excluding flake scars. Types of trauma include battering where the edge appears to have been hit repeatedly perhaps causing pits. An edge of a tool may become crushed and/or distorted during use, and will be recorded (i.e. distal end of the ice chisel has been crushed and deformed although not broken – note orientation of the distortion and the direction of the pressure). Record the location, orientation of battering or crushing in relation to the proximal, distal, lateral, medial, ventral and dorsal side of the tool as defined above. Indicate if battering or crushing occurs in association with flake scars.

Fracturing Location

If a tool breaks the type of fracture and the location of the fracture is recorded. Record the length of time required to break the tool (i.e. 8 minutes of use resulted in the tool breaking in a spiral fracture). Collect as many of the broken fragments of the tool as possible. Note if the break occurred along a crack previously identified. Record length of the break and orientation (esp. in relation to bone laminae) in relation to the proximal, distal, lateral, medial, ventral and dorsal side of the tool as defined above. The types of fractures include the following:

- **Hinge Fracture:** The broken edge has a step appearance, one side protruding more than the other with a smooth curved cross section not at a 90° angle.
- **Spiral Fracture:** The broken edge twists and spirals, with a smooth surface.
- **Transverse Fracture:** Broken edge is smooth and perpendicular to the axis of the

tool.

- **Oblique Fracture:** broken edge is smooth and oblique to the axis of the tool.
- **Longitudinal Fracture:** broken surface is oriented along the longitudinal surface.

Step or Columnar Fracture: broken surface has multiple hinge fractures, alternating from longitudinally to transverse orientation many 90° angles.

Splintered Fracture: broken surface is uneven and jagged.

Groove Location

Grooves are wider and deeper than a striation; grooves may have microscopic or macroscopic striations within them. Record the location, depth and orientation of a groove in relation to the proximal, distal, lateral, medial, ventral and dorsal side of the tool as defined above. Note the presence/absence of deep or fine striae within the groove. If striae are identified record the location and orientation in relation to the groove (i.e. parallel to the groove or perpendicular to the groove).

Modern Manufacturing Marks

Marks from modern tools used in manufacturing may be present on the surface of the replica tools. The presence of manufacturing marks from modern tools must be recorded prior to experimental activities at time interval - minute 0. (i.e. 8 cm from the proximal end of the tool on the dorsal surface three parallel striations are present caused by a modern file, subsequent refinishing could not eliminate these striations without jeopardising the thickness of the tool).

Appendix 3

Consent Form

Consent Form

Research Project:
Ethnoarchaeology and Experimental Archaeology: Socially relevant techniques of archaeological interpretation.

Researcher:
Kevin Brownlee

This consent form will provide you with a basic understanding of this research project and details on your involvement in this study. Please ensure that you take the time to read this form carefully. A copy of this form will be left with you for your records and reference. If you require more detailed information mentioned in this form or on any aspect of this project, please feel free to ask.

Please accept this tobacco as a gift for your participation in this study. It serves to honour the knowledge that you carry and the time that you have taken to share it with me during this interview.

This project has been developed around a set of bone and antler tools found at an archaeological site near the community of Nelson House. The tools were part of a burial that was reburied in the community of Nelson House in 1997. My project involves an attempt to understand how the tools were used during the past. I have produced a number of bone and antler tools made from moose and caribou that I have obtained while hunting in northern Manitoba. I will test these tools on various activities. I hope that you may provide guidance in suggesting what activities the tools may have been used for. I hope to learn about the activities people do during different times of the year. I will show you the tools that I have made and ask for your expertise on how they may have been used.

I will not use any electronic recording devices and I will only record the information that you share with me in writing.

You may choose to do the following regarding any information that you share with me:
- You may request that your name is not written in the thesis.
- You may choose to have your name written down as an advisor although the information you share is not associated with your name specifically.
- You may choose to have your name written down each time the information you share is used.
- You may choose to remove your name from anything that you feel uncomfortable sharing with me.
- If you share information for my benefit that is not to be shared with others, I will not write it down or include it in this thesis.

Before I leave this interview, I will read through what you have told me to ensure that the information is accurate and that you want to have the information included in the project.

The information that I receive during this project will be incorporated into my Masters thesis. I hope to have my thesis published upon completion so that youth can learn about the great accomplishments of our ancestors. Our heritage is very important and this is why I hope to publish the thesis. I may use your picture in the thesis and book if you consent to doing so. I will also include your information in the book so that future generations can learn about how you have helped in this understanding of the past.

Your signature on this form indicates you have understood to your satisfaction the information regarding your participation in this research project and that you agree to participate as a subject. In no way does this waive your legal rights nor release the researchers, sponsors, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time, and/or refrain from answering questions you prefer to omit, without prejudice or consequence. Your continued participation should be as informed as your initial consent, so you should feel free to ask for clarification or new information throughout your participation.

You can phone me (Kevin Brownlee) at ***-**** for any additional information and I will keep you informed as to the progress of the project.

This research has been approved by the Joint-Faculty Research Ethics Board (REB). If you have any concerns or complaints about this project you may contact any of the above named persons or the Human Ethics Secretariat at 474-7122. A copy of this consent form has been given to you for your records and reference.

Participant's Signature　　　　　　　　　　　　Date

Researcher and or Delegate's Signature　　　　　　　　　　　　Date

Appendix 4

Production sequence for Replicated tools

Replicated Bone Harpoon Head Production Sequence

The metatarsals were cut with a hacksaw longitudinally. The blank was carved using files roughing out the general shape. The ventral surface was carved flat, and leaving the dorsal surface convex in profile. The final stage of manufacture was the addition of barbs. Barbs were added using a small triangular file carving on both the dorsal and ventral surface slightly undercutting the lateral edge. The surface of the fish spears was smoothed with a fine 500 grit sandpaper. The file marks could not be removed from the inner surface of the barbs, without breaking the barbs.

At the Rust River camp one 7 foot tamarack pole was cut and pealed. Keith Anderson suggested tamarack for the poles, as it is strong and durable. The thick end of the pole was drilled to a depth of 40 mm to hold the bone harpoon. Moose rawhide was soaked in water and tied around the pole to prevent the pole from splitting. A metal cable was secured to the harpoon through the line hole. The harpoon was wedged into the hole, and was held by the lateral edges. Nylon rope was attached to the metal cable and secured to the pole, 15 feet of nylon line was held in the hand of the researcher to retrieve the fish following harpooning.

Replicated Bone Fish Spear Point Production Sequence

The same process was used to manufacture both replica fish spears. The metatarsals were cut with a hacksaw longitudinally producing two blanks. The blanks were then carved using files roughing out the general shape. The ventral surface was carved flat, and leaving the dorsal surface convex in profile. The final stage of manufacture was the addition of barbs. Barbs were added using a small triangular file carving on both the dorsal and ventral surface slightly undercutting the lateral edge. Replica 1 had the bards on the left lateral side and Replica 2 had the barbs on the right lateral side. The surface of the fish spears was smoothed with a fine 500 grit sandpaper. The file marks could not be removed from the inner surface of the barbs (Figure 6.21).

At the Rust River camp two 5 foot tamarack poles were cut and pealed. Keith Anderson suggested tamarack for the poles, as it is strong and durable. The thick end of the pole was drilled to a depth of 50 mm to insert the bone fish spear. A plano-convex piece of tamarack was inserted into the hole wedging the fish spear tightly into the end of the pole. Moose rawhide was soaked in water and tied around the pole to secure the fish spear in place and prevent the pole from splitting.

Replicated Antler Adze Production Sequence

A large shed antler was chosen to make the tool. A section near the base of the palmate was chosen that was both thick enough and relatively flat in profile, similar to original tool. It was cut using a hand held hacksaw to duplicate the general shape of the tool. Shaping the tool was accomplished by using a wood rasp followed by a finer metal file. The lateral sides had exposed spongy antler material and both the dorsal and ventral surfaces were dense antler, identical to the original tool.

A paper birch tree was cut down and a portion of the trunk with a branch protruding was selected for the handle. The length of the handle was 326 mm. The branch was cut flat to rest the ventral side of the adze on the surface at a 30° angle. Moose rawhide lacing was soaked in water to make the lacing pliable and used to attach the adze to the handle. The antler blade rests perpendicular to the handle. When the rawhide lacing dried it shrank securing the antler adze to the handle.

Replicated Antler Chisel Production Sequence

This tool was reproduced from a shed moose antler collected in March from a camp on the Gauer River, east of Southern Indian Lake. A wide round tine was used for the reproduction. Extra length was given to the tool by carving into the palate portion of the antler. The blank used to make this tool was cut using a hand held hacksaw to obtain the appropriate length and split the antler into two pieces. Once the blank was created it was carved into final shape using progressively finer files, duplicating the working edge of the original tool.

Replicated Antler Pick #1 Production Sequence

A large tine was selected from a moose antler. Cutting into the palmate section of the moose antler created a tool blank using a hacksaw. The tip of the tine was removed to reproduce the length and curvature of original tool. The palmate section of the antler was sawn longitudinally to reproduce the thickness of the working edge of the tool. The ventral surface is mostly composed of the interior spongy portion of antler. The dorsal surface is the exterior of the moose antler and entirely dense antler. The distal end of the tine represents the proximal end of the tool. The proximal end was left round in cross section to facilitate hafting into a hole drilled into the tamarack pole. Grinding the tool into shape was accomplished by using many types of files. Initial roughing out was done using a wood rasp followed by finer files to finish the surface.

A small living tamarak was selected for the pole 10 feet tall. The tip of the tree was removed leaving a 7 foot pole and the bark was removed. The thick end (base of the tree) was drilled using a 1 inch drill bit to a depth of 60 mm. The antler pick was inserted into the hole and secured with moose rawhide.

Replicated Antler Pick #2 Production Sequence

A large tine was selected from a moose antler. The tool blank was created by cutting into the surface of the palmate section of the antler. Subsequent to the production of the first replica it was determined that the orientation of the tool was opposite. The distal end of the tine should have been used as the distal end of the tool, rather than the proximal end. The second replica was produced using the distal end of the tool as the distal end of the antler tine. The palmate end of the blank was used as the proximal end of the tool. The tine was removed to reproduce the length and shape of the original tool. The blank was carved dry initially using a metal wood rasp, flowed by finer metal files.

The same tamarak pole was used in this experiment as replica 1. The butt end of the pole was cut to remove the replica 1 and the hole drilled into the surface. Due to the poor performance of the first hafting technique a second type was devised based on Osgoods (1970: 221-222) description of how an ice chisel is hafted. This involves chiseling out one side of the butt end of the pole removing half of the diameter to a total length of 150 mm. The ventral (flat) side of the antler pick was placed against the pole and the dorsal surface (rounded) exposed. Moose rawhide was then wrapped from 30mm below the area removed to keep the pole from splitting to 20mm beyond the pole and tied. A total of 156 mm of the tool was adjacent to the poll and the distal 75 mm of the tool extended beyond the pole and lacing.

Replicated Birchbark Peeling Tool Production Sequence

The left antler was chosen to produce the tool. A long tine, circular in cross section with a similar curve to the original tool was chosen. The dorsal surface was carved using a wood rasp, leaving a slight flare on the left edge. The ventral surface was carved to produce a relatively flat surface. The working edge was filed to produce an asymmetrical edge.

Replicated Bone Chisel Tool Production Sequence

The outer surface of the element was cleaned in the field, and the element cut in half down the lateral plane to remove the marrow. The metatarsal element was chosen to replicate this tool based on the flat straight surface and the thickness of the bone, similar to the observed characteristics of the original tool. All four replicas were produced from a single element to eliminate any sources of variation in density and durability.

A bone blank was created from the lateral surface of the element. It was cut using a hand held hacksaw and ground into shape using a variety of files. The bone was used fresh and not soaked or softened in any way. The bone was naturally greasy and no attempt was made to eliminate the grease from the bone. Once the thickness was reproduced the bone blank was cut into four equal sections

Two of the tools (Replica 1 and 3) used the anatomical distal end of the element and two (replica 2 and 4) used the proximal end. It was impossible to determine what side of the element was used for the working edge of the original tool or if the orientation mattered in use, either culturally or technologically.

Replicated Bone Awls Production Sequence

All the awls were manufactured in the same fashion by carving the surface with files. Minimal modification of the working edge of replica 1 (Figure 12.5), more modification on replica 2 (Figure 12.6) and 3 (Figure 12.7) were required.

Replicated Bone Knife Production Sequence

A relatively flat section of a moose rib was chosen for the replicated tool. Filing both the dorsal and ventral surface on the distal right lateral edge produced a sharp cutting edge (caudal edge of the rib).

Replicated Antler Ladle Production Sequence

A small palmate moose antler was chosen to reproduce the tool. One small tine extended from the edge of the palmate and it was carved into the handle. The blank was cut from the palmate with a hacksaw. Once removed the lateral edges were shaped to reproduce the morphology of the original ladle. The ventral side of the ladle was smoothed by filing. Once the shape of the tool was reproduced the interior was removed. This was accomplished by using a wood chisel. The antler was soaked in water overnight and carved, while carving was improved by the soaking, hours were spent carving the inner surface. Care was required to ensure the bottom of the ladle was not carved through completely.