Wanuskewin Heritage Park and the Concept of Resource Patches, Ecological Islands, and Special Places on the Northern Plains

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Abstract

The Wolf Willow site (FbNp-26) is a multicomponent Precontact site located within the confines of Wanuskewin Heritage Park approximately 2 km north of the city of Saskatoon Saskatchewan. The site was excavated during 2010 and 2011 field seasons with the participation of The University of Saskatchewan's archaeological field school and the Saskatchewan Archaeological Society's field school. As a result of these excavations, 30 m^2 were exposed and four distinct cultural levels were identified. These include the Plains Side-Notched complex, Prairie Side-Notched complex, McKean series, and Oxbow complex cultures. An analysis of artifacts, ecofacts, and features from each cultural level was undertaken in order to determine site usage for each time period.

Ecological concepts are often used as heuristic devices in archeological studies. The theory of island biogeography and the study of patch dynamics are two concepts that can lend themselves to the archeological study of past human groups. Island biogeography was developed to explain speciation in insular environments. In archeological studies, the same mechanisms affecting speciation can be employed to study the development of culture. Patch dynamics can be used to hypothesize how resource availability affected the behavior of past populations. Using the aforementioned concepts, the Wanuskewin/Opimihaw Valley area can be viewed as a terrestrial island. The unique combination of resources both tangible and intangible combined to make the area a draw for Precontact populations for the past 6000 years. Wanuskewin continues to attract people from around the world as a centre of spiritual and cultural renewal, a world class tourism destination, and an educational facility.

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Chapter 1

Introduction

1.1 Introduction

The Wolf Willow site is situated within the confines of Wanuskewin Heritage Park which is located approximately 2 km north of the city of Saskatoon, Saskatchewan. Archaeologists have been aware of the archaeological resources within the area now known as Wanuskewin since the 1930s. In the early 1980s, Dr. Ernie Walker of the Department of Anthropology and Archaeology (as it was then known) at the University of Saskatchewan was commissioned by the Meewasin Valley Authority to conduct an archaeological survey of the area. The survey process revealed 21 archaeological sites, two historical and 19 precontact. Wanuskewin Heritage Park became a Provincial Heritage Property in 1983, and in 1987, HRH Queen Elizabeth II declared it a National Historic Site. In 1992, an Interpretive Centre and walking trails were opened to the public. Wanuskewin's archaeological significance stems from the fact that it was repeatedly visited by virtually every Middle to Late Precontact cultural group recognized in the Northern Plains culture area. The result is a remarkably complete and intact archaeological record reaching back some 6,000 years.

The Wolf Willow site (FbNp-26) is the ninth archaeological site to undergo excavation at Wanuskewin Heritage Park. Previously excavated sites include: the Tipperary Creek site (FbNp-1); Meewasin; (FbNp-9); Redtail; (FbNp-10); Newo Asiniak (FbNp-16); Amisk (FbNp-17); Cut Arm (FbNp-22); Thundercloud (FbNp-25); and Dog Child (FbNp-24). The Wolf Willow site is a multicomponent site with four archaeological levels associated with four different cultural complexes. The site was excavated during the 2010 and 2011 field seasons, which are the focus of this thesis. The occupation levels include numerous diagnostic artifacts related to the Plains Side-Notched, Prairie Side-Notched, McKean, and Oxbow cultural groups. Excavations have continued at the Wolf Willow site to the present times and are the focus of other research initiatives in geoarchaeology and site formation processes as well as spatial analysis of artifacts and features over a 100 m^2 excavation block.

Thesis Objectives

Through the analysis of artifacts recovered from the Wolf Willow site, several objectives will be addressed. These can be summarized as follows:

1. Analyzing and describing artifacts, features, and ecofacts (i.e. organic materials that have archaeological significance) recovered from the Wolf Willow site in order to determine the nature of the site itself.
2. Determining the cultural sequence of the Wolf Willow site.
3. Determining the number and types of faunal taxa present in each level.
4. Identifying activity areas and interpreting seasonality and subsistence patterns when possible to understand temporal patterns of site use.
5. Examining the history of human use of Wanuskewin in terms of the area's biological, cultural, and spiritual significance.
6. Proposing how the recovered material at Wolf Willow contribute to the existing body of scholarly research at Wanuskewin to explain the intensity and consistency of human occupation of the area.
7. Determining Wanuskewin's eligibility for the status of "terrestrial island" based on archaeological recoveries and human use of the locale.

It is hoped that this study will add to the larger body of research involving Wanuskewin Heritage Park in order to expand our understanding of the archaeological sequence and the history of human/environmental interactions on the Northern Plains. By applying the theoretical concepts of "terrestrial islands" and "resource patches" to the archaeological data gathered at Wanuskewin, the role of Opimihaw Valley in the subsistence and settlement choices of past populations can be better understood.

1.3 Thesis Organization

This thesis commences with an overview of the site locale in Chapter 2 including the geological, geographical, climatic, and biological context of the Wolf Willow site. Chapter 3 provides a cultural chronology of the Northern Plains area from the Early Precontact period to the historic period. The methodology, excavation techniques, laboratory procedures, and analytical processes are outlined in Chapter 4. Chapters 5 through 9 examine the archaeological assemblages associated with each cultural level. Level C1 is discussed in Chapter 5, Level C2 in Chapter 6, Level C3 in Chapter 7, Level C4 in Chapter 8, and Level 5 in Chapter 9. Chapter 10 examines the concept of “terrestrial islands” in terms of their utility in describing and identifying areas of unique ecological, social, cultural, and spiritual significance relating to archaeological sites. Chapter 11 summarizes the conclusions regarding the Wolf Willow site and Wanuskewin’s status as a terrestrial island and incorporates some suggestions for future research initiatives.

Chapter 2

The Biophysical Environment of the Wolf Willow Site

2.1 History of the Study Area

In 1903, the land surrounding the Opimihaw Valley was homesteaded by the Penner family whose descendants still reside in the immediate vicinity. The late Mike Vitkowski was the most recent owner of the land. Mr. Vitkowski was very aware of the cultural and natural heritage of the Opimihaw valley and when the time came for him to sell the property, he enlisted the help of other concerned individuals in the hope that the land would be entrusted to an organization whose goal would include the preservation of the area for future generations (Walker 1983).

The Opimihaw Creek area has been known to amateur and professional archaeologists alike since approximately 1930. The Saskatoon Archaeological Society visited the area numerous times during the 1930s and 1940s with the site being officially recorded in 1959 by the newly established Saskatchewan Government's archaeological office (Derek Murray Consulting Associates 1985).

Tipperary Creek, as Opimihaw was formerly known, was investigated in 1978 as part of the Saskatoon Municipal Archaeological survey conducted for the preparation of the Meewasin Valley Authority Master Plan. In 1982 and 1983, Dr. Ernie Walker carried out a detailed assessment of the area and uncovered 19 precontact and two historical archaeological sites (Walker 1988:76) The Province of Saskatchewan designated Wanuskewin Heritage Park a Provincial Heritage Property in 1983 and Wanuskewin received National Historic Site designation in 1987 (Walker 1988:77). In 1992, the Wanuskewin Heritage Park Interpretive Centre was opened with a mandate that included archaeological research, tourism, and education. On August 27, 1993, the name of the creek was officially changed from Tipperary to Opimihaw. Opimihaw was the spiritual name of the late Senator Hilliard McNab which translates as "the one who flies". Senator McNab was instrumental in the development of Wanuskewin Heritage Park and the name change honors his many contributions.

2.2 Background

The study area is located within the Great Plains of North America. The Plains area is a complex mosaic of seasonally and geographically defined patches which varied through time subject to climatic and human influences. The Plains area does not correspond to any circumscribed physiographic, climatic, or biotic provinces (Wood 1998: 9). In general terms, it is bounded by the Gulf Coastal Plain, the Subarctic Boreal forests, the Rocky Mountains, and the mixed temperate grasslands and deciduous forests of the Prairie Peninsula (Kay 1996: 16). Wanuskewin Heritage Park is located within the subsection of the Great Plains known as the Northern Plains. This area consists of the most northerly section of grasslands which extends from the Rocky Mountains in the west to the woodlands in the east. The area includes North Dakota, South Dakota, parts of Wyoming and Montana east of the Continental Divide, and the portion of Canada that lies between the Saskatchewan River and the United States border (Hurt 1966: 101).

Wanuskewin Heritage Park is located two km north of the city of Saskatoon, Saskatchewan and occupies 63 hectares in the SW1/4 section 36 and SE1/4 section 35, Township 36, Range 5, West of the 3rd Meridian. Wanuskewin is situated within the physiographic region known as the Saskatchewan Rivers Plain at 52º 13’ N and 106° 35’ W (Walker 1988:77). The Opimihaw Creek area is a microcosm of the South Saskatchewan River (Moriyama 1979:37). The creek has cut a steeply sloped ravine with slopes of generally 15% to 30% (Figure 2.1). The valley where it joins the South Saskatchewan River is over 30 m deep (MVA 1994:19). This locale is important archaeologically because major occupational sites on the Northern Plains are often located in stream valleys (Reeves 1973: 1243).

Figure 2.1: Wolf Willow Site and East Valley Wall before Excavations Spring 2010

2.3 Geology

The Northern Great Plains are characterized by a variety of glacial landforms (Widdis 2006). The physiographic subsection typical of the study area is the Warman Plain, which consists of undulating, eroded till plains and gravelly glaciolacustrine plains. These uplands are deeply dissected by the South Saskatchewan River and its tributary Opimihaw Creek (Walker 1988:77).

The development of the Saskatchewan River valley spans five distinct phases of geological activity:

1. Glacial (20,000 BP) - presently represented by till comprising the Battleford formation;
2. Glacial Lacustrine (12,000 BP) - the formation of Glacial Lake Saskatchewan;
3. Glaciofluvial - erosional activity that led to the creation of the major landforms around Saskatoon;
4. Fluvial (7,000 BP) - decrease in discharge and major reduction in flow and the downcutting

of Opimihaw Creek;

5. Eolian - a phase of little importance to the Opimihaw Creek area (Walker 1992).

The glacial episode occurred when the Laurentide ice sheet advanced across the Opimihaw Creek area at circa 20,000 BP. The glacier persisted over the site for about 8,000 years before beginning its retreat. Proglacial lake basins and meltwater spillways formed as the Laurentide ice sheet retreated in a northeasterly direction down a steep isostatically created regional slope. This slope extended from the Continental Divide in Cypress Hills to sea level off the coast of Hudson Bay (Aitken 2000). During this retreat, a large glacial lake called Glacial Lake Saskatchewan was formed, covering most of the area around present day Saskatoon (Aitken 2002).

Many meltwater spillways began as shallow valleys containing braided stream channels. These valleys were entrenched deeply into the landscape during succeeding episodes of proglacial lake drainage and abandonment. During the deglaciation of Saskatoon and area, the South Saskatchewan River acted as a glacial spillway emptying into glacial Lake Saskatchewan, which flooded the area surrounding Saskatoon including the North and South Saskatchewan River Valleys (Rutherford 2004: 3). Once abandoned, the former spillways were occupied by non-glacial streams which now comprise the modern drainage network of Saskatchewan (Aitken 2000).

The South Saskatchewan River is geologically young, about 10,000 years old (Aitken 2002), and flows in a meandering pattern (Aitken 2000). Opimihaw Creek is a relic channel, a vestige of the time prior to 7,500 BP when the South Saskatchewan was a braided stream. The Opimihaw Creek channel was created mainly by postglacial meltwater (Walker 1983). Most postglacial landscape changes have involved prairie streams cutting down to the floors of the large meltwater valleys (Aitken 2000). Both depositional and incisional periods created the modern features of the Opimihaw Valley. Sometime during the past 100 to 200 years, the modern incision stage began and the Opimihaw Creek returned to downcutting. At present, the modern incision phase continues (Burt 1997: 180).

The Quaternary geology of the area includes alluvial deposits of gravel, sand, silt and clay, as well as slump material, on flood plains and terraces of modern day streams (Fung 1999:89). The depositional terraces of the Opimihaw Creek Valley were probably formed as a result of flooding of the South Saskatchewan River. When flooding occurs, the waters back up into the Opimihaw Valley which acts as a natural settling basin (The Land Plan Collaborative 1984:20).

Wanuskewin is included in the area occupied by the Dark Brown Soil Associations. These soils have a richer, darker color than the Brown associations because of their slightly higher organic content provided by the grassy vegetative covering. The Dark Brown Soils are transitional between the Brown and Black soil zones (Mitchell et al. 1944: 79-80). The dominant soil is dark brown Chernozemic with sandy loam texture (Fung 1999:130). A chernozem is any of a group of dark-colored zonal soils with a deep rich humus horizon found in regions of temperate to cool climate (Canada Department of Agriculture 1976:8). These soils have a dark colored A horizon and brownish colored B horizons underlain by light colored (grayish) horizons with lime carbonate accumulation (Fung 1999:130).

The glacial sediments in the Saskatoon area include tills belonging to the Sutherland and Saskatoon group. The Opimihaw Valley dissects tills of the Saskatoon group which include the Floral and Battleford formations. The Battleford Till is soft, massive and unstained and overlies the Floral formation, which is hard and jointed with yellowish brown and black staining (Simpson 2000). The soils on the two sides of the Opimihaw Valley are very different. The creek itself separates the area to the east, which has Battleford till exposed on the surface, from the area to the west, where a veneer of glacial lake sediments from Glacial Lake Saskatchewan has been deposited on top of the till. Four different soil types have been identified in the Opimihaw Creek Valley: dark brown chernozemic of the Bradwell Association, dark brown chernozemic of the Weyburn Association, Regisolic soils, and hillwash soils (Ellis and Stonehouse 1970). Bradwell Association soils form on loamy lacustrine materials and are usually stone free unless they are shallow (< 1 m thick) and underlain by glacial till or gravel, in which case some stones may be encountered (Saskatchewan Soil Survey 1991: 3). Bradwell Association soils occur on undulating landscapes with very gentle to gentle slopes and often occur in complex with soils of other associations (Mitchell et al. 1944: 80). Weyburn Association soils are developed on undifferentiated boulder clay (glacial till) deposits. Glacial stones and boulders are common features on the wavy relief of knolls, intermediate slopes and depressions associated with Weyburn soils (Mitchell et al.1944: 80). Regosolic soils have been encountered in some valley bottom and hillslope stratigraphic sequences at Wanuskewin Heritage Park.

Because soils require long periods of stability in order to develop, the slopes at Wanuskewin which are subject to mass wasting, may produce Regosols. The buried soils at Wanuskewin are therefore not necessarily Dark Brown Chernozems. They may be weakly developed Regisols with thin or no A horizons, no B horizons and often only a C horizon (Rutherford 2004: 6).

Coulee depressions along the Opimihaw Valley are generally composed of hillwash or colluvium. The terraces and point bars along the valley bottom are generally represented by alluvium (Walker 1988: 77). Hillwash or colluvium is a general term applied to any loose, heterogeneous, and incoherent mass of soil material and/or rock fragments deposited by rainwash, sheetwash, or slow, continuous downslope creep, which usually collects at the base of gentle slopes or hillsides (U.S. Geological Survey). Alluvium soils have variable textures and occur mainly on river and creek floodplains. Alluvium deposits consist of layers or strata of variable composition. The layers represent different types of alluvial material laid down by the stream at different points in time. Alternating layers of clay sand and silty deposits are common (Mitchell et al. 1940: 177).

2.4 Biophysical Environment

Ecoregions are determined based on land form and soil zone boundaries (Omernik 1987:118). Wanuskewin Heritage Park is located on the border between two distinct ecoregions, the Aspen Parkland and the Mixedgrass Prairie, and consequently incorporates features of both regions. Wanuskewin is situated at the northernmost extent of the Grassland ecoregion which occupies about 27% of Saskatchewan. Within the Grassland ecoregion, the Mixedgrass Prairie ecodistrict represents the area around Wanuskewin (Saskatchewan Parks 1983: 38). Wanuskewin is also located near the southernmost boundary of the ecoregion characterized by a mixture of aspen groves and fescue grasslands known as the Aspen Parkland. The area is characterized by glacial till landscapes with short, steep slopes and numerous, undrained depressions or sloughs which provide an ideal habitat for ducks and other waterfowl (Fung 1999). The Aspen Parkland belt is a buffer between the grasslands to the south and the boreal forest to the north. This diagonally running belt represents an ecotone (i.e. a transition area between two adjacent ecological communities) and, as such, it incorporates characteristics of both open grassland and deciduous forest in a patchy mosaic (Fung 1999:25). A continuous gradation of vegetation exists within the Aspen Parkland Region. In the southern areas, the proportion of grassland increases with aspen groves restricted to depressions and steep northward facing slopes (Thorpe 2000).

Both tall (C_3 and C_4) grasses and short (C_4) grasses and forbs species are represented (Yansa 2007: 114). Before the area was extensively settled by European immigrant populations, frequent fires helped prevent the expansion of trees into grassland areas. Aboriginal people have been historically reported to have started fires in order to promote the growth of grass fodder to attract bison, and trampling by massive herds of bison would have also served to inhibit tree growth (Yansa 2007: 114).

The Aspen Parkland designation is not, however, without its detractors. Ritchie (1975: 1796) contends that precontact burning and the subsequent clearing of the land by settlers have produced the "patchy mosaic" rather than climatic influences. He goes on to say that the term Aspen Parkland has become a catchall for an area that incorporates unique vegetation patterns that are poorly understood ecologically.

2.5 Paleoenvironment

Archaeologists are concerned with all aspects of paleoclimate. Climate can produce changes in plant communities and geological phenomena which are important factors that influenced the Aboriginal peoples' occupation of the Plains (Frison 1975:289). In fact, cultural discontinuities have been found to occur together with or closely following botanic discontinuities (Wendland and Bryson 1974:23). In Western Canada, efforts to reconstruct postglacial vegetation have utilized pollen and plant microfossil studies and the examination of cores extracted from lake sediments (Vance et al. 1995:82). In arid regions of western North America, plant macrofossils preserved in fossilized packrat middens have also been used as proxy indicators of past vegetation (Prentice 1986:132).

The Northern Plains were covered with ice during the Late Wisconsinan Glacial Maximum. As the Laurentide ice sheet retreated northeastward (ca. 14,100 - 13,500 BP), it was followed by a spruce dominated boreal forest (ca. 15,600 – 13,000 BP). As the boreal forest began to decline, between 13,000 and 10,200 BP, the boreal forest biomes across central Saskatchewan were replaced by parkland and later by grassland. By 9,000 BP the grassland biome reached its maximum northerly extent (Wolfe et al. 2006:20).

The Hypsithermal climatic episode (ca. 8,300-5,700 BP) is coincident with the early part of the Holocene (Reeves 1973:1223). Mulloy first proposed the idea of a cultural hiatus on the Great Plains during the Holocene in 1952. The prevailing notion was that the Plains were abandoned by humans and game animals alike as a consequence of desert-like conditions caused by a period of drought and increased temperature (Reeves 1973:1221). We now know that frequent and severe drought alternated with periods when the climate was wetter and/or cooler than it is today. Lakes may have also dried or become saline (Vance and Clague 1992:881). A study of collagen from 6,000-year-old bison recovered at Head Smashed In, Alberta has indicated changes in vegetation. During the periods from 5,750 to 5,550 B.P and 5,150 to 2,300 BP heat and drought tolerant C_4 plants are present in higher than normal amounts (Tieszen 1994:278). Temperature is the main factor controlling the distribution of C_4 species.

Even in times of widespread and/or prolonged drought, some areas may have retained enough water to become important refuges for animals and people. The Saskatchewan River would have continued to flow at a reduced volume despite these conditions, making it one of the crucial natural refugia of the period (Hurt 1966:110). During the Hypsithermal, the reduction of flow and sediment discharge within the Saskatchewan River system caused a corresponding reduction in flow and sediment discharge within the Opimihaw Valley. The reduction in discharge lead to the development of the underfit Opimihaw Creek which has likely existed since at least 6,000 BP (Rutherford 2004:11).

The Holocene was long assumed to include a period of severe drought and decline in ecological productivity across the Plains; however, the paleoenvironmental record does not necessarily support this assumption. The evidence suggests that climatic, ecological, and hydrological conditions varied across the area and throughout the period (Meltzer 1999:413). In Saskatchewan, increasingly moister conditions are evident between 5,500 and 4,000 BP. This time of transition marks the divide between the driest postglacial period and the onset of climatic conditions similar to the present (Vance et al. 1995:94). Cooler, moister climatic conditions returned after the Hypsithermal between 6,300 and 4,400 BP. This was followed by a relatively dry and warm period lasting between 2,400 and 1,400 BP (Wolfe et al. 2006:21).

2.6 Modern Climatic Conditions

The present climate and vegetation have existed for approximately 3,000 years with the exception of the interval between 3,000 BP and 2,400 BP which was cooler than present (Rutherford 2004:10). Modern climate characteristics of the Northern Plains are influenced by three air masses: the Arctic, the Tropical Maritime and the Mild Pacific. For more than 50% of the time, the dry Mild Pacific air mass holds sway over the Plains. In the early spring it is displaced by Arctic air and later by Tropical Maritime air which dominate the region until

October. These seasonal variations in air masses are responsible for the distribution of precipitation. In the winter, the Mild Pacific air results in low precipitation values. During the spring and summer, precipitation is characteristic of the region (Reeves 1973:1224).

Based on decadal fluctuations, Wanuskewin falls within the climatic region Koppen Classification Dfb, humid continental with cool summers (Fung 1999:96). The moisture region of the area is Semiarid, based on data collected from 1961 to 1990 (Fung 1999:97). The Thornwaite Moisture Classification of the area is Dry Subhumid with a -33.3 to 0 moisture index. Thornwaite's system not only takes temperature and precipitation into account, it also includes evapotranspiration which is 548 mm for the Saskatoon area (Lundqvist 1999).

The annual mean temperature is 2°C according to data collected from 1961 to 1990 (Fung 1999:99). The area experiences an average of 164 frost free days per annum (Lundqvist 1999). Temperature range is 36°C with the monthly mean temperature in January reaching a maximum of -12.3°C and a minimum of -22.9°C. Monthly mean temperatures in July reach a maximum of 25.3°C and a minimum of 11.6°C (Lundqvist 1999).

Modern climatic data classifies the Saskatoon region as a cold sub-humid climate which is included in the semi-arid region of the Great Plains due to a lack of precipitation. The annual mean precipitation for the area is 360 mm, 30% of which is in the form of snowfall (Lundqvist 1999). The average windspeed in the Mixed Prairie ranges from 19 to 26 km per hour, usually reaching a maximum in March, April and May (Coupland 1961: 140). In the Saskatoon area, the prevailing winds are west-northwest with an average speed of 16 km/h (Lundqvist 1999).

2.7 Flora and Fauna

Vegetation zones are recognized based on vegetative features only (Thorpe 2000). The area surrounding Wanuskewin is comprised of the Mixed Prairie (*Stipa-Bouteloua*) vegetation association. The most important species are spear grass (*Stipa spartea)* var. western porcupine grass (*curtiseta)* and northern wheatgrass (*Agropyron dasystachyum)* with an abundance of needle grass (*Stipa comate)* and western wheatgrass (*Agropyron smithii*) (Coupland 1961: 147).

The majority of woodlands in the Saskatoon area are dominated by trembling aspen (*Populus tremuloides*). The ground vegetation under the aspen stands is made up of snowberry (*Symphoricarpos* spp.), rose (*Rosa* spp.), saskatoon (*Amelanchier alnifolia*), chokecherry (*Prunus virginiana*) and a variety of herbs (Fung 1999). Balsam poplar (*Populus balsamifera*) is associated with aspen throughout the region becoming most prominent in the lowest, wettest parts of stands. Moisture dependent species like red-osier dogwood (*Cornus stolonifera*) and cow parsnip (*Heracleum lanatum*) also increase in these situations. Shrub stands often appear in depressions or on the margins of aspen stands. The wetter sites have the tallest shrubs, including Saskatoon, chokecherry and hawthorn (*Crataegus chrysocarpa*) (Fung 1999). Valleys show patches of brush dominated by willows (*Salix spp*.), Saskatoon (*Amelanchier alnifolia*), chokecherry (*Prunus virginianus*), snowberry (*Symphoricarpos occidentalis*), and wolf willow (*Elaeagnus commutata*) (Saskatchewan Parks 1983: 38).

Over much of the Aspen Parkland, the grassland patches are made up of fescue prairie. These are dominated by a single species, plains rough fescue (*Festuca hallii*). Of a variety of common forbs (i.e. herbs other than grass) the occurrence of species like northern bedstraw (*Galium boreale*) and three flowered avens (*Genum triflorum*) differentiates fescue prairie from drier grasslands (Fung 1999). The most common herb is likely pasture sage (*Artemesia frigida*) (Saskatchewan Parks 1983: 38), which comprises between 54% and 79% of the non-grassy cover (Coupland 1961: 158).

The Opimihaw Creek area can be divided into three distinct vegetative zones. The Upland Prairie Zone consists of two major vegetative communities, the native grass complex and an association consisting of dense thickets of shrubs (The Land Plan Collaborative, 1984:28). The second zone is the Valley Slope Zone found on stable valley slopes and transitional areas between lowlands and slopes. This zone is comprised of the Mixed Deciduous Tree/Shrub Association and the Poplar/Shrub Association. The Flood Plain Zone includes the Ash-Maple/Meadow Association and the Channel/Shore Association (willow [*Salix bebbiana, interior, lutea, petiolaris*], red-osier dogwood, water birch (*Betula occidentalis*), buckthorn (*Rhamnus cathartica*) and snowberry) and is found in the lowland areas of the valley (The Land Plan Collaborative 1984:29).

In the precontact period, the grasslands were dominated by the buffalo (*Bison bison*), however, the modern fauna has undergone drastic changes since the onset of European settlement. Formerly present species included elk, mule deer and pronghorn (Walker 1992: 11). The white-tailed deer (*Odocoileus virginianis*) is now the dominant artiodactyl (split hooved animal). Present day carnivores include the coyote (*Canis latrans*), skunk (*Mephitis mephitis hudsonica*) and badger (*Taxidea taxus*), which have replaced the wolf (*Canis lupis*), swift fox (*Vulpes velox*), grizzly bear (*Ursus arctos horribilis*) and mountain lion (*Felis concolor*) of former periods. Rodents are well represented by a number of species and leoprids like the jackrabbit (*Lepus townsendii campanius*) and snowshoe hare (*Lepus americanus americanus*) are common (Walker 1983:9). Amphibians found at Opimihaw Valley include: boreal chorus frog, northern leopard frog, wood frog, Canadian toad, and tiger salamander. Reptiles include the red sided garter snake and the Plains garter snake (Fung 1999:143).

Migratory songbirds, waterfowl, and birds of prey populate the Opimihaw Valley. Of these, the majority are Passeriformes (perching birds) (Smith 1999). Major fish species of the South Saskatchewan River include northern pike (*Esox lucius*), walleye (*Sander vitreus*), perch (*Percopsis omiscomaycus*), whitefish (*Stenodus* sp.) (Saskatchewan Parks 1983: 40), suckers (*Catostomus catostomus*), goldeye (*Hiodon alosiodes*), sturgeon (*Acipenser fulvescens*) and burbot (*Lota lota*) (Neilsen and Grismar 1982: 87).

A complete list of the floral and faunal resources of the Wanuskewin Heritage Park is provided in Appendix A.

Chapter 3
Cultural Chronology of the Northern Plains

3.1 Introduction

The Great Plains area has seen continuous human occupation for the past 11,500 years (Wood 1998:1). For the bulk of its human history, the Great Plains has been inhabited by people who were typically big game hunters, used the buffalo as the mainstay of their subsistence strategy, and followed a seasonal round. For at least part of the year, they lived in modest shelters, the most iconic of which was the conical hide covered tipi. These common lifeways allow us to consider the Great Plains as a culture area in that its people shared a large number of cultural traits and inhabited a continuous territory (Lowie 1954:5). The Northern Plains incorporates the great interior grassland of North America including North and South Dakota; the prairie parts of Wyoming, Montana and Minnesota; along with Alberta, Saskatchewan and Manitoba south of the subarctic boreal forest (Wood 1998:9; Kay 1996:17).

A cultural chronology provides a frame of reference that assists in answering the most fundamental questions about how human culture changed in relation to temporal, technological, and environmental conditions. It allows us to summarize archaeological data in a convenient manner that chronologically elucidates the nature of human lifeways (Dyck 1983:63). In order to understand a cultural chronology in a meaningful way, several terms must first be discussed and defined. According to established tradition, the archaeological record of the Northern Plains has been divided into discrete segments of time called periods. Each period is again subdivided into smaller segments of time referred to as complexes, traditions or phases (Peck and Ives 2001).

The term complex is invoked when the relationship between serial archaeological assemblages is unclear (Peck 2011:3) even if they are found within common geographical and temporal parameters and show similarities in function, style, technology and subsistence/settlement patterns (Willey and Phillips 1958:22; Dyck 1983:69). Complexes on the Northern Plains usually derive their names from their associated diagnostic projectile points (Peck 2011:3). The definition of an archaeological complex is a chronological subdivision of artifacts that implies an archaeological culture. A phase is a unit of archaeological study based on similarities in the material culture between components located in a particular region over a relatively brief interval of time (Walde 2004:39; Willey and Phillips 1958:22). A phase can change through time and does not necessarily correlate to a single locale or region. Phases are almost always named for diagnostic projectile points (Peck 2011:6). The horizon is a primarily spatial phenomenon in which similar art, artifacts, and cultural traits are rapidly spread over a large geographical area (Willey and Phillips 1958:33). A tradition is a primarily temporal concept wherein identifiable relationships between serial phases are manifested via abiding forms of technology or other systems of related forms (Willey and Phillips 1958:37; Peck 2011:3). A component represents the artifact assemblages belonging to a single period of occupation at a site. Components which evidence an identical range of artifact types and share a high frequency of similar cultural traits are grouped as a single phase (Trigger 1989:190).

In Northern Plains archaeology, projectile point styles provide the diagnostic markers and the monikers for virtually every archaeological culture as they are persistent throughout the human occupation of the area, preserve readily, and are morphological indicators of technological and cultural change over time (Peck and Ives 2001:163). The first archaeological sequence defined in Saskatchewan spanned 3,500 years BP and was derived from a multicomponent series at the Mortlach site (Dyck 1983:63). A broader, regional outline was developed in 1958 by Mulloy who proposed four major periods; Early, Middle, and Late Prehistoric and Historic. Mulloy also included a cultural hiatus between the Early and Middle Prehistoric (Dyck 1983:64). The exact nature of human occupation in the Plains area during the "hiatus" was once a controversial subject of debate among Plains archaeologists (Artz 1996:383).

The concept of a hiatus or abandonment of the Plains area by human populations is attributed to a climatic episode, then known as the Hypsithermal, thought to have started ca. 7,500 BP and ended ca. 4,000 BP (Antevs 1955:329). Archaeologists had assumed that the resultant widespread desertification of the Plains area had caused bison numbers to decline (Reeves 1973:1222), forcing human populations to abandon the region in search of more dependable food and water sources. What appeared, at the time, to be a paucity of archaeological evidence from the period served only to further entrench Mulloy's hypothesis in Northern Plains archaeology (Dyck 1983:87; Reeves 1973). By the 1970s, however, the discovery of new archaeological complexes on the western, northern and eastern fringes of the Plains (Dyck 1983:88) had fostered a general agreement among most archaeologists that the Plains area was at least partially occupied during the Hypsithermal (Walker 1999:12

The new information garnered about the Holocene required yet another retooling of the Plains cultural chronology. Dyck (1983) introduced a revised chronology which excluded the concept of a hiatus. However, some scholars have dismissed this version as lacking more precise chronological divisions (Walker 1999:121). Frison's (1978) chronology of the Northern Plains furnishes the finer distinctions deemed lacking from Dyck's (1983) attempt. However, it does require some modification to truly reflect the cultural sequence of the Saskatchewan area. Frison uses the term Archaic, which many researchers feel does not accurately represent cultural adaptations in the most northerly reaches of the Plains (Walker 1999:121). This thesis will therefore follow Walker's (1992) chronology as it was expressly developed to suit the study area in question.

Since the development of Walker's chronology, the term “prehistoric” has fallen out of favour in response to a more literal interpretation of the word rather than its scientific intent. The term “precontact” has been substituted for “prehistoric” in most cases, although this term is not without controversy (Peck 2011:7). This thesis will continue to use the term “precontact” in order to acknowledge that Aboriginal cultures are not devoid of history and with the hope of causing the least offense to the descendants of Saskatchewan's first people.

3.2 Pre-Clovis

The question of when and how people first entered the Americas has remained unresolved in spite of more than 60 years of research (Elias 2002:19). To date, three different scenarios for the colonization of the New World have been proposed: overland migration via the Bering Land Bridge, westward expansion of sea mammal hunters following the north Atlantic ice margin, or a coastal route around the north Pacific rim traveled by paleomariners (Jablonski 2002:313).

From ca. 22,000 to 15,000 BP, the Bering Land Bridge was exposed due to a global decrease of up to 120 m in sea levels (Elias 2002:10). A northern overland route for early migrants would have involved crossing Beringia and proceeding southward through an interglacial corridor that opened up along the foothills of the Canadian Rockies. As the newcomers were “pre-adapted” to a tundra environment, the recently deglaciated landscape should have presented no obstacle to permanent colonization (Haynes 1964:1412). Detractors of the Bering Strait theory contend that an interior ice-free corridor would not have existed at the crucial time for human migrants (Roosevelt et al. 2002:172). If indeed unglaciated land were available, it would have likely been unsuitable for human use due to climatic and hydrological factors (Fladmark 1979:64).

The second theory cites the distinct similarities between west European Solutrean and Clovis lithic technology as evidence that the first migrants arrived from Europe. This hypothesis suggests that coastally adapted groups from the Solutrean culture in Western Europe arrived in North America while pursuing marine faunal resources around the north Atlantic ice margin. The proponents of this theory eschew the notion that convergence is responsible for what they consider the inordinate number of commonalities between Clovis and Solutrean cultures (Bradley and Stanford 2004).

The coastal corridor theory supposes that a chain of "sea-level refugia" allowed marine adapted populations to travel along the Pacific coast of North America (Fladmark 1979:64). Between 14,000 and 10,000 BP this route was readily accessible, biologically productive, at least partially vegetated, and likely able to support terrestrial fauna (Mandryk et al. 2001:310). Once the groups were beyond the southern margin of the Cordilleran glacier, migration would have expanded throughout the continent (Fladmark 1979; Mandryk et al. 2001).

Regardless of the manner in which they arrived, irrefutable evidence for the presence of humans in the Americas before 12,000 BP remains elusive due to old carbon contamination, lack of cultural association, and research methodology issues (Roosevelt et al. 2002:174). The first undisputed archaeological culture to occupy the Great Plains area are the Clovis people. At the time of this writing; "The Clovis site in New Mexico and the Clovis tool complex dating between 12,000 and 11,000 BP remains the gold standard against which all other claims for early arrival into the Americas has been judged" (Jablonski 2002:3).

3.3 The Paleo-Indian Period ca. 11,050 – 7,500 BP

The Paleo-Indian Period was a dynamic era for human populations and the environment alike. Environmental conditions changed considerably as the landscape transitioned from glacial to more modern conditions. Grazing animals gained dominance over browsing species as drier, milder conditions allowed the grasslands to expand northward replacing the spruce forest, and the bison emerged as the staple of the hunting economy (Dyck 1983:73-86; Meyer et al. 2011:6).

Very little is known about the site structure, dwellings, group dynamics, economic organization or mortuary customs from the Early Period (Hofman and Graham 1998: 121). The cultures of this period were likely small, nomadic groups of hunter-gatherers (Mulloy 1954:208) who practiced a big game hunting subsistence strategy (Peck 2011:43). Because Paleo-Indian cultures are not represented in any of the excavated sites at Wanuskewin Heritage Park, they will be given a relatively brief overview here.

3.3.1 Clovis Phase ca.11,050 – 10,800 BP

The Clovis phase represents the earliest widely recognized archaeological culture in North America (Peck 2001:24). Clovis sites are associated with large, lanceolate spear points with flutes (Dyck 1983:71). Most excavated sites from the Clovis period have been interpreted as kill sites, meat processing sites, burials, and caches of foodstuffs, tools, or projectile points (Peck 2011:27). Little is known about the social organization of Clovis people. However, it seems likely that they moved about in small bands hunting high-return, big game animals such as the mammoth and fossil species of bison (Hofman and Graham 1998:117). In Saskatchewan, Clovis points have been recovered as surface finds only (Dyck 1983:71).

3.3.2 Goshen/Plainview/Midland ca. 11,000 – 10,000 BP

There has been considerable debate and confusion surrounding the consolidation and dissolution of archaeological complexes based on recoveries of poorly dated and highly similar lanceolate point varieties. These three point variations appear to represent a short time interval between or possibly contemporaneous with Clovis and Folsom and have been considered as both separate cultural entities and a single cultural group (Frison 1993; Sellet 2001:15). Goshen points were first recovered at the Hell Gap site in Goshen County, Wyoming (Frison 1993:8) and are described as unfluted lanceolates (Frison 1991:45; Stanford 1999:308; Hofman and Graham 1998:96). Goshen points exhibit traits of both Clovis and Folsom, but remain morphologically and technologically distinct from both (Frison 1993:45). Plainview points bear a strong resemblance to Folsom points (Frison 1991:382). Midland points resemble unfluted Folsom points (Mulloy 1958:43) and have been supposed to be technologically tied to Folsom as a solution to restricted access to lithic resources and limited production time (Amick 1995:34). Midland points show a range of attributes of both Folsom and Goshen types (Sellet 2001:5).

3.3.3 Folsom Complex ca. 10,900 – 10,500

The Folsom complex is the most accurately dated Paleo-Indian complex on the Northern

Plains (Holliday 2000:266). Folsom sites are associated with distinctive, fully fluted lanceolate spear points (Dyck 1983:74). Folsom pressure flaking techniques are unequaled among global lithic technologies and the remarkably advanced flint technology of the Folsom people is also reflected in their highly functional tool kits (Frison 1980:130). Folsom populations were likely highly mobile bison hunters (Andrews et al. 2008:486; Hofman and Graham 1998:119).The Folsom complex also shows a wider range of site types than the preceding Clovis phase, which may indicate a greater familiarity with their surroundings and an increase in specialized activities (Peck 2011:39).

3.3.4 Agate Basin Complex ca. 10,200 – 9,000 BP

Agate Basin points are long, narrow, horizontally flaked lanceolates with a distinctively lenticular and relatively thick cross-section (Bubel et al. 2012:38; Frison 1991:57). To date, no in situ, excavated Agate Basin occupations have been found in Saskatchewan (Meyer et al. 2011:21); however, a large surface collection was recovered from the Parkhill Site near Moose Jaw (Ebell 1980). Agate Basin groups likely relied on the bison to meet the better part of their economic needs throughout most of the year (Hofman and Graham 1998:103). New methods of bison procurement appeared at this time, including arroyo traps, parabolic sand dune traps, jumps and possibly corrals and diverging fence lines (Meyer et al. 2011:21).

3.3.5 Hell Gap Complex ca. 10,000 – 10,300 BP

The Hell Gap point seems to have developed directly out of the Agate Basin point (Frison 1991:62). They are lanceolate, exhibiting a stemmed appearance with a restricted basal portion, slight shouldering, and a lenticular cross-section (Bubel et al. 2012:40). Hell Gap people regularly conducted large scale bison kills (Meyer et al. 2011:26) and most associated sites are focused on the procurement of bison (Epp 1991:55). Hell Gap is considered to have evolved into the large, lanceolate spear points characteristic of the Alberta point from the following Cody Complex (Meyer et al. 2011:26).

3.3.6 Cody Complex ca. 9,000 – 8,500 BP

The Cody complex consists of several lanceolate point types including Alberta, Scottsbluff and Eden. It also incorporates a wide variety of artifact types including Cody knives, which have a distinctive stem and transversely retouched blade (Hofman and Graham 2009:109). Cody people practiced high order flint knapping (Meyer et al. 2011:30) and their preference was for high quality lithics, some of which were sourced from distant areas. These exotic lithics could be indicative of long distance travel, widespread social/trade contacts, or both (Meyer et al. 2011:34). Alberta points are named for the Fletcher Site, which is located in south-central Alberta (Meyer et al. 2011:27). They feature distinct wide shoulders and a wide, parallel-sided stem which can make up approximately one-third of the point (Bubel et al. 2012:42). The Scottsbluff bison kill site in western Nebraska is the type site for the second point variety in the complex (Hofman and Graham 2009:109). Scottsbluff spear points are generally narrow with straight lateral blade edges, distinct shoulders, and a wide stem (Bubel et al. 2012:44). Eden points are formed with a sequence of comedial pressure flaking (Knell 2003:38), producing a diamond shaped cross-section (Bubel et al. 2012:46). Eden points are named for their type site, Finley, near Eden, Wyoming (Frison 1991:66). During Cody times, faunal numbers were elevated, which would suggest that the human population was also higher (Meyer et al. 2011:31). The fate of the Cody culture, however, remains unknown as little data exists to define its relationship to later cultures (Peck 2011:93).

3.3.7 Frederick/Allen Complex ca. 8,600 – 8,000 BP

The terminal Paleo-Indian complex is characterized by lanceolate points with parallel oblique flaking and concave bases (Frison 1991:66; Dyck 1983:82). The people who crafted these spear points were the last of the highly mobile Paleo-Indian groups whose economic activities were centred around bison hunting (Hofman and Graham 1998:113). After 8,000 BP, dramatic changes in the environment, such as droughts and increasingly arid conditions, precipitated major changes in culture, demography, and life ways. People appear to have coalesced into localized bands, confined themselves to more restricted territories, and transitioned to a more regional, foraging way of life which relied on the resources at hand (Hofman and Graham 1998:113; Meyer et al. 2011:42).

3.4 The Middle Precontact Period ca. 7,500 – 1,500 BP

The Middle Period sees some carry over from the Early Period with bison hunting continuing to be the focus of subsistence activities and most of the chipped stone tool kit remains unchanged (Dyck 1983:87). There are marked changes, however, the most notable of which are the appearance of new projectile point styles and an increase in the frequency of tools used to prepare plant foods (Frison 1998:163). A major technological innovation of the period was the atlatl; a throwing board that used smaller projectile points hafted to darts which could be propelled with greater force and distance than spears (Kooyman 2000:169).

3.4.1 The Early Middle Precontact Period ca.7,500 – 5,000

The beginning of the Middle Precontact Period corresponds to a change in the environment referred to variously as the Altithermal, the Mid-Holocene Climatic Optimum, or the Hypsithermal. The abandonment of the Plains by human groups due to drought conditions was long held to be the reason for an apparent lack of archaeological evidence from this period. Continuing research into the climatic conditions during this time has revealed that the long drought concept was an over-simplification of what was, in fact, a time of considerable variation in terms of the severity and regionality of thermic conditions and increased aridity (Meltzer 1999:404; Walker 1999:145). The Hypsithermal was "marked by a north-south gradient of increasingly warmer and drier conditions, with a reduction in effective moisture, surface water, and resource abundance, and an increase in resource patchiness, sediment weathering, erosion and aeolian activity" (Meltzer 1999:404).

The environmental consequences of the prolonged drought included an increase in the area of the shortgrass Plains extending eastward and southward (Reeves 1973:1225). The bison would have responded to an overall decline in carrying capacity due to decreased yield. However, the increase in grassland area likely acted as a leveling mechanism in terms of maintaining bison population numbers at levels comparable to times previous (Reeves 1973:46). The response of human populations was likely one of adaptation to differential distribution of resources rather than a wholesale abandonment of the region (Frison 1998).

The problem of scarcity in terms of archaeological sites from the Hysithermal is likely not related to human abandonment as a consequence of bison habitat destruction; rather, it is a product of geological processes such as erosion (Artz 1996:3). Numerous sites may have been destroyed or deeply buried by paleohydrological activity (Reeves 1973:1243) or inundated with large volumes of eroding sediments. Both scenarios would effectively render any archaeological remains undetectable by conventional archaeological survey methods (Artz 1996:3: Sheehan 1995:261). The resultant sampling errors may have contributed to the under-representation of Hypsithermal era sites in the archaeological record (Reeves 1973:1243).

The nature of human occupation on the Plains continues to be a topic of debate. The presumably negative effects of the Hypsithermal on the human populations of this period would have necessitated changes in lifestyles and adaptive strategies (Oetelaar 2011:58). On the Northern Plains, Early Middle Period settlement patterns appear to incorporate small, single component campsites located on floodplains or river terraces (Walker 1999:130).

3.4.2 Mummy Cave/Bitterroot/Gowen Series ca. 7,500 – 4,500 BP

Projectile points from this series are referred to as dart tips and are indicative of the adoption of the atlatl or spear-thrower. At least five different projectile point styles are associated with this series: (1) Mount Albion Corner-Notched, (2) Gowen Side-Notched (Salmon River Side-Notched), (3) Bitterroot Side-Notched (Northern Side-Notched), (4) Hawken Side-Notched, and (5) Blackwater Side-Notched (Walker 1992:133). The points in this series are side-notched with straight, concave, or convex bases. In Saskatchewan, Bitterroot and Gowen Side-Notched dart tips are commonly found (Walker 1999:25). Mummy Cave lithic technologies also incorporated split pebble technology, large hafted bifaces, ovoid bifaces, and flake perforators (Green 2005:103). It is likely that that the band was the highest order of social organization reached at this time. What may have been sparser distributions of resources would have required repeated cycles of group fission and fusion (Frison 1998:147). Sites were inhabited by small groups for short periods of time who conducted small scale bison kills or stalked lone animals (Green 2005:103).

3.4.3 The Middle Middle Precontact Period ca. 4,100 – 2,100 BP

The persistently warm, dry, continental climate gradually abated throughout the period resulting in a return to climatic conditions similar to those of the present. The gradual cooling trend and moister conditions (Nicholson and Webster 2011:82) facilitated a southward shift of the boreal forest and the westward retreat of the grasslands to their modern position (Dyck 1983:88). An apparent increase in archaeological recoveries from the period suggests that human populations were growing at this time (Dyck 1983:88).

3.4.4 Oxbow Complex ca. 4,500 – 4,100 BP

Oxbow points were first noted at a site near the town of Oxbow, Saskatchewan (Nero and McCorquodale 1958). They are side-notched with a deeply concave base and characteristic basal edges that lend them an “eared” appearance (Bubel et al. 2012:54). The Oxbow dart tip may have developed as an offshoot of the Mummy Cave series as they exhibit morphometrical similarities suggestive of some cultural continuity between the two (Bubel et al. 2012:54; Reeves 1973:1245; Walker 1992: 144).

Oxbow people likely engaged in seasonally switching/alternating economic activity that may have been based on the movement of bison into ecotonal areas during the winter months

(Spurling and Ball 1981:101). Their camps tended to be small and probably housed family groups. Small scale bison hunts likely remained the norm, as no Oxbow kill sites have been recorded (Nicholson and Webster 2011:85).

While their economic focus was directed towards bison hunting, it did not preclude the use of canids, beaver, porcupine, and goose as part of their subsistence strategy. They developed new methods for extracting the maximal nutritive value from faunal resources via the use of hammerstones to crush bones for marrow extraction and stone boiling to pits to extract bone grease (Peck 2011:192).

The burial style of the Oxbow culture usually consisted of isolated primary internments, with the notable exception of the Gray Burial Site (Millar 1978). Burials were generally associated with red ochre and located away from habitation areas (Spurling and Ball 1981:93). The Oxbow people may have been displaced from the Northern Plains by the McKean complex (Spurling and Ball 1981:93) subsequently abandoning the central grasslands in favour of the northernmost areas of their known range (Nicholson and Webster 2011:82).

3.4.5 The McKean Complex ca. 4,200 – 3,500 BP

This complex was first defined by Wheeler (1954) after the recovery of a McKean point from the McKean site, located in northeast Wyoming. Duncan and Hanna style points are also included in the McKean complex, although the relationship between them is not well understood (Frison 1998:163). McKean points are lanceolate with deeply notched bases (Bubel et al. 2012:56) and convex blade edges that are slightly narrower at the base than toward the midsection (Frison 1991:91). Duncan dart tips have a distinct stem (Bubel et al. 2012:58), sloping shoulders and a notched base (Frison 1991:91). Hanna points are stemmed with distinct shoulders and relatively straight margins that converge at the tip (Bubel et al. 2012:58). Other items in the McKean toolkit include end scrapers and utilized/retouched flakes (Peck 2001:216). The McKean complex clearly represents hunter-gatherers (Frison 1998: 163) who traveled and camped in small groups showing a preference for areas with high biodiversity (Nicholson and Webster 2011:91). Although they had a prairie hunting focus (Hannus 1994:182) they also engaged in a wide range of subsistence strategies that prudently employed diverse local resources (Nicholson and Webster 2011:88). McKean burials utilize shallow pits in primary living floors in which red ochre and grave goods are usually absent (Webster 2004: 93). For reasons not yet apparent in the archaeological record, the McKean occupation of the Northern

Plains came, rather suddenly, to an end approximately 3,000 BP (Nicholson and Webster 2011:91).

3.4.6 The Late Middle Precontact Period ca. 3,000 – 1,350 BP

During the Late Middle Period, corner-notched projectile points emerged as the dominant style (Mulloy 1958:209). Climatic conditions favoured an increase in vegetation throughout the period, promoting an increase in game populations (Epp 1991:60). The end of the period was precipitated by an influx of Woodland cultural influences (Dyck 1983:88) and, most notably, the arrival of the bow and arrow (Frison 1998:147).

3.4.7 Pelican Lake Complex ca. 2,800 – 2,100 BP

The first Pelican Lake point was identified at the Mortlach Site and named for Pelican Lake, Saskatchewan (Bubel et al. 2012:62). The points themselves exhibit a distinctive "Christmas tree" shape with corner notches, sharp tanged shoulders, and a slightly concave to convex basal shape (Nicholson and Webster 2011:91). Bifaces, endscrapers, and retouched flakes are commonly present in the Pelican Lake lithic tool kit (Peck 2011:236). A preference for high quality raw materials indicates that that their lithic procurement activities lead them farther afield than earlier cultures (Hannus 1994:187). Pelican Lake sites include campsites, bison pounds, and cairn graves (Brink 1988:105). Most sites are campsites and, although their subsistence strategy centred around bison, little evidence of large scale bison procurement has been found (Peck 2011:236). Burial sites are located in high prominent areas and utilize shallow pits. They often contain more than one individual and are associated with red ochre. Grave goods are diverse and may include shells, projectile points, and copper (Brink 1988:131). Following a brief co-existence with the Besant people, the Pelican Lake culture rather abruptly disappears from the archaeological record (Nicholson and Webster 2011:95).

3.4.8 Besant Phase ca. 2,500 – 1,350 BP

The Besant culture is associated with very distinct lithic artifact assemblages (Reeves 1970:93). Besant points are lanceolates with slightly concave, convex or straight bases and wide, shallow side notches that are twice as wide as they are deep (Peck and Ives 2001:304; Dyck 1983:115). Besant people exhibited a distinct preference for Knife River flint as their preeminent lithic material (Dyck 1988:115). Besant sites are usually clustered along major river drainages (Greiser 1994:37). Common features in Besant sites include; stone circles, surface and basin hearths, earth pits, and fire cracked rock concentrations (Peck 2011:307). Pottery is also regularly found in Besant assemblages in Saskatchewan (Meyer and Rollins 1990:14).

The origins of the Besant culture likely trace back to the eastern or northern woodlands (Greiser 1994:36). They were nomadic hunter-gatherers who relied heavily on the bison (Peck 2011:305). Their mastery of mass kill methods of bison hunting is evident archaeologically from the remains of pounds, jumps, and large encampments (Dyck 1983:113). Some disagreement exists as to whether the Besant phase represents the terminus of the Middle Period or the beginning of the Late Precontact. The appearance of cord-roughened pottery and the occasional smaller projectile point suitable for use with the bow and arrow is suggestive of Late Precontact technology. However, the persistent use of the atlatl, as indicated by the recovery of “dart type” projectile points, firmly ties them to the Middle Period (Hamilton et al. 2011:106). Some have suggested that Besant should straddle the juncture between the two periods as a type of transitional phase (Peck 2011:3). However, it is not the intent of this thesis to remedy these issues and so the reader is welcome to make their own judgments regarding the matter.

3.5 The Late Precontact Period ca. 1,350 – 250 BP

This period is defined by the appearance of a greater variety of material culture, including ceramics, and the introduction of side-notched arrow points (Mulloy 1958:215). The bow and arrow represent the height of weapons technology at this time. Open grassland dominated the region at the start of the Late Period, but slowly transformed into mixed grassland and forest habitat (Hamilton et al. 2011:111).

3.5.1 The Avonlea Horizon ca. 1,350 –1,100 BP

The Avonlea type site is located near the town of Avonlea in south-central Saskatchewan (Dyck 1983:70). Avonlea points are small, finely made, triangular arrow points with side notches located low on the lateral edges and a slightly concave base (Hamilton et al. 2011:119). Avonlea ceramics are represented by several types including; Rock Lake net/fabric impressed, Truman parallel grooved and Etheridge cord-roughened pottery wares (Meyer and Walde 2009:68). Avonlea settlement patterns are not well understood, but it appears that they moved in anticipation of the appearance of bison herds (Peck 2011:339). Their mortuary customs are also poorly understood, but it has been suggested that pit internment beneath cairns was used (Peck 2011:366).

3.5.2 Prairie Side-Notched Complex ca. 1,150 – 800 BP

Prairie side-notched points are similar to Avonlea (Hannus 1994:190), although they sometimes appear crudely made and asymmetrical (Dyck 1983). They are triangular in shape, with notches close to or touching the base and blade edges that are slightly convex to straight converging (Bubel et al. 2012:72). Prairie Side-Notched pottery is usually conical in shape, thick walled and poorly consolidated (Peck 2001:8) with a cord roughened exterior and simple incisions or impressions on the lip. The use of cord-roughened pottery is associated with several different cultures, including Blackduck (Walker 1999:27). The Old Women's culture is also associated with this poorly constructed pottery, the main difference being the inclusion of shoulders and necks in the design (Epp 1991:62). Mass bison kills in the form of jumps, pounds or traps, campsites, and medicine wheels are the sites most commonly associated with the Prairie Side-Notched complex (Dyck 1983).

3.5.3 Plains Side-Notched Complex ca. 600 – 250 BP

Narrow side-notches, a “v” shape, well defined basal edge heights and wide bases are characteristic of the Plains Side-Notched point (Bubel et al. 2012:72; Dyck 1983). These points reflect more careful workmanship than their predecessors; they are finely flaked and more aesthetically pleasing (Dyck 1983:132). Ceramics from this phase are likely associated with either the Mortlach or Wascana cultures (Epp 1991:62). The vessels are compact, thin walled, and vary greatly in their exterior treatments, including incised and check stamped versions (Walde 2004:43; Walker 1999:27). Pottery from the Prairie Side-Notched complex shows influences from Middle Missouri, Woodland and Selkirk traditions (Dyck 1983). Plains Side-Notched components are common in Saskatchewan (Dyck 1988:126), which is no great mystery due to their relatively recent age. However, as they are often closer to the ground surface, they are subject to disturbance, admixture, and pot hunting (Dyck 1983).

3.6 The Contact Period ca. 340 BP

The end of the Late Precontact period is marked by the arrival of Europeans and their influence. The first Europeans ventured into the Northern Plains area around 1670 in association with the booming fur trade, which was based in the eastern regions of Canada (Ray 1978:29). Although at first the trade relationships provided mutual benefits to both traders and Aboriginal people, the resultant culture change and loss would affect the Aboriginal people in ways they could never have foreseen at the time of first contact.

European goods likely arrived in the Plains area well in advance of their purveyors as guns, gunpowder, tobacco, metal knives, cloth, kettles, and horses flowed north and west via

Aboriginal trade networks (Peck 2011:7). As the actual physical contact between Europeans and Aboriginal people grew more common, epidemic diseases were introduced into Aboriginal populations who had no natural immunity. Small pox, measles, whooping cough, and scarlet fever ravaged the Aboriginal populations and decimated their numbers in wave after wave of epidemics (Dyck 1983:135; Russell and Meyer 1999:33).

In their weakened state, Aboriginal peoples became more and more dependent on the trading posts for the means of their own subsistence. The growing demand on the part of the traders for pelts and pemmican and the need to repay debts incurred to the posts resulted in the abandonment by Aboriginal peoples of their traditional subsistence activities and lifeways (Wolf 1997:194). Widespread killing for sport and for profit combined with "unofficially" sanctioned extermination practices lead to the extirpation of the great herds of bison that were at the centre of traditional Aboriginal subsistence strategies. The loss of their traditional lifestyle was further exacerbated by the loss of Aboriginal elders to disease epidemics. Elders were repositories of information and their absence was devastating to cultures whose traditional knowledge was passed on via the oral tradition (Russell and Meyer 1999:33).

As the fur trade declined, it was closely followed by the opening of the west for prospectors, ranchers and European settlers. As the last remaining impediment to Euro-Canadian expansion, Aboriginal peoples were forced from their traditional homelands and confined to reservations (Scott 1998:482). Thus the nomadic hunting and gathering lifestyle that had sustained human populations on the Great Plains for millennia came to grief.

Chapter 4

Methodology, Stratigraphy and Radiocarbon Dating

4.1 Site Reconnaissance and Assessment

The importance of the Wanuskewin area as a locale encompassing considerable archaeological resources merited a detailed assessment of the area, which was undertaken by Dr. E. Walker in 1982 to 1983. The assessment involved conducting archaeological surveys and test excavations. The Wolf Willow site (FbNp-26), was located on a point bar of the Opimihaw Creek, then known as Tipperary Creek, via the excavation of a test pit (Figure 4.1). Four occupation levels were identified at this time. Significant recoveries included a Duncan projectile point.

4.2 Excavation Methodology

Full scale excavations at the Wolf Willow site began in May of 2010 under the supervision of Dr. E. Walker of the University of Saskatchewan and the author. A datum point was established to the northwest of the area selected for excavation and designated as 0S 0E. All excavated units were plotted in relation to the datum point. At the outset of the 2010 season, ten units were established in a long trench extending east to west. Each unit measured one by one metre. Groups of two students from the University of Saskatchewan's archaeological field school were assigned one unit to excavate. As the season progressed, each pair of students was assigned a second unit. These excavations continued for approximately six weeks during May and June of 2010 and resulted in the excavation of eight units. In July of 2010, three new units were established to the north of the original trench. Members of a public field school facilitated by the Saskatchewan Archaeological Society excavated another five units over a period of four days to bring the total number of excavated units for the 2010 field season to 13 m^2. During the 2011 field season, excavations were undertaken in May and June, resulting in 13 units being excavated by University of Saskatchewan students and four units being excavated by public field school participants. A total of 30 m^2 were excavated in the two field seasons (Figure 4.2).

Figure 4.1: Location of the Wolf Willow Site (map modified by author from Google Maps)

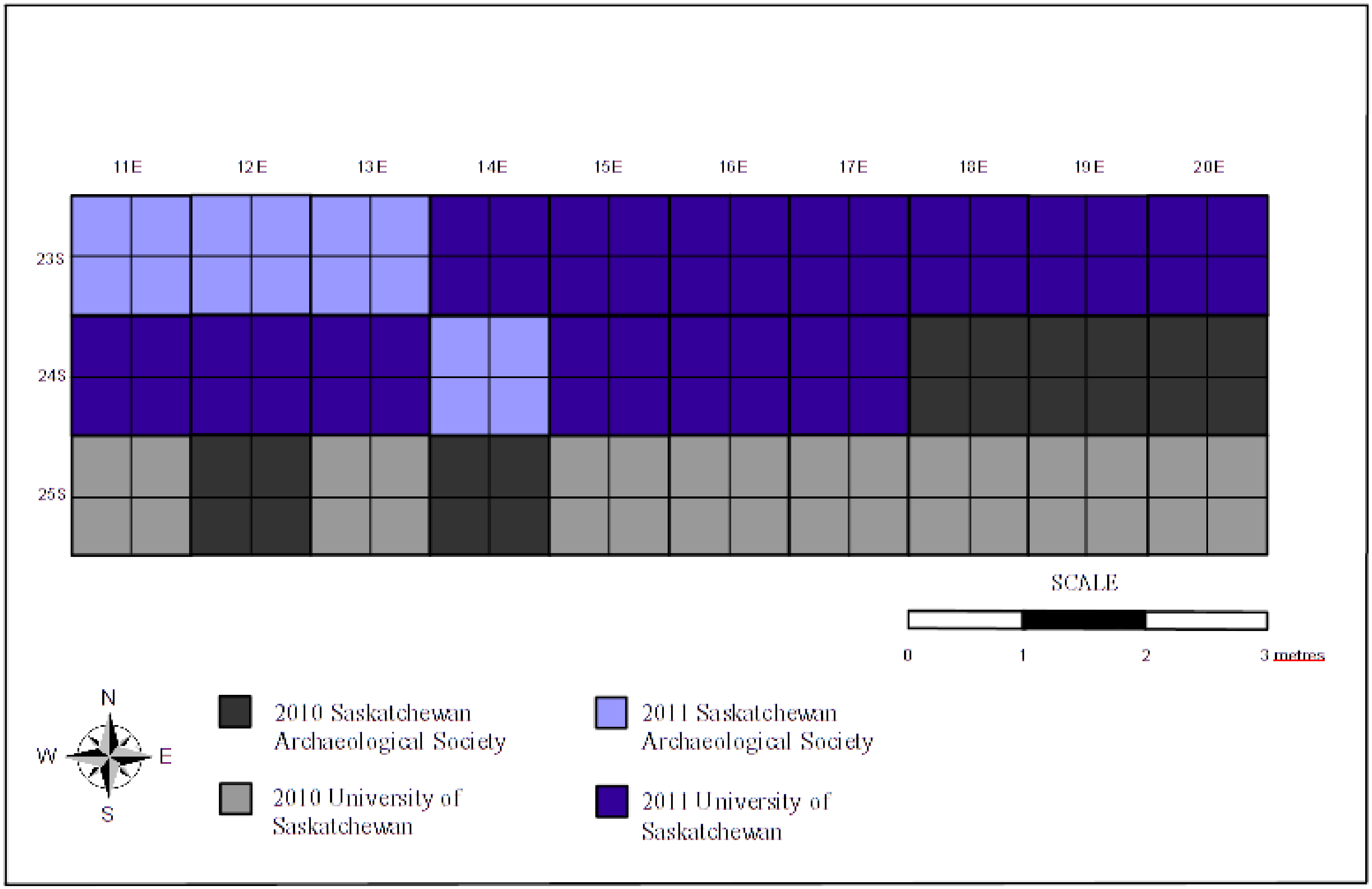

Figure 4.2: Location of Excavated Units at Wolf Willow

The excavation procedure began with units being divided into quadrants which were to be excavated sequentially one level at a time. The excavation of all units proceeded with the removal of the sod layer to a depth of approximately 5 cm below datum. Sod was removed with a spade and closely inspected for artifacts but not screened. Sediments were then removed in arbitrary 5 cm levels in order to determine the cultural and/or stratigraphic sequence. Sediment was removed via the employment of several different hand tools in order to proceed judiciously and to ensure minimal disturbance or damage to artifacts as they began to emerge. Trowels, dental picks, wooden skewers, and brushes were used to slowly and methodically remove the sediments and expose artifacts. Artifacts that were larger than 2 cm or identifiable (e.g. small identifiable bones, formed tools, etc.) were left in situ. The sediment was removed from around the artifact to effectively "pedestal" the item until the bottom of its associated level was reached. When features such as hearths were encountered, the sediment was collected separately and curated for fine screening and/or water screening to be completed at the university. When sterile levels were encountered, shovel shaving was employed as the primary excavation technique. The blade of the shovel was carefully used to remove thin layers of sediment as this method offers more expediency than hand troweling. All sediments removed from the units were carefully sieved, by quadrant and level, through a 6 mm screen. The screen captured any small artifacts and fragments that may have been overlooked during the mechanical first phase of excavation.

When the end of an arbitrary, cultural, or stratigraphic interval was reached, all artifacts left in situ were measured using three point provenience. This entails recording the position of the artifact by taking a measurement of its distance south and east of the unit's datum point (i.e. the northeast corner of each unit) and a measurement of its depth below datum. In order to provide depth measurements below datum, each unit was equipped with a datum and a line level. Artifacts were then mapped on to planview sheets by the excavators. Once mapped, the artifacts were removed and their associated pedestals were taken down by troweling away the sediment until the bottom of the level was reached. Hearths, middens, and any other features, both cultural and natural, were mapped onto planview sheets as well. A level record form which recorded excavation depths, matrix description, significant finds, feature description, samples taken, level type, and other comments was completed by the excavators at the end of each level.

In the field, all artifacts and fragments were bagged with an enclosed card recording the artifact's provenience, catalog number, date recovered, and the names of the excavators. At the end of each day in the field, artifacts were transported to the Archaeology Laboratory at the University of Saskatchewan by students and/or supervisors. At this time, students also completed a daily log sheet that summarized their observations and recoveries. Pertinent information about each artifact was also recorded by the excavators in a preliminary catalog. The artifacts were then recatalogued by the author in order to verify and synthesize the information gathered by the excavators. This information was then used by the author to create a master catalog using Excel®.

4.3 Laboratory Procedures

All artifacts in good condition were washed using cold water and soft bristled tooth brushes and subsequently left to dry completely. Washing removes the bulk of the soil and sediment clinging to the artifact, allows for closer visual inspection, and ensures that sediments do not constitute a significant part of the collection. Thorough drying prevents problems associated with mold and fungus and allows for more consistent and accurate weight recording. Artifacts that were too fragile for wet washing, such as pottery and fragile bone, were dry brushed with soft-bristled tooth brushes. Sediments collected from hearths were passed through window screen (approximately 1 mm by 1 mm) with water to allow for the collection of any small bones, microdebitage, and other small artifacts. Artifacts recovered via fine screening were also left to dry completely. Once dry, artifacts were sorted into one of four categories according to material type; lithic, faunal, metal, or ceramic. These four categories were then subdivided into more specific classifications.

4.4 Lithic Analysis

Lithic items were first classed by material type based on the comparative lithic collection in the Department of Archaeology and Anthropology and Johnson's (1998) examination of common Saskatchewan lithics. Lithic raw materials found in Saskatchewan are referred to as local while those not commonly found in Saskatchewan, like Knife River flint, obsidian, cathead chert, and Rainy Buttes chert are considered to be exotic Lithics recovered from the Wolf Willow site include tool stone materials such as; chert, quartzite, chalcedony, quartz, jasper, porcellanite, silicified peat, siltstone and agate. Other lithic materials recovered at the site include sandstone, schist, basalt, and gneiss.

All lithic materials underwent macroscopic inspection to detect evidence of thermal alteration. Exposure to extreme temperatures can occur for two reasons associated with cultural practices. The first purpose is to alter the mechanical properties of the rock to render it more conducive to consistent fracturing and thus easier to form into knapped tools (Johnson 1998:15). Differences in colour and lustre were the most common indicators that a particular material had undergone heat treatment. Heat treatment is most effective on chalcedonies (Johnson 1998:16), however, Swan River chert is the material that most consistently exhibited evidence of thermal alteration. Thermal alteration may also occur via the heating of certain igneous and metamorphic rock types for use in cooking or ceremonial practice. These fire-cracked rocks exhibit abrupt angles and cracks resulting from extreme changes in temperature. Freeze-thaw cycles can also mimic the effects of thermal alteration and, therefore, reddening and charring were also used as indicators when identifying fire-cracked rocks.

Lithics were also classed according to the following formal and functional categories as: formed tools, expedient tools, cores/core fragments, flakes, shatter, fragments, and cobbles. Formed tools can include projectile points, biface tools, uniface tools, grooved mauls, scrapers, spokeshaves, and drills. Projectile points include spear points, dart tips, and arrowheads. Projectile points are, technically speaking, bifacial tools. Biface tools are manufactured through a process of lithic reduction and display flake scars on both the dorsal and the ventral surface. A cross-sectional view of the final product tends to exhibit a lenticular shape. Other less specialized biface tools may be hand held or hafted and are thought, in most cases, to represent either an all-purpose knife-like cutting implement or a piercing tool (Kooyman 2000:170). Scrapers are uniface tools made from a flake blank (Morrow 1997:71) whose working edge may be located on its lateral and/or distal portion. It is hypothesized that scrapers were used as hide working tools, but use wear and residue analysis testing have, thus far, been generally unsupportive of this idea. Spokeshaves are another type of unifacial tool. They have one or more concave working edges and were likely used to smooth the wooden shafts of arrows, darts, and spears (Bubel et al. 2012:82).

Expedient tools require little to no forming or manufacturing (Bubel et al. 2012:77). These types of tools include utilized flakes, retouched flakes, hammerstones, anvils, and grinding slabs. Utilized flakes are flakes which were used without any modification (Kooyman 2000:177). Retouched flakes show some retouch on one or both surfaces of the flake (Bubel et al. 2012:78). Hammerstones were used for lithic manufacture or any of a variety of tasks which require one to “hammer” another object (Bubel et al. 2012:78). Anvils are relatively large stones used to support the material that is being struck by the hammerstone or other instrument (Kooyman 2000:169).

Grinding slabs are large, flat rocks that usually exhibit a distinctive polish on the surface which was used to grind substances such as seeds and plant material.

Cores are pieces of stone from which flakes are removed. There are generally five types of cores which are classified according to the types and location of flakes removed. Unipolar cores have had flakes removed in one direction. When flakes are removed via the use of a supporting anvil, the cores are known as bipolar. Microblade cores have had small blades removed from them. Amorphous or multidirectional cores have had flakes removed from different directions. Bifacial cores have had flakes removed by alternating between flaking one face and then the opposite face (Bubel et al. 2012:77).

Flakes are segments of lithic material that have been detached from a core. They display some or all of the following features: striking platform, bulb of percussion, bulbar scar, bulbar fissures, lateral fissures, compression rings, and arrises (Kooyman 2000:12-14). For the purpose of the lithic analysis in this thesis, flakes were only classed as such when they exhibited most of the flake features listed above. Primary flakes are those which have their entire dorsal surface covered with cortex. Secondary flakes are those in which some, but not all, of the dorsal surface is covered by cortex. Tertiary flakes exhibit no cortex on their dorsal surface (Kooyman 2000:18). Shatter does not exhibit flake characteristics and is usually an unintended bi-product of detaching flakes from a core or the result of the shattering of the core from whence the flake is struck (Kooyman 2000:176).

Fragments are pieces of toolstone that have likely been transported to the site by humans, but, for reasons unknown, remain unmodified. Cobbles are unmodified clasts of toolstone that have not undergone further lithic reduction but are assumed to have been brought to the site for that purpose. They are occasionally tested in that they are broken apart in order to ascertain the quality of the lithic material that is hidden beneath the cortex.

4.5 Faunal Analysis

The purpose of the faunal analysis, in this context, was to attempt to determine as precisely as possible the type, number, and species represented by the bone recovered from each level. Bones were classed according to element, specimens (or portions), and fragments. The term element refers to a single complete bone, tooth, or shell. A specimen can be either a complete bone, tooth, or shell, or an identifiable portion thereof (Reitz and Wing 2008:9). Fragments are unidentifiable pieces of bone which can be identified no further than a class of elements like long bones, or a phylum like mammal, fish, etc. Elements and specimens were examined in order to determine the species and anatomical side when possible. When the species or taxon was indeterminate, the bone was assigned to one of a number of size classes ranging from Very Large Mammal to Micro-mammal (Dyck and Morlan 1995:140). Proxy indicators of age such as woven bone, billowed surfaces, or deciduous teeth were noted in order to assist in determining seasonality. Evidence of taphonomic processes were also recorded. Taphonomy can be considered as any and all of the postmortem processes a biological specimen undergoes during its transition from the biosphere to the lithosphere (Efremov 1940). Both cultural and natural taphonomic processes were noted. Cultural processes can include burning and cut marks. The burning of animal bones is often an indicator of human consumption. Bone undergoes two distinct stages of alteration when exposed to heat. When burned at lower temperatures, the collagen is carbonized and the bone appears black. At higher temperatures, the bone becomes calcined as the organic collagen is burned away and only the mineral constituents of the bone remain. Calcined bone is white to bluish white and extremely brittle (Lyman 1994:385). Cut marks are usually an indicator of butchering or defleshing and thus implies human usage of the animal. Bite marks, rodent gnawing, root etching, staining, and the presence of mineral deposits were among the natural processes recorded.

Bone weathering is the process by which the "original microscopic organic and inorganic components of a bone are separated from each other and destroyed by physical and chemical agents operating on the bone in situ" (Behrensmeyer 1978:153). Weathering of bones was also recorded in accordance with Behrensmeyer's (1978) stages of bone weathering as follows:

Stage Zero - no surface cracking or flaking, bone may be greasy, marrow and tissue may be present

Stage One - longitudinal cracking, mosaic cracking on articular surface, tissue may be present

Stage Two - outer layers show flaking and cracking which may result in the loss of the outermost layer, crack edges are angular in cross-section, ligament and cartilage may be present

Stage Three - surface patches of rough, weathered compact bone, fibrous texture, crack edges rounded in cross section, tissue rarely present

Stage Four - rough, coarsely fibrous surface, small splinters which may fall away from the bone, weathering penetrating into inner cavities, cracks open

Stage Five - bone falling apart in situ, large splinters, fragile, easily broken, cancellous bone exposed

4.6 Metal Artifacts

Very few metal artifacts were found at the Wolf Willow site and those that were are considered to be intrusive elements. Two shell casings were recovered and were given approximate dates by tracing the manufacturing runs via the information on the headstamp. Ammunition does present some difficulty with regard to dating as the curation of such items for periods well beyond the initial date of manufacture lends a significant bias.

4.7 Ceramic Artifacts

Pottery can be a valuable aid in determining the cultural affiliations and temporal parameters of an occupation level. A few pottery fragments were recovered from the late occupation levels at Wolf Willow. Most sherds were small in size and highly fragmented. The type of sherd was noted in regard to where the sherd originated from on the original vessel; for example, body, lip, shoulder. Decoration and temper were also recorded.

4.8 Quantitative Analysis

Quantitative analysis of faunal elements is necessary in order to determine the number and types of animals represented by the remains in an occupation level. Before a discussion of the analysis can proceed, some terms need to be defined. These terms include: NISP (number of identified specimens; MNI (minimum number of individuals); MNE (minimum number of elements); MAU (minimum number of animal units), and %MAU.

The most basic method of tallying animal remains is the NISP. This value represents the number of elements and fragments of elements that have been identified to taxon (Lyman 2008:27). Recovery techniques, laboratory procedures, cultural practices, and differential rates of preservation are factors that can bias the NISP count and therefore NISP is only used as a general estimate of the overall taxonomic variation and abundance of a particular faunal assemblage (Reitz and Wing 2008:202-205). MNI calculates the smallest number of individuals of each identified taxon required to account for the number of bones in a faunal assemblage (Reitz and Wing 2008:205). This value is obtained by tallying the number of right-side and left-side specimens of the most commonly occurring element of a species in an assemblage and using the higher number as an indication of the minimum number of individuals (Lyman 2008:39-43). In the case of paired bones, the total will be divided by the number present in the species in question, for example; where artiodactyls are concerned, the total number of phalanges would be divided by eight. When the most abundant element is an unpaired bone, like the axis, this number is used as the MNI indicator (Lyman 2008:40). Consideration was also given to size and age, where appropriate. However, the small sample size of this assemblage precludes the use of sex as an indicator. MNE values are derived from the number of identifiable fragments to provide an estimate of the minimum number of skeletal elements based on the number of landmark features (Reitz and Wing 2008:226). The highest frequency landmark is used to represent the minimum number of skeletal elements. MAU values are obtained from MNE values. An anatomical unit is a given anatomical part used in classification. MNE is divided by the number of such elements present in the skeleton. This number will vary depending on the number of times an element appears in the skeleton in question. The %MAU is calculated by dividing each MAU value by the largest MAU determined for that particular assemblage (Reitz and Wing 2008:229).

4.9 Stratigraphy

Archaeological investigations at the Wolf Willow site revealed four discernable cultural levels. Unfortunately, poor stratigraphic separation between these levels, especially levels one and two, made assigning artifacts to a particular occupation often somewhat difficult. Diagnostic items such as projectile points were heavily relied upon to establish the depths, location, and nature of cultural levels. The thickness of a particular level was determined by plotting the depths of recoveries on a histogram and supplementing that information with the recorded depths of projectile points and careful stratigraphic analysis (see Figure 4.3). Four cultural levels were identified; Plains Side-Notched, Prairie Side-Notched, McKean, and Oxbow. A fifth level is present beneath the Oxbow level; however, no diagnostic artifacts have been recovered at those depths. This fifth level is likely cultural, but until such time as a culture can be assigned to it, it will be referred to as “Level 5”. Below Level 5, recoveries were limited to very large, complete *Bison* sp. elements. Their presence at the site is likely either the result of an alluvial depositional event which incorporated some skeletal remains in the sediments.

Wanuskewin has been subject to periodic flooding, especially before the construction of the Gardiner Dam in the 1960s (Webster 1999:10). It is likely these flooding events that are responsible for the absence of approximately 2,000 years of archaeological deposits. Pelican

Lake (ca. 3,000-2,000 BP), Besant (ca. 2,500-1,350 BP), and Avonlea (ca. 1,350-1,100 BP) archaeological cultures are not represented in the deposits at the Wolf Willow site. This absence can also be tied to the presence of gravel filled channels in the western units of the site. The gravel layers are probably the remnants of high-energy colluvial (mass wasting) events of the valley walls which may have obliterated any deposits associated with these Late Period cultures (Figures 4.4, 4.5, and 4.6).

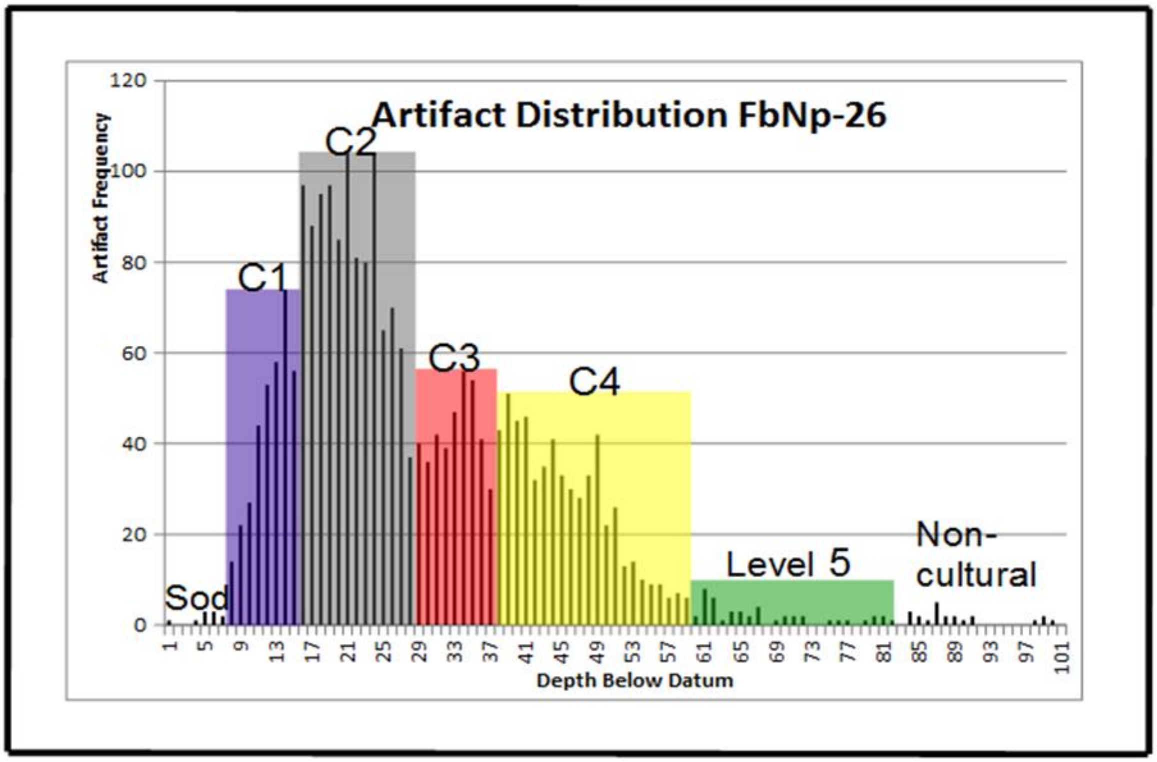

Figure 4.3: Artifact Distribution by Depth

Figure 4.4: Gravel Deposit in Unit 25S 12E

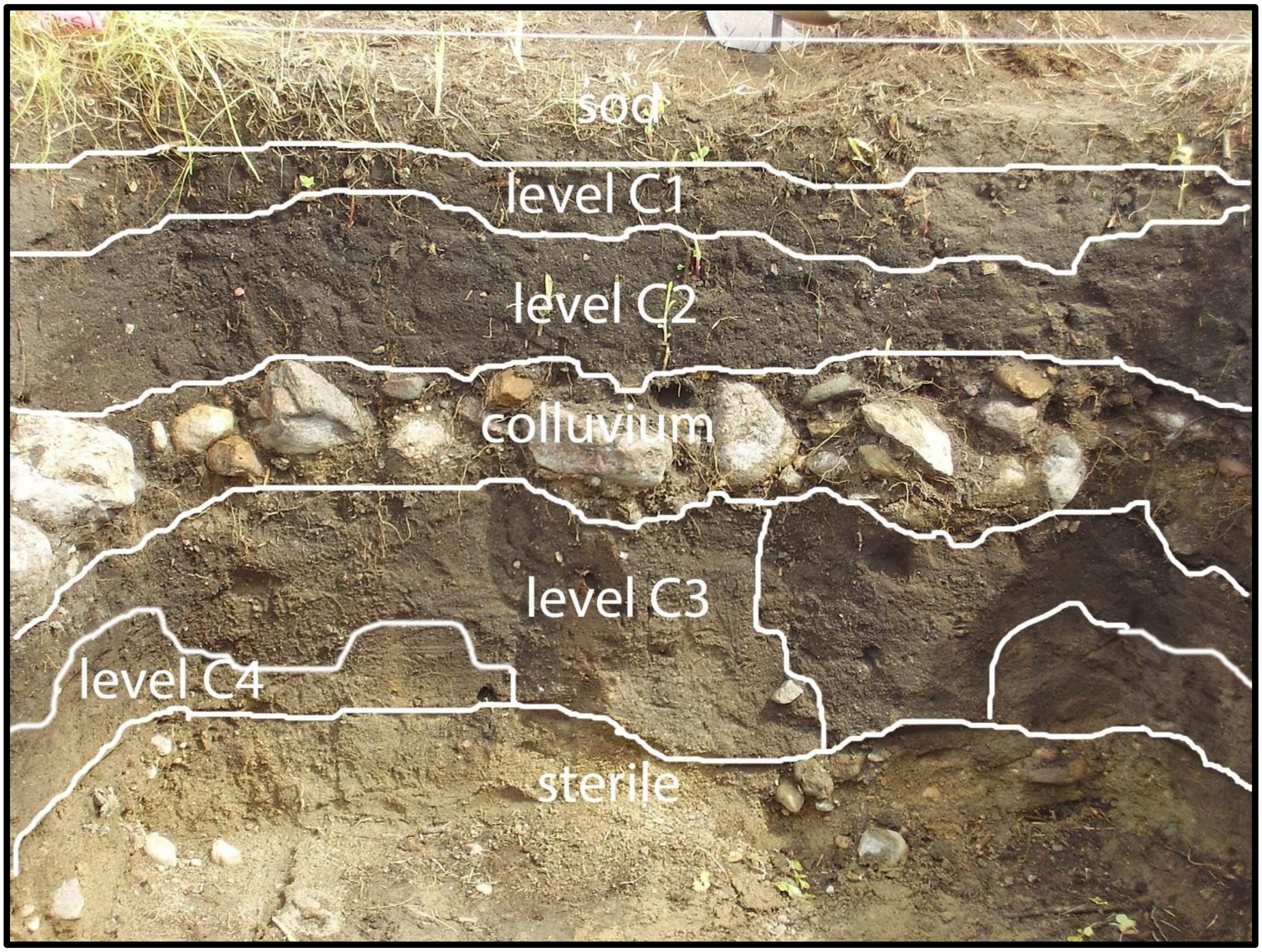

Figure 4.5: Gravel deposit in North Wall of Unit 25S 15E

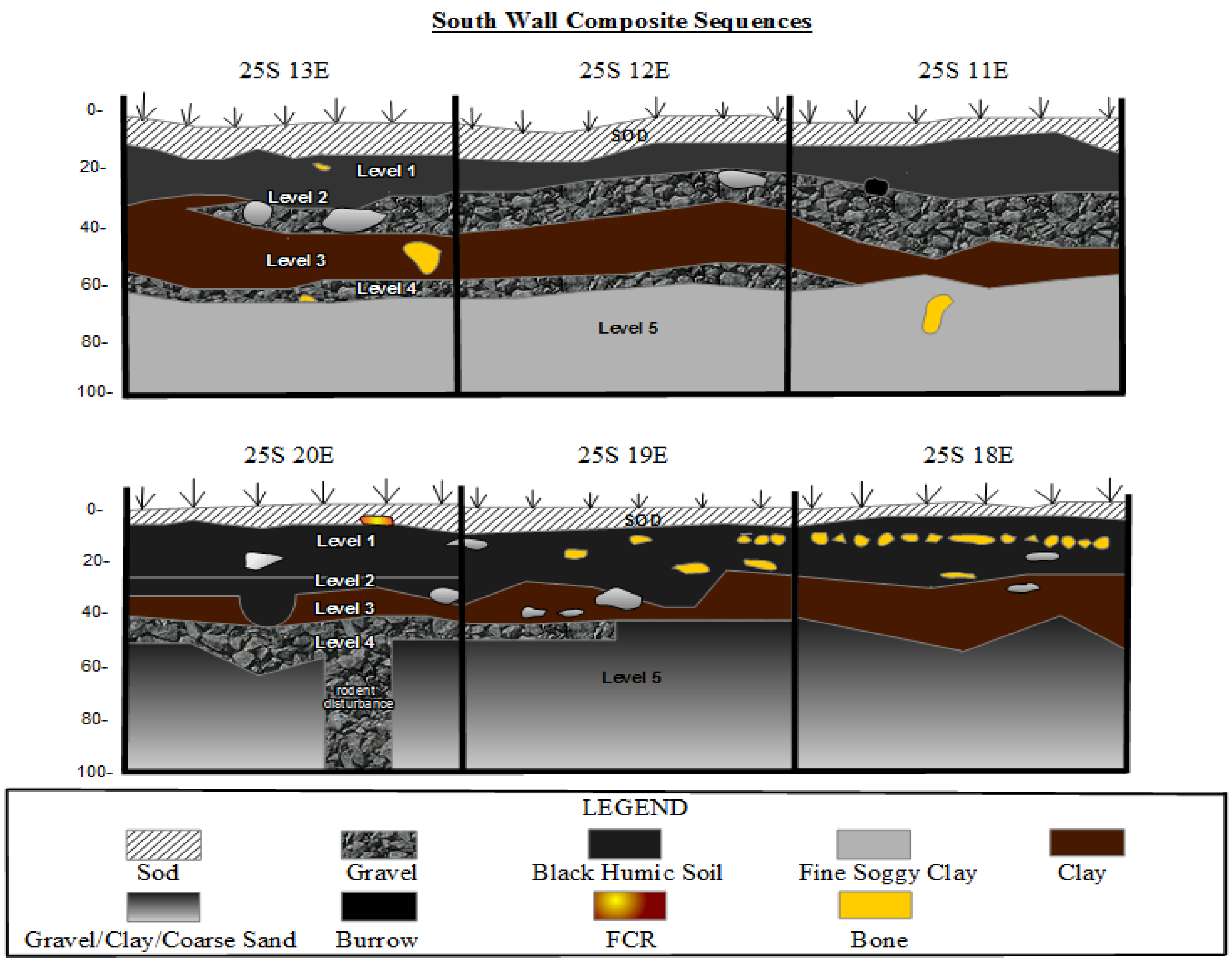

Figure 4.6: Stratigraphic Sequence of Selected Units

4.10 Radiocarbon Dating

Four samples were selected for radiocarbon dating. All the samples consisted of *B. bison* bone that was well preserved and recovered from good stratigraphic context. The radiocarbon dates were completed by Beta Analytic in the summer of 2015.

Sample Beta-414920 consisted of a *B. bison* petrous temporal which was recovered from Level C1 in unit 25S 19E. The calibrated age of the sample after applying ^{13}C correction is 220 BP.. This date is consistent with a Plains Side-Notched occupation.

Sample Beta-414921 consisted of a *B. bison* petrous temporal which was recovered from Level C2 in unit 25S 19E. The calibrated age of the sample after applying ^{13}C correction is 3300 BP. This date is not consistent with the Prairie Side-Notched culture which has been ascribed to Level C2. It is more consistent with the McKean occupation in Level C3. The reasons for the discrepancy are likely poor stratigraphic control during excavation or mislabeling during the cataloguing process.

Sample Beta-414922 consisted of a *B. bison* vertebral fragment which was recovered from Level C4 in unit 17S 19E. The calibrated age of the sample after applying ^{13}C correction is 4620 BP. This date is consistent with an Oxbow occupation.

Sample Beta-414923 consisted of a *B. bison* vertebral fragment which was recovered from Level 5 in unit 16S 19E. . The calibrated age of the sample after applying ^{13}C correction is 4960 BP. This date is concurrent with the Mummy Cave occupations found elsewhere at Wanuskewin; however, no diagnostic artifacts have been recovered from this level.

Chapter 5

Cultural Level 1

5.1 Introduction

Cultural Level 1 is situated immediately below the sod layer and above Cultural Level 2. It consists of dark brown humic soil which represents the modern A horizon and yielded a moderate number of artifacts that can, with some confidence, be assigned to the Plains Side-Notched culture based on the recovery of seven identifiable projectile points. Cultural Level 1 appears in all excavated units and ranges from 5 to 12 cm below datum in depth. A chronometric age was not obtained for this level.

5.2 Lithic Assemblage

A total of 1,462 pieces of debitage was recovered from Level 1 (Table 5.1). Shatter comprised most of the recoveries at 82.5%, followed by fragments at 13.7% and secondary flakes at 1.2%. Swan River chert was the most common material representing 58.8% of the assemblage. Quartzite was the second most common material type, accounting for 14.1%, followed by quartz at 8.1%. Fifteen different material types were represented, most being locally available, having been transported to the area via glacial processes or fluvial action with the exception of Knife River flint which is sourced in North Dakota (Clayton et al. 1970:283). Swan River chert occurs naturally in a wide area that is, as yet, poorly delineated and was heavily used by almost all almost precontact cultures in central and southern Saskatchewan (Johnson 1998:31). Gronlid siltstone is found in a glacial erratic exposure north of Gronlid, Saskatchewan (Johnson 1998:21). Fused shale, silicified wood, silicified peat, quartzite, agate, pebble chert, and other miscellaneous cherts represented all have sources located within central and southern Saskatchewan (Johnson 1998).

Table 5.1: Level C1 Lithic Debitage and Fragments

Material Type	Primary Flakes	Secondary Flakes	Tertiary Flakes	Shatter	Frags	Total	%	% Heat Treated
Swan River Chert	30.3g (n=4)	22.8g (n=2)	21.5g (n=44)	1100.9g (n=869)	102.4g (n=6)	1277.9g (n=925)	58.8% (63.3%)	1114.3g (87%)
Pebble Chert	2.4g (n=2)			16.9g (n=4)	78.4g (n=13)	97.7g (n=19)	4.5 (1.3%)	
Unknown Chert			1.0g (n=5)	56.5g (n=79)	21.3g (n=5)	78.8g (n=89)	3.6 (6.1%)	
Chert Precipitated in Limestone				27.6g (n=22)	11.4g (n=1)	39g (n=23)	1.8 (1.6%)	
Cathead Chert			.5g (n=4)	2.2g (n=8)		2.7g (n=12)	0.1 (0.8%)	
Gronlid Siltstone		0.2g (n=1)		16.4g (n=6)		16.6g (n=7)	0.8 (0.5%)	
Quartz	0.5g (n=1)		3.4g (n=8)	105.5g (n=72)	84.0g (n=2)	193.4g (n=83)	8.9 (5.7%)	
Quartzite				307.4g (n=131)		307.4g (n=131)	14.1 (9.0%)	
Agate				8.8g (n=10)		8.8g (n=10)	0.4 (0.7%)	
Chalcedony				5.1g (n=15)		5.1g (n=15)	0.2 (0.1%)	
Silicified Peat				114.2g (n=124)		114.2g (n=124)	5.3 (8.5%)	
Knife River Flint				9.6g (n=6)		9.6g (n=6)	0.4 (0.4%)	
Fused Shale				0.5g (n=1)		0.5g (n=1)	<0.1 (<0.1%)	
Porcellanite				7.4g (n=7)		7.4g (n=7)	0.3 (0.5%)	
Silicified Wood				14g (n=10)		14g (n=10)	0.6 (0.7%)	
Total Weight Total Count	33.2g (n=7)	23g (n=3)	26.4g (n=61)	1793g (n=1364)	297.5g (n=27)	2173.1g (n=1462)	100 (100%)	
% Weight % Count	1.5% (0.5%)	1.1% (0.2%)	1.2% (4.2%)	82.5% (93.3%)	13.7% (1.8%)	100 (100%)		

5.3 Flaked Stone Tools

The excavation of Cultural Level 1 yielded a total of 30 flaked stone tools: 13 bifaces, nine projectile points, three end scrapers, two retouched flakes, one side/end scraper, one awl tip, one drill tip, and one projectile point preform.

5.3.1 Level C1 Uniface Tools

The unifacial tools recovered from this level included three end scrapers, one side/end scraper, and two retouched flakes. The first end scraper (Fig. 5.1, A) is composed of red chert. Its distal corner has been broken off transversely, and its proximal edge has been broken off transversely. The second end scraper (Fig. 5.1, B) was created from a chert pebble. It has been broken horizontally across the midpoint and its distal edge is missing. The third end scraper (Fig. 5.1, D) is made from a brown/grey banded chert. Its left margin, proximal portion, and right margin are missing, making its original shape difficult to determine. The broken margins of the tool appear quite jagged and irregular. It does exhibit some usewear along its working edge. The side/end scraper (Fig. 5.1, C) is composed of yellow chert. Its working edge was broken off, likely when an attempt was made to rejuvenate the tool by splitting it longitudinally. It does exhibit some retouch along the left lateral margin. The first retouched flake (Fig. 5.2, A) is composed of banded grey/white chert precipitated in limestone. It has had flakes removed from the left lateral edge to produce a straight working edge. The second retouched flake (Fig. 5.2, B) is composed of pink, heat-treated, Swan River chert and exhibits percussion flake removals along its lateral edge.

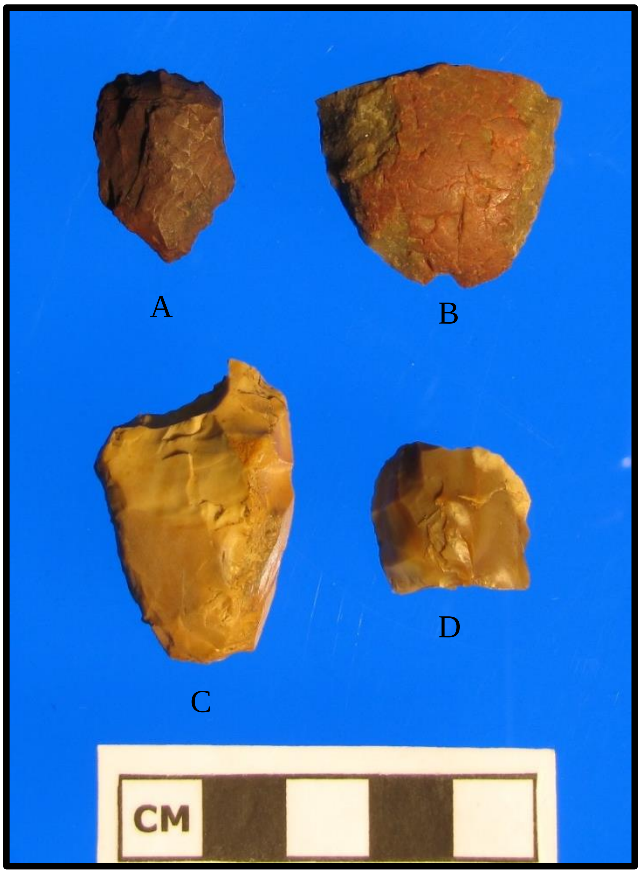

Figure 5.1: Level C1 End Scrapers and End/Side Scraper.
(A=cat#1356; B=cat#1825A; C=cat#5364; D=cat#3198)

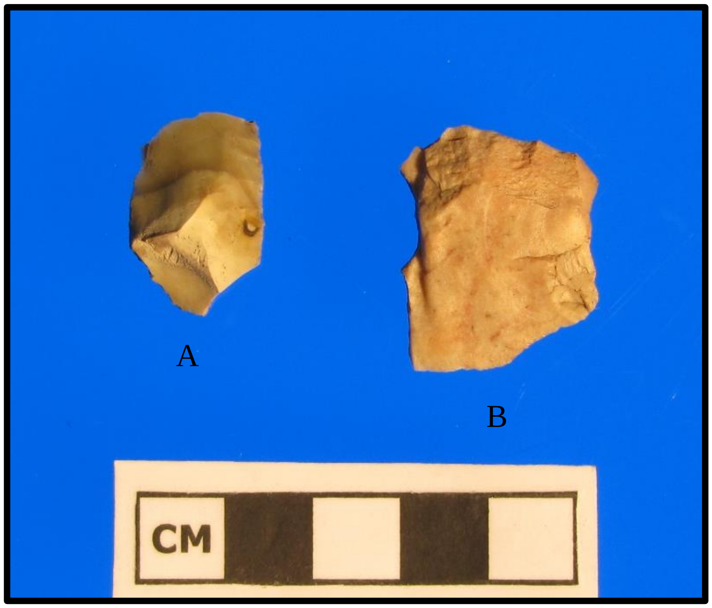

Figure 5.2: Level C1 Retouched Flakes.
(A=cat#1347; B=cat#3020)

5.4 Level C1 Bifacial Tools

A total of 15 bifacial tools was recovered from Level C1, including; 13 bifaces, one awl tip, and one drill tip. Six bifaces were formed from Swan River chert and five underwent heat treatment. All the heat-treated Swan River chert bifaces were broken either transversely across the midsection (Fig.5.3, A, B) or across both the distal and proximal portions leaving only the midsection (Fig.5.4, C, D). The remaining heat-treated Swan River chert biface (Fig. 5.3, E) was square in shape and bifacially worked along three lateral edges. The non-heat-treated Swan River chert biface was also likely ovoid and had been broken transversely across its midsection. Three silicified peat bifaces were recovered, two triangular and one ovoid in shape. The triangular bifaces are both broken obliquely at their distal ends (Cat.# 5379; not pictured, Fig. 5.3, F) and the ovoid biface (Fig. 5.3, G) is represented by the midsection only. Catalogue number 213 (not pictured) is comprised of grey, medium grained, quartzite. It is triangular in shape and has been broken transversely across its distal end. Item H (Fig. 5.3) is constructed from Swan River chert. Item I (Fig. 5.3) is formed from white quartz. It was probably ovoid originally, but has been broken transversely and longitudinally resulting in a quarter of the original tool remaining. Item J (Fig. 5.3) is formed from brown chalcedony. Its distal and proximal ends have been broken off transversely, leaving the midsection only. The final biface (Cat.# 3022; not pictured) is made of grey chert, and has been broken transversely across the midsection, resulting in the distal end missing. The awl tip (Fig.5.4, A) is made of Gronlid siltstone. It has some cortex remaining on its ventral surface and is triangular in shape. The drill tip (Fig. 5.4, B) is composed of heat treated Swan River chert and has been broken transversely across the midsection, leaving only the extreme distal portion.

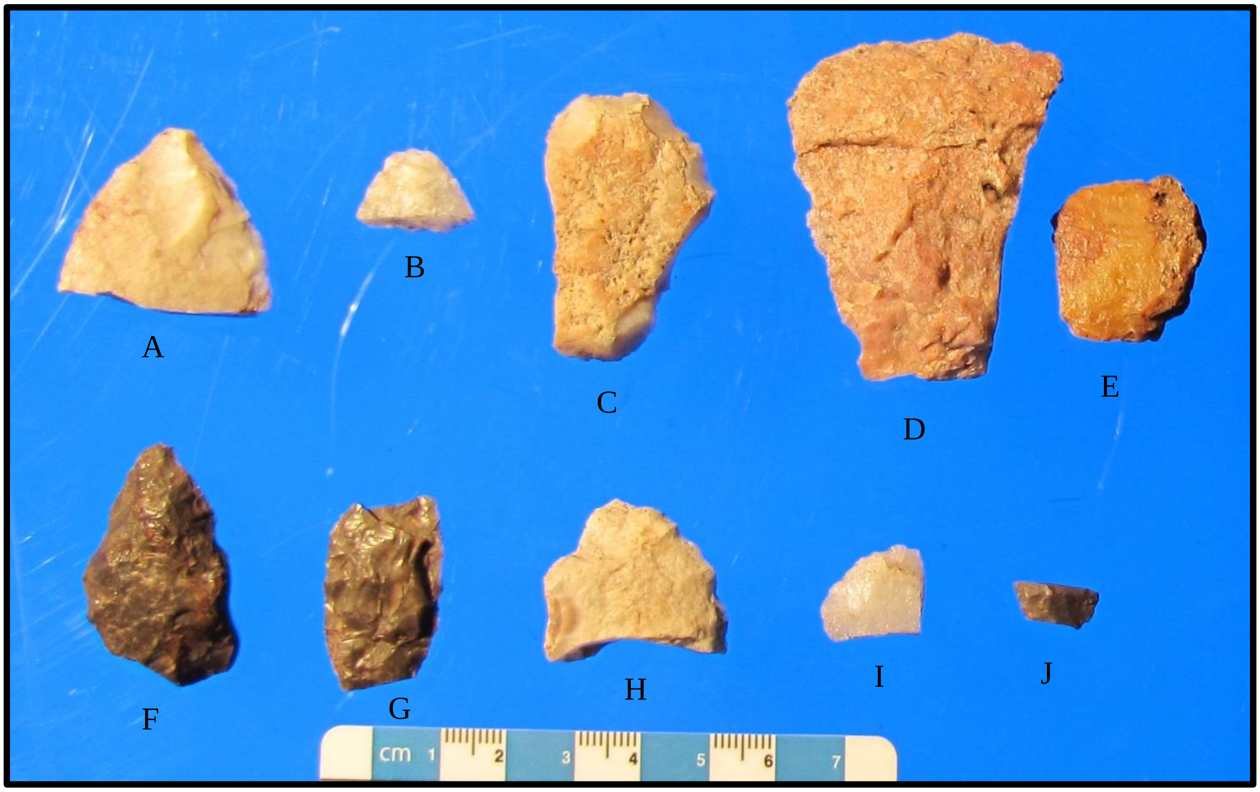

Figure 5.3: Level C1 Bifaces. (A=cat#2644; B=cat#585; C=cat#4867; D=cat#5187B; E=cat#3752; F=cat#3021; G=cat#1345; H=cat#1538; I=cat#1359; J=cat#584)

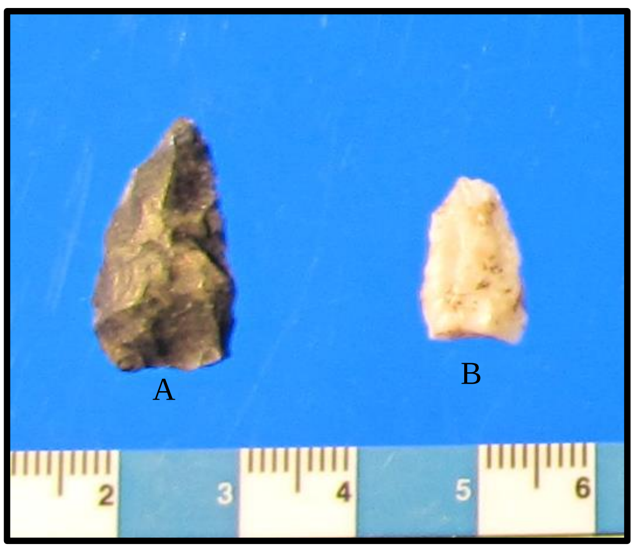

Figure 5.4: Level C1 Awl and Drill. (A=cat#1571; B=cat#2055)

5.4.1 Projectile Points

Six identifiable projectile points, one base, two tips, and one preform were recovered from Cultural Level 1. All the points, with the exception of the preform and tips, have been attributed to the Plains Side-Notched cultural complex. Of these, one is complete, and five are missing their tips. The first point (Fig. 5.6, A) was recovered in two pieces from unit 25S 15E at a depth of 13.5 cm. It is composed of heat-treated Swan River chert and had been broken in half transversely 4.5 mm from shoulder. Two projectile points (Fig. 5.6, B, C) are made from silicified peat. The first was recovered from unit 24S 11E at a depth of 7 cm. It exhibits small, shallow side notches, an extensively reworked blade and is missing the tip. The second was found in unit 23S 11E at a depth of 7.5 cm below datum. Its tip has been broken off transversely. Projectile point (Fig. 5.6, D) was recovered from unit 23S 11E at a depth of 11.8 cm. It is made from a black, split chert pebble, and exhibits a straight base and broad notches. A grey chalcedony point (Fig. 5.6, E) was recovered from unit 23S 11E at a depth of 5 cm and has had its blade broken obliquely approximately halfway up. The final projectile point (Fig. 5.6, F) was recovered from unit 23S 11E at an unknown depth. It is made from Knife River flint and has had its tip broken off transversely. One projectile point base made from heat-treated Swan River chert was found in unit 24S 17E at an unknown depth. Two projectile point tips were recovered (Fig. 5.6, G, H) made of silicified peat and heat-treated Swan River chert respectively.

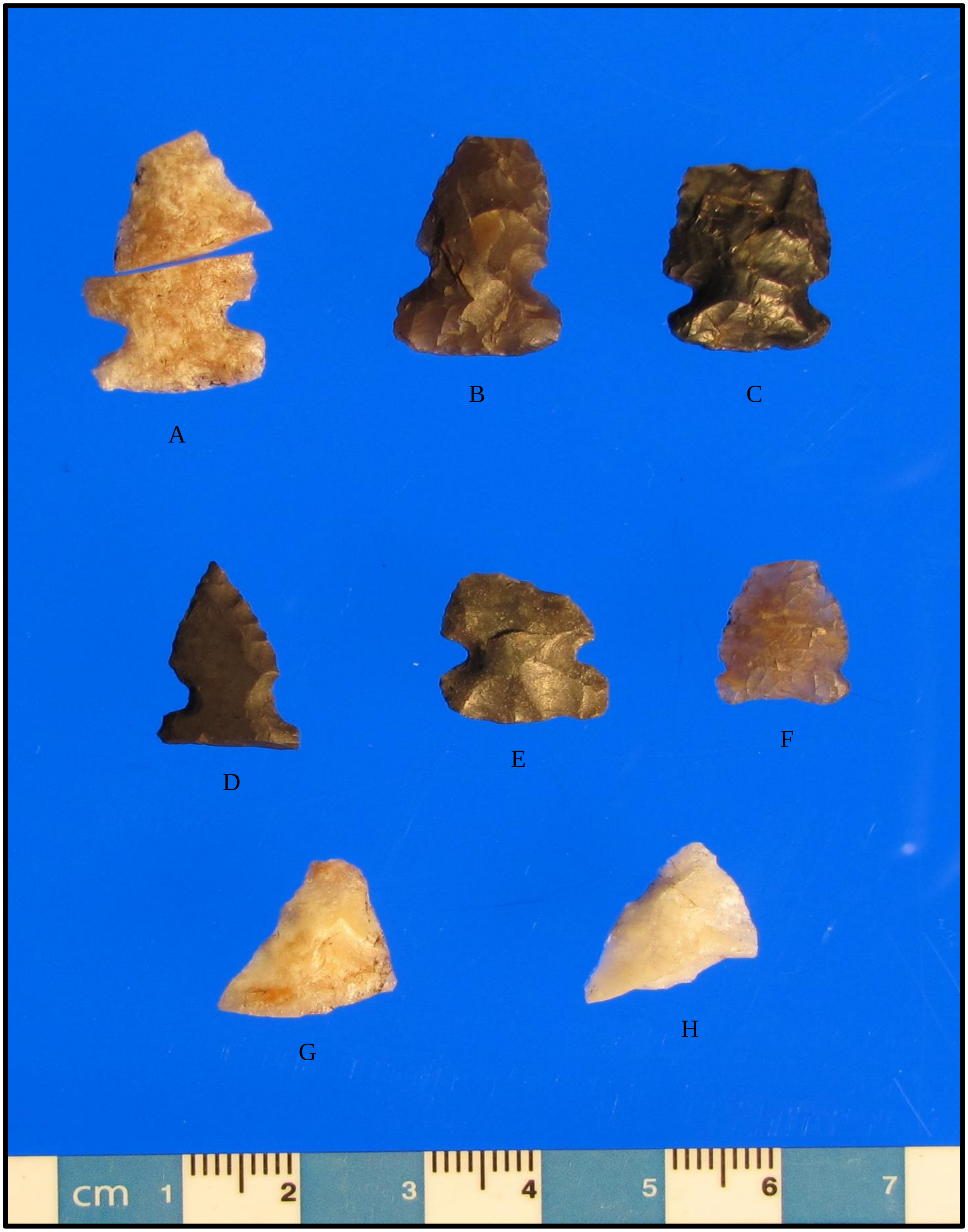

Figure 5.5: Level C1 Projectile Points. (A=cat#1576 & 1579; B=cat#3197; C=cat#5549A: D=cat#5369; E=cat#5549; F=cat#5871; G=cat#1581; H=cat#586)

5.5 Cores

A single core fragment (Fig.5.6) of unknown grey chert with a mass of 2.2 g was recovered from unit 25S 14E.

Figure 5.6: Level C1 Core Fragment. (cat#1357)

5.6 Fire-Cracked Rock

A total of 196 pieces of fire-cracked rock were recovered from Level C1 (Table 5.2). The most common material by weight was basalt at 2,947.6 g (36%). The remainder of the fire-cracked rock assemblage was comprised of local metamorphic and igneous rocks.

Table 5.2: Level C1 Fire Cracked Rock

Material	Count	%	Mass (g)	%
Basalt	40	24	2947.6	36
Diabase	2	1	60	<1
Diorite	1	0.6	8.1	<1
Gneiss	2	1	759.1	9
Granite	101	60	3666.3	45
Sandstone	21	12.4	763.1	9
Schist	2	1	13	1
Total	169	100%	8217.2g	100%

5.7 Pottery

Two sherds of pottery were recovered from Level C1 (Table 5.3). The first is a single small rim sherd, with grit temper and a single cord-wrapped tool impression on the rim surface. The second is a body sherd, with grit temper and a fabric-impressed exterior. Fabric impressions and cord wrapped tool marks on rim surfaces are consistent with pottery styles found in association with Plains Side-notched points (Epp 1991:62). However, the small sample size precludes drawing any meaningful conclusions with regard to the pottery assemblage for Level C1.

Table 5.3: Level C1 Pottery

Fragment Description	Mass (g)	Count	%
Complete Sherd	14.3	11	88
Rim Sherd	1.9	1	12
Total	16.2g	12	100%

Figure 5.7: Level C1 Pottery Rim Sherd. (cat#5370)

5.8 Metal Artifacts

Metal artifacts recovered from level C1 consist of a single .22 short Dominion rim fire shell casing from unit 25S 17E. Based on the impressed “D” that appears on the headstamp, the manufacture of the cartridge has been traced to the Dominion Cartridge Company, which was founded at Brownsburg, Que. in 1886 by Captain A. L. ("Gat") Howard. The Dominion Cartridge Company merged with five explosives companies and a plant making acids and fertilizers to form Canadian Explosives Limited in 1910 (Canadian Manufacturers’ Association, 1967). Therefore, it appears likely that that the shell casing dates from 1886-1910 and was probably associated with the Penner homestead. However, ammunition is often curated for long periods of time, so the shell may date to a later period.

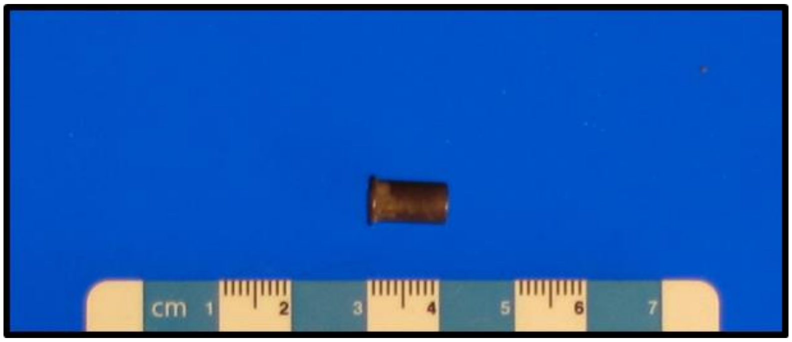

Figure 5.8: Level C1 Shell Casing. (cat#576)

5.9 Faunal Assemblage

The excavations of Level C1 produced a total of 8,321 elements, specimens, and unidentified fragments (Table 5.4). The majority of the faunal remains in Level C1 are unburned, number 7,901 (94.9%), and weigh a total of 5,646 g. Unidentifiable fragments of bone weighing a total of 5,608.2 g, comprising 96.3% of the total assemblage. Of these, 95.6% are unburned, 1.98% are burned, and the remaining 2.32% are calcined. The most common degree of weathering was Stage 3 and root etching was most common taphonomic process noted.

Table 5.4: Level C1 Faunal Counts

Faunal Type	**Number of Elements**	**Mass (g)**	**Number of Specimens**	**Mass (g)**	**Number of Unidentified**	**Mass (g)**
Unburned Bone	33	414.2	29	544.5	7618	5463.3
Burned Bone	0	0	0	0	159	71.4
Calcined Bone	0	0	0	0	186	55.8
Unburned Enamel	39	8	5	60	240	181.9
Burned Enamel	0	0	0	0	0	0
Calcined Enamel	0	0	0	0	0	0
Shell	0	0	0	0	0	0
Total	72	422.2g	34	604.5g	8203	5772.4g

Table 5.5: Level C1 Faunal Remains by Taxa

Common Name	Taxon	NISP	MNI
Mammals			
Bison	*B. bison*	66	2
Dog/Coyote/Wolf	*Canus* sp.	1	1
Pig	*S. Scrofa*	1	1
Ground Squirrel	*Spermophilus* sp.	2	1
Miscellaneous			
Bison/Moose Size	Very Large Mammal	595	
Deer/Wolf Size	Large Mammal	183	
Coyote/Badger Size	Medium Mammal	104	
Ground Squirrel Size	Small Mammal	3	
Total		954	5

5.10 Order Artiodactyla

5.10.1 *Bison bison*

The Number of Identified Specimens for *Bison bison* is 66 with a mass of 1,125.8g. Forty-two percent of the identified specimens recovered from Level C1 have been classified as bison. The results of the quantitative analysis by element summarized in Appendix C indicate that at least two adult *B. bison* are represented by the recovery of two right side lateral malleoli. Seasonality could not be determined via the examination of *B. bison* skeletal remains as the only immature specimens recovered consisted of a single unfused femoral head and the root of a deciduous premolar which could not be aged.

Bison are the largest terrestrial mammal in North America. These horned bovids preferred grazing habitats found primarily on the Great Plains and Prairies. They also favoured river valleys and, occasionally, forests. Historically, the bison ranged from the Atlantic coast nearly to the Pacific and from Mexico and Florida into central Canada with populations estimated in the tens of millions until their extirpation by the beginning of the twentieth century (Whitaker 1980: 666-7).

5.10.2 *Sus scrofa domestica*

A second mandibular molar from a domestic pig was recovered from Level C1. This specimen is an intrusive element likely associated with an historic hog farming operation on the site of the present day Wanuskewin Heritage Park.

5.11 Order Carnivora

5.11.1 *Canis* sp.

A complete navicular from an adult wolf sized canid was recovered from level C1. This specimen compares favorably to the wolf specimen in the U of S faunal collection; however, it may also be from a large sized domestic dog. With limited skeletal remains available for analysis, it is impossible to definitively identify the specimen as belonging to one or the other taxon. Identification is further complicated by the fact that domestic dogs are known to interbreed with wolves. Domestic dogs were kept by precontact groups as pack animals; to alert against predators; to assist hunters in tracking, immobilizing, and killing prey; and as a food source (Tito et al. 2011). The wolf's historic range encompassed most of North America. They form lifelong pair bonds and live in packs of family members and relatives numbering two to 15. Large mammals like deer, moose, and caribou form the bulk of the wolf's prey. However, they will also feed opportunistically on berries, birds, fish, and insects (Whitaker 1980: 531).

5.12 Order Rodentia

5.12.1 *Spermophilus richardsonii*

A humerus and innominate were recovered in Level C1. These likely represent intrusive elements as ground squirrels are fossorial and are known to expire in their burrows on a fairly regular basis. Richardson's ground squirrels are diurnal, burrowing, hibernating sciurids that consume a diet of insects and plant materials. They prefer an open prairie habitat, ranging from southern Alberta, Saskatchewan, Manitoba, south to northeast Idaho, Wyoming, northwest Colorado, northeast South Dakota and western Minnesota (Whitaker 1980: 393).

5.13 Miscellaneous Specimens

The size classes identified for miscellaneous specimens in Level 2 were Very Large Mammal (SC6), Large to Very Large Mammal (SC5-6), Large Mammal (SC5), Medium Mammal (SC5) and Small Mammal (SC4). The NISP for SC6 is 61 and consists of mainly long bone fragments. The NISP for SC5-6 is 595 and consists primarily of long bone fragments. The NISP for SC5 is 183 and is primarily long bone and rib fragments. The Small Mammal NISP is 3 and consists of a sesamoid and tooth fragments. It is likely that the Very Large to Large Mammal remains are bison as no other large mammals are known or suspected to be present in Level C1 and bison represents a high proportion of the faunal assemblage.

5.14 Features

The single feature in this level consists of a charcoal stain in unit 25S 17E. This staining is likely related to a larger feature that directly underlies this stain in Level C2. The poor separation between Level 1 and Level 2 probably led to the excavators encountering the charcoal stain while nearing the bottom of level C1. No significant recoveries are associated with this feature in Level C1.

5.15 Interpretation

The assemblage recovered from Level C1 is consistent with a Plains Side-Notched occupation. While no chronometric dates have been obtained for this level, the recovery of several projectile points from controlled depths lend ample credence to this conclusion.

The faunal assemblage is dominated by thoroughly comminuted bone. The reasons for such can be numerous, including secondary processing and trampling, but all are consistent with practices associated with habitation activities. Carpals, tarsals, and phalanges are highly represented in the bison faunal assemblage. This may represent butchering practices that did not involve the removal of low utility items before transporting dismembered carcasses back to camp or may be a function of taphonomic processes that favour smaller, denser elements like carpals and tarsals.

Local materials form the bulk of the lithic recoveries which conforms to a pattern of lithic procurement seen across the Canadian Prairies (Kooyman 2000: 143). The single core fragment and small number of flakes recovered suggest that lithic reduction did not comprise a significant portion of the activities taking place at the site. However, the relatively large number of bifacial tools suggest that a substantial amount of processing activity was taking place, perhaps in the form of secondary processing or an activity involving hides or some other type of organic material that would not have readily preserved.

The occupants of this habitation level practiced an economy that relied heavily on bison procurement and the employment of local lithic materials. No definitive activity areas can be identified which suggests that this occupation represents a mixed use site where multiple activities related to food processing, tool use, and household economy took place over a relatively short term occupation (Figure 5.9).

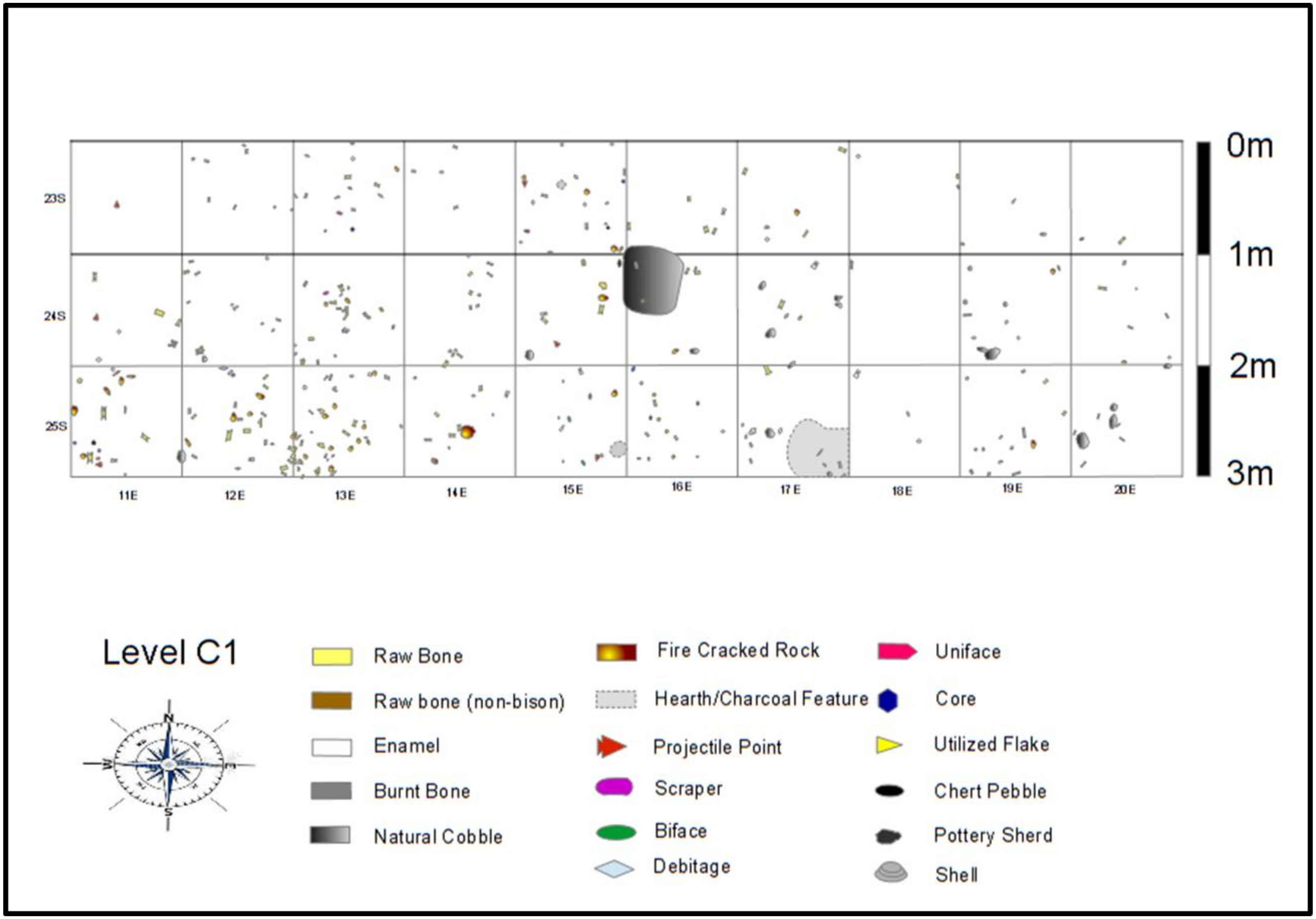

Figure 5.9: Distribution of Artifacts. Ecofacts, and Features in Level C1

Chapter 6

Cultural Level 2

6.1 Introduction

Cultural Level 2 is located immediately beneath Level C1 within an homogenous layer of dark brown humic soil. It ranges in depth from 17 cm below datum to 29 cm below datum and was encountered in all excavated units. The recovery of numerous Prairie Side-Notched projectile points has led to the assignment of the level to that time period. Level 2 yielded a considerable number of artifacts.

6.2 Lithic Assemblage

A total of 4,943 pieces of lithic debitage were recovered from Level C2 (Table 6.1). The dominant form of debitage was shatter, which made up 77.95% of the recoveries by weight. The second most frequently recovered debitage type were primary flakes at 1.83%. Swan River chert was the most common material type at 50.6%, followed by quartzite at 31.16%, and quartz at 6.68%. Twenty different material types were recovered. Most materials are locally available with the exception of Knife River flint, obsidian, and Rainy Buttes chert. The nearest source of obsidian is Yellowstone National Park in Wyoming and it would have been obtained through long-distance trade networks (Park 2010). Rainy Buttes chert originates from surface available deposits near West Rainy Butte in southwest North Dakota (Loendorf et al. 1984:33

Table 6.1: Level C2 Lithic Debitage and Fragments

Material Type	Primary Flakes	Secondary Flakes	Tertiary Flakes	Shatter	Fragment	Total	%	% Heat Treated
Swan River Chert	71.9g (n=152)	5.1g (n=2)	71.9g (n=152)	3805.3g (n=2756)	895.4g (n=23)	4849.6g (n=3085)	50.6% (62.41%)	84.0% (91.9%)
Quartz	9.4g (n=12)	5.2g (n=1)		623.9g (n=350)	1.0g (n=1)	639.5g (n=364)	6.68% (7.36%)	
Unknown Chert	10.6g (n=15)			142.2g (n=112)	67.1g (n=5)	219.9g (n=132)	2.29% (2.67%)	
Chalcedony	1.0g (n=5)		5.0g (n=28)	26.2g (n=51)		32.2g (n=84)	0.34% (1.7%)	
Knife River Flint				7.7g (n=22)		7.7 (n=22)	0.08% (0.45%)	
Silicified Peat	8.6g (n=21)	0.5g (n=2)		282.6g (n=231)	38.7g (n=4)	330.4g (n=258)	3.45% (5.22%)	
Agate	4.7g (n=1)		9.5g (n=12)	18.1g (n=26)		32.3g (n=39)	0.34% (0.79%)	
Quartzite	44.2g (n=18)	8.3g (n=3)		2342g (n=656)	591.6g (n=10)	2986.1g (n=687)	31.16% (13.9%)	
Gronlid Siltstone	6.2g (n=6)	5.1g (n=8)	3.8g (n=8)	56.2g (n=53)	13.1g (n=1)	84.4 (n=76)	0.88% (1.54%)	
Pebble Chert	0.4g (n=1)			17.1g (n=7)	140.4g (n=45)	157.9g (n=53)	1.65% (1.07%)	
Chert Precip. in Limestone	2.5g (n=1)		2.7g (n=3)	65.8g (n=58)	16.4g (n=1)	87.4g (n=63)	0.92% (1.27%)	
Porcellanite	3.5g (n=5)	2.9g (n=1)		48.8g (n=33)		55.2g (n=39)	0.58% (0.79%)	
Silicified Wood					18.3g (n=3)	18.3g (n=3)	0.19% (0.06%)	
Obsidian				0.2g (n=1)		0.2g (n=1)	<0.01% (0.02%)	
Cathead Chert	1.1g (n=2)			4.1g (n=5)		5.2g (n=7)	0.05% (0.14%)	
Jasper	3.4g (n=1)			7.6g (n=6)		11.0g (n=7)	0.11% (0.14%)	
Argillite	6.7g (n=1)		12.5g (n=6)	2.7g (n=3)		21.9g (n=10)	0.23% (0.20%)	
Feldspathic Siltstone	0.7g (n=1)			12.8g (n=2)		13.5 (n=3)	0.14% (0.07%)	
Fused Shale			0.2g (n=1)	7.0g (n=8)		7.2g (n=9)	0.07% (0.18%)	
Rainy Buttes Chert					23.6g (n=1)	23.6g (n=1)	0.24% (0.02%)	
Total	174.9g (n=242)	27.1g (n=17)	105.6g (n=210)	7470.3g (n=4380)	1805.6 (n=94)	9583.5 (n=4943)	100% (100%)	
%	1.83% (4.90%)	0.28% (0.34%)	1.10% (4.25%)	77.95% (88.61%)	18.84% (1.90%)	100% (100%)		

6.3 Flaked Stone Tools

Seventy flaked stone tools were recovered from Cultural Level 2 including: 26 projectile points, 21 bifaces, 13 end scrapers, four retouched flakes, two awl tips, two spokeshaves, one tool fragment, and one uniface.

6.3.1 Bifaces

Six bifaces manufactured from heat-treated Swan River chert were recorded in Level C2. Item A (Fig. 6.1) is represented by its distal portion only as it was broken transversely across the midsection. Item B (Fig. 6.1) is also broken transversely across midsection, leaving only the proximal portion of the tool. Item C (Fig. 6.1) has had both the proximal portion broken off transversely and the left lateral portion broken off longitudinally. Item D (Fig. 6.1) was likely ovoid in shape originally, but has had its distal portion broken off transversely. Item E (Fig. 6.1) has been broken longitudinally and transversely resulting in a fragment of the distal portion remaining. Item F (Fig. 6.1) represents the distal tip of a triangular biface that has broken transversely.

Seven bifaces formed from silicified peat were recovered from Level C2. Item G (Fig. 6.1) consists of the proximal portion of a biface that may have been hafted as it appears to have been basally thinned. Item H (Fig. 6.1) is rectangular in shape and has had its distal portion broken off obliquely. Item I (Fig. 6.1) has a very thin cross section and its distal portion and tip have been broken off transversely. Item J (Fig. 6.1) was broken transversely and longitudinally resulting in a quarter of original tool remaining. It was likely ovoid in shape originally. Item K (Fig. 6.1) was broken transversely across its midsection and was probably ovoid in shape. Item A (Fig. 6.2) represents the distal tip of what was possibly a triangular biface.

Three bifaces were constructed from quartzite. Item B (Fig. 6.2) has been broken in half longitudinally. Item C (Fig. 6.2) has broken transversely and consists of the basal portion only. Item D (Fig. 6.2) is rectangular and has been broken transversely leaving only the distal portion.

Two bifaces were formed from quartz. Item E (Fig. 6.2) has had its basal and distal portions broken off transversely, resulting in only the midsection remaining. Item F (Fig. 6.2) is represented by its proximal portion only, as it has been broken obliquely across the midsection.

Knife River flint, obsidian, and fused shale respectively comprise the remainder of the bifaces. Item G (Fig. 6.2) was broken obliquely across midsection, making its original shape indeterminate. Item H (Fig. 6.2) is represented by a square fragment of a larger tool. Item I (Fig. 6.2) was possibly ovoid originally, but has been broken obliquely across the midsection.

The final biface fragment (Fig. 6.2, J) is composed of unknown chert. It has been burned, and is represented by the lateral edge of a bifacial tool that has been broken off longitudinally. It was recovered from a midden feature in unit 25S 18E.

Two bifacially retouched flakes were unearthed in Level C2.The first (Fig. 6.3, A) was created from a black chert pebble flake, and the second (Fig. 6.3, B) is fabricated from red jasper. Two awl tips and a fragment of a larger tool were also recovered in level C2. The awls are made from silicified peat (Fig. 6.3, C) and heat-treated Swan River chert (Fig. 6.3, D). The tool fragment is fabricated from obsidian (Fig. 6.3, E). It appears to have become detached from a larger tool, but the fragment is too small to determine what the form or function of the original tool may have been.

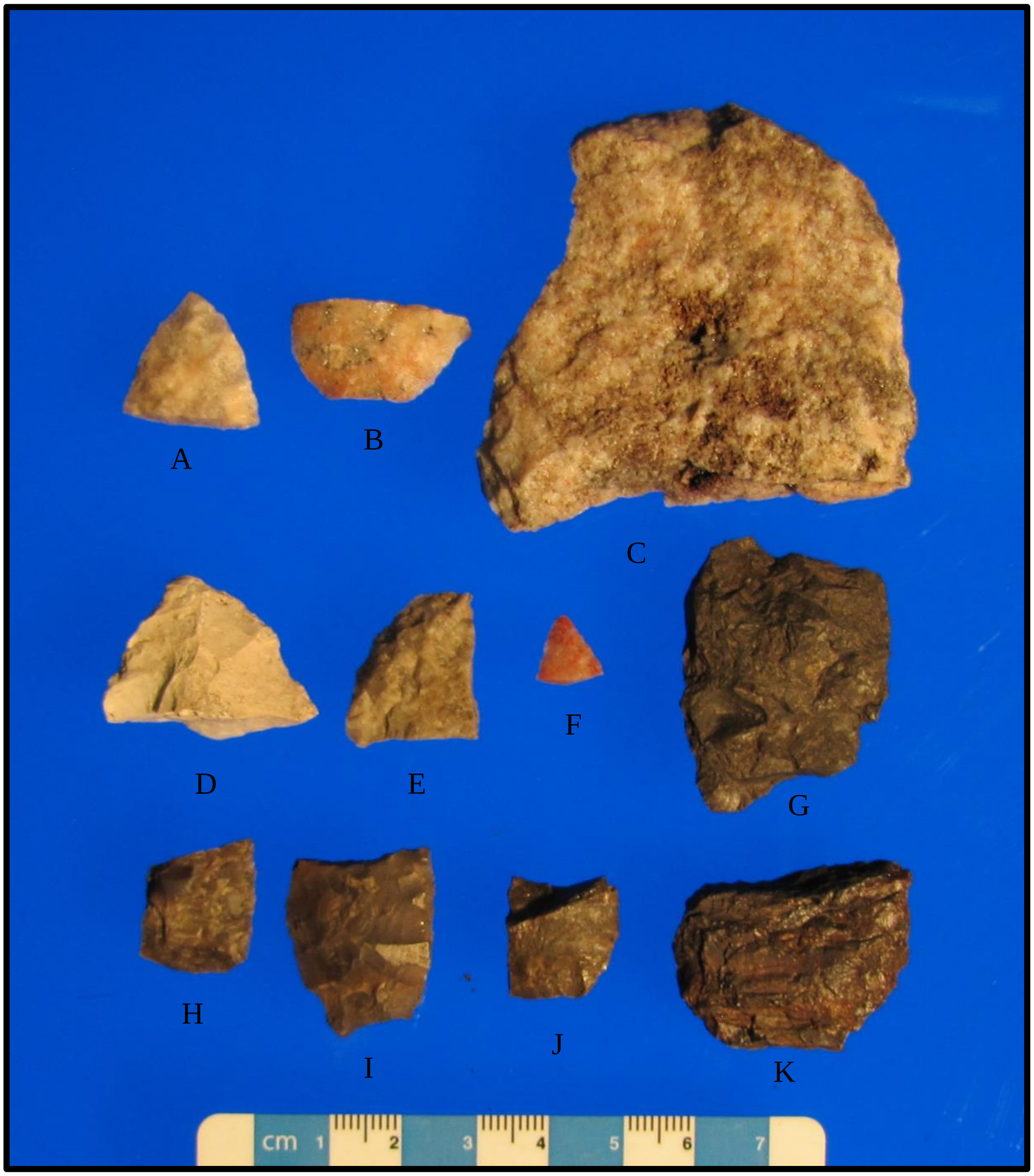

Figure 6.1: Level C2 Bifaces. (A=cat#1425; B=cat#397; C=cat#4181; D=cat#4214; E=cat#3425; F=cat#5054; G=cat#5379; H=cat#1610; I=cat#34; J=cat#3936; K=cat#1867)

Figure 6.2: Level C2 Bifaces. (A=cat#3786; B=cat#470A; C=cat#4195; D=cat#213; E=cat#4708; F=cat#3430; G=cat#2645; H=cat#633; I=cat#4517; J=cat#2410)

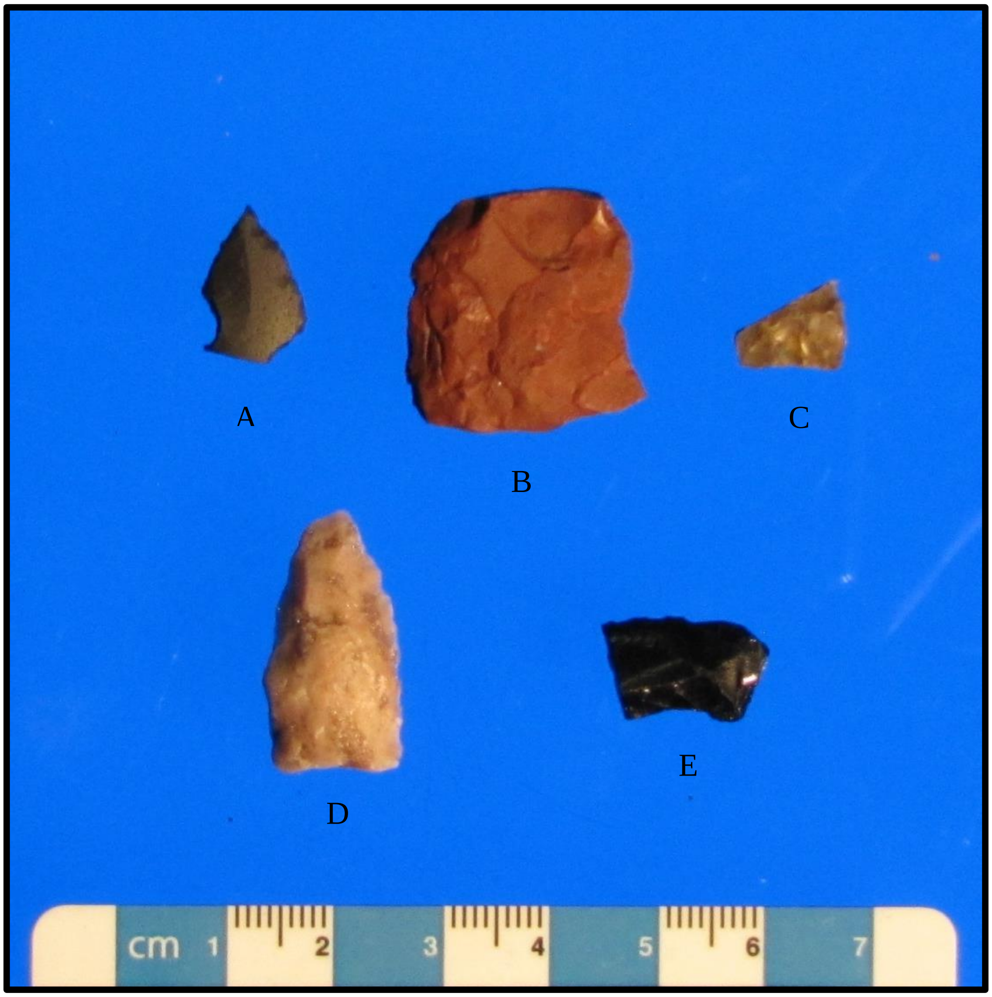

Figure 6.3: Level C2 Bifaces. (A=cat#4177; B=cat#3909A; C=cat#256; D=cat#1608; E=cat#5220)

6.3.2 Unifacial Tools

Of the 13 endscrapers recovered in Level C2 five are complete. They are fabricated from silicified peat (Fig. 6.4, A), heat-treated Swan River chert (Fig. 6.4, B), agate (Fig. 6.4, C), and unspecified chert (Fig. 6.4, D). Item E (Fig. 6.4) is fabricated from chert precipitated in limestone. The material is so poor as to almost be non-functional in terms of any ability to resharpen the tool. Five of the scrapers have been broken transversely across their midsections resulting in only the distal portion remaining. Of these, (Fig. 6.4, F) and (Fig. 6.4, G) are fabricated from Knife River flint and the remainder are made from Swan River chert (Fig. 6.4, H), jasper (Fig. 6.4, I), and chalcedony (Fig. 6.4, J). Item K (Fig. 6.4) was made from silicified siltstone. Only the distal portion remains, as the tool was broken obliquely across the midsection.

Item L (Fig. 6.4) is fabricated from grey chert and has sustained more extensive damage, having been broken transversely across the midsection and having its left lateral edge broken away longitudinally. Item M (Fig. 6.4) is made from Swan River chert and has also been fragmented. It has been broken transversely across the midsection and half of the working edge has broken away. The final end scraper (Cat.# 3763A, not pictured) is fabricated from silicified siltstone and has been broken obliquely across the midsection.

Figure 6.4: Level C2 End Scrapers. (A=cat#=5042; B=cat#2331; C=cat#2172; D=cat#86; E=cat#4770; F=cat#5702; G=3540; H=cat#3429; I=cat#2073; J=cat#3947; K=cat#3763A; L=cat#3431; M=cat#2872)

Two unifacially retouched flakes were recovered. The first (Fig. 6.5, A) is fabricated from quartzite and the second (Fig. 6.5, B) is made from Knife River flint. Two spokeshaves were also recorded. Item C (Fig. 6.5) is a rectangular quartzite spokeshave and (Fig. 6.5, D) is a Knife River flint spokeshave. The final uniface (Fig. 6.5, E) is made from heat-treated Swan River chert, ovoid in shape, and broken transversely across the midsection.

Figure 6.5: Level C2 Unifaces. (A=cat#2486; B=cat#65; C=cat#5789; D=cat#1228; E=cat#219)

6.3.3 Projectile Points

Twenty-six projectile points and projectile point fragments were recovered from Level C2. Twenty-one were classified as Prairie Side-Notched point types, one is an unknown type, three are blade portions, and one is represented by the tip only. The majority of the recovered points are highly fragmented. Only six of the points recovered are complete specimens. The remainder are missing one or often more than one of their components and many appear to have been resharpened.

Of the complete points, three appear to have been made from flakes. Item A (Fig. 6.6) was recovered from 24S 15E at a depth of 12 cm below datum. It is fabricated from silicified wood, and exhibits a very thin cross section. Item B (Fig. 6.6) is made from Knife River flint and has broad shallow notches. It was recovered from unit 25S 15E at 21 cm below datum. Item C (Fig. 6.6) from unit 25S 15E is also silicified wood and triangular in shape. It was found at a depth of 22 cm below datum. Two of the complete points exhibit low, shallow notches. One is fabricated from porcellanite (Fig. 6.6, D) and was found at 24 cm below datum in unit 24S 18E and the other (Fig. 6.6, E) is chert with black inclusions and was found in unit 25S 12E between 15 and 20 cm below datum. The final complete point (Fig. 6.6, F) is fabricated from heat-treated Swan River chert. It has broad notches and was found in 25S 16E at 15 cm below datum.

Five points are fabricated from silicified peat. Four have had their tips broken off and one (Fig. 6.6, G) has had its base and tip broken off. Item H (Fig. 6.6) from unit 23S 17E has wide shallow notches and was found at 26 cm below datum. Item I (Fig. 6.6) was found at 9 cm below datum in unit 24S 14E.

The tip of item J (Fig. 6.6) is broken off irregularly, its left base corner is broken off obliquely, and it was recovered from unit 25S 14E at 18 cm below datum. Item K (Fig. 6.6) has had its tip broken off obliquely approximately half way up the blade and exhibits low narrow notches. It was found in unit 25S 18E at 20 cm below datum. The final point (Cat.# 3247:not pictured) was recovered from 24S 11E at 19 cm below datum. Its base was broken off at the neck and the tip has been broken obliquely.

Five points were made from heat-treated Swan River chert. Item L (Fig. 6.6) has had its tip broken off transversely, exhibits small, low, shallow notches, and has a very thin cross section. It was recovered from 24S 16E at 13 cm below datum. The base of item A (Fig. 6.7) has been broken off transversely at the neck and the left lateral side of the blade is also missing. It was recovered at a depth of 19 cm below datum in unit 25S 17E. The tip of item B (Fig. 6.7) from unit 25S 11E was broken off and reworked and it has broad shallow notches. Item C (Fig. 6.7) is missing its left corner and was found in unit 24S 19E between 15 and 20 cm. The final point (Fig. 6.7, D) was recovered from 24S 19E at 10 to 15 cm below datum. It is broken in half longitudinally and has a broad low notch.

A quartzite point (Fig. 6.7, E), was recovered from unit 23S 19E at 22 cm below datum. Its tip and left shoulder are missing and it has shallow notches. Item F (Fig. 6.7) is made from porcellanite and its tip has been broken off transversely. It exhibits broad shallow notches and was found in unit 25S 15E at 25 cm below datum. Item G (Fig. 6.7) is fabricated from pebble chert and was found at 20 cm below datum in unit 25S 18E. It is very thin in cross section and the tip and left corner of the base are missing.

A Knife River flint point (Fig. 6.7, H) recovered from unit 25S 19E at 15 cm below datum has had its left basal corner broken off. Item I (Fig. 6.7) is white quartz and is missing its base, which was broken off at the neck. It was found in unit 23S 20E between 15 and 25 cm below datum. Item J (Fig. 6.7) is fabricated from agate and has its tip broken off transversely, one shoulder broken off, low broad notches, and a convex base. It was found in unit 23S 20E between 19 and 25 cm below datum.

One base and two blade portions were also recovered. Item K (Fig. 6.7) is made of Knife River flint and consists of the base only. It was recovered from unit 24S 15E between 17 and 25 cm below datum. The blade fragments are made from white chert (Fig. 6.7, L) or pebble chert (Fig. 6.7, M) and were discovered in units 24S 20E and 25S 17E respectively.

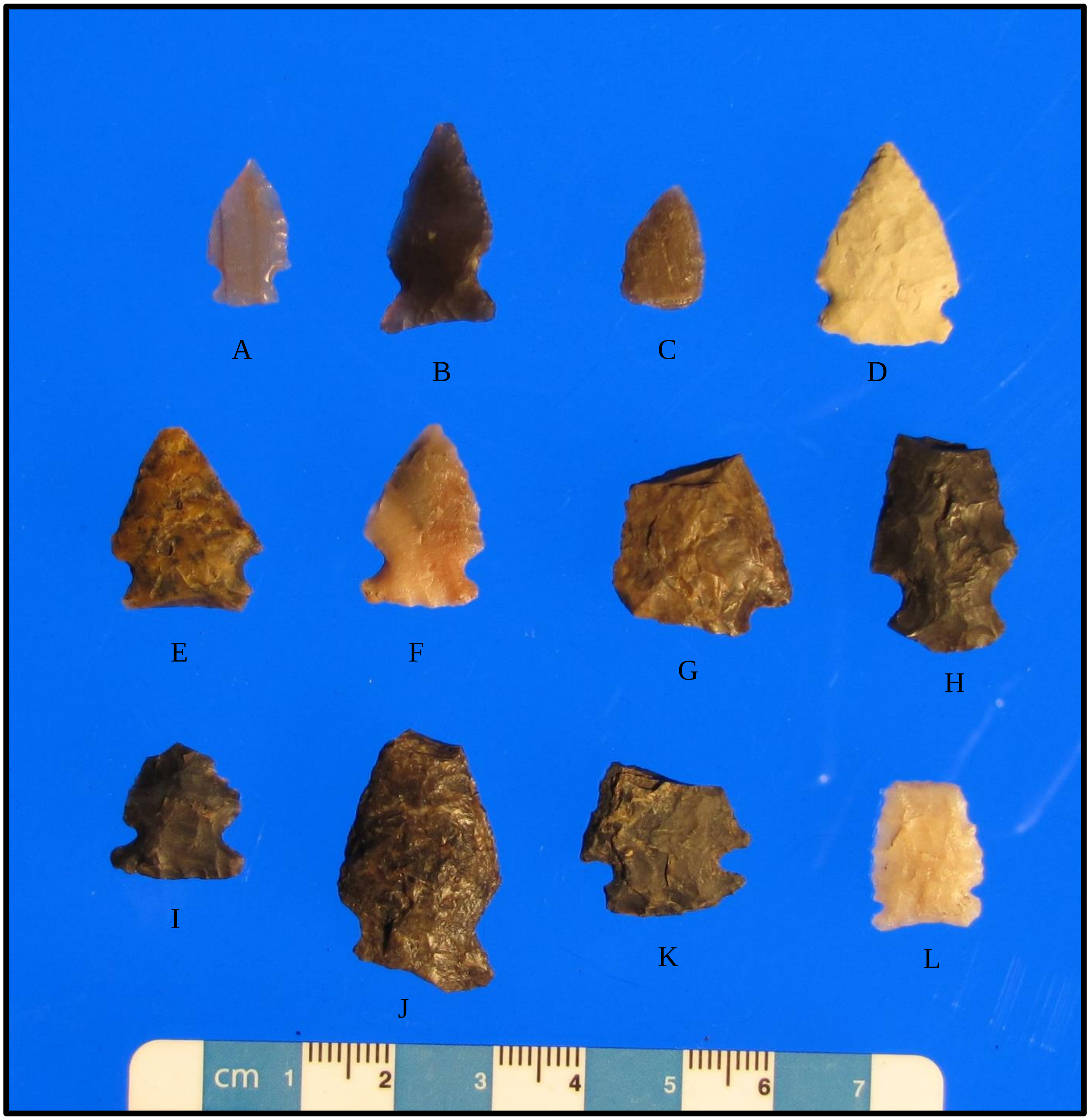

Figure 6.6: Level C2 Projectile Points. (A=cat#4696; B=cat#1607; C=cat#1617; D=cat#45; E=cat#1045; F=cat#1876; G=cat#3247; H=cat#4405; I=cat#3741; J=cat#1405; K=cat#2421; L=cat#4161)

Figure 6.7: Level C2 Projectile Points. (A=cat#2079; B=cat#617; C=cat#279; D=cat#197; E=cat#4550; F=cat#1630; G=cat#2420; H=cat#2704; I=cat#5225; J=cat#5233; K=cat#4762; L=cat#392; M=cat#2089)

6.4 Cores

One core fragment, three cores, and a tested cobble were recovered from Level C2 (Table 6.2). The core frag (Cat.# 5033) is composed of Swan River chert. Of the three cores, two are multidirectional cores and one is exhausted. Catalogue number 5584 is Swan River chert and exhibits numerous flake scars. Catalogue number 3769 is a platform type and consists of Gronlid siltstone (Fig. 6.8). Catalogue number 4167 is an exhausted porcellanite platform core. The tested cobble (Cat.# 2107C) is comprised of Swan River chert and has had a single flake removed from one of its margins.

Table 6.2: Level C2 Cores

Cat. #	Material	Mass (g)	Type
5033	SRC	28.2	frag
5584	SRC	80.1	frag
4167	porcellanite	38.1	exhausted
3769	Gronlid siltstone	94.3	multidirectional
2107C	SRC	216.5	tested cobble

Figure 6.8: Level C2 Gronlid Siltstone Core (cat#3796)

6.5 Miscellaneous Stone Tools

Two fragments from the lateral edge of a hammerstone fashioned from a quartzite cobble were recovered from unit 23S 17E (Fig. 6.9). The distal edges of the hammerstone show considerable defects, likely resulting from heavy battering, which ultimately caused the tool to fail.

Figure 6.9: Level C2 Hammerstone Fragments (cat#4359 & 4895)

6.6 Fire-Cracked Rock

Excavations of Level C2 yielded a total of 895 pieces of fire-cracked rock (Table 6.3). The dominant material type by mass is granite, at 32,475.9 g (62.9%), followed by basalt (13.6%), and sandstone (10.7%). Other material types recovered include common local igneous and metamorphic rocks (Table 6.3). There is no apparent pattern in the distribution of fire-cracked rock throughout the level.

Table 6.3 Level C2 Fire-Cracked Rock

Material	Count	%	Mass (g)	%
Basalt	85	9.5	7022.7	13.6
Diabase	9	1.0	803.4	1.5
Diorite	11	1.2	1344.3	2.6
Gneiss	15	1.7	1531.0	3.0
Granite	633	70.7	32475.9	62.9
Quartzite	16	1.8	1912.2	3.7
Rhyolite	4	.4	135.3	.3
Sandstone	109	12.2	5499.4	10.7
Schist	13	1.5	873.9	1.7
Total	895	100%	51598.1g	100%

6.7 Metal Artifacts

A single .22 short rimfire shell casing headstamped with an impressed “U” was recovered in Level C2 (Fig. 6.10). The shell was made by Union Metallic Cartridge Company which was incorporated in 1867 and merged with Remington in 1912. The “U” headstamp was in use until the mid-1980s (Remington Arms Company, 2014). This is an intrusive element recovered in the screen so the exact provenience of the shell is unknown.

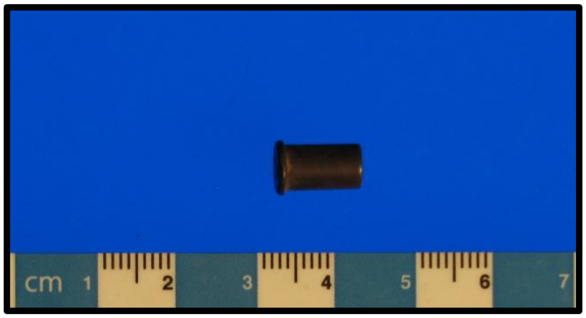

Figure 6.10: Level C2 Shell Casing. (cat#4759)

6.8 Pottery

A total of 39 pottery fragments weighing 48.8 g and representing five distinct vessels were recovered from Level C2 (Table 6.4). The first vessel is represented by clusters of body fragments recovered in units 24S 13E, 23S 14E, and 24S 11E. This vessel was constructed with quartz temper and its exterior was net impressed and smoothed. Two rim sherds (Fig. 6.11) and 11 body fragments were recovered from the second vessel. This vessel was also fabricated with quartz temper and has a net impressed finish. A clear fingerprint and fingernail impression remain in the clay just below the margin of the rim on item A (Fig. 6.11). The remains of the fourth vessel consist of six body sherds which were constructed with a fine grit temper and finished with a smoothed net-impressed exterior. The final vessel is represented by eight body sherds with a smoothed exterior and a series of fingernail dentates. All the sherds show characteristics consistent with the Mortlach style of pottery. Dentate stamping with fingernail patterns is a common exterior decoration (Wettlaufer and Meyer-Oakes 1960:100), as is fingernail pinching (Malainey 1991:236). Mortlach ceramics can be found in association with both Plains and Prairie Side-Notched points (Wettlaufer 1955:264).

Table 6.4 Level C2 Pottery

Fragment Description	Mass (g)	Count	% (mass)
Complete Sherd	29.6	19	60.7
Rim Sherd	4.4	2	9.0
Exterior Exfoliation	10.9	14	22.3
Interior Exfoliation	2.2	2	4.5
Unidentified	1.7	2	3.5
Total	48.8g	39	100%

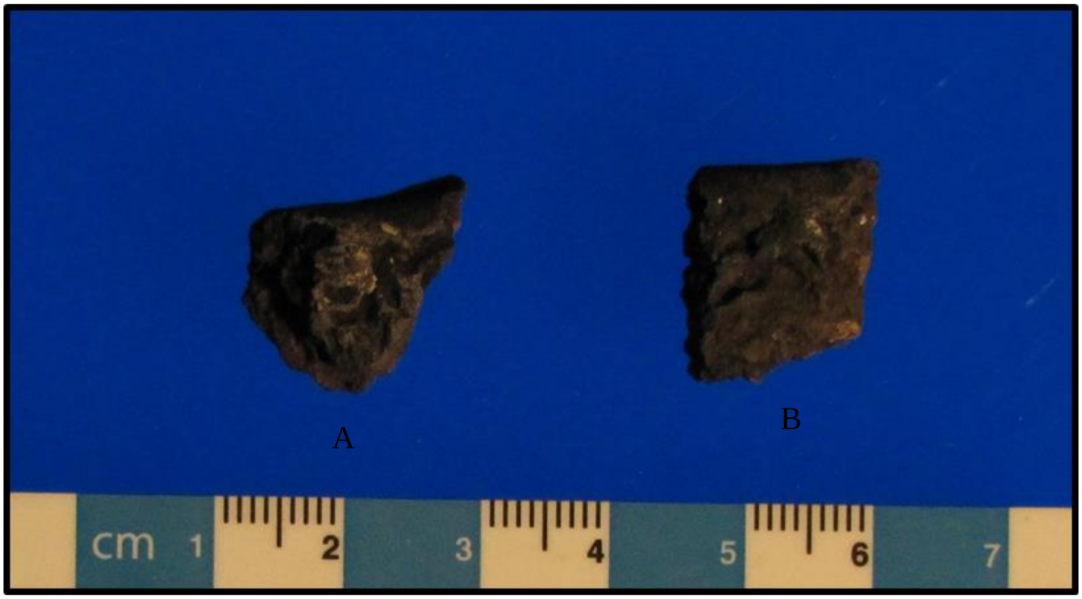

Figure 6.11: Level C2 Pottery Rim Sherds. (A=cat#2852; B=cat#2853)

6.9 Faunal Assemblage

A total of 23,017 elements, specimens, and unidentified fragments were recovered from Level C2 (Table 6.5). Most of the faunal remains were unburned, with a total number of 20,935 (88.6%) and a weight of 19,099.3g (95.1%). Specimens that could not be confidently assigned to a taxon were placed within a size class whenever possible. Unidentifiable specimens represent 98.54% of the assemblage, the majority of which (87.2%) is unburned bone.

Table 6.5: Level C2 Faunal Counts

Faunal Type	**Number of Elements**	**Mass (g)**	**Number of Specimens**	**Mass (g)**	**Number of Unidentified**	**Mass (g)**
Unburned Bone	45	984.2	255	4793.5	19702	12933.5
Burned Bone	0	0	17	58.1	1430	652.7
Calcined Bone	0	0	0	0	1165	273.7
Unburned Enamel	17	119.3	0	0	370	259.9
Burned Enamel	0	0	0	0	3	1.5
Calcined Enamel	0	0	0	0	7	0.8
Shell	0	0	0	0	6	8.9
Total	62	1103.5g	272	4851.6g	22683	14131g

Table 6.6: Level C2 Faunal Remains by Taxa

Common Name	Taxon	NISP	MNI
Mammals			
Bison	*Bison bison*	199	3
Pronghorn	*Antilocapra Americana*	1	1
Dog/Wolf/Coyote	*Canis* sp.	7	1
Striped Skunk	*Mephitis mephitis*	2	1
Prairie Vole	*Microtus ochrogaster*	1	1
Weasel	*mustelid*	1	1
Ground Squirrel	*Spermophilus richardsonii*	1	1
Northern Pocket Gopher	*Thomomys talpoides*	2	1
Swift Fox	*Vulpes velox*	1	1
Invertebrates			
Freshwater Clam	*Unionidae*	6	1
Miscellaneous			
Bison/Moose Size	Very Large Mammal	109	n/a
	Very Large/Large Mammal	1913	n/a
Deer/Wolf Size	Large Mammal	152	n/a
	Med/Large Mammal	615	n/a
Coyote/Badger Size	Medium Mammal	1	n/a
Badger/Squirrel Size	Med/Small Mammal	2	n/a
Total		3013	11

6.10 Order *Artiodactyla*

6.10.1 *Bison bison*

Three mature, one juvenile, and one fetal individual are represented in the bison remains. The mature bison counts are based on the recovery of three right side fused second and third tarsals. Bison accounts for 37% of the faunal assemblage by weight in this level with an NISP of 199. Twenty-four percent, amounting to 4826.5 g, of the identified specimens by weight recovered from Level C2 have been classified as bison. Root etching was the most common taphonomic process recorded and the most common degree of weathering was 2.

A second phalanx from a fetal *B. bison* at approximately 9 months gestation was recovered. A humerus from a juvenile *B. bison* individual aged approximately one year and a deciduous third molar were also recorded. The complete quantitative analysis by element for *B. bison* is summarized in Appendix C.

Figure 6.12: Level C2 Juvenile *B. bison* 2nd Phalanx (cat#2850)

6.10.2 *Antilocapra americana*

A fragment of the distal potion of a metatarsal from a pronghorn was recovered in Level C2. Pronghorn are the fastest animal in the Western hemisphere, having been clocked at speeds of 70 mph. They prefer open terrain and their traditional range includes the grasslands/brushlands of southern Saskatchewan south to California, Arizona, New Mexico and West Texas. Pronghorn cannot leap fences. This made them ideal for pounding techniques employed by precontact hunters, but was also responsible for a steep decline in their numbers owing to the fencing off of rangeland in the late nineteenth and the early twentieth century (Whitaker 1980:662).

6.11 Order *Carnivora*

6.11.1 *Vulpes velox*

A partial left dentary of a swift fox was recovered in Level C2 (Figure 6.13). The swift fox's range consists of most of Great Plains area. Their preferred habitat includes the shortgrass prairies and other arid areas. They are primarily nocturnal and prey on small mammals, birds, and insects while also ingesting grasses and berries (Whitaker 1980:547).

Figure 6.13: Level C2 *Vulpes velox* Left Dentary (cat#628)

6.11.2 *Canis* sp.

The NISP for *Canis* sp. was seven including a complete premolar and canine tooth. A maxillary fragment with first, second and third molars intact was also recovered. The remaining specimens consist of fragments of the mandible, a metapodial, and a metatarsal. The fragments recovered are compatible with those of a wolf or large-sized domestic dog.

6.11.3 *Mephitis mephitis*

The elements represented include a maxilla fragment and an upper first molar. The striped skunk can adapt to a variety of habitats from woodlands to suburbs and their range includes all of the U.S. and the southern tier of the Canadian provinces. They are omnivorous and do not hibernate, but may become dormant during extremely cold weather (Whitaker 1980:586).

6.11.4 Mustelid

A fragment of a right dentary from an unspecified mustelid was recorded in Level C2. Members of the mustelid family include weasels, skunks, and badgers.

6.12 Order *Rodentia*

6.12.1 *Spermophilus richardsoniii*

A left dentary fragment from a Richardson's ground squirrel was recovered in Level C2.

6.12.2 *Microtus ochrogaster*

A right mandible fragment of a prairie vole was collected in Level C2. The prairie vole's habitat includes the dry grass prairie, and its range extends from southeastern Alberta, southern

Saskatchewan and Manitoba, south to Colorado, Oklahoma, Tennessee, and Kentucky (Whitaker 1980:504).

6.12.3 *Thomomys talpoides*

A complete left and right dentary were collected from Level C2. The northern pocket gopher's range extends from southern British Columbia to southern Manitoba, and south to Nevada, Arizona and New Mexico. Their preferred habitat includes areas with good soil in meadows or along streams, in the mountains and in the lowlands.

6.13 Order Unionoida

Six shell fragments from a fresh water clam were found in Level C2. No cultural modifications were noted on the specimens and their presence may be explained by the site's proximity to both Opimihaw Creek and the South Saskatchewan River.

6.14 Miscellaneous Specimens

The fragmentary nature of much of the Level C2 faunal assemblage precludes precisely classifying the remains any further than gross categorization according to size. Most of specimens identified in Level C2 are represented by Very Large (SC6) and Large (SC5) mammal bone fragments. These specimens are likely bison as there is no evidence for the presence of other large mammal species, but they possess no identifying characteristics except for their size. The majority of the Very Large to Large Mammal fragments were represented by long bone fragments and unidentifiable fragments.

6.15 Bone Tools

A bone awl or perforator was recovered in unit 25S 18E in association with a midden feature (Fig. 6.14). It exhibits some polishing and has been fabricated from an unknown fragment of mammalian long bone.

Figure 6.14: Level C2 Bone Awl (cat#2378)

6.16 Items of Personal Adornment

An item of personal adornment fabricated from a segment of cortical bone was recovered from a midden feature in unit 25S 18E (Table 6.15). The segment has been incised with a series of marks extending from a larger perforation that may functioned to suspend the item as a pendant.

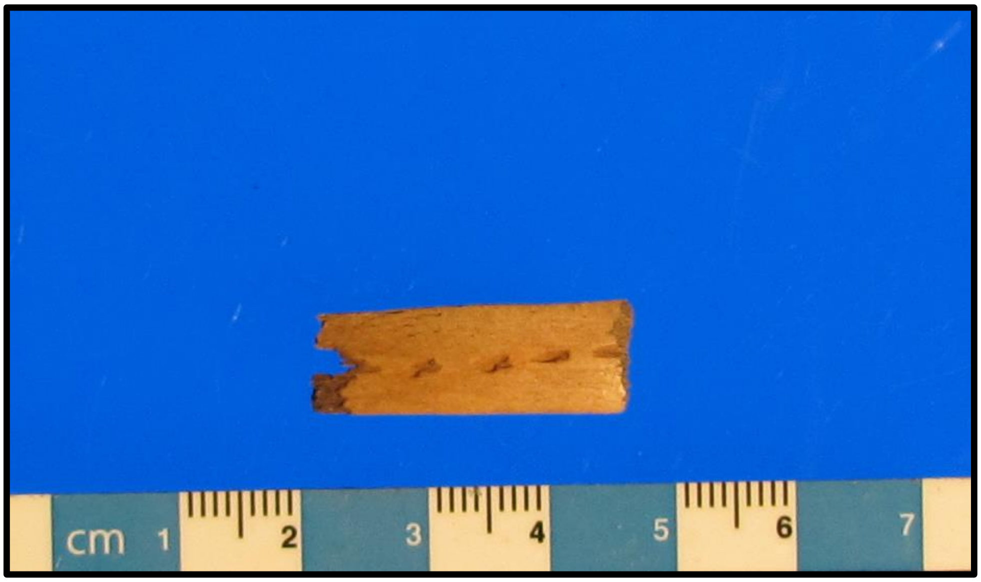

Figure 6.15: Level C2 Item of Personal Adornment (cat#2521)

6.17 Features

A midden feature was encountered in unit 25S 18E (Fig. 6.16)**.** The feature was 6 cm thick, ranging in depth from approximately 19 to 25 cm below datum and encompassed the southwest, southeast, and northeast quadrants of the unit. The feature also extended into the northeast and northwest quads of the adjacent unexcavated unit, 26S 18E. Recoveries from this feature were quite extensive. The number of faunal specimens collected was 4,488, with a combined weight of 3,132.9 g. Of these remains, 1694 specimens were immature bone, amounting to 37.7% of the total number of specimens. By weight, immature bone accounted for 981.2 g or 31.30% of the faunal recoveries. Ninety-one percent of the faunal remains were unburned. The bone awl/perforator and possible bone pendant fragment discussed in Section 6.16 were also found in association with the midden. Lithic artifacts recovered from the midden had a combined weight 2753 g, of which, 1608.2 g was fire-cracked rock. Two projectile points, one point body, two biface fragments, one core, and one retouched flake were also found in association with this feature.

In unit 24S 17E, a 40 cm by 55 cm oval charcoal stain in the southeast quadrant and eastern third of the southwest quadrant was uncovered. Artifacts associated with this feature range in depth from 20 to 24 cm below datum. Recoveries from the feature include two rib shaft fragments and a glenoid from a *B. bison*, a depleted heat-treated Swan River chert core, schist fire-cracked rock, one flake of heat-treated Swan River chert, and heat-treated Swan River chert shatter. Fine screening of the sediments associated with the feature produced 585.5 g of bone fragments, 4.69% of which were burned, and 0.2% of which were calcined. Lithic fragments recovered amounted to 60.3 g and were dominated by heat-treated Swan River chert at 96.9%.

Figure 6.16: Level C2 Midden Feature

In unit 23S 19E at 29 cm below datum, a limestone boulder weighing 15 kg was recovered (Fig. 6.17). The boulder was associated with a scatter of fragmented artifacts and accumulations of micro-debitage on its west and east margins. Artifacts associated with the rock included: 12 Very Large (SC6) mammal bone fragments, one *B. bison* calcaneus fragment, one *B. bison* humerus fragment, *B. bison* enamel fragments, one *B. bison* first phalanx, one piece of fire-cracked rock, five pieces of shatter, and a tool fragment. Based on the associated scatter of fragmented artifacts, it can be concluded that the rock functioned as an anvil stone and was presumably used to break apart bones for further processing. The presence of debitage in association with the boulder may suggest that lithic reduction was also taking place, perhaps using the boulder as a support for bipolar core techniques.

Figure 6.17: Level C2 Anvil Stone

6.18 Interpretation

The faunal remains recovered from Level C2 are copious and highly fragmented. The high level of fragmentation is probably due to secondary processing of skeletal elements including the practice of breaking apart bone to extract marrow for immediate consumption and to facilitate the extraction of bone grease. Only five percent of the faunal assemblage shows evidence of burning. The relative absence of burning and high degree of fragmentation of skeletal elements may indicate activities related to the production of pemmican. The presence of an anvil stone that seems to have been used to smash bison long bones lends support to this theory.

The presence of a near-term *B. bison* fetus and a year-old juvenile indicate that Level C2 represents a late spring occupation. Bison are known to have a concentrated calving season that typically occurs during the end of April through the beginning of May (Rutberg 1984:420).

While the faunal remains indicate a spring occupation, the sheer thickness of the level stratigraphically speaking seems to suggest that a longer term occupation or series of relatively closely temporally spaced occupational episodes was likely. The presence of a midden feature suggests an extended occupation was responsible for the massiveness of Level C2 as some time would have needed to elapse for refuse to accumulate to levels that necessitated its disposal.

A substantial number of manufactured tools of considerable variety were recovered from Level C2. This lends support to the theory of this level representing a habitation site as campsites sites are often associated with a wide variety of tools. Because much time is spent there, tool manufacturing, repair, and maintenance are common activities (Kooyman 2001:129).

A variety of subsistence related activities were participated in by the occupants of Level C2. The presence of pottery, hearths, a hammerstone, and an anvil stone indicate that secondary processing of faunal remains represented a major portion of the activities undertaken in this level (Figure 6.18). The recovery of primary and tertiary flakes confirm that tool manufacture and repair were also undertaken. Based on the analysis of Level C2, it appears to represent a spring campsite where people were involved in secondary processing of bison, tool manufacture and maintenance, and other activities related to household economy.

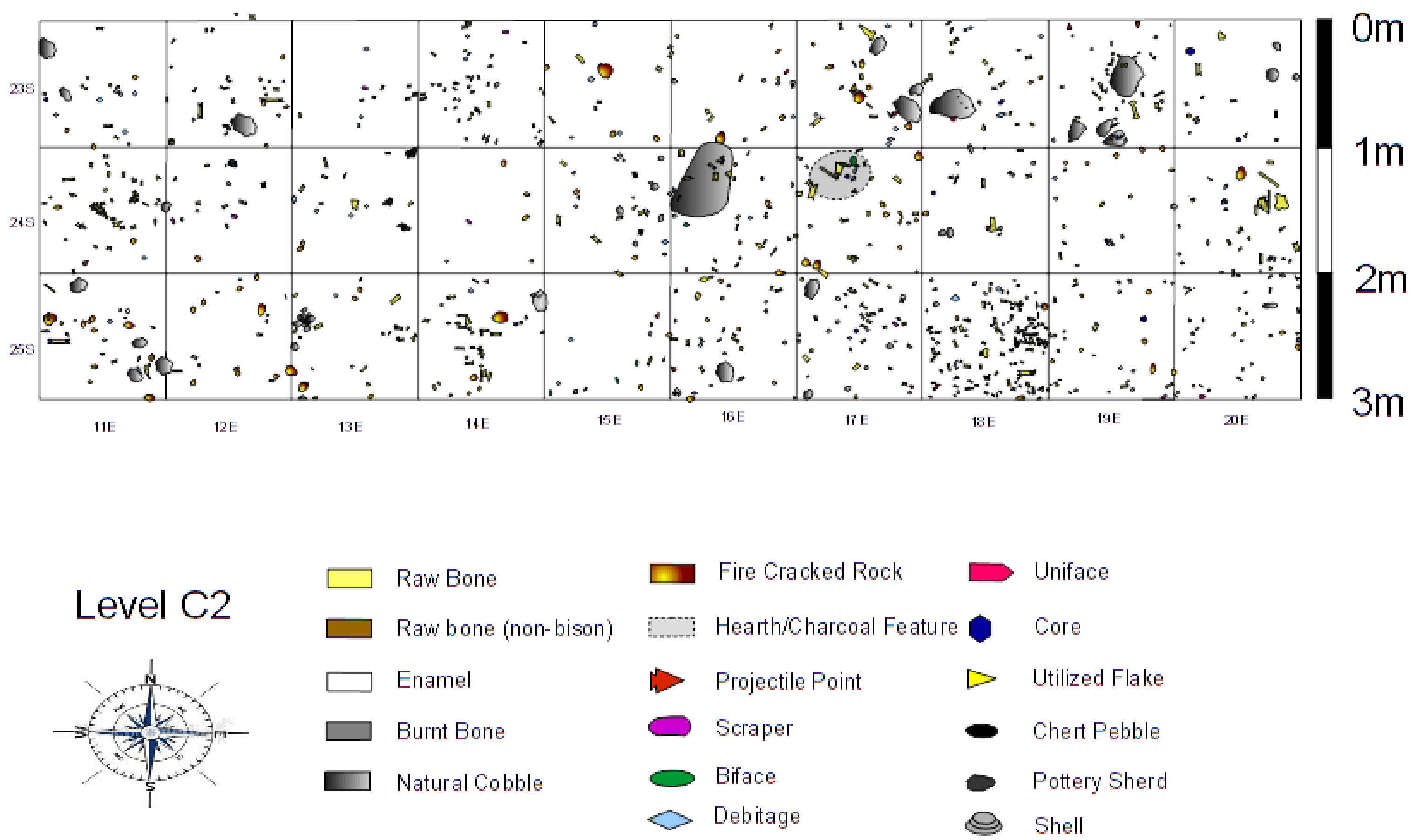

Figure 6.18: Distribution of Artifacts, Ecofacts, and Features in Level C2

Chapter 7

Cultural Level 3

7.1 Introduction

Cultural Level 3 ranges in depth from 28 to 43 cm below datum and was encountered in all excavated units. Most of the artifacts were recovered from a clay deposit separated from level C2 by a layer of gravel in the western units that pinches out in unit 25S 14E (see Fig. 4.6). Numerous projectile points belonging to the McKean complex were recovered, leading to the conclusion that Level C3 was associated with this archaeological culture.

7.2 Lithic Assemblage

Excavations of Level C3 yielded a total of 2,606 shatter fragments and flakes (Table 7.1). The dominant material type is Swan River Chert accounting for 47.05% of the entire sample by mass. Evidence of heat treatment is present in 57.48% of the Swan River Chert material. The second most frequently recovered material is quartzite, comprising 25.87% of the lithic assemblage. Seventeen discrete material types make up the remainder of the sample. Knife River flint and Rainy Buttes chert are the only exotic materials noted. Pieces of shatter comprise 61.9% of the sample. Fragments constitute 34.3%, followed by tertiary flakes at 2.2%, secondary flakes at 0.8%, and primary flakes at 0.7%.

Table 7.1: Level C3 Lithic Debitage and Fragments

Material Type	Primary Flakes	Secondary Flakes	Tertiary Flakes	Shatter	Frags	Total	%	Heat Treated
Swan River Chert	16.8g (n=2)	10.4g (n=3)	82.7g (n=115)	2518.6g (n=1179)	1327g (n=34)	3955.5g (n=1333)	47.05% (51.15%)	2273.5g (n=1260)
Quartz	-	-	5.3g (n=3)	875.8g (n=326)	745.7g (n=8)	1626.8 (n=337)	19.35% (12.93%)	-
Unknown Chert	-	-	6.6g (n=14)	62.2g (n=34)	-	68.8g (n=48)	0.82% (1.84%)	-
Chalcedony	-	-	0.6g (n=5)	47.6g (n=18)	9.8g (n=1)	58.0g (n=24)	0.69% (0.92%)	-
Knife River Flint	-	-	20.5g (n=26)	15.8g (n=21)	-	36.3g (n=47)	0.43% (1.8%)	-
Silicified Peat	<0.1g (n=1)	1.0g (n=1)	0.1g (n=1)	116.1g (n=56)	126.5g (n=3)	243.7g (n=62)	2.9% (2.38%)	-
Agate	-	-	0.4g (n=3)	1.4g (n=2)	2.8g (n=1)	5.6g (n=6)	0.05% (0.23%)	-
Quartzite	46.7g (n=4)	52.4g (n=6)	59.7g (n=51)	1457.7g (n=586)	558.0g (n=7)	2174.5g (n=654)	25.87% (25.09%)	-
Gronlid Siltstone	-	5.6g (n=4)	-	2.0g (n=3)	17.2g (n=10)	24.8g (n=17)	0.3% (0.65%)	-
Pebble Chert	-	-	-	2.7g (n=1)	62.9g (n=11)	65.6g (n=12)	0.8% (0.46%)	-
CPL	-	-	-	55.8g (n=30)	33.2g (n=1)	89g (n=31)	1.06% (1.19%)	-
Cathead Chert	-	0.2g (n=1)	0.8g (n=1)	14.5 (n=7)	-	15.5g (n=9)	0.18% (0.35%)	-
Argillite	-	-	1.4g (n=1)	-	-	1.4g (n=1)	0.01% (0.04%)	-
Feldspathic Siltstone	-	-	5.4g (n=2)	17.0g (n=3)	-	22.4g (n=5)	0.26% (0.19%)	-
Porcellanite	-	-	1.7g (n=1)	6.9g (n=8)	-	8.6g (n=9)	0.1% (0.35%)	-
Rainy Butte Chert	-	-	-	9.8g (n=9)	-	9.8g (n=9)	0.12% (0.35%)	-
Siltstone	-	-	0.3g (n=1)	0.8g (n=1)	-	1.1g (n=2)	0.01% (0.08%)	-
Total	63.5g (n=7)	69.6 (n=15)	185.5g (n=224)	5204.7g (n=2284)	2883.1g (n=76)	8406.4g (n=2606)	100% (100%)	2273.5g (n=1260)
%	0.76% (0.3%)	0.83% (0.6%)	2.2% (8.6%)	61.91% (87.6%)	34.3% (2.9%)	100% (100%)		57.48% (94.52%)

7.3 Flaked Stone Tools

The excavation of Cultural Level 3 returned a total of 37 flaked stone tools: nine bifaces, eight unifaces, five end scrapers, and 15 projectile points.

7.3.1 Unifacial Tools

Eight unifacial tools were recovered in Level C3. They consisted of two retouched flakes, one uniface, and five end scrapers. The uniface (cat#3656, not pictured) was comprised from quartzite. One of the retouched flakes were composed from quartzite (Fig. 7.1, A) and the second (Fig. 7.1, B) was made from chert precipitated in limestone

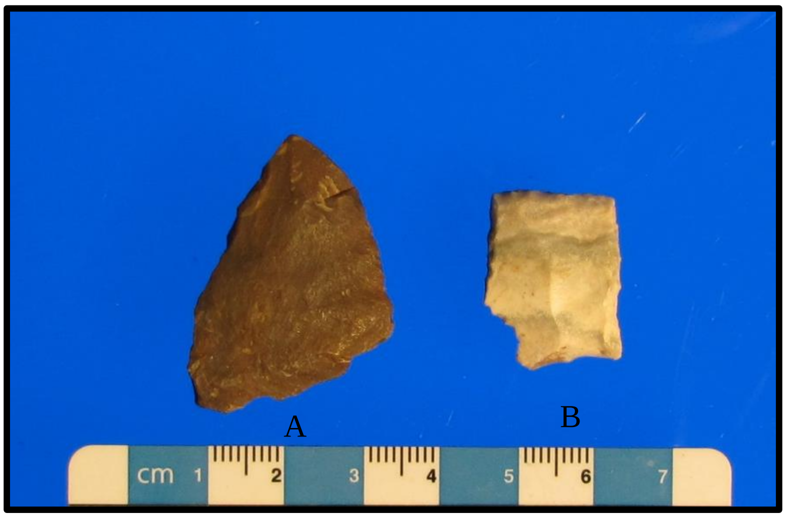

Figure 7.1: Level C3 Unifaces. (A=cat#155; B=cat#1486)

7.3.2 End scrapers

Of the five end scrapers recovered from Level C3, three were complete. One of the complete scrapers, (Fig 7.3, A) was fabricated from Knife River flint and is almost fully patinated. The two remaining complete scrapers were made from chert precipitated in limestone (Fig 7.3, B) and porcellanite (Fig. 7.3, C). Catalogue number 3671 (not pictured) was made from Swan River chert and has had its distal end broken off transversely. The final end scraper (Fig 7.3, D) was broken transversely across the midsection and fabricated from white chert.

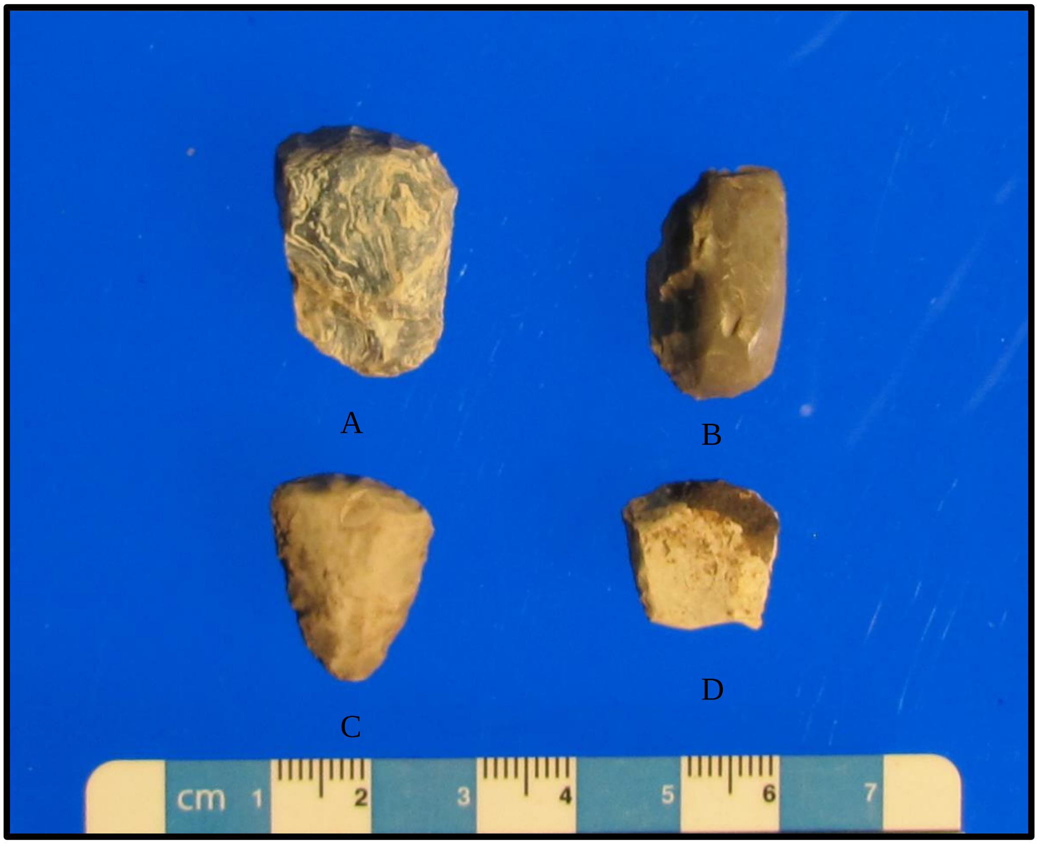

Figure 7.2: Level C3 End Scrapers. (A=cat#726; B=cat#2780; C=cat#721; D=cat#2560)

7.3.3 Bifacial Tools

In level C3, nine bifaces were identified. Five bifaces were fabricated from heat-treated Swan River chert. Two (Fig. 7.4, A and Fig. 7.4, B) were likely ovoid in shape originally before they were broken across their midsections. Item C (Fig. 7.4) was triangular in shape with working edges on both lateral margins. The final Swan River chert biface (Fig. 7.4, D) was a fragment of a tool whose original shape cannot be determined. Three bifaces were triangular in shape and made from brown chalcedony (Fig. 7.4, E), quartzite (Fig. 7.4, F), and silicified peat (Fig. 7.4, G). The remaining biface (Fig. 7.4, H) was ovoid in shape and made from quartzite. A bifacially retouched flake was also recovered (Fig. 7.4, I). It was fabricated from unidentified brown chert and was irregular in shape with a lateral working edge.

Figure 7.3: Level C3 Bifaces. A=cat#127; B=cat#4623; C=cat#1683; D=cat#4615; E=cat#3389; F=cat#4443; G=cat#472; H=cat#2232; I=cat#5525

7.4 Projectile Points

The excavations of Level C3 uncovered a total of 15 projectile points. Ten projectile points were identified as Duncan, two were classified as McKean, and four are lacking diagnostic features and are considered indeterminate.

7.4.1 Duncan

Of the Duncan points, five are complete. Three of these are made from heat-treated Swan River Chert. Item A (Fig. 7.5) has a small portion of its lateral edge missing just above the waist. It was found in unit 23S 14E at 43 cm below datum. Item B (Fig. 7.5) has a small chip missing from its tip and was found at 43 cm below datum in unit 23S 14E. The final Swan River chert point (Fig. 7.5, C) was found in unit 24S 15E at 29 cm below datum. The other complete points are fabricated from grey chert and non-heat-treated Swan River chert. Item D (Fig. 7.5) was found in unit 25S 18E at 32 cm below datum. Item E (Fig. 7.5) was recovered at a depth of 34 cm in unit 23S 18E.

Four of the Duncan points are incomplete. Item F (Fig. 7.5) was made from heat treated Swan River chert and is missing its tip. It was unearthed at 38 cm below datum in unit 25S 13E. Item G (Fig. 7.5) consists of the blade portion only. It was fabricated from heat treated Swan River chert and located at a depth of 44 cm below datum in unit 23S 16E. Item H (Fig. 7.5) is missing its tip and a basal corner and was recovered from unit 24S 15E at an unknown depth. A silicified peat point (Fig. 7.5, I) was also found in unit 25S 15E at 36 cm below datum.

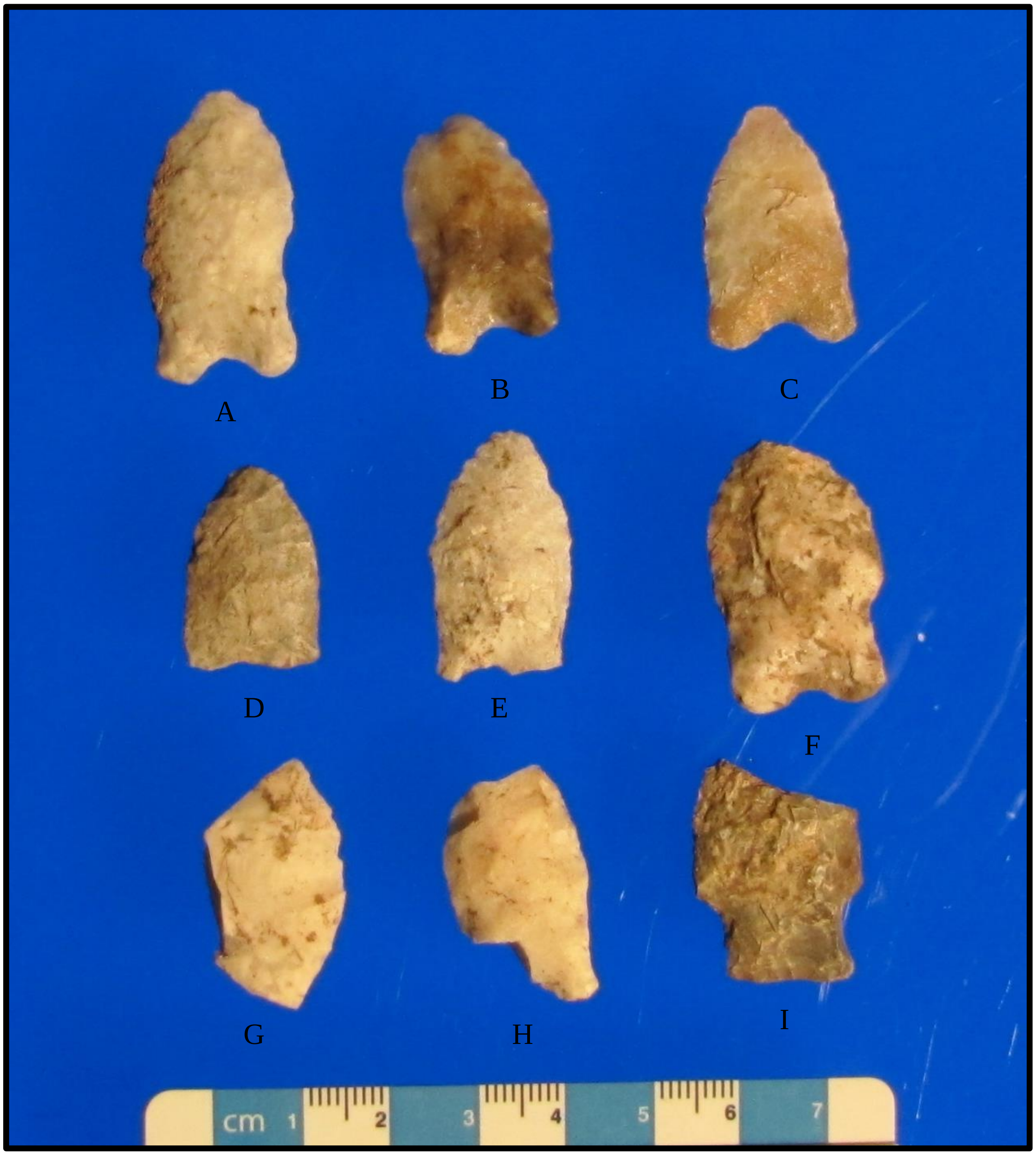

Figure 7.4 Level C3 Duncan Points. (A=cat#3661; B=cat#2566; C=cat#4785; D=cat#4801; E=cat#4950; F=cat#1251; G=cat#5875; H=cat#4835; I=cat#1688)

7.4.2 McKean

Two of the recovered points were identified as McKean style. Item A (Fig. 7.6) is a complete quartz point and was unearthed at 34 cm below datum in unit 24S 16E. Item B (Fig. 7.6) has had its tip broken off transversely. It was fabricated from quartzite and was found in unit 24S 18E at 34 cm below datum.

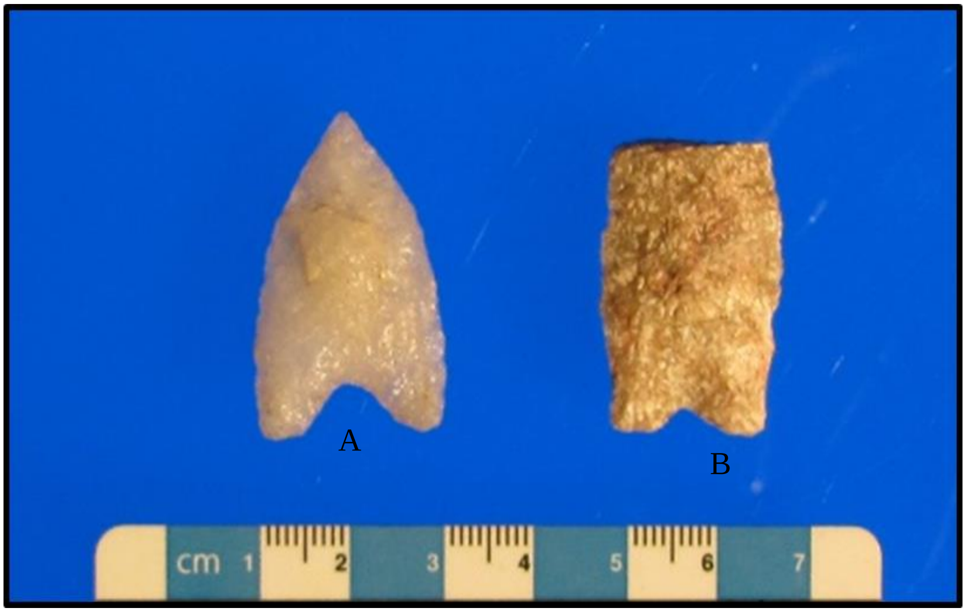

Figure 7.5: Level C3 McKean Points. (A=cat#4274; B=cat#117)

7.4.3 Indeterminate

Four of the projectile points lack the diagnostic features that would allow them to be assigned to a particular cultural complex. Item A (Fig. 7.7) is a heat treated Swan River chert body fragment found in unit 24S 18E at an unknown depth. A body fragment fabricated from heat treated Swan River chert (Fig. 7.7, B) was recovered from unit 25S 16E at an unknown depth. Item C (Fig. 7.7) is the lateral portion of a projectile point found in unit 25S 18E at an unknown depth. Item D (Fig. 7.7) is the blade portion of a quartz point. It was recovered from unit 24S 12E at 28 cm below datum.

Figure 7.6: Level C3 Indeterminate Points. (A=cat#134; B=cat#1979; C=cat#2605; D=cat#3476)

7.5 Cores

A total of eight cores and fragments were recovered from Level C3. Of these, four are composed of Swan River chert, two of basalt, and one each of quartz, quartzite, and pebble chert. Two tested cobbles (Cat.# 4408 & #4089, not pictured) were recovered in unit 23S 17E. One core (Cat.# 1945, not pictured) and two fragments were located in the same unit, 25S 16E. The two fragments (Cat.# 5857 & #5858, not pictured) were part of the same original core and can be fitted back together. Figure 7.9 has had multiple flake scars removed from a single direction. Figure 7.8 is a core with numerous flake scars removed from multiple directions.

Table 7.2: Level C3 Cores

Cat. #	Material	Mass (g)	Type
5864	ht SRC	85.9	multidirectional
1748	ht SRC	259.0	multidirectional
5858	basalt	41.2	fragment
5857	basalt	77.9	fragment
4089	quartz	1022.8	tested cobble
4408	quartzite	299.8	tested cobble
5121	ht SRC	32.1	fragment
1945	pebble chert	11.0	bipolar
2579	ht SRC	375.5	multidirectional

Figure 7.7: Level C3 Core. (cat#2579)

Figure 7.8: Level C3 Core. (cat#5864)

7.6 Hammerstones and Miscellaneous Stone Tools

In Level C3, four hammerstones and one anvil stone were identified. Items A and B (Fig. 7.11) and are fragments of the same quartzite hammerstone found in units 24S 20E and 23S 20E respectively. Both fragments show evidence of battering in the form of peck marks around their margins. Item A (Fig.7.12) is a rounded diorite cobble which exhibits peck marks on three surfaces.

A greywacke hammerstone frag (Fig. 7.12, B) was also recovered which seems to have failed along a spherical carbonate concretion. The final hammerstone fragment (Fig. 7.12, C) is composed of quartzite and exhibits large defects from heavy battering. An anvil stone (Fig. 7.13) was also recovered from Level C3. It is composed of basalt and is 144.2 mm long, 105.8 mm wide, and 61.6 mm high. The superior surface (based on its in situ position) is relatively flat and smooth and has two distinct areas of pecking.

Figure 7.9 Level C3 Hammerstones.
(A=cat#495, B=cat#5300)

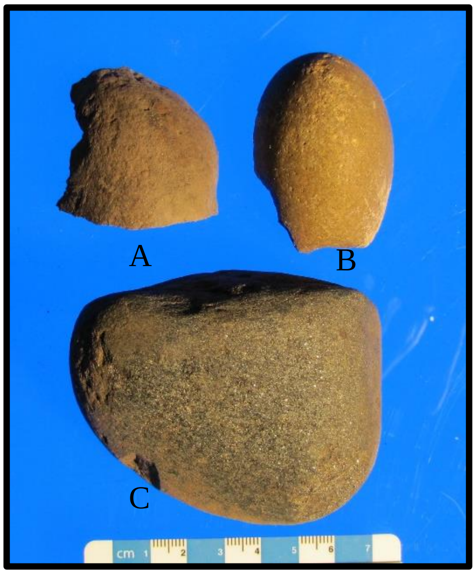

Figure 7.10 Level C3 Hammerstones
(A=cat#4631; B=cat#5676; C=cat#3127)

Figure 7.11 Level C3 Anvil Stone (cat#5304)

7.7 Fire-Cracked Rock

The excavations of Level C4 yielded a total of 158 pieces of fire-cracked rock (Table 7.3). The most common material type by mass is granite at 11,100.5g (80.2%). The next most common material types were quartzite (5.7%) and diorite (3.7%). The remaining material types include local igneous and metamorphic lithic types.

Table 7.3: Level C3 Fire-Cracked Rock

Material	Count	%	Mass (g)	%
Basalt	3	1.9	51.8	0.4%
Diabase	3	1.9	286.6	2.1%
Diorite	3	1.9	520.7	3.8%
Gneiss	3	1.9	132.6	0.9%
Granite	125	79.1	11,100.5	80.3%
Sandstone	8	5.1	375.6	2.7%
Schist	4	2.5	434.4	3.1%
Quartzite	6	3.8	801.0	5.8%
Rhyolite	3	1.9	125.5	0.9%
Total	158	100%	13,828.7g	100%

7.8 Faunal Assemblage

In Level C3, the faunal assemblage is composed of 11,536 specimens (Table 7.4). The total mass of the collection is 34,189.8g. Unidentified materials represent the majority of the assemblage, accounting for 69.2% of the specimens by weight. Unburned bone represents 91.3% of the faunal remains by weight. Specimens that could not be confidently assigned to a taxon were placed within a size class whenever possible. Root etching, mineral deposits, and staining were the most common taphonomic processes noted. The degree of weathering on this bone is primarily Stage 2 and Stage 3.

Table 7.4 Level C3 Faunal Counts

Faunal Type	Number of Elements	Mass (g)	Number of Specimens	Mass (g)	Number of Unidentified	Mass (g)
Unburned Bone	148	5721.1	3182	21852.03	6775	5787.8
Burned Bone	0	0	4	21.6	576	219.8
Calcined Bone	0	0	0	0	392	91.6
Unburned Enamel	8	23.5	211	337.7	210	116.7
Burned Enamel	0	0	2	2.0	20	12.5
Calcined Enamel	0	0	0	0	5	1.3
Shell	0	0	3	2.2	0	0
Total	156	5744.6g	3402	22215.53g	7978	6229.7g

Table 7.5: Level C3 Faunal Remains by Taxa

Common Name	Taxon	NISP	MNI
Mammals			
Bison	*Bison bison*	405	10
Pronghorn	*Antilocapra americana*	1	1
Dog/wolf/coyote	*Canis* sp.	19	1
Rabbit	*Lepus* sp.	1	1
Striped Skunk	*Mephitis mephitis*	1	1
Muskrat	*Ondatra zibethicus*	1	1
Richardson's Ground Squirrel	*Spermophilus richardsonii*	6	2
Northern Pocket Gopher	*Thomomys talpoides*	2	1
Birds			
Bird	*Aves*	1	1
Invertebrates			
Freshwater Clam	*Unionidae*	2	1
Miscellaneous			
Bison/Moose Size	Very Large Mammal	77	
	Large/Very Large Mammal	1717	
Deer/Wolf Size	Large Mammal	193	
	Medium-Very Large Mammal	614	
Coyote/Badger Size	Medium Mammal	5	
	Small/Medium Mammal	2	
Ground Squirrel Size	Small Mammal	4	
Total		3051	20

7.9 Order Artiodactyla

7.9.1 *Bison bison*

Ten mature, four juvenile, and one fetal individual are represented in the bison remains. Sixty percent, amounting to 16,792.63 g, of the identified specimens by weight recovered from Level C3 have been categorized as bison. The most common taphonomic process recorded was root etching and the most common degree of weathering was Stage 3.

Mature animal counts are attributed to the recovery of ten right side tali in the Level C3 assemblage. Juvenile animals were represented by: a left metatarsal from a neonatal animal (Figure 7.14); a metacarpal from a three-week to one-month old individual (Figure 7.15); a metacarpal from a month-old animal (Fig. 7.16); and a metacarpal from a yearling (Fig. 7.17). The fetal remains consist of a metacarpal (Fig. 7.15) from a fetus at approximately seven months gestation. The complete quantitative analysis by element for *B. bison* is summarized in Appendix C.

Figure 7.12: Level C3 Juvenile *B. bison.* (cat#5271)

Figure 7.13: Level C3 Juvenile *B. bison.* (cat#3355)

Figure 7.14: Level C3 Juvenile *B. bison*. (cat#5850)

Figure 7.15 Level C3 Juvenile *B. bison.* (cat#5851)

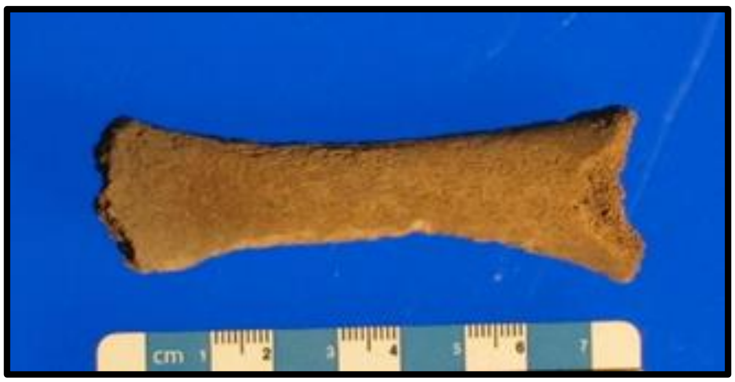

Figure 7.16 Level C3 Fetal *B. bison*. (cat#728A)

7.9.2 *Antilocapra americana*

The distal metacarpal of a pronghorn was recorded in the faunal assemblage from Level C3. The specimen was noted to have canine tooth punctures on both the cranial and caudal surfaces.

Figure 7.17: Level C3 *A. Americana.* (cat#2581)

7.10 Order Carnivora

7.10.1 *Canis* sp.

The NISP for canid remains was 19 with a MNI of one individual. A fourth metacarpal with cut marks was noted among the specimens (Fig. 7.20), as was a cervical vertebra (Fig. 7.21).


Figure 7.18: Level C3 Canid Metacarpal. (cat#3160)

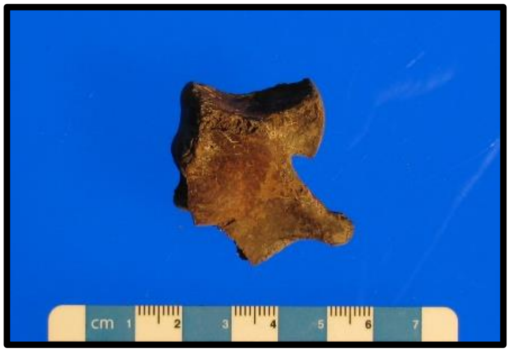
Figure 7.19: Level C3 Canid Vertebra. (cat#721)

7.10.2 *Mephitis mephitis*

Level C3 contained a fragment of the right dentary of a striped skunk.

7.11 Order Lagomorpha

7.11.1 *Lepus* sp.

A talus fragment from either a snowshoe hare (*Lepus americanus*), cottontail (*Silvilagus nuttallii*), or jack rabbit (*Lepus townsendii*) was found in Level C3. Snowshoe hares inhabit most regions of Canada while cottontails and jackrabbits tend to populate the southern regions of the prairie provinces (Whitaker: 1980). No evidence of human utilization was noted on the sample, although rabbits and hares are often hunted for their meat and pelts.

7.12 Order Rodentia

7.12.1 *Ondatra zibethicus*

A complete left maxilla from a muskrat was recorded in Level C3. Muskrats are hunted for their flesh and their fur; however, no evidence of butchering or skinning was evident on these remains. The muskrat's habitat includes marshes, ponds, lakes, rivers, and canals. Their range encompasses most of U.S. and Canada. Muskrats are active at all times of the year, but especially so in spring (Whitaker 1980: 511).

7.12.2 *Spermophilus richardsonii*

The NISP for the Richardson's ground squirrel in Level C3 as 6 and the MNI was two. Three humeri, one radius, and two femurs were recovered. These remains were likely intrusive as no direct evidence of human modification were noted.

7.12.3 *Thomomys talipoides*

A left and a right dentary from a pocket gopher were found in Level C3. No cultural modifications were documented on these specimens.

7.13 Class Aves

7.13.1 Aves Indeterminate

A portion of a tarso-metatarsus form an indeterminate species of bird was recovered from Level C3 (Figure 7.22). This specimen exhibits a distinct polish on its exterior that suggests it was extensively curated by an individual. The exact purpose or meaning attributable to the specimen which would account for its curation is unknown; however, such items may be found in contemporary and historic medicine bundles.

Figure 7.20: Level C3 Aves. (cat#3344)

7.14 Order Unionoida

7.14.1 Fresh Water Clam

Two shell fragments from a fresh water clam were recorded in Level C3. Their presence at the site is likely related to its close proximity to water.

7.15 Miscellaneous Specimens

The NISP for Very Large Mammal (SC6) fragments is 77. Most of the specimens in this class consist of long bone fragments or unidentifiable fragments. Large to Very Large (SC5-6) mammal bones are mainly unidentifiable fragments and total 1,717. The Large Mammal size class (SC 5) has an NISP of 193. Medium to Very Large Mammal (SC 4-6) specimens number 614 and are largely unidentifiable fragments. Long bone and rib fragments account for the 5 Medium Mammal (SC 4) specimens. Small to Medium Mammals (SC 3-4) consist of a rib and a condyle frag. The Small Mammal assemblage is made up of 4 unidentifiable fragments.

7.16 Bone Tools

A single bone tool was identified in the Level C3 assemblage (Figure 7.23). It was made from the shaft of a long bone, probably a bison tibia. One end of the tool has been smoothed and rounded with a beveled edge. The intended use of the tool is unknown. It was recovered in unit 24S 13E at 53 cm below datum.

Figure 7.21: Level C3 Bone Tool. (cat#3163)

7.17 Features

In unit 24S 15E, a hearth feature was encountered at 45 cm below datum in the northeast and northwest quadrants. Fine screening of the hearth sediments yielded 87 (14.7 g) raw bone fragments, 80 (3.9 g) calcined bone fragments, 67 (7.7 g) burned bone fragments, eight (1.5 g) enamel fragments, and 20 (3.3 g) pieces of heat treated Swan River chert shatter.

A second hearth feature was recorded in unit 25S 15E. The hearth was roughly circular in shape and measured approximately 25 by 25 cm. It was encountered at about 50 cm below datum in the southwest and southeast quadrants of the unit. Recoveries from the hearth included two (0.4 g) burned bone fragments, ten (2.0 g) raw bone fragments, and five (5.5 g) pieces of granite fire-cracked rock.

7.18 Interpretation

Preliminary investigations of the vicinity of the Wolf Willow site evinced that a bison kill may be associated with the site. A series of 15 stone cairns were noted on the upland at the end of a long swale to the west of the excavations. The cairns may have been the remains of a drive lane that might have led to a trap or pound structure (Walker 1988:87). The faunal analysis of Level C3 supports the theory that the Wolf Willow Site was associated with some type of bison trap, likely to the south of the excavation block. At least 14 bison are represented in the faunal assemblage from the 2010 and 2011 excavations. The bison MNI increases to 16 individuals when the preliminary data from 2012 and 2013 are also considered (Devon Stumborg: personal communication). Multiple kill events and possibly multiple events may be represented at the Wolf Willow site within Level C3. The recovery of expedient tools such as flake tools and the high number of distal limb elements are consistent with a kill site. Expedient tools and hammerstones are also suggestive of the first stage of bison processing. The presence of two hearth features, processing tools, and burned and calcined bones are all indicative of cooking and processing that is associated with kill sites (Figure 7.24).

The presence of muskrat, rabbit, and pronghorn skeletal elements as well as a canid specimen with cut marks indicate that the inhabitants were pursuing a well-rounded subsistence strategy. The presence of other animals in addition to bison may be reflective of a longer-term occupation or episodic occupations as the bison trap may not have been operational or productive at all times.

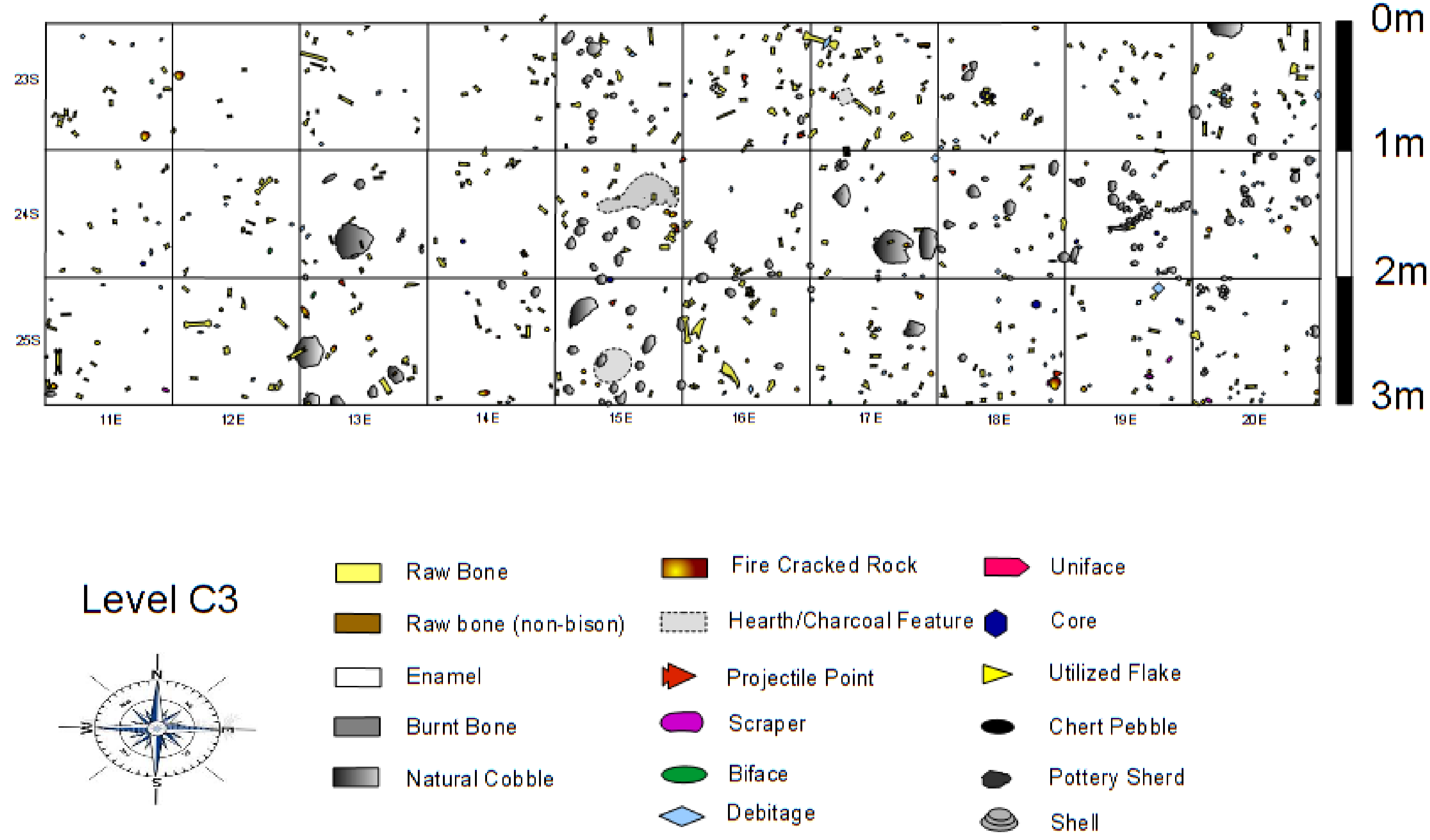

Figure 7.22: Distribution of Artifacts, Ecofacts , and Features in Level C3

Chapter 8

Cultural Level 4

8.1 Introduction

Level C4 ranges in depth from approximately 38 to 59 cm below datum. It was encountered in all excavated units except 23S 12E and 23S 18E. Level C4 was located within a layer of gravel immediately below Level C3. Level C4 yielded a modest number of artifacts and was the least productive of all the cultural levels. It seems likely that fluvial action during overbank flooding episodes of Opimihaw Creek are responsible for the scanty artifact recoveries in the eastern units. This level has been ascribed to the Oxbow culture based on the recovery of two in situ projectile points conforming to the Oxbow type.

8.2 Lithic Assemblage

Excavations from 2010 and 2011 recovered 197 pieces of shatter, flakes, and fragments. The debitage was predominantly composed of Swan River chert (74.51 %), with quartz being the second most common lithic material at 16.01% of the assemblage. Shatter was the most common form of debitage at 54.3%, followed by tertiary flakes at 3%. Lithic fragments accounted for 42.7% of the lithic assemblage.

Table 8.1: Level C4 Lithic Debitage and Fragments

Material Type	Primary Flakes	Secondary Flakes	Tertiary Flakes	Shatter	Fragment	Total	%	Heat Treated
Swan River Chert			17.5g (n=23)	215.1g (n=93)	294.1g (n=4)	526.7g (n=120)	74.51% (60.9%)	521.4g (n=116)
Quartz				113.2g (n=28)		113.2g (n=28)	16.01% (14.3%)	
Unknown Chert			0.6g (n=4)	2.4g (n=4)	1.2g (n=1)	4.2g (n=9)	0.59% (4.56%)	
Chalcedony				2.7g (n=1)		2.7g (n=1)	0.38% (0.50%)	
Knife River Flint			2.1g (n=5)			2.1g (n=5)	0.30% (2.54%)	
Silicified Peat				1.5g (n=1)		1.5g (n=1)	0.21% (0.50%)	
Agate				0.7g (n=1)		0.7g (n=1)	0.1% (0.50%)	
Quartzite				47.1g (n=26)		47.1g (n=26)	6.67% (13.19%)	
Gronlid Siltstone				0.3g (n=1)		0.3g (n=1)	0.04% (0.50%)	
Pebble Chert					6.6g (n=2)	6.6g (n=2)	0.94% (1.01%)	
Chert Precipitated in Limestone				1.1g (n=1)		1.1g (n=1)	0.16% (0.50%)	
Feldspathic Siltstone			0.6g (n=1)			0.6g+ (n=1)	0.08% (0.50%)	
Porcellanite			0.1g (n=1)			0.1g (n=1)	0.01% (0.50%)	
Total	0	0	20.9g (n=34)	384.1g (n=156)	301.9g (n=7)	706.9g (n=197)		
%	0	0	3.0% (17.2%)	54.3% (79.2%)	42.7% (3.36%)	100% (100%)		

8.3 Flaked Stone Tools

A total of three unifacial tools, three end scrapers, one bifacial tool, two projectile points, and two cores were recorded in Level C4.

8.3.1 Unifaces

All of the three unifacial tools recovered from Level C4 were fabricated from quartzite. Figure 8.1 is a bulky roughly hewn tool made on a large spall from a quartzite cobble. A teardrop shaped uniface (Fig. 8.2, A) was also recorded. The final uniface is a retouched flake (Fig. 8.2, B).

Figure 8.1: Level C4 Uniface. (cat# 1538)

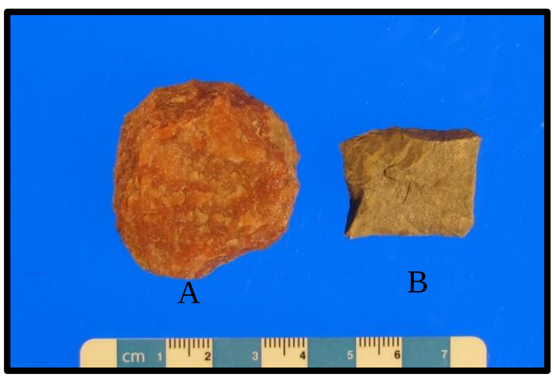

Figure 8.2: Level C4 Unifaces. (A=cat#3656; B=cat#1738)

8.3.2 End Scrapers

Two of the three end scrapers recovered from Level C4 were complete. The first of these was made from Knife River flint (Fig. 8.3, A) and exhibits some light patination of its surface.

The second (Fig. 8.3, B) was fabricated from white chert. Item C (Fig. 8.3) is comprised of Swan River Chert. Its distal end is missing as it has been broken obliquely across its midsection.

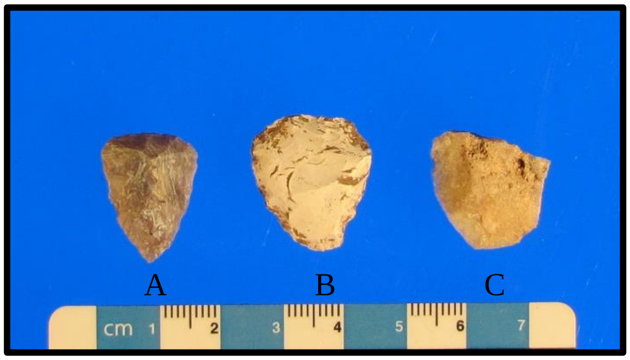

Figure 8.3: Level C4 End Scrapers. (A=cat#1133; B=cat#1786; C=cat#3671)

8.3.4 Bifaces

A single small biface (Fig. 8.4) of Swan River chert was uncovered in Level C4. It is teardrop shaped with working edges on both the distal and lateral margins.

Figure 8.4: Level C4 Biface. (cat#842)

8.3.5 Projectile Points

Two complete projectile points have been associated with Level C4. Both of the specimens have been attributed to the Oxbow archaeological culture. Item A (Fig. 8.5) was fabricated from Swan River Chert. It was found in unit 24S 14E at a depth of 44 cm below datum. The second projectile point (Fig. 8.5, B) was found at 48 cm below datum in unit 24S 15E. This point was made from basalt.

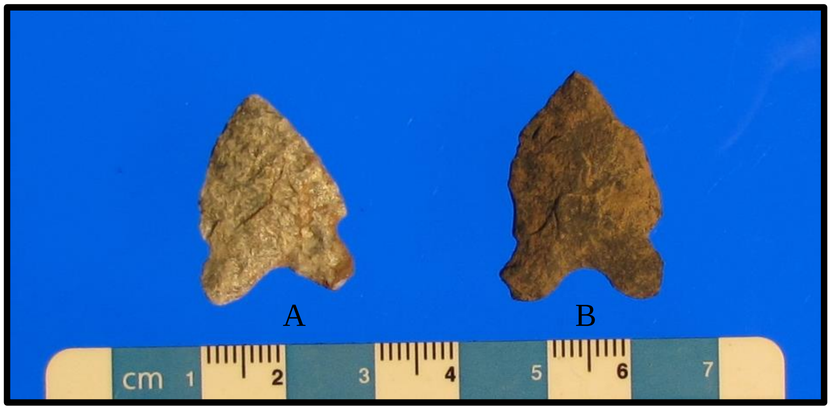

Figure 8.5: Level C4 Projectile Points. (A=cat#3791; B=cat#4802)

8.4 Cores

Two cores were found in Level C4. Item A (Fig. 8.6) consists of heat treated Swan River chert. It has multiple flake scars and was possibly discarded due to the presence of large druzy vugs. Item B (Fig. 8.6) is an exhausted multidirectional core and also consists of heat treated Swan River chert.

Figure 8.6: Level C4 Cores. (A=cat#1748; B=cat#3800)

8.5 Fire-Cracked Rock

A total of 41 pieces of fire-cracked rock were recovered in the 2010 to 2011 excavations (Table 8.2). The most common material type by mass is granite, at 5,111.1 g (84.6%). The remaining material types include quartzite and sandstone.

Table 8.2: Level C4 Fire Cracked Rock

Material	Count	%	Mass (g)	%
Granite	37	90.2	5,111.1	84.6
Sandstone	3	7.4	716.2	11.8
Quartzite	1	2.4	217	3.6
Total	41	100%	6,044.3g	100%

8.6 Faunal Assemblage

The excavations of Level C4 yielded a total of 1,716 elements, specimens, and unidentified fragments (Table 8.3). The majority of the faunal remains in Level C4 are unburned, with a total number of 1,655 (96.4%), and weigh a total of 7,343.9 g. Unidentifiable fragments of bone weighing a total of 2,654.6g comprise 35.8% of the total assemblage. Of these, 98% are unburned, 1.5% are burned, and the remaining 0.5% are calcined. The most common degree of weathering was Stage 2 and root etching was most common taphonomic process noted.

Table 8.3: Level C4 Faunal Counts

Faunal Type	Number of Elements	Mass (g)	Number of Specimens	Mass (g)	Number of Unidentified	Mass (g)
Unburned Bone	56	1,603.2	74	2,967.9	1,480	2,566.1
Burned Bone	0	0	0	0	35	41.1
Calcined Bone	0	0	0	0	26	10.5
Unburned Enamel	6	165.9	1	3.9	38	36.9
Total	62	1,769.1g	75	2,971.8	1,579	2,654.6g

Table 8.4: Level C4 Faunal Remains by Taxa

Common Name	Taxon	NISP	MNI
Mammals			
Bison	*Bison bison*	157	4
Dog/Wolf/Coyote	*Canis* sp.	11	1
Ground Squirrel	*Spermophilus richardsonii*	3	1
Northern Pocket Gopher	*Thomomys talpoides*	2	1
Birds			
Bird	Aves	1	
Sharp Tailed Grouse	*Tympanuchus phasianellus*	4	1
Miscellaneous			
Bison/Moose Size	Very Large Mammal	4	
	Very Large/Large Mammal	179	
Deer/Wolf Size	Large Mammal	36	
	Large/Medium Mammal	57	
Coyote/Badger Size	Medium Mammal	2	
Ground Squirrel/ Badger Size	Small/Medium Mammal	1	
Total		457	8

8.7 Order Artiodactyla

8.7.1 *Bison bison*

Four mature and at least one juvenile are represented in the bison faunal assemblage based on MNI element counts. Bison accounts for 70.8% of the identified faunal specimens in this level. Unidentified specimens by weight recovered from Level C4 which amount to 13.3 %, or 354.9g, have been classified as bison. It should be noted, however, that most, if not all, of the unidentifiable skeletal remains assigned to the Large to Very Large to Very Large size classes (SC5 and SC6) likely also represent bison. Root etching and trowel damage were the most common taphonomic processes recorded and the most common degree of weathering was Stage 2. The presence of four right side fused central and fourth tarsals indicate that a minimum of four mature animals are represented in the assemblage. The presence of a sub-adult was indicated by the recovery of an unfused femoral head, immature vertebral fragments, and immature tibia fragments. The complete quantitative analysis by element for *B. bison* is summarized in Appendix C.

8.8 Order Carnivora

8.8.1 *Canis* sp.

Canid remains recorded in Level C4 included; four metapodials, a first phalanx, a humerus fragment, an ulnar carpal, and lumbar vertebra fragments from a wolf-sized canid. These elements are consistent in size with those of a large domestic dog or wolf-sized animal. An upper carnassial from a smaller canid was also recovered. The size range for this element falls within the domestic dog-coyote continuum. The historic range of the coyote spans all of North America excluding the far north and parts of New England. They prefer open plains or brushy habitat and travel and hunt in small packs or pairs feeding opportunistically on game, fruits, birds, frogs, snakes, insects and carrion (Whitaker 1980:535).

8.9 Order Rodentia

8.9.1 *Spermophilus richardsonii*

Richardson's ground squirrel remains from Level C4 included dentary, a femur, and an innominate. No evidence of cultural modifications were noted on these remains.

8.9.2 *Thomomys talpoides*

A left and a right dentary from a northern pocket gopher were recovered in Level C4. These are likely naturally occurring remains as no evidence of human modification was documented.

8.10 Order Galliformes

8.10.1 *Tympanuchus phasianellus*

Two right coracoids, a humerus, and an ulna from a sharp-tailed grouse were located in Level C4. The NISP was four and the MNI was two. Grouse are common in Saskatchewan and often hunted for their meat. No taphonomic indicators suggesting that these animals were utilized by humans were noted.

Figure 8.7: Level C4 *T. phasianellus* coracoid

8.11 Aves

A long bone fragment from an unidentifiable bird with digestion marks was recovered.

8.12 Miscellaneous Specimens

The faunal assemblage in Level C4 was less fragmented than that of the other cultural levels; however, some remains were too fragmented to be classified any more accurately than by size. Most of specimens identified in Level C4 are represented by Very Large (SC6) and Large (SC5) mammal bone fragments. These specimens are likely bison as no other large mammals are known or are suspected to have been present at the site. Long bone fragments comprise the majority of the unknown specimens from Level C4.

8.13 Features

Two charcoal features were encountered in Level C4. The first was located in the NW quadrant of unit 23S 14E. The feature consists of an oval shaped charcoal stain measuring 45 cm by 32 cm at its maximum width. This feature appears to be too ephemeral to be the remains of a hearth as no sediment discoloration or artifacts could be directly associated with it. What is more likely is that this stain represents an ash dump or small temporary fire. The second feature was located in unit 25S 15E. It is a circular charcoal lens measuring approximately 30 cm by 20 cm located at approximately 45 cm below datum in the SW and SE quadrants. This feature was also probably an ash dump as it is not associated with any sediment staining or artifacts.

8.14 Interpretation

Level C4 appears the represent the remains of a small campsite whose inhabitants participated in activities related to subsistence and household economy. The inhabitants of Level C4 focused on tool maintenance rather than lithic reduction as evidenced by the recovery of a lone core and a lack of primary and secondary flakes. They also expressed a distinct preference for local lithic materials as exotics are essentially absent from the lithic assemblage. No distinct activity areas or hearths can be identified which suggests a shorter term occupation (Figure 8.8). The faunal assemblage is relatively well preserved and less fragmented than that of other levels. This may also denote a relatively short term occupation that resulted in less comminution of the remains from trampling or a different subsistence strategy that excluded the excessive processing of bones to extract their maximum nutritive value. Grouse remains are also unique to this level which suggests that a broader subsistence base may have been employed by the residents. No seasonality for this occupation could be ascertained due to a lack of fetal or juvenile bison remains and the absence of migratory birds or obligate hibernators from the faunal assemblage. The data recovered from the 2010 and 2011 excavations strongly suggest that Level C4 embodies a habitation or campsite associated with the Oxbow archaeological culture.

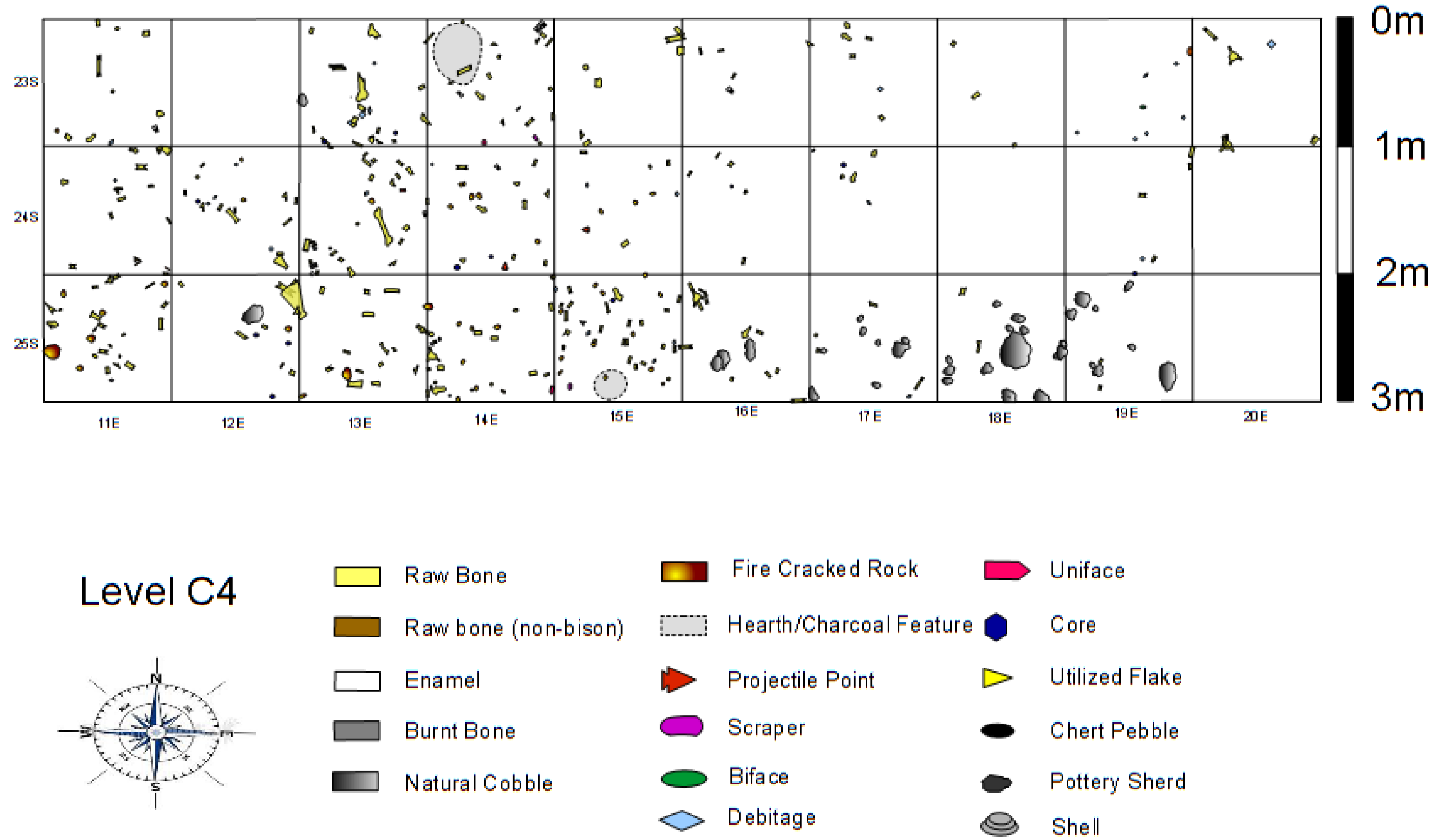

Figure 8.8: Distribution of Artifacts, Ecofacts, And Features in Level C4

Chapter 9

Cultural Level 5

9.1 Introduction

Level 5 ranges in depth from approximately 59 cm below datum to 80 cm below datum. It is found directly below Level C4 in a layer of clay and coarse sand. No artifacts were recovered from this level that could be confidently associated with a discrete cultural entity.

9.2 Lithic Recoveries

Lithic recoveries from this level were limited to two specimens. One quartz and one quartzite piece of shatter were recorded on this level.

9.3 Faunal Assemblage

The Level 5 faunal assemblage consists of 75 elements, specimens, and unidentified fragments with a mass of 3,101.1 g (Figure 9.1). Unidentifiable fragments represent 15.2% of the assemblage. Unburned bone accounts for 99.1% of the unidentifiable remains. Identifiable remains account for 84.7% of the faunal assemblage. The majority (99.3%) of the identifiable assemblage is unburned bone. Burned or calcined faunal remains make up 0.09% and 0.04% of the faunal assemblage respectively. Taphonomic alterations to the faunal assemblage include waterlogging, trowel damage, and breakage when specimens had dried.

Table 9.1: Level C5 Faunal Counts

Faunal Type	Number of Elements	Mass (g)	Number of Specimens	Mass (g)	Number of Unidentified	Mass (g)
Unburned Bone	7	355.0	16	2,255.4	48	469.1
Burned Bone	0	0	0	0	1	2.8
Calcined Bone	0	0	0	0	2	1.3
Unburned Enamel	1	17.5	0	0	0	0
Total	8	372.5g	16	2,255.4g	51	473.2g

Table 9.2: Level C5 Faunal Remains by Taxa

Common Name	Taxon	NISP	MNI
Mammals			
Bison	*Bison bison*	47	2
Dog/Wolf/Coyote	*Canis* sp.	1	1
Miscellaneous			
Deer/Wolf	Large Mammal	9	
Coyote/Badger	Medium Mammal	1	
Total		58	3

9.4 Order Artiodactyla

9.4.1 *Bison bison*

Based on the recovery of two right side calcanei, two mature bison are represented in the Level 5 faunal assemblage. Bison accounts for 99.9% of the identified faunal specimens in this level. The complete quantitative analysis by element for *B. bison* is summarized in Appendix C.

9.5 Order Carnivora

9.5.1 *Canis* sp.

A single specimen from an unspecified canid was documented in Level 5. The metapodial fragment shows no evidence of cultural modification and exhibits weathering consistent with the rest of the faunal assemblage.

9.6 Miscellaneous Specimens

The size classes represented in Level 5 are Large Mammal (SC 5) and Medium Mammal (SC 4). The NISP for Large Mammal is nine and consists mainly of long bone fragments. Medium Mammals are represented by a single long bone fragment. The average degree of weathering is Stage 3.

9.7 Interpretation

Level 5 cannot be definitively associated with any archaeological culture nor can it be unequivocally linked with human activity. The recovery of two pieces of shatter is less than conclusive especially since they are materials that occur naturally in the area and that do not readily show characteristics of being intentionally worked by humans. The skeletal elements are less fragmented than one would expect to find in a campsite (Figure 9.1), but that does not necessarily preclude human involvement. The decreased rate of comminution may be reflective of butchering/processing preferences, brief occupancy, or taphonomic factors that favoured larger heavier remains. Secondary redeposition may also be responsible for the presence of the large and relatively intact skeletal elements. Bioturbation processes may have pulled the larger elements downward from Level 4. The recovery of minute amounts of burned and especially calcined bone lend support to the idea of human activities occurring at the site, although, once again, this is not irrefutable evidence. Clearly, more excavations and recoveries are required in order to determine the cultural affiliation, if any, of Level 5.

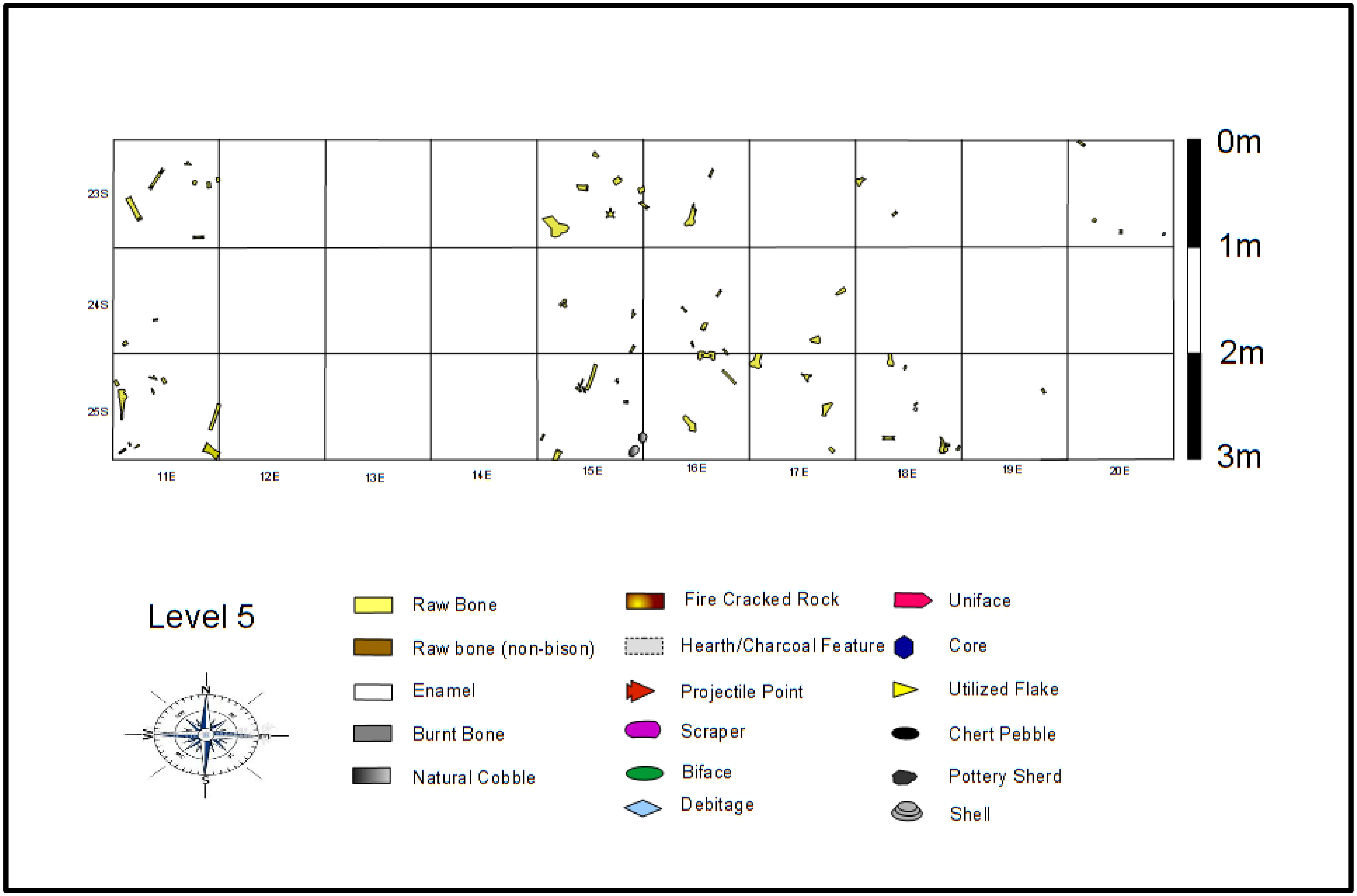

Figure 9.1: Distribution of Artifacts, Ecofacts, and Features in Level C5

Chapter 10

Resource Patches, Ecological Islands, and Special Places on the Northern Plains

10.1 Introduction

If the Great Plains of North America are known for anything, it is unfortunately and quite inaccurately their vast, never-ending, monotonously flat topography. The image of the Plains as a desert of grass belies its ecological complexity, which allowed human populations to successfully exploit the Great Plains environment for 12,000 years. The lifeways of Plains culture groups were characterized by extensive mobility and an extended home range. Landscape heterogeneity in the form of ecological islands and resource patches played an important role in the settlement and subsistence strategies of Plains dwellers. Past populations utilized these islands and patches as sources of spatially and temporally predictable resources (Holdaway et al. 2015:67).

Excavations at Wauskewin Heritage Park, including those conducted at the Wolf Willow site, have revealed a pattern of continued and intensive human usage of the area. One explanation for the persistence of human occupation of the Opimihaw valley lies in the area's ecological complexity. Wanuskewin incorporates a unique suite of resources, both ecological and ideological, that make it a place set apart on the Northern Plains landscape. A discussion of ecological islands and resource patches and how these theoretical concepts apply to Wanuskewin can help determine what factors have contributed to its enduring attractiveness to human populations.

In order to expand our archaeological understanding of how people interacted with their environment, theoretical models from other scientific disciplines are often employed as heuristic devices. The incorporation of ecological concepts like "patches" and "islands" can be extremely useful. The utilization of ecological concepts such as resource patches and ecological islands can allow archaeologists to study the ways in which habitat variation influenced cultural dynamics and evolution. Expanding on a purely ecological approach via the inclusion of perspectives from landscape archaeology and phenomenological approaches the human/landscape interaction can aid in the development of a more complete picture of how and why past populations moved about on the landscape. The analysis of how past populations adapted to different islands on the Plains can elucidate how these adaptive strategies evolved over time (Osborn and Kornfeld 2003:2).

10.2 Ecological Studies

Evolution and the concepts of adaptation and fitness form the basis of ecological studies (Jochim 1979:78). Evolutionary ecology is the study of adaptation and biological design in an ecological setting via the application of natural selection theory (Winterhalder and Smith 1992:5). All living species develop solutions for basic ecological and biological problems like obtaining food, securing a place to live and successfully reproducing (Jochim 1979:79). Ecological models in general suggest that ecology creates human behavior as part of human adaptation to the natural environment (Amundsen-Meyer 2014b:78).

The use of evolutionary ecology to study human behavior is not new, nor is it without controversy due to the association of this approach with radical views like extreme Darwinism, the nature vs. nurture dichotomy, determinism, and reductionism (Winterhalder and Smith 1992). However, the use of ecological theoretical concepts facilitates the systemic study of biological remains, geomorphic data, and cultural material which can address the relationship between humans and the environment (Koch and Bozell 2003:184). Ecological anthropology is "the study of cultural behavior in its natural and social environment, in terms of its relationship to this environment" (Jochim 1979:78). Ecological archaeology explores behavioral subsystems like social organization, demography, settlement, technology, and subsistence along with the spatial and geographical extent of these behaviors. Levels of organizational complexity and system processes like homeostasis are also considered (Jochim 1979). Ecological anthropology provides a research framework with which to understand human activities in relation to ecosystems. Archaeological data can then be used to understand the relationships between human populations and their environments (Litwinionek et al. 2003:22)

In archaeological studies, ecology is used as an heuristic device rather than a set of formal explanatory principles (Hardesty 1980:157). Ecologists use the concept of species in three ways: species richness (the number of species present); species evenness (the relative importance of species present); and total species (measures that combine species richness and evenness) (Whittaker 1977). In ecology, the species concept implies a difference in life style. That means that lifestyle differences between species which are approximately the same as those separating species can be used to define the species equivalent. The species separation rule can translate to the differences in behavior among social groups being compared where groups are considered as species equivalents. Because behavior will manifest itself in archaeological remains, the differences between groups are measured by comparing similarities in archaeological assemblages (Hardesty 1980:163).

10.3 Biogeographical Models

Biogeographic models are employed to explain the present distribution of organisms and the factors that may have operated to produce speciation (Veth 1989:83). In archaeological applications, biogeographical concepts and especially those from human biogeography, allow one to consider questions about the distribution, size, ecology, and population structure of human groups (Terrell 1977:237). Human biogeography also concerns itself with the interactions between human populations. In addition, it also studies the conditions and events leading to differences and similarities between human groups. Its field of study is more extensive than human ecology as it also encompasses the history, distribution, characteristics, and interrelationships of human communities from the regional to the global scale of analysis (Terrell 1997:420). It seeks to identify systemic relationships between “the multiple dimensions of human variability on one hand and geographical and biological parameters on the other” (Fitzhugh and Hunt 1997:379). In general, human biogeography aims to illustrate similarities between the spatial behavior of humans and that of other organisms in order to explain this behavior in relation to environmental factors (Jochim 1979:102)

10.4 The Theory of Island Biogeography

In 1963, Robert MacArthur and Edward O. Wilson debuted their theory of island biogeography. They built their new theory on the principles of evolutionary biology. Island biogeographic theory states that the number of species inhabiting an island represents an equilibrium between rates of extinction and colonization and these processes are a function of an island’s area, its isolation, and its age (MacArthur and Wilson 1967, Brown 1978:210). An island will be populated with species up to a predictable limit based on its size and its distance from a colonizing source, such as a “mainland” (Hardesty 1980:175).

MacArthur and Wilson’s concept was developed to explain the diversity of species on oceanic islands. Their theory was meant to provide a simple model of insular biogeography that essentially represents the number of species inhabiting an island as an equilibrium between rates of colonization and extinction. It can, however, be a valuable heuristic device for analysing may kinds of insular ecosystems because it examines general processes and allows for robust, testable predictions (Brown 1978:211). Both true and terrestrial islands have been important concepts in the development of evolutionary ecology and biogeography for half a century (Koch and Bozell 2003:167).

Since the time of Charles Darwin, islands have always held a certain fascination for scientists and have garnered an enormous amount of study of their natural history and species types (Forman and Godron 1986:104). Island study can help us to understand the process of behavioral adaptation to new environments (Hamilton and Nicholson 1999:5). Its greatest worth to the archaeologist, however, may lie in how the concept affects the utility of optimal foraging, patch choice, diet breadth, and other models of resource procurement (Vehik 2003:317). If archaeologists are to understand the organization of past societies, they must also understand the relationships between places which were subject to differential use by past cultural systems (Binford 1982:5). Links between island characteristics and human behavior could ultimately shed light on the organization of past cultures (Osborn and Kornfeld 2003:8).

Islands are important to human populations because the flora and faunal can differ in predictability, density, and variability from their surrounding environment. The frequency of species can also differ tremendously (Koch and Bozell 2003:167). People seek out areas like islands with a high diversity of resources because the variety of choices means less risk. Therefore, islands with "high resource potential" show repeated use over time (Litwinionek et al. 2003:21).

10.5 Definition of Islands

MacArthur and Wilson (1963) defined islands as having a relatively bounded and isolated ecosystem, limited external contacts, low species diversity, low genetic diversity within species, a high frequency of individuals to species ratios, diminished interspecies competition, simple food webs, high extinction rates, rapid adaptive radiation and heightened exploratory and migratory behavior. These conditions are always relative to a "mainland" (Fitzhugh 1997:387). An island can also be defined as a "patch of suitable habitat surrounded by an unfavourable environment that limits the dispersal of individuals" (Brown 1978:211). Islands are insular biotas and as such are subject to the processes of colonization, extinction, and speciation which in turn determine their composition. Islands are colonized by new species when barriers are temporarily absent or by species successfully traversing existing habitat barriers (Brown 1978:211).

The connotation of the island concept to an archaeologist has been less clear. If isolation is the abiding characteristic, then many environments such as desert oases and mountain refugia, or for that matter any ecological community that is geographically or biologically isolated can be considered an island (Fitzhugh 1997:389). Islands are not limited to true marine ecosystems, they are widespread on the terrestrial landscape as well (Pianka 1988:364). Anything from a patch of forest, to an isolated lake, or a mountaintop could be considered an island (Pianka 1988:364). Islands will often incorporate diverse, predictable, high density resources (Osborn and Kornfeld 2003:11).

10.6 Islands in Archaeological Studies

Understanding how and why people utilized islands and whether or not the behaviors associated with their use of islands is predictable based on the tenets of island biogeography is a major goal of the archaeological study of islands (Osborn and Kornfeld 2003:6). Osborn and Kornfeld (2003:4) suggest that the study of terrestrial islands may elucidate certain characteristics of human systems while simultaneously expanding our understanding of biogeographical processes. In order to study islands, archaeologists must consider some quantifiable features of landscape mosaics such as size, distribution, boundary form, perimeter to area ratio, patch orientation, context, connectivity, richness, evenness, dispersion and predictability (Weins et al. 1993:371). Archaeologists can use these factors to consider whether large Plains islands enable more diverse behaviors (as they would allow for increased species richness) than small islands and whether or not this is a function of ecological processes (Osborn and Kornfeld 2003:6). If an entire terrestrial region is treated as a cluster of islands with differing characteristics, archaeologists could predict things like language, ethnicity, and cultural diversity according to the calculated equilibria for each island. The diversity of cultural “species” could then be predicted from the equilibria (Hardesty 1980:177).

10.7 Terrestrial Islands on the Plains

It has been suggested that the lack of anthropological acknowledgement of the diversity present in Plains environments stems from a perceived monotony in the topography, flora, and fauna of the region (Bamforth 1988:3). However, the Great Plains incorporates a wide variety of habitats like uplands, stream drainages, canyons, playas, escarpments, dune fields, and other distinct geomorphic and topographic discontinuities (Osborn and Kornfeld 2003:2). These features form biogeographical islands that create a greater assortment of available resources and facilitate ecological diversity and complexity on the Plains (Holdaway et al. 2015:67). Examples of areas that could be considered terrestrial islands on the Great Plains include: the Black Hills in Wyoming and South Dakota, the Denver Basin in Colorado, the Bridger Mountain Range in Montana, and the Nebraska Sand hills (Osborn and Kornfeld 2003:3) The ecological heterogeneity created by biogeographical islands was extremely relevant to human groups because it increased the predictability of resources and created opportunities for the exploitation of a wider variety of floral and faunal species (Osborn and Kornfeld 2003:2).

10.8 Patch Theory

Patch theory is essentially based on the supposition that resources will vary in their distribution through time and across space (Winterhalder and Smith 1992:237). Ecologists have made note of the fact that biophysical environments are often discontinuous or patchy (Osborn and Kornfeld 2003:6). Ecological studies have long shown an interest in the study of patches which are essentially areas of higher or lower biotic productivity than the surrounding region (Brunswig 2003:44).

A patch can be defined as “a hole, a bounded, connected discontinuity in an homogenous reference background” (Levin and Paine 1974:2744) whose “productivity varies from season to season and year to year” (Bamforth 1988: 18). These discontinuities are organism defined in that they are presumed to have biological significance to an organism. Patches, therefore, must be considered in terms of their perceived importance to the organism rather than that of the investigator (Weins 1976:83). They are relative to the behavior, size, mobility, habits and perceptive capabilities of a particular organism (Winterhalder 1994:30). Patches vary widely in terms of their shape, size, type, heterogeneity, and boundary characteristics. Plant and animal communities form patches which are embedded in a larger matrix that has a different composition (Forman and Godron 1986:83).

Forman and Godron (1986) have defined five patch types based on the origin of the patches:

1. Disturbance patches are formed by events such as avalanches, mudslides, burning and logging. They are quick to form and in turn are the most rapidly disappearing patch type.

2. Remnant patches are created when a widespread disturbance passes over a small area; such as when areas are circumscribed by forest fires.
3. Environmental resource patches are the most permanent as they have their origins in the spatial distribution of resources like water or soil.
4. Planted patches are generated when humans introduce plants; for example, in rice paddies, wheat fields, or golf courses.
5. Habitation patches include houses, yards, courtyards, farm buildings or any highly artificial environment that is dependent on human maintenance.

In any large scale physiographic region there will be a complex mosaic of higher and lower density patch environments (Brunswig 2003:45). The rate of patchiness is a function of the number of patch types, the distinctions between them and their relative size (Butzer 1982:215). Patches are evaluated according to a number of other properties as well, including quality, turnover, developmental dynamics, and distribution (Winterhalder 1994:30). Most importantly, patches are "localized discontinuities in the landscape that affect behavior" (Winterhalder 1994:30). Past populations recognized and exploited these features and the resources associated with them (Osborn and Kornfeld 2003:1).

10.9 Patches and Islands

Some archaeologists prefer to use the term patch when discussing discontinuous resources as the concept is well established and has a supportive theoretical framework (Vehik 2003:303). It has also been suggested that the term "island" be reserved for unique resources which occur only in one location (Vehik 2003:304). The author would suggest that the difference between a true terrestrial island and a resource patch may lie in the diversity and the permanence of the resources involved. While landscape patches may have high turnover rates, islands are much more stable and essentially permanent features on the landscape (Forman and Godron 1986:104). For example, Forman and Godron's (1996) environmental resource patches should qualify as islands because they are essentially permanent and offer resources like water that are attractive to many different organisms and ensure a degree of ecological abundance.

In ecological study, no real distinction has been made between the patch and island concepts (Osborn and Kornfeld 2003:10). The term "patch" would perhaps be better employed in archaeological studies to denote resources that are seasonal in nature, homogenous, or one of many sources of a resource within a group's exploitation area. The island concept is more suited to places that were essentially permanent and offered a suite of resources that could be exploited by many organisms, including humans, rather than the patch concept which is defined by its utility to individual organisms. The biological definition of an island also requires an increase in scale to be relevant for archaeological study (Osborn and Kornfeld 2003:10). The consideration of an island as something as miniscule and specific as drop of water to a bacterium is useful in biological study (Pianka 1988:364), but is not appropriate for archaeological problems. Archaeology, with its focus on the study of past human populations, should gear its definition of a "resource island" to areas of ecological abundance. Because of their trophic level, in order for an island to be of use to humans the presence of many species is required. This definition does not, however exclude ideological islands as they are usually closely linked to ecological resources and so remain associated with resource islands (Sundstrom 2003).

10.10 Patch Theory and Human Behavior

Patch theory has been used in evolutionary ecology to analyze habitat selection, foraging behavior, life history strategies, population dynamics, dispersal, social organization, predator/prey relationships, population stability and the genetic structure of organisms (Winterhalder 1994:33; Wiens 1976). In archaeological studies, the analysis of patchy environments can contribute to our understanding of the settlement and subsistence behaviors of past cultures (Banks 2003:67). The mosaic environment created by patchy discontinuities exerts powerful influences on the distribution of organisms as well as their interactions and adaptations (Weins 1976:81). Human behavior is also strongly influenced by temporal and spatial distribution of resources (Bamforth 1988). Through the study of patchiness, one can postulate the basic patterns and relationships with regard to resource distributions, subsistence strategies, group networks and demographic aggregations (Butzer 1982:241).

For hunter-gatherer groups, this environmental patchwork was significant because it meant that the resources they depended on were not evenly distributed across the landscape (Boyd et al. 2006:238). Their livelihood depended on developing logistical strategies to exploit seasonally and consistently dense patches which would allow them to "increase their dietary breadth" without diminishing their returns with long search times (Brunswig 2003:245; Boyd et al. 2006:238).

10.11 Terrestrial Patches and Islands

Forman and Godron (1986:104) suggest that patches on the landscape show significant differences from islands surrounded by water. While marine islands are essentially permanent, landscape patches may have high average turnover rates. Marine islands have sharp boundaries while terrestrial patches may have less defined borders which may allow for increased ease of movement for species when moving from matrix to patch. The importance of isolation, one of the three determining factors in island biogeographic theory, may therefore be considerably reduced.

Hardesty (1980:177) claims that researchers should not overlook the potential of "conceptual islands" in terms of their usefulness for understanding human ecology due to a reduction in their rates of isolation or boundedness. While the degrees may differ, terrestrial islands are still isolated from other "land-bound geographical regions" in essentially the same manner as marine islands are. Plains islands, in particular, do have "relatively abrupt boundaries which are generally marked more clearly than those of patches" (Osborn and Kornfeld 2003:11) resulting in species filtering effects being more pronounced in these cases.

10.12 Ecological Models of Landscape Use

Because patch shape and orientation are decisive factors in the dispersal of species in a landscape, a field of study surrounding animal foraging strategies has developed (Forman and Godron 1986:107). These studies have their basis in optimal foraging theory. The first assumption is that a patchy environment will include a number of different patch types of differing quality (Winterhalder 1981). Optimal foraging theory goes on to describe the manner in which a predator will exploit a patchy environment. In short, predators find food sources within patches, but must also spend time and energy travelling between said patches. Therefore, the optimal predator will make energy-return-based decisions regarding which patch it will visit and when it will leave a given patch based on diminishing resource return rates (Charnov 1976:129). This theory should also apply to human hunter-gatherer groups which can be viewed as foraging animals as well as predators. Optimal foraging studies in archaeology are becoming more and more important as the world's living population of hunter-gatherers continues to decline (Yesner 1981:149).

Because landscape features vary in shape and size, it is important to note how the scale of these features influenced human behavior. An important concept to consider when looking at subsistence strategies in patchy environments is that of grain. In a fine-grained environment, patches are small relative to a particular organism's mobility or are used in a general manner by foragers. In a coarse-grained landscape, patches are much larger than the home range of an organism or are utilized very selectively. Therefore, in fine-grained environments human forgers will use patches in a more general manner while a coarse-grained environment will prompt more specialized use of patches (Winterhalder 1994:33). The grain of the environment will affect subsistence strategies because it is economical to utilize fewer patch types in a seasonal round when resource density increases (Winterhalder 1981). Specialized use may also result in other activities being embedded in the exploitation of the patch rather than the other way around (Vehik 2003:317). High predictability and low risk are essential factors in resource exploitation strategies (Litwinionek et al. 2003:21).

Archaeologists have shown an increasing willingness to use biological theory along with ethnographic study to derive subsistence behavior hypotheses (Yesner 1981:149). When discussing foraging strategies in the context of evolutionary ecology, the focus is usually on subsistence or non-produced resources (Vehik 2003:317). Ecological archaeology in particular has focused on subsistence studies. Perhaps this is because the relationships between humans and their environment is most obvious and archaeologically visible when it is associated with food getting behavior (Jochim 1979:84).

The use of ecological models allows for the recognition of discrete resource patches with differing productivity in a landscape (Butzer 1982:223). Studies of patch selection correspond to settlement pattern studies because they elucidate the manner in which settlements are centrally located to facilitate the exploitation of resources which are seasonally available (Yesner 1981:150). Foragers will gather where resources are most plentiful (Cashdan 1992). In patchy environments, settlement strategies will be organized with regard to both predictable and unpredictable resources (Butzer 1982:223). When resources are unpredictably located or clustered settlement at a central place is likely (Winterhalder 1981).

Biogeography theory and models have made it possible to plot likely routes and directions of human interaction (Kaplan 1976:87). An important concept in the theory of island biogeography involves the use of "stepping stone islands" that facilitate the movement of species from one locale to another (MacArthur and Wilson 1967). The terrestrial equivalent of stepping stone islands are microhabitats which enable the expansion of groups into new areas. This is a major factor in culture change and transmission because it enables groups to adapt to new environments by transplanting elements of their existing lifeways into new habitats (Hamilton and Nicholson 1999:22).

The author would suggest that microhabitats may conform to patch types that are seasonal and have lower rates of ecological diversity. These microhabitats do not necessitate drastic changes in lifestyle, just gradual adjustments in procurement strategies that allow a group to be successful enough to move on, but do not necessitate an overwhelming change in life style that may prove too radical to be compatible with survival. Stepping stone islands may also contain resources that are quickly exhausted, due to scale or homogeneity, bringing optimal foraging decisions into play and making them suitable for short term use only. Stepping stones islands are employed to move populations from major island to major island. Stepping stones are important because they shorten travel distances and, therefore, form the most likely routes of travel and they regulate the frequency and rate of species movement between larger islands (MacArthur and Wilson 1967). The species filtering effect of stepping stone islands may also impact patterns of trade, movement, and biological exchange between cultural areas (Kaplan 1976:77). A consideration of the evolution of ethnological, biological, and linguistic similarities and differences could be facilitated by the study of the use of stepping stone islands (Kaplan 1976:37).

10.15 Sacred Islands

In modern Plains archaeological studies, one of two models are generally employed to explain the distribution and spatial arrangement of archaeological sites. The ecological models previously discussed focus on how the environment influences human behavior while phenomenological models suggest that culturally important places determine how humans interact with their environment (Amundsen-Meyer 2014a:1). Critics of the ecological approach would suggest that Plains archaeologists have oversimplified the human connection to the landscape as one that begins and ends with food procurement (Sundstrom 2003:260). Contemporary researchers have called for the employment of post-processual approaches that include the consideration of human agency and praxis when considering settlement and subsistence strategies (Oetalaar and Meyer 2006:355). This is not to suggest that ecological models be discarded entirely when studying people's relationship to their environment. Ecological models are valuable heuristic tools that can be incorporated into the phenomenological approaches to landscape. It is the combination of "tangible and sometimes intangible attributes" that marks a place as significant to a people (Sundstrom 2003:260).

Phenomenological models are based on the notion that human beings are always interpreting the world around them and their agency is a result of their relationship with their surroundings. The phenomenological approach contends that it is human behavior that creates a cultural landscape and, therefore, ecology is the result of this behavior (Amunsen-Meyer 2014b:81). Christopher Tilley, one of the founding fathers of the phenomenological approach in archaeology, has expounded a methodological approach that incorporates visiting archaeological sites and making note of one's sensory experiences. It is through the *experience* of places that the archaeologist can interpret how past cultures lived in and understood the world (Tilley 1994:11).

One of the most important elements of phenomenological approaches involves recognizing the difference between spaces and places. Tilley (1994:11) contends that space is never neutral. The perception of space is a completely subjective experience that is vested with power, social position, and relationships to others. Places are social constructions (Basso 1996:74) in that the investment of meaning transforms a space into a place. Places differ from spaces in that the former incorporates elements of space, time, and experience. By integrating landscape archaeology into the examination of ecological islands it allows for the inclusion of the ideological perspectives that transform spaces into places (Amundsen-Meyer 2014a:2). This approach, however, is admittedly complex. In order to successfully employ it, "a continuous dialectic between ideas and empirical data" is necessitated (Tilley 1994:11).

The phenomenological approach allows for a discussion of another type of terrestrial island whose full range of resources may not be so readily apparent to the researcher; the sacred or spiritual island. Sacred islands are those places which held and continue to hold spiritual significance for Aboriginal Plains cultures (Sundstom 2003:258). What is not always discernable to archaeologists is that past and present cultures experience their homelands as much more than a series of resource patches (Oetelaar and Oetelaar 2007:73). A more complete understanding of past cultures and their responses to the landscape requires the consideration of sacred islands.

On the Northern Plains, sacred sites are often associated with physical topography such as caves, water features, or rock faces (Sundstrom 2003:259). Sacred islands can also be human generated; stone alignments and effigies are also considered sacred. Physical and biological uniqueness are associated with sacred islands, as is ideological differentiation as people regarded these areas as places of peace and abundance (Sundstrom 2003:290). Sacred places are also islands in the sense that they are locations in which supernatural power is concentrated and often serve as "anchors" for oral traditions (Oetelaar and Oetelaar 2007:66). While sacred islands may lack physical isolation, they often incorporate ideological boundaries that may only be crossed via acts of personal sacrifice or religious discipline. This may include prohibitions on certain behaviors, ceremonial activities such as sweat baths, or the gathering of offerings (Sundstrom 2003:259).

The archaeological study of islands on the Great Plains cannot divorce itself from the consideration of the relationship between Aboriginal people and their landscape. Aboriginal people consider themselves to be stewards of the lands with this relationship being based on "their roles as intermediaries between the spirits, the ancestors and the resources" (Oetelaar and Oetelaar 2007:66). It has been suggested that the behaviors of hunter-gatherers are not determined by ecology alone. Behaviors are performed in concert with the actions of the ancestors or culture heroes who created the features on the landscape. As a result, these spirit beings exert their influence on the weather as well as on floral and faunal resources. Resources came into being as a direct result of the ancestors' activities and as such must be maintained by the people through remembrance, ritual, and storytelling (Oetelaar 2014). Named places on the landscape are considered sacred and must be visited yearly to perform the activities that will ensure the success of the people and the renewal of the associated resources. This is highly relevant to archaeological studies as such repeated use will undoubtedly leave an archaeological signature (Amundsen-Meyer 2014a:4).

Ideological activity is also reflected in subsistence and settlement patterns. Both ecological and ideological islands are selected to meet survival needs like food, shelter, and water. However, within an ecologically rich area, certain locales are selected for their phenomenological importance (Amundsen-Meyer 2014b:326). Resource-rich areas tend to be selected for core habitation areas or seasonal hunting grounds. Resource islands and clusters of sacred sites are often closely associated (Sundstrom 2003:289). Game resources are also closely correlated to ideological sites (Sundstrom 2003:286). The distribution of sacred islands should also be comparable to resource procurement sites and habitation sites in terms of their distribution, i.e., near resources (Amundsen-Meyer 2014b:77). Archaeological sites will also generally cluster around sacred islands due to the constant need for renewal which can only be achieved by revisiting the site again and again to remember the names of the places, retell the associated stories, and repeat the appropriate rituals (Amundsen-Meyer 2014a:4, Oetelaar 2014).

It would seem that purely ecological models are overlooking one of the most important aspects of archaeological study, the human element. By viewing the relationship between people and their environments in purely materialistic terms where demographics, subsistence strategies, and social organization are simply a means of exploiting environmental resources to meet biological needs, an incomplete picture has developed. Past and present Aboriginal people maintain a complex and multi-faceted relationship with their landscape. Many aspects of this relationship have no obvious connection to meeting basic survival needs, but play an essential role in directing other types of social activity. Aboriginal people have a "moral relationship" with the land that is as vital as any economic dimension (Basso 1996:67). Social and religious obligations as well as subsistence and economic needs are ultimately what drives people's movements across the landscape (Oetelaar and Meyer 2006:356).

Conventional ecological studies will remain incomplete without the inclusion of traditional Aboriginal landscape knowledge. It is impossible to separate cultural meanings from the ecological dimension in the study of subsistence and settlement patterns (Amundsen-Meyer 2014b:321). The element of the spiritual exerts much more of a significant influence than many ecological studies have allowed for (Amundsen-Meyer 2014b:310). Instead of viewing the landscape as a series of resource islands, Aboriginal cultures see places that are connected by paths, movement, and narratives (Oetelaar and Meyer 2006:357). While human ecologists view the symbolic elements of landscape as outside of their range of study, the incorporation of cultural meaning into the examination of how human beings interacted with their surroundings can only serve to broaden the picture. The presumption that people's perception of the environment had little bearing on how they led their lives is a false premise. The spiritual and cultural significance of the landscape is highly relevant to all cultures, past and present, and to omit this factor from the archaeological study of people's interactions with the land is to commit a grave error.

10.16 Wanuskewin as an Island

To consider Wanuskewin for island status, it is important to note that the traditional scope of study, the site, should be expanded upon. The analytical scale must be increased to include Wanuskewin as a whole. All of the excavated sites at Wanuskewin reveal a pattern of relatively short-term, repeated occupations with some spanning back as far as 6,000 years before present. Although Wanuskewin did not experience long-term occupations, through cumulative archaeological study, one is able to recognize it as an important place on the landscape (Binford 1982).

The excavations at Wolf Willow have contributed to the body of archaeological data gathered at Wanuskewin in conjunction with the long-term, multi-year research project outlined for the area. Previous to Wolf Willow, eight other sites within Wanuskewin Heritage Park have undergone excavation. All of these excavated sites show a pattern of multicomponent habitations. The Tipperary Creek Site (FbNp-1) has cultural deposits from Plains and Prairie Side-Notched, Avonlea, and Besant cultures (Harty 2005). Meewasin Creek (FbNp-9) includes Avonlea, Outlook Complex, Sandy Creek, Pelican Lake, and Duncan cultural deposits (Frary 2009). The Redtail site (FbNp-10) incorporates Avonlea, Besant, Sandy Creek, and McKean occupation levels (Ramsay 1993). Newo Asiniak (FbNp-16) has Plains Side-Notched, Avonlea, Besant, and Pelican Lake cultural levels (Kelly 1986). Recoveries from the Amisk site (FbNp-17) included Plains and Prairie Side-Notched, Avonlea, and Oxbow cultural materials (Amundsen 1986). The Cut Arm Site (FbNp-22) is another multi-component site which includes Plains and Prairie Side-Notched, Besant, McKean, Oxbow, and Mummy Cave occupations (Smith 2012). The Dog Child Site (FbNp-24) has deposits from Plains and Prairie Side-Notched, McKean, Oxbow, and Mummy Cave cultures (Cyr 2006). Occupation levels at the Thundercloud Site (FbNp-25) include Plains and Prairie Side-Notched, Besant, Avonlea, McKean, and Oxbow (Mack 2000). A consideration of the results of the Wolf Willow excavations along with those of previous excavations shows a distinct pattern of focused and repeated human occupations which targeted the Opimihaw Valley locale over thousands of years, particularly during McKean times. Wanuskewin is remarkable in that no other area on the Canadian Northern Plains is known to show the same persistency and concentration of human occupations. To understand why this area exerted such a strong pull on the occupants of the Northern Plains, a consideration of Wanuskewin as a “terrestrial island” is in order.

Wanuskewin offers many of the elements of a resource island, such as surface water, floral and faunal diversity and density, and protection from the elements. The Opimihaw Creek offers a source of water that was likely much safer for human use than the nearby Saskatchewan River with its unstable banks and treacherous currents. Many birds and animals that were important prey animals for human populations were also drawn to the Opimihaw Valley (see Appendix A) as it was a microenvironment that remained cooler and lusher than the surrounding prairie even during xeric episodes (Stead 2013). The valley affords protection from the unceasing prairie winter winds and the uplands provide the spring and summer breezes that relieve the torment of biting flies and mosquitoes. The combination of these resources was highly attractive to past hunter-gatherer groups.

Wanuskewin can also be considered as an ecological island rather than a resource patch because it offers unique and spatially limited resources (Vehik 2003:304). The unique topography of the Opimihaw Valley allowed for the operation of two bison jumps, the Opimihaw jump and the Newo Asiniak jump. No other areas in the region have the suitable topography with which to perform a successful bison jump. Other bison procurement sites in the region, such as Tschetter, Gull Lake, and Estuary sites, relied on natural or manmade containment systems to operate communal hunts (Kelly 1986:189). The persistently flat topography of the Northwestern Plains area made areas of geological relief, like Wanuskewin, relatively rare.

The operation of communal bison hunts also made Wanuskewin a social island. A successful bison jump required the coordinated efforts of many people, and the activities within the hunting encampment encompassed a wide range of social and ritual activities. The communal hunt was an integral part of the seasonal round of activities and provided a vital basis for aggregations which also afforded people an opportunity to procure food, hides, and other bison centred resources (Bamforth 1988:11).

Wanuskewin exhibits features of a terrestrial island such as isolation and boundedness. The Opimihaw Valley is biologically isolated from the surrounding matrix, which would have been comprised of a relatively homogenous short grass prairie prior to European settlement. In modern times, the valley area remains isolated as a microcosm of original prairie amid a larger matrix of cultivated farmland. Wanuskewin also exhibits well defined physiographical and ecological boundaries. The boundaries of the proposed terrestrial island encompass the Opimihaw Creek, the valley slopes, and the immediately adjacent uplands (Figure 10.1). Beyond the boundary, very little cultural material has been recovered and the landscape quickly reverts to the relatively flat topography common throughout the region. Ecological diversity outside of the boundary is also reduced due to the absence of the variety of physiographic subsections present in the valley. These microenvironments include the Upland Zone, the Valley Slope Zone, the Lowland Zone, Opimihaw Creek, and the South Saskatchewan River. The combination of several microenvironments within a circumscribed area results in an increase in biodiversity due to the availability of a wide range of habitats which attract a variety of plant and animal species (Smith 2011:206).

Figure 10.1: Boundaries of Opimihaw Creek Valley Terrestrial Island (Smith 2011)

Wanuskewin is also a sacred island. It is the home of the Wanuskewin Medicine Wheel, the most northerly of such structures in the Great Plains area. Medicine wheels are sacred stone alignments constructed by Plains cultural groups as monuments or directional markers. A possible vision quest site is also located within the park boundaries. The location of an obvious spiritual site such as the medicine wheel near the Opimihaw Valley is not surprising as many sacred sites are associated with natural resources (Sundstrom 2003:285).

Wanuskewin conforms most closely to Forman and Godron's (1986) definition of an environmental resource patch. It has its origins in geomorphological and geological features like water and is relatively permanent with a low turnover (Osborn and Kornfeld 2003:7). Geoarchaeological studies carried out within the confines of Wanuskewin Heritage Park have confirmed that the area experienced a "fairly consistently cool, moist climate" even though the surrounding prairies may have undergone several episodes of drought ranging from severe to mild (Stead 2013:113). This relative stability in terms of geomorphological and environmental conditions qualifies Wanuskewin as an island rather than a resource patch.

10.17 Conclusion

Binford has stated that "in order to understand the past, we must understand places" (Binford 1982:5). By researching terrestrial islands on the Great Plains, insight can be gained into the behavior of past cultural groups like pedestrian hunter-gatherers, equestrian hunters, and horticulturalists (Osborn and Kornfeld 2003:4). The completeness of the archaeological record and the focused nature of the precontact occupation of the immediate locale makes Wanuskewin unique among places on the Northern Plains. Wanuskewin has considerable potential for future research because it is not constrained by cultural resource management practices. It is one of the few areas that has been and will continue to be the subject of pure academic research. Wanuskewin is distinctive from a research perspective because its mandate includes incorporating and implementing directives from the Aboriginal groups that are known to have frequented the area in the past. The archaeological findings from the park can be enriched via the incorporation of traditional knowledge, thus prolonging and enhancing its traditional role as a cultural mnemonic device.

Ecological models do have value as heuristic devices for archaeological researchers. They enable archaeologists to study how habitat variation influenced human behavior. Ecological models, however, are missing the most important dimension of the subject of archaeological study, the human element. This is where the concept of the sacred or ideological island can fill in the gaps.

Special places like Wanuskewin have always been set aside as places of peace and abundance (Sundstrom 2003:290). The name Wanuskewin is, in fact, translatable from the Cree language to "seeking peace of mind" or "sanctuary". Throughout the ages people have sought out special places on the landscape for sustenance, both physical and spiritual. Wanuskewin is one of these unique locations with a definite sense of place all its own. As a researcher and an Aboriginal person, the author acknowledges that there are some qualities that cannot be measured with scientific instruments. The author would suggest that in order to truly understand a place one must incorporate elements of the phenomenological approach along with ecological methodologies. Researchers would do well to follow Tilley's advice and open themselves to "experiencing" the places they intend to study. If the world is perceived through the senses, it follows that bodily experience is a valid area of study (Johnson 2012:273). Tilley (1994) recommends that one approach a place on foot as past populations once did, and experience it in all environmental conditions, in different seasons, and learn its history from those who have constructed the cultural meaning that transforms a space into a place. Incorporating the spiritual and social dimensions of peoples' interactions with their landscapes into archaeological studies can only serve to broaden our understanding of how people lived in and made sense of their surroundings.

Since time immemorial, places have been employed by human populations as mnemonic devices to remind them of the stories of their people and even today, when people encounter or observe a new landscape they yearn to know "what happened here?" (Basso 1996:7). Islands have always been a draw for researchers and for people in general (Renfrew 2004:278) and Wanuskewin is a unique terrestrial "island on the Plains". Despite all the cultural change and upheaval that Wanuskewin has witnessed over the 6,000 year history of its human use, the "pull" of this place remains as strong as ever.

Wanuskewin is unique among the islands on the prairie because of the wide range of activities that were and still are carried out there. Everything from the sacred to the social to the subsistence needs of the people could all be met there in the past and continue to be in the present. During this researcher's time as an employee of Wanuskewin Heritage Park and throughout the course of my research there I have learned that this place remains a powerful draw for Aboriginal and non-Aboriginal people alike. Wanuskewin is still a social island and gathering place which attracts people from around the world. Wanuskewin continues to actively maintain its status as a sacred island with many traditional Aboriginal ceremonies such as sweats and fasts still being performed there. Modern visitors to Wanuskewin are seeking many things; connection to culture, communion with the landscape, knowledge of the sacred and the secular, and a sense of fellowship. With Wanuskewin's potential designation as a World Heritage Site in the near future, it stands to reason that Wanuskewin's powerful sense of place will continue to attract a multitude of "seekers" well into the future.

Chapter 11

Conclusion

The focus of this thesis was on the archaeological investigations at the Wolf Willow site (FbNp-26) located within Wanuskewin Heritage Park. The site was initially located in 1983 when test excavations suggested the presence of several cultural components including a McKean occupation. Full-scale excavations led to the verification of four discrete cultural levels and a fifth level which may or may not be a cultural level. These cultural deposits span approximately 4,000 years of human occupation. Artifacts recovered from the Wolf Willow site were recorded using three-point provenience whenever possible. The research included in this thesis is based on the excavations conducted during the 2010 and 2011 field seasons.

Several research objectives were addressed in this thesis. Artifacts, features, and ecofacts from each level were analyzed and described. The cultural sequence of the Wolf Willow site was determined based on the recovery of diagnostic artifacts. The number and types of animal remains present in each level was determined via the analysis of the faunal assemblage. Seasonality and subsistence patterns were considered. Detailed maps, photographs, and stratigraphic analysis contributed to the understanding of site usage.

The analysis of the cultural assemblage from the Wolf Willow site indicated that four discrete occupation levels were present. Level C1 represents a Plains Side-Notched occupation, likely in the form of a campsite where basic domestic activities were carried out. Several diagnostic items were recovered from this level including eight projectile points. Some pottery sherds were recovered, but were too sparse to draw any firm conclusions about their cultural associations. Faunal remains included bison and canid. Level C2 contained the remains of a Plains Side-Notched culture campsite, which yielded considerable archaeological returns. Twenty-six diagnostic projectile points were recovered from this level as well as 44 other flaked stone tools. Several sherds consistent with the Mortlach style of pottery were also recovered. Bison, canid, antelope, weasel, and fox were represented in the faunal assemblage. A McKean occupation formed Level C3, which was also archaeologically prolific and possibly associated with a bison kill. Nine Duncan points, two McKean points and four indeterminate points were recovered. The analysis of the *B. bison* faunal remains indicated that a minimum of 10 mature and five juvenile individuals were represented. These high MNI counts are consistent with a bison kill. Other taxa represented in Level C3 include rabbit, antelope, muskrat, skunk, canid, and bird remains. Level C4 was consistent with the Oxbow culture and probably represents a habitation site. Two Oxbow points were recovered from this level. Bison, canid, and bird remains are also associated with level C4. Pelican Lake, Besant, and Avonlea are noticeably absent from the cultural sequence at Wolf Willow. This may be due to colluvial activity or possible erosional loss associated with the shifting position of the Opimihaw Creek. The creek may have removed the deposits or rendered the area unsuitable for habitation at different points over the last 2 millennia.

Excavations at the Wolf Willow site have continued beyond the 2011 season and the results will be discussed in forthcoming thesis projects. These excavations can hopefully shed more light on the history of the human use of the Wolf Willow site as well as the Opimihaw Valley as a whole. Geoarchaeological investigations can possibly explain why there is a 2,000 year gap in the archaeological deposits. Future analysis can also further the evidence for or against the operation of some type of bison trap or pound structure associated with the site. The nature of the trap as well as its seasonality may also be determined.

The final chapter of this thesis focuses on the theoretical aspects of islands and patches, how these concepts are applied in ecological and archaeological studies, and whether any of these concepts can be successfully applied to Wanuskewin. Both concepts are founded on the assumption that resources are distributed unequally across a landscape. Patches are spatial units which are relatively homogenous in terms of their environmental conditions. Islands are ecosystems that show remarkable differences from the surrounding territory. They can be true marine islands or terrestrial areas that show the same characteristics. The patch/island concept in archaeology draws from many disciplines including ecology, landscape archaeology and ecology, evolutionary ecology, human ecology, optimal foraging theory, and island biogeography. The theory of island biogeography was developed by MacArthur and Wilson in the 1960s. It was built on the principles of evolutionary biology. Island biogeography is the study of species diversity and richness on islands. It is aimed at establishing and explaining the factors that affect species diversity. Ecologists and archeologists use the island/patch concept to study differing phenomena. Ecological studies use the concepts to study speciation through observing adaptation, distribution, interaction, population stability, predator/prey relationships and the social organization of organisms. Archaeologists use the concepts to study human behavior in terms of behavioral adaptation, settlement patterns, subsistence strategies, optimal foraging and the organization of past cultural systems. The island concept in archaeology is used to determine how habitat variation affects cultural dynamics and evolution. In archaeological island studies, culture is analogous to species. Archaeological island studies seek to find links between island characteristics and human behavior. It also expands upon the purely ecological approach by incorporating less tangible elements like the sacred and social uses of landscape.

An examination of the results of the excavations at Wolf Willow combined with evidence gathered from previous excavations conducted at Wanuskewin Heritage Park reveals a pattern of intensive and consistent human occupation. The concept of “terrestrial islands” can be employed to explain why human populations persistently exploited the Opimihaw Valley over thousands of years. Wanuskewin incorporates several of the characteristics that have been used to define archaeological islands. It has unique resources like the topography suitable for bison jumping and a rich complement of floral and faunal resources. It is essentially permanent as its origins lie in geomorphological features. Its climate has been consistently cool and moist and its long history of human use paired with a high diversity of resources make it the ideal example of a terrestrial island. Wanuskewin also has the characteristics of a sacred island like the presence of the Wanuskewin Medicine Wheel. By incorporating data from all the excavations at Wanuskewin, we see that although it was targeted for short-term occupations, the area as a resource draw attracted human populations repeatedly for approximately 6,000 years and continues to do so into the present.

The use of the concept of ecological islands as an heuristic device in archaeological studies is not new, however, it appears to be seriously underutilized especially in areas of perceived ecological heterogeneity such as the Great Plains. Wanuskewin Heritage Park is embarking on its 32nd consecutive year of academic archaeological research, a feat that is unprecedented in the history of Canadian archaeological study. As an archetypal example of a terrestrial island in terms of its ecological, social, and spiritual significance, Wanuskewin offers an unparalleled opportunity for pure academic research that can elucidate the manner in which past populations utilized these islands on the landscape and how they contributed to the cultural evolution of Plains societies. By expanding our knowledge of the differential use of places by past populations we come ever closer to understanding the organization of past cultural systems.

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Appendix A: Floral and Faunal Resources of Wanuskewin

Floral Resources of the South Saskatchewan River Valley
(Walker 1983)

	<u>EQUISETACEAE</u>
Equisetum arvense L.	Common Horsetail*
Equisetum hyemale L. *var. affine*	Common Souring-Rush*
	<u>SELAGINELLACEAE</u>
Selaginella densa Rydb.	Prairie Selaginella*
	<u>PINACEAE</u>
Juniperus communis L.	Low Juniper*
Juniperus horizontalis Moench	Creeping Juniper*
	<u>TYPHACEAE</u>
Typha latifolia L.	Common Cattail
	<u>GRAMINEAE</u>
Agropyron cristatum (L.) Gaertn.	Crested Wheat Grass
Agropyron dasystachyum (Hook.) Scribn.	Northern Wheat Grass
Agropyron repens (L.) Beauv.	Couch Grass
Agropyron trachycaulum (Ling) Malte.	Slender Wheat Grass
Agropyron smithii Rydb.	Western Wheat Grass
Andropogon scoparius Michx.	Little Bluestem
Avena hookeri	Hooker's Oat Grass
Bouteloua gracilis (HBK.) Lag.	Blue Gramma
Bromus anomalus Rupr.	Nodding Brome
Calamovilla longifolia (Hook.) Scribn.	Sand Reed Grass
Elymus canadensis (L.)	Nodding Wild Rye*
Elymus glaucus Buckl.	Smooth Wild Rye
Festuca scabrella Torr.	Rough Fescue*
Hierochloe odorata (L.) Beauv.	Sweet Grass*
Hordeum jubatum L.	Wild Barley*
Koeleria cristata (L.) Pers.	June Grass*
Muhlenbergia racemosa (Michx.) BSP.	Marsh Muhly
Phleum pretense L.	Timothy*
Poa compressa L.	Canada Blue Grass
Poa palustris L.	Fowl Blue Grass
Poa pratensis	Kentucky Blue Grass
Puccinellia nuttaliana (Schult.) Hitche.	Nuttall's Salt-Meadow Grass
Sporobolus crypandrus (Torr.) A. Gray	Sand Dropseed
Stipa comata Trin. & Rupr.	Spear Grass*
Stipa spartea Trin.	Porcupine Grass*

Stipa viridula Trin.	Green Needle Grass*
	CYPERACEAE
Carex aquatilis Wahlenb.	Water Sedge*
Carex eleocharis Bailey	Low Sedge*
Carex lanuginose Michx.	Wooly Sedge
Carex rostrata Stakes	Beaked Sedge
Eleocharis acicularis (L.) R. & S.	Needle Spike-Rush
Scirpus americanus Pers.	Three Square Bulrush
Scirpus validus Vahl.	Great Bulrush*
	LEMNACEAE
Lemna minor L.	Lesser Duckweed
	JUNCACEAE
Juncus alpinus Vill.	Alpine Rush
Juncus balticus Willd.	Baltic Rush
Juncus nodosus L.	Knotted Rush
	LILIACEAE
Allium cernuum Roth.	Nodding Onion*
Allium textile Nels. & Macbr.	Prairie Onion*
Lilium philadelphicum L.	Wood Lily*
Maianthemum canadense Desf.	Two-Leaved Solomon's Seal*
Smilacina stellata (L.) Desf.	Star Flowered Solomon's Seal*
Smilax lasioneura Hook.	Carrionflower*
	IRIDACEAE
Sisyrinchium montanum Greene	Common Blue Eyed Grass
	ORCHIDACEAE
Habenaria hyperborean (L.) R. Br.	Green Flowered Bog Orchid*
	SALICACEAE
Populus balsamifera L.	Balsam Poplar*
Populus Deltoides Marsh *var. occidentalis* Rydb.	Cottonwood*
Populus tremuloides Michx.	Aspen Poplar*
Salix bebbina Sarg.	Beaked Willow*
Salix interior Rowlee	Sandbar Willow*
Salix lutea Nutt.	Yellow Willow*
Salix petiolaris Smith	Basket Willow*
	BETULACEAE
Alnus rugosa (Du Roi) Spreng. *var.*	Speckled Alder*

americana (Regel.) Fern.	
Betula fontinalis Sarg. Or	
Betula occidentalis Hook.	River Birch*
Betula papyrifera Marsh	White Birch*
Corylus cornuta Marsh	Beaked Hazelnut*
	<u>URTICACEAE</u>
Urtica dioica L. *var. procera* Wedd.	Common Nettle*
	<u>SANTALACEAE</u>
Comandra pallida A.	Pale Comandra
	<u>POLYGONACEAE</u>
Eriogenum Flavum Nutt.	Yellow Umbrella Plant
Rumex occidentalis S. Wats.	Western Dock
	<u>CHENOPODIACEAE</u>
Chenopodium album L.	Lamb's Quarters*
Kochia scoparia (L.) Schrad.	Summer-Cypress
	<u>NYCTAGINACEAE</u>
Miribilis nyctaginea (Michx.) MacM.	Heart Leaved Umbrellawort
	<u>CARYOPHYLLACEAE</u>
Arenaria lateriflora L.	Blunt Leaved Sandwort
Cerastium arvense L.	Field Chickweed
	<u>RANUMCULACEAE</u>
Anemone canadensis L.	Canada Anemone*
Anemone multifida Poir.	Cut Leaved Anemone*
Anemone patens L. *var. wolfgangiana* (Bess.) Koch	Crocus Anemone*
Caltha palustris L.	Marsh Marigold*
Ranumculus cymbalaria Pursh	Seaside Buttercup*
Ranumculus macounii Britt.	Macoun's Buttercup*
Thalictrum venulosum Trel.	Veiny Meadow-Rue*
	<u>CRUCIFERAE</u>
Brassica juncea (L.) Casson	Indian Mustard*
Capsella bursa-pastoris (L.) Medic.	Shepard's Purse
Descurainia sophia (L.) Webb.	Flixweed
Lepidium densiflorum Schrad.	Common Pepper Grass*
Rorippa islandica (Oeder) Borbas *var. fernaldiana* Butte. & Abbe	Marsh Yellow Cress
Thlaspi arvense L.	Stinkweed

SAXIFRAGACEAE

Heuchera richardsonii R. Br.	Alumroot*
Ribes hirtellum	Low Wild Gooseberry*
Ribes hudsonianum Richards	Northern Black Currant*
Ribes oxyacanthoides L.	Northern Gooseberry*

ROSACEAE

Amelanchier alnifolia Nutt.	Saskatoon*
Crataegus chrysocarpa Ashe	Round Leaved Hawthorn
Fragaria virginiana var. terraenovae (Rydb.) Fern & Wieg.	Smooth Wild Strawberry*
Geum triflorum Pursh	Torchflower*
Potentilla anserine (L.)	Silverweed*
Potentilla pennsylvanica L.	Prairie Cinqufoil*
Prunus pensylvanica L. F.	Pin Cherry*
Prunus verginiana L.	Red Fruited Choke Cherry*
Rosa acicularis Lindl.	Prickly Rose*
Rosa arkansana Porter	Prairie Rose*
Rosa woodsii Lindl.	Wood’s Rose*
Rubus idaeus L. *var. strigosus* (Michx.) Maxim.	Wild Red Raspberry*

LEGUMINOSAE

Astragalus americanus (Hook.) Jones	American Milk Vetch
Astragalus caryocarpus Ker	Ground Plum
Astragalus missouriensis Nutt.	Missouri Milk Vetch
Astragalus pectinatus Dougl.	Narrow-Leaved Milk Vetch
Glycyrrhiza lepidota (Nutt.) Pursh	Wild Licorice*
Lathyrus ochroleucus Hook.	Cream Colored Vetchling
Melilotus officinalis (L.) Lam.	Yellow Sweet Clover
Oxytropis splendens Dougl.	Showy Locoweed*
Oxytropis macounii (Greene) Rydb.	Early Yellow Locoweed*
Petalostemum candidum (Willd.)	White Prairie Clover*
Petalostemum purpureum (Vent.) Rydb.	Purple Prairie Clover*
Psoralea argophylla Pursh	Siverleaf Psoralea*
Psoralea esculenta Pursh	Indian Breadroot*
Psoralea lanceolate Pursh	Lance Leaf Psoralea
Thermopsis rhombifolia (Nutt.)	Golden Bean
Vicia Americana Muhl.	American Vetch

LINACEAE

Linum lewisii Pursh	Lewis Wild Flax*
Linum rigidum Pursh	Yellow Flax*

POLYGALACEAE

Polygala senega L.	Seneca Snake Root*

	ANACARDIACEAE
Rhus radicans L. *var. rydbergii* (Small) Rehder	Poison Ivy
	ACERACEA
Acer negundo L. *var. interius* (Britt.) Sarg.	Manitoba Maple*
	RHAMNACEAE
Rhmnus cathartica L.	Buckthorn*
	MALVACEAE
Malvastrum coccineum (Pursh) A. Gray	Scarlet Mallow
	VIOLACEAE
Viola adunca Sm.	Early Blue Violet*
Viola nuttalli Pursh	Nuttall's Yellow Violet*
Viola Rugosa Greene	Western Canada Violet*
	CACTACEAE
Mamillaria vivipara (Nutt.) Haw.	Purple Cactus
	ELAEAGNACEAE
Elaeagnus commutate Bernh.	Silverberry*
Shepherdia argentea Nutt.	Buffaloberry*
Shepherdia canadensis (L.) Nutt.	Canada Buffaloberry*
	ONAGRACEAE
Gaura coccinea Pursh	Scarlet Gaura
	HALORAGACEAE
Hippuris vulgaris L.	Mare's Tail
	UMBELLIFERAE
Heracleum lanatum Michx.	Cow-Parsnip*
Sanicula marilandica L.	Snakeroot
Sium suave Walt.	Water Parsnip*
Zizia aptera (Gray) Fern.	Heart-Leaved Alexanders
	CORNACEAE
Cornus canadensis L.	Bunchberry
Cornus stolonifera Michx.	Red-Osier Dogwood*
	PYROLACEAE
Pyrola asarifolia var. purpurea	

(Bunge) Fern	Pink Wintergreen*
Pyrola secunda L.	One-Sided Wintergreen*
	<u>ERICACEAE</u>
Arctostaphylos uva-ursi (L.) Spreng.	Bearberry*
	<u>PRIMULACEAE</u>
Androsace septentrionalis L.	Pygmyflower
	<u>OLEACEAE</u>
Fraxinus pennsylvanica Marsh *var. subintegerrima* (Wahl.) Fern	Lance-Leaved Ash*
	<u>GENTIANACEAE</u>
Gentiana amarelle L.	Northern Gentain*
	<u>APOCYNACEAE</u>
Apocynum androsaemifolium L.	Spreading Dogwood
Apocynum sibiricum Jacq.	Clasping-leaved Dogbane
	<u>ASCLEPIADACEAE</u>
Asclepias ovalifolia Dcne.	Dwarf Milkweed*
	<u>POLEMONIACEAE</u>
Phlox hoodii Richards	Moss Phlox*
	<u>BORAGINACEAE</u>
Lappula redowskii (Hornem) Greene *var. occidentalis* (Wats.) Rydb.	Western Bluebur
Lithospermum angustifolium Michx.	Narrow Leaved Puccoon
Lithospermum canescens (Michx.) Lehm.	Hoary Puccoon
Oreocarya glomerata (Pursh) Greene	Clustered Oreocarya
	<u>LABIATAE</u>
Mentha arvensis L. *var. villosa* (Benth.) S.R.Stewart	Wild Mint*
Monarda fistulosa L. *var. menthaefolia* (Graham) Fern	Western Wild Bergamont
	<u>SCROPHULARIACEAE</u>
Orthocarpus luteus Nutt.	Owl’s Clover
Pentstemon gracilis Nutt.	Lilac-Flowered Beardtongue
Penstemon nitidus Dougl.	Smooth Blue Beardtongue
	<u>PLANTAGINACEAE</u>
Plantago major L.	Common Plantain*

	RUBIACEAE
Galium boreale L.	Northern Bedstraw
Galium triflorum Michx.	Sweet-Scented Bedstraw
	CAPRIFOLIACEAE
Lonicera dioica L. *var. glaucescens* (Rydb.) Butters	Twinning Honeysuckle*
Symphoricarpos albus (L.) Blake	Snowberry*
Symphoricarpos occidentalis Hook.	Western Snowberry*
Viburnum edule (Michx.) Raf.	Low-Bush Cranberry*
Viburnum trilobum Marsh	High-Bush Cranberry*
	CUCURBITACEAE
Campanula rotundifolia L.	Harebell*
	COMPOSITAE
Agoseris glauca (pursh) Raf.	Large-Flowered False Dandelion
Lygodesmia juncea (Pursh) D. Don	Skeletonweed
Taraxacum officinale Weber	Dandelion
Tragopogon pratensis L.	Goat's-Beard
Achillea lanulosa Nutt.	Wooly Yarrow
Antennaria rosea (D.C. Eat) Greene	Rosy Everlasting
Antennaria nitidae	Pussy Toes
Artemisia campestris L. *var. scouleriana* (Besser.) Cronq.	Plains Wormwood*
Artemisia frigida Willd.	Pasture Sage*
Artemisia ludoviciana Nutt. *var. gnaphalodes* (Nutt.) T. & G.	Prairie Sage*
Aster falcatus Lind.	White Prairie Aster*
Aster hesperius Gray	Willow Aster*
Aster laevis L.	Smooth Aster*
Aster pansus (Blake) Cronq.	Many-Flowered Aster*
Chrysopsis villosa (Pursh) Nutt.	Hairy Golden Aster
Cirsium arvense (L.) Scop.	Canada Thistle
Cirsium vulgare (Savi) Tenore	Bull Thistle
Crepis runcinata Subsp. *glauca* Babcock & Stebbins	Scapose Hawk's-Beard
Crepis tectorum L.	Narrow Leaved Hawk's- Beard
Erigeron canadensis l.	Canada Fleabane*
Erigeron glabellus Nutt.	Smooth Fleabane*
Erigeron philadelphicus L.	Philadelphia Fleabane*
Gaillardia aristata Pursh	Great-Flowered Gaillardia*
Grindelia squarrosa (Pursh) Dunal *var. quasiperennis* Lunnel	Gumweed*
Gutierrezia diversifolia Greene	Common Broomweed

Gutierrezia sarothrae (Pursh) Britt & Rasby	Broomweed
Liatris punctata Hook.	Dotted Blazing Star
Matricaria matricarioides (Less.) Porter	Pineappleweed
Rudbeckia hirta L. *var. pulcherrima* Farwell	Black-Eyed Susan*
Senecio canus Hook.	Silvery Groundsel
Solidago canadensis var. gilvocanescens Rydb.	Canascent Goldenrod*
Solidago missouriensis Nutt.	Low Goldenrod*
Sonshus arvensis var. glabrescens Guenth. Grab. & Wimm.	Smooth Perennial Sow Thistle*

* denotes ethnographic plant use

Mammalian Fauna of Wanuskewin Heritage Park

Scientific name	Common name
	SORICIDAE
Sorex cinereus haydeni Baird	Masked Shrew
Microsorex hayi hayi (Baird)	Pygmy Shrew
	VESPERTILIONIDAE
Myotus lucifungus lucifungus (Le Conte)	Little Brown Bat
Lasionycteris noctivigans (Le Conte)	Silver Haired Bat
Eptesicus fuscus pallidus Young	Big Brown Bat
Lasiurus borealis borealis (Muller)	Red Bat
Lasiurus cinereus (Beauvois)	Hoary Bat
	LEPORIDAE
Sylvilagus nuttallii grangeiri (Allen)	Nuttall's Cottontail
Lepus americanus americanus Erxleben	Snowshoe Hare
Lepus townsendii campanius Hallister	White-Tailed Jack Rabbit
	SCIURIDAE
Eutamias minimus borealis (Allen)	Least Chipmunk
Marmota monax canadensis (Erxleben)	Woodchuck
Spermophilus richardsonii richardsonii (Sabine)	Richardson's Ground Squirrel
Spermophilus tridecemlineatus tridecenlineatus	Thirteen-Lined Ground Squirrel
Spermophilus franklinii (Sabine)	Franklin's Ground Squirrel
	GEOMYIDAE
Thomomys talipoides talipoides (Richardson)	Northern Pocket Gopher
	HETEROMYIDAE
Perognathus fasciatus fasciatus Weid-Neuwied	Olive-Backed Pocket Mouse
	CASTORIDAE
Castor canadensis canadensis Kuhl	American Beaver
	MURIDAE
Peromyscus maniculatus osgoodi Mearns	Deer Mouse
Onychomys leucogaster missouriensis (Audobon and Bachman)	Northern Grasshopper Mouse
Clethrionomys grapperi loringi (Bailey)	Gapper's Red Backed Vole
Ondatra zibethicus albus (Sabine)	Muskrat
Microtus ochrogaster minor (Merriam)	Prairie Vole
Microtus pennsylvanicus drummondii (Audobon and Bachman)	Meadow Vole
	DIPODIDAE
Zapus princeps minor Preble	Western Jumping Mouse

	ERETHIZONTIDAE	
Erethizon dorsatum dorsatum (Linnaeus)	American Porcupine	
	CANIDAE	
Canis latrans latrans Say	Coyote	
Canis lupis nubilus Say	Buffalo Wolf*	
Vulpes vulpes regalis Merriam	Red Fox	
Vupes velox (Say)	Swift Fox*	
	URSIDAE	
Ursus americanus americanus Pallus	American Black Bear	
Ursus arctos horribilis Ord	Grizzly Bear*	
	PROCYONIDAE	
Procyon lotor hirtus Nelson and Goldman	Raccoon	
	MUSTELIDAE	
Mustela erminea invicta Hall	Ermine	
Mustela frenata longicauda Bonaparte	Long-Tailed Weasel	
Mustela nivalis rixosa (Bangs)	Least Weasel	
Mustela vison lacustris (Preble)	American Mink	
Gulo gulo luscus (Linneaus)	Wolverine*	
Taxidea taxus taxus (Schreber)	American Badger	
Mephitus mephitis hudsonica Richardson	Striped Skunk	
Lutra canadensis preblei (Goldman)	River Otter*	
	FELIDAE	
Felis concolor missoulensis Goldman	Mountain Lion*	
Lynx lynx canadensis Kerr	Lynx	
	CERVIDAE	
Odocoileus hemionus hemionus (Rafinesque)	Mule Deer*	
Odocoileus virginianus dacotensis Goldman and Kellogg	White-Tailed Deer	
Cervus elaphus manitobensis Millais	American Elk*	
	ANTILOCAPRIDAE	
Antilocapra americana americana Ord	Pronghorn*	
	BOVIDAE	
Bison bison bison (Linnaeus)	Bison*	

*denotes species which are rare or extinct in the study region

Appendix B: Lithic Analysis

Level C1 Metric Analysis of Formed Tools

Level	Cat. #	Weight	Primary Working Edge (mm)	Secondary Working Edge (mm)	Maximum Length (mm)	Maximum Width (mm)	Maximum Thickness (mm)
C1	1356	2.6g	14.8	-	22.9	16.6	6.9
C1	1825A	7.9	missing	-	25.5	28.8	8.2
C1	3198	3.1	18.9	-	18	18.8	8.1
C1	5364	8.7	missing	29.5	36	23.6	11.2
C1	1347	1.8	16.7	-	22.5	15.5	6.3
C1	3020	4.7	18.3	-	22.2	27.4	7.4
C1	213	3.6	29.2	27.9	28.9	17.1	6.1
C1	2644	7.4	30.8	28.6	30	32	8.6
C1	5379	9.1	37.9	29.2	37.7	28.5	8.3
C1	3752	4.5	24.6	20	23.7	24.7	7.7
C1	1358	5.0	24.3	21.1	22.8	27.2	8.1
C1	1359	1.3	18.1	-	16.3	13.1	5.4
C1	1345	3.8	26.1	26.8	29.5	18.3	6.4
C1	5187B	24.9	42.4	-	41.8	51.8	12.8
C1	3021	6.8	34.3	14.3	35.2	23.8	8.8
C1	584	0.3	5.9	6.1	6.2	13.1	3.6
C1	585	1.1	13.6	11.5	12.3	18.1	4.7
C1	4867	11.9	27.3	11.6	39.7	26.2	9.5
C1	3022	1.2	14.2	14.1	14.0	14.7	14.1
C1	2055	0.4	13.9	14.9	15.1	9.0	2.8
C1	1571	1.5	21.2	21.8	22.3	12.5	5.8

Level C1 Non-Metric Analysis of formed Tools

Level	Cat.#	Unit	Material	Tool Type	Modification	Shape	Primary Working Edge (location)	Secondary Working Edge (location)	Long-itudinal Cross-section	Trans-Verse Cross-Section
C1	1356	25S 14E	chert	end scraper	retouched	teardrop	convex/ distal	-	planar/ convex	planar/ convex
C1	1825A	25S 16E	chert pebble	end scraper	retouched	oval	missing	-	planar/ convex	planar/ convex
C1	3198	24S 11E	banded chert	end scraper	retouched	ovoid*	convex distal	-	planar/ convex	planar/ convex
C1	5364	23S 15E	yellow chert	side/end scraper	retouched	teardrop*	missing	right lateral	planar/ convex	planar/ convex
C1	1347	25S 15E	chert precipitated in limestone	retouched flake	retouched	polygonal	straight/ lateral	-	planar/ convex	planar/ convex
C1	3020	24S 13E	SRC (ht)	retouched flake	retouched	polygonal	straight/ lateral	-	irregular	planar/ convex
C1	213	24S 19E	quartzite (mg)	biface	retouched	triangular	straight (lateral)	straight(lateral)	bi-convex	bi-convex
C1	2644	25S 19E	SRC (ht)	biface	retouched	ovoid*	convex (lateral)	convex (lateral)	bi-convex	bi-convex
C1	5379	23S 15E	silicified peat	biface	retouched	triangular*	convex (lateral)	convex (lateral)	bi-convex	bi-convex
C1	3752	24S 14E	SRC (ht)	biface	retouched	square	straight (lateral)	straight (lateral)	planar	planar
C1	1358	25S 14E	SRC	biface	retouched	ovoid*	convex (lateral)	convex (lateral)	planar	bi-convex
C1	1359	25S 14E	quartzite	biface	retouched	ovoid*	convex (lateral)	-	bi-convex	bi-convex
C1	1345	25S 14E	silicified peat	biface	retouched	oviod	convex (lateral)	convex (lateral)	bi-convex	bi-convex
C1	5187B	23S 20E	SRC (ht)	biface	retouched	ovoid*	convex (lateral)	convex (lateral)	convex/ concave	convex/ concave

C1	3021	24S 13E	silicified peat	biface	retouched	triangular	convex (lateral)	convex (lateral)	bi-convex	bi-convex
C1	584	24S 11E	chalcedony	biface	retouched	unknown	convex (lateral)	convex (lateral)	bi-convex	bi-convex
C1	585	25S 11E	SRC (ht)	biface	retouched	ovoid*	convex (lateral)	convex (lateral)	bi-convex	bi-convex
C1	4867	23S 18E	SRC (ht)	biface	retouched	ovoid*	convex (lateral)	convex (lateral)	bi-convex	bi-convex
C1	3022	24S 13E	chert	biface	retouched	ovoid*	convex (lateral)	convex (lateral)	bi-convex	convex/ planar
C1	2055	25S 17E	SRC (ht)	drill	retouched	triangular*	convex (lateral)	convex (lateral)	bi-convex	bi-convex
C1	1571	25S 15E	Gronlid siltstone	awl	retouched	triangular	convex (lateral)	convex (lateral)	planar/ convex	bi-convex

Level C1 Projectile Point Metric Data

Cat.#	Max. Length (mm)	Max Width (mm)	Max Thick (mm)	Body Length (mm)	Base Width (mm)	Base Height Left (mm)	Base Height Right (mm)	Notch Depth Left (mm)	Notch Depth Right (mm)	Notch Width Left (mm)	Notch Width Right (mm)	Neck (mm)	Weight
1576 1579	22.8	14.3	3.11	14.9	13.8	3.0	4.8	3.2	1.9	2.8	2.3	7.8	1.4
1581	14.8	14.9	4.8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.9
3197	21.2	14.0	3.9	13.1	14.0	5.8	6.4	1.6	1.2	4.4	3.0	8.7	1.1
3989C	5.6	12.9	2.9	n/a	12.9	4.7	4.9	2.6	2.8	n/a	n/a	8.5	0.5
5369	18.0	12.1	3.0	12.2	12.1	3.2	3.9	2.4	2.2	3.4	4.8	7.4	0.5
5549	14.7	14.1	4.0	7.0	13.8	5.6	5.4	2.6	1.7	3.8	3.1	9.1	0.8
5781	13.9	11.1	2.2	9.1	11.1	3.8	3.6	0.8	0.7	1.6	2.6	9.9	0.4
586	0.5	3.2	14.5	16.3	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.5
3022	14.1	14.8	5.6	n/a	10.8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1.2
5549A	17.8	14.3	4.5	11.4	14.0	3.2	3.6	2.4	2.1	3.3	3.5	9.6	1.4

Level C1 Projectile Points Non-Metric Data

Level	Cat.#	Unit	Completeness	Cultural Affiliation	Material	Longitudinal Cross-Section	Transverse Cross-Section	General Symmetry	General Quality	Basal Edge Shape	Basal Edge Mod.
C1	1576 1579	25S 15E	tip missing	Plains Side-Notched	SRC (ht)	asym. bi-convex	asym. bi-convex	asym.	fair	straight	thinned
C1	1581	25S 15E	tip only	-	SRC (ht)	asym. bi-convex	asym. bi-convex	n/a	poor	-	-
C1	3197	24S 11E	tip missing	Plains Side-Notched	silicified peat	plano/ convex	asym. bi-convex	asym.	poor	straight	ground
C1	3989C	24S 17E	base	Plains Side-Notched	SRC (ht)	n/a	asym. bi-convex	slightly asym.	fair	straight	ground
C1	5369	23S 15E	complete	Plains Side-Notched	pebble chert	plano/ convex	asym. bi-convex	asym	poor	straight	none
C1	5549	23S 11E	tip missing	Plains Side-Notched	grey chalcedony	asym. bi-convex	lenticular	asym.	poor	straight	ground
C1	5781	23S 11E	tip missing	Plains Side-Notched	Knife River Flint	bi-convex	lenticular	slightly asym.	fair	concave	thinned
C1	586	25S 11E	tip only	-	SRC (ht)	n/a	asym. bi-convex	n/a	poor	n/a	n/a
C1	3022	24S 13E	proximal half	preform	grey chert	convex/ concave	lenticular	n/a	n/a	straight	n/a
C1	5549A	23S 11E	tip missing	Plains Side-Notched	silicified peat	bi-convex	lenticular	sym	fair	straight	thinned retouched

Level C2 Metric Analysis of Unifacial Tools

Cat. #	Weight	Primary Working Edge (mm)	Secondary Working Edge (mm)	Maximum Length (mm)	Maximum Width (mm)	Maximum Thickness (mm)
3431	5.4	19.0	-	21.8	19.4	6.5
3429	4.7	15.7	-	16.6	16.5	6.9
2872	2.5	17.4	-	14.2	18.0	3.5
3540	2.1	11.0	-	14.9	13.6	3.0
2331	2.1	12.6	-	17.7	12.8	4.4
2073	2.6	17.7	-	13.5	18.3	2.9
2172	1.1	15.4	-	15.5	15.2	4.2
86	1.4	16.9	-	12.9	16.9	2.0
5702	1.3	22.1	-	11.4	22.0	2.2
5042	1.3	9.7	-	12.4	9.8	3.4
3947	0.7	12.8	-	6.3	12.7	0.6
3763	8.8	18.0	-	32.7	21.2	5.9
4770	2.2	7.1	-	9.7	7.3	6.2
2486	6.2	32.4	-	37.8	24.8	8.1
65	1.7	14.1	17.4	17.9	18.0	3.9
219	16.7	36.7	32.9	36.1	37.2	11.0
5789	20.3	51.1	-	55.9	25.1	12.2
1228	2.7	22.5	-	24.9	13.6	6.8

Level C2 Non-metric Analysis of Formed Tools Unifaces

Cat. #	Unit	Material	Tool Type	Shape	Primary Working Edge (Location)	Secondary Working Edge (Location)	Longitudinal Cross Section	Transverse Cross Section
2486	25S 18E	quartzite	retouched flake	polygonal	convex (lateral)	-	irregular	planar/ convex
65	23S 18E	KRF	retouched flake	polygonal	straight (lateral)	convex (distal)	planar/ convex	planar/ convex
219	24S 19E	ht SRC	uniface	ovoid	convex/ lateral	convex/ lateral	concave/ convex	convex/ irregular
5789	23S 16E	quartz	uniface/ spokeshave	rectangular	concave/ lateral	-	concave/ convex	planar/ convex
1228	25S 13E	KRF	uniface/ spokeshave	rectangular	concave/ lateral	-	irregular	planar/ convex

Level C2 Metric Analysis of Formed Tools Bifaces

Cat. #	Weight	Primary Working Edge (mm)	Secondary Working Edge (mm)	Maximum Length (mm)	Maximum Width (mm)	Maximum Thickness (mm)
1425	1.4	19.4	20.6	19.0	18.9	4.1
397	1.8	14.0	14.5	13.8	24.8	4.4
5379	9.1	35.9	27.2	37.9	29.0	8.7
4195	1.3	25.1	15.3	24.6	15.8	5.0
633	1.1	12.6	10.6	14.3	13.0	5.2
4517	8.3	32.9	-	30.4	33.0	9.5
2410	3.7	36.9	-	36.9	9.8	11.4
4181	49.7	44.6	40.8	60.4	62.2	14.3
4214	5.0	23.4	27.1	21.7	29.1	12.2
470A	5.9	33.9	12.4	36.9	18.5	8.2
3425	2.9	21.8	-	19.5	17.9	6.4
4708	2.4	18.6	17.5	20.0	16.4	5.6
3430	2.0	19.3	-	15.3	27.8	5.5
5054	0.2	9.5	9.9	9.5	9.3	2.6
1610	1.5	19.0	14.1	20.1	15.3	4.4
34	2.6	25.2	23.8	24.9	20.8	4.3
3936	2.0	11.6	17.1	15.1	16.6	6.9
3786	0.3	9.7	12.2	12.3	10.1	2.5
867	8.1	22.5	27.1	25.5	33.4	7.9
2645	7.2	35.6	22.2	30.0	32.2	9.5
213	3.6	29.8	26.2	28.7	17.2	6.2
4177	0.4	12.9	10.6	14.5	9.7	2.6
5220	0.5	15.9	-	14.8	9.8	2.8
256	0.2	8.5	-	8.5	10.5	2.1
1608	2.3	22.0	23.0	24.1	12.8	6.5

Non-metric Analysis of Formed Tools C2 Bifaces

Cat.#	Unit	Material	Tool Type	Shape	Primary Working Edge (location)	Secondary Working Edge (location)	Long-itudinal Cross-section	Trans-Verse Cross-Section
1425	23S 14E	ht SRC	biface	oviod	convex/lateral	convex/lateral	planar/ convex	planar/convex
397	24S 20E	ht SRC	biface	broken	convex/lateral	convex/lateral	-	bi-convex
5379	23S 15E	silicified peat	biface	triangular	convex/lateral	convex/lateral	bi-convex	irregular
4195	24S 16E	quartzite	biface	triangular	convex/lateral	convex/lateral	bi-convex	lenticular
633	25S 11E	obsidian	biface	irregular	convex/lateral	convex/lateral	irregular	irregular
4517	23S 19E	fused shale	biface	ovoid	convex/lateral	convex/lateral	-	bi-convex
2410	25S 18E	chert	biface	broken	convex/lateral	-	-	-
4181	24S 16E	ht SRC	biface	ovoid	convex/lateral	convex/distal	bi-planar	bi-convex
4214	24S 16E	SRC	biface	broken	convex/distal	-	bi-convex	diamond
470A	24S 20E	quartzite	biface	oviod	convex/lateral	convex/ distal	bi-convex	bi-convex
3425	24S 12E	SRC	biface	broken	convex/lateral	-	-	-
4708	24S 20E	quartz	biface	triangular	straight/lateral	straight/lateral	bi-planar	bi-convex
3430	24S 12E	quartz	biface	broken	straight/lateral	-	-	concave/convex
5054	23S 13E	ht SRC	biface	triangular	straight/lateral	straight/lateral	bi-convex	bi-convex
1610	25S 15E	silicified peat	biface	rectangular	straight/lateral	straight/lateral	bi-convex	bi-convex
34	24S 18E	silicified peat	biface	triangular	convex/lateral	convex/lateral	bi-convex	lenticular

Level C2 Projectile Point Metric Data

Cat.#	Max. Length (mm)	Max Width (mm)	Max Thick (mm)	Body Length (mm)	Base Width (mm)	Base Height Left (mm)	Base Height Right (mm)	Notch Depth Left (mm)	Notch Depth Right (mm)	Notch Width Left (mm)	Notch Width Right (mm)	Neck (mm)	Weight
5225	18.3	17.7	5.4	15.1	-	-	-	4.1	3.2	-	-	10.8	1.5
4405	23.3	5.5	5.3	15.4	12.6	3.5	2.7	3.5	3.7	5.6	6.1	9.4	2.0
4161	15.9	11.8	2.7	13.	11.5	3.4	2.1	1.0	1.2	.2	1.1	8.9	0.6
5233	17.2	15.4	4.4	16.3	14.0	3.3	3.0	3.5	1.2	-	4.0	12.1	1.1
1617	13.3	8.8	2.6	-	-	-	-	-	-	-	-	-	0.4
2079	14.9	9.3	3.5	12.0	-	-	-	2.3	1.8	-	-	6.1	0.5
617	23.5	20.5	6.3	16.5	17.6	5.5	6.8	3.5	2.9	6.8	7.3	15.4	3.3
4696	15.6	8.8	1.6	12.4	6.9	2.1	1.8	1.8	1.6	2.6	2.7	5.5	0.3
197	14.5	7.6	2.1	11.3	4.5	3.3	-	2.3	-	2.7	-	4.2	0.2
1607	22.6	12.4	4.5	16.6	12.4	4.0	4.0	2.0	2.1	4.6	5.2	8.2	1.1
4550	19.9	16.9	3.8	16.0	14.7	4.6	3.5	2.0	2.4	2.4	2.5	11.4	2.2
3247	19.4	19.2	6.0	18.1	-	-	-	-	4.0	-	-	9.9	2.3
1876	19.5	2.9	3.6	14.7	12.3	3.0	3.2	2.1	2.9	3.3	4.2	8.5	0.9
3741	14.5	14.3	2.8	9.9	14.3	3.4	3.6	2.4	2.6	3.2	2.2	9.1	0.6
1630	18.4	13.6	3.2	12.9	10.2	4.1	3.5	2.4	3.1	3.7	4.5	9.0	0.5
279	19.4	16.6	4.6	14.2	13.4	-	3.0	-	1.7	3.2	-	14.0	1.2
2420	16.2	11.3	2.9	11.5	8.5	2.8	3.5	2.7	2.6	4.5	3.3	6.2	0.5
2740	35.2	21.1	5.8	28.3	17.8	4.5	4.2	2.7	2.7	3.0	5.1	16.0	4.1
1405	27.7	17.3	6.4	19.3	15.0	-	5.8	2.8	3.3	5.1	7.7	12.4	2.9
2421	16.8	18.2	4.0	11.3	15.0	3.6	4.1	3.5	3.4	3.0	2.5	11.3	1.2
45	21.5	15.1	3.9	16.8	14.4	3.0	2.8	2.0	1.9	2.8	3.7	12.1	1.1
1045	19.2	16.0	4.9	14.4	14.1	3.1	3.9	2.4	2.7	4.0	4.1	12.0	1.5
4762	8.1	16.6	4.2	-	16.5	4.8	4.4	2.4	1.9	-	-	12.9	5.7
392	22.6	13.2	4.7	22.8	-	-	-	-	-	-	-	-	1.3
2089	21.0	17.3	3.	-	-	-	-	-	-	-	-	-	1.4
2422	8.9	8.8	2.6	-	-	-	-	-	-	-	-	-	0.2

Level C2 Projectile Point Non-Metric Data

Cat.#	Unit	Completeness	Cultural Affiliation	Material	Longitudinal Cross-Section	Transverse Cross-Section	General Symmetry	General Quality	Basal Edge Shape	Basal Edge Mod.
5225	23S 20E	base & tip missing	Prairie Side-Notched	quartzite	bi-convex	bi-convex	-	fair	-	-
4405	23S 17E	tip missing	Prairie Side-Notched	silicified peat	bi-convex	bi-convex	slightly asym.	fair	convex	-
4161	24S 16E	tip missing	Prairie Side-Notched	SRC	bi-planar	bi-planar	slightly asym.	fair	concave	thinned
5233	23S 20E	tip & left shoulder missing	Prairie Side-Notched	agate	bi-convex	planar/convex	slightly asym.	poor	convex	retouched
1617	25S 15E	complete	unknown	silicified wood	bi-planar	lenticular	slightly asym.	poor	straight	retouched
2079	25S 17E	base & lat. blade edge missing	unknown	SRC	bi-planar	lenticular	-	poor	-	-
617	25S 11E	tip missing	Prairie Side-Notched	SRC	irregular	lenticular	slightly asym.	fair	straight	retouched
4696	24S 15E	complete	Prairie Side-Notched	silicified wood	bi-planar	bi-planar	sym	fair	straight	retouched
197	24S 19E	left leteral half missing	Prairie Side-Notched	ht SRC	bi-planar	lenticular	-	poor	convex	retouched
1607	25S 15E	complete	Prairie Side-Notched	Knife River Flint	plano/convex	plano/convex	asym.	poor	concave	retouched

Level C2 Projectile Point Non-Metric Data

Cat.#	Unit	Completeness	Cultural Affiliation	Material	Longitudinal Cross-Section	Transverse Cross-Section	General Symmetry	General Quality	Basal Edge Shape	Basal Edge Mod.
4550	23S 19E	tip & left corner missing	Prairie Side-Notched	quartzite	bi-planar	lenticular	asym.	poor	straight	retouched
3247	24S 11E	base & tip missing	Prairie Side-Notched	silicified peat	-	lenticular	-	fair	-	-
1876	25S 16E	complete	Prairie Side-Notched	ht SRC	convex/concave	lenticular	asym.	fair	straight	retouched/thinned
3741	24S 14E	tip missing	Prairie Side-Notched	silicified peat	bi-planar	bi-planar	slightly asym.	poor	straight	retouched/thinned
1630	25S 15E	tip missing	Prairie Side-Notched	porcellanite	bi-convex	bi-convex	slightly asym.	poor	straight	thinned
279	24S 19E	left corner missing	Prairie Side-Notched	ht SRC	bi-convex	lenticular	slightly asym.	fair	convex	thinned/ground
2420	25S 18E	tip & left corner missing	Prairie Side-Notched	chert pebble	bi-convex	bi-convex	asym.	poor	convex	retouched/ground
2704	25S 19E	left corner missing	Prairie Side-Notched	Knife River Flint	bi-convex	lenticular	asym.	good	convex	thinned/retouched
1405	25S 14E	tip & left corner missing	Prairie Side-Notched	silicified peat	convex/concave	bi-convex	asym.	poor	convex	retouched

Level C2 Projectile Point Non-Metric Data

Cat.#	Unit	Completeness	Cultural Affiliation	Material	Longitudinal Cross-Section	Transverse Cross-Section	General Symmetry	General Quality	Basal Edge Shape	Basal Edge Mod.
2421	25S 18E	tip missing	Prairie Side-Notched	silicified peat	bi-convex	lenticular	slightly asym.	poor	convex	retouched/thinned
45	24S 18E	complete	Prairie Side-Notched	porcellanite	bi-convex	lenticular	slightly asym.	fair	convex	retouched
1045	25S 12E	complete	Prairie Side-Notched	chert	bi-convex	lenticular	slightly asym.	fair	concave	retouched
4762	24S 15E	base only	Prairie Side-Notched	Knife River flint	-	bi-convex	-	-	convex	retouched
392	24S 20E	blade fragment	unknown	chert	bi-convex	bi-convex	-	poor	-	-
2089	25S 17E	blade fragment	unknown	chert pebble	-	irregular	-	-	-	-
2422	25S 18E	tip	unknown	ht SRC	-	bi-convex	-	-	-	-

Level C3 Metric Analysis of Formed Tools Unifaces

Cat. #	Weight	Primary Working Edge (mm)	Secondary Working Edge (mm)	Maximum Length (mm)	Maximum Width (mm)	Maximum Thickness (mm)
155	6.9	29.4	-	32.0	27.5	7.6
1486	1.4	16.3	21.2	23.5	17.6	2.5
3656	27.5	39.7	-	43.2	39.4	13.9
726	3.8	16.9	-	24.7	17.9	6.9
2780	2.5	12.4	-	23.8	13.7	6.9
2560	2.6	15.6	-	14.7	15.4	4.9
721	1.6	15.5	-	20.3	16.1	4.7
3671	2.9	-	-	19.6	19.9	7.0

Level C3 Non-metric Analysis of Formed Tools Unifaces

Cat.#	Unit	Material	Tool Type	Shape	Primary Working Edge (location)	Secondary Working Edge (location)	Long-itudinal Cross-section	Trans-Verse Cross-Section
155	24S 18E	quartzite	retouched flake	triangular	lateral	-	planar-convex	bi-convex
1486	25S 14E	CPL	retouched flake	rectangular	distal	lateral	concave-planar	planar-convex
3656	23S 14E	quartzite	uniface	circular	distal	-	bi-planar	bi-planar
726	25S 11E	KRF	end scraper	rectangular	distal	-	planar-convex	planar-convex
2780	25S 19E	CPL	end scraper	oviod	distal	-	planar-convex	planar-convex
2560	25S 18E	white chert	end scraper	polygonal	distal	-	planar-convex	planar-convex
721	25S 11E	porcellanite	end scraper	teardrop	distal	-	planar-convex	planar-convex
3671	23S 14E	SRC	end scraper	polygonal	distal	-	planar-convex	planar-convex

Level C3 Metric Analysis of Formed Tools Bifaces

Cat. #	Weight	Primary Working Edge (mm)	Secondary Working Edge (mm)	Maximum Length (mm)	Maximum Width (mm)	Maximum Thickness (mm)
3389	0.5	13.1	13.3	12.6	14.7	4.0
2232	12.7	48.3	47.7	50.1	26.8	8.4
4615	6.9	38.0	-	40.9	16.7	8.3
1683	4.9	34.9	34.9	33.7	21.7	7.4
4623	30.3	54.3	44.2	48.0	47.2	14.5
4443	1.4	18.9	17.7	16.9	16.8	5.8
472	2.6	23.4	23.8	22.5	17.4	5.7
127	8.5	26.8	29.4	27.2	31.5	8.3
5525	1.6	12.2	-	22.9	15.0	4.2

Level C3 Non-metric Analysis of Formed Tools Bifaces

Cat.#	**Unit**	**Material**	**Tool Type**	**Shape**	**Primary Working Edge (location)**	**Secondary Working Edge (location)**	**Long-itudinal Cross-section**	**Trans-Verse Cross-Section**
3389	24S 11E	chalcedony	biface	triangular	lateral	lateral	-	planar-convex
2232	25S 17E	quartzite	biface	ovoid	lateral	lateral	bi-convex	bi-convex
4615	23S 19E	ht SRC	biface	-	-	-	-	-
1683	25S 15E	ht SRC	biface	triangular	lateral	lateral	-	lenticular
4623	23S 19E	SRC	biface	ovoid	lateral	lateral	irregular	planar-convex
4443	23S 17E	quartzite	biface	triangular	lateral	lateral	-	bi-convex
472	24S 20E	silicified peat	biface	triangular	lateral	lateral	-	bi-planar
127	24S 18E	ht SRC	biface	ovoid	distal	lateral	-	planar-convex
5525	25S 15E	chert	retouched flake	irregular	lateral	-	planar-irregular	planar-irregular

Level C3 Projectile Point Metric Data

Cat.#	Max. Length (mm)	Max Width (mm)	Max Thick (mm)	Body Length (mm)	Base Width (mm)	Base Height Left (mm)	Base Height Right (mm)	Basal Indent (mm)	Notch Depth Left (mm)	Notch Depth Right (mm)	Notch Width Left (mm)	Notch Width Right (mm)	Neck (mm)	Weight
3661	33.3	17.9	5.9	25.8	16.0	6.7	6.3	3.0	-	-	-	-	15.1	3.7
1251	30.6	19.4	8.1	21.9	17.4	7.8	8.4	2.6	-	-	-	-	15.8	5.2
2566	27.8	16.1	6.4	21.4	15.2	5.8	6.8	2.5	-	-	-	-	14.3	3.0
4801	23.2	15.3	4.8	19.2	15.1	4.3	4.5	1.7	-	-	-	-	14.9	2.2
4785	27.4	17.1	6.3	21.3	17.1	5.7	5.3	3.5	-	-	-	-	16.2	2.9
4950	28.7	16.4	5.16	22.2	14.2	4.7	4.3	2.4	-	-	-	-	14.3	2.4
1688	26.6	19.6	4.7	17.4	14.5	8.1	8.8	0.7	-	-	-	-	14.1	2.8
5875	27.7	16.7	6.2	27.7	-	-	-	-	-	-	-	-	-	2.7
4835	26.9	16.0	5.8	19.4	-	6.4	-	-	-	-	-	-	-	2.1
4274	32.9	20.8	5.5	27.9	20.1	-	-	4.9	-	-	-	-	-	5.4
117	29.8	19.6	8.3	23.3	16.8	5.1	6.1	2.6	-	-	-	-	17.0	3.5
134	24.7	15.1	4.8	24.7	-	-	-	-	-	-	-	-	-	1.9
1979	17.5	20.1	6.1	17.5	-	-	-	-	-	-	-	-	-	2.3
2605	23.0	11.4	5.6	23.0	-	-	-	-	-	-	-	-	-	1.7
3476	30.9	23.5	7.7	30.9	-	-	-	-	-	-	-	-	-	6.1

Level C3 Projectile Point Non-Metric Data

Cat.#	Unit	Completeness	Cultural Affiliation	Material	Longitudinal Cross-Section	Transverse Cross-Section	General Symmetry	General Quality	Basal Edge Shape	Basal Edge Mod.
3661	27S 14E	complete	Duncan	SRC	bi-convex	lenticular	asym	fair	convex	thinned
1251	25S 13E	tip missing	Duncan	ht SRC	bi-convex	bi-convex	asym	poor	convex	thinned
2566	25S 18E	complete	Duncan	ht SRC	bi-convex	bi-convex	asym	poor	convex	thinned
4801	24S 15E	complete	Duncan	grey chert	bi-convex	lenticular	sym.	fair	slightly convex	-
4785	24S 15E	complete	Duncan	ht SRC	bi-convex	lenticular	sym.	fair	convex	thinned
1688	25S 15E	tip missing	Duncan	silicified peat	bi-planar	slightly bi-convex	sym.	fair	straight	thinned
4950	23S 18E	complete	Duncan	SRC	bi-convex	lenticular	asym	poor	-	-
5875	23S 16E	portion of the blade	Duncan	ht SRC	-	lenticular	-	fair	-	-
4835	24S 15E	tip broken, basal corner missing	Duncan	ht SRC	bi-convex	lenticular	-	fair	-	-
1688	25S 15E	tip missing	Duncan	silicified peat	bi-planar	bi-planar	asym.	poor	-	-
4274	24S 16E	complete	McKean	quartz	bi-convex	bi-convex	sym	good	convex	thinned
117	24S 18E	tip missing	McKean	quartzite	-	bi-convex	sym.	fair	convex	thinned
134	24S 18E	blade fragment	unknown	ht SRC	-	lenticular	-	good	-	-
1979	25S 16E	blade fragment	unknown	ht SRC	-	lenticular	-	fair	-	-
2605	25S 18E	lateral half	unknown	ht SRC	irregular	-	-	poor	-	-
3476	24S 12E	blade portion	unknown	quartz	-	bi-convex	-	fair	-	-

Level C4 Metric Analysis of Formed Tools

Cat. #	Weight	Primary Working Edge (mm)	Secondary Working Edge (mm)	Maximum Length (mm)	Maximum Width (mm)	Maximum Thickness (mm)
842	1.5	16.7	17.1	18.1	17.9	4.2
1133	1.5	15.5	-	21.1	15.5	4.8
1538	283.8	53.5	-	112.1	67.4	32.9
1786	2.7	19.3	-	22.7	19.4	6.2
1738	6.6	27.4	-	30.2	23.3	7.7
3671	2.9	-	-	20.5	19.8	692

Level C4 Non-Metric Analysis of Formed Tools

Cat.#	Unit	Material	Tool Type	Shape	Primary Working Edge (location)	Secondary Working Edge (location)	Long-itudinal Cross-section	Trans-Verse Cross-Section
842	25S 11E	ht SRC	biface	teardrop	distal	lateral	-	lenticular
1133	25S 12E	KRF	end scraper	teardrop	distal	-	planar-convex	planar-convex
1538	25S 14E	quartzite	uniface	polygonal	distal	-	bi-convex	irregular
1786	25S 15E	white chert	end scraper	teardrop	distal	-	planar-convex	planar-convex
1738	25S 15E	quartzite	retouched flake	rectangular	lateral	-	planar-irregular	planar-convex
3671	23S 14E	SRC	end scraper	polygonal	distal	-	-	planar-convex

Level C4 Projectile Point Metric Data

Cat.#	Unit	Completeness	Cultural Affiliation	Material	Longitudinal Cross-Section	Transverse Cross-Section	General Symmetry	General Quality	Basal Edge Shape	Basal Edge Mod.
4802	24S 15E	complete	Oxbow	basalt	biconvex	biconvex	poor	poor	concave	thinned
3791	24S 14E	complete	Oxbow	SRC	biconvex	biconvex	fair	fair	concave	thinned

Level C4 Projectile Point Non-Metric Data

Cat.#	Max. Length (mm)	Max Width (mm)	Max Thick (mm)	Body Length (mm)	Base Width (mm)	Base Height Left (mm)	Base Height Right (mm)	Basal Indent (mm)	Notch Depth Left (mm)	Notch Depth Right (mm)	Notch Width Left (mm)	Notch Width Right (mm)	Neck (mm)	Weight
4802	26.6	19.1	4.4	19.6	18.8	6.3	6.3	3.7	1.9	2.4	4.7	3.6	15.4	2.1
3791	23.8	18.0	4.6	16.6	18.0	5.8	6.5	3.8	1.4	2.1	4.6	5.3	15.0	1.8

Appendix C: Faunal Analysis

Level C1 *Bison bison* Element Quantification Table

B. bison	**C1 MNE**					
Element	Axial	Right	Left	Indeterminate	NISP	MNI
Skull, mandible					1	1
Skull, petrous		1			4	1
Incisor		1		1	2	1
M^2					1	1
M^1					1	1
P^2		2			2	2
P^1			2		2	2
Vertebrae, thoracic (13)					1	1
Radius/Ulna					6	2
Metacarpal		1			1	1
2nd/3rd Carpal		1			1	1
Ulnar Carpal		1			1	1
Internal Carpal			1		1	1
Pisiform			1		1	1
Accessory Carpal				1	1	1
Femur					4	1
Tibia					2	1
Lateral Malleolus		2	1		3	2
Metatarsal					3	2
2nd/3rd Tarsal			1		1	1
Central/4th Tarsal		1			1	1
Sesamoid				12	12	2
1st Phalanx (8)				2	2	1
2nd Phalanx (8)				5	7	1
3rd Phalanx (8)				3	4	1
Unidentified Metapodial					1	1

Level C2 *Bison bison* Element Quantification

B. bison	**C2**	**MNE**				
Element	Axial	Right	Left	Indeterminate	NISP	MNI
Skull, zygomatic					2	1
Skull, premaxilla					1	1
Maxilla					2	1
Dentary					5	1
Skull, petrous		1	1		11	1
Horn Core				1	1	1
Incisor		6	2	1	12	2
Upper premolar				1	6	1
M^1		1	1	1	3	1
M^2		1			1	2
P^1					1	1
P^2					1	1
M_2		1			1	1
M_3			1		4	1
P_1					1	1
P_2					1	1
Vert. Thoracic					3	1
Vert. Lumbar					3	1
Vert. Caudal					0	1
Indeterminate Vertebrae					3	1
Innominate					5	1
Hyoid				1	1	1
Ribs					10	1
Scapula					3	1
Humerus					4	1
Radius/Ulna					5	1
Radial Carpal			1		1	1
Ulnar Carpal		2			2	2
Unciform		1	2		3	2
2nd/3rd Carpal		1			1	
Accessory Carpal		1			1	1
Internal Carpal		1			3	1
Femur					7	1
Tibia					12	1
Lat. Malleolus		1	l		2	1
Metatarsal					3	1

Calcaneous			l		6	1
2nd/3rd Tarsal		3	2		5	3
C/4th Tarsal		1			1	1
Sesamoid				5	5	1
Metapodial					3	1
Phalanx				1	3	1
1st Phalanx (8)				4	11	1
2nd Phalanx (8)				8	13	2
3rd Phalanx (8)					4	1

Level C3 *Bison bison* Element Quantification

B. bison	**C3 MNE**					
Element	Axial	Right	Left	Indeterminate	NISP	MNI
Skull, zygomatic					4	1
Skull, maxilla					3	1
Skull, mandible					8	1
Skull, petrous					17	1
M_3		1			1	1
M^3			1		1	1
P_1			1		1	1
Molars					11	1
Premolars				2	8	1
Incisors				3	11	1
Vertebrae, cervical (7)					2	1
Vertebrae, thoracic (13)					8	1
Vertebrae, caudal	1				1	1
Vertebrae unknown					3	1
Ribs					20	1
Hyoid		1			1	1
Scapula					12	1
Humerus					5	1
Radius/Ulna		1			19	1
Metacarpal			2		19	2
2nd/3rd Carpal		4	4		9	4
Radial Carpal		2	2		4	2
Accessory Carpal		2		2	4	2
Ulnar Carpal		6	1		7	6
Unciform Carpal		4	4		9	4
Pisoform				1	1	1

Internal Carpal		4	6		10	6
Innominate					18	1
Femur					9	1
Tibia					19	1
Lateral Malleolus		3	2		8	3
Metatarsal			1		10	1
Calcaneous			4		19	4
Talus		3	10		17	10
1st Tarsal		1			1	1
2nd/3rd Tarsal		4	5		12	5
Central/4th Tarsal		2	4		8	4
Sesamoid				7	7	1
1st Phalanx (8)				19	24	3
2nd Phalanx (8)				14	23	1
3rd Phalanx (8)				9	19	1
Metapodial					12	1

Level C4 *Bison bison* Element Quantification

B. bison	**C4 MNE**					
Element	Axial	Right	Left	Indeterminate	NISP	MNI
Upper M^3			1		1	1
Lower M_3		1			1	1
Lower M_2		1			1	1
Incisors				1	1	1
Petrous Temporal					2	1
Vertebrae, cervical (7)	1				2	1
Vertebrae, thoracic (13)					5	1
Vertebrae, lumbar (6)					1	1
Ribs					5	1
Scapula					1	1
Radius					2	1
Ulna					1	1
Metacarpal					4	1
2nd/3rd Carpal		1	1		2	1
Radial Carpal			1		1	1
Accessory Carpal				1	1	1
Ulnar Carpal			2		2	2
Unciform Carpal		1	1		2	1
Internal Carpal		1	1		2	1
Ischium					1	1
Femur					4	1
Tibia					4	1
Metatarsal					6	1
Lateral Malleolus		1			1	1
Talus		1	1		3	1
Calcaneus					3	1
2nd/3rd Tarsal		3	1		4	3
Central/4th Tarsal		4	2		6	4
Sesamoid				4	4	1
1st Phalanx (8)				7	11	1
2nd Phalanx (8)				8	9	1
3rd Phalanx (8)				3	4	1

Level 5 *Bison bison* Element Quantification

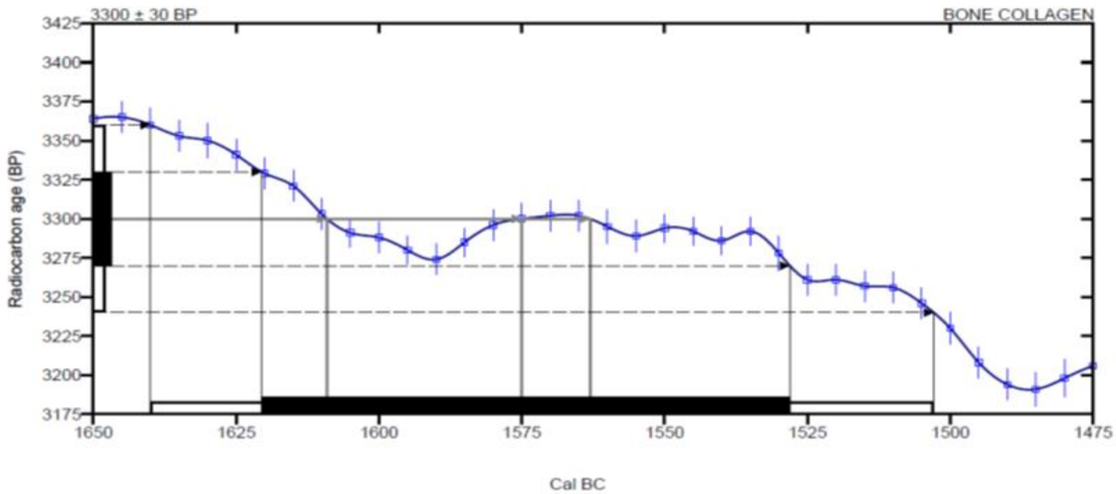
B. bison	**Level 5 MNE**					
Element	Axial	Right	Left	Indeterminate	NISP	MNI
Premolar P^2			1		1	1
Unciform Carpal		1			1	1
Calcaneous		2			2	2
1st Phalanx (8)			2		2	1
2nd Phalanx (8)			1		1	1
3rd Phalanx (8)			1		1	1

Appendix D: Radiocarbon Dating

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -19.1 o/oo : lab. mult = 1)

Laboratory number	**Beta-414921**
Conventional radiocarbon age	**3300 ± 30 BP**
Calibrated Result (95% Probability)	**Cal BC 1640 to 1505 (Cal BP 3590 to 3455)**
Intercept of radiocarbon age with calibration curve	Cal BC 1610 (Cal BP 3560) Cal BC 1575 (Cal BP 3525) Cal BC 1565 (Cal BP 3515)
Calibrated Result (68% Probability)	Cal BC 1620 to 1530 (Cal BP 3570 to 3480)



Database used
INTCAL13

References
Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
References to INTCAL13 database
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0– 50,000 years cal BP. Radiocarbon 55(4):1869– 1887., 2013.

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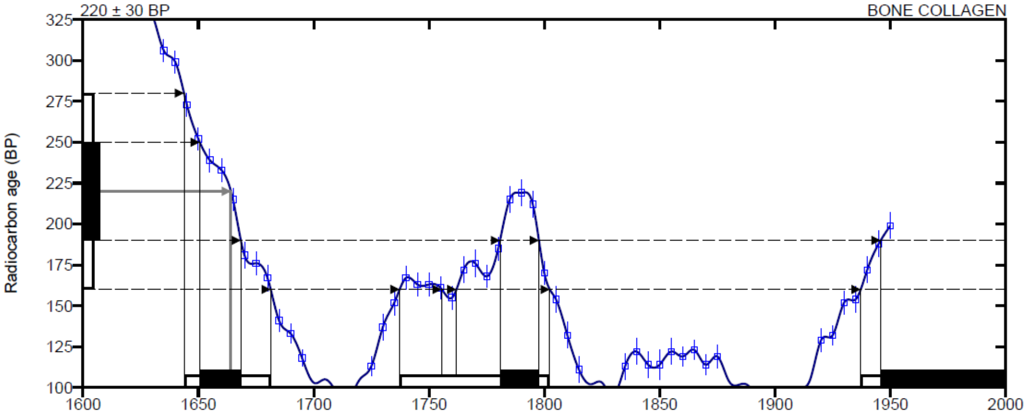
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -20.8 o/oo : lab. mult = 1)

Laboratory number	**Beta-414920**
Conventional radiocarbon age	**220 ± 30 BP**
Calibrated Result (95% Probability)	**Cal AD 1645 to 1680 (Cal BP 305 to 270)** **Cal AD 1735 to 1800 (Cal BP 215 to 150)** **Cal AD 1935 to Post 1950 (Cal BP 15 to Post 0)**
Intercept of radiocarbon age with calibration curve	Cal AD 1665 (Cal BP 285)
Calibrated Result (68% Probability)	Cal AD 1650 to 1670 (Cal BP 300 to 280) Cal AD 1780 to 1800 (Cal BP 170 to 150) Cal AD 1945 to Post 1950 (Cal BP 5 to Post 0)



Database used
INTCAL13

References
Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
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