McKean Lithic Resource Utilization at the Wolf Willow and Dog Child sites, Wanuskewin Heritage Park: A New Look at Saskatchewan Raw Materials.

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By

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ABSTRACT

The scientific importance of Wanuskewin Heritage Park lies in the number and diversity of archaeological sites present in a single area. Wolf Willow and Dog Child are multicomponent occupation sites located in the Opimihaw Valley and both contain McKean components. McKean Complex sites are relatively uncommon on the Northern Plains which makes the cluster at Wanuskewin Heritage Park important. McKean lithic materials are mainly locally produced with very few exotics. Materials from McKean assemblages have a heavy reliance on local lithic materials such as chert and quartzite. McKean levels at the Thundercloud, Cut Arm, and Red Tail sites, all located in Wanuskewin Heritage Park, are consistent with this pattern of lithic resource utilization.

The presence of exotic lithic materials can allude to territory, trade networks spanning vast amounts of land, or even show preference for an exotic material over locally available tool stone. This thesis will allow Wolf Willow and Dog Child to be understood in the broader context of McKean sites on the Northern Plains. Secondarily, Eldon Johnson's 1998 "Properties and Sources of Some Saskatchewan Lithic Materials of Archaeological Significance", a popular and highly utilized thesis, is updated here with new information concerning raw materials found in Wanuskewin Heritage Park.

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Chapter 1

Introduction

1.1.Introduction

Wanuskewin Heritage Park (WHP) is a National Historic Site located near Saskatoon, in south-central Saskatchewan, Canada. This locale is of high scientific importance due to the number and diversity of archaeological sites present in a single area. A cluster of sites dating to the McKean Complex were found in WHP including Cultural Level 3 at the Wolf Willow site (FbNp-26) and Cultural Level 2a at the Dog Child site (FbNp-24). Geoarchaeological and material culture studies have been completed on the Dog Child site (Cyr 2006; Pletz 2010), and work is currently underway for the Wolf Willow site. In this thesis, an updated lithic analysis for the Dog Child site and a new analysis for the Wolf Willow site has been completed for the McKean levels. Past research in WHP has shown that the McKean Complex exhibits a locally adapted subsistence strategy and the associated lithic assemblages are characterized by local materials with very few non-local (exotic) lithics. McKean levels at the Dog Child, Thundercloud, Cut Arm, Meewasin, and Red Tail sites all located in WHP provide evidence for a heavy reliance on local lithics such as Swan River Chert, quartzite, and miscellaneous chert (Cyr 2006; Mack 2000; Peck 2011; Pletz 2010; Webster 2004).

1.2 Research Objectives

The majority of the McKean lithics from the Wolf Willow site, presumably fitting within the McKean lithic utilization pattern, should be made from local materials with little dependence on trade for exotic (at least 400km away from site) materials. The amount of exotic material imported to the Wolf Willow site will be explored to see whether it is a lower or higher percentage than the Dog Child site in Saskatchewan and the Cactus Flower site (EgOn-3) in Alberta. This will make it possible to show an increase or decrease in trade relations or access to new material. The presence of exotic lithic materials can reveal possible restrictions in territory, trade networks, or even show preference for an exotic material over locally available tool stone. This will allow the Wolf Willow site to be understood in the broader context of McKean Sites on the Northern Plains.

A complete lithic and faunal analysis of the Dog Child site was completed by Talina Cyr in 2006 and later supplemented by research by Jody Pletz (2010). This thesis will update the lithic analysis portion for the Dog Child site and complete the analysis for the Wolf Willow site in order to use more recent geological and archaeological terminology. The latter half of this thesis will address Eldon Johnson's (1998) "Properties and Sources of Some Saskatchewan Lithic Materials of Archaeological Significance", a popular and highly utilized source for southern Saskatchewan tools stone sources and identification. Johnson's material types, photographs, and terminology will be updated with new information concerning raw materials found in WHP.

1.3 Organization of Thesis

Chapter 2 will describe the biophysical environment and site history of WHP that includes the Wolf Willow and Dog Child sites. This includes climate, sedimentology, floral environment, and faunal resources. Chapter 3 will include the cultural chronology of the site area including Early Precontact (12000-7500 B.P) to Late Precontact Period (2000-300 B.P). Methodology will be included in Chapter 4 with a focus on raw material and statistical analyses that are typically employed in lithic analysis. An introduction, summary of excavation seasons, statistical analysis, and general summary for the Wolf Willow site will be completed in Chapter 5. Similarly, the analysis for the Dog Child site will be discussed in Chapter 6. In Chapter 7, a comparative analysis with the Cactus Flower site in southeastern Alberta, Canada and a summary of the McKean Complex will be completed. In Chapter 8, Eldon Johnson's research will be described and updated with current photographs, and lithic descriptive notations. Common issues in terminology, misconceptions, and conclusions about McKean lithic materials will also be addressed in Chapter 8. Summaries, conclusions, and future directions for the thesis will discussed in Chapter 9.

Chapter 2

Site History and Biophysical Environment

2.1 Site History

Located two kilometers north of Saskatoon, Saskatchewan, Canada, the Opimihaw Creek valley is an area rich of biological diversity, archaeological importance, and geological complexity (Figure 2.1). The area was used intensively by human populations over the past six thousand years and was occupied until the signing of Treaty 6 in 1876 (Walker and Smith 2012).

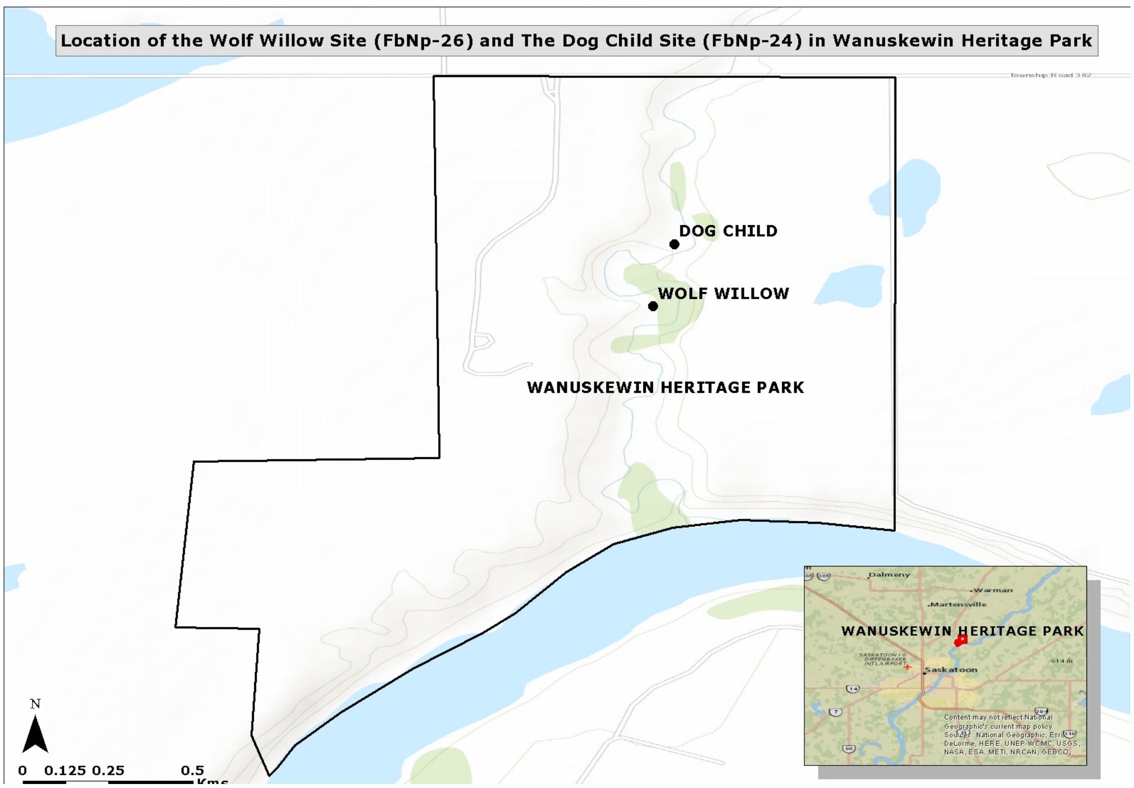


Figure 2.1 Location of Wanuskewin Heritage Park

Initial visits oriented towards archaeological discoveries to the area began in 1932 by members of the future Saskatoon Archaeological Society which was formed in 1935. In 1978, Raymond Moriyama, an architect from Toronto, visited the valley as part of his mandate to design a 100 Year Conceptual Master Plan for the newly established Meewasin Valley Authority (MVA), an agency that is dedicated to the protection and preservation of the Saskatoon portion of the South Saskatchewan River valley through compatible development and public education (Walker 1988; 2012).

Two historical sites and 19 pre-contact sites were discovered by Dr. Ernest G. Walker in 1982 and 1983 during an archaeological survey of the area (Walker 1988; Walker and Smith 2012). It was also in 1983 that a plan designed to provide detailed information about the Precontact occupation of the area was created. The development of WHP received media attention due to the participation of the Saskatchewan First Nations communities which overall made the project unique. In 1983, WHP was designated as a Provincial Heritage Property and in 1987 the park was designated as a National Historic Site by the federal government.

Under the direction of Dr. Ernest G. Walker from the Department of Archaeology and Anthropology, the University of Saskatchewan has had a continuous presence at WHP. This is due to the archaeological importance of WHP and the quantity and diversity of archaeological sites present in a single location. Of the nineteen sites located within the park boundaries, nine of these sites have been excavated. Many of these excavated sites are multicomponent and span both the Middle and Late Precontact periods (Walker 1988).

Wolf Willow (FbNp-26) is a multicomponent occupation site located on a point bar on the west side of Opimihaw Creek. Excavations at the site began in 2010 and are still in progress. The archaeological material that has been excavated in the last two years has provided information concerning paleoenvironments as well as six cultural levels ranging from Historic to Precontact Oxbow occupations. Wolf Willow has been be categorized as a habitation site with a potential association with a small bison trap situated in a long swale to the south of the site (Walker 2012).

The Dog Child site is located on a terrace on the west bank of the Opimihaw Creek, 750m from the South Saskatchewan River (Refer to Figure 2.1). The creek can be accessed from the site by the gradual slope of the bank. An incline that provides shelters from the wind is present west of the site.

2.2. Geography of the Wanuskewin Heritage Park

WHP is located at 52°13' 26''N latitude and 106°35'46''. W longitude in the SW 14 Section 36, SE 14 Section 35, township 36, Range 5, West of the Third Meridian, and lies approximately 500m above sea level (Mack 2000). The Park currently comprises over 63 hectares of land 3km north of the city of Saskatoon. WHP is located in the Moist Mixed Grassland ecoregion (Figure 2.2), which is south of the Aspen Parkland (Mack 2000).

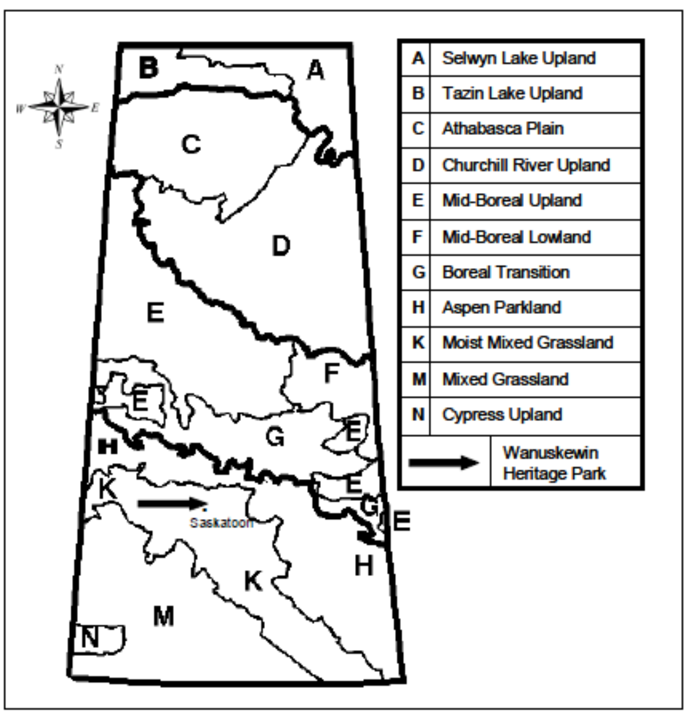


Figure 2.2 Wanuskewin Heritage Park, adapted from Cyr 2006

The Moist Mixed Grassland zone is characterized by open native grasslands and is commonly disconnected by slough depressions that harbour aspen groves (Amundsen 1986; Mack 2000). WHP is found in the South Saskatchewan River valley, the physiographic classification of the park is the Saskatchewan Rivers Plain region (Martz and de Boer 1999). Ground moraines and glacial lake plains characterize this area with hummocky and glacial outwash channels having contoured the surface (Amundsen 1986).

WHP is in the Warman Plain physiographic subsection and the topography in the plain is described as having "undulating, eroded till plains and gravelly, glaciolacustrine plains" (Walker 1988:77). The large numbers of sites found in this area is because of the location and terrain of Opimihaw valley. The steep valley walls are also attractive because of their suitability for bison procurement. The ravines and coulees along the river valley are optimal locations for settlement due to their proximity to a permanent and stable water source (South Saskatchewan River) while also providing shelter in a harsh environment.

2.3 Geophysical setting of the Wolf Willow and Dog Child sites.

Christiansen (1968) and Skwara (1988) suggest that there have been at least four past glaciation events that have occurred in the Saskatoon area before 12,000 B.P. Approximately 17,000 years ago, all of Saskatchewan except for the Cypress Hills area was entirely covered in glacial ice. At 12,000 years ago, the Saskatoon region was either covered by ice or submerged beneath the meltwaters of Glacial Lake Saskatoon (or Saskatchewan) (Skwara 1988). Around 11,000 years ago, the meltwaters of Glacial Lake Saskatoon merged with Glacial Lake Agassiz and to the southeast, the Saskatchewan River delta began to form. Eventually the water level dropped and drainage became channelized. Approximately 11,500 years ago, the formation of the modern Southern Saskatchewan River began and was later stabilized during the Holocene (Skwara 1988).

During this period of glaciation, sediment was deposited and shifted which drastically altered the topography. In the process of soil formation, the parent material was created from these deposited sediments though glaciofluvial and glaciolacustrine processes altering the sediment's original form and placement. Sediments found within braided streams tend to be coarse gravels mixed with a variety of silt and sand (Waters 1992). Primarily, alluvial processes have sculpted the landforms found in the Opimihaw Valley. Frequent flooding and alternating periods of stream channel aggradation and degradation can cause terracing (Waters 1992). This process has occurred within WHP. Older terraces are optimal habitation sites due to the proximity to a water source, shelter, and level of stability. The Wolf Willow site is situated on an older alluvial terrace. Evidence confirming this terracing is alternating layers of sand, clay, sorted gravel and debris (E.G Walker personal communication 2013).

2.4 Sedimentology of the Saskatoon Region

A matrix consisting of coarse gravels alludes to the glacial past of the Opimihaw Valley. A large percentage of this matrix creates the parent material of the valley slopes. Glacial deposits are primarily cobbles, pebbles, and sand. More recent post-glacial sediments, however, are fine-grained sands and silts (Christiansen 1970) that have primarily been deposited due to fluvial, colluvial, and aeolian processes. Sediments in Saskatoon represent two deposits which are glacial and interglacial. Glacial deposits were laid down directly or indirectly by ice during glacial periods. Interglacial deposits were laid down during interglacial periods when the great ice sheets melted away (Skwara 1988). Tills are sediments that are characterized by a wide range in grain size (from clay to gigantic boulders) and the absence of any obvious arrangements of the constituent particles (Acton and Ellis 1978; Skwara 1988; Waters 1992). During interglacial periods, sediments were moved by water and are characterized by the sorting and layering of the particles according to size and weight.

There are two main groups representing Pleistocene stratigraphy of the region. The first is the Sutherland Group, which is comprised of older tills. The second group, which is named the Saskatoon Group, includes the Floral Formation and the Battleford Formation. The Floral Formation has four separate layers, the base of which is a layer of stratified sand which is overlain by till. The second layer of stratified sand is called the Riddell Member, which contains many fossils and extinct megafauna remains (Skwara 1988).

2.5 Sedimentology and Pedology of Wanuskewin Heritage Park

Excavations within WHP have revealed that periodic flooding has changed the valley in the past. However, archaeological deposits generally have been protected from surficial erosional processes. The current elevation difference between the Opimihaw Creek and the modern cultural surface is several meters. This has arisen as a result of deposits accumulating on the terrace as well as the creek eroding further into the valley floor. Aeolian forces also have contributed to deposition on the terraces. Rutherford's analysis of the formation of archaeological sites within the park suggests "hill slope sedimentation influenced the formation of these archaeological sites" (Rutherford 2004:96). The alluvial and colluvial activity is believed to have occurred during a time of increased temperatures and aridity during the terminal period of the Mid-Holocene Climatic Optimum. These processes continued until moisture levels had increased enough to support the development of soils and eventually the re-establishment of vegetation and the stabilization of the slopes (Rutherford 2004).

There are five factors that contribute to the processes of soil formation. These include climate, biotic factors, parent material, topography, and time (Acton and Ellis 1978). Human activity also affects soil formation with most agricultural activity resulting in ploughed horizons. Fortunately for WHP, agriculture has not seriously influenced the valley. The soils along the South Saskatchewan River valley are usually classified as hillwash, which has a profile of a combination of Regosolic, Podzolic, and Chernozemic soils that developed on colluvial and eroded deposits on the slopes of valleys (Acton and Ellis 1978). Hillwash soils can be visually seen along the slopes and terraces of the Opimihaw Creek valley. Chernozemic soils are dark brown, and in the upland prairie surrounding the valley, support thick grass cover. The standard soil texture is sandy to clayey loam and generally darker soil colour can indicate an accumulation of organic material within the strata.

2.6 Hydrology

The Opimihaw Creek valley was formed approximately 12,000 years ago following the retreat of Glacial Lake Saskatchewan to the north. Sedimentary analysis shows that a glaciofluvial channel existed parallel to the modern South Saskatchewan River. This paleo-channel is the reason why the upland (areas significantly higher than the level of the proximal water source) of the Opimihaw Valley is dominated by coarse gravels. In the spring there can be periods of increased precipitation as well as spring runoff. This can cause excess water in the area to flow toward the Opimihaw Valley which in turn forms the Opimihaw Creek. Opimihaw Creek is supported by groundwater which means in times of low or no precipitation, it continues to have some flow classifying it as a perennial stream. The primary source of water for the Opimihaw Creek is the Hudson Bay slough located northwest of the valley (Mack 2000).

2.7 Climate: Modern Temperatures, Precipitation, Wind, and Cloud Coverage

Based on palaeoenvironmental studies, environmental patterns of the Northern Plains have remained relatively constant throughout the past 2000 years in temperature and precipitation (Mack 2000; Walker 1999). In the prairies, the seasonal temperature can vary by approximately 90 degrees Celsius throughout the course of one year. In the Köppen-Geiger system, Saskatoon is classified as bordering two climate regimes (Strahler and Strahler 2002). The first of these is a semiarid climate that is characterized by a water deficit, where the average evaporation exceeds average precipitation on a year-to-year basis. These areas are usually grasslands and have relatively cold mean annual temperatures. The moist snowy-forest climate is the second regime bordering the Saskatoon area. This regime has warm summers and the absence of a dry season as precipitation levels are constant year-round. The Saskatoon area is characterized by long cold winters and short warm summers with July being the warmest month (Acton and Ellis 1978; Hare and Thomas 1974). During the coldest months, the temperature can reach -40 C with January and February as the coldest months and average temperatures vary from -10 C to -25 C (Acton and Ellis 1978; Hare and Thomas 1974).

The South Saskatchewan River Basin has the lowest level of annual precipitation within the prairies (Hare and Thomas 1974). This area has a mean annual precipitation of between 35cm and 40cm with around 100cm and 114cm of snow fall each year (Acton and Ellis 1978). The majority of the precipitation falls between May and September, representing 70% of the annual moisture regime which results in quite a low precipitation rate. Saskatoon is one of the sunniest regions in Canada (Hare and Thomas 1974) with the cloudiest months being May, June, November, and December (Maybank and Bersteinsson 1970). July and August are the months that receive the most sunshine which in turn contributes to the fact that they are the warmest months of the year.

2.8 Floral Environment

WHP is located in a transition zone between the moist mixed prairie and the fescue prairie. Situated on the northern edge of the mixed moist grassland eco-region, WHP can be split into three eco-zones, characterized by natural grassland, tree groves, and shrubs. WHP has remained relatively untouched by agriculture and urban development although other factors like fire and grazing pressure have affected it over time. The three eco-zones are referred to as the Upland Prairie zone, Valley Slope zone, and Floodplain zone. In all of these zones the vegetation is representative of moisture availability, topography and climate. Due to the biological diversity of the area, it is a haven for human populations seeking shelter and easy access to plentiful resources (Epp 1988).

2.8.1 Upland Prairie Zone

The Upland Prairie zone can be classified as areas that are significantly higher than the level of the proximal water source. Native species of grass cover the valley slopes including the dominant western porcupine grass and the co-dominant northern wheatgrass. The primary grasses and sedges associated with these two species are needle and thread (spear grass or *Stipa comata*), green needle grass (*Stipa viridula*), western wheat grass (*Agropyron smithii*), June grass (*Keoleria cristata*), thread leaved sedge (*Carex filifolia*) and rough fescue (*Festucata hallii*)

(Agriculture and Agri-food Canada 2008). Warm season grasses such as the little blue stem (*Andropogon scoparius*) are associated with the tall grass prairie and are commonly found in WHP. Blue grama (*Bouteloua gracilis*) is also found locally on exposed southern slopes and dry soils.

Pasture sage (*Artemisia frigida*) is the most abundant forb found in this zone. Moss phlox (*Phlox hoodia*) and dense club moss (*Selaginella densa*) are also present on drier sites but will be absent in the more favorable growing condition areas. Western snow berry (*symphoricarpos occidentalis*), low prairie rose (*Rosa arkasnana*), and wolf willow (*Elaeagnus commutate*) are present along the upland slopes of the Opimihaw Valley. Further downslope, where soils retain more moisture, grasses such as sweet grass (*Hierochloe odorata*) and tall manna grass (*Glyceria grandis*) thrive. Fruiting plants such as buffalo berry (*Shepherdia canadensis*), Saskatoon berry (*Amelanchier alnifolia*), chokecherry (*Prunus virginiana melanocarpa*), pin cherry (*Prunus pennsylvanica*) and wild red raspberry (*Rubus idaeus aculeatissimus*) are readily available and are valuable to human populations occupying the area (Agriculture and Agri-food Canada 2008; Budd et al 1987). Immature aspen poplar (*Populus termuloides*), hawthorn (*Crataegus sp.),* red-osier dogwood (*Cornus stolonifera*), and Beb's willow (*Salix bebbiana*) can also be found in the moister area of the upland zone.

WHP has not been effected by agriculture but grazing pressure and fire have modified the present plant community. Some invasive species have become prevalent on the site such as Kentucky Bluegrass (*Poa pratensis*), dandelions (*Taraxacum officinale*) Canada thistle (*Cirsium arvense*), smooth brome grass (*Bromus inermis*) and leafy spurge (*Euphorbia esula)* (Agriculture and Agri-Food Canada 2008).

2.8.2 Valley Slope Zone

The Valley Slope zone consists of the banks of the South Saskatchewan River valley as well as the Opimihaw Creek Valley. The flora within this zone is primarily composed of mature trees shrubs and herbs. The most common trees of the area are birch (*Betula sp.),* Manitoba maple (*Acer negundo*), and balsam poplar (*Populus balsamifera*) (Amundson 1986). Shrubs such as Western snow berry (*symphoricarpos occidentalis*), low Prairie rose (*Rosa arkasnana*), wolf willow (*Elaeagnus commutate),* Northern gooseberry (*Ribes oxyacanthoides*), willow (*Salix sp*.), and sedges (*Carix sp.)* are also present in this zone (Amundson 1986, Agriculture and Agri-Food Canada 2008). In the moist shady areas of the Valley Slope zone, herbs like wild rye (*Elymus canadensis*), Northern bedstraw (*Galium boreale*), early blue violet (*Viola adunca*), and horsetail (*Equisetum arvense*) are found in abundance (Budd et al 1987; Mack 2000). The Prairie crocus (*Anemone patens)* can be found on south facing slopes in the spring. If the slope is unstable the Upland Prairie zone vegetation is more likely to thrive.

2.8.3 Floodplain Zone

The floodplain zone is a region adjacent to water sources that is prone to flooding during snowmelt in the spring. Due to the amount of moisture present in this zone there is a lush collection of riparian flora such as rushes (*Scirpus sp*.), wild mint (*Mentha arvensis*), sedges (*Carex sp*.), cattail (*Typha latifolia*), wild barley (*Hordeum jubatum*), mustard (*Brassica sp.),* marsh marigold (*Caltha palustris*), water parsnip (*Sium sauve*), willow (*Salix sp.),* wolf willow (*Elaeagnus commutate)*, and a variety of other herbs and shrubs (Amundson 1986; Walker 1992). Trees prefer cooler, wetter environments so they are commonly found in the floodplain zone. At WHP, trees are represented by the balsam poplar (*Populus balsamifera*), paper birch (*Betula papyrifera),* and aspen poplar (*Populus tremuloides*) (Budd et al 1987).

2.9 Faunal Resources

The fauna of the Opimihaw valley is typical of the Canadian prairie grassland and parkland ecological zones. Evidence of these animals may or may not be represented in excavation data. Reasonably, there are species that can be expected to have inhabited Opimihaw Valley contemporaneously with human occupations in the last 6,000 years.

2.9.1 Mammals

The faunal record of the Opimihaw valley primarily consists of mammals. The fur trade industry in western Canada drastically influenced the animals that can be found in the area. Before the Fur Trade era the dominant large herbivore in the WHP region was the American Bison (*Bison bison)*. Before their near extinction, many bison would have inhabited the Great Plains (Roe 1970; McDonald 1981). Bison are currently absent from this area of their former range. Other herbivores include mule deer (*Odocoileus hemionus*), white-tailed deer (*Odocoileus virginianus),* elk (*Cervus elaphus*), moose (*Alce alces*), and pronghorn (*Antilocapra americana*). Elk and pronghorn used to be abundant within the area before the arrival of European settlers but do not occupy the area any more.

There are several carnivores that have been extirpated from the WHP region due to human influence. Wolves (*Canis lupus*), river otter (*Lontra canadensis*), grizzly bears (*Ursus arctos*), black bear (*Ursus americanus*), mountain lions (*Felis concolor*) and swift foxes (*Vulpes velox*), are rarely if ever seen in modern day contexts even though their presence in the past would have been of the norm. The most common carnivores still present within the park are the long-tailed weasel (*Mustela frenata*), the coyote (*Canis latrans*), American badger (*Taxidea taxus*), striped skunk (*Mephitis mephitis*) and in fewer numbers the red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), mink (*Mutela vision*), porcupine (*Erethizon dorsatum*) and the least weasel (*Mustela nivalis*) (Banfield 1974).

Several species of the Order Rodentia can be found in the Opimihaw valley. The Richardson's ground squirrel (*Spermophilus richarsonii*), muskrat (*Ondatra zibethicus*), American beaver (*Castor canadensis*), least chipmunk (*Eutamias minimus*), thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*), northern pocket gopher (*Thomomys talpoides*), deer mouse (*Peromyscus maniculatus*), Franklin's ground squirrel (*Spermophilus franklinii*), Gapper's red-backed vole (*Clethrionomys gapperi*), prairie vole (*Microtus ochrogaster*), meadow vole (*Microtus pennsylvanicus*), and the American porcupine (*Erethizon dorsatum*) (Banfield 1974). Ground squirrels and pocket gophers are perhaps the most obvious residents of WHP due to their burrowing activity. This behaviour can present problems for archaeologists because of the displacement of artefacts from their primary context and the mixing of soil strata. Archaeologists, however, can search the soil brought to the surface by burrowing for cultural material.

Two leporid species are most commonly present in WHP. These are the snowshoe hare (*Lepus americanus*) which prefers to inhabit the more forested sections of the park and the white-tailed jack rabbit (*Lepus townsendii*), which is found in the open, grassy sections. These lagomorph species are active year-round (Banfield 1974).

2.9.2 Avifauna

Many species of songbirds, birds of prey, corvids, and migratory waterfowl are commonly found in the Opimihaw Valley. Songbirds include red-winged black bird (*Agelaius phoeniceus*) and the western meadowlark (*Sturnella sp.)* while the black-billed magpie (*Pica pica*), and crow (*Corvus brachyrhynchos*) represent the corvids of the area. Migratory waterfowl species include the Canada goose (*Branta Canadensis*), the snow goose (*Chen caerulescens*), northern pintail duck (*Anas acuta*), blue-winged teal (*Anas discors*), mallard duck (*Anas platyrhynchos*), and great blue heron (*Ardea herodias*). Birds of prey include the red-tailed hawk (*Buteo jamaicensis*), ferruginous hawk (*Buteo regalis*), bald eagle (*Haliaeetus leuco*), golden eagle (*Aquila chrysaetos*), great horned owl (*Bubo virginianus*), and the great grey owl (*Strix nebulosa*) (Banfield 1974). The sharp-tailed grouse (*Tympanuchus phasianellus*) has also been seen in the valley.

2.9.3 Reptiles and Amphibians

The number of reptile and amphibian genera present in the park is minimal due to the environment of the Saskatoon region. The leopard frog (*Rana pipiens*), Canadian toad (*Bufo hemiophrys*), tiger salamander (*Ambystoma tigrinum*), and garter snake (*Thamnophis sp.)* are some of the species that survive here.

2.9.4 Fish

Presently, Opimihaw Creek has a very low rate of discharge which results in species that would have originally inhabited the waters of the creek now only found in the nearby South Saskatchewan River. These species include walleye (*Sander vitreus*), yellow perch (*Perca* *flavescens*), sauger (*Sander canadense*), northern pike (*Esox Lucius*), and lake sturgeon (*Acipenser fulvescens*) (Banfield 1974).

Chapter 3

An Overview of Northern Plains Prehistory

3.1 Introduction

Cultural chronology on the Northern Plains has been re-written throughout the past several decades. Malouf (1960), Mulloy (1958), Wormington and Forbis (1965), and Reeves (1983) all presented cultural frameworks and chronologies for the Northern Plains that did not account for archaeological evidence for a cultural hiatus during the dry Altithermal Period (Walker 1992). Dyck (1983) has issues with distinctions recognized for the same time period between 2000 years B.P and 7500 years B.P (Mack 2000). This also presents a problem with Frison's (1978) "Plains Archaic" in his cultural chronology. The term "Plains Archaic" a regionally variant term more appropriately used in Wyoming and the northern section of the United States may not be appropriate in south-central Saskatchewan because of the differences in subsistence patterns between the two regions (Walker 1992). This adaptive strategy is currently being re-evaluated (Walker, personal communication 2014). Reeves proposed a chronology that uses the terms Early I and Early II, which can be irrelevant when reviewing the literature. When terms are not consistent, the comparing and analyzing of data becomes difficult. Others (Mack 2000; Cyr 2006; Pletz 2010) who have also researched this time period in the region of south-central Saskatchewan feel a chronology with finer distinctions is needed. The chronology for this thesis will be based off of Walker (1992), and Mack (2000) in order to keep consistency.

3.2 Saskatchewan's Precontact Cultural Chronology

Walker's 1992 cultural sequence is the cultural chronology utilized for this thesis with the revision whereby Prehistoric is replaced by Precontact (Figure 3.1). The date range focused on in this thesis is 4200-3500 B.P which dates to the Middle Middle Prehistoric.

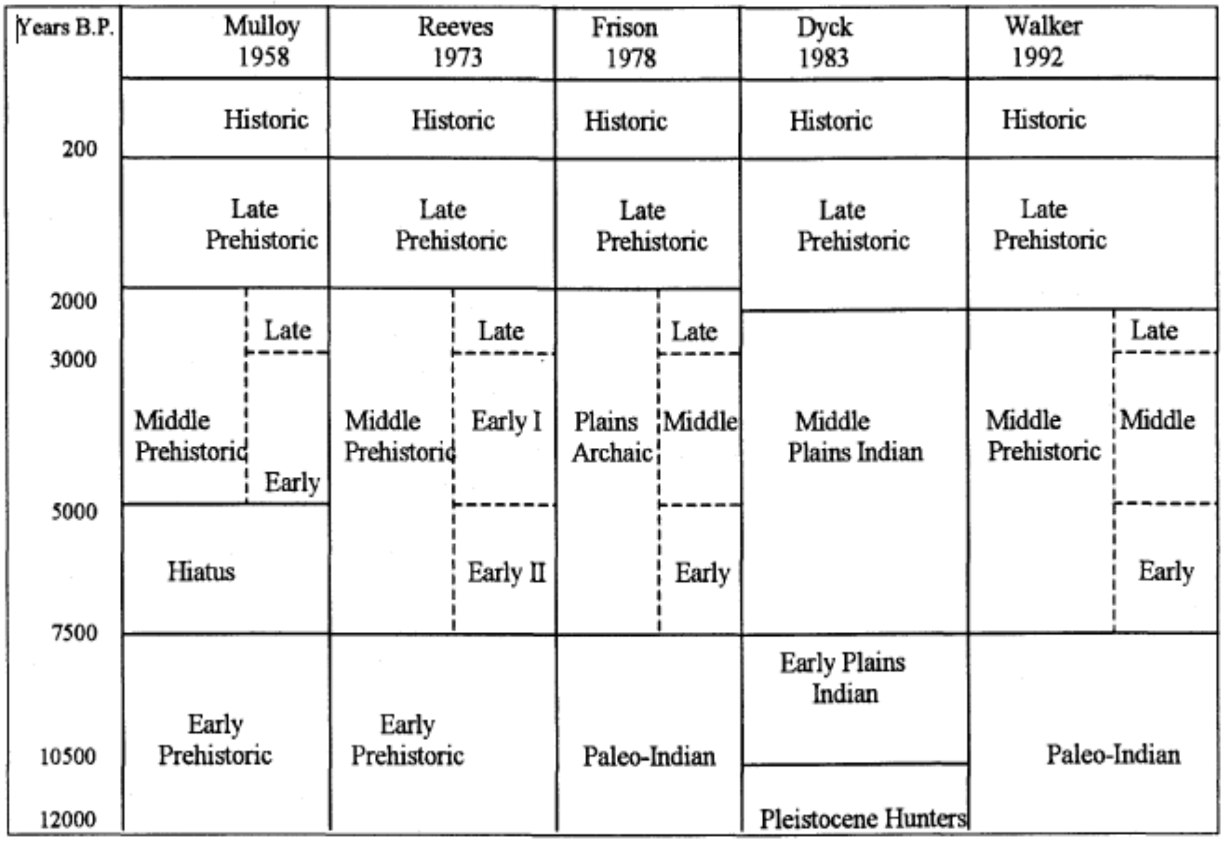


Figure 3.1 Walker's 1992 Cultural Chronology for the Northern Plains.

Terminology has been an issue when it comes to the use of cultural chronologies. Different authors have used different terms for separate cultural identities. The terms "Complex" and "Series", regarding the McKean Complex have been defined in the following ways:

A *complex* can be defined as a composite unit that consists of interconnected sites, artifacts, and features that are also connected by similar functions, technologies, styles, subsistence, and settlement patterns (Frary 2009:27; Trigger 2006:283; Willey and Phillips 1955: 724). Syms described a complex as the "total expression of a number of assemblages left for the same groups over a sufficiently narrow time period that cultural expressions undergo minor changes" (Syms 1977:70-71). An assemblage then, is defined as the materials, features, and evidence of activities from a single residential group over a short period at one site (Syms 1977: 70).

Dyck defined a complex as

> a large composite archaeological unit. It consists of interconnected sites, features, and artifacts, tied together by similarities in function, style, technology, and subsistence-settlement system. The parts of a complex are found within a common geographical distribution and within a common segment of time (Dyck 1983:69).

A complex shares the same geographical area during the same timeline. The McKean Complex occupies the northern half of the Great Plains. This includes the High Plains of Colorado and southeastern Wyoming, the middle Missouri area of the Dakotas, the northeastern periphery of the Dakotas, Manitoba, southeastern Saskatchewan, and the northwestern Plains of Alberta, Montana, and Wyoming (Reeves 1983:25).

A "series" has been defined as a higher level category that groups together similar temporal types (Thomas 1989:382). Dyck (1983:69) defined a series as

> A sequence of archaeological components sharing a common geographical space (sometimes within a single site, sometimes within a region), but belonging within separate segments of time. A series is a crude unit of archaeological analysis used for convenience before sites, features, and artifacts are ready for reclassification into complexes and traditions.

It is clear that both terminologies are correct when dealing with cultural identities based on the found material culture. In this thesis the term "complex" is used in order to maintain continuity between literature in Canada and the United States.

3.3 Early Precontact Period 12,000 to 7500 years B.P

Towards the end of the Pleistocene, major environmental changes in climate and vegetation occurred on the Northern Plains. These changes created alterations in ecology and hydrology which in turn altered the erosional depositional processes of the land and animal populations (Skwara 1988:30-31). This did not end the spread of Paleoindian cultures to the area, but instead, led to a natural deviation from the past environment. Paleoindian cultures have been important agents of disturbance and change.

The rapid warming climates in the Holocene created isolated valleys within which spruce and entirely different animal populations took hold between 8000-6000 B.P (Sherow 2007:13-14). People lived on the fringes of the grasslands and employed fire management practices to shape their surroundings (Sherow 2007:13-14). Paleoindian and Archaic lifestyles shifted between adaptation strategies, and climatic flux and the change in climate changed their technologies.

Paleoindian cultures are recognized in Sasaktchewan by surface collections. Clovis, Folsom, and Goshen projectile points have been discovered in Saskatchewan indicating that there was human occupation almost immediately as the ice sheets retreated. A conservative date of the initial occupation of Saskatchewan is 11,500 B.P (Frison 1991).

The Saskatchewan Paleoindian tool assemblage consists primarily of chipped stone tools. The most well known and noted in the area are the fluted spear points and knives of the Paleoindian complexes. One of the most popular raw material choices was Knife River Flint (KRF) from North Dakota, an exotic to Saskatchewan (Wright 1995). Surface collections and excavations also identify later Paleoindian cultures. Surface collections include the Parkhill site 6800-5800 B.P, a Saskatchewan Paleoindian site where 137 Agate Basin projectile points were identified (Ebell 1980:4). Another Saskatchewan late Paleoindian site is the McLeod site, which had a collection of 76 Cody Complex projectile points (Joyes 1997). The Heron Eden Bison Kill site, an excavated bison kill located near the Great Sand Hills of southwestern Saskatchewan dates to approximately 9000 B.P (Corbeil 1995).

3.4 Saskatchewan Early Middle Precontact Period 7500 to 5000 years B.P

The onset of the Altithermal coincides with the Early Middle Prehistoric Period. Due to this, the period is sparsely represented in the Saskatchewan archaeological record. The impact of the Altithermal or Mid-Holocene Climatic Optimum (which dated from 7500 to 4700 B.P) was a fluctuating and gradual increase in temperature and decrease in precipitation (Vance et al. 1995). The climate during the Altithermal was harsher, warmer, and drier than before. This has led several authors (Malouf 1960; Mulloy 1958; Wheeler 1958; Wormington and Forbis 1965) to hypothesize about an overall abandonment of the Northern Plains. More recent evidence suggests that complete abandonment was unlikely and that populations would have congregated near water sources.

The most common projectile point styles found in Saskatchewan dating to this period are Bitterroot and Gowen. The Gowen Sites I and II (Walker 1992) and the Norby site (Zurburg 1991) are Early Middle Prehistoric sites in the Saskatoon region. During this time period, there was an intensification of resource utilization. The Below Forks site located near the fork of the North Saskatchewan and the South Saskatchewan rivers also dates to the Early Middle Precontact period. Other sites include the Beaver Creek site, and the Amisk Site, both located in Central Saskatchewan.

There was a shift in hunting technology during this time period. The spear projectile point was replaced by smaller side-notched projectile points suitable for use with an atlatl. Excavated sites dating to 7400 to 4700 B.P have exposed atlatl projectile points classified as part of the Mummy Cave Series (7500 to 4500 B.P).

3.5 Middle Middle Precontact Period 5000 to 3000 years B.P

During the Middle Middle Precontact Period, human populations increased on the Northern Plains based on the number of sites. This was likely due to a gradual decrease in temperature and an increase in moisture. Multiple campsites and burials have been encountered in Saskatchewan that reveal information about settlement, ideology, and seasonal activities. The Oxbow Complex is the first identified complex within this time period. In southeastern Saskatchewan, the Oxbow Dam site is where the Oxbow Complex was first recognized. The temporal span for Oxbow in Saskatchewan is thought to be between 4700 and 3800 B.P (Pletz 2010). This date implies that the Oxbow Complex was already in place on the Northern Plains before the end of the Altithermal. It is possible that the Oxbow Complex developed *in situ* from a local variant of the Mummy Cave Series (Walker 1992). Another Oxbow site in Saskatchewan is the Gray site (Millar 1978; 1981), a burial site that contained non-utilitarian trade items from the east coast and Great Lake region. Subsistence patterns suggest a heavy reliance on bison.

The McKean Complex is also included within this time period. The three morphological styles of projectile points found in Saskatchewan are called McKean Lanceolate, Duncan, and Hanna. McKean projectile points have been found in the same stratigraphical context as Oxbow projectile points which suggests a link between the two complexes. Regardless of the area of origin, whether it is the Great Basin or Rocky Mountains, it was well established on the

Saskatchewan Plains by 4150 B.P (Dyck 1983). The lithic assemblage for the McKean Complex consists primarily of local chert and quartzite. A detailed description of the McKean Complex is presented in Chapter 7.

3.6 Late Middle Precontact Period 3000 to 2000 years B.P

The late extent of the Middle Precontact Period developed during the same time as the decline of the McKean Complex (Mack 2000). This period has been associated with an intense focus on bison as was the previous period (Mack 2000). This period also indicates that the bow and arrow was introduced to Plains groups possibly earlier than the Late Precontact Period (Cyr 2006).

The Pelican Lake Complex (3300 to 1850 B.P) was first identified at the Mortlach site in Saskatchewan (Wettlaufer 1955). The Pelican Lake projectile point includes two basic types. The earlier form of this projectile point appears stemmed due to the narrow base and large notches. Pelican Lake assemblages commonly include a chipped stone tool kit. Flat plano-convex and heeled endscrapers, bifaces, elongated drills, and unifacial tools are commonly associated with Pelican Lake. Also found are bone tools, including awls, ornaments, and beads. Shell gorgets, and beads have been discovered as well (Dyck 1983). Raw materials appear to be mostly locally available cherts and quartzites. Higher quality lithics such as obsidian and KRF are also present. People who made the stone tools that archaeologicats call the Pelican Lake Complex have been characterized as nomadic and communal bison hunters (Peck 2010). Pelican Lake Complex material culture has been found at the Walter Felt (EcNm-8) site (Kehoe 1974), the Mortlach (EcNl-1) site (Wettlaufer 1955), and the Long Creek (DgMr-1) site (Wettlaufer and Mayer Oaks

1960), all located in Saskatchewan. After 2000 B.P Pelican Lake Complex material culture is absent from the archaeological record in this region.

3.7 Late Precontact Period 2000 to 300 years B.P

The Late Precontact Period is associated with cultural fluorescence and technological advances. It was also during this time that ceramics, originating in the Eastern Woodlands, became a commonly used technology on the Northern Plains (Cyr 2006). A research area that developed pertaining to this time period is focused on cultural origins and influences (Cyr 2006). More sites have been excavated from this time period than any other on the Northern Plains. During the Late Precontact, the Besant Phase flourished for approximately 800 years, between 2500 to 1400 B.P (Cloutier 2004:42). The origins of the Besant Complex are thought to be in the Eastern or Northern Woodlands (Greiser 1994). Reeves (1983) speculated that the Besant Phase may have developed from the Early Middle Prehistoric II Oxbow Phase, as part of the Napikwan Tradition which links the Old Woman's phase, Sandy Creek, Besant, and Oxbow phases together. The concept of the Napikwan Tradition is now primarily rejected. The Besant Phase was either coeval with the Avonlea Phase on the Northern Plains (Vickers 1994) or was separate (Cloutier 2004).

Ceramics recovered from Besant sites are simple in design and functional. Most are conoidal-shaped, and are either cord-marked or smooth finished. Besant projectile points are generally side-notched with a concave or straight basal edge with some variation. The Besant Phase represents a culture in technological transition (Vickers 1994). That there are two technologies, atlatl and bow and arrow, used contemporaneously that show that technological transition is not as seamless as once believed. Besant occupations have revealed that the preferred material that was most utilized for stone tool production was KRF. The high percentages of KRF in Besant lithic assemblages show a connection with the Woodlands since the only known source of KRF is in Dunn and Mercer Counties, North Dakota. However, there are high percentages of KRF found far away from the lithic source. This has led many archaeologists to believe that there is another lithic source nearer to the heart of the Northern Plains or that there is a problem with terminology or identification. Besant Phase sites in Saskatchewan include, but are not limited to, the Mortlach site (Wettlaufer 1955), Melhagen site (Novecosky 1999; Ramsey 1991), and Long Creek site (Wettlaufer and Mayer Oaks 1960).

The Avonlea Complex sites on the Northern Plains date between 1750 and 1150 B.P. (Cloutier 2004). The radiocarbon age of occupation overlaps with the Besant Phase, but it is argued based on the stratigraphic separation of the complexes that there was little or no contact (Cloutier 2004:147-52). Avonlea projectile points tend to be thin and small and demonstrate a fine pressure flaking technique. Avonlea ceramics include net impressed vessels with punctates or incisions around the rim. In Saskatchewan, most Avonlea sites relate to bison procurement and processing. The Gull Lake Bison Jump (EaOd-1) near Gull Lake, Saskatchewan is one example (Kehoe 1973).

Towards the end of the Precontact Period pottery usage becomes more prevalent and vessel shape changes from concoidal to shouldered globular forms. Projectile point morphology changes to the Late-Side-Notched series, which contains both Prairie Side-Notched and Plains Side-Notched forms (Dyck 1983:126-139).

3.8 Discussion

This is but a very brief summary of the paleocultural sequence on the Northern Plains. As shown in this outline, there are many areas that still require more research and clarification. The majority of this brief summary is constructed from sites from the Northern Plains, but not necessarily limited to Saskatchewan. Therefore, further development and understanding of Saskatchewan's archaeological resources are needed. Further research is necessary to connect existing sequences together. This thesis provides clarification and fills in some gaps concerning the Middle Middle Precontact period.

Chapter 4

Methods

4.1 Introduction

There is a large variety of lithic material that can be used to create stone artifacts on the Northern Plains. An archaeological understanding of human selection and modes of acquisition is based upon accurate identification of which material types were used in the past. Raw materials can be classified by physical and chemical composition, texture, the size of artifact, shape, and organization of particles within the stone. A rock is composed of one or more minerals. The type of classification for this material within the disciplines of archaeology and geology is dependent on the proportions of these minerals within the stone itself. Minerals are naturally occurring and are usually homogeneous solids with a certain, but flexible, chemical composition. This section will also include a review of lithic properties, excavation methods, laboratory methods, as well as definitions of texture, lustre, colour, and how heat-altered materials can be identified. A more detailed discussion of Saskatchewan's raw materials can be found in Chapter 8.

4.2 Excavation Methods for the Wolf Willow and Dog Child sites.

When excavating on the Northern Plains, many methods are used to ensure excavations are both time efficient and thorough. A common excavation methodology was used for both the Wolf Willow and Dog Child sites. At the beginning of a field season, a datum was established in the northwestern corner of the site. Units then were established south and east of the datum in

1m^2. During the excavation, 5cm arbitrary levels were used. This method is used in order to determine the original depositional environment of the sediment. As the stratigraphic sequence became apparent, the units were dug in natural levels. All units were excavated in 50cm X 50cm quadrants in order to simplify both excavation and cataloguing.

When excavating an occupation level, trowels were used as well as hard bristled brushes, dental sticks, and chopsticks. Trowels were most utilized to remove sediment around features whereas dental sticks and chopsticks were used to excavate bone and other smaller archaeological remains. These tools were useful when a high concentration of artifacts were encountered. Archaeologically sterile levels were excavated carefully using a shovel shaving technique instead of a trowel. This involved thin sections being removed by shovel in quadrants. All sediment from the excavations was screened in a 6mm screen. However, if a concentration of micro-debitage was found, a 3mm screen was used instead.

For the lithic artifacts recovered, methodology was consistent for both the Wolf Willow site, and the Dog Child site. All lithic artifacts, diagnostic, or formed tools were left *in situ* and mapped. After mapping, the artifact was given a number and tag then bagged carefully. All artifacts recovered from the screens were accumulated in fragment bags. These bags were specific to a unit, quadrant, and occupation level.

4.3 Lithic Laboratory Analysis

All of the lithic material collected from the Wolf Willow and the Dog Child site was brought to the Archaeological Laboratory in the Department of Archaeology and Anthropology at the University of Saskatchewan for analysis. For the 2014 Wolf Willow excavation season, all lithic artifacts were screened and bagged by the students from the Archaeological Field School of the University of Saskatchewan. For the 2010-2013 Wolf Willow excavation seasons, this process had been completed. All lithic material for the Dog Child site had previously been catalogued and stored in the department of Archaeology and Anthropology at the University of Saskatchewan. For the purpose of this thesis, all lithic artifacts from the Wolf Willow and Dog Child sites were separated and reanalyzed in order to maintain consistency. Analysis included the artifact number, quadrant, unit, level, depth, artifact type, material type, alteration, colour, texture, lustre, and weight. The complete Wolf Willow and Dog Child lithic analyses are presented in chapters 5 and 6.

Microsoft Excel was used in order to create the catalogue. Once data collection was completed, a percentage of the total count of the items of interest, material type, artifact type, and weight was then divided by the total count within that category. For instance, in order to calculate the percentage of material type, the total number of chert artifacts as calculated then divided by the count for entire assemblage. If a material type was found to be altered by heat treatment it was then placed into a separate analysis. This was also completed in terms of weight. These statistics were created to determine whether or not the lithic assemblages of the two sites were similar in composition or varied substantially to one another.

4.4 Raw Material Classification

Raw material classification requires grouping artifacts into defined stone types. Rock types tend to grade into one another and there can be variability within a single type. In some cases, lithic flakes produced from a single nodule may be different in colour and texture. For these reasons it is often difficult to classify raw materials from artifacts. Detailed type descriptions, as well as an extensive reference collection, are needed to classify raw materials. Both were highly utilized for the analysis of raw materials present in the Wolf Willow (FbNp-26) and Dog Child (FbNp-24) sites. In order to concretely assign raw material categories to artifacts, chemical analyses can be undertaken in order to link the material to a reference source. Due to the size of the assemblages and the cost being prohibitive for this thesis, this was not possible.

The specific geological characteristics used to identify a material are fairly consistent and reliable within geological identification of rocks and minerals. Raw material types were macroscopically assessed based on texture which includes the size, shape, and organization of the particles, lustre, colour, and translucency in this study. Once the geological characteristics were assessed for each lithic artifact they were then added to the respective site catalogue and assigned a material type. A more descriptive summary of Saskatchewan material types is available in Chapter 8 and Appendix A. These lithic material type categories were used by Dr. Shawn Bubel (2014) at the Fincastle site in Taber, Alberta and found to be useful for this study. Characteristics used for this thesis such as textural grade, lustre, colour, and alteration are defined below.

4.4.1 Textural Grade

The textural grades that are used in the raw material description are:

Very coarse-grained: the individual grains of the stone are clearly visible to the naked eye. Facets are abrasive to the touch.

Coarse-grained: the individual grains can be viewed with a hand lens or are visible to the naked eye. Particles are more compacted which results in less abrasive surfaces and facets (Bubel 2014).

Medium-grained: the individual grains may be visible to the naked eye. A hand lens is needed to distinguish each individual grain. The surface of the stone will be slightly abrasive.

Fine-grained: the individual grains are distinguishable with a hand lens. The surface that has been flaked is smooth.

Very-fine grained: the individual grains are not detectable without a microscope. The flaked surface is smooth and polished.

Amorphous: non-granular glassy texture.

4.4.2 Lustre

Lustre is defined by the way the surface of the rock appears in reflected light (National Audubon Society 2000:26-27). It is dependent on the textural grade and mineral composition of the rock. For the Wolf Willow and Dog Child sites, lustre was assessed by examining a non-cortical surface in direct sunlight as well as a bright light under a microscope. The following categories are as listed:

Vitreous: Light directly reflects off the surface of the non-cortical surface and appears glass-like.

Resinous: Only some light is directly reflected off of the non-cortical surface. These stones have an appearance of plastic or tree resin.

Waxen: Some light reflected off of the non-cortical surface. Similar lustre to wax.

Dull: Light will scatter in all directions so no reflection is seen on the non-cortical surface. Essentially the rock exhibits no lustre.

4.4.3 Colour

Colour directly depends on the elements present in the raw material. The concentration of these minerals and texture determine the colour of the stone. The classification of colour is a subjective process and, because of this, a reference collection based upon the Munsell colour system was used. If a specimen was difficult to classify, at least two researchers had to come to a consensus before a colour could be defined. Primary colour is recorded under "colour" of the catalogue and any secondary colours were noted in the comments section.

White	**Brown**
White-Light grey	**Orange**
Light grey	**Yellow**
Medium grey-Light grey	**Pink**
Medium grey	**Red**
Medium- Dark grey	**Purple**
Dark grey	**Blue**
Dark grey-black	**Green**
Black	**Translucent (colourless)**

4.4.4 Translucency

Translucency is the degree to which it can transmit light. The following categories were used.

Opaque: No light is transmitted through the stone, no matter how thin the specimen has been flaked.

Slightly translucent: Only a limited amount of light is transmitted through the stone, only seen through thin sections.

Moderately translucent: Only a moderate amount of light is transmitted through thin sections of the raw material.

Highly translucent: A high amount of light will be transmitted through thick sections of the raw material.

Translucent: Completely translucent.

Using debitage to identify raw materials used at a site can become problematic due to flake size. When raw material is flaked thinly, the identification process is complicated since particle size and colour are less apparent. Flake thickness is the distance from the dorsal side to the ventral side of the flake perpendicular to the flake line (Andresfsky 2005:101). The technique used in this analysis was to measure at maximum flake thickness at the midpoint.

4.4.5 Alteration

The process of heat treatment can increase a stones workability for lithic manufacturing. Heat-treating certain raw material positively alters the molecular structure. Heating elicits a structural change that causes some types of lithic material like chert to behave more like glass and therefore fracture more evenly (Low 1996:165). This process alters materials to have different manufacturing and functional characteristics that can be more easily worked (Boras 1991:17, Low 1996:165). Heating enhances flaking properties and reduces durability of the material's original chemical structure. In some stones, the tensile strength is reduced by half, which will allow for longer flakes to be detached with the same amount of force applied (Olausson 1983). In other materials the particles can become vitrified, thus creating a smoother texture. Identifying heat-treated material for this project is based on lustre. Some stone types that were originally dull develop a greasy lustre when heated (Crabtree and Butler 1964). Colour change is also a factor noted here due to an alteration of the oxidation state of iron impurities in the material (Purdy and Brooks 1971).

4.5 Summary

Past glacial events have had the effect of limiting knowledge of Saskatchewan geological deposits. Many of the local raw materials used for lithic tool production in the WHP area were either directly or indirectly laid down by glacial ice (Johnson 1998:9-12; Skwara 1988:27-28). Glacial sediments are characterized by their wide range in grain size, from clay to boulders, and the absence of any obvious arrangements of the constituent particles (Skwara 1988:27-28). These factors cause most of the raw material found in this area to have a larger particle size and are therefore not the most desirable lithics for tool production. This means that heat treatment is a valuable tool that was likely highly utilized in Saskatchewan for tool production. The Pleistocene stratigraphy of the area consists of the Sutherland Group and the Saskatoon Group (Floral Formation and the Battleford Formation). The Floral Formation is further subdivided into four separate layers (Skwara 1988:28). This is where most of the lithic material in the Saskatoon area would have originated. This means that when compared to the neighbouring states and provinces, Saskatchewan's stone is of poor quality. The geology of the area determines what local siliceous stones would have been utilized at both the Wolf Willow and Dog Child sites.

Chapter 5

The Wolf Willow Site (FbNp-26) Cultural Level 3 Lithic Analysis

5.1 Introduction

This thesis is concerned with the lithic material recovered from four excavation seasons, 2010/2011, 2012, 2013, and 2014 at the Wolf Willow site, Cultural Level 3 (Figure 5.1). Assisting in the 2010/2011 seasons was Maria Mampe M.A Candidate, from the University of Saskatchewan, under the supervision of Dr. Walker. The 2012 and 2013 excavation seasons were supervised by Devon Stumborg (M.A Candidate) and Dr. Walker.

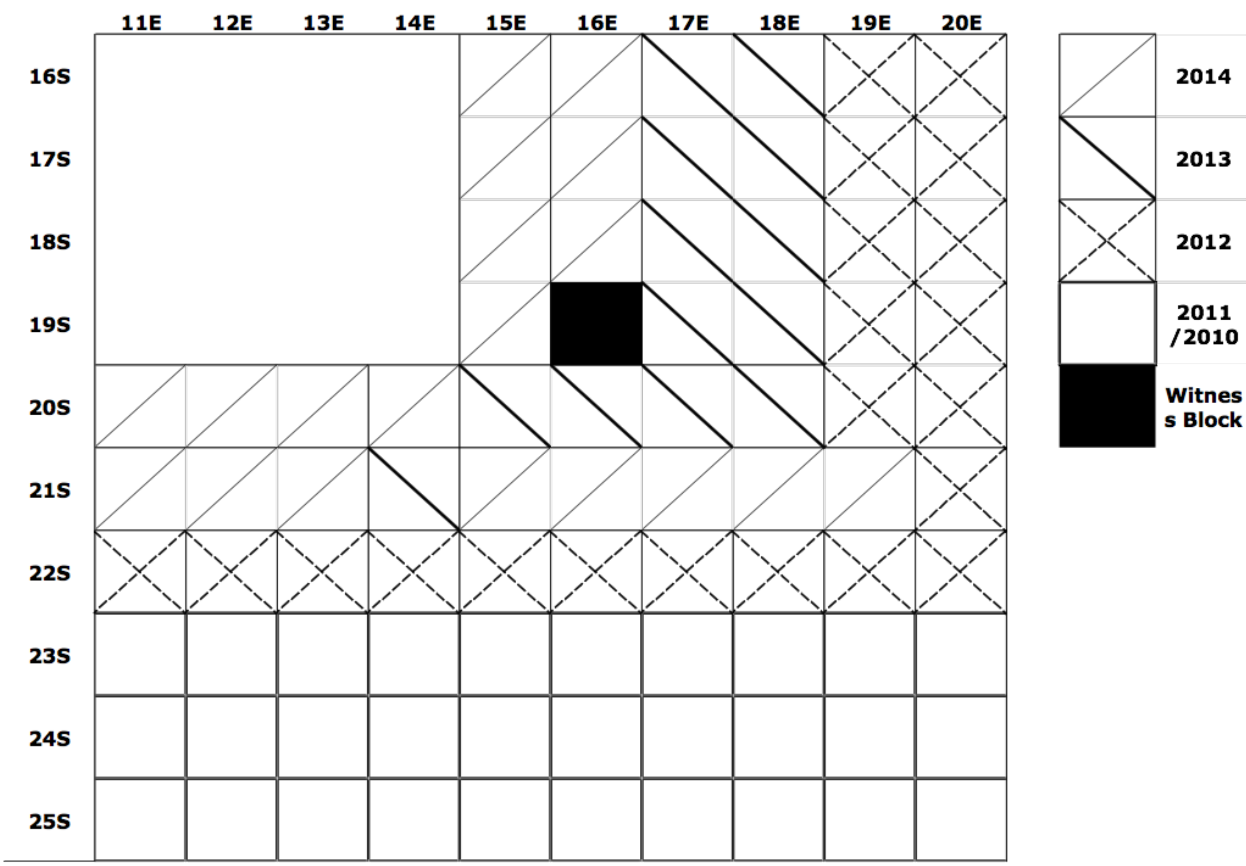


Figure 5.1 Excavation Seasons at the Wolf Willow Site (FbNp-26)

Volunteers of the Saskatchewan Archaeological Society have assisted throughout the four seasons of excavation. The most recent 2014 excavation season was the University of Saskatchewan Archaeological Field School under the supervision of Dr. Walker, Devon Stumborg, and the author. As of the 2014 field season, $83m^2$ have been excavated at the Wolf Willow site (refer to Figure 5.1).

5.2 The Wolf Willow Lithic Assemblage

In total, 3739 lithic artifacts were recovered from level 3 at the Wolf Willow site. There was a total of 14 artifact types; anvil, biface, core, core fragment, debitage, endscraper, hammerstone, knife, mano, maul, projectile, retouched flake, and utilized flake (Table 5.1 with values rounded upwards).

Table 5.1 Artifact Type vs. Percent of Total Lithic

Artifact Type	% of Total
Debitage	98.45
Core	1.20
Projectile Point	0.40
Biface	0.24
Endscraper	0.19
Hammerstone	0.16
Utilized Flake	0.11
Retouched Flake	0.08
Core Frag	0.08
Knife	0.03
Mano	0.03
Maul	0.03
Scraper	0.03
Anvil	0.03

Debitage is the largest percent of total artifacts (3644) recovered from the site at 98.45%. Debitage usually dominates lithic assemblages on the Northern Plains because it is the by-product of tool production. Cores were the second largest percentage of artifacts found. There were 45 cores recovered from Cultural Level 3 making up 1.20% of the lithic assemblage.

Projectile points are the third most represented category. There were fifteen projectile points recovered from Cultural Level 3, which makes up 0.40% of the entire lithic assemblage. Bifaces (9), endscrapers (7), hammerstones (6), and utilized flakes (4) make up the fourth largest percentage of the assemblage while knives, manos, mauls, scrapers, and anvils each make up .03% of the assemblage. SRC is the most commonly represented raw material in the Wolf Willow Assemblage (n=59.37%) (Table 5.2).

Table 5.2 Percentage of Material Type for Total Assemblage Tools

Material Type	% of Total
Swan River Chert	59.38
Medium to Coarse Grained Quartzite	12.07
Massive Quartz	10.52
Fine Grained Quartzite	6.82
Misc. Cherts	4.39
Silicified Siltstone	1.42
Silicified Peat	1.34
Brown Chalcedony	1.15
White Chalcedony	0.83
Patinated Brown Chalcedony	0.75
Basalt	0.72
Silicified Wood/ Petrified Wood	0.24
Black Chert	0.16
Porcellanite	0.13
Yellow Chalcedony	0.03
Granite	0.03
Diorite	0.03

Medium to coarse-grained quartzite, massive quartz, and fine-grained quartzite were other locally procured raw materials that were represented in larger quantities at the Wolf Willow site. Artifact types were further cross referenced with raw material types (Table 5.3).

Table 5.3 Artifact Type Separated by Material Type

Artifact Type	Material Type	% of Total
Anvil	Basalt	100.00
Biface	Massive Quartz	22.22
	Silicified Peat	11.11
	Silicified/ Petrified Wood	11.11
	Swan River Chert	**55.56**
Core	Medium to Coarse Grained Quartzite	2.38
	Basalt	7.14
	Massive Quartz	16.67
	White Chalcedony	2.38
	Black Chert	2.38
	Swan River Chert	**61.90**
	Misc. Chert	7.14
Core Frag	Medium to Coarse Grained Quartzite	**33.33**
	Silicified/ Petrified Wood	**33.33**
	Silicified Siltstone	**33.33**
Debitage	Fine Grained Quartzite	6.94
	Medium to Coarse Grained Quartzite	12.11
	Basalt	0.60
	Massive Quartz	10.51
	Brown Chalcedony	1.13
	Black Chert	0.11
	Silicified Peat	1.35
	Silicified/ Petrified Wood	0.19
	Swan River Chert	**59.70**
	Misc. Chert	4.23
	Patinated Brown Chalcedony	0.74
	Yellow Chalcedony	0.03
	White Chalcedony	0.82
	Silicified Siltstone	1.40
	Porcellanite	6.94

Table 5.3 Continued

Endscrapers	Brown Chalcedony	14.29
	Misc. Chert	**42.86**
	Patinated Brown Chalcedony	14.29
	Silicified Siltstone	14.29
	Porcellanite	14.29
Hammerstones	Basalt	16.67
	Medium to Coarse Grained Quartzite	**66.67**
	Diorite	16.67
Knife	Swan River Chert	**100.00**
Mano	Granite	**100.00**
Maul	Medium to Coarse Grained Quartzite	**100.00**
Projectile Point	Medium to Coarse Grained Quartzite	6.67
	Massive Quartz	6.67
	Brown Chalcedony	6.67
	Black Chert	6.67
	Swan River Chert	**66.67**
	Misc. Chert	6.67
Retouched Flake	Fine Grained Quartzite	**66.67**
	Misc. Chert	33.33
Scraper	Misc. Chert	**100.00**
Utilized Flake	Medium to Coarse Grained Quartzite	**50.00**
	Swan River Chert	25.00
	Misc. Chert	25.00

This was done to determine whether or not a material type was utilized more or less than others for the manufacturing of certain tools. Coarse-grained quartzite, SRC, fine-grained quartzite, and miscellaneous cherts are the most represented material types in the Cultural Level 3 lithic assemblage. All these materials can be locally procured.

Percussion tools such as anvils, hammerstones, manos, and mauls were all dominated by the use of granite, basalt, and coarse-grained materials. Coarse-grained quartzite was the most represented material type in utilized flakes (50%). Bifaces, projectile points, endscrapers, and retouched flakes all require thinner pressure flaking and delicate shaping so that finer materials such as heat-treated SRC, miscellaneous chert, and fine-grained quartzite dominated these tool types. Cores are represented by SRC (61.9 %), massive quartz (16.7%), basalt (7.1%), miscellaneous chert (7.1%), black chert (2.4%), and white chalcedony (2.4%). Core fragments were equally split (33.3%) between silicified siltstone, silicified peat, and coarse-grained quartzite. SRC is the most represented raw material in the debitage artifact category (59.7%). This correlates closely with cores (61.9%). This high number is likely caused from high utilization of SRC at the Wolf Willow site.

The Wolf Willow site has a total of 45 cores recovered from Cultural Level 3. It is interesting to note that the core fragment category does not correlate with the core artifact category in terms of material type. This may represent a complete exhaustion of the material present in the core fragment category. Silicified siltstone and silicified peat core used for tool production could have been either completely exhausted or taken away from the site. Although silicified siltstone and peat are very fine-grained materials they also tend to fracture unevenly due to the impurities and fragments within the stone. Because of this, they may have been discarded more readily. These two material types are also nearly absent from the debitage artifact category which supports this theory that people took the cores away from the site or discarded them. Since debitage is the by-product of tool production, it would be present at the site if the cores were being worked at the site.

Proportion of weight and type of raw material was also analysed (Appendices B, C ,D ,E ,F, and G). The total weight of each raw material was divided by the total weight of the assemblage to determine the proportion of each material type that occurred within each artifact type in weight. This analysis was done to see whether there were any deviations or anomalies when compared to the other tests that were completed. The results and conclusions drawn from the weight analysis were very similar to the proportion of total artifacts separated by raw materials. No new information was gathered and the results can be seen in Appendices B, C, D, E, F, and G.

5.3 Heat Treatment

Three material types were identified as being heat-treated. Heat-treated raw materials are SRC, fine-grained quartzite, and miscellaneous cherts. All of these materials can be procured locally and heat-treated. SRC in its natural cobble form can be similar to quartzite. Heat-treating alters the structure of the lithic material. The raw material becomes more yielding, meaning better suited and easier to knap and manufacture into tools (Boras 1991:17; Crabtree 1967:24; Low 1996:165). It was found that 95% of all the SRC recovered from Cultural Level 3 at the Wolf Willow site was heat-treated (Table 5.4).

Table 5.4 Heat Alteration

Material Type	% HT
Swan River Chert	95.13
Fine Grained Quartzite	88.24
Misc. Cherts	1.83

Lithic assemblages in WHP tend to be dominated by SRC (Cyr 2006; Mack 2000; Pletz 2010). The majority of recorded SRC artifacts in the archaeological record are thermally treated (Low 1996:167). The SRC artifacts recovered from the Wolf Willow site appear to follow this broader trend. A large amount of quartzite was found to be heat treated (88.24%) at the Wolf

Willow site. Most of the fine grained quartzite exhibited colour change and red was a common secondary colour.

Only a small percentage of the miscellaneous chert category was altered by heat. Pebble chert, precipitated chert, and cathead chert, are all found in the miscellaneous chert category are already fine grained in nature and do not require additional alteration by heat treatment. This small percentage is likely representative of experimentations in heat alteration. Most cherts were suitable for tool production without the additional effort of heat-treating.

5.4 Discussion and Conclusions

The majority of the material recovered from the Wolf Willow site Cultural Level 3 can be locally procured. There is a heavy reliance on SRC, quartzite, massive quartz, and locally available cherts. Many archaeologists assign a subjective rule in order to determine what is a "local" and "exotic" lithic that may vary by region, province, location, and distance.

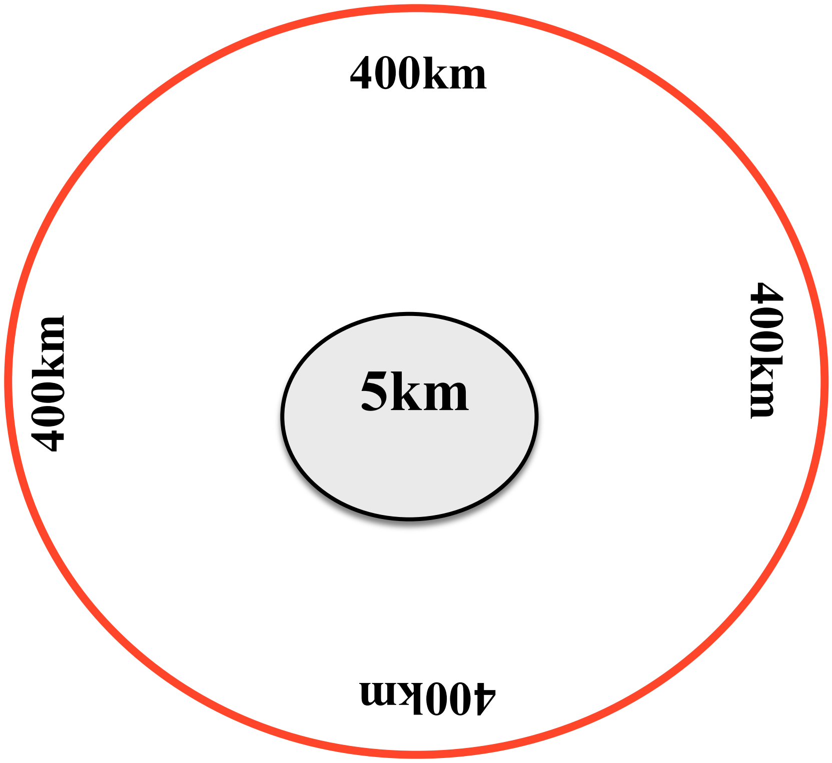
Raw material, whether it be local or exotic is chosen for a variety of factors. These factors include distance to the source of the quarry or source site, the ability to access the quarry, the lithic exchange networks that were in place at the time and the site type (Hamza 2013: 37). Local can be defined as a small resource that is usually exploited by small groups in a restricted area; and a regional or exotic source is one that can serve a wide geographical area (Leonoff 1970:16).

Andrefsky (2005) created a simple model based on quality and abundance of local lithic materials. If locally procured materials were of high quality and abundance, all tools types will mostly be made of these local materials with some minor exotics being present in the assemblage

(Andrefsky 2005). Precontact people have been known to travel massive distances. George T. Jones, Charolette Beck, and Richard E.Hughes (2003) came to the conclusion that paleoarchaic mobility in the central Great Basin, which is a possible origin area of the McKean Complex, had a ranging area of more than 450km for acquiring raw materials. This was based on a systematic analysis designed to analyse the distance between sites and geological quarries. The geographical distance of 400km is the ranging zone chosen for this thesis. Exotic materials are anything outside of this perimeter and would have been more difficult to procure that could support a large geographical area.

Brown Chalcedony, certain cherts and silicified siltstones, as well as fused shale, are all materials that would have likely been procured within the 400km local boundary. Pebble chert for the purpose of this thesis can be considered local due to a quarry being located approximately 330 kilometers away from the Wolf Willow site and can also be procured locally in nodule form from within glacial till and drainage valleys. Many of the miscellaneous cherts can be also found in glacial till. There is a white high-quality chert present in the assemblage that resembles a Montana chert but may also be found locally in Saskatchewan and southeastern Alberta. Chalcedony can be found in a nodule form within drainage basins and glacial till. It is likely that many of the chalcedonies recovered from Cultural Level 3 are exotically procured. However, without macroscopic analysis it is impossible to determine its source. It is for these reasons that it will be considered a local material for the purposes of this thesis.

Since most raw materials utilized for tool production at WHP were acquired from the immediate vicinity of the area (5km), a buffer model was utilized (Figure 5.2). All materials recovered from the Wolf Willow and Dog Child site were separated by if they could be procured from ether an immediate vicinity (5km) or within previously defined buffer zone (5-400km).



Distance from Wanuskewin Heritage Park	Material Type
0-5 KM	• Fine-grained Quartzite • Medium to Coarse Grained Quartzite • Basalt • Massive Quartz • Precipitated Chert • Swan River Chert • Chalcedony • Silicified Wood • Silicified Peat • Silicified Siltstone • Granite
5-400 KM	• Brown Chalcedony • Cathead Chert • Pebble Chert • Gronlid Siltstone • Feldspathic Siltstone • Fused Shale

Figure 5.2 Buffer Model

The large amount of debitage recovered from the Wolf Willow site is made from materials that can be locally procured from a 400-kilometer area near WHP. Locally procured materials also dominate all of the artifact categories. Some materials such as the brown chalcedony and other chalcedonies are likely to have been transported to the site by means of contact or trade between other cultural populations during seasonal rounds to certain areas. What is known about the McKean Complex at the Wolf Willow site is that most materials used for lithic manufacturing could have easily been acquired from the local area. After an analysis of the lithic materials recovered from cultural level three, it is clear that the Wolf Willow site follows the local pattern of McKean Complex sites on the Northern Plains.

Chapter 6

Dog Child Site Occupation Level 2A Lithic Analysis

6.1 Introduction

This chapter is concerned with all of the lithic material that was recovered from the Dog Child Site Level 2a. The Dog Child site had three excavation seasons (Figure 6.1). The University of Saskatchewan archaeological field school under the supervision of Dr. Ernest Walker and Talina Cyr completed the 2004 and 2005 excavation season. Members of the Saskatchewan Archaeological Society (SAS), and Talina Cyr conducted subsequent excavations.

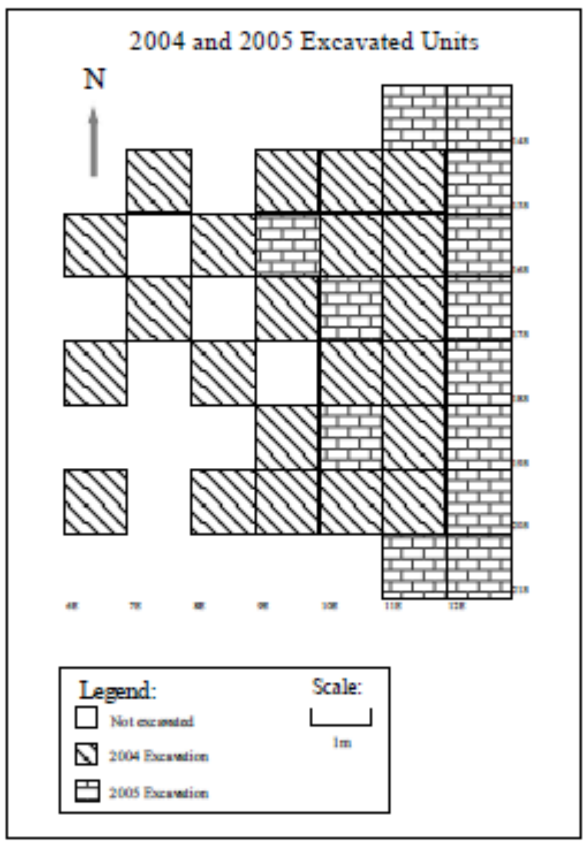


Figure 6.1: Excavated Area of Dog Child Site (Credit Talina Cyr 2006)

6.2 The Dog Child Lithic Assemblage

In total, 3348 lithic artifacts were recovered from Cultural Level 2a including a total of 9 artifact types: anvils, biface, core, debitage, endscraper, hammerstone, preform, projectile point, and retouched flakes (Table 6.1).

Table 6.1 Artifact Type vs. Percent of Total Lithic Artifacts.

Artifact Type	% of Total
Anvil	0.03
Biface	0.09
Core	0.48
Debitage	98.63
Endscraper	0.24
Hammerstone	0.06
Preform	0.03
Projectile Point	0.36
Retouched Flake	0.09

Debitage was the largest percent of total artifacts (3302) recovered from the site at 98.63%. The high percentage of debitage is not surprising. Mentioned in Chapter 5, debitage usually dominates lithic assemblages for Northern Plains archaeological sites because it is the by-product of the manufacturing of stone tools.

The Dog Child site had a large percentage of projectile points (12) when compared to other tools at the site. Projectile points made up .36% of the assemblage whereas preforms and anvils only counted for .03%. Endscrapers (8) were the third most common artifact type at .24%.

SRC is the most represented material in this assemblage (60%) and massive quartz was the second most represented at 15.26% (Table 6.2). Granite was the second least represented, but this is most likely due to the fact that there was only one tool manufactured from the all of the raw material recovered.

Table 6.2. Percentage of Material type for Total Assemblage Tools.

Material Type	**% of Total**
Fine Grained Quartzite	0.15
Medium to Coarse Grained Quartzite	7.86
Basalt	0.21
Massive Quartz	15.26
Brown Chalcedony	5.76
Black Chert	0.03
Silicified Peat	1.25
Silicified Wood/ Petrified Wood	0.21
Swan River Chert	60.01
Misc. Cherts	7.97
White Chalcedony	0.93
Silicified Siltstone	0.30
Granite	0.06

The artifact types were further broken down into two different categories. The first was a separation by material type and the second was a percentage of the total number of artifact type (Table 6.3). This was done in order to determine whether or not a certain material type was utilized for the manufacturing of certain tools. SRC outnumbers all other material types in every category it was present in except in the biface category, where it was equalled by both white and brown chalcedony. This is most likely due to the low numbers of bifaces (3) gathered from the site.

Table 6.3 Artifact Type separated by Material Type

Artifact Type	Material Type	% of Total
Anvil	Basalt	100.00
Biface	Brown Chalcedony	33.33
	Swan River Chert	33.33
	White Chalcedony	33.33
Core	Swan River Chert	**62.50**
	Misc. Cherts	18.75
	Massive Quartz	12.50
	Basalt	6.25
Debitage	Fine Grained Quartzite	0.15
	Medium to Coarse Grained Quartzite	7.87
	Basalt	0.18
	Massive Quartz	15.41
	Brown Chalcedony	5.72
	Black Chert	0.03
	Silicified Peat	1.27
	Silicified/ Petrified Wood	0.18
	Swan River Chert	**60.05**
	Misc. Cherts	7.93
	White Chalcedony	0.88
	Silicified Siltstone	0.30
Endscrapers	Brown Chalcedony	25.00
	Swan River Chert	**62.50**
	White Chalcedony	12.50
Hammerstones	Granite	100.00
Preform	Swan River Chert	100.00
Projectile Point	Medium to Coarse Grained Quartzite	16.67
	Silicified/ Petrified Wood	8.33
	Swan River Chert	**58.33**
	Misc. Cherts	16.67
Retouched Flake	Brown Chalcedony	33.33
	Swan River Chert	**66.67**

The coarser grained stones such as basalt, quartzite, and granite dominate the percussion tools. The tools that require thinner flaking and delicate retouching (bifaces, endscrapers, and projectile points) were dominated by the finer-grained materials such as cherts, silicified wood, silicified siltstone, chalcedony, and silicified peat. SRC also dominates the core artifact category (62.5%) that correlates closely with debitage (60.1%). This high number is likely caused from high utilization of SRC.

An analysis was also done for proportion with weight and type of raw material. The conclusions drawn were similar to the proportion of total artifacts by type of raw material. The total weight of each raw material was divided by the total weight of the assemblage to determine the proportion of each material type that occurred within each artifact type in weight. This was done to see whether there were any deviations or anomalies when compared to the other statistical tests. The results correlated with the percentage of material type analysis and therefore presented no new information. The analysis and results can be seen in Appendices B, C, D, E, F, and G.

6.3 Heat Treatment

Only three material types were identified as being altered by heat treatment: fine-grained quartzite, SRC, and miscellaneous cherts. Ninety-nine percent of all of the SRC from the Dog Child site assemblage was found to be heat-treated. This is a normal trend for WHP. SRC is in its natural cobble form is similar to coarse quartzite. In order to attain a finer grain and make the stone easier to work with, heat-treating is essential for SRC (Boras 1991: 17).

A large percentage of the fine-grained quartzite was also found to be heat-treated (60%) (Table 6.4). Heat-treated quartzite is commonly mislabelled as chert on the Northern Plains. The defining characteristic of a heat-treated quartzite is the presence of quartz crystals and colour change (Purdy and Brooks 1971). Much of the fine-grained heat-treated quartzite from the Dog Child site was red in colour and when viewed with a microscope, quartz crystals were apparent. Most of the fine-grained quartzite was originally medium-grained quartzite.

Most of the miscellaneous chert recovered from the site was precipitated chert, pebble chert, or a white chert. These materials have a low percentage of heat treatment (1.12%): this is most likely due to the fine-grained nature of the material that additional alteration and heat treatment was not required.

Table 6.4 Heat Alteration

Material Type	% HT
Fine Grained Quartzite	60.00
Swan River Chert	99.60
Misc. Cherts	1.12

6.4 Discussion and Conclusions

Talina Cyr completed a lithic analysis on the Dog Child site in 2006. Cyr (2006:83) immediately recognized that the majority of material recovered from Cultural Level 2a was procured locally. Cyr (2006:83-84) noted an almost exclusive reliance on SRC, massive quartz, and quartzite for tool manufacturing. She clearly noted that this assemblage follows the local pattern of McKean Complex sites on the Northern Plains.

All but two of the cores recovered from the site are highly utilized. Both heat-treated SRC cores are also from the final stages of processing. SRC also dominates the core artifact category (62.5%), which correlates closely with the percentage of SRC debitage (60.1%). The high amount of debitage shows the intensive lithic production of local materials at the Dog Child site. The presence of 7 scraper tools and high debitage numbers in combination with a minimum of three bison recovered from Cultural Level 2a (Cyr 2006:102), suggests of a high amount of processing in both lithics and bison took place at the time of occupation.

In this site assemblage, like the Wolf Willow site the highest frequencies are the locally procured materials from the immediate vicinity (5km) (refer to Figure 5.2). Local materials such as SRC, miscellaneous cherts, and quartzite were all highly utilized. Many of the pebble cherts flakes recovered from the site were primary flakes. The high number of primary flakes could mean people were testing local river nodules to see if they were satisfactory for tool manufacturing. The high number indicates close proximity of the source since people are likely to test cores near the site of production. The large amount of debitage at the site, but low number of tools suggests they were removing the tools from the site at abandonment. Both hammerstones recovered were manufactured from locally available cobbles of granite and quartzite, and likely collected and used at the time of occupation. The hammerstones may have been used for processing or to retouch some of the lithic tools as evidenced by the battered distal end.

Local lithic materials were depended on at this site, although some materials were likely to have been transported to the site by means of contact with other cultural populations or collection during any seasonal rounds (Cyr 2006:111). The focus on locally procured lithic material rather than exotic trade material could allude to territorial boundaries for the people who occupied the Dog Child site during the McKean Complex. Since most lithic materials were easily gathered from the local area, this site was mostly self-contained in terms of stone tool materials. Whether that was their choice or it was restriction laid upon them, McKean people were self sufficient and locally adapted to utilizing local faunal species and local lithic resources. If SRC is present at a site people tend to use it over other materials possibly because it is so easily improved with heat-treatment.

When comparing the results of the Dog Child site and the Wolf Willow site the heavy utilization of SRC and heat treatment appears to be evident. Bruce Low (1996:167) found that larger percentages of thermally-altered material tend to occur within habitation sites and workshop locales in Manitoba. At the Wolf Willow and Dog Child sites over 90% of the recovered lithic material was SRC and over 90% of that material was thermally-altered. It is logical that the people inhabiting the Wolf Willow and Dog Child sites would stay in the WHP area since it was an ecologically ideal for habitation. Occupants could have heat altered the large number of SRC that was locally procured rather than spend extra energy and time procuring exotic stone tool resources.

Chapter 7

Comparison with Cactus Flower and Other Sites

7.1 Introduction

McKean Complex sites are located throughout the Northern Plains with the greatest concentration (of academically published) McKean sites in Wyoming. This concentration may be due to Cultural Resource Management (CRM) data not being incorporated into past analyses. Projectile points that are morphologically similar to "McKean" projectile points have been recovered from both the Great Basin and Plateau regions but there is a lack of systematic analysis of the relationship between these geographical areas. McKean Complex sites located on the Northern Plains occupy the foothills and short grass prairie regions (Mack 2000). High altitude sites are usually smaller in both artifact number and total area. In general, sites tend to be located along water sources and in areas where shelter can be provided from wind (Morris *et al* 1985).

In order to determine similarities and anomalies between the McKean Complex on the Saskatchewan Northern Plains and the McKean Complex from the Great Basin and Plateau regions, the origins of the complex and lithic tool assemblages are summarized with a focus on the lithic assemblage from the McKean levels at the Cactus Flower site in Alberta. The data from the lithic analysis from both the Wolf Willow site and the Dog Child site will then be compared to the overall McKean Complex lithic pattern.

7.2 McKean Complex Origin

The McKean Complex was first recognized in 1954 as a result of excavations of the McKean site in northeastern Wyoming (Mulloy 1954). Lower occupation levels at the McKean type-site revealed a number of stemmed and lanceolate projectile points (McKean lanceolate, Duncan, and Hanna), that appeared to be in direct association with one another which suggested a complex. One theory supported by Mulloy (1954) was that each of these projectile point styles were variants of a single type. Wheeler (1954) supported the opposing idea that each of the variants were a different recognizable type. Excavations at the Mummy Cave site (Husted and Edgar 2002) and Signal Butte (Strong 1935) revealed a similar assemblage to the McKean site thus supporting Mulloy's original proposal that the points were variants within a single complex. Similar stemmed and lanceolate points were found in both Saskatchewan and Manitoba. Shortly thereafter, the McKean Complex became widely recognized throughout the Canadian Plains (Syms 1969).

Currently, there are two main theories on the McKean Complex origins that are still utilized by archaeologists. The first, put forth by Brumley (1978: 188), is that the initial origin of the McKean Complex was in the Great Basin geographical region based upon projectile point morphology. Correlations between style and age in the McKean Complex have been documented in Great Basin sites which suggests a pattern. Beginning in the Wyoming area, the McKean Complex can be traced to the southern portion of the Northern Plains only to be abandoned when a specialized focus on bison subsistence pattern was adopted.

Benedict and Olson (1973) theorized that the complex partly evolved from Paleoindian cultures in the Northern and Central Rocky Mountains. The McKean Complex in this theory, would be an outgrowth of Late Paleoindian complexes in the area including, Lovell Constricted, Pryor Stemmed, and Jimmy Allen. It is theorized that these Paleoindian Complexes represent Plains hunters who retreated to the highlands during the Altithermal. This represents the first and earliest broadly based archaic adaptations to the Altithermal. Keyser and Davis (1985) believe that a several thousand-year gap between the Terminal Paleoindian and the McKean Complex is a problem with this theory. However, the recovery of a large side-notched point in the Pryor and Absaroka Mountains east of Yellowstone National Park may allude to a transitional Early Archaic period. These points are generally found stratigraphically between Late Paleoindian and McKean Complex cultural levels (Keyser and Davis 1985).

One problem with Benedict and Olson′s theory is that there is still a lack of archaeological evidence linking these two complexes together. It is certain from past excavations at the Fourth of July site in northern Colorado that a part of the development of the McKean Complex originated in these high altitude sites (Keyser and Davis 1985; Mack 2000). Studies at the Fourth of July site (5880+/-120 B.P) suggest that there is continuity between lanceolate indented base point forms including Pryor Stemmed, Lovell Constricted, Jimmy Allen, and McKean/ Duncan projectile points (Benedict and Olson 1973). Benedict and Olson (1973) believe that once the regional climate improved around 5000 years B.P, people began to migrate into the previously arid regions.

The theory that the McKean Complex developed from the Early Archaic Oxbow Complex, put forth by Reeves (1978) is not widely supported. Reeves (1978:171-172) suggested that McKean hunters were not indigenous to the northwestern Plains region based upon the absence of McKean levels at the UNESCO World Heritage Site Head-Smashed-In in Southern Alberta. The lack of McKean Complex levels to Reeves shows a lack of participation in communal bison drives. The foundation of this theory is negated by other archaeologists such as

Lobdell (1973) and Reher et al (1985) who showed that the occupants of the Scoggin site and the Cordero site (both communal bison hunting sites) have a McKean Complex communal bison hunting strategy but it is not widely practiced.

The dispersal of McKean Complex sites across the Northern Plains appears to have had a rapid start shortly after originating. Syms' (1977) mapping of radiocarbon dates may indicate that the oldest McKean Complex sites are present in the mountain ranges around the Big Horn Basin with younger sites occurring further north and east. Keyser and Davis (1985) agree in part with Sym′s hypothesis that an outward migration occurred, however, ecological adaptations vary greatly. Keyser and Davis (1985) see this information indicating the diffusion of a techno-complex amongst a series of *in situ* populations and that the McKean Complex is actually comprised of several cultural traditions.

The use of Geographical Information Systems (GIS) to study the movements of the McKean Complex has provided some insights on the origins debate. A more recent analysis completed by Mazza (2015) indicated that the oldest McKean sites are located in the mountainous and basin areas such as the Bighorn Basin, the Great Divide Basin, the Wind River Range, and the Wyoming Range of the Rocky Mountains (Mazza 2015). Sites continue into the mountainous regions of the Absaroka Range and the Bighorn Mountains until approximately 3750 B.P. Between 4000 and 3500 B.P. McKean sites appear along the Front Range in Colorado. Generally, these sites appear to be spreading in a north-south direction (Mazza 2015).

7.3 McKean Complex Lithic Tool Assemblage

The McKean tool kit is composed of plano convex endscrapers, spokeshaves, bilaterally-flaked knives, bilateral percussion flake cores and projectile points that are mostly constructed from local raw materials (Mack 2000:241). Hafted knives, spokeshaves, flaked ovoid choppers, and finely ovoid knives are also represented. The McKean Complex tool assemblage on the Northern Plains differs from a usual migratory hunter kit due to the presence of manos and metates as well as grinding stones that are present at the Wolf Willow site and the Dog Child site. This is a direct correlation with the complete and fragmentary manos and metates that were recovered from the McKean Complex type site, as well as many others, all made from local lithic raw materials (Mulloy 1954).

Exploitation of local plant resources is also seen as being a component of a multi-focused subsistence economy of the McKean Complex. Large numbers of manos, metates, and roasting pit hearts are continuously present from the Great Basin to the Northern Plains (Mack 2000). At least ten of these sites are located in Wyoming, Montana, Colorado, Nebraska, and South Dakota. Most of these sites also have hearth features or roasting pits. These features are deep and often rock filled or lined, which would have served as ovens to roast vegetable foods (Keyser 1986). Frison (1978: 352-254) regarded the complex as a "florescence" of the plant food gathering adaptation. This plant food reliance is the reason why several authors proposed the Great Basin Desert Culture as the origin for the McKean Complex (Brumley 1975; Mulloy 1954).

Authors such as Tratebas and Vagstad (1979:220-221) have theorized that instead of seed and plant processing, the manos and metates were used for the crushing of small bones or other non-plant materials. This idea has been contradicted by other authors such as Frison (1978) and Mulloy (1954), who suggest that based on ethnographic evidence from the Great Basin, manos and metates were used largely for seed processing. Others argue for a multi-use scenario regarding manos and metates rather than a single purpose (Adams 1988). The presence of manos and metates signify the extensive use of plant resources indicated a foraging type of subsistence.

It has been argued that since the northern portion of the Northern Plains does not contain manos and metates, this reflects a different economic orientation between the southern and northern McKean groups (Brumley 1975; Mack 2000). Sites such as the Cactus Flower site in Alberta (Brumley 1975), and both the Mortlach site (Wettlaufer 1955) and Long Creek (Wettlaufer 1960) (Saskatchewan) support this notion. However, more recent excavations at WHP contradict this notion because of the many grinding stones as well as manos and metates found in the McKean component of the Wolf Willow site and Thundercloud site (FbNp-25) (Webster 2004:14).

Other sites in WHP such as the Redtail, Cut Arm, and Meewasin have also revealed McKean components. The Redtail site (FbNp-10) has at least seven McKean occupations of which four are associated with McKean Lanceolate points and at least three Hanna style projectile points (Ramsay 1993). The problem of a separation between the McKean complex in the Northern most extent of the Northern Plains and the United States may stem from the problem that a large body of unpublished data from McKean sites in the United States as well as Canada.

7.4 McKean Complex Site Comparison

In order to determine any similarities or anomalies within the lithic assemblage of the Wolf Willow (FbNp-16) and Dog Child (FbNp-24) sites, it is necessary to compare the cultural assemblage with another McKean Complex site. The Cactus Flower site (EbOp-16) serves as a viable comparative site due to well recorded and preserved McKean Complex levels.

7.5 The Cactus Flower Site (EbOp-16)

The Cactus Flower site is located in the southeast corner of Alberta on the Canadian Forces Base, near Suffield (Figure 7.1). This multicomponent site is situated on the bank of the South Saskatchewan River. Excavated between 1972 and 1974, the site contains dates from Pelican Lake to McKean Complex occupations. The McKean Complex occupations are recorded as level III to IX (Brumley 1975:1). A lack of projectile points and diagnostic materials created dating issues for level X. However, a radiocarbon sample from this level provided a date consistent with the McKean Complex radiocarbon dates 3725 +/-95 B.P (Brumley 1975:111).

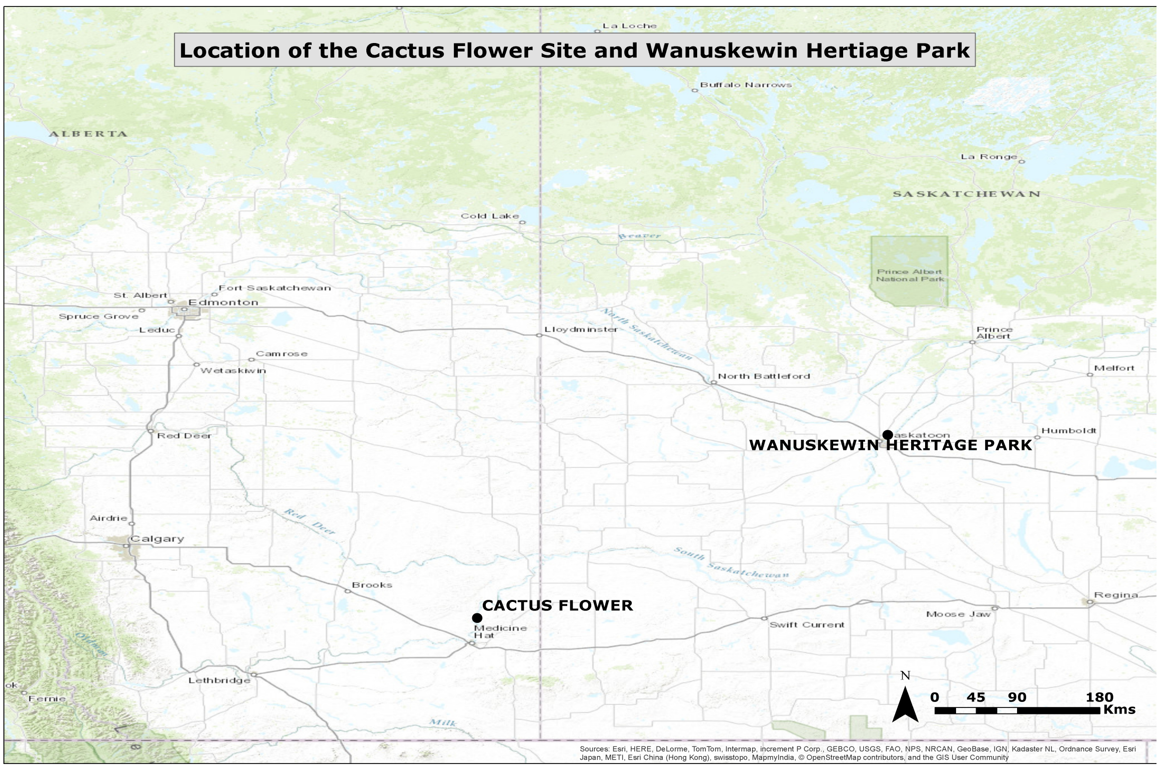


Figure 7.1 Location of the Cactus Flower Site

No radiocarbon dates were acquired from level III. Levels IV, VI and VIII had radiocarbon dates consistent with McKean Complex dates; 3620+/-95 B.P [S-822] to 4130+/-85 B.P [S-782] (Brumley 1975:111). There was an anomalous date that came from a charcoal scatter identified in occupation XI dated to 2130+/- 130 B.P [S-783] (Brumley 1975:111). Since this date was too recent when compared to the others, it was discarded. Dates at the Cactus Flower site range from 3740±100 rcybp (S-1209; cal 4415 [4090] 3783) in Occupation III to 4220±130 rcybp (S-1210; cal 5213 [4828] 4418) in Occupation VII.

The distribution and types of cultural debris from the site are indicative of a secondary processing and tool manufacturing camp (Brumley 1975:95). Lithic tool manufacture primarily consists of local materials, but a small amount of exotics were recovered from the site including obsidian. McKean lanceolate, Duncan, and Hanna style projectile points were recovered from Cactus flower. Brumley (1975:72) believed that this reflected a cultural continuity from occupation IX through III. McKean lanceolate projectile points are most commonly found in the initial McKean Complex Occupations, IX and VIII. Duncan style projectile points predominate the earlier occupations and Hanna points dominate the later occupations.

Occupation III had very few artifacts. The only cultural materials identified were a Duncan projectile point and two Hanna points. Like most McKean Complex sites, bifacial tools (17) were more prevalent in the older occupations with hafted bifaces not evident until Occupation VII. Both pointed and ovate bifaces were sparsely represented in the more recent levels. Endscrapers (27) were small and triangular in form and were present in equal numbers in all levels except cultural level III. Spokeshaves were very rare, three were hafted, and a single non-hafted type were recovered from the McKean Occupations.

Occupation	III	IV	V	VI	VII	VIII	IX	X
McKean Lanceolate		1				2	1	
Duncan	1	1	1	1	2	5		
Hanna	2	2		3		2		
Hafted bifaces					3	1		
Ovate bifaces		2		2	2	3	4	
Endscraper		3	3	5	3	8	5	
Sidescrapers								
Spokeshaves, Hafted		1				2		
Spokeshaves		1						
Cores		11	3	16	8	55	9	1
Hammerstones						2	5	1
Anvils				1		2		
Stone Disk				1				
Stone Pipe						1		

Figure 7.2 Cactus Flower Lithic Assemblage. Adapted from Brumley 1975

There was a lack of identified hammerstones and anvils in the McKean occupations. Five hammerstones were recovered from level IX and a single one from level X. Anvils were only found in level VI and VIII. Non-utilitarian items were recovered including ground stone disks, part of a stone pipe (undetermined raw material) and an ammonite septa (Brumley 1975). Summary of lithics recovered from the McKean levels are depicted in Figure 7.2. The Cactus Flower site is thought to represent a late spring to early autumn hunting camp.

Evidence for tool manufacture for plant processing was not recovered from the site. This has led researchers like Brumley (1975), to suggest that the McKean Complex occupations at the Cactus Flower site relied either heavily or completely on a mobile hunting strategy focused on bison. The soil was screened through a ¼ inch mesh and there was no flotation of samples. The lack of evidence and therefore Brumley’s conclusion could be a result of sampling errors.

7.6 Discussion

In order to assess the similarities of lithic utilization between the McKean Complex sites three sites were compared. The local material types utilized at both the Dog Child site and the Wolf Willow site were SRC, massive quartz, medium to coarse grained quartzite, chert, fine grained quartzite, silicified peat, silicified siltstone, white chalcedony, basalt, silicified wood, black chert, fused shale (porcellanite), granite, yellow chalcedony, and diorite.

Local materials were also the most utilized at the Cactus Flower site. Chert, silicified siltstone, silicified wood, silicified peat, chalcedony and quartzite were the most represented in the assemblage. Exotic materials recovered from the Cactus flower site are obsidian and Knife River Flint (KRF). No sourcing techniques were applied to the obsidian gathered from the Cactus Flower Site, but source areas are likely from Glass Butte, Montana, the Cascade Formation in British Columbia, or Bear Gulch Area in Idaho. KRF is found in secondary deposits in North Dakota and is a highly traded material throughout the Northern Plains.

The location of glacial till within south-central Saskatchewan and southeastern Alberta directly correlates to what local material types would have been present for utilization. Based on data compiled in 2011, at least seven Laurentide (continental) glaciations are recognized in Saskatchewan (Barendregt 2011: 705). These episodes of glaciations have caused multiple till sheets to blanket most of the Canadian prairies. The geology of Saskatchewan is relatively simple resulting in sources for raw materials being limited and often being of poor quality. The Empress Group is the source of the oldest till in Saskatchewan. This till is preglacial and includes quartzite and chert gravel as well as an upper proglacial sand and gravel mixture that contains a mixture of igneous, metamorphic, and carbonate clasts (Christiansen 1992:5). All of these materials in nodule and cobble form can be utilized for tools locally manufactured. Cobbles and nodules are found in situ at both the Wolf Willow and Dog Child sites (Figure 7.3).

Figure 7.3 *In situ* Swan River Chert Cobble

Surficial stratified deposits are one of the most abundant stone deposits in Saskatchewan. This is an informal designation for lacustrine, outwash, ice-content sediments, alluvium, colluvium and aeolian deposits (Christiansen 1979). These deposits can be up to 100m thick and are likely significant sources of local raw materials for WHP. WHP was not free of glacial ice completely until 12,000 years ago, but would have been partially uncovered around 12,500 although glacial lake Saskatoon would have taken up a large amount of total area (Christiansen 1979: 927-928).

Till is heavily concentrated in the Saskatoon region, Wascana Creek, Regina, and Gillam Manitoba (Barendregt 2011:706-708). Interestingly, the three sites focused on for this study are also located in these heavy till locations, further establishing a firmer connection between these McKean Complex sites and a focus on locally procured materials from glacial till. Saskatoon in particular has an extensive record of Pleistocene tills, and a borecore taken from the Sutherland area includes the tills of the Mennon, Dundurn, and Warman formations, which are collectively referred to as the Sutherland Group (Christiansen 1970; 1992). The Sutherland Group includes all sediments between the oldest formation, the preglacial Empress Group, and a younger formation, the Saskatoon Group. The Sutherland Group is defined from outcrops along the North Saskatchewan River Valley as well as borecores. The outcrops of this formation allow the materials within the till to be gathered along both the South and North Saskatchewan River Valleys in close proximity to both the Wolf Willow and Dog Child sites. The Cactus Flower site has very similar till geology to Sasaktchewan, that helped create a focus on locally procured materials.

It is apparent that for some reason, whether it is territory, possible source locations, or cultural preference that local materials were the most highly utilized for tool manufacturing. This is a pattern that has continued up from the Great Basin and Plateau regions. Most of the materials from WHP could be found in Opimihaw Creek Valley as well as the Saskatchewan River basin of which are within a 5km radius of both the Wolf Willow site and the Dog Child Site. The Cactus Flower site is also present on a river terrace overlooking the South Saskatchewan River which means that the inhabitants of the area would have had the opportunity to look for chert, chalcedony, and quartzite nodules from the till in the adjacent drainage basin.

7.7 Summary and Conclusions

As stated previously, local adaptation is a central component to the McKean Complex. It is apparent from these three sites located in the Northern Plains, and the general summary of McKean sites from the Great Basin and Plateau regions, the pattern of the McKean Complex utilizing local lithic resources continues past the United States border. The majority of lithics recovered from the Wolf Willow, Dog Child, and Cactus Flower sites were local materials that could have easily been gathered from the local environment around the sites.

The mobility of Paleoindian groups has been partly reconstructed using lithic material types and trade networks. The same type of mobility may apply to the McKean Complex. Saskatchewan, in general is lacking in high quality lithic sources. Generally it is thought that the environment of the Northern Plains is not conducive to low mobility for people due to the harsh seasons and unpredictable resources. This model cannot be applied to WHP since the park is an ecological island with suitable lithic materials. The ecological resources of the area allowed people to settle with dependable resources. People utilizing the ecological region of WHP most likely did not have to range as much as other people during this time period which may have allowed them to be more self-sufficient and rely on local materials.

The locally procured lithic material is satisfactory for lithic tool production. With heat treatment, SRC, quartzite, and other miscellaneous cherts become more suitable for tool manufacturing. The natural state of local materials is satisfactory for tool production. Due to this there is no need to spend energy and resources on trade for better raw materials. Rather, people could focus their energy on other aspects of subsistence such as trade for more prestigious items. Exotic materials found in these three sites such as obsidian and brown chalcedony are commonly traded material items on the Northern Plains. It is not surprising that they are represented in these assemblages to an extent. At WHP and the Cactus flower site in Alberta, the local pattern that the McKean Complex is known for in the Great Basin and Plateau appears to extend into the Northern Plains.

Chapter 8

An Elaboration of Eldon Johnson's Saskatchewan Lithic Materials

8.1 Introduction

The first part of this thesis was concerned with data analysis and identifying any patterns of raw material utilization from the McKean levels at WHP. The second purpose of this thesis is to add to the discussion of local raw materials in Saskatchewan. This includes an elaboration of Eldon Johnson's (1998) "Properties and Sources of Some Saskatchewan Lithic Materials of Archaeological Significance". The main objective is to provide an updated valuable lithic identification resource that archaeologists can utilize. Lithics analyzed from both the Wolf Willow and Dog Child sites are used to update the past materials that Johnson focused on. These materials included quartzite, chert, silicified peat, silicified wood, silicified siltstone (pebbles, gronlid and felspathic), and porcellanite (fused shale). Chalcedony (brown chalcedony, agate), granite, massive quartz, and basalt were absent from Johnson's past analysis. Since these materials were recovered from WHP they are added to this update. For a visual reference of geological formations refer to Appendix H.

8.2 Metamorphic Rocks

Metamorphic rocks are igneous or sedimentary rocks that have been altered through exposure to high temperatures and pressure. The type of metamorphic rock is dependent on the original texture, the amount of heat and pressure, as well as fluid that passed through the stone during alteration. Metamorphic rocks are commonly found in Alberta and Saskatchewan and are much harder than many other types of rock. These rocks were used for hearth construction, in boiling features, and other structures (Bubel 2014). Quartzite and fused shale are the most common metamorphic stones found in Saskatchewan.

8.2.1 Quartzite

Johnson (1998) originally separated quartzite into two categories, “Athabasca Quartzite” (tan/white/”mauve”) and “Rocky Mountain Quartzite” (tan/white/blue/grey/purple/pink). Since a chemical analysis was only completed for one of the types, both categories will be combined under the geologic term quartzite. There are generally two different “types” or “categories” of quartzite; coarse-grained quartzite and medium to fine grained quartzite. Quartzite has a large variation in texture, colour, and lustre. Generally, quartzite is present in cobble form. The metamorphic alteration of sandstone changes the structure of the quartz grains. This allows a more even fracture of the material but the grainy structure of the rock limits the ability to create thin flakes (Bubel 2014).

Quartzite can be heat treated, usually resulting in a secondary colour change. Red is the most common colour in heat-treated quartzite. This material is used to make a variety of tools in Saskatchewan and it occurs in the archaeological record in boulder form, commonly known as a glacial erratic. The larger erratics like the Big Rock in Okotoks, Alberta, commonly have pictographs and petroglyphs associated with them. The structure of the material is usually massive, but can have banding. Quartzite cortex is dull in lustre and has polishing, impact scars, and striations from fluvial transportation and glacial movement. Johnson (1998:30) described potential sources for quartzite as Northern Saskatchewan exposures, Wollaston Lake, Geikie River, Uplands of the Cypress Hills, Wood Mountains, and in an area east of La Ronge. The abundance of this raw material throughout Saskatchewan can account for its presence in most sites in the archaeological record. Various quartzite samples are depicted in figures 8.2, 8.3, and 8.4.

Figure 8.2 Heat Treated Quartzite

Figure 8.3 Quartzite Biface

Figure 8.4 Quartzite Nodule Fragment

8.2.2 Fused Shale (Porcellanite)

Porcellanite and fused shale are two terms that are used interchangeably within North American archaeology. Both have been used to refer to a type of fused shale that occurs in the roof and floor of burned coal seams. It has been referred to in the archaeological literature under a variety of names such as “fused brick”, “metamorphosed siltstone”, clinker, orthoquartzite, silcrete, Powder River chert, and Silicified siltstone. The term has been applied to a wide variety of stones from impure chert to baked clay to silicified tuff (Rapp 2009).

One definition of porcellanite is that it is a silica cemented mudstone that forms in fossil soils and playa lakes through migration of fresh water through sediments saturated with hyperalkaline water that favours silica suspension (Knauth 1979). Miller (2010) believed that the definition of this material depended on the size of the clasts or grains that constitute the rock and that porcellanite forms through subaerial weathering of silica-bearing sediment or rock and the subsequent concentration of the silica in zones (2010: 562).

This stone has also been defined in terms of being a clinker (metamorphic rock). Baked shale is a low-grade low-heat clinker, “Porcellanite” is a medium-grade, medium-heat clinker, and non-volcanic glass (or fused shale) is a high-grade, high-heat clinker (Frison et al 1968). This material was also deemed to be an impure chert by Jackson (1970:406). Most terms for this stone are out of date with current geology. Johnson chose to refer to the material as “fused shale” since this is the term that more closely correlates with the formation of the stone. The term porcellanite is mostly used by archaeologists and simply implies that the stone looks like ceramics. For the sake of consistency and in agreement with Johnson, this material will be referred to as “fused shale”.

Fused shale is recognizable by its fine-grained unglazed ceramic-like texture, which has a dull to slightly vitreous lustre. There are large outcrops of this stone in Montana (Clark 1985). It consists of a mixture of silty clay and calcarous matter that was silicified with a large amount of opaline silica (Rapp 2009). It can be created in a number of ways, but is often found on the floor and roof of burned coal seams. It is generally a single opaque colour that can be greyish or reddish. It also may contain vesicle inclusions that are discernable with a hand lens. It is less hard, dense, and vitreous than chert. Fused shale can occur wherever coal beds and seams are present. Coal seams are present in Saskatchewan in the Ravenscrag Formation that dates to the Paleocene era (Johnson 1998). Two sites exist near the village of Big Beaver and exposures near Estevan provide the province of Saskatchewan with ample fused shale resources. Images depicting fused shale can be seen in Figures 8.5 and 8.6.

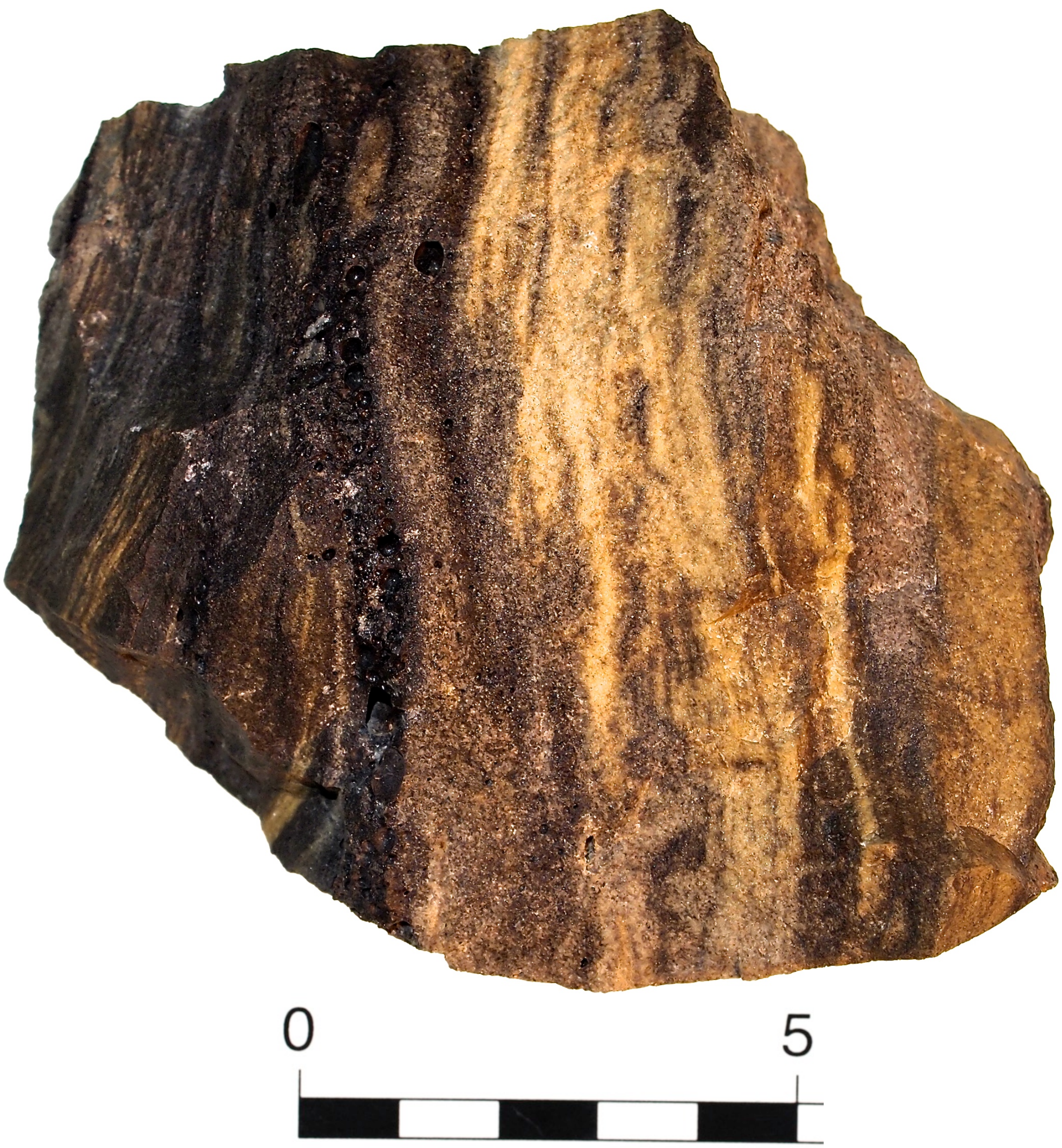


Figure 8.5 Fused Shale

Figure 8.6 Fused Shale Core

8.3 Sedimentary Rocks

Sedimentary rocks provide the greatest variety and absolute quantity of lithic material that is present within the archaeological record in Saskatchewan. These rocks are created when chemical, clastic, or organic sediments are cemented together near or on the surface of the earth. Sandstone, mudstone, and siltstone are made up of clastic sediments, but were rarely used for lithic production because the fracture path follows the grains of the rock thus creating an uneven fracture and softer hardness level.

Precipitation of silica can create sedimentary rocks called silicates. Chalcedonic silica Si^{02}, the most dominant chemical within most lithics in the archaeological record, is not considered a mineral because it does not have a crystal structure. However, it is the most dominant molecule when determining if a stone is suitable for tool production. Si^{02} has an ability to create a tetrahedral coordination with four oxygen atoms surrounding a central Si^{02} atom (Kooyman 2000). This creates a stable bond meaning it contributes to a homogenous stone that fractures more evenly due to these stronger bonds.

The most common example of this is seen in the quartz crystalline form of silica Si^{O2}. This group has a three-dimensional framework that is non-ferromagnesious (does not contain iron or magnesium). Element impurities give the mineral unique characteristics such as colour and texture. Microcrystalline and cryptocrystalline silicate minerals have crystals that can be viewed with a microscope. Amorphous silicates lack any crystal structure that are therefore difficult to view. These features are used to classify the variety of silicates found, such as basic chert, flint, jasper, agate, and chalcedony all of which are commonly used for lithic tool production (Andresfsky 2005; Bamforth 1991; Bamforth 2002; Boras 1991; Bouldurain 1991; Bubel 2014; Clark 1984; Johnson 1998). Common sedimentary rocks from Saskatoon include cherts (Swan River chert, Pebble chert, Cathead chert, Precipitated chert), silicified peat, silicified wood, siltstone (gronlid siltstone and feldspathic siltstone), and chalcedony (agate and brown chalcedony).

8.4 Chert

8.4.1 Swan River Chert

Swan River Chert (SRC) is a sedimentary rock and is the most common lithic material recovered from the Dog Child and Wolf Willow sites in WHP. SRC is a cryptocrystalline silicate and has nonfibrous microscopic crystals of fine-grained quartz. There are three characteristic crystal habits of SRC. First is a medium-grained chalcedonic spherulites, second is a larger grained well-shaped granoblastic quartz, and third is a fine grained poorly shaped quartz (Low 1996: 165).

Archaeologists have misidentified and continue to misidentify SRC in archaeological assemblages (Low 1996: 167). Most commonly, SRC has been misidentified as a porous quartzite, when in truth, it is a porous chert and can be difficult to work with since nodules within the stone are full of voids called vugs. Vugs are irregular crystal growths that occur throughout the stone's matrix.

SRC is commonly mistaken for white chert, Etherington Chert (from a quarry in the Crowsnest Pass in Alberta, Canada), fine quartzite, and even jasper in some instances. Colours range from whites and greys to reds, blues, and yellows. This colour range has contributed to misidentification of the material. The lustre of SRC can be glassy to waxy. Due to the lack of homogeneity, SRC is commonly heat-treated. Heating elicits a structural change that causes some types of lithic material like chert to behave more like glass and, therefore, fracture more evenly (Low 1996:165). Since SRC is a coarser material it only needs to be heated to approximately 300 degrees (Johnson 1986, Low 1994). SRC has been used by people from all prehistoric cultural complexes that have occupied Saskatchewan with the exception of the fluted point traditions (Johnson 1998:28, Leonoff 1970:28).

SRC is known as the most common lithic type for Manitoba and Saskatchewan (Leonoff 1970:28). The distribution of SRC extends from south to west central Manitoba to a larger area of the Northern Plains and Southern Boreal forest (Leonoff 1970:29, Low 1996:165). The distribution of SRC has a connection between many of the collection locales and glacial deposits that dot Saskatchewan, Alberta, and Manitoba. SRC occurs naturally over a large area of the Northern Plains due to the till geology of the area. Wisconsinan glacial processes (Christiansen 1979) are directly responsible for the geologic occurrence and distribution of SRC (Figure 8.7).

The advance and retreat of the Laurentide ice sheet explains the vast geographical range of this material (Low 1996:168). These ice sheets travel in consistent directions moving southwest out of the Hudson Bay area and continue that trend across Manitoba, and southern Saskatchewan into the fringe areas of southeastern Alberta, northern Montana, and north/north-eastern North Dakota which coincides with the geographical range of SRC (Low 1996: 169). This material was likely scooped up by the Wisconsinan ice mass out of the Hudson Bay area and carried by the Laurentide ice sheets. This most likely occurred between 14000 years ago to 10000 years ago (Low 1996:169).

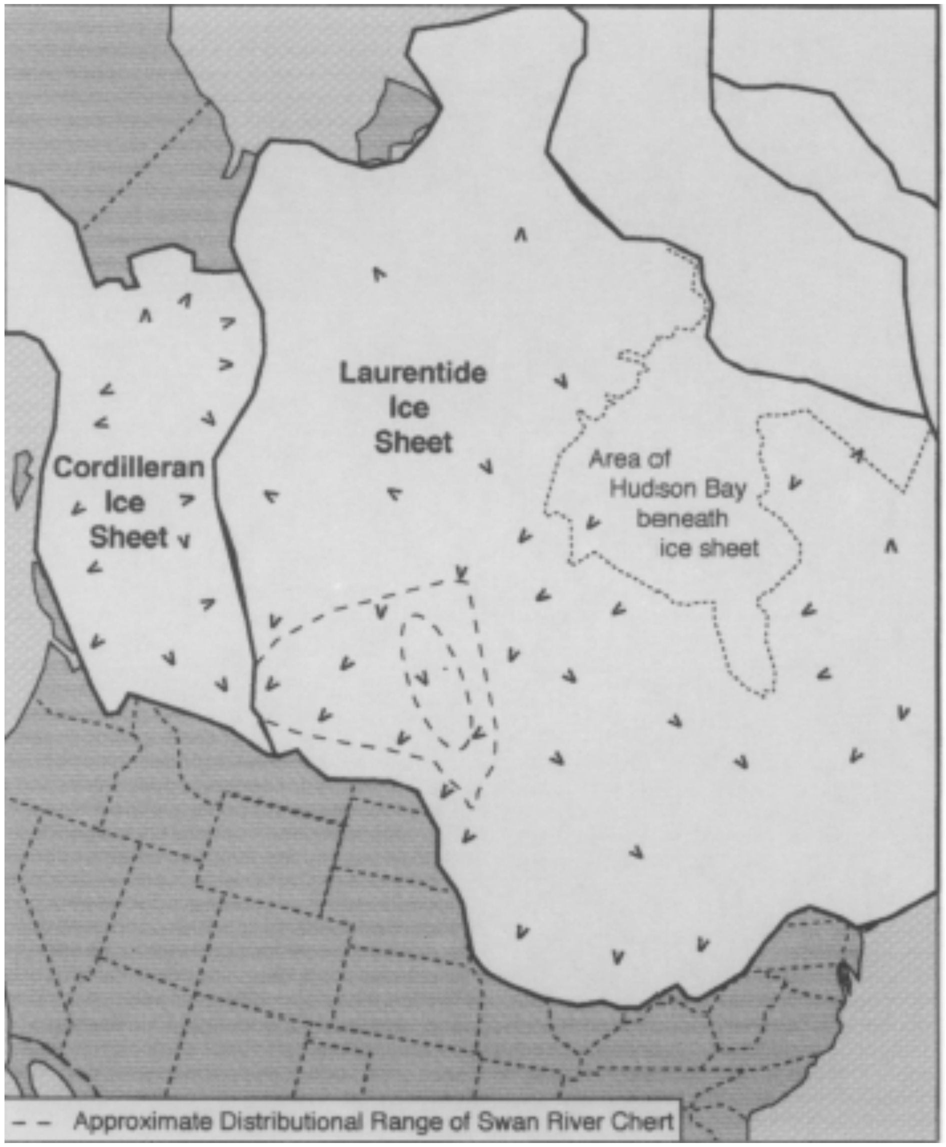


Figure 8.7 Distribution Range of Swan River Chert (Low 1996)

A primary bedrock source for SRC was found in Mafeking quarry in west-central Manitoba. This location is an exposure of the Devonian Souris River formation in Manitoba (Grasby et al 2002: 276). Images of SRC are depicted in Figures, 8.8, 8.9, 8.10, and 8.11.

Figure 8.8 Swan River Chert Debitage

Figure 8.9 Swan River Chert Biface

Figure 8.10 Swan River Chert Projectile Point

Figure 8.11 Swan River Chert Projectile Point

8.4.2 Pebble Chert/ Silicified Siltstone Pebbles

Known broadly throughout Alberta and Saskatchewan, pebble chert, or black pebbles, are a highly used material at WHP. Johnson (1998:36) mentioned that a petrographic analysis indicated to him that these pebbles are composed of silicified siltstone rather than chert. Steuber (2008) noted that while siltstone pebbles appear to be found in river gravels and pockets throughout the Canadian Plains, pebble chert is indeed a chert that originates from the Neutral Hills area in Alberta (Steuber 2008:22). Since a new petrographic analysis was not possible for this study, it is assumed that there are both silicified siltstone pebbles gathered from local valleys and chert pebbles present in Saskatchewan. Both silicified silstone pebbles and pebble chert were recovered from the Dog Child and Wolf Willow sites and are considered to be local materials.

Odell (2004) notes that the bipolar technique is used in splitting open large nodules and cobbles as well as small pebble cores and is effective in economizing raw materials. Potential source areas include the Consort Pebble Chert Quarry site (EkOr-8), located south of the town of Consort in east-central Alberta. Quigg (1977) also reported a pebble source within the Neutral Hills. Grassy Lakes, Alberta is also a known source for pebble chert. Silicified siltstone pebbles are present in glacial drift deposits of west-central Saskatchewan. The most common colour of Pebble chert is black, but the colour can range from light grey, mauve, green, yellow, to dark brown as well. The cortex of most pebbles is black and is well polished. The lustre tends to be dull to waxy with the texture ranging from fine grained to very fine grained. This material is pebble sized and the typical shape is a flattened ellipsoid (Johnson 1998:36). Images of this material can be seen in Figures 8.12 and 8.13.

Figure 8.12 Pebble Chert Ventral Face

Figure 8.13 Pebble Chert Cortex

8.4.3 Cathead Chert

Cathead chert is a bluish/white/grey chert (Figure 8.14) that is found in the Grand Rapids area in Manitoba and central Saskatchewan. The name comes from the Cathead member of the Red River Formation comprised of dolostone of Ordovician age. Petrographic or chemical analyses are usually not completed in identification of this material. Cathead chert is fine to very fine grained in nature and exhibits a vitreous to dull lusture. Natural exposures also occur near the village of Riverton in Manitoba (Leonoff 1970: 26). It is likely that it also occurs in Dolostone exposures in Saskatchewan as well.

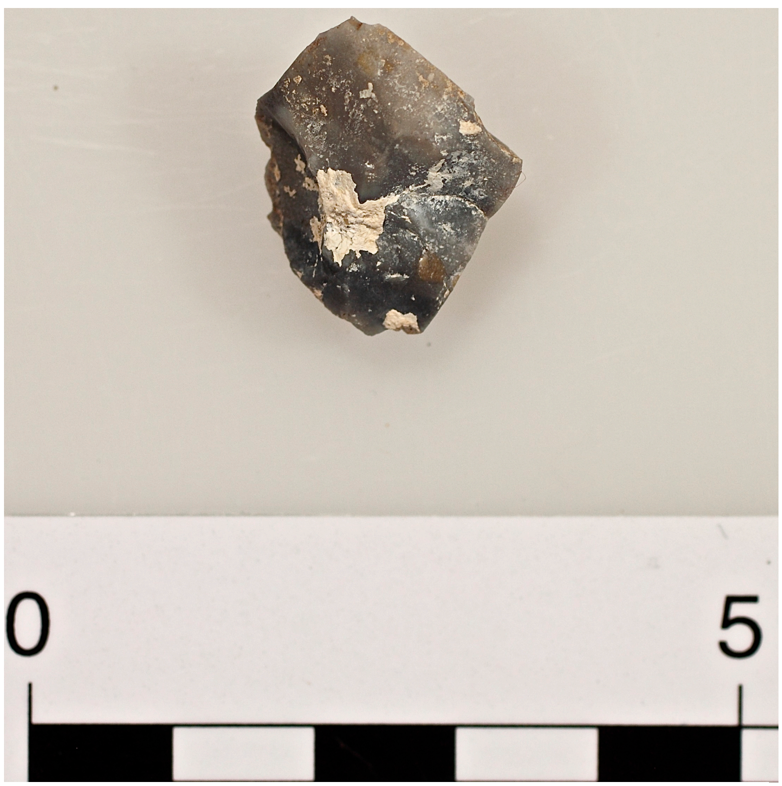


Figure 8.14 Cathead Chert Fragment

Cathead fossils of algae and baculites are found along the west shore of Lake Winnipeg, in bedded fine-grained dolostones of the Cathead Member and Red River Formation (Leonoff 1970:25). Fossils from this area have long been known since it is most famous for algae (Young et al 2012). The ancient marine sea environment would have eventually become the Cathead chert found in Saskatchewan in archaeological assemblages.

8.4.4 Precipitated Chert

This type of stone is a replacement chert that is formed when a silica rich fluid percolates through a porous material such as limestone, wood, peat, and rock voids (National Audubon Society 2010). A banded type of chert found in WHP is referred to as precipitated chert. The stone is fine grained and has a dull lustre. The cortex of this stone is grainy in texture and is composed of limestone. Colours include but are not limited to blue, yellow, white, and grey. The original creation of the stone would have been in a laminated limestone deposit. It is likely that this is a material gathered locally from till exposures, deposits, and drainage basins throughout Alberta, Saskatchewan, and Manitoba. Precipitated chert is often found as small nodules of carbonate, which when broken open reveal a core of chert. Images of this material are depicted in Figures 8.15, 8.16, and 8.17.

Figures 8.15 Precipitated Chert Debitage

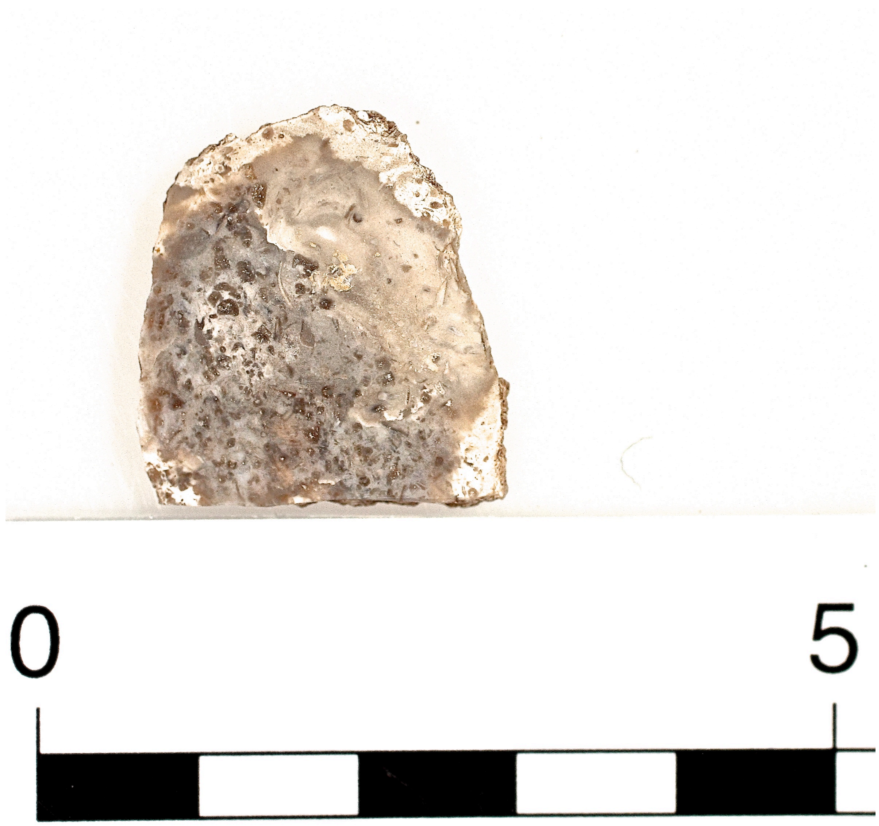


Figure 8.16 Precipitated Chert Ventral Face

Figure 8.17 Precipitated Chert Cortical Face

Figure 8.18 Precipitated Chert Retouched Flake

8.5 Silicified Peat

Silicified peat, depending on the quality, has been misidentified as chalcedony or chert in the archaeological record. Other names for petrified peat in Saskatchewan as Johnson (1998) noted, are petrified bog, silicified lignite, petrified wood, petrified sard, and South Saskatchewan River Chalcedony. Even though natural silicified peat tends to be very fine grained, it is a tough material to chip due to the grains of the peat. Johnson (1998:33) noted that “inherent parting planes may limit the usefulness of the material in any specific nodule but on the other hand, where the parting planes were suitably spaced and reasonably parallel, they permitted a nodule to be separated". When heat-treated the material becomes easier to fracture and has a tendency to fracture more evenly. This stone is comprised primarily of silica. The colour of silicified peat ranges from a light grey to a dark brown. Lustre of the stone tends to be glassy to dull. Texture of silicified peat ranges from very fined grained to fine grained. Cortex may be lighter in colour and it is common for a patina to cover this stone and may be mistaken for cortex. Small tabular nodules of a cobble size are most commonly utilized. Sources are present near Lake Diefenbaker and in areas that experience erosion and in gravel deposits throughout the province. Images of this material are depicted in Figures 8.19 and 8.20.

Figure 8.19 Silicified Peat

Figure 8.20 Silicified Peat with Patina

8.6 Silicified Wood/ Petrified Wood

Silicified wood is formed when wood is fossilized and replaced with silica. It is also called petrified wood or agatized wood. Petrified wood is a more appropriate term to use if materials other than silica such as carbon or quartz replace the original material. Silicified wood can be difficult to fracture due to the original structure of the wood (growth rings). Similar to silicified peat, heat-alteration can cause this material to fracture more easily. Heat-treatment will also turn the stone a darker colour. Silicified woods are amorphous or granular in texture. There is no distinctive cortex for silicified wood but a white patination can occur. Colours can range even in a single sample, but yellows, reds, browns, and greys are the most common. Lustre can be opaque to vitreous. Silicified wood can be found in secondary till deposits in Alberta and Saskatchewan, but a well-known source of silicified wood can be found in the Wood Mountain Formation south of Rockglen, Saskatchewan. Images of this raw material are depicted in Figures 8.21, 8.22, 8.23, and 8.24.

Figure 8.21 Silicified Wood Fragment with Patina

Figure 8.22 Silicified Wood Projectile Point Base

Figure 8.23 Agatized Wood Debitage

Figure 8.24 Petrified Wood Fragment

8.7 Silicified Siltstone

Silicified siltstone is a fine-grained sedimentary rock. It is opaque and is generally dark in colour. It also tends to have a dull resinous lustre. Due to the laminated structure of silt deposits, banding is commonly present. It can be identified because its silt particles can be seen with the naked eye or a hand lens. Sources are known in the Nordegg and Banff area in Alberta as well as in pebbles from mountain drainages. It can also be found in river valleys and drainages in Saskatchewan. A silicified siltstone image can be seen in Figure 8.25.

Figure 8.25 Silicified Siltstone Debitage

8.7.1 Gronlid Siltstone

Other names this stone has been referred to as are “altered felsic lava” and “River House chert”. Gronlid siltstone is the most correct name because it links this material with the bedrock erratic found north of Gronlid (Johnson 1998:37). The greatest proportion of Gronlid siltstone recovered from precontact occupations is in the east-central portion of Saskatchewan. As a material, this type of siltstone tends to break off in long feathered flakes.

Gronlid siltstone gets its salt and pepper colour from black siltstone fragments embedded within a light grey siltstone. Some of the carbonate within the stone has been replaced by silica while the majority of the stone is composed of microcrystalline carbonate. This stone is comprised of 95% silica where aluminum, iron, and carbon contribute to colour. The cortex of this material is composed of light coloured calcareous shale. Since this is a porous material and can crumble easily, many Gronlid siltstone artifacts have no cortex. Material can have patination that will appear to look like “grey mottling” (Johnson 1998:38). Formed as lens embedded shale, nodules were fractured during glaciation and were deposited across Saskatchewan.

This material can be ascribed with a certain amount of confidence to the Turonian Favel Formation of the Upper Cretaceous (Appendix H). This formation was ground up by glacial movement that resulted in this type of siltstone being distributed in a region that lacks clear borders. There is a small significant deposit near Lake Lenore (Johnson 1998:29). James Finnigan while conducting an assessment at the Nipawin Dam Archaeological Project in 1985 reported an outcrop of Gronlid siltstone on the north bank of the South Saskatchewan near the town of Codette (Johnson 1998:29). Images of this raw material are depicted in Figures 8.26, 8.27, 8.28, and 8.29.

Figure 8.26 Gronlid Siltstone Debitage

Figure 8.27 Gronlid Siltstone Cortex

Figure 8.28 Gronlid Siltstone Nodule

Figure 8.29 Cross Section of Gronlid Siltstone

8.7.2 Feldspathic Siltstone

Commonly misidentified as quartzite or argillite, feldspathic siltstone is a fine-grained material that can be shaped fairly easily with soft percussion. The rock is composed of sub-angular to angular detrital quartz grains. Muscovite, feldspar, and clay minerals are also present within the stone (Johnson 1998). Red is the most common colour of this material. The texture tends to be fine grained. Mica crystals will show when there is a fresh fracture of the stone. Known sources for this material include tertiary gravels, surface deposits, and exposures. The original source is most likely in Montana and the gravels travelled fluvially into southwestern Saskatchewan (Johnson 1998). Images of Feldspathic siltstone can be seen in Figures 8.30, 8.31, and 8.32.

Figure 8.30 Feldspathic Siltstone Core

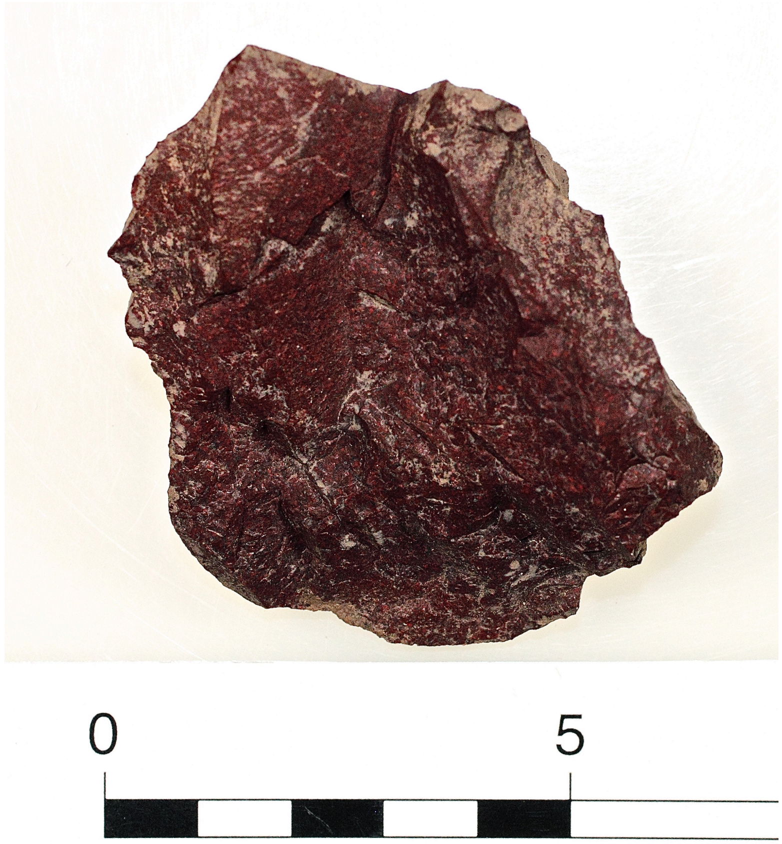


Figure 8.31 Feldspathic Siltstone Ventral Face

Figure 8.32 Feldspathic Siltstone Cortical Face

8.8 Chalcedony

Chalcedony is much more translucent material than chert due to more extracrystalline water and fewer impurities present in the material. There are a number of specific names for varieties of chalcedony such as agate, flint, petrified wood, petrified peats, and jaspers. Petrified woods and petrified peats consist of both opaque to translucent varieties of chalcedony that have replaced and replicated the molecular and cellular structure of wood or other materials (Leonoff 1970; National Audubon Society 2010). Chalcedony can be sub-classified based on colour and the presence or absence of banding, dendrites, and mottling. Unless petrographic or microscopic analyses can be completed on material recovered, calling the material chalcedony is the most accurate term that one can use. This group does not include jasper, an opaque cryptocrystalline silicate that is typically red to brown and is typically rare to find in Saskatchewan. The texture of the material is microcrystalline and very fine grained. Colours range from clear, yellows, reds, whites, and browns and the lustre will be dull. Images of chalcedony are depicted in Figures 8.33 and 8.34.

Figure 8.33 Blue Chalcedony

Figure 8.34 Yellow Chalcedony

8.8.1 Brown Chalcedony

Brown chalcedony can have a waxy to dull lustre and very fine texture. A typical brown chalcedony found in Saskatchewan is a dark to medium amber brown colour (Figure 8.35, 8.36, 8.37, and 8.38). This colour however, can be homogenous or mottled as well as vitreous and slightly translucent. Colourless areas can be completely translucent whereas the dark patches may be opaque.

Figure 8.35 Brown Chalcedony

Brown clacedony is similar to Knifer River Flint, a material located in North Dakota. Artifacts not made of KRF have been labelled as such based on colour alone which is flawed. This is a significant problem within Northern Plains archaeology because a number of sources of these non-KRF rock types are present in the Northern Plains, such as Hand Hills chert from Alberta (Bubel 2014).

Figure 8.36 Brown Chalcedony Biface

Figure 8.37 Brown Chalcedony Nodule

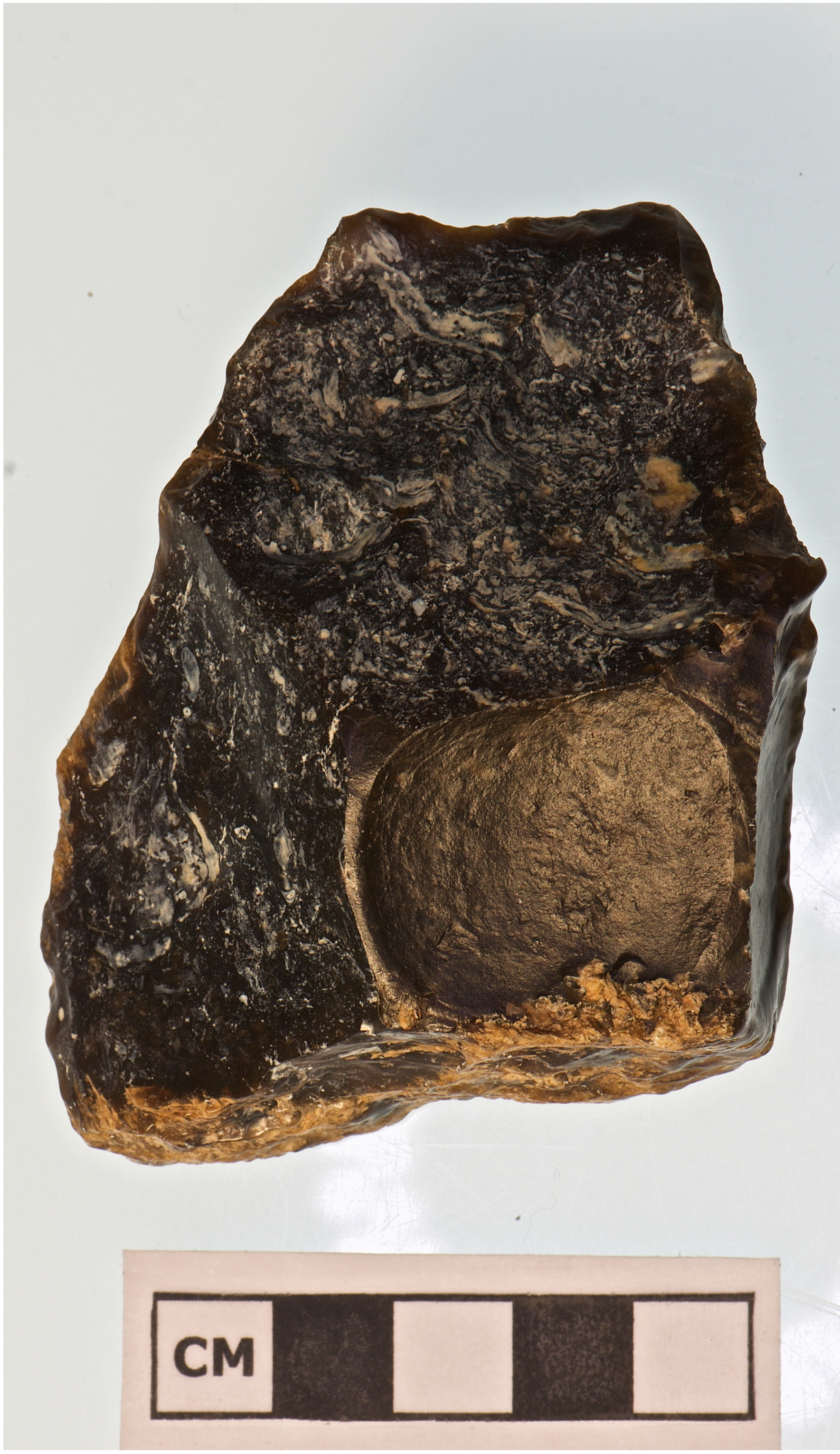


Figure 8.38 Brown Chalcedony Ventral Face

8.8.2 Agate

Agate is a cryptocrystalline variety of silica (Figure 8.39). It is a moderately translucent chalcedony that through the mixing of silica dioxide and some opal can have a moss-like appearance and a variety of colours (Bubel 2014). Agates are commonly characterized by bright colours that are dependant on what minerals and elements were present in the siliceous solution at the time of formation. They range from whites, blues, banded combinations to reds and blacks.

Figure 8.39 Translucent Agate Nodule

Agates occur as nodules in volcanic rocks or in former cavities that once held volatiles in the original molten mass (National Audubon Society 2010). Variations in agates can be due to the conditions of deposition. It is common for bands of chalcedony and agate to alternate with bands of crystalline quartz. The cortex in most instances will appear to be dull and similar to quartzite. The occurrence of agates in Saskatchewan is rare. Nodules can be found in secondary glacial fluvial deposits throughout the province.

8.9 Igneous Rocks

Igneous rocks are created from differential cooling rates of magma (molten rock below the surface of the earth) and lava (molten rock on the surface). The cooling rate of the magma and lava directly affects the texture of the igneous rock. Quickly cooled magma may not have crystals visible to the naked eye. Microcrystalline rocks, including basalt, fracture conchoidally making them better suited for lithic tool production. Rapid cooling of magma can create a glassy texture that has no visible crystals at high magnification. Obsidian is prized as a raw material due to this process. Magma that is slowly cooled results in larger crystals, which creates macrocrystalline rocks such as granite. Igneous rock colour is tied to the mineral composition. Dark igneous rocks tend to be rich in iron, calcium, and magnesium whereas lighter rocks contain more silica and aluminum (Andrefsky 2005). Granite, massive quartz, and basalt are the most common igneous rocks found in Saskatchewan.

8.10 Granite

Granite is one of the most widely found igneous rocks in Canada. Unlike obsidian that was cooled quickly, granite is cooled slowly which causes large crystals to form. The predominant minerals of granite are quartz, feldspar, and mica. Depending on what other elements are present, a variety of colours such as pink, white, orange, and grey can occur. The coarse-grained massive texture of granite makes it extremely hard. For this reason knapping is difficult, but it can be effectively utilized for a hammerstone or similar tool. It is locally available as a cobble. This raw material is depicted in Figure 8.40.

Figure 8.40 Granite Hammerstone

8.11 Massive Quartz

Massive quartz is an igneous formation of silica crystals. It forms within cooling molten rock and builds a six-sided quartz crystal that is often distorted to the point where it lacks crystal faces which creates a massive appearance (Bubel 2014). Normally the colour is white or transparent. Tinges of pink, yellow, and black can be seen due to mineral impurities. It is highly translucent and vitreous. Massive quartz can be used in a variety of well-formed artifacts. It can be found in secondary alluvial deposits and glacial tills. It is highly translucent and vitreous. Examples of this raw material are depicted in Figures 8.41 and 8.42.

Figure 8.41 Massive Quartz Debitage

Figure 8.42 Massive Quartz Debitage

8.12 Basalt

Basalt is a dark fine to coarse-grained igneous rock that ranges from grey to black or dark green in colour (Crabtree 1972:36). The lustre tends to be dull and it is opaque. The presence of small vesicles and small glass shards can distinguish it from silicified siltstone and quartzite (Figures 8.43 and 8.44). Basalt will have white crystals similar to vugs on SRC. Basalt is commonly used for flaked tools and hammerstones. In Saskatchewan, basalt is only found in secondary glacial till deposits. Exposures of till on the plains or water drainages are the best areas to find basalt in Saskatchewan.

Figure 8.43 Basalt Debitage

Figure 8.44 Basalt Cortex

8.13 Common Issues in Terminology

There is a tendency in archaeology to ignore geological descriptions of materials and instead use the original name a stone was given in the archaeological literature. This is a problem that Johnson pointed out in 1998 and still remains an issue today. There still is a lack of confidence in using lithic materials as a genuine source of information in archaeology. This is perhaps due to a lack of knowledge about geology in general. This hesitation can result in a lack of information concerning developing theories about Precontact activities such as tool production and trade networks.

Terminology has been a constant issue and has contributed to problems in studying archaeological lithic materials. The nomenclature of lithic materials is usually dependent on the dominant mineral present within the stone, or in archaeology, they are named by common usage or by the name they were first published under. Leondoff (1970), Thomas (1983), and Johnson (1998) have attempted to resolve this issue in their respective works. The only way to remedy this issue is to use consistent geological terms that are based on of how the stone itself was formed. Without a general understanding of geology, materials like SRC, Chalcedony, Siltstones, and KRF, which exhibit different colours and textures, can commonly be misidentified. This can affect information concerning trade networks, territory, and tool production.

Archaeology is a profession that is known for borrowing methodology from other professions. This is not a fault, but perhaps one of the most interesting aspects about archaeology that make this a discipline that survives and remains relevant in today’s society. This becomes an issue when terminology and concepts are brought over to archaeology but not understood. Using geological names rather than archaeologically inconsistent terms will further the discipline and allow a deeper level of understanding to exist and ease regional comparisons between raw material types.

8.14 Summary and Conclusion

The 17 material types described above can be locally found and utilized at sites all over Saskatchewan. This chapter is meant to be a valuable resource for future archaeologists in lithic identification. The lithics that were analysed for this thesis were used to create an updated version of Eldon Johnson's 1998 published work. Issues in terminology, sourcing, and identification were explored in order to represent a extensive manual for North American archaeologists to utilize in future research.

Chapter 9

Summary and Conclusion

This thesis was designed to complete a lithic analysis on the Wolf Willow site (FbNp-26) and the Dog Child site (FbNp-24), to determine if the McKean Complex at WHP utilized locally procured or exotic lithic materials. This was completed to learn what types of lithic raw materials were being utilized at WHP during the McKean Complex occupation and the extent of dependence of the site's inhabitants on local geological deposits. The results of this were then used to assess whether the McKean Complex levels at three separate sites on the Northern Plains fit into the overarching pattern of McKean Complex and local lithic source utilization. The end goal of this thesis was to update Eldon Johnson's 1998 "Properties and Sources of Some Saskatchewan Lithic Materials of Archaeological Significance" with the data derived from this thesis to create a new resource on lithic raw materials for Saskatchewan archaeologists to use.

The majority of the lithic material recovered from the Wolf Willow site cultural level 3 is locally procured. A heavy reliance on heat-treated SRC, quartzite, massive quartz, and local cherts is clear. Locally procured materials dominate all artifact categories and are procured from a 400-kilometer radius near WHP. Most materials used for lithic manufacturing from the McKean Complex at the Wolf Willow site could have easily been acquired from the local area. After an analysis of the lithic materials recovered from Cultural Level 3, it is clear that the Wolf Willow site follows the overall pattern of McKean Complex sites on the Northern Plains.

Local lithic materials were relied upon on at the Dog Child site (FbNp-24) as well. The focus on locally procured lithic material rather than exotic trade material could allude to territorial boundaries for the people who occupied the Dog Child site during the McKean

Complex. Exotics are not being traded for in large quantities which may allude to the inhabitants having access to suitable materials locally. The analysis proves this theory correct. Raw materials easily gathered from the local area meant that the site was mostly self-contained in terms of stone tool materials.

If SRC is present at a site people tend to use it over other materials possibly because it is so easily heat-treated. Comparing the results of the Dog Child site with the Wolf Willow site, the heavy utilization of SRC and heat treatment supports this. Over 90% of the recovered lithic material was SRC and over 90% of that material was thermally altered. It is logical that the people inhabiting the Wolf Willow and Dog Child sites would stay in the WHP area since it was an ecological island for habitation year round. Occupants could have heat altered the large amount of SRC that was locally procured rather than spend extra energy and time procuring exotic stone tool resources. Local materials were also the most utilized at the Cactus Flower site in southeast Alberta. Chert, silicified siltstone, silicified wood, silicified peat, chalcedony and quartzite were the most represented in that assemblage.

The location of glacial till within south-central Saskatchewan and southeastern Alberta directly correlates to what local material types would have been present for utilization. At least seven Laurentide (continental) glaciations are recognized in Saskatchewan (Barendregt 2011: 705). These episodes of glaciations have caused multiple till sheets to blanket most of the Canadian prairies. The geology of Saskatchewan is relatively simple which means sources for raw materials are limited and are often of poor quality. The Empress Group is the source of the oldest till in Saskatchewan.

Surficial stratified deposits are one of the most abundant stone deposits in Saskatchewan. This is an informal designation for lacustrine, outwash, ice-content sediments, alluvium, colluvium and aeolian deposits (Christiansen 1979). These deposits can be up to 100m thick and were significant sources of local raw materials for past occupants of WHP. WHP was not completely free of glacial ice until 12,000 years ago but would have been partially uncovered around 12,500, although glacial lake Saskatoon would have taken up a large amount of total area (Christiansen 1979: 927-928). Till is heavily concentrated in the Saskatoon region. Saskatoon in particular has an extensive record of Pleistocene tills and outcrops of old formations allowing raw materials within the till to be gathered along the North Saskatchewan River valley, in very close proximity to both the Wolf Willow and Dog Child sites. These glacial deposits would have been available for all Saskatchewan precontact complexes to utilize for the past 12,500 years. It is apparent that for some reason, whether it is territory, possible source locations, or cultural preference, local materials are the most highly utilized for tool manufacturing. This pattern has continued from the Great Basin and Plateau regions to the Northern Plains.

The utilization of locally procured raw materials is a trend that extends to all occupations in WHP (E. Walker, personal communication). People were utilizing exposures and surficial till deposits in the upland grasslands as well as water exposures for raw material procurement. It is likely that water exposures were utilized due to their convenient locations at the head of Opimihaw Creek and the adjacent river valley. Pebbles, nodules, and cobbles of suitable raw materials can be procured from fluvial exposures within the park. The uplands are also a suitable area to acquire raw materials for tool production. WHP is in the Warman Plain physiographic subsection and the topography in the plain is described as having "undulating, eroded till plains and gravelly, glaciolacustrine plains" (Walker 1988:77). However, the natural grasslands in the area can make the spotting of exposures and erosions difficult. This is why the fluvial drainages were most likely favoured when acquiring raw material procurement at WHP.

Most of the local raw materials from WHP could be found in Opimihaw Creek Valley as well as the Saskatchewan River basin, all within a 5km radius of both the Wolf Willow site and the Dog Child Site. The Cactus Flower site is also present on a river terrace overlooking the South Saskatchewan River which means that the inhabitants of the area would have had the opportunity to look for chert, chalcedony, and quartzite, nodules from the till in the adjacent drainage basin.

The natural state of local materials is satisfactory for tool production or can be easily improved with heat-treatment. There is no need to spend energy and resources on trade for better raw materials. Rather, people could focus their energy on other aspects such as trade for more prestigious items, or better protected territory.

Local adaptation is a central component of the McKean Complex. It is apparent from the three sites examined for this thesis, all located in the Northern Plains, as well as the general summary of McKean sites from the Great Basin and Plateau regions, that the pattern of the McKean Complex utilizing local lithic resources continues north of the United States border.

During the creation of this thesis many issues in terminology were discovered. It is imperative that we as archaeologists create a common terminology based upon geological terms for lithic analysis in archaeology that is not solely based upon visual cues. Misidentification of raw materials is all too common within archaeology, which in turn will affect the end analysis of sites, trade routes, overall summaries, and the ability to compare site assemblages with one another in a meaningful way.

9.1 Future Research

Future research in this area would be to complete microscopic and petrographic analyses for each material type listed in Chapter 8 in order to assign a true lithic material type. In addition, Saskatchewan archaeology would greatly benefit if source sites were thoroughly sampled, recorded, and connected back to these material types. This would help to fill in some gaps in research that Saskatchewan archaeologists have dealt with for decades.

Connecting lithic material types with the seasonality of the Dog Child site, Wolf Willow site, and Cactus Flower site would also help to define whether or not there are correlations with certain material types and seasons. Seasonality was not completed for the Wolf Willow site at the time this thesis was completed. It cannot be stressed enough that the merger of archaeology and geology is important for the future of the profession. This merger will increase the depth of information that can be determined from an archaeological site. Future archaeologists would benefit with such a multidisciplinary approach within archaeology.

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APPEDNDIX A
ARTIFACT AND MATERIAL TYPES

Artifact type:

(1) Debitage

Tool Classes:

2. Utilized Flake
3. Retouched Flake
4. Chopper
5. Hammer stone
6. Projectile Point
7. Biface
8. Scraper
9. Drill
10. Wedge
11. Anvil
12. Split Pebble
13. Cores

Material Types

Material: Coarse Quartzite

Group: B-1

Material Colour: **Primary:** medium –light grey, medium red, light yellow, medium green, dark green, dark blue green, dark red purple. **Secondary:** None

Texture: Coarse to very coarse

Lustre: Vitreous to dull

Translucency: Opaque, slightly translucent

Fracture: Even to uneven

Known Sources: B-1 quartzite is available in a variety of glacial till and river ground sources throughout Alberta, Saskatchewan and northern Montana.

Material: Medium Fine Quartzite

Group: B-2

Material colour: **Primary:** light grey, medium grey, dark yellow red, medium green, and medium red purple. **Secondary**: light to dark yellow red

Texture: Medium-fine grained

Luster: Vitreous to dull

Translucency: Opaque to moderately translucent.

Fracture: Even

Other Attributes: Some banding

Similar Lithic Groups: E-10 mottled chalcedony/quartzite

Material: Basalt

Group: C-Undiff

Material Colour: **Primary:** dark grey to black. **Secondary**: green.

Texture: Fine grained to coarse

Fracture: Even

Other attributes: Some can be vesicular and contain small volcanic glass shards

Similar lithic groups: can be confused with E-11 (black chert). Use vesicles to distinguish. May also resemble darker varieties of silicified siltstone.

Known Sources: Tertiary basalts could have been obtained from central Montana, Washington, or British Columbia quarries, glacial till, or can come from Midvale Basalt Quarry of Western Idaho.

Material: Massive Quartz

Group: D-Undiff

Material Colour: **Primary:** clear to white. **Secondary**: as pink, yellow, and black.

Texture: Vitreous

Luster: Vitreous

Translucency: Highly translucent

Fracture: Uneven

Known Sources: Possible sources include quarries in southern British Columbia and Montana. Similar materials can be found widely from glacial till and river cobbles.

Material: Brown Chalcedony

Group: E-1

Material Colour: **Primary:** Dark Yellow Red

Texture: Very fine grained.

Luster: Vitreous

Translucency: Moderate to high.

Fracture: Conchoidal to even

Other attributes: several specimens have areas of milky white patina. This patina can give a bluish cast.

Known Sources: This material is also referred to as brown chert, Knife River Flint, or brown chalcedony. Although a major source is in North Dakota, it can also be formed in cobbles in glacial till. E-1 has no evidence of fossil plant materials.

Material: Patinated Brown Chalcedony

Group: E-2

Material Colour: **Primary**: white with underlying dark yellow red showing though in areas creating a bluish cast.

Texture: Very fine grained

Luster: Predominately vitreous, can be dull

Translucency: Opaque to slightly

Fracture: Conchoidal to Even

Similar Lithic Groups: E-1 and E-3

Known Sources: E-2 could be Knife River Flint but it also exhibit traits of a “Montana Chert”. This type of stone can also have Vugs.

Material: Opaque Yellow Chert

Group: E-4

Material Colour: **Primary:** dark yellow red, medium yellow red, light yellow red, dark grey to black, dark yellow

Texture: Very fine grained.

Luster: Vitreous

Translucency: Opaque

Fracture: Conchoidal to even

Other Attributes: Solid and mottled colours are both present in this material. Dendrites are also common and it can have irregular vugs with or without quartz. Sub parallel banding may or may not be present

Known Sources: Also known as “Montana Cherts”. The colour variation is broad.

Material: White to Grey-Brown Chalcedony

Group: E-7

Material Colour: **Primary:** white, clear, dark grey, and some mottled browns.

Texture: very fine grained

Luster: vitreous

Translucency: Slightly to moderately

Fracture: Conchoidal to even

Known Sources and Comments: Similar to E-4 but lacks yellow colour. Also similar to Montana Cherts. Can occur as lag gravels locally in Saskatchewan. Some specimens that show the sugary texture that is typical of finer quality could be Etherington Chert from Southern

Alberta if it is a mottled dark grey brown. Agates are also included in this category, since the closest chemical signature of a typical agate correlates with most chalcedonies.

Material: Black Chert

Group: E-11

Material Colour: **Primary:** dark grey, to dark grey black. **Secondary**: medium yellow red

Texture: Fine grained

Luster: Dull to resinous

Translucency: Opaque

Fracture: Even to conchoidal

Other Attributes: Slight evidence of banding

Similar Lithic Groups: Silicified siltstone (J-11) has duller luster and slightly coarser texture. Banded black chert E-19 is identical except for clearly defined banding.

Known Sources/Comments: Majority of specimens are chert but basalts, mudstones, and siltstones may fall into this category. Some of these materials are derived from pebble sources and others from formations such as the Banff Formation and lower Mississippian.

Material: Petrified Peat

Group: E-13

Material Colour: **Primary:** medium to dark yellow red and mottled dark grey.

Texture: Fine grained

Luster: Vitreous to dull

Translucency: Opaque

Fracture: Uneven

Other attributes: Clear evidence of banding and organic structure

Known Sources/ Comments: Relatively common in till and gravel deposits in the plains of northern Montana, and southern Alberta and Saskatchewan.

Material: Petrified Wood

Group: E-14

Material Colour: **Primary:** medium to dark yellow red. **Secondary:** dark grey and dark red bands.

Texture: Fine grained

Luster: Vitreous to dull

Fracture: Even-uneven

Other Attributes: Wood grains are still present in stone.

Known Sources/ Comments: Relatively common in till and gravel deposits throughout Northern Montana, and southern Alberta and Saskatchewan

Material: Swan River Chert

Group: E-15

Material Colour: **Primary:** white-light grey to medium grey as well as dark red to medium yellow. **Secondary:** white and medium yellow red.

Texture: Fine- very fine grained

Luster: Vitreous to Dull

Translucency: Slightly to moderately

Fracture: Even to uneven

Other attributes: Vugs and microfossil inclusions

Known Sources/ Comments: Sources of this material are known outcrops from the Swan River Valley in Manitoba, but it also occurs in glacial gravels and deposits throughout Alberta, Saskatchewan and Montana.

Material: Miscellaneous Cherts

Groups: E-17

Material Colour: Varied, Predominantly Medium Grey, Medium Yellow Reds, Red Purples, Many Mottled Specimens

Texture: Fine Grained

Luster: Dull- Resinous

Translucency: Opaque-Slightly

Fracture: Even

Known Sources/ Comments: This category includes many local chert types of Saskatchewan such as precipitated chert, cat head chert, and pebble chert. For more information see Chapter 8.

Material: Porcellanite

Group- F-1

Material Colour: medium to dark grey, light yellow, black, dark red to medium red, light red.

Texture: Very fine grained

Luster: Vitreous to dull

Translucency: Opaque

Fracture: Conchoidal to even

Known Sources/Comments: A high quality outcrop of porcellanite exists in southern Montana but since the material can be created in a number of ways and is often found on the floor and roof of burned out coal seams, it could also be procured locally to central Saskatchewan.

Material: Silicified Siltstone/ mudstone

Group: J-Undiff

Material Colour: medium to dark grey, Patinated Exterior, dark yellow red, with occasional patches of medium red to medium green.

Texture: Fine grained

Luster: Dull

Translucency: Opaque

Fracture: Even

Other attributes: Interior has a uniform colour, exteriors have a range of colours. Microfossil inclusions and roots bleached patination are common. Includes silicified mudstone.

Similar Lithic Groups: E-11, E-19, are brighter.

Known Sources/Comments: pebbles and cobbles of siltstone occur in Alberta, Saskatchewan and Montana. This category includes local silicified siltsone material types to Saskatchewan such as feldspathic siltstone and gronlid siltstone. For more information see Chapter 8.

Material: Granite

Group: K-1

Material Colour: Varies depending on minerals present.

Lustre: Dull or resinous

Translucency: Opaque

Fracture: Uneven

Other Attribute: Exterior and interior have a range of colours.

APPENDIX B

PERCENT OF WEIGT (g) SEPERATED BY MATERIAL TYPE
FOR THE DOG CHILD SITE

Artifact Type	**Material Type**	**% of Total**
Biface	Brown Chalcedony	16.26
	Swan River Chert	**79.96**
	White Chalcedony	3.78
Core	Swan River Chert	**78.30**
	Misc. Cherts	7.19
	Massive Quartz	13.35
	Basalt	7.22
Debitage	Fine Grained Quartzite	10.33
	Medium to Coarse Grained Quartzite	0.51
	Basalt	0.88
	Massive Quartz	17.95
	Brown Chalcedony	1.69
	Black Chert	0.14
	Silicified Peat	1.74
	Silicified/ Petrified Wood	0.04
	Swan River Chert	**57.82**
	Misc. Cherts	7.82
	White Chalcedony	0.68
	Silicified Siltstone	0.40
Endscrapers	Brown Chalcedony	12.78
	Swan River Chert	**77.78**
	White Chalcedony	9.44
Preform	Swan River Chert	100.00
Projectile Point	Medium to Coarse Grained Quartzite	33.66
	Silicified/ Petrified Wood	4.95
	Swan River Chert	**56.11**
	Misc. Cherts	5.28
Retouched Flake	Brown Chalcedony	5.60
	Swan River Chert	**94.40**

APPENDIX C

ARTIFACT TYPE SEPERATED BY MATERIAL TYPE BY WEIGHT (g) FOR THE DOG CHILD SITE

Artifact Type	Material Type	% of Total
Anvil	Basalt	100.0
Biface	Brown Chalcedony	33.3
	Swan River Chert	33.3
	White Chalcedony	33.3
Core	Swan River Chert	**62.5**
	Misc. Cherts	18.8
	Massive Quartz	12.5
	Basalt	6.3
Debitage	Fine Grained Quartzite	0.2
	Medium to Coarse Grained Quartzite	7.9
	Basalt	0.2
	Massive Quartz	15.4
	Brown Chalcedony	5.7
	Black Chert	0.0
	Silicified Peat	1.3
	Silicified/ Petrified Wood	0.2
	Swan River Chert	**60.1**
	Misc. Cherts	7.9
	White Chalcedony	0.9
	Silicified Siltstone	0.3
Endscrapers	Brown Chalcedony	25.0
	Swan River Chert	**62.5**
	White Chalcedony	12.5
Hammerstones	Granite	100.0
Preform	Swan River Chert	100.0
Projectile Point	Medium to Coarse Grained Quartzite	16.7
	Silicified/ Petrified Wood	8.3
	Swan River Chert	**58.3**
	Misc. Cherts	16.7
Retouched Flake	Brown Chalcedony	33.3
	Swan River Chert	**66.7**

APPENDIX D

MATERIAL TYPE SERPATED BY WEIGHT FOR THE DOG CHILD SITE

Material Type	**% of Total**
Fine Grained Quartzite	0.15
Medium to Coarse Grained Quartzite	7.86
Basalt	0.21
Massive Quartz	15.26
Brown Chalcedony (KRF)	5.76
Black Chert	0.03
Silicified Peat	1.25
Silicified Wood/ Petrified Wood	0.21
Swan River Chert	60.01
Misc. Cherts	7.97
White Chalcedony	0.93
Silicified Siltstone	0.30
Granite	0.06

APPENDIX E

MATERIAL TYPE SEPERATED BY WEIGHT FOR THE WOLF WILLOW SITE

Material Type	**% of Total**
Diorite	0.027
Yellow Chalcedon	0.027
Granite	0.027
Porcellanite	0.134
Black Chert	0.161
Silicified Wood/ P	0.241
Basalt	0.722
Patinated Brown C	0.749
White Chalcedony	0.830
Brown Chalcedon	1.151
Silicified Peat	1.338
Silicified Siltstone	1.418
Misc. Cherts	4.389
Fine Grained Quar	6.822
Massive Quartz	10.516
Medium to Coarse	12.065
Swan River Chert	59.379

APPENDIX F

PERCENT OF WEIGHT (g) SEPERATED BY MATERIAL TYPE AND ARTIFACT TYPE FOR THE WOLF WILLOW SITE

Artifact Type	Material Type	% of Total
Biface	Massive Quartz	17.13
	Silicified Peat	1.90
	Silicified/ Petrified Wood	6.44
	Swan River Chert	74.52
Core	Medium to Coarse Grained Quartzite	5.04
	Basalt	14.18
	Massive Quartz	25.03
	White Chalcedony	0.12
	Black Chert	0.18
	Swan River Chert	54.59
	Misc. Chert	0.85
Core Frag	Medium to Coarse Grained Quartzite	39.17
	Silicified/ Petrified Wood	16.39
	Silicified Siltstone	44.43
Debitage	Fine Grained Quartzite	4.21
	Medium to Coarse Grained Quartzite	21.90
	Basalt	1.43
	Massive Quartz	11.30
	Brown Chalcedony	0.35
	Black Chert	0.04
	Silicified Peat	1.95
	Silicified/ Petrified Wood	0.22
	Swan River Chert	51.95
	Misc. Chert	4.32
	Patinated Brown Chalcedony	0.19
	Yellow Chalcedony	0.01
	White Chalcedony	0.31
	Silicified Siltstone	0.01
	Porcellanite	1.80
Endscrapers	Brown Chalcedony	22.49
	Misc. Chert	44.38
	Patinated Brown Chalcedony	15.38
	Silicified Siltstone	8.28
	Porcellanite	9.47
Hammerstones	Basalt	70.86
	Medium to Coarse Grained Quartzite	3.34
	Diorite	25.80
Knife	Swan River Chert	100.00
Mano	Granite	100.00
Maul	Medium to Coarse Grained Quartzite	100.00
Projectile Point	Medium to Coarse Grained Quartzite	14.59
	Massive Quartz	16.49
	Brown Chalcedony	5.14
	Black Chert	7.57
	Swan River Chert	51.62
	Misc. Chert	4.59
Retouched Flake	Fine Grained Quartzite	93.75
	Misc. Chert	6.25
Scraper	Misc. Chert	100.00
Utilized Flake	Medium to Coarse Grained Quartzite	98.68
	Swan River Chert	1.04
	Misc. Chert	0.28

APPENDIX G

ARTIFACT TYPE SEPARATED BY MATERIAL TYPE BY WEIGHT (g) FOR THE WOLF WILLOW SITE

Artifact Type	Material Type	% of Total
Anvil	Basalt	100.0
Biface	Massive Quartz	22.2
	Silicified Peat	11.1
	Silicified/ Petrified Wood	11.1
	Swan River Chert	**55.6**
Core	Medium to Coarse Grained Quartzite	2.4
	Basalt	7.1
	Massive Quartz	16.7
	White Chalcedony	2.4
	Black Chert	2.4
	Swan River Chert	**61.9**
	Misc. Chert	7.1
Core Frag	Medium to Coarse Grained Quartzite	33.3
	Silicified/ Petrified Wood	33.3
	Silicified Siltstone	33.3
Debitage	Fine Grained Quartzite	6.9
	Medium to Coarse Grained Quartzite	12.1
	Basalt	0.6
	Massive Quartz	10.5
	Brown Chalcedony	1.1
	Black Chert	0.1
	Silicified Peat	1.3
	Silicified/ Petrified Wood	0.2
	Swan River Chert	**59.7**
	Misc. Chert	4.2
	Patinated Brown Chalcedony	0.7
	Yellow Chalcedony	0.0
	White Chalcedony	0.8
	Silicified Siltstone	1.4
	Porcellanite	6.9
Endscrapers	Brown Chalcedony	14.3
	Misc. Chert	**42.9**
	Patinated Brown Chalcedony	14.3
	Silicified Siltstone	14.3
	Porcellanite	14.3
Hammerstones	Basalt	16.7
	Medium to Coarse Grained Quartzite	**66.7**
	Diorite	16.7
Knife	Swan River Chert	100.0
Mano	Granite	100.0
Maul	Medium to Coarse Grained Quartzite	100.0
Projectile Point	Medium to Coarse Grained Quartzite	6.7
	Massive Quartz	6.7
	Brown Chalcedony	6.7
	Black Chert	6.7
	Swan River Chert	**66.7**
	Misc. Chert	6.7
Retouched Flake	Fine Grained Quartzite	**66.7**
	Misc. Chert	33.3
Scraper	Misc. Chert	100.0
Utilized Flake	Medium to Coarse Grained Quartzite	**50.0**
	Swan River Chert	25.0
	Misc. Chert	25.0

APPENDIX H

GEOLOGIC MAP OF ALBERTA, SASKATCHEWAN, AND MANITOBA (ALBERTA GEOLOGICAL SURVEY)