LITHIC COLLECTION LOCALES:

PREHISTORIC QUARRIES

IN

SOUTHWESTERN MANITOBA

by

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ABSTRACT

This thesis examines the evidence that establishes several lithic collection locales within the Tiger Hills in the Pembina Valley Trench of southwestern Manitoba as prehistoric lithic quarries. Quarry areas are usually restricted to the testing and extraction of material rather than the manufacture of implements. Therefore, lithic quarries are characterized by a predominance of cores and core-reduction debitage. More finely manufactured tools are seldom recovered within a quarry. This is the characteristic pattern of artifact recovery within the study area.

Particular attention is paid to the frequency of the lithic material recovered, in particular, whether this material is locally derived or exotic to southern Manitoba. This analysis provides additional insight into the trade and migration patterns within the Tiger Hills.

In view of the examination of the types of artifacts and the frequency of lithic material recovered within the study area it has been discovered that lithic collection within the Tiger Hills was more extensive prehistorically than had been previously realized.

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CHAPTER 1: INTRODUCTION

This thesis presents evidence that establishes the identity of several recently discovered archaeological sites in southern Manitoba as prehistoric lithic quarries. These sites are located in the Tiger Hills, within Manitoba's Pembina Valley Trench, to the north and east of Pelican Lake (Figure 1, upper right inset).

This thesis will also discuss the region's glacial history, its physical characteristics and the rich ecological resources of southern Manitoba. These characteristics will be outlined to place the quarry sites in a resource context within southern Manitoba and to illustrate their importance to the human groups that utilized them prehistorically. It is reasonable to assume that having a lithic source within an ecologically resource rich locale would be most advantageous. A local lithic source would allow human groups to spend more time on subsistence strategies rather than on lithic procurement. In addition a regional lithic quarry would have provided an essential resource that could have been used locally, as well as a commodity that could have been traded, and it is reasonable to suppose that the presence of a lithic quarry would have important implications for the settlement of a region. Therefore, this thesis will also (briefly) examine the question of the importance of regional lithic quarries in the selection of habitation sites.

Most work to date within southern Manitoba has concentrated on the ecology of the region as the primary driving factor for the

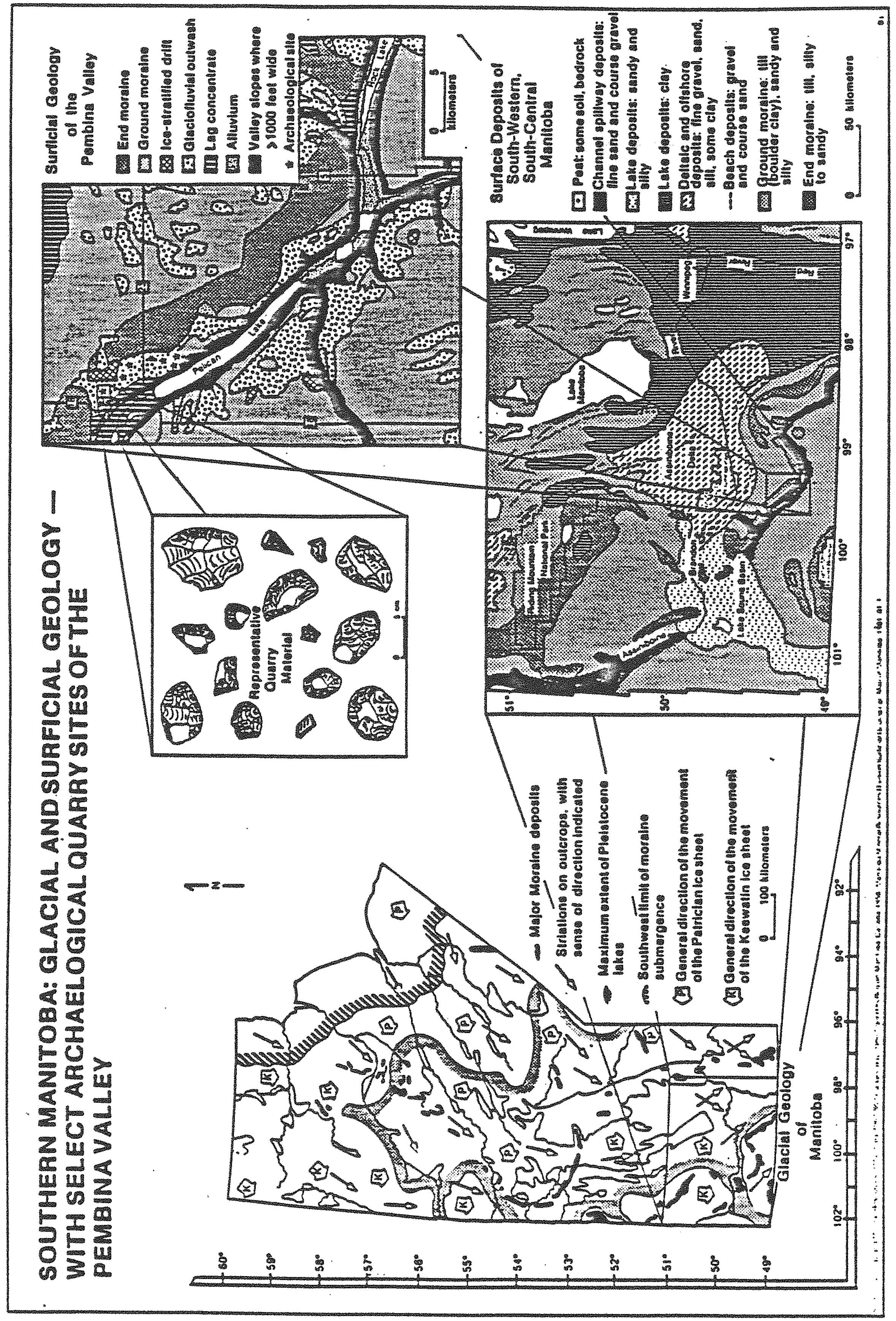

Figure 1

prehistoric settlement density observed within this zone (Nicholson 1987a, 1987b, 1988; Pettipas 1983; Reeves 1970; Syms 1976, 1977). In fact, the local ecology of the Pembina Valley has been classed as the major settlement determinant for southern Manitoba. This thesis does not attempt to undermine the concept that ecology is important in cultural settlement patterns, but rather, it suggests the importance of an additional influence of another resource, that is, the raw lithic materials available prehistorically within, and in proximity to, the Pembina Valley.

The discovery of a major raw lithic source within the Tiger Hills is archaeologically significant, not only to southern Manitoba but to the discipline over-all. Very little work has been conducted regarding quarries, particularly in Manitoba; therefore, the potential to supply the discipline with any information regarding this subject area is meaningful. The significance of these quarries also includes the recognition that the discovery of a large local lithic source in southern Manitoba should provide information for the further understanding of settlement patterns here and elsewhere as well as trade and migration within southern Manitoba

CHAPTER 2: BACKGROUND

Preamble

Many of the most dramatic and informative archaeological discoveries have come from sites with no prominent surface evidence of human occupation. In seeking such sites we need to keep in mind the local resources that provide the attractions for habitation. In considering these attractions we must focus on some of the basic requirements for human existence: shelter, food, water, ground cover and so on. In any particular environment, the locations that would have satisfied such requirements are likely to have been repeatedly inhabited. However, human habitation is not confined to places that seem to offer special advantages of one kind or another. Indeed, if we are interested in learning something about settlement behavior in the past, we should not seek sites only in places where we already know they are likely to exist. This would merely confirm prejudices without discovering anything new about behavior of prehistoric peoples.

In the case of quarry sites the accessibility of the site and surface exposure of lithic materials (for ease of extraction) would be of primary concern. Thus, archaeological survey requires that the search for sites be aimed not only at those areas that are conspicuous or strategically located, but also at the vast number of inconspicuous sites that occur at unlikely places. In other words, we must search in places where there is no obvious reason to expect habitation, as well

as where human occupation is predictable, for only after a thorough reconnaissance of a research area has been conducted can predictive models for a region be accurately constructed.

Research History

An archaeological survey, directed by Dr. Nicholson of Brandon University, was conducted within the Pembina Valley Trench during 1991, 1992, and 1993. The intent of this survey was to locate previously unrecorded archaeological sites within the Pembina Valley, in particular, habitation sites that displayed evidence of prehistoric horticulture. During the 1992 phase of this survey evidence was discovered that supported the initial conclusion that a concentrated area within the Tiger Hills locale of the Pembina Valley contained several archaeological lithic collection sites (Figure 1: upper right inset). This discovery was significant in that it was previously believed that no locale existed within this area that would have provided extensive raw lithic materials. The author sought permission from Dr. Nicholson to pursue, for this thesis, the possibility that large scale prehistoric quarrying was taking place within the Tiger Hills and further investigation of the study area was initiated.

During the 1992 field season several lithic collection areas were located. Therefore it was decided that the author would conduct further reconnaissance of the area during the 1993 field season. At this time the author sought only those areas that displayed lithic collection activities. Several further lithic collection areas were located during 1993. These collection areas are all located within cultivated fields through surface survey. Several of these areas have been broken and cultivated within the last two or three years.

In total nine collection sites were discovered within the study area. Three of these sites are of particular interest - the Sandhill Site, the Killdeer Site and the Deleurme Site (Figure 2). These three sites contained the largest concentrations of core-related materials and appear to have been utilized only for the collection and testing of raw lithic material. The Pembina Valley archaeological survey also discovered many small lithic sites (Figure 2) with no visible signs of occupation other than for the collection and manufacture of lithic tools. The surficial concentrations of recovered artifacts in these lithic areas are quite low and the site boundaries are restricted in comparison to the overall areas of the Sandhill, Killdeer and Deleurme sites. However, their presence indicates that an abundance of quarrying activity took place within the Tiger Hills and provides an indication of the density of the prehistoric lithic quarries within southern Manitoba.

A lithological connection exists between the sites examined within this thesis in that they all occur within a single regional glacio-fluvial deposit (Figure 1: upper right inset). The author discovered in the fall of 1992, during research for Dr. Quinn of the Brandon University Geology Department, that almost the entire study area is underlain with a large glacio-fluvial deposit. The initial indication is that this glacio-fluvial deposit provided the source of raw lithic material within the Tiger Hills. This deposit is the primary reason why these sites were extensively searched prehistorically

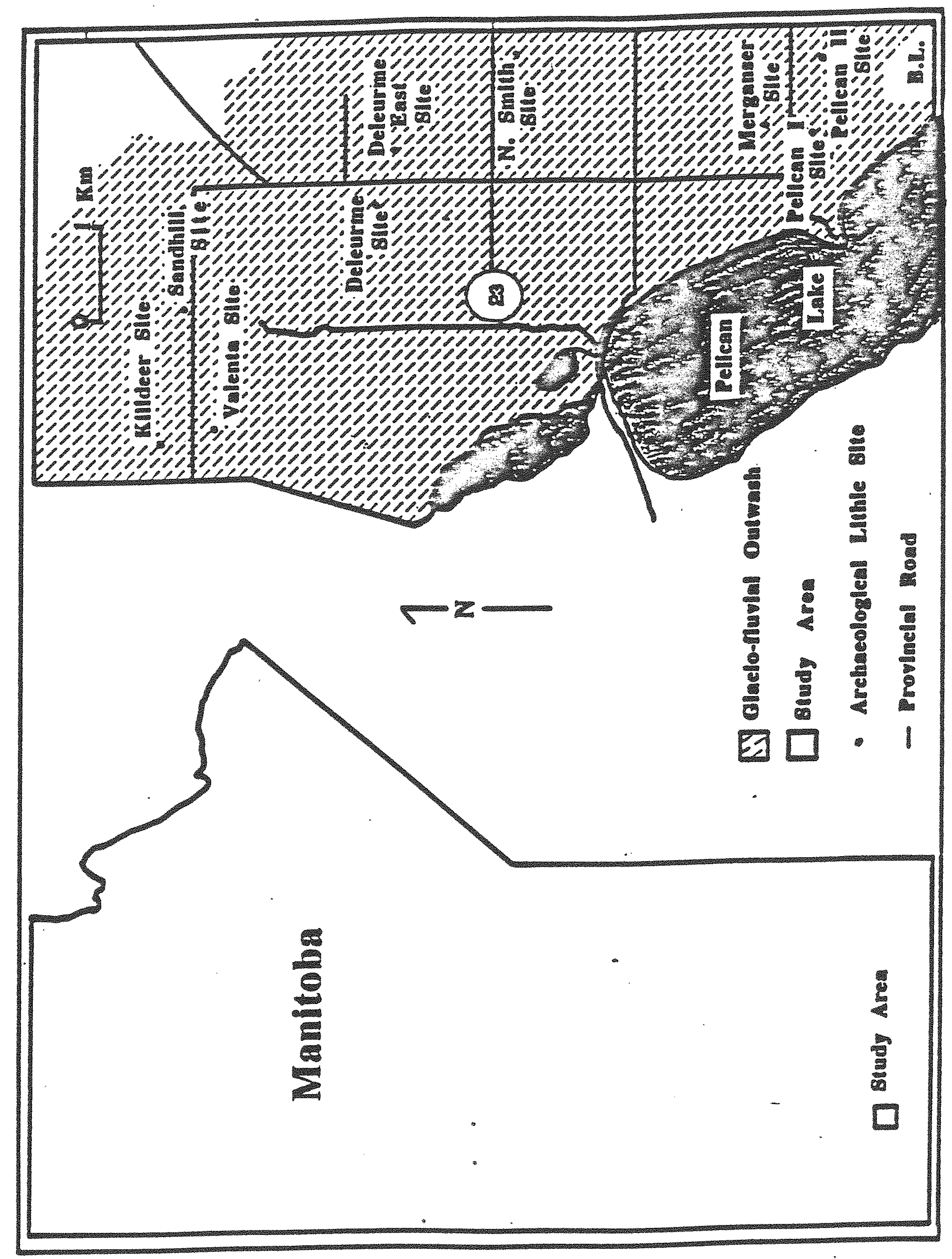

Figure 2: Primary Study Area

for raw lithic material.

Project Objectives and Limitations

The major objective in this thesis is to establish that the Sandhill, Killdeer, Deleurme, Valenta, Deleurme East, N. Smith, Merganser, Pelican I, and Pelican II Sites (Figure 2) and their associated locales within the Tiger Hills are prehistoric quarries used for the explicit purpose of collecting raw lithic material and secondly, to understand to what extent they were utilized. An archaeological quarry is characterized by a predominance of cores, core-reduction debitage and preforms. Alternatively, an archaeological habitation site contains an abundance of more finely manufactured tools (Ahler 1986; Losey 1971).

The pattern of acquisition of raw lithic material can be either concentrated, occasional or dispersed. The type of activity is largely dependent upon regional cultural patterns and the local geological conditions within a region (Butler and May 1984: 185). In examining the lithic collection areas within southern Manitoba it is necessary to assess:

1) The location of these sites to the large regional glacio-fluvial outwash deposit in which they were discovered;

2) The age structure of the collection areas;

3) The possible provenance of the lithic materials recovered.

Considerations affecting the scope of this thesis include:

1) The general lack of previous archaeological work conducted in southern Manitoba;

2) The scarcity of literature relating to prehistoric lithic quarries, in particular those dealing with the Great Plains region (with the exception of the Knife River Flint quarries);

3) The difficulties associated with sourcing lithic material;

4) Time constraints;

5) The limited availability of funding.

Primary Study Area

The primary study area for this thesis covers a locality within the Tiger Hills, in southern Manitoba, extending from Ninette 4 miles north on highway #18, 3 miles east, 6 miles south, west to the shore of Pelican Lake and north-west along the lake shore (Figure 2). The study area encompasses an area of approximately 15 mi^2 or 24 km^2 and includes the nine site localities examined within this thesis. Almost this entire area is underlain with outwash from a single regional glacio-fluvial deposit as illustrated in the upper right inset of Figure 1.

CHAPTER 3: REGIONAL ENVIRONMENT

Physical Characteristics of Southern Manitoba

The different aspects presented by the various landscape areas of southern Manitoba (Ellis 1938; Ellis and Shafer 1943) are due, in part, to variations in surface geology, topography, drainage, native vegetation, and to a greater or lesser degree, culture or the activities of human groups. From a physical standpoint most of southern Manitoba may be considered a plateau or steppe that is transected from north-west to south-east by part of the wide, deep channel of the Pembina Valley (Figure 3). South of the channel in southern Manitoba the terrain is relatively smooth; however, north of the channel the landscape is characterized by an irregular morainic topography.

The major biomes of southern Manitoba are the Aspen Parkland and Prairie divisions (Bird 1961: 3; Rowe 1972:34). The Aspen Parkland consists of large islands of poplar, oak, and other boreal species interspersed with poorly drained grassland (Ellis 1938:33). The Tiger Hills is located within the midst of this Parkland/Prairie region.

The Tiger Hills physiographic zone of mixed woods and prairie is a distinctly separate landscape area of the Pembina Valley that occurs on the north western portion of the upland plateau in southern Manitoba. Altitudes range from 1350 feet to around 1500 feet although a few hills are higher (Ellis 1938:49). The Tiger Hills,

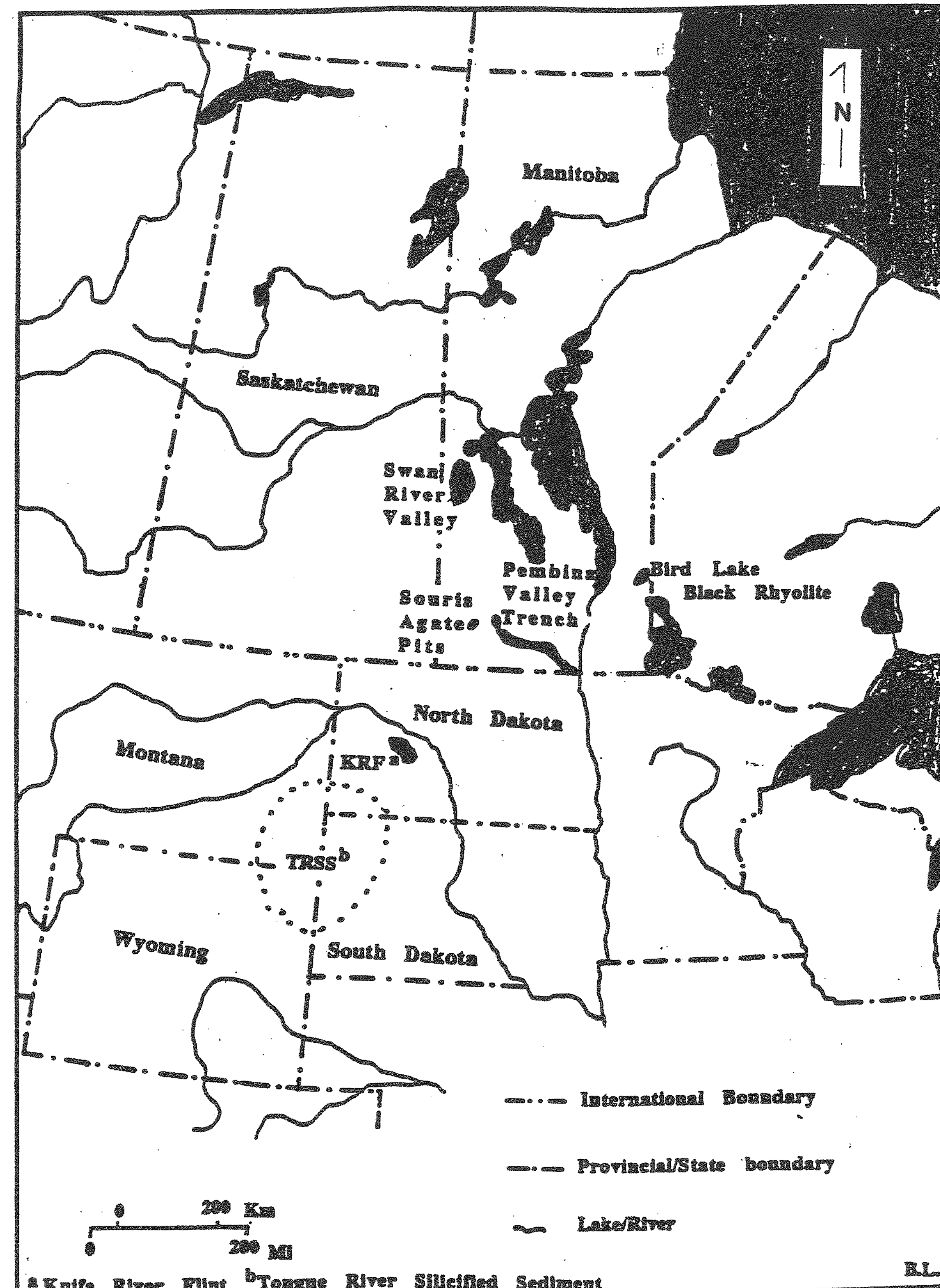

Figure 3: Primary Lithic Source Areas

which are invariably stony (Figure 4), are subjected to excessive run-off on the steeper slopes and as a result they tend to be droughty (Ellis and Shafer 1943:20).

Figure 4: Tiger Hills - Steep, Stony Slopes

Within the Tiger Hills physiographic zone there is a wide variety of biotic communities found within the many riverine habitats (Figure 5) and surrounding lakes and marshy regions (Figure 6) of the area (Bird 1961; Nicholson 1987a). These ecotone systems provide important and diverse seasonal resources within the region (Nicholson 1988:353). It is this diversity within southern Manitoba that provides the Pembina Valley with an ecologically rich resource base.

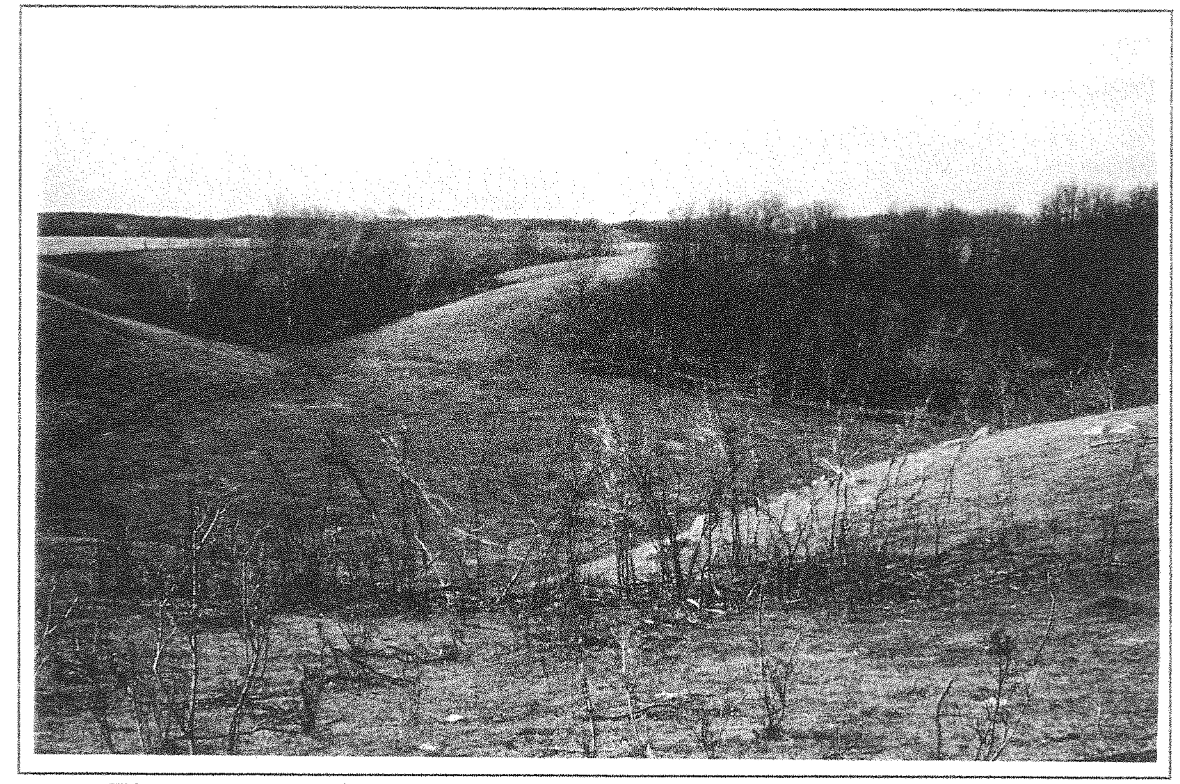

Figure 5: Riverine Habitat Within the Study Area

Figure 6: Marsh Environment Within the Tiger Hills

The Aspen Parkland is situated on black chernozemic soils. Important factors that determine soil type are:

(1) Temperature and moisture within the soil;

(2) Vegetation;

(3) Parent material;

(4) The length of time the soil has been under the influence of its environment (Bird 1961:2).

Black chernozemic soils are formed under a heavy grass and herbaceous vegetation whereas a gray chernozemic type develops under forest (Bird 1961:2; Rowe 1972: 34). The degrading black earths are soils which were first developed as black earth, but, with the invasion of woods the soil climate became more humid and the soil-forming processes became modified (Ellis 1938:51). The Tiger Hills soils, within the study zone, are currently intermixed black earths and grey-blacks (Ellis and Shafer 1943:61).

Regional soils within the Tiger Hills, largely due to the morainic topography and the excessive slope run-off, are generally shallow in depth (Figure 7) and are often very stony (Ellis and Shafer 1943:21). The significance of the shallow soils and steep slopes are that the near ubiquitous glacio-fluvial deposits of the region have been exposed over large areas by erosion. This is especially evident within the many small channels of the Tiger Hills in which cobbles are now completely exposed on the surface (Figure 8).

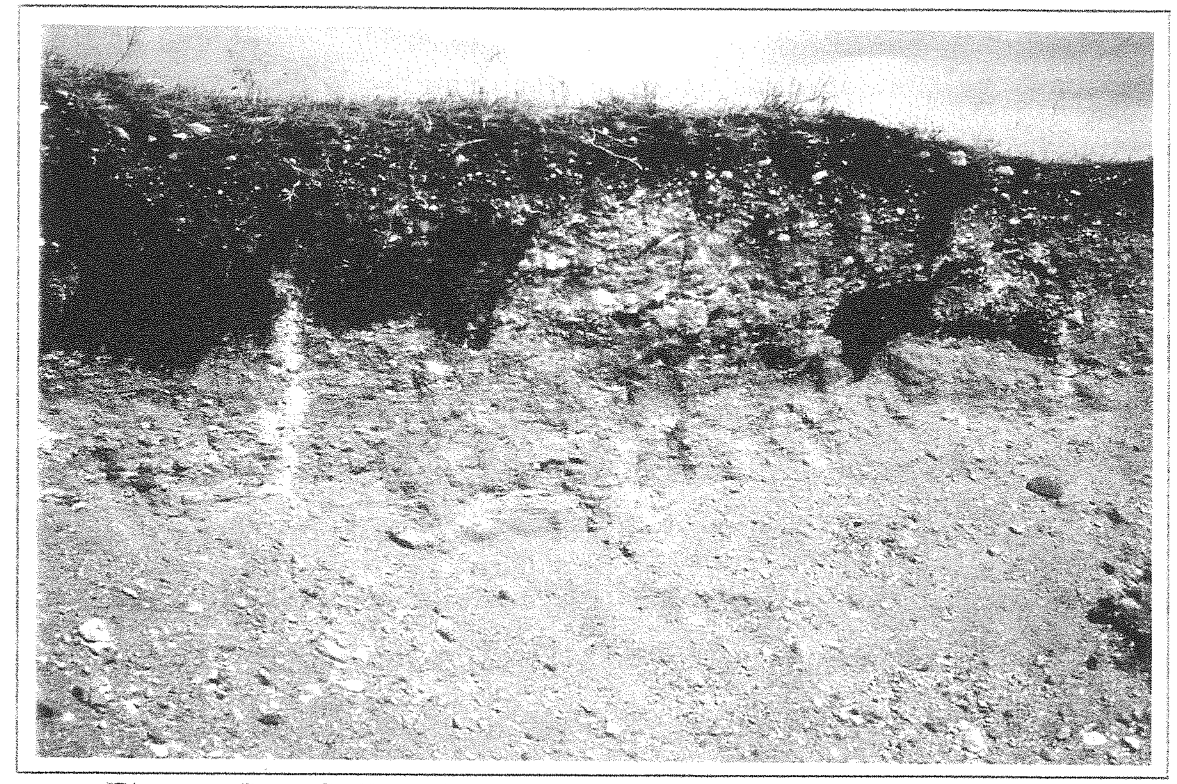

Figure 7: Soils of the Study Area

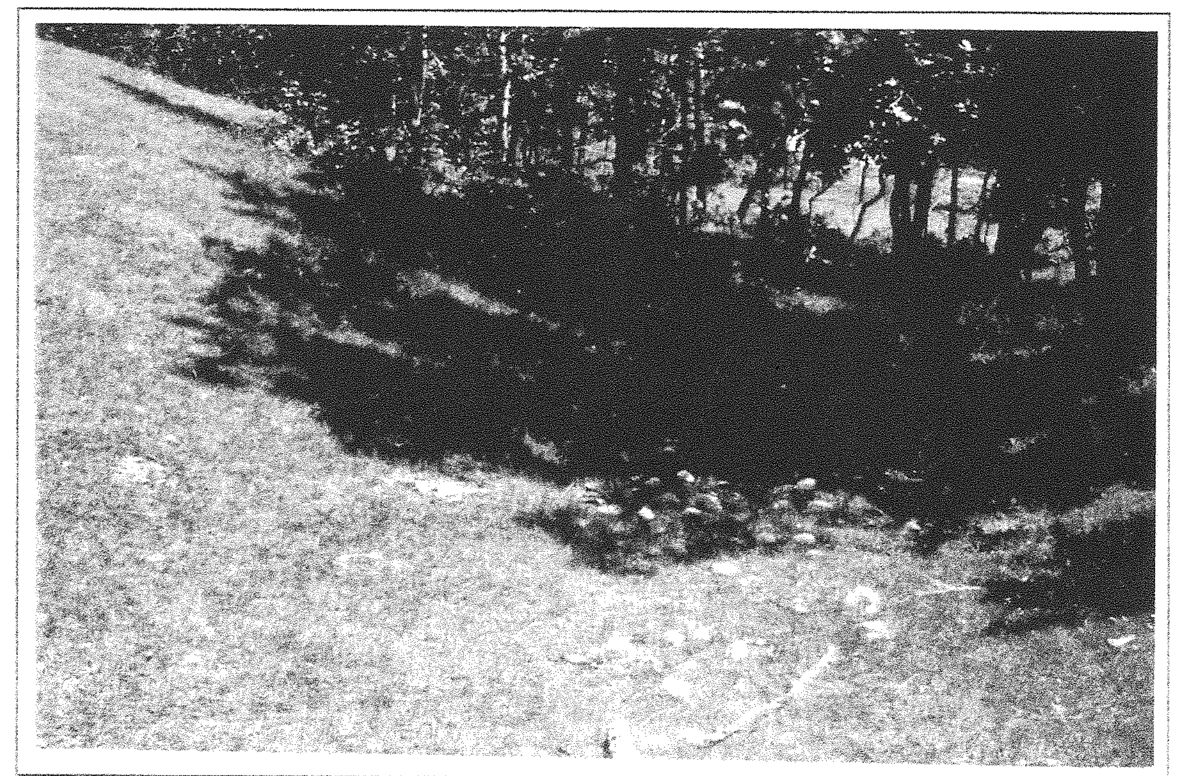

Figure 8: Small Tiger Hills Channel Displaying Surface Cobbles

Glacial Geology of Manitoba

The surficial deposits within the Tiger Hills have a direct relevance to this thesis, therefore, a brief examination of southern Manitoba's glacial and depositional history is necessary. This discussion will be limited to the Pleistocene period since it is the glacial history of this period that has a direct bearing on the deposits and current topography of the province.

The Wisconsin was the last period of glaciation (Davies *et al.* 1962; Pielot 1991) and it covered over 60% of North America's surface area (Rogers *et al.* 1991:624). Manitoba was almost entirely covered with ice sheets during at least four periods of the Wisconsin glaciation (Davies *et al.* 1962:151; Pielot 1991:14). Studies have indicated that two ice sheets collided and converged over Manitoba during the last phase of the Wisconsin. These were the Keewatin and Patrician (or Hudson) ice sheets and they formed the two major accumulation centers over the province at that time (Davies *et al.* 1962:151; Pielot 1991:17).

The Keewatin ice sheet moved south (Figure 1: left inset) out of the North West Territories west of Hudson Bay, and the Patrician ice sheet moved southwest (Figure 1: left inset) from James Bay into southern Manitoba (Davies *et al.* 1962:151; Dyke *et al.* 1982; Klassen 1983:219; Shifts, 1980). As the massive Keewatin and Patrician ice sheets began to recede much of central and southern Manitoba was covered by glacial lakes, the largest being glacial Lake Agassiz (Christiansen 1979; Elson 1971, 1983; Klassen 1972, 1983). As the glaciers receded huge amounts of material were glacially deposited

throughout Manitoba leaving behind major moraine deposits (Figure 1: left inset) which dramatically altered the pre-existing landscape. The large amounts of glacio-fluvial outwash within southern Manitoba are the direct consequence of the wasting of the glaciers that previously covered this locale.

Deglaciation created a number of spillways that included the Pembina spillway (Kehew and Clayton 1983) which is the system of valleys and basins in southern Manitoba referred to as the Pembina Valley Trench (Figure 3) (Elson 1956). It has been suggested by various authors (Christiansen 1979; Elson 1971, 1983; Klassen 1972, 1983; Pettipas 1970; Ritchie and Lichti-Federovich 1968) that southern Manitoba could have been free of ice by 13,000 years ago.

Surface Deposits. The Wisconsin deposits of Manitoba have remained, in essence, unchanged since their deposition by the Keewatin and Patrician ice sheets (Davies *et al.* 1962:158). Provenance studies have identified three probable sources (Davies *et al.* 1962:151) for detritus in the surface deposits in southern Manitoba, these are:

1) Precambrian Rocks;
2) Early Paleozoic carbonate rocks;
3) Cretaceous and Jurassic shales

Figure 1 (lower right inset) illustrates the surface deposits left behind following the Wisconsin glaciation. The formation of soil over these deposits has allowed for the development of parkland vegetation throughout the region (Davies *et al.* 1962:159).

The Tiger Hills are classed as end moraines (Davies *et al.* 1962:

Elson 1956). The topography of end moraines varies from smooth gently undulating surfaces, that are common in moraines built of clay-rich till, to sharply irregular surfaces marked by knolls, hummocks and closed depressions. The latter are common in moraines containing coarse grained till and stratified gravel. This type dominates within the study area (Edwards, 1986; Ellis and Shafer 1943).

Surficial Geology. Morphology is not the only basis for classification or the only source of data for interpreting the origins of landforms. The character of the materials constituting a landform must also be analyzed (Boggs, 1987).

The surficial deposits common in southern Manitoba are illustrated in Figure 1, upper right inset. They include numerous areas of glacio-fluvial outwash. Of particular interest is the large outwash deposit within the study area along the north and east shore of Pelican Lake. This deposit contains concentrated areas of cryptocrystalline materials suitable for flint-knapping and it contains the nine prehistoric lithic sites identified in this thesis.

Glacio-fluvial outwash deposits, being the result of meltwater transportation and deposition, have two characteristics that separates them from deposits resulting from transportation and deposition by the ice itself: they tend to be stratified and to consist of rounded or sub-rounded particles (Price, 1973; Sugden and John, 1976). Outwash sediments have all the characteristics of stream deposits and are typically composed of gravels and sands (Edwards 1986; Miall, 1983; Price, 1973).

Glacio-fluvial processes are important because they completely rework sediment deposited by a glacier (Miall 1983; Price 1973). The sedimentary record indicating the presence of ice may therefore be destroyed. This is a problem in the interpretation of ancient deposits because glacial connections may be very difficult, if not impossible to identify (Spalletti, 1983; White, 1980).

In passing it should also be noted that southern Manitoba contains many areas of glacio-fluvial outwash (Figure 9) and that these deposits may contain concentrations of cryptocrystalline materials similar to those discovered within the study area. If they do contain large concentrations of cryptocrystalline cobbles then they could represent other possible lithic collection areas. If these deposits have characteristics different from the sites examined in this thesis then the study area would be an anomaly in southern Manitoba. There are many locales within southern Manitoba that have yet to be tested and only further research will answer these questions.

CHAPTER 4: SUMMARY OF ARCHAEOLOGICAL RESEARCH

Purpose and Scope.

The field research, the literature review, and the laboratory analysis of the artifacts have been combined to demonstrate the importance of the Tiger Hills as a raw lithic collection locale. In addition, the lithic collection sites within the Tiger Hills are reviewed in conjunction with the regional ecological resources of the Pembina Valley to provide further archaeological interpretations regarding settlement density patterns of southern Manitoba, although this is a peripheral aspect of this thesis.

Clarification is required here regarding the usage of the terms region(al) and local(e). The use of the terms region or regional refers for example to an area the extent of southern Manitoba or larger. Alternatively, the use of the terms local and locale refers to much smaller areas. Locale would refer to areas like the Tiger Hills whereas the use of the term local would refer to a small localized area within a locale.

Methodology

Field Collection. Artifacts were recovered in the field through surface survey, test pitting, and the excavation of a select number of test units. Surface collection was conducted along arbitrary compass transects. Transect lines were initially spaced at

thirty meter intervals. Areas discovered with dense horizontal areal artifact recoveries in 1992 were surface collected a second time using a transect spacing of 10 meter intervals.

Test pit lines were placed arbitrarily along what the author judged to be the external limits of the sites determined from the surface collections. Pits were spaced at 25 meter intervals along these lines. Test pits were used to verify the external site boundaries and to examine the vertical subsurface lithic material concentrations. The test pit matrix was trowelled through in search of artifacts. Collection within the test pits was conducted down to the underlying gravels and averaged 25-35 cm. in depth.

A grid, 100 m x 100 m, was arbitrarily placed over an area of the Sandhill Site that contained the highest surficial concentration of artifacts. This grid was judgmentally selected based on the Sandhill site being centrally located between the Killdeer and Deleurme sites. These three sites taken together are the largest of the lithic collection areas discovered within the study area.

From the initial 10,000 m^2 grid a 10 m x 10 m unit was selected using a random numbers table and subdivided into units of 1 m^2. Four 1 m^2 units were randomly selected from the 100 m^2 block and the soil matrix in each was excavated to about 30 cm below surface. The matrix removed from the test units was screened through a 1/4 inch mesh. This was done so that all material over 2 cm in diameter could be collected from the screen and compared. The 2 cm size for this material was decided upon because the surface collected core materials generally exceeded this size. Although materials of less than 2 cm could have been subjected to bipolar percussion technologies, surface collected materials that displayed bipolar percussion accounted for a small percentage of the over-all recoveries and generally exceeded 2 cm in diameter. The object of conducting the test excavations was to evaluate the percentage and type of subsurface materials in comparison to the surficial concentrations of the recovered lithic material.

Samples. Surface collection was limited to artifacts that displayed some form of cultural alteration. However, collection within the test pits and test units also included unworked pieces of cryptocrystalline materials larger than 2 cm in diameter. All materials analyzed for this thesis were curated by the archaeological laboratory at Brandon University.

Data Compilation. Standard archaeological cataloguing and identification methods were employed for all recovered materials. Once the artifacts were catalogued they were recorded on a Macadem data management system at Brandon University along with all site information.

Library Research. An extensive literature search involving the investigation of previously recorded archaeological quarry sites was undertaken. This information was used in conjunction with the field research to establish whether the lithic sites from the study area are indeed quarries. This was done by comparing accepted quarry site descriptions in the literature to the lithic material recovered from the study area. A study of the literature pertaining

to the surficial geology of the Pembina Valley, specifically the glacio-fluvial outwash deposit within the study area, was also conducted.

The literature search included research of the regional glacial history, present geology, the physical characteristics of the Pembina Valley, quarrying technologies and an examination of the various lithic descriptions regarding materials recovered from the Tiger Hill sites of southern Manitoba (discussed in this thesis) including possible geological source areas.

Laboratory Procedures. All materials recovered from the lithic collection sites were examined, identified, categorized and catalogued by various members of the Brandon University Archaeology Laboratory team. The final analysis was completed by the author.

Recovered artifacts were compared with current established parameters of a quarry site as defined in the literature. The work of Holmes (1919) who first defined the characteristics of a quarry, and the subsequent work by Losey (1971) and Ahler (1986) were the primary references consulted for this purpose.

CHAPTER 5: REVIEW AND REEVALUATION OF PREVIOUS ARCHAEOLOGICAL RESEARCH AND LITERATURE

Site Specific Lithic Materials within the Tiger Hills

An appraisal of the extent of lithic utilization (prehistorically) within the study area may be evaluated by examining the lithic assemblages recovered from nearby archaeological sites. The types of lithic artifacts and the frequency of the materials used within local sites should provide at least a qualitative comparison between materials within those sites to those locally available within the raw lithic sources of the study area. The recoveries from the Heron Site, DiLv-13, (Figure 9) will be compared to those of the study area to provide a limited comparison between an occupation site and raw material collection locations. The Heron Site is located outside the study area.

The Heron Site was discovered within the Pembina Valley Trench during the 1991 archaeological survey. The Heron Site is situated within a small ravine of the Tiger Hills to the north of Pelican Lake and is located approximately 5 km north of the main area of lithic collection within the study area. The Heron Site is an undisturbed Woodland site that contains Avonlea and Blackduck components.

There were 207 lithic artifacts recovered from the Heron Site (Table 1). Of the total lithics recovered 80.2% of the materials were locally derived (Table 2). These include 43.5% Swan River Chert,

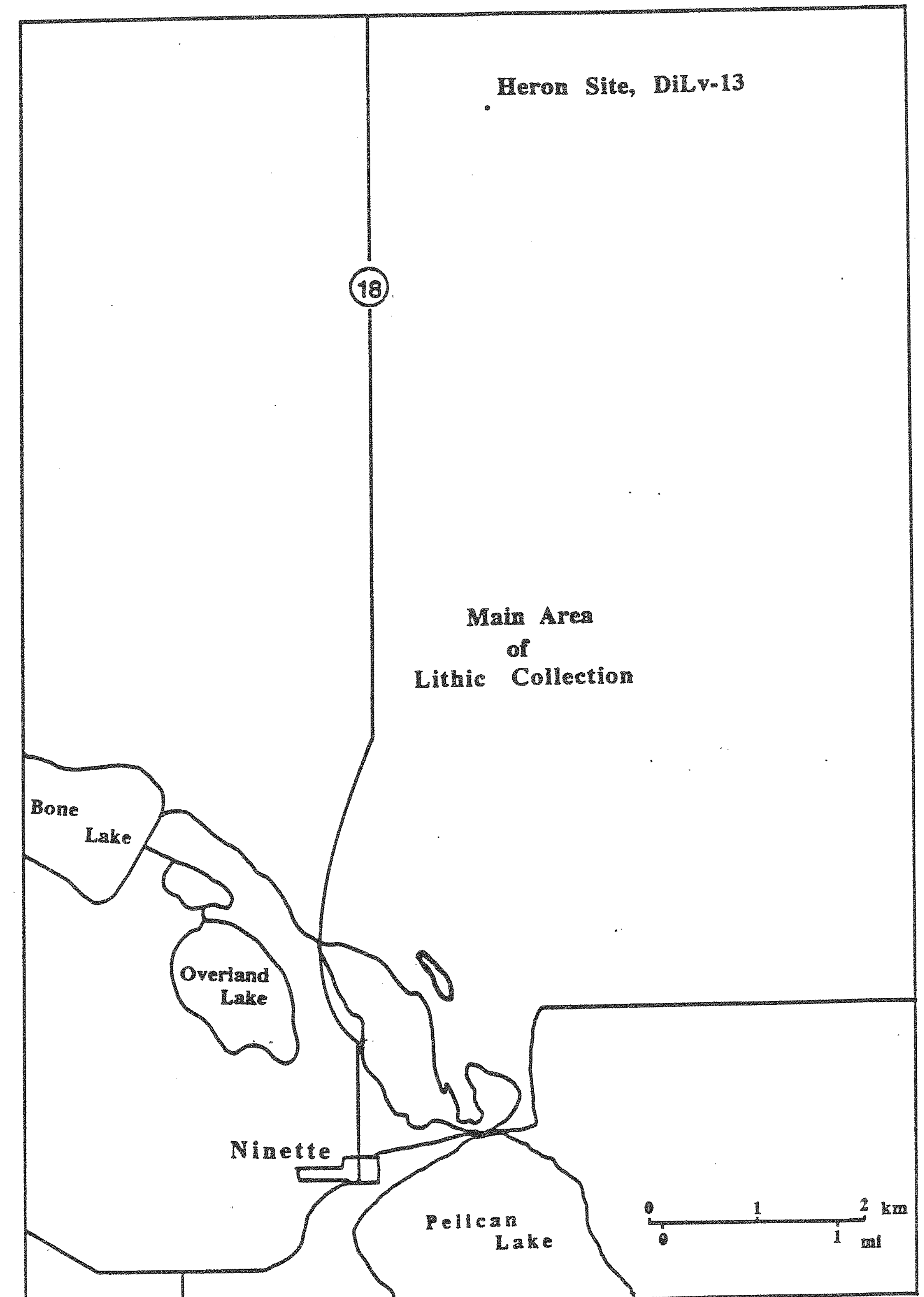

Figure 9: Heron Site, DiLv-13

Table 1: Heron Site, DiLv-13, Artifact Frequency

Class	Element	Count	Relative %	Count	Relative %
Core				9	4.30
Core Reduction Debitage				186	89.90
	Flake	84	44.90		
	Shatter	82	39.60		
	Misc. Un Ret[a]	13	6.30		
	Utilized Flake	4	1.90		
	Misc. Bf Ret[b]	3	1.50		
Stone Tool				12	5.80
	P.P.[c] Blank	3	1.45		
	P.P. Avonlea	2	0.90		
	Knife	2	0.90		
	Side-Scraper	1	0.48		
	Flake Blank	1	0.48		
	P.P. Triangular	1	0.48		
	Pecking Stone	1	0.48		
	Uniface	1	0.48		
Total				207	100.00

[a]Miscellaneous Unifacially Retouched Flake
[b]Miscellaneous Bifacially Retouched Flake
[c]Projectile Point

Table 2: Classification of Lithic Material at the Heron Site, DiLv-13

	Element	Count	Relative %	Count	Relative %
Local				166	80.20
	SRC	90	43.50		
	Misc. Chert	55	26.60		
	Jasper	15	7.20		
	Chalcedony	6	2.90		
Exotic				41	19.80
	KRF	24	11.60		
	TRSS	17	8.20		
Totals				207	100.00

26.6% misc. chert, 7.2% jasper and 2.9% misc. chalcedony. Exotic lithic materials comprised 19.2% of the total frequency of recovered lithics (Table 2). Exotics consisted of 11.6% Knife River Flint and 8.2% Tongue River Silicified Sediment.

It is likely that the majority of the Heron lithics were collected from the study area since it is only a relatively short distance (5 km) from the site to the quarry areas. The high frequency of SRC (especially) within the Heron assemblage indicates that the site occupants relied heavily upon local lithic material.

The frequency counts of lithic materials within the Heron site suggests that the lithic collection locales of the Tiger Hills were important to the prehistoric occupants of this site. This statement could possibly be quantified through a more detailed mineralogical analysis of the Heron lithics and the collection locale materials. An analysis of a number of sites, as well as materials from the study area may determine if a correlation between local sites and the collection areas exists. Lithics from sites on the periphery of southern Manitoba could also be examined for such material as Swan River Chert to determine if the use of this material has been localized or if there has been some curation and trade of this material into other regions. As well, the possibility exists of additional quarry sites in untested glacio-fluvial deposits within southern Manitoba. Any of these avenues of further research would provide additional information regarding the settlement, trade and migration patterns of southern Manitoba.

Supportive Archaeological Evidence For The Prehistoric Collection of Lithic Material Within The Tiger Hills.

In order to adequately evaluate the lithic collection potential within the study area we also need to look beyond the artifacts and re-examine literature that has inadequately interpreted the archaeological record of southern Manitoba. An examination of this literature should help to clarify the interpretations within this thesis regarding the lithic collection locales discovered within the Tiger Hills.

An example of previous literature that inadequately evaluates southern Manitoba is the report by Leonoff (1970). Leonoff (1970:58) bases his interpretations of regional lithics from south-west Manitoba on the materials collected from one site, the Avery Site (Joyes 1970), along the north-east shore of Rock Lake. It is the author's opinion that the size of the sample used by Leonoff (1970) would have been an inadequate base from which to properly reflect any archaeological interpretation regarding lithic utilization practices for the entire southern Manitoba region. At the time of Leonoff's (1970) report there were a number of available archaeological studies from various locales in south-western Manitoba (MacNeish and Capes 1958; Syms 1969; Vickers 1945, 1949, 1950a, 1950b; for example). The addition of any of these would have added significantly to his interpretations.

Leonoff (1970) outlines the cultural sequence for southern Manitoba from the Paleo-Indian to early historic periods based on the Avery Site artifacts as reported by Joyes (1970). His report concludes that KRF was utilized to a much greater frequency in southern Manitoba than is actually the case and that it is the predominant lithic of the region. Subsequent work within this region has shown that KRF usually comprises a smaller portion of the over-all lithics recovered (Brandzin 1992; Low 1992a, 1992b, 1993; Nicholson 1986) although individual sites or assemblages (Joyes 1970; MacNeish and Capes 1958) may contain a high percentage of this material. Leonoff's report has perpetuated a false evaluation of the types and frequency of lithics in southern Manitoba.

McKean Complex. One of the few pieces of literature that attempts to synthesis previous archaeological work regarding a single complex is the report by Syms (1969) on the McKean people. Leonoff (1970) reinforces his conclusions by utilizing Syms' (1969) report on the McKean Complex. He states that although Syms (1969) noted a predominance of SRC within south-western Manitoba this material must have been carried into southern Manitoba by the McKean people as most lithic recoveries in this region, according to him, are KRF. However, the pattern of lithic utilization by the McKean people indicates that they were not concerned about transporting any one particular lithic material with them as they migrated from one locale into another. Although they may have curated a small amount of exotic lithic material "most [McKean] artifacts were made from local raw [lithic] materials" (Syms 1969: 130). This is substantiated by the various site reports cited throughout Syms' (1969) report.

Every locality that the McKean people inhabited is represented by a different localized lithic material within their archaeological assemblages. In Manitoba this pattern is represented by:

1) SRC in the Swan River Valley (Pettipas 1969; Syms 1969);
2) Quartz and argillite east of Winnipeg near the Ontario border (MacNeish 1958; Syms 1969);
3) Selkirk (Lockport) Chert near Winnipeg (Mayer-Oakes 1967; Syms 1969);
4) Cathead Chert north-west of Lake Winnipeg (Mayer-Oakes 1967; Syms 1969); and,
5) SRC, miscellaneous cherts, KRF, and miscellaneous lithics in the south-western, south-central region (Joyes 1969; MacNeish and Capes 1958; Syms 1969; Vickers 1949, 1950a, 1950b).

It appears that the McKean people were quite confident about being able to quarry lithics within the various localities in southern Manitoba and therefore they saw no need to curate lithic material with them from other localities or regions. Contrary to Leonoff's (1970) interpretation, Syms' (1969) report indicates that prehistoric quarrying within Manitoba (overall) may have been more extensive than has previously been realized.

Summary. If there was a high density of raw SRC available for collection (prehistorically) within southern Manitoba then the previous assumptions that this lithic material was carried into the region will need to be re-examined. If the high frequency of SRC observed within the study area is not an anomaly peculiar to the

Tiger Hills, and therefore, not traded or curated into this locale, then it must have been readily available for utilization by groups like the McKean. Due to the high frequency of cobbles of SRC recovered and observed within the study area, the lithic collection areas within the Tiger Hills are clearly not an anomaly within this locale.

The McKean occupation is only one group of mobile hunters and gatherers among the many who inhabited southern Manitoba prehistorically. Given the high frequency of local lithic utilization among this group, it seems obvious that the McKean people would be expected to have used the resources available to them as they moved into a new locality. Therefore, the SRC within their southern Manitoba assemblages was likely derived locally and not imported. This thesis will examine the hypothesis that groups occupying southern Manitoba made extensive use of local lithic resources, and used little exotic material. The evidence to be examined includes the artifact and material analysis of the nine lithic collection sites discovered within the Tiger Hills.

CHAPTER 6: LITHIC SITES OF THE STUDY AREA

The Sandhill Site, DiLv-14

The Sandhill Site (Figure 10) was discovered on the terraced area north of Ninette. It is the largest of the lithic collection locales discovered within the Tiger Hills. The Sandhill Site is situated at the base of the Tiger Hills moraine and lies north of Pelican Lake on a large tract of land covered with glacial outwash.

The series of morainic hills within the area of the Sandhill Site provides a key to the complex modification of the surface deposits that has occurred over much of the Pembina Valley Trench. Till in these moraines is stony and at several localities large deposits of outwash gravel are found next to the morainic hills. Topography of the entire area is rolling and deeply cut (Figure 11) with incised channels and bowls that are interspersed with areas of steep slopes and sinuous ridges. Localized soil ranges from about 15 to 20 cm in depth and is underlain by outwash gravels with a variable range in depth. The gravels are underlain by glacial till.

In many areas of the Sandhill Site cobbles of unworked cryptocrystalline material can be observed lying on the surface. These materials have been exposed through erosion and form part of the glacio-fluvial outwash deposit of this locale.

The Sandhill Site lithics are extremely varied in forms and types. The lithics from the Sandhill Site are primarily composed of SRC chalcedony, miscellaneous chert and quartzite (Table 3). Small

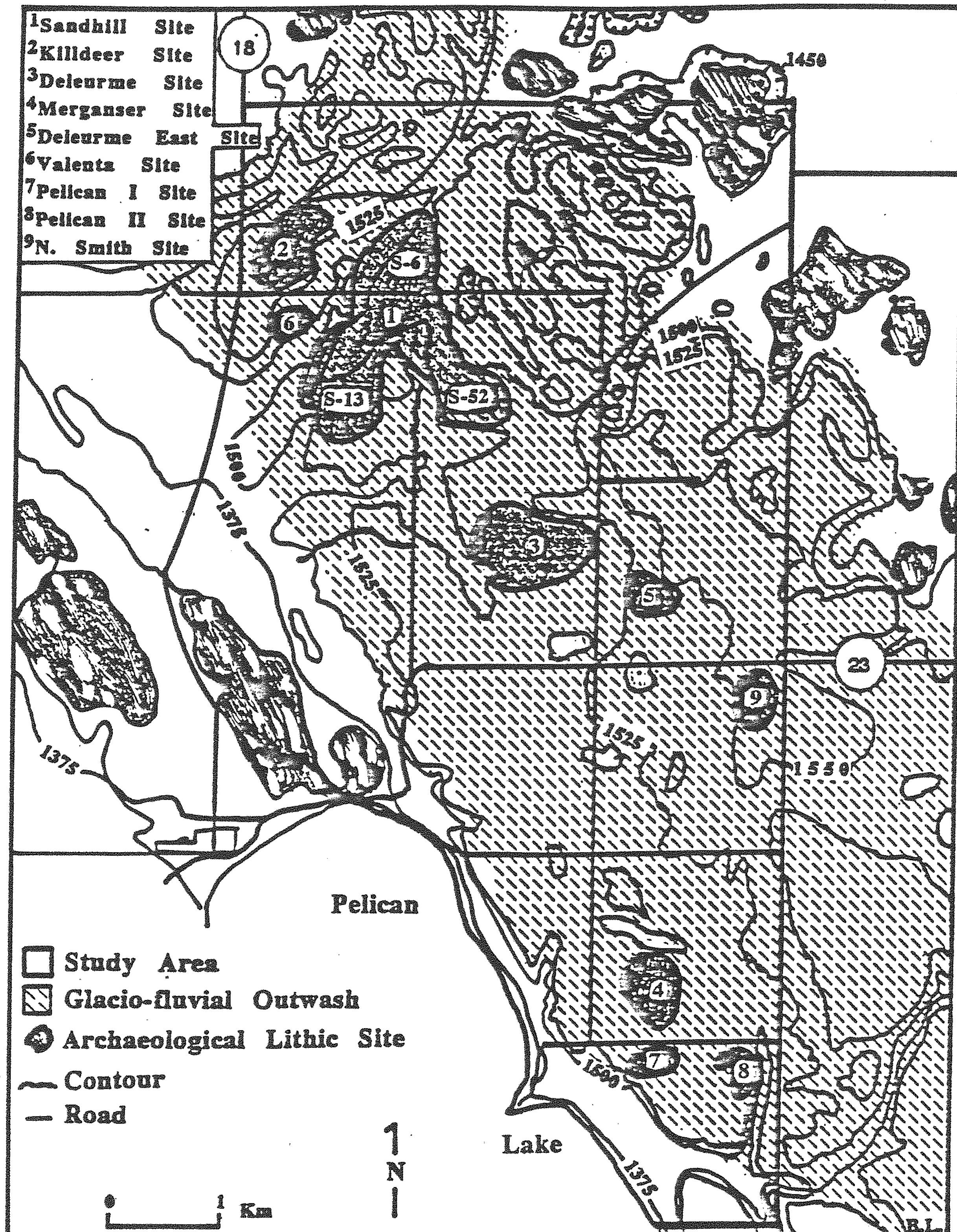

Figure 10: Archaeological Lithic Sites Within the Study Area

Figure 11: Rolling and Cut Topography of the Sandhill Site

amounts of jasper, miscellaneous silicified sediments, agate and Knife River Flint are also represented at this site (Table 3). Artifact recoveries were concentrated in three main localities within the Sandhill Site. These localities are illustrated in Figure 10 and include S-6 (Table 4), S-13 (Table 5) and S-52 (Table 6).

A total of 892 artifacts were collected from the Sandhill Site (Table 7). The majority of these are cores which comprise 58.18% of the total Sandhill recoveries. The Sandhill Site location S-13 produced the highest frequency of cores followed by S-6 and S-52.

The Sandhill cores are primarily cobble cores, but pebble and bipolar cores are also represented. Cores range from amorphous to prepared and a large number display multiple platforms.

Table 3: Distribution of Lithic Materials Among Sites within The Study Area

Study Area Sites	Local Lithic Material: SRC[a]	Misc. Chert	Chalcedony	Misc. Quartzite	Jasper	Silicified Sediment	Agate	Granite	Exotic Lithics: KRF[b]	TRSS[c]	BLBR[d]
Sandhill	X	X	X	X	X	X		X	X		
Killdeer	X	X	X	X	X	X			X	X	
Deleurme	X	X	X	X	X	X	X				X
Merganser	X	X	X		X						
Deleurme East	X	X	X								
Valenta	X	X		X	X						
Pelican I	X	X					X				
Pelican II	X	X									
N. Smith	X	X		X							

[a]Swan River Chert
[b]Knife River Flint
[c]Tongue River Silicified Sediment
[d]Bird Lake Black Rhyolite

This table only illustrates the presence of material within the individual study area sites. It in no way suggests the frequency of the materials recovered. The frequency of the study materials is illustrated in a subsequent Table (16) within this thesis.

Table 4: Sandhill Site Area S-6 Artifact and Lithic Frequency

Class	Element	Count	Lithic Frequency	Rel.%	Count	Lithic Frequency	Rel.%
Core					155	100-SRC; 33-misc. chert; 13-chalcedony; 4-misc. quartzite; 4-jasper; 1-sil. sediment	56.57
Debitage					107	78-SRC; 20-misc. chert; 6-chalcedony; 1-jasper; 1-sil. sediment; 1-KRF	39.05
	Flake	64	48-SRC; 12-misc..chert; 2-chalcedony; 1-jasper; 1-sil. sediment	23.36			
	Utilized Flake	22	15-SRC; 4-chalcedony; 2-misc. chert; 1-KRF	8.03			
	Shatter	11	7-SRC; 4-misc. chert	4.01			
	Misc. Un Ret[a]	9	8-SRC; 1-misc. chert	3.28			
	Misc. Bf Ret[b]	1	1-misc. chert	0.36			
Stone Tool					12	7-SRC; 2-KRF; 2-granite; 1-misc. quartzite	4.38
	Incomplete Fragment	3	3-SRC	1.09			
	Drill	3	3-SRC	1.09			
	Pecking Stone	2	2-Granite	0.73			
	Side-Scraper	1	1-KRF	0.36			
	Projectile Point	1	1-KRF	0.36			
	Chopper	1	1-misc. quartzite	0.36			
	Preform	1	1-SRC	0.36			
Total					274		100.00

[a]Miscellaneous Unifacially Retouched Flake
[b]Miscellaneous Bifacially Retouched Flake

Table 6: Sandhill Site Area S-52 Artifact and Lithic Frequency

Class	Element	Count	Lithic Frequency	Rel.%	Count	Lithic Frequency	Rel.%
Core					127	109-SRC; 11-chalcedony; 4-misc. quartzite; 3-misc. chert	80.38
Core Reduction Debitage					28	20-SRC; 4-chalcedony; 3-misc. chert; 1-quartzite	17.72
	Flake	21	15-SRC; 4-chalcedony; 1-misc. quartzite; 1-misc. chert	13.29			
	Shatter	7	5-SRC; 2-misc. chert	4.43			
Stone Tool					3	2-SRC; 1-KRF	1.90
	Projectile Point	1	1-KRF	0.63			
	Chopper	1	1-SRC	0.63			
	Side-Scraper	1	1-SRC	0.63			
Total					158		100.00

Table 5: Sandhill Site Area S-13 Artifact and Lithic Frequency

Class	Element	Count	Lithic Frequency	Rel.%	Count	Lithic Frequency	Rel.%
Core					237	198-SRC; 28-misc. chert; 5-chalcedony; 3-misc. quartzite; 2-agate; 1-KRF	51.52
Core Reduction Debitage					213	182-SRC; 18-misc. chert; 11-chalcedony; 1-agate; 1-misc. quartzite	46.30
	Flake	136	113-SRC; 14-misc. chert; 7-chalcedony; 1-agate; 1-misc. quartzite	29.57			
	Shatter	69	61-SRC; 4-misc. chert; 4-chalcedony	15.00			
	Utilized Flake	4	4-SRC	0.87			
	Misc. Un Ret[a]	4	4-SRC	0.87			
Stone Tool					10	7-SRC; 2-KRF; 1-granite	2.17
	Drill	4	3-SRC; 1-KRF	0.87			
	Projectile Point	2	2-SRC	0.43			
	Incomplete Fragment	2	2-SRC; 1-KRF	0.43			
	Chopper	1	1-granite	0.22			
	Side-Scraper	1	1-SRC	0.22			
Total					460		99.99

[a]Miscellaneous Unifacially Retouched Flake

Table 7: Total Lithic Frequency from the Sandhill Site DiLv-14

Class	Count	Lithic Frequency	Relative %
Core	519	407-SRC (45.63%); 64-misc. chert (7.17%); 29-chalcedony (3.25%); 11-mc. quartzite (1.23%); 4-jasper (0.45%); 2-agate (0.22%); 1-sil. sediment 0.11%; 1-KRF (0.11%).	58.18
Core Related Debitage	348	280-SRC (31.39%); 41-misc. chert (4.60%); 21-chalcedony (2.35%); 2-mc. quartzite (0.22%); 1-agate (0.11%); 1-sil. sediment (0.11%); 1-jasper (0.11%); 1-KRF (0.11%).	39.01
Stone Tool	25	16-SRC (1.79%); 5-KRF (0.56%); 3-Granite (0.34%); 1-mc. quartzite (0.11%).	2.80
Total	892		99.99

A sample of the Sandhill Site cores is illustrated in Figure 12.

The Sandhill Site debitage is composed primarily of a wide range of flakes and core shatter (Tables 4, 5, 6). This material consists of 39.01% of the total Sandhill Recoveries (Table 7). The

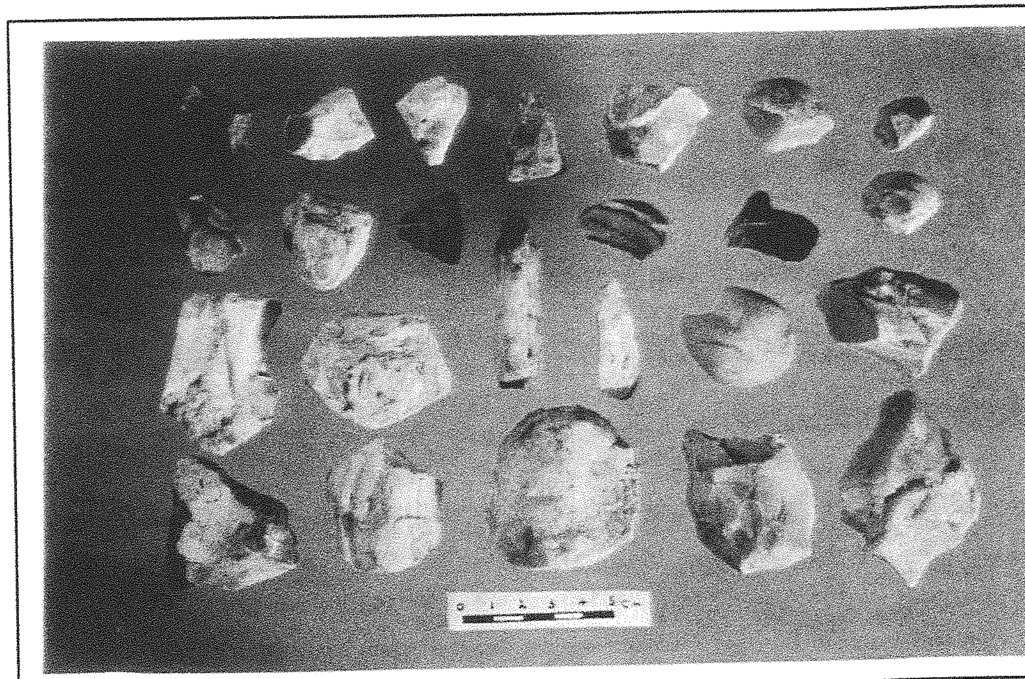

Figure 12: Representative Sample of Sandhill Site Cores

heaviest concentrations of this material came from site location S-13 with the lowest frequency coming from S-52. Several of the flaked materials display some level of utilization. A sample of debitage from the Sandhill is illustrated in Figure 13.

While several tools from the Sandhill Site are poorly made others are quite finely manufactured. Stone Tools comprise only 2.8% of the total site recoveries. Tools recovered (Tables 4, 5, 6) include: a Swan River Chert (SRC) biface, a SRC Pelican Lake projectile point, a SRC Sonota projectile point, a SRC Paleo-Indian projectile point base, a Knife River Flint (KRF) biface, and a KRF Pelican Lake projectile point. Other tool recoveries include a preform, 2 pecking stones, 3 choppers, 3 side-scrapers, 7 drills and 5 incomplete tools. A sample of Sandhill Site tools is illustrated in Figure 14.

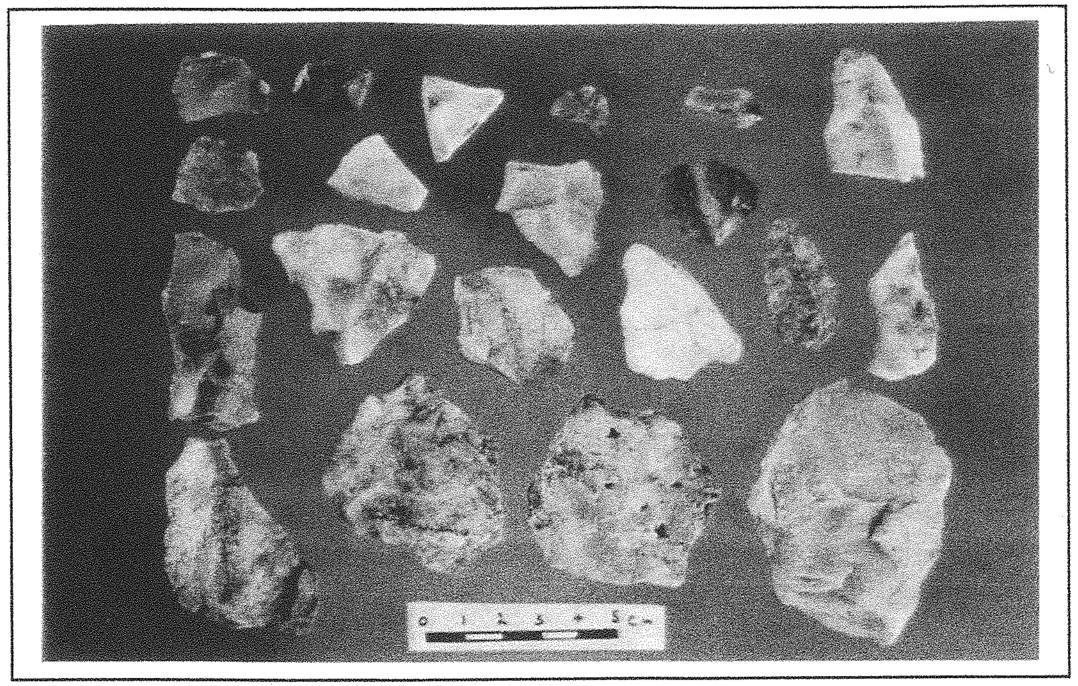

Figure 13: Representative Sample of Sandhill Site Debitage

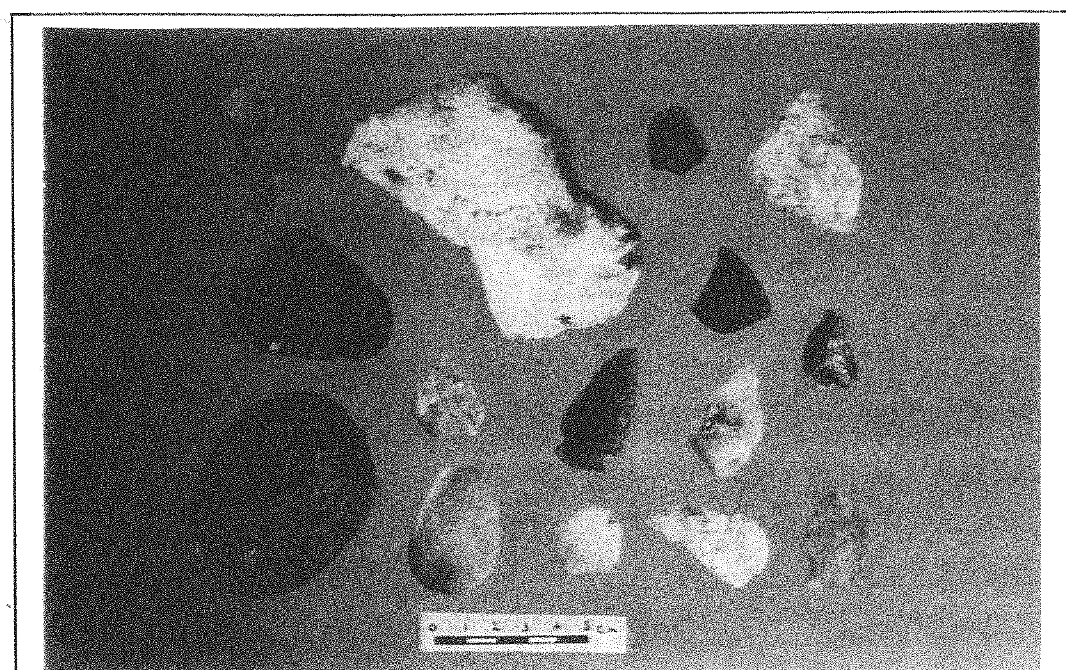

Figure 14: Representative Sample of Sandhill Site Tools

It is important to note that the lithic recoveries from the Sandhill Site are comprised of 99.22% local materials (Table 7) and that these lithics are derived from and appear to have been collected within the local glacio-fluvial deposits of this locality. Only 0.78% of the recoveries from this site consist of exotic material (Table 7), all of which is KRF. The heavy use of the local cryptocrystalline materials recovered from the Sandhill Site attest to the importance of this site locale for the prehistoric collection of lithics.

The Killdeer Site, Dilv-16

The Killdeer Site (Figure 10) was discovered on a terraced area west of the Sandhill Site. The Killdeer Site and the Sandhill site are separated by a wide slough bottomed channel. The Killdeer Site is the second largest lithic collection area located within the study area. This site also contains a large and diverse amount of lithic materials (Table 3) that consist of primarily SRC, miscellaneous chert, chalcedony and quartzite (Table 8). Small amounts of jasper, miscellaneous silicified sediments were recovered and one piece each of KRF and TRSS (Table 8). There were also a number of raw unworked pieces of cryptocrystalline material observed upon the surface of this site.

In total 343 artifacts were collected from the Killdeer site (Table 8). As with the Sandhill Site, the majority of the Killdeer artifacts are cores (57.14%). These include cobble, pebble and bipolar cores. Bipolar cores are separated from pebble cores because they display evidence that they had one end placed on a hard

Table 8: Killdeer Site DiLv-16 Artifact and Lithic Frequency

Class	Element	Count	Lithic Frequency	Rel.%	Count	Lithic Frequency	Rel.%
Core					196	118-SRC (34.4%); 55-misc. chert (16.03%); 13-chalcedony (3.79%); 7-misc. quartzite (2.04%); 1-jasper (0.29%); 1-KRF (0.29%); 1-TRSS (0.29%).	57.14
Core Reduction Debitage					137	67-SRC (25.95%); 35-misc. chert (10.5%); 4-misc. quartzite (1.17%); 4-chalcedony (1.17%); 2-jasper (0.58%); 1-agate (0.29%); 1-KRF (0.29%).	39.94
	Shatter	66	38-SRC; 26-misc. chert; 1-chalcedony; 1-agate	19.24			
	Flake	42	29-SRC; 9-misc. chert; 4-misc. quartzite	12.24			
	Utilized Flake	24	20-SRC; 2-chalcedony; 1-jasper; 1-misc. chert	7.00			
	Misc. Un Ret[a]	3	1-SRC; 1-chalcedony; 1-jasper	0.87			
	Misc. Bf Ret[b]	2	1-SRC; 1-KRF	0.58			
Stone Tool					10	9-SRC (2.62%); 1-misc. quartzite (0.29%).	2.92
	Side-Scraper	5	5-SRC	1.46			
	End-Scraper	4	3-SRC; 1-misc. quartzite	1.17			
	Drill	1	1-SRC	0.29			
Total					343		100.00

[a]Miscellaneous Unifacially Retouched Flake [b]Miscellaneous Bifacially Retouched Flake

surface while flakes were removed from the opposite end with a percussor. Bipolar cores also displayed evidence that they had been extensively worked. Many pebble cores were small (2-4 cm) discoidal artifacts that only had several edges worked so that they could be utilized as a tool, leaving the majority of the cortex intact. The Killdeer cores range from amorphous to prepared and the majority display multiple platforms. A sample of Killdeer Site cores is illustrated in Figure 15.

Debitage comprises 39.94% of the total Killdeer Site recoveries. This material consists primarily of core shatter, but there is also a high frequency of flake material represented. This material varies in size and form; several flakes display utilization. A sample of debitage collected from the Killdeer Site is illustrated in Figure 16.

The tools collected from the Killdeer Site include: 4 end-scrapers, 5 side-scrapers, and a drill. These are generally rough and represent 2.92% of the total Killdeer Site recoveries. A sample of Killdeer Site tools is illustrated in Figure 17.

As with the lithic recoveries from the Sandhill Site the Killdeer Site artifacts are composed of 99.13% local lithic materials (Table 8) derived from the glacio-fluvial deposit of this locale. The only exotic materials recovered were two pieces of KRF and one piece of TRSS (Table 8).

The importance of this locality for the prehistoric collection of lithics becomes even more convincing when the Sandhill and Killdeer Site areas are combined. These sites comprise 73.3% of the total study area recoveries almost all of which were derived locally.

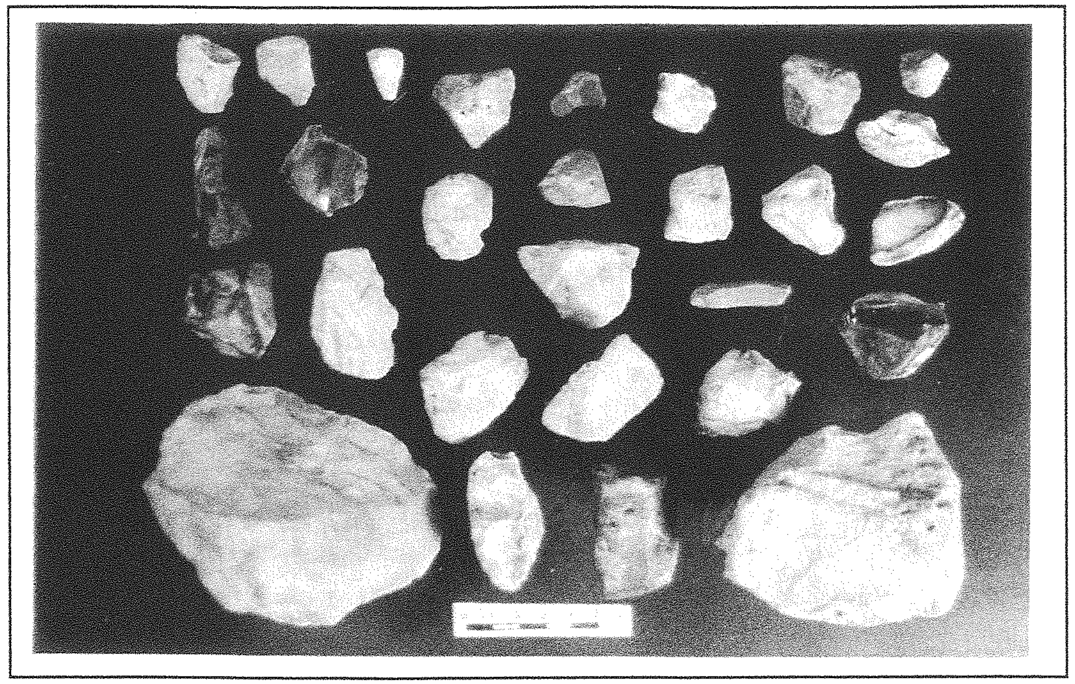

Figure 15: Representative Sample of Killdeer Site Cores

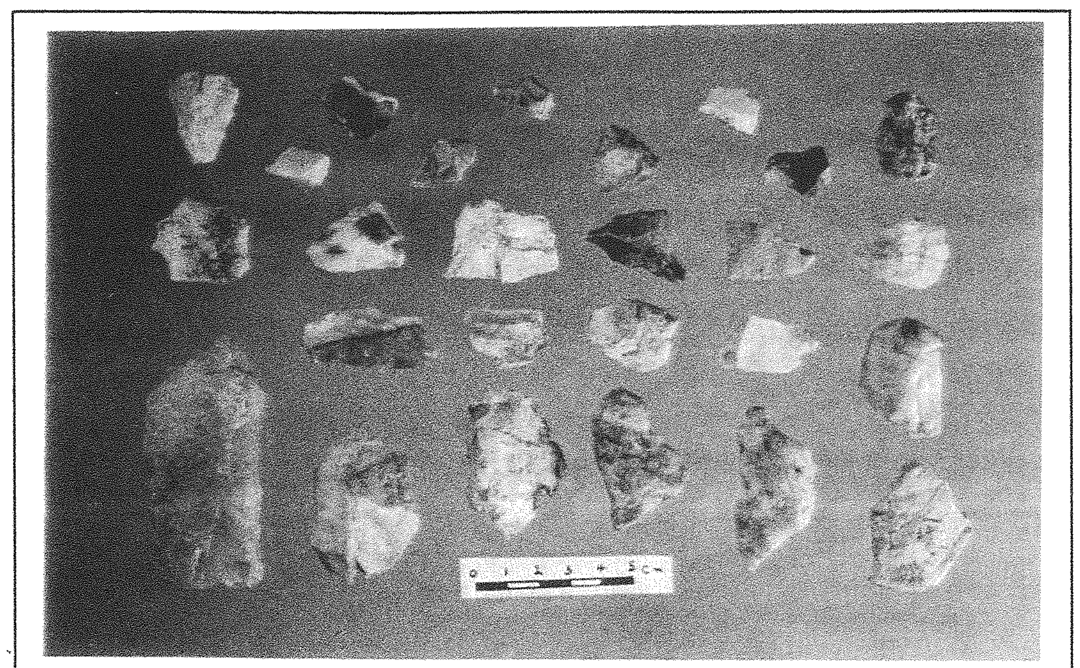

Figure 16: Representative Sample of Killdeer Site Debitage

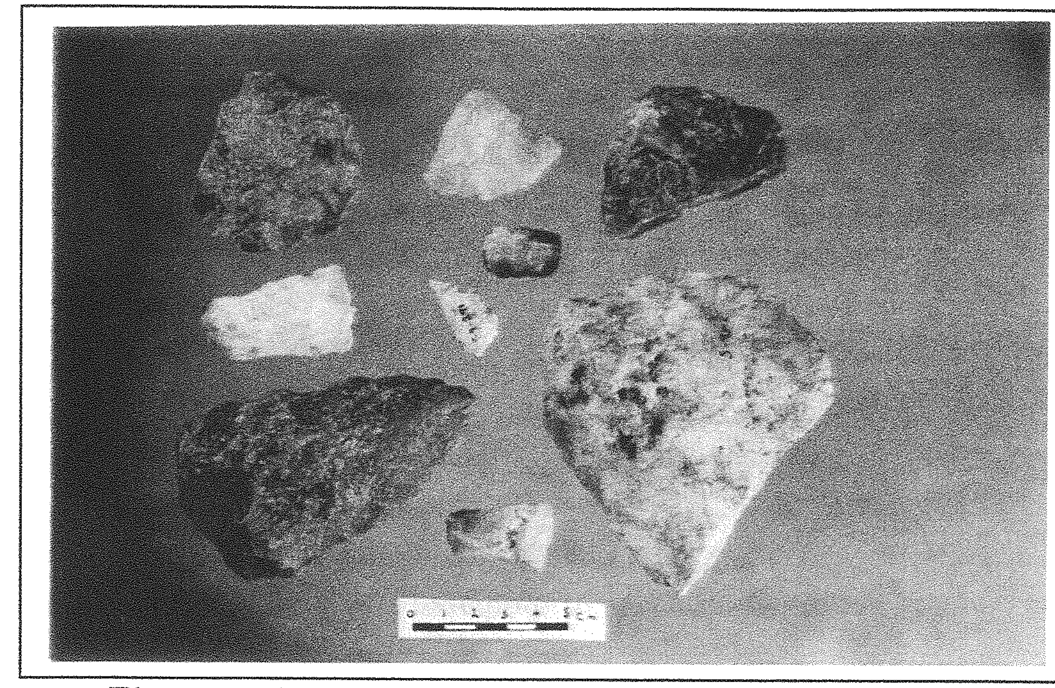

Figure 17: Representative Sample of Killdeer Site Tools

The Deleurme Site

The Deleurme Site (Figure 10) is located approximately 3 km south-east of the Sandhill Site. The situation of the Deleurme Site is slightly different from that of the previous sites. Rather than being located along the upper ridges of the slopes that extend down to Langs Valley from the Tiger Hills ridge, this site is located at the base of those slopes. It is contained entirely within a section of rolling field that extends south from the slope base.

The Deleurme Site is the third largest lithic collection area discovered within the study area. The surface area of this locality also contains areas of exposed unworked cryptocrystalline materials, primarily cherts and quartzite. However, there was a lower concentration of unworked material in this locality than in the previously indicated sites. Lithic materials recovered from the Deleurme Site (Table 3) consist primarily of SRC, miscellaneous chert, chalcedony and quartzite. There were also minor amounts of jasper, silicified sediment and agate, and one piece of Bird Lake Black Rhyolite recovered at the Deleurme Site.

A total of 311 artifacts were recovered from the Deleurme Site (Table 9). A larger percentage of cores (64.31%) were recovered, in comparison to the overall site recoveries, from this site than from those previously discussed. Cores consisted of the cobble and pebble types and ranged from amorphous to prepared with several levels of platform preparation present in many of these artifacts. A sample of cores from the Deleurme Site is illustrated in Figure 18.

The percentage of debitage from the Deleurme Site (34.73%) is similar to that of the Sandhill (39.01%) and Killdeer Sites (39.94%). The Deleurme Site debitage almost equally consists of flake material (20.46%) and core shatter (14.47%). Several of the flakes also display some utilization. A sample of debitage from the Deleurme site is illustrated in Figure 19.

There was a smaller number of stone tools (0.96%) recovered from the Deleurme Site in comparison to the Sandhill and Killdeer Sites. The tools recovered from the Deleurme Site are a SRC side-scraper, a SRC preform and a Bird Lake Black Rhyolite preform. These are illustrated in Figure 20.

The lithics recovered within the Deleurme Site, as with the lithic recoveries from the Sandhill and Killdeer Sites, are composed of over 99% (99.68%) local materials (Table 9). These have also apparently been derived from the local glacio-fluvial deposit of this

Table 9: Deleurme Site Artifact and Lithic Frequency

Class	Element	Count		Rel.%	Count		Rel.%
Core					200	150-SRC (48.23%); 48-misc. chert (15.43%); 1-agate (0.32); 1-jasper (0.32).	64.31
Core Reduction Debitage					108	80-SRC (25.72%); 20-misc. chert (6.43%); 7-misc. quartzite (2.25%); 1-jasper (0.32).	34.73
	Flake	63	43-SRC; 12 misc. chert; 7-misc. quartzite; 1-jasper	20.26			
	Shatter	45	37-SRC; 8 misc. chert	14.47			
Stone Tool					3	2-SRC (0.64%); 1-Bird Lake Black Rhyolite (0.32).	0.96
	Side-Scraper	2	2-SRC	0.64			
	Preform	1	1-Bird Lake Black Rhyolite	0.32			
Total					311		100.00

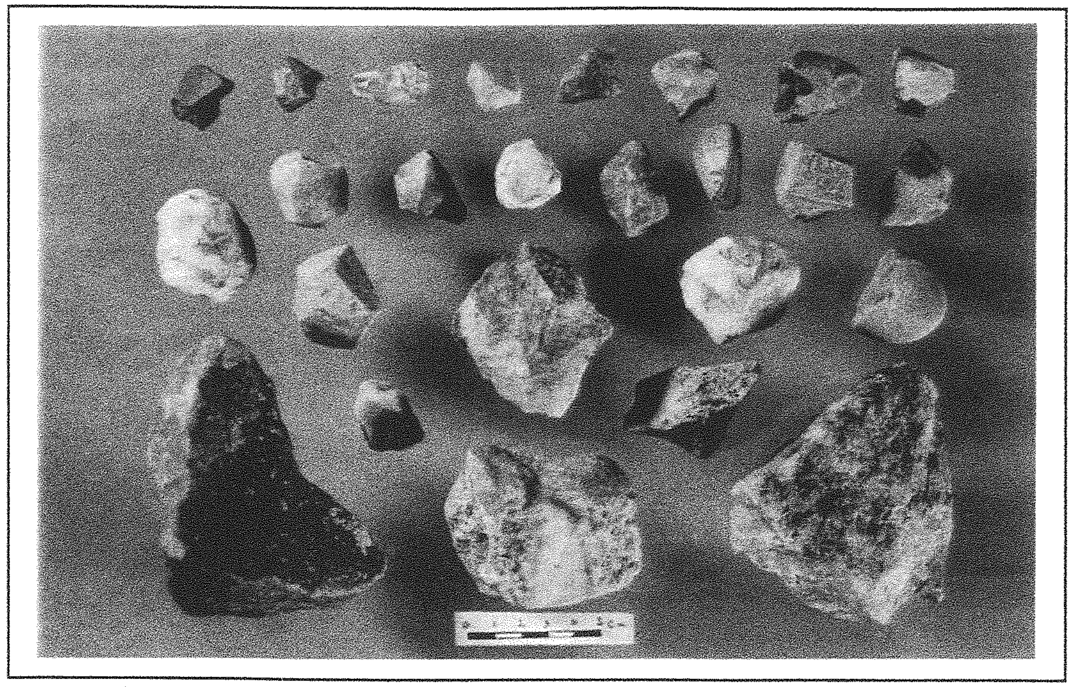

Figure 18: Representative Sample of Deleurme Site Cores

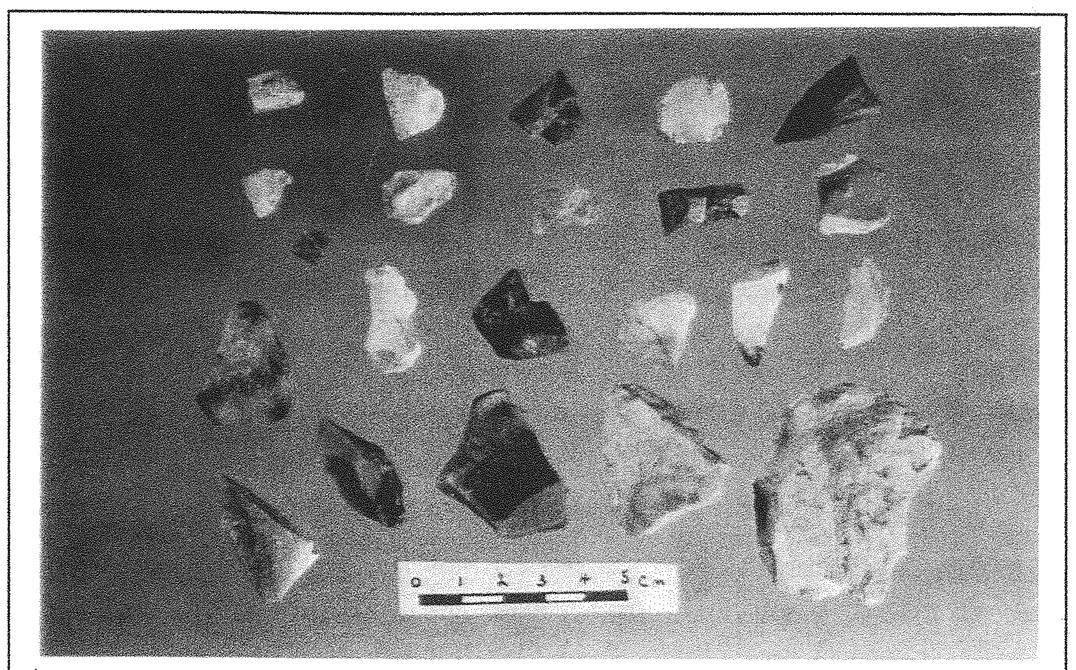

Figure 19: Representative Sample of Deleurme Site Debitage

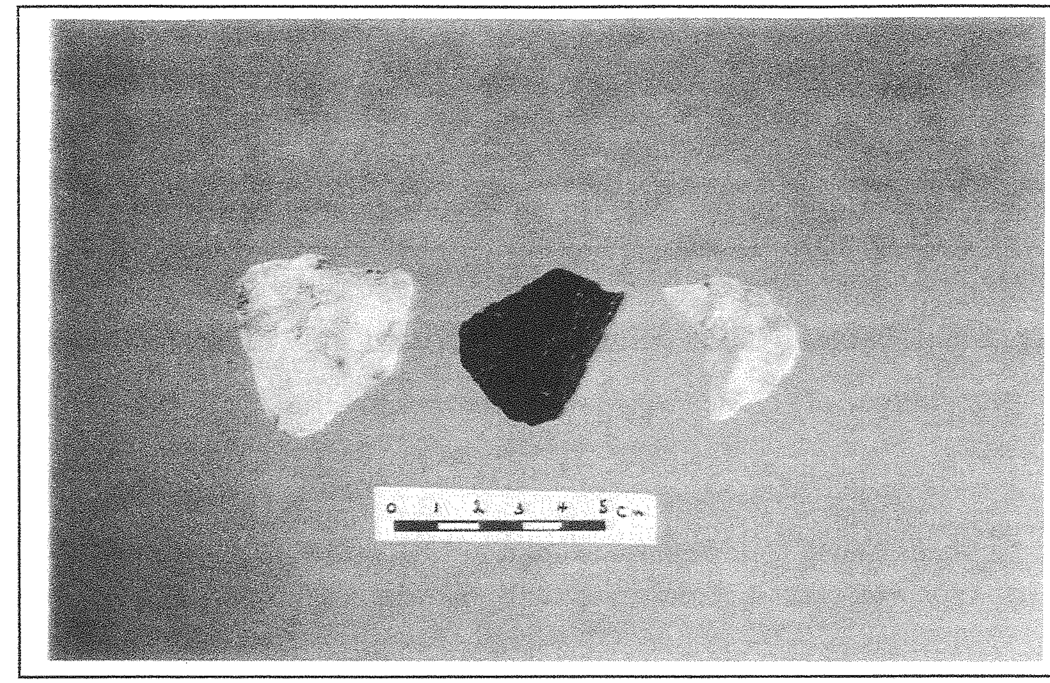

Figure 20: Representative Sample of Deleurme Site Tools

locality. The only exotic material recovered from the Deleurme Site was one piece of Bird Lake Black Rhyolite (Table 9).

The Sandhill, Killdeer and Deleurme Sites form a combined total of 91.7% of the recoveries from within the Study Area. As previously indicated these sites also cover a combined area of approximately 9 km^2. Prehistoric lithic collection at these sites would therefore appear to have been quite extensive. This is particularly the case when viewed from the context of the combined collection area and the frequency with which local material has been recovered within the study area and the types of artifact recoveries at these sites.

The Merganser Site, DiLv-15

The Merganser Site (Figure 10) is located on the plateau area along south-east Pelican Lake. This area consists of a series of rolling hills intermixed with flat terraces. The lithic materials from the Merganser Site (Table 3) are primarily SRC and miscellaneous chert. A small percentage of chalcedony was also recovered and one piece of jasper. There were no exotics recovered from the Merganser Site. The Merganser Site artifact and lithic recoveries (Table 10) are similar in type to those found at the Sandhill, Killdeer and the Deleurme sites; however, less material was collected from this site and very little unworked lithic material was observed.

The Merganser artifacts are entirely composed of cores and debitage. There were only 54 artifacts recovered from the Merganser site, however, the majority of these are cores (79.63%). They are mainly cobble cores, but there are also 8 pebble cores represented. The cores display various types of platforms. The debitage from this site consists of 6 miscellaneous flakes, 4 pieces of core shatter and one utilized flake. A sample of cores and debitage recovered from the Merganser Site is illustrated in Figure 21.

The lithics recovered within the Merganser Site are entirely comprised of local materials (Table 10). The total recoveries from within the Merganser Site are small in comparison to those of the Sandhill, Killdeer and Deleurme Sites. However, the Merganser Site recoveries provide a further indication of the extent of the raw lithic material collection that took place within the Tiger Hills prehistorically.

Table 10: Merganser Site DiLv-15 Artifact and Lithic Frequency

Class	Element	Count	Lithic Frequency	Rel.%	Count	Lithic Frequency	Rel.%
Core					43	23-SRC (42.59%); 16-misc. chert 29.63%); 2-chalcedony (3.7%); 2-jasper (3.7%).	79.63
Core Reduction Debitage					11	7-misc. chert (12.96%); 4-SRC (7.41%).	20.37
	Flake	6	4-misc. chert; 2-SRC	11.12			
	Shatter	4	3-misc. chert; 1-SRC	7.41			
	Utilized Flake	1	1-SRC	1.85			
Total					54		100.00

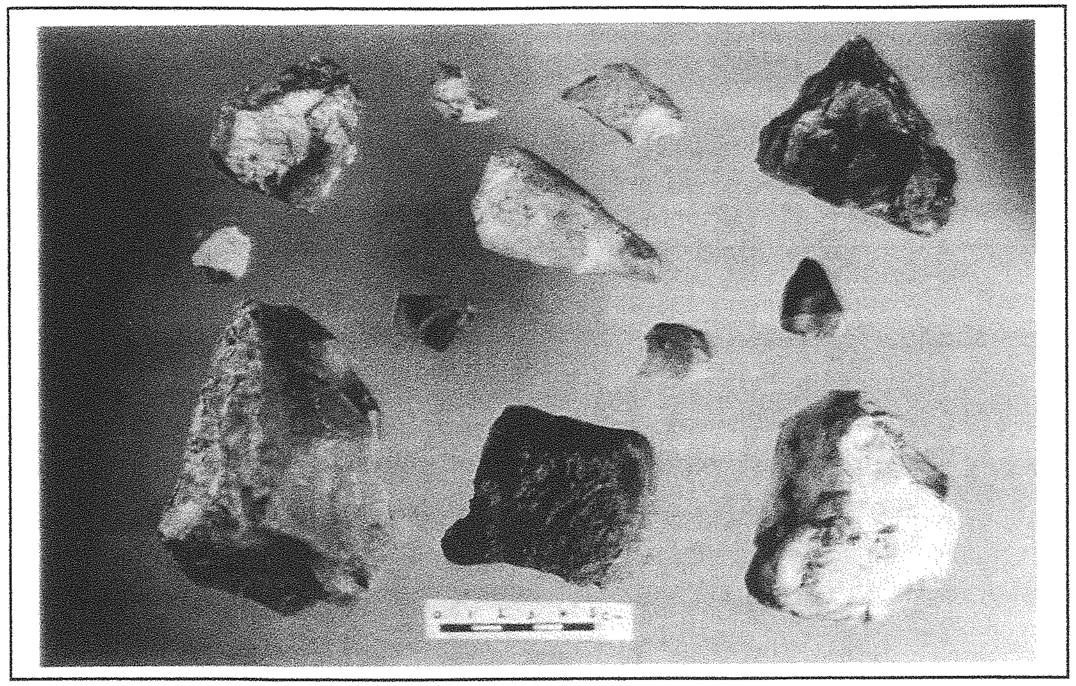

Figure 21: Representative Sample of Cores and Debitage from the Merganser Site

The Deleurme East Site

The Deleurme East Site (Figure 10) is located approximately 3 1/2 km south-east of the main Sandhill Site locale and 1/2 km east of the Deleurme Site. This site, like the Deleurme Site, is located south of the Tiger Hills slopes that extend down to Langs Valley. The lithic material from this site (Table 3) is composed of SRC, miscellaneous chert and chalcedony.

The Deleurme East Site is a small lithic collection area in comparison to the previous sites. Only 37 artifacts were recovered (Table 11) consisting of 28 cores (75.68%) and 9 pieces of debitage (24.32%). The artifacts from the Deleurme East Site include 24 cobble cores, 4 pebble cores, 2 pieces of core shatter and 7 flakes. Several cores display multiple platforms that indicate the high level

Table 11: Deleurme East Site Artifact and Lithic Frequency

Class	Element	Count	Lithic Frequency	Rel.%	Count	Lithic Frequency	Rel.%
Core					28	20-SRC (54.05%); 4-misc. chert (10.8%); 4-chalcedony (10.8%).	75.68
Core Reduction Debitage					9	7-SRC (18.92%); 2-misc. chert (5.41%).	24.32
	Flake	7	6-SRC; 1-misc. chert	18.92			
	Shatter	2	1-SRC; 1-miisc. chert	5.41			
Total					37		100.00

of testing and use they underwent. A sample of cores and debitage collected from this site is illustrated in Figure 22.

The lithics from the Deleurme East Site consist entirely of local materials (Table 11) that were also derived from within the local glacio-fluvial deposits. The significance of this site is that it too illustrates that extensive collection of raw lithic material took place within the Tiger Hills prehistorically.

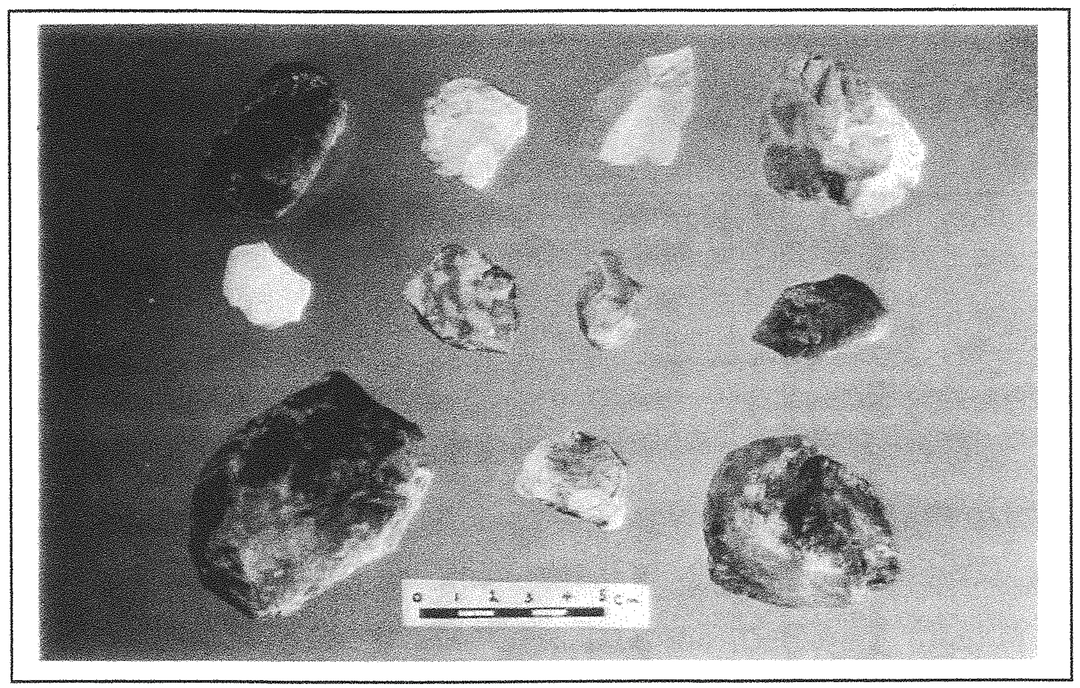

Figure 22: Representative Sample of Cores and Debitage from the Deleurme East Site

Valenta Site

The Valenta Site (Figure 10) is located north of Pelican Lake on the terraced area of the Tiger Hills directly south of the Killdeer Site. This is a small lithic collection area located on a terrace that extends along the west side of the slough bottomed channel that separates

this site and the Killdeer Site from the Sandhill Site to the east. The Valenta Site contains 66.67% cores and 33.34% debitage with a total of 21 artifacts recovered (Table 12). Lithics recovered (Table 3) include SRC, miscellaneous chert, miscellaneous quartzite and jasper. The frequency of this material is illustrated in Table 12.

The artifacts recovered from the Valenta site are composed mainly of cobble cores, although 2 pebble cores were recovered. Cores display varying levels of platform development. The debitage from this site consists of flakes and one piece of core shatter. A representative sample of cores and debitage from the Valenta Site is illustrated in Figure 23.

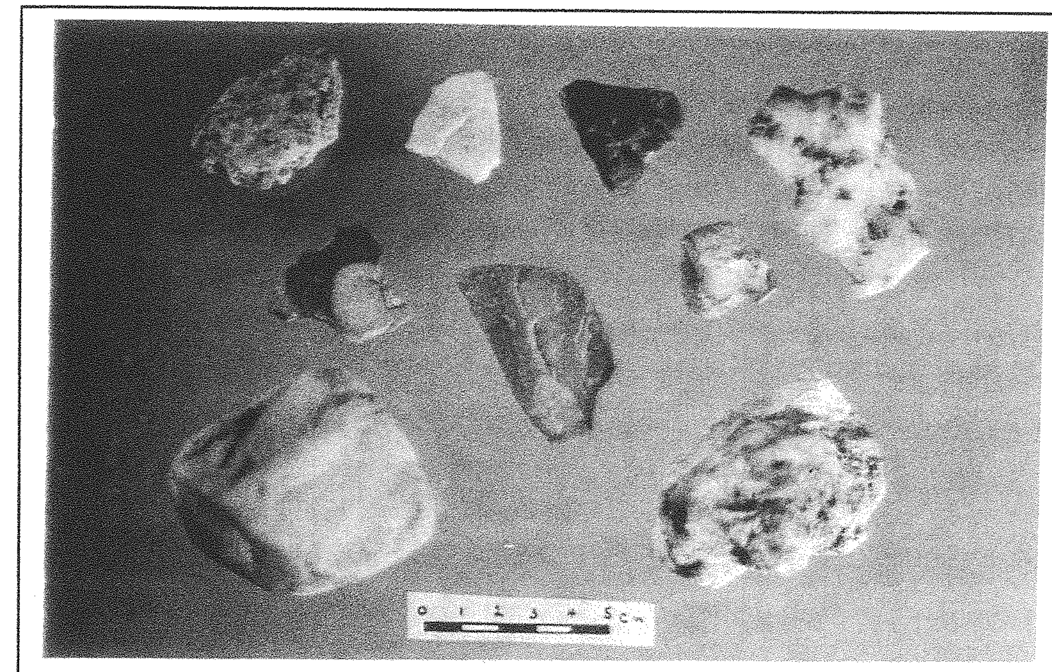

Figure 23: Representative Sample of Cores and Debitage from the Valenta Site

The lithic material collected within the Valenta site is entirely derived from the local glacio-fluvial deposit. Small lithic sites such

Table 12: Valenta Site Artifact and Lithic Frequency

Class	Element	Count	Lithic Frequency	Rel.%	Count	Lithic Frequency	Rel.%
Core					14	8-SRC (38.1%); 3-misc. chert (14.29%); 2-misc. quartzite (9.52%); 1-jasper (4.76%).	66.67
Core Reduction Debitage					7	4-misc. chert (19.05%); 2-SRC (9.52%); 1-misc. quartzite (4.76%).	33.34
	Flake	6	3-misc. chert; 2-SRC; 1-misc. quartzite	28.57			
	Shatter	1	1-misc. chert	4.76			
Total					21		100.00

as this indicates how widely this deposit was searched prehistorically for raw material.

Pelican Sites I and II

The Pelican I and II Sites (Figure 10) are located southeast of Pelican Lake on the plateau area directly south of the Merganser Site. Like the Merganser terrain this locale is rolling and cut. A small number of artifacts was collected from these sites. A total of 6 cores (54.55%) and 5 pieces of core related debitage (45.45%) were collected from Pelican I (Table 13), and 5 cores (62.50%) and 3 pieces of core related debitage (37.50%) were recovered from Pelican II (Table 14).

Lithic material from the Pelican I and II sites (Table 3) consist of SRC and miscellaneous chert with one piece of agate recovered from the Pelican I Site. The frequency of lithic material from these sites is illustrated in Tables 13 and 14. However, there were several smaller pieces of unworked cryptocrystalline material observed on the surface of this site. The cores display a varying range of platform development. A sample of cores and debitage from these sites are illustrated in Figure 24.

Although there was a very small total recovery from the Pelican I and II Sites, when these sites are added to the overall recoveries from the study area they, like the previously identified site locales, provide an indication of the extensive network of lithic collection that took place. The lithic materials collected from the Pelican I and II Sites are also derived from the local outwash.

Table 13: Pelican I Site DiLv-17 Artifact and Lithic Frequency

Class	Element	Count	Lithic Frequency	Rel.%	Count	Lithic Frequency	Rel.%
Core					6	4-SRC (36.36%); 1-misc. chert (9.1%); 1-agate (9.1%).	54.55
Core Reduction Debitage					5	3-SRC (27.3%); 2-misc. chert (18.18%)	45.45
	Flake	3	3-SRC	27.30			
	Shatter	2	2-misc. chert	18.18			
Total					11		100.00

Table 14: Pelican II Site DiLv-18 Artifact and Lithic Frequency

Class	Element	Count	Lithic Frequency	Rel.%	Count	Lithic Frequency	Rel.%
Core					5	4-SRC (50.0%); 1-misc. chert (12.5%).	62.50
Core Reduction Debitage					3	3-SRC (37.5%).	37.50
	Flake	3	3-SRC	37.50			
Total					8		100.00

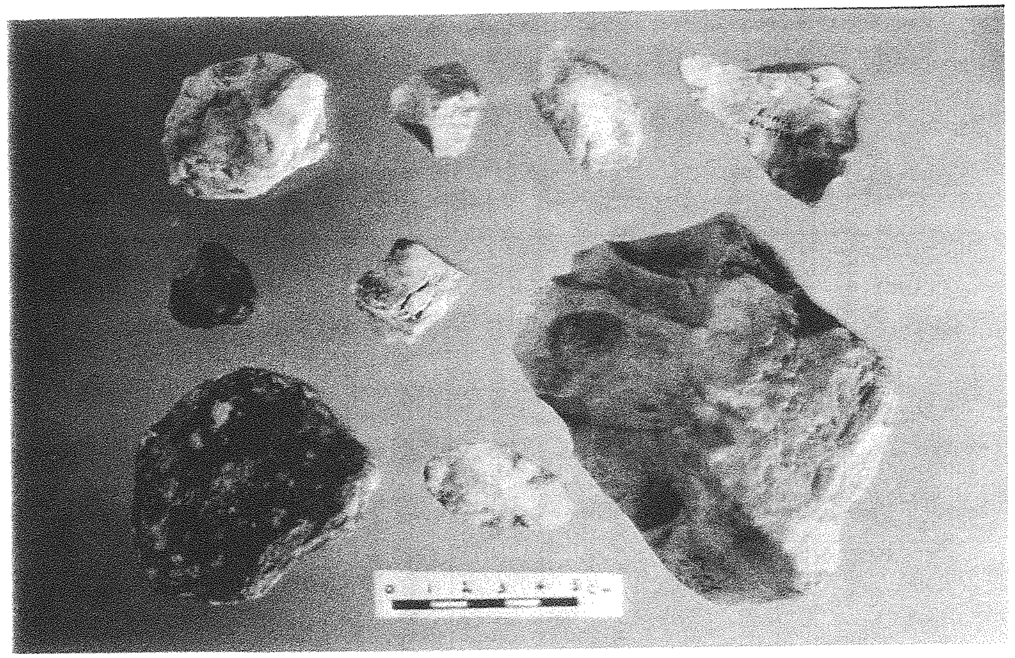

Figure 24: Representative Sample of Cores and Debitage from the Pelican I and II Sites

N. Smith Site

The N. Smith Site (Figure 10) is located east of Pelican Lake and about 1 km south of the Deleurme Sites. The topography of this site is slightly rolling. Although only 9 artifacts were collected from this site (Table 15) they are (all) rather large cobble cores. A sample of these is illustrated in Figure 25.

The N. Smith site lithics include SRC, miscellaneous chert and quartzite derived from the local glacio-fluvial deposit (Table 3). The frequency of the recovered lithics is illustrated in Table 15. This site also contained un-worked lithic material observable on the surface at several locations. The nature of the recoveries from this site also

Table 15: N. Smith Site Lithic Frequency

Class	Count	Lithic Frequency	Relative %
Core	9	5-SRC (50.00%); 3-mc. quartzite (30.00%); 1-misc. chert (10.00%).	100.00
Total	9		100.00

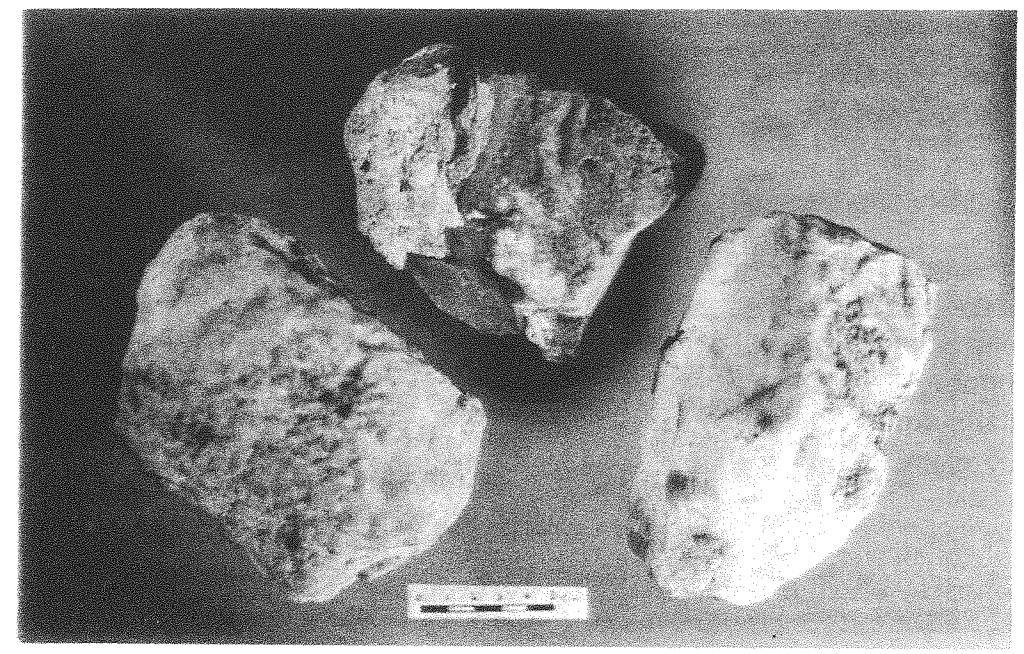

Figure 25: Representative Sample of Cores and Debitage from the N. Smith Site

indicates that this locale was used for the express purpose of collecting raw lithic material.

CHAPTER 7: ARTIFACT ANALYSIS

The Data Base

The data base for this thesis includes a variety of locally available and exotic lithic materials (Table 16). Table 16 illustrates

Table 16: Frequency of Lithic Materials Recovered within the Study Area

Material	Count	Relative %
Local Lithic Material		
Swan River Chert	1235	73.25
Miscellaneous Chert	304	18.03
Misc. Chalcedony	73	4.33
Misc. Quartzite	39	2.31
Jasper	13	0.77
Agate	6	0.36
Granite	3	0.18
Silicified Sediment	2	0.12
Exotic Lithic Material		
Knife River Flint	9	0.53
Tongue River Silicified Sediment	1	0.06
Bird Lake Black Rhyolite	1	0.06
Total	1686	100.00

the total frequency of recovered lithic material within the study area. Table 17 illustrates the total artifact frequency of the 1686 recovered artifacts within the study area.

The data base also includes those materials observed but not collected within the study area. The uncollected materials include large cores noted outside the main collection areas, and all natural raw lithic material observed within the main site locales.

Scope and Purpose

As has already been stated, a literature review has been combined with the laboratory analysis of the collected artifacts to assist in developing an understanding of the technological expertise of those groups who utilized the Tiger Hills lithic collection areas. This has aided in the archaeological interpretations and in appreciating the extent of prehistoric lithic collection within southern Manitoba as well as determining whether or not these sites were archaeological quarries.

An archaeological quarry site was defined by Holmes (1890, 1894, 1919) as a location in which a suitable stone source has been aboriginally quarried for the purpose of manufacturing stone tools for human use. Great quantities of stone tools and detritus resulting from a specific technological process, namely flint knapping, are found at such sites. Typical artifacts recovered from a quarry include cores from which flakes are struck, tools in various stages of completion, and objects and cores discarded due to some flaw or breakage in the material. Occasionally, materials used to quarry and

Table 17: Total Artifact Frequency within the Study Area

Class	Element	Count	Relative %	Count	Relative %
Core				1020	60.50
Core Reduction					
Debitage				629	37.31
	Flake	353	20.94		
	Shatter	205	12.16		
	Utilized Flake	52	3.08		
	Misc. Un Ret[a]	16	0.95		
	Misc. Bf Ret[b]	3	0.18		
Stone Tool				37	2.19
	Drill	9	0.53		
	Side-Scraper	9	0.53		
	Projectile Point	4	0.24		
	End-Scraper	4	0.24		
	Biface	3	0.18		
	Preform	3	0.18		
	Incomplete Fragment	3	0.18		
	Uniface	1	0.06		
	Chopper	1	0.06		
Total				1686	100.00

[a]Miscellaneous Unifacially Retouched Flake
[b]Miscellaneous Bifacially Retouched Flake

shape the raw material are also recovered. Preforms and specialized cores were often transported to adjacent areas for finishing or used in trade with people of other regions (Ahler 1986; Losey 1971; Holmes 1919).

Ahler (1977:142) suggests that sites containing high frequencies of cores and core-related debitage would likely be found where there are locally available raw lithic materials. He also notes that the examination of materials ranging from cores to tool types should assist in the study of raw lithic material exploitation at specific locales (Ahler 1977:143).

Typical quarry artifacts were recovered in great quantities within the study area although very little finished material was observed. These artifacts included materials in various stages of manufacture and utilization, including discarded cores that exhibited some flaw or breakage in the material.

General Artifact Classification

Core Analysis and Classification. Cores were classified according to size and morphology into cobble, pebble or irregular fragment categories. Each group was then analyzed for scars or evidence of flaking that would provide information as to the extent to which they had been previously utilized or prepared and whether they displayed single or multiple striking platforms. This provided the necessary information to classify the recovered cores into amorphous, prepared or bipolar types (Ahler 1986; Leaf, 1979; Losey 1971). Pebble cores were also analyzed for the degree to which they had been subjected to percussion flaking. Classification and analysis of cores provided the principle source of information that determined the density of the quarrying activity that took place within the study area in southern Manitoba.

Flaking Debris Analysis and Classification. Debitage was examined to determine if it might indicate whether the lithic work taking place was directly related to that of raw material collection. Debitage associated with core reduction was classified as either core shatter or flake material (reduction, thinning, etc.). Flaked debitage was analyzed for utilization or those traits that would relate it to the core reduction technologies.

Stone Tool Analysis and Classification. Diagnostic stone tools were classified based on the original analysis of those traits that allowed them to be assigned to a specific focus or phase. For example, those traits that are characteristic of Pelican Lake (Wettlaufer, 1955; Reeves, 1974a, 1974b) or Sonota (Wettlaufer, 1955) would allow a projectile point to be assigned to those phases as defined by the authors who originally identified them.

Classification of non-diagnostic tools was based on the analysis of four traits as adopted from various authors (Bryan 1950; Collins 1975; Holmes 1919; Losey 1971; VanBuren 1974). These basic characteristics are: blank; preform; primary flaking; and, secondary (retouch) flaking.

A blank is a tool that has no specific form although it can have many uses, such as large or crude choppers. A preform is the

beginning of a tool design. A preform that has been properly prepared would allow for the product to be completed in any number of forms. Unfinished knives, scrapers and projectile points are often identified as preforms. Primary flaking is the flaking that eliminates irregularities and prepares striking platforms allowing a preconceived form to be completed. Secondary flaking or retouch is the process of forming a special finish or edge, usually through pressure exerted by a punch like implement and a percussor or by applying a steady pressure through a hand held implement.

The preparation of a core usually involves the removal of the outer cortex of the lithic material to allow the striking platforms to be properly prepared. Most cores and some preforms display some cortex, although the presence of cortex on flaked, finished or highly worked material is rare.

Heat Treatment of Lithics

Many methods for the thermal treatment of lithic material have been described (Crabtree and Butler 1964; Griffiths *et al.* 1987; Hester, 1972; Mandeville and Flenniken, 1974; Patterson 1979; Purdy and Brooks 1971; Ray, 1982). Heat treating lithic material alters its original structure making it more yielding (Crabtree 1967:24; Mandeville 1973: 177; Patterson 1979: 255) which improves its workability in the manufacture of stone tools (Griffiths *et al.* 1987:44; Patterson 1979: 255). This method has been commonly used for flints and hard coarse cherts (Mandeville 1973: 177), such as SRC which is a major lithic material collected within the

Tiger Hills.

Flakes and debitage derived from the heat treatment of lithic materials are identified by surface luster and textural alteration (Mandeville 1973: 183; Syncrude Canada Ltd. 1974: 9). Chert, in particular, also has a recognizable, highly variable change in coloration throughout the matrix of the material (Crabtree and Butler 1964:2). When chert has been heat treated, except for the change in coloration, there are no visible differences between heated and unheated chert preforms or blanks in a hand specimen. Only in flakes removed after the heat treatment of a larger block is the change in luster visible (Mandeville 1973: 183). For example, if the ventral side of a chert flake is lustrous in comparison to its dorsal side it is assumed to have been subjected to thermal alteration (Crabtree 1975:109). The cortex of a stone does not respond to heat treatment.

Heat treated artifacts make up only 0.71% of the total artifact recoveries (Table 18; Figure 26). This fraction seems unusually small

Table 18: Frequency of Total Heat Treated Artifacts Recovered within the Study Area

Site	Count	Relative %
Sandhill Site DiLv-14	8	0.47
Killdeer Site DiLv-16	2	0.12
Deleurme Site	1	0.06
Pelican I Site DiLv-17	1	0.06
Total	12	0.71

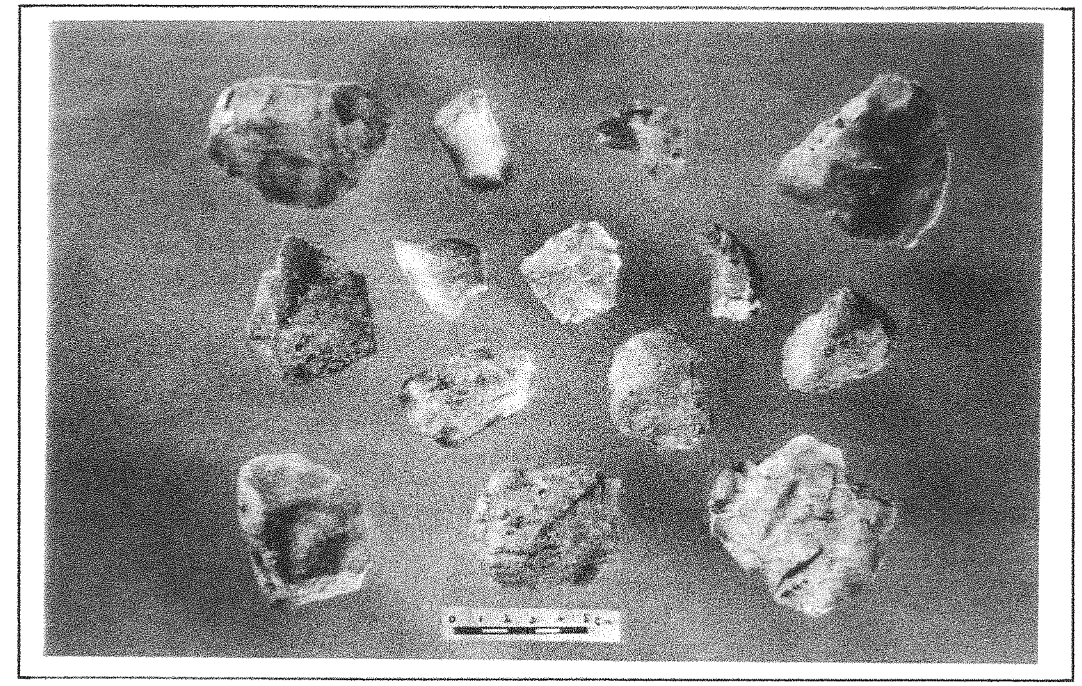

Figure 26: Heat Treated Artifacts of the Study Area

given the extensive occurrence of Swan River Chert recovered from this region and the level of collection activity that is believed to have occurred in this locale.

The Swan River Chert available within these quarries would have been much easier to work if it had been thermally altered. This is possibly an indicator of the lack of technological advancement of the different groups frequenting this locale or an unfamiliarity with the fracture properties of SRC. However, given the possible long term use of these lithic collection sites it is likely that at some point groups became familiar with the working properties of SRC. There was, after all, a limited number of heat treated artifacts recovered within the study area. What seems more likely is that the areas where heat treatment of lithics was being undertaken have yet to be located. There is also a further possibility, which is that cores worked to remove flakes or blanks and roughed out at a quarry were then carried back to a campsite and heat treated there (Crabtree 1967; Crabtree and Butler 1963). If this is the case then there should be a larger percentage of heat treated SRC artifacts located within local habitation sites than there was recovered within the lithic collection areas.

Artifact Patination

One trait that may provide information on the age of these sites is the degree of patination discovered on a small percentage of the recovered lithics. These are principally composed of chalcedony and SRC (Figure 27).

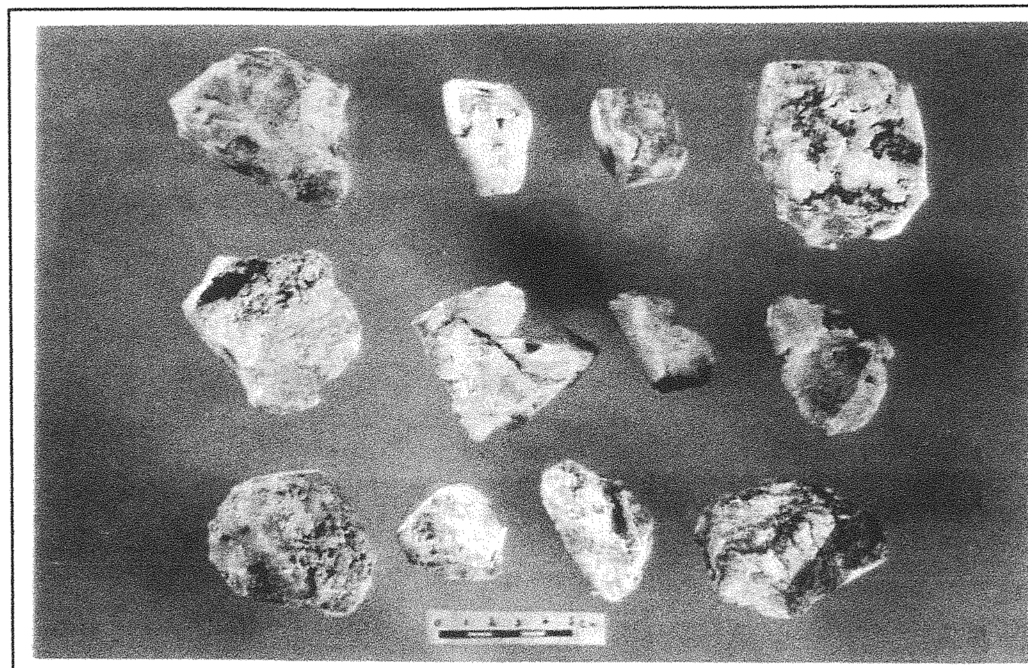

Figure 27: Patinated Artifacts of the Tiger Hills Study Area

Patina is the chemically induced surface alteration of siliceous stone over time and under certain environmental conditions (Honea 1964:14). The factors and conditions generally required for the formation of patina on cryptocrystalline material are the permeability of the material, the type of impurities it contains, its microstructure and the conditions of the surrounding soil (Kelly and Hurst 1956:194).

Patinated artifacts frequently display varying densities of "chalky to white to cream colored surfaces" (Honea 1964:14) which is commonly referred to as bleaching. A brown surface may be also formed but is less common (Hurst and Kelly 1961:251). All the patinated artifacts recovered from the study area display the former light colored patination type.

In total, 8.72% of the recovered artifacts from the study area displayed some degree of patination on their outer surfaces (Table 19). Many of these materials have become entirely coated with patina. However, closer investigation shows that several artifacts display varying degrees of patination.

Natural cortex has the heaviest coating of patina and this ranges from heavy on unworked and weathered surfaces to no patina on what appears to be the most recently worked surface of the artifact. Various authors (Honea 1964; Hurst and Kelly 1961; Kelly and Hurst 1956; VanNest 1985) have suggested that the presence of patination (on worked surfaces) in some artifact assemblages can be used as an indicator of chronological artifact mixture caused by multiple episodes of quarrying activity. Therefore, the varying degrees of patination found on the worked

Table 19: Frequency of Patinated Artifacts Recovered within the Study Area

Site	Count	Relative %
Sandhill Site DiLv-14	73	4.33
Killdeer Site DiLv-16	2	0.12
Deleurme Site	52	3.08
Deleurme East Site	11	0.65
Valenta Site	6	0.36
N. Smith Site	1	0.06
Pelican II Site DiLv-18	2	0.12
Total	147	8.72

surfaces of these artifacts possibly indicates that these quarries were used for an extended time.

Rottlander (1975:109) indicates that patination can not be used as a chronological indicator of artifact age determination as too many environmental variables are involved in the patination processes. While this is true, it does not account for the variation of patination formed on individual artifacts. Environmental factors might control the over-all thickness of the patina that forms on a piece of lithic material, but they do not account for the highly variable and mixed levels of patination on a single specimen. For example, some artifacts display one face with heavy patina, the face next to this may have none, then there will be a face that is thinly patinated, then another face will be totally covered with patination.

There appears to be no set sequence to whether one side of an artifact varies from the other with regard to the level of patina

present. However, multiple episodes of quarrying activity over time followed by long periods of artifacts being exposed on the surface could account for this variation. For example, if a piece of patinated chert was picked up and several flakes knapped off then the material tossed back on the surface this would expose a number of fresh surfaces. If this piece was left untouched for many years so that patina again began to form on its surfaces then the patination formed on the newly exposed surfaces would be relatively light, whereas that formed on the previously patinated surfaces would be considerably thicker. This appears to have been the case within the study area, indicating an extended and continuous period of lithic exploitation and reuse within this locale.

Lithic Collection and Reduction Practices Within The Study Area

The frequency of the recovered lithics is outlined in Table 17 and includes 60.5% cores, 37.31% debitage and 2.19% stone tools. This would seem to indicate that this locale was primarily being accessed for the quarrying and collection of raw lithic material. In most cases, raw material must be frequently extracted from its geologic host; however in some locales and under certain circumstances (such as within the study area) lithic material may be easily acquired through selective surface collection (Collins 1975:19). It is also feasible that later groups within such collection locales could have picked over abandoned cores and core-debitage and utilized these as a source of raw lithic material.

Cores collected for this study display evidence that they were repeatedly collected, tested, utilized and discarded by prehistoric flintknappers with only the usable flakes being carried off the site. Many cores have been exhausted to the extent that attempting to remove any further utilizable flakes would likely be extremely difficult.

Chronology of Quarry Use within the Study Area

The evidence presented within this thesis suggests that the Tiger Hills glacio-fluvial deposit may have been used for an extended time for the collection of raw materials. Also, the recovered artifacts from the study area indicate that these lithics have been repeatedly tested and worked. There are a number of variables that provide verification of these possibilities. For example, there is a wide range in the projectile point types (Figure 28) recovered from the study area ranging from Paleo-Indian to Pelican Lake to Sonota. The sample of points is small but suggest repeated use over an extended time. This does not however provide the quantitative evidence needed to place a precise period of usage on this locale. The problem is that they may have been introduced at any time into the locale. For example, the Pelican Lake projectile point is made from KRF. As previously noted, the primary source area of KRF is North Dakota. Therefore, this point or the raw material was obviously carried into the study area.

The presence of patination indicates an extended usage of these lithic collection areas as well, but as previously noted, much more

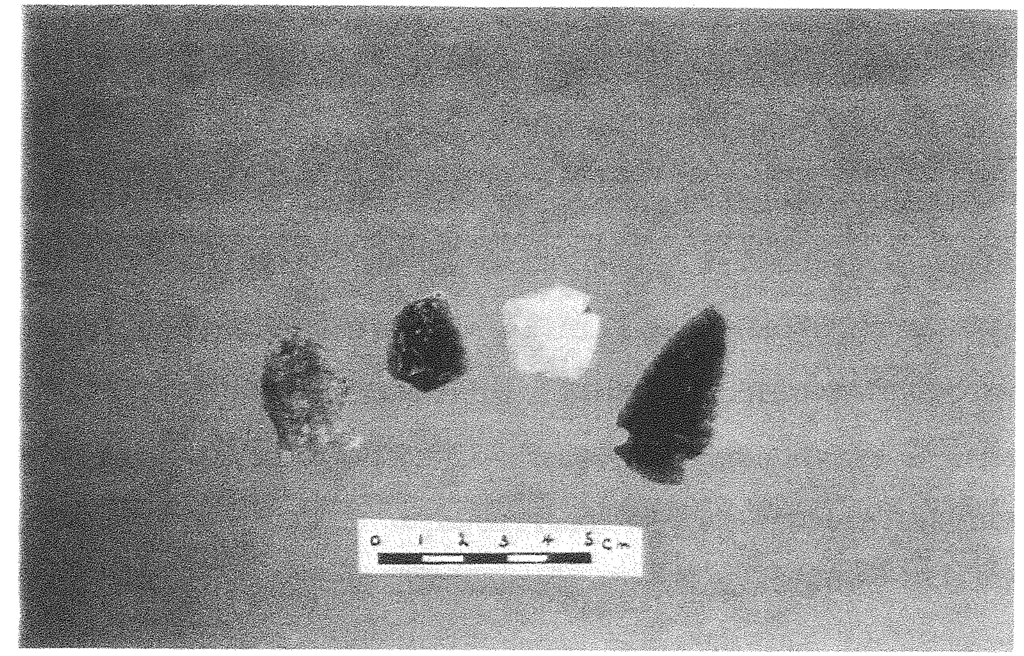

Figure 28: Recovered Projectile Points From the Study Area

work would need to be done to verify this statement. Therefore, the answer to the age of the lithic collection areas within the study area is tentative until further research can be continued in southern Manitoba following that initiated within this thesis. However, the types of artifacts, the variation of patination, and the range of recovered projectile points does indicate that these quarries may have been utilized for several thousand years, from the Paleo-Indian period to perhaps two or three hundred years before present.

CHAPTER 8: MATERIAL ANALYSIS

Frequency of Modified and Curated Cryptocrystalline Materials

The cumulative total of local lithic materials recovered from the nine sites of the study area consist of 73.52% SRC, 18.03% miscellaneous chert, 4.33% chalcedony, 2.31% miscellaneous quartzite, 0.77% jasper, 0.36% agate, 0.18% granite and 0.12% silicified sediment (Table 16). The frequency of exotic materials recovered in the study area is 0.53% KRF, 0.06% TRSS and 0.06% Bird Lake Black Rhyolite (Table 16). This yields a total of 99.29% local material with only 0.71% comprising all exotic lithic material recovered (Table 20).

Table 20: Frequency of Local Lithics in Comparison to Exotic Lithic Material Recovered within the Study Area

Material	Count	Relative %
Local	1675	99.29
Exotic	11	0.71
Total	1686	100.00

Range of Locally Available Lithics Recovered

Swan River Chert. Rocks that consist of cryptocrystalline silica displaying non-fibrous microscopic crystals of fine-grained quartz (Loomis 1948) or have composite, exceedingly small, quartz crystal grains (microcrystalline quartz) are called chert (Boggs 1987). Cherts may be organically derived (from shells, carbons, hydrocarbons, or phosphates) or of an inorganic origin (derived from fragmentary rock material resulting by processes such as weathering) and they display great variation from one form to another (Blatt *et al.* 1980; Loomis 1948; Whitten and Brooks, 1988: 76). The highest proportion of material recovered within the study area is SRC. This lithic material comprises 71.59% of the total artifact recoveries from this locale (Table 16).

Swan River Chert (Figure 29) displays an extreme variation in its external appearance and coloration (Campling 1980: 294; Leonoff 1970:12). According to Leonoff (1970:12) colors of SRC range from, "cream white through to medium grey, pink to deep rust, pale yellow to deep orange" and its composition in thin section is quartz with chalcedony acting as the cementing agent. Campling (1980:291) expands on this definition by identifying three distinct microscopic crystal habits in SRC:

1) medium-grained chalcedonic spherulites;
2) larger-grained well-shaped granoblastic quartz;
3) fine-grained poorly-shaped quartz.

He adds that if the material does not display these three habits then it is not SRC.

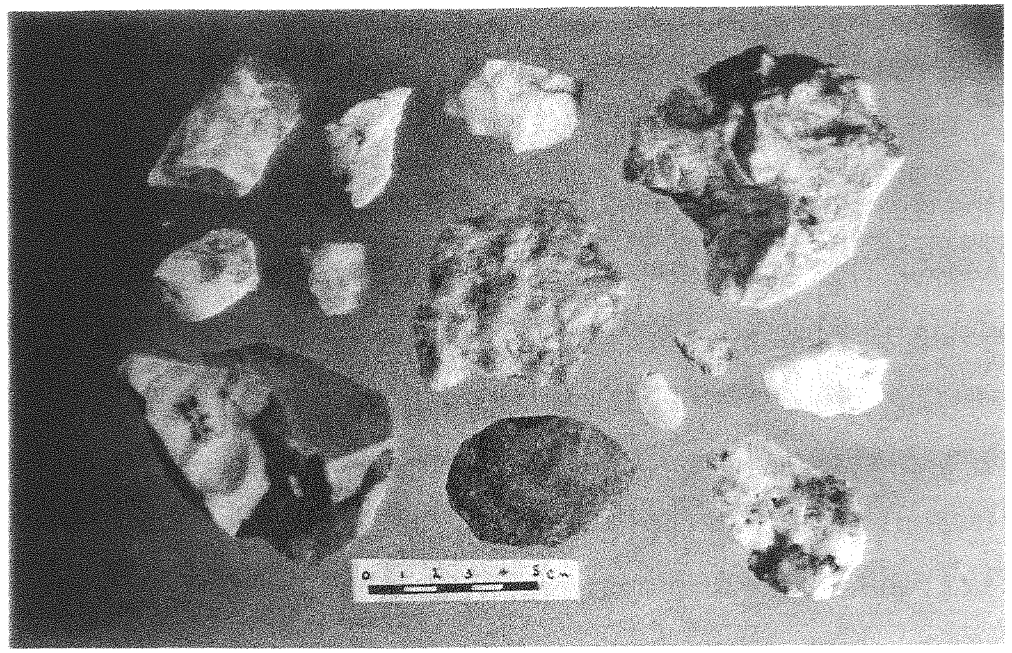

Figure 29: Representative Sample of Swan River Chert

One of the major distinguishing macroscopic characteristics of SRC is the high density of vugs and crystal growths that occur throughout the matrix of this lithic material (Ahler 1977:139; Campling 1980:295). This characteristic is evident in almost all the SRC recovered from the southern Manitoba lithic collection locales. Although SRC is generally difficult to knap, some artifacts manufactured from this material display superb craftsmanship.

The high density of SRC within southern Manitoba has caused some debate as to its origin. No bedrock of this material has been located to date (Campling 1980:292). Leonoff (1970:12), however, notes that it is mainly recovered within the Swan River Valley (Figure 3) from which it derives its name. Leonoff (1970:29) notes that SRC is occasionally recovered from within the channels of stream and river beds. Pettipas (1969:5, 1970:18) adds to Leonoff's

recovery areas moraines, beach ridges and outwash deposits as areas where SRC has been collected.

In the analyses conducted by Leonoff (1970) and Pettipas (1969, 1970) they do not expand on the importance of local lithic materials within Manitoba. However, Pettipas (1975:14) does indicate that the frequency of chert, particularly along the Manitoba escarpment, is found in large concentrations. Also, more recent research within southern Manitoba has shown Leonoff's data to be seriously incomplete (Brandzin 1992; Low 1992a, 1992b, 1993; Nicholson 1985, 1986, 1994; Nicholson and Kuijt 1990; Nicholson and Malainey 1991).

The extensive use of SRC for the manufacture of stone tools, due to its high frequency and broad distribution in Manitoba, makes it a primary lithic of this region. This statement is supported by the fact that it is widely recovered from within archaeological assemblages throughout Manitoba (Brandzin 1992; Gibson 1976; Hamilton *et al.* 1980; Haug 1976; Low 1992a, 1992b, 1993; Nicholson 1985, 1986, 1994; Nicholson and Kuijt 1990; Nicholson and Malainey 1991; Syms 1969; Tisdale 1978). This seems reasonable in view of the high frequency of SRC in exposed deposits throughout Manitoba.

Although no primary source for SRC has been located there are a number of factors that may provide some information on this. For example, several of the materials recovered from the study area contain fossils and a few corals indicate a Paleozoic age of this material. Dr. Harvey Young of the Brandon University Geology Department examined these materials and all identifiable specimens were classed as being either of a Silurian or Ordovician origin.

The SRC recovered within the study area also displayed extensive alteration. The density of vugs, in particular, is common throughout the matrix of SRC. Due to the high degree of alteration of this material and the presence of the above noted fossils the initial indication is that these cherts are altered carbonates. Campling (1980:298) identifies SRC as a "chert replacing limestone of Paleozoic age, as indicated by [its] macroscopic and microscopic features." If these cherts are altered carbonates of Paleozoic age then they probably were not glacially derived from the shield. Rather, they may have originated from the area of the Hudson Bay platform.

One further aspect that may provide an indication to the origin of SRC is it's distribution throughout Manitoba. It has been observed by the author that the distribution of this material throughout the province coincides with the series of moraines left behind by the Keewatin and Patrician ice sheets (Figure 1, left inset) during the last phase of glaciation. Figure 1, left inset, illustrates the movement and deposition of these ice sheets over Manitoba.

Beginning in central northern Manitoba, where the Keewatin and Patrician ice sheet converge together, a series of glacial outwash moraines is deposited along their margins as they move south-west. Along the western border of central Manitoba the Keewatin ice sheet pushes the Patrician ice sheet back toward the east. At this point the Keewatin ice sheet begins to move south-east. As the Keewatin ice sheet moves south-east along the Patrician glacial outwash is no longer being deposited between the margins of these ice sheets. Rather, almost all of the major moraine deposits are being developed from the Keewatin ice sheet alone. Beginning north of the Swan

River Valley and continuing into southern Manitoba the Keewatin deposits large amounts of glacial material. As the distribution of SRC follows this series of moraines, and since the indication is that the Keewatin is responsible for the deposition of the majority of this material, then it is also suggested here that SRC must originate somewhere within the Hudsons Bay area. However, sourcing of a rock to its place of origin is difficult and time consuming and beyond the scope of this project.

Miscellaneous Chert. These cherts are cryptocrystalline siliceous rocks that display non-fibrous microscopic crystals of fine-grained quartz (Loomis 1948) and display great variation between forms (Blatt *et al.* 1980; Loomis 1948; Whitten and Brooks, 1988: 76). A variety of cherts (Figure 30) are frequently recovered within

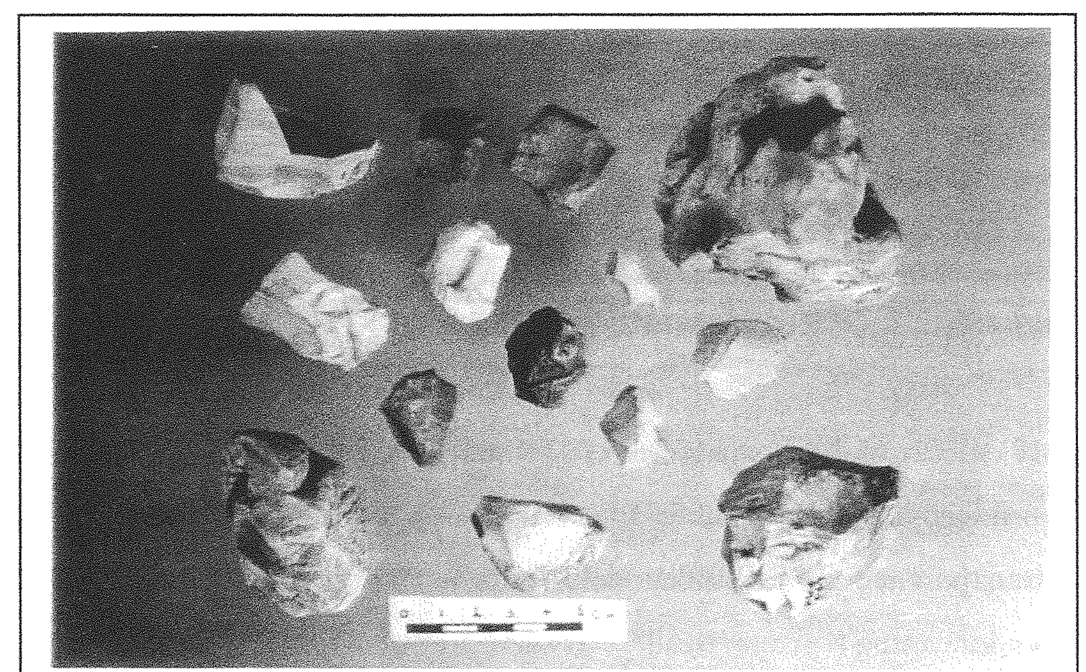

Figure 30: Representative Sample of Miscellaneous Cherts

archaeological sites of southern Manitoba (Brandzin 1992; Gibson 1976; Hamilton *et al.* 1980; Haug 1976; Low 1992, 1993; Nicholson 1986, 1994; Nicholson and Malainey 1991; Syms 1969; Tisdale 1978).

There were 307 pieces of miscellaneous cherts (non-SRC) recovered from the Tiger Hills deposits that comprised 18.21% of the total artifact recoveries from the study area (Table 16).

Chalcedony. Chalcedony (Figure 31) is a cryptocrystalline

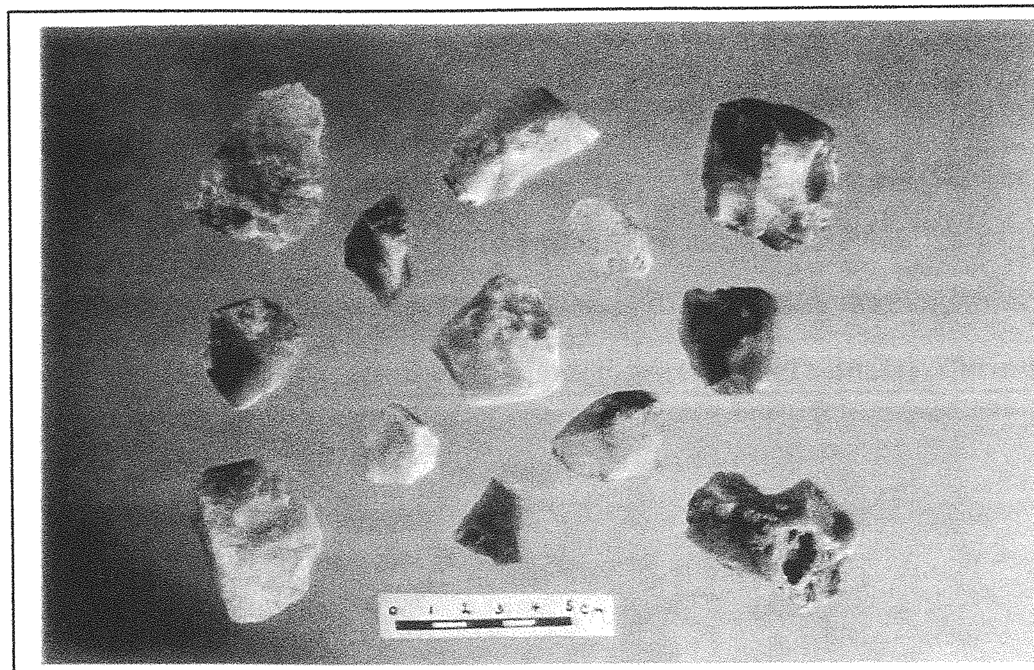

Figure 31: Representative Sample of Chalcedony

variety of silica with a structure of primarily fine-grained quartz and a fibrous micro-structure visible in thin section. It has a waxy luster and is transparent to translucent along thin edges. Chalcedony has excellent knapping properties. It is frequently recovered from within various archaeological contexts in southern Manitoba (Brandzin 1992; Hamilton *et al.* 1980; Haug 1976; Low 1992a, 1992b,

1993; Nicholson 1986, 1994; Nicholson and Kuijt 1990; Nicholson and Malainey 1991; Tisdale 1978).

Artifacts of chalcedony make up 4.63% of the total recoveries within the study area (Table 16). Chalcedony is recovered from a variety of geologic environments and is frequently recovered from stream gravels and glacial deposits (Loomis 1948: 104-5).

Miscellaneous Quartzite. Quartzites (Figure 32) are

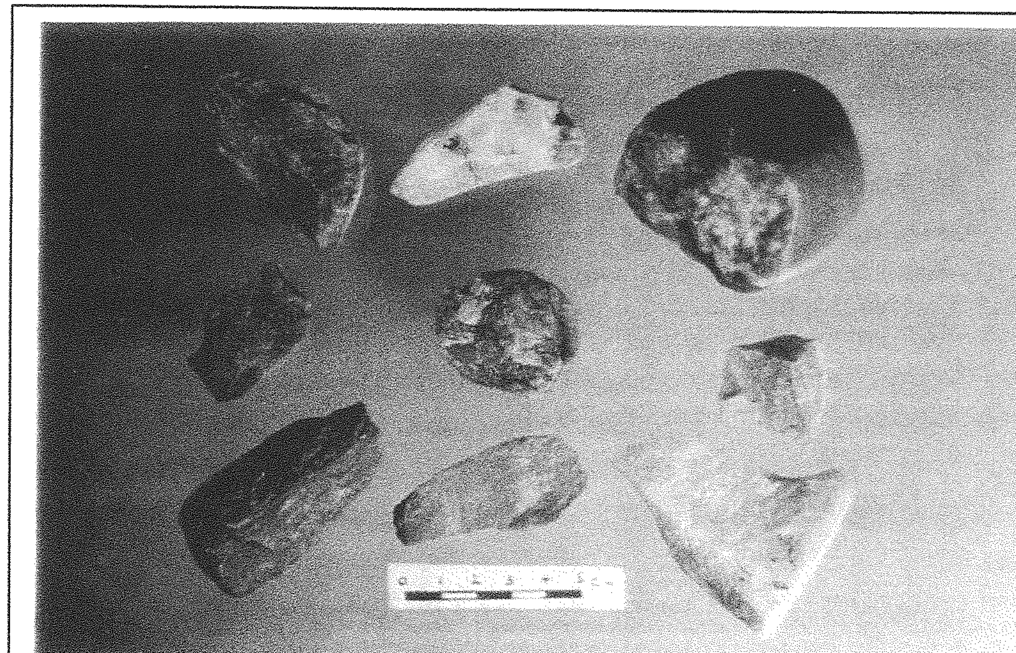

Figure 32: Representative Sample of Quartzite

generally thought of as thermally metamorphosed rocks in which constituent grains have re-crystallized and developed an interlocked mosaic texture with little or no trace of cementation. Quartz is the essential component of quartzite, however, it can have many accessory minerals (Mottana *et al*, 1988: 554; Whitten and Brooks, 1988: 375).

Quartzites are extremely dense and difficult to knap, but they are occasionally recovered in archaeological assemblages of southern Manitoba (Hamilton *et al.* 1980; Low 1993; Nicholson 1985, 1986, 1994; Nicholson and Kuijt 1990; Nicholson and Malainey 1991). Only 3.5% (Table 16) of the total artifacts from the study area were manufactured from quartzite.

Jasper. Jasper (Figure 33) is a sedimentary chert-like

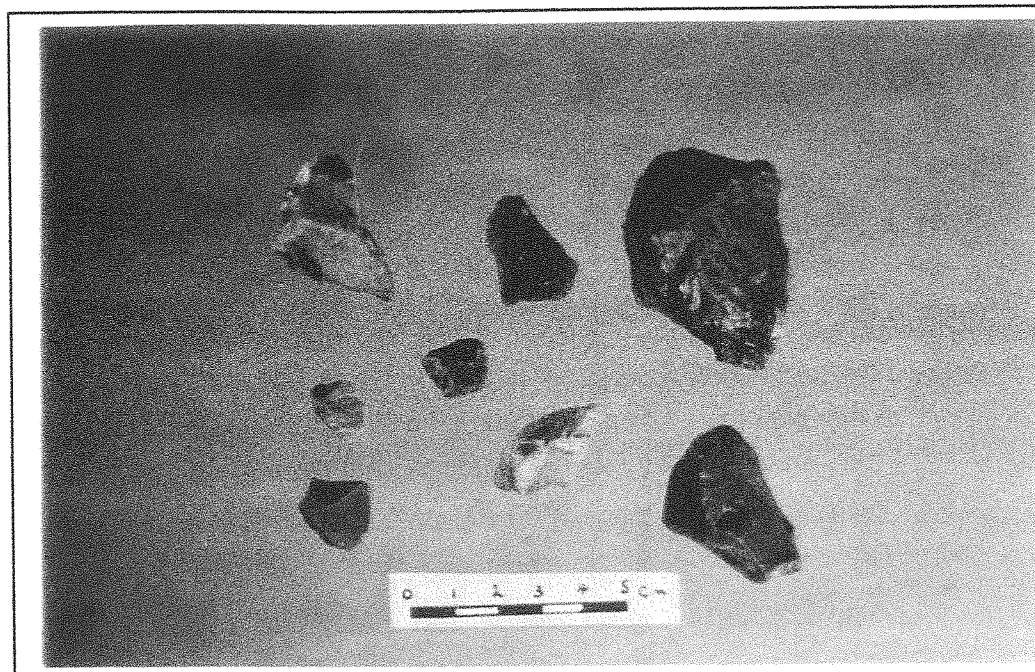

Figure 33: Representative Sample of Jasper

siliceous rock that typically displays a waxy luster. It is composed primarily of chalcedony and quartz but it also contains elements of hematite, limonite, clay, pyrolusite and sometimes calcite and it is always opaque (Loomis 1948: 106; Mottana *et al.* 1988: 528; Whitten and Brooks, 1988: 251). It is usually red in color due to the included hematite (Blatt *et al.* 1980) and is recovered from various geologic

contexts, including glacial deposits.

Jasper has fine working qualities for knapping and it is found in a variety of archaeological contexts (Brandzin 1992; Hamilton *et al.* 1980; Haug 1976; Low 1992a; Nicholson 1994; Nicholson and Kuijt 1990; Nicholson and Malainey 1991). It composed 0.95% (Table 16) of the total recoveries.

Agate. Agates (Figure 34) can be quite elaborately colored

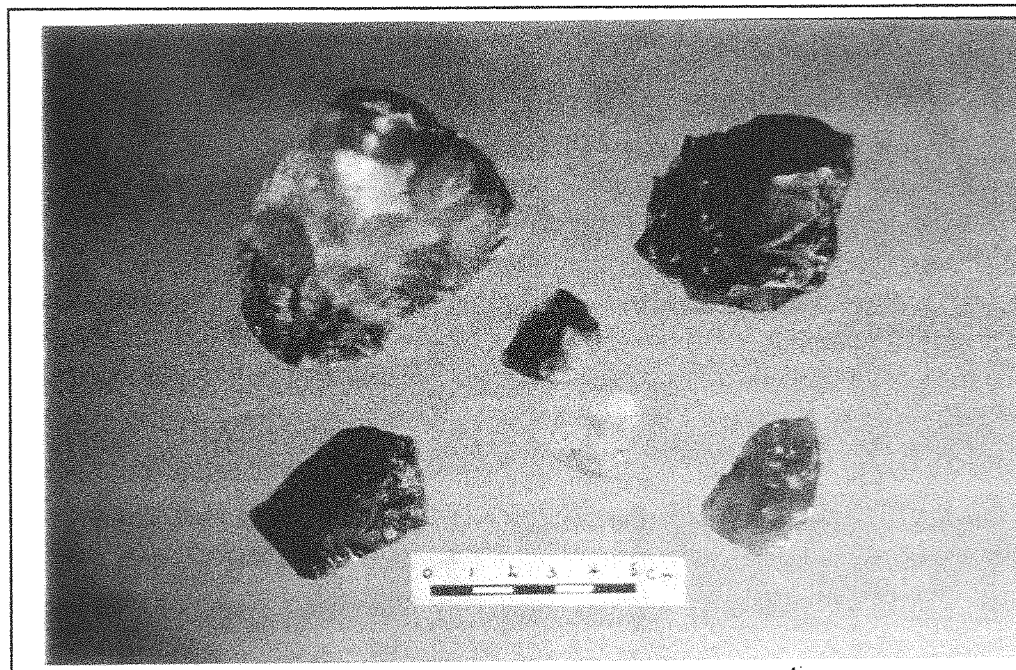

Figure 34: Representative Sample of Agate

and are well suited for the manufacture of lithic artifacts. Most agates are banded, very fine grained chalcedonic rocks. A variation of the banded types are the moss agates that have a mottled moss-like dendritic structure (Whitten and Brooks, 1988: 17) Agates are frequently recovered from glacial gravels and have a variety of possible origins.

A known source in southern Manitoba is the Souris gravels. It is recovered in small quantities within most southern Manitoba archaeological contexts (Brandzin 1992; Haug 1976; Nicholson 1986, 1994; Nicholson and Malainey 1991; Tisdale 1978) and comprises 0.30% (Table 16) of the total recoveries.

Silicified Sediment. Silicified sediments (Figure 35) are fine grained, evenly textured, silicified, chalcedonic rocks. They contain a

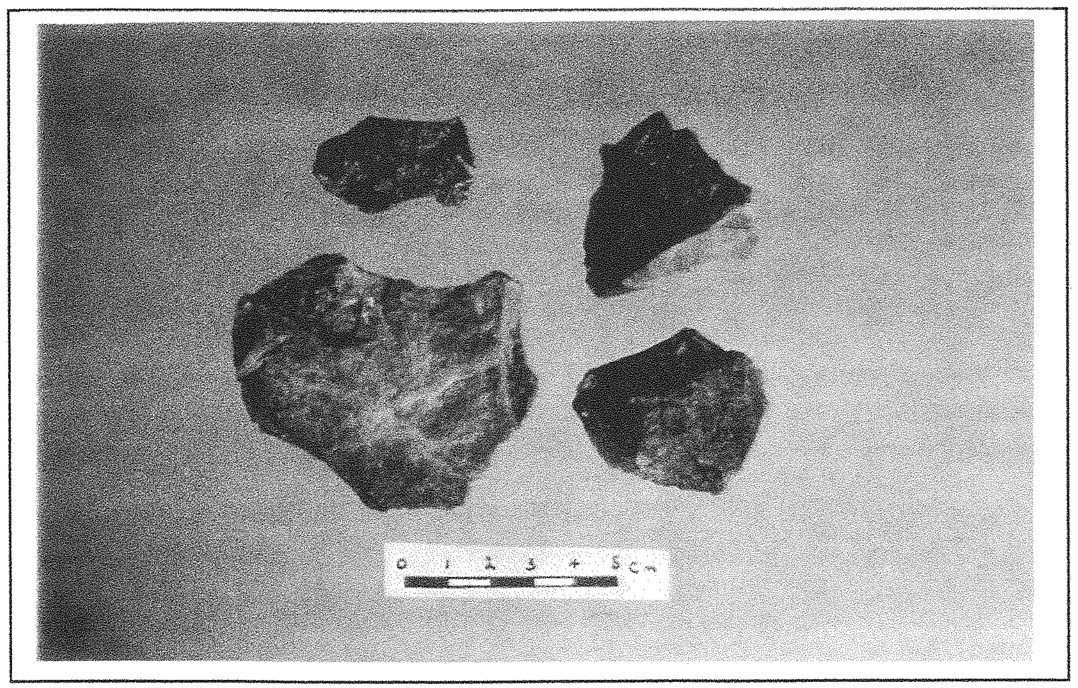

Figure 35: Representative Sample of Silicified Sediment

high organic content, and silica has replaced the original organic material although internal structures are still visible (Porter 1960: 45). A common example would be a silicified wood in which silica has replaced the wood and yet all the wood structure is still retained (Loomis 1948: 99). The higher quality pieces of this material are

commonly mis-identified as Brown Chalcedony or Knife River Flint, although the microstructure of these materials differ from those of silicified sediments.

Silicified sediments make up only 0.12% (Table 16) of the total recoveries. This material consists of a small percentage of the total recoveries from southern Manitoba archaeological sites (Hamilton *et al.* 1980; Nicholson 1994; Nicholson and Malainey 1991).

Range of Exotic Lithic Materials Recovered

Knife River Flint. Knife River Flint (Figure 36) is generally of

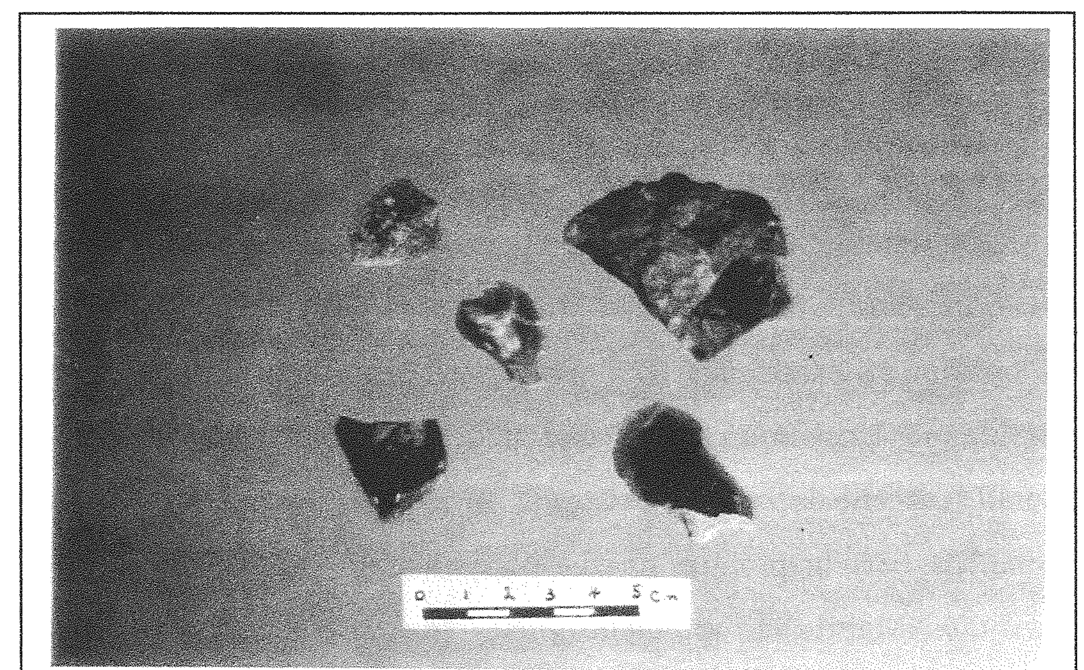

Figure 36: Representative Sample of Knife River Flint

a non-porous, dark brown fine-grained quartz with a uniform composition that has a non-fibrous (equidimensional) micro-structure in thin section (Ahler 1986: 3; Clayton *et al.* 1970: 287). Flints in general range from gray to black in color because of included organic matter (Blatt *et al.* 1980); however, KRF typically displays a brown coloration. Distinctive characteristics of KRF are the many white, cream or pale yellow flecks or splotches that occurs throughout the matrix (Ahler 1986: 3).

The study area assemblage included a total of 0.59% KRF (Table 16). However, it must be noted that this study sought lithic collection areas and not occupational sites. KRF is regularly recorded within southern Manitoba archaeological assemblages (Brandzin 1992; Gibson 1976; Hamilton *et al* 1980; Haug 1976; Low 1992a, 1992b, 1993; Nicholson 1986, 1994; Nicholson and Kuijt 1990; Nicholson and Malainey 1991; Syms 1969; Tisdale 1978) from habitation sites.

There has been much discussion within the literature as to the origin of KRF within Manitoba archaeological sites. Earlier reports by Hlady (1965, 1966) indicate that the Souris gravels of southern Manitoba contain a source of KRF. However, it has since been proven that there are no local sources for this material in Manitoba and it is now generally accepted that this material is exotic to the region.

There has been a problem in the classification of KRF evident in much of the Manitoba archaeological literature in that it is consistently referred to as, and treated as equivalent to, Brown Chalcedony (Hlady 1965; Leonoff 1970; Syms 1969). Hlady (1965) mis-identified the better quality petrified wood in the Souris gravel

pit as KRF, and Leonoff (1970) and Clayton *et al.* (1970) perpetuated this mis-identification. A major difference between Brown Chalcedony and KRF is that the fibrous microstructure that is characteristic in chalcedony is not present in KRF (Ahler 1986: 3; Clayton *et al.* 1970: 287).

Brown Chalcedony and KRF can be differentiated by a simple test using ultra-violet light (Root personal communication, 1993). Porter (1960: 76) describes this method:

> Short ultra-violet rays are around 2500 Angstroms in length and are produced only by artificial means . . . these short ultra-violet rays create fluorescence in many minerals . . . The importance of the application to lithic studies is that many common minerals that possess a characteristic fluorescence in one geographic area will not display it in another area. This method of determining whether or not some unique impurity is present in a given specimen can be used to trace sources of raw material.

Tests were conducted on samples collected from the southern Manitoba quarries as well as on pieces collected from the Souris Gravels and KRF quarries. These tests determined that the material collected from the Souris Gravels is a high quality petrified wood or Brown Chalcedony and is quite different from the KRF traded into this region. The closest primary source of KRF for southern Manitoba (Figure 3), therefore, appears to have been several quarries within North Dakota (Clayton *et al.* 1970; Ahler, 1986).

Tongue River Silicified Sediment. There are two common varieties of Tongue River Silicified Sediment and their differences are based on color (a smooth grey variety and a coarse yellow and red variety), texture, fossil plant impressions (Ahler 1977: 137; Anderson 1978: 149; Porter 1960: 12, 40) and flaking qualities (Ahler 1977: 137). The red and yellow varieties contain mineral inclusions such as hematite. Petrographic analysis identifies the individual grains of quartz of TRSS as being cemented together by opal and chalcedony (Keyser and Fagan 1987: 233; Porter 1962: 268). A distinguishing characteristic of TRSS, evident in hand specimen, is the presence of the numerous fossil plant root and stem hole impressions, lacking any orientation, and occurring throughout the matrix of this material (Ahler 1977: 137; Johnson and Pierce 1990; Porter 1962: 268).

The original source area for this TRSS (Figure 3) is the Tongue River member of the Fort Union formation that extends through Wyoming, Montana, South Dakota and North Dakota (Anderson 1978: 149). This member was formed by deposition on an alluvial fan (Johnson and Pierce 1990) and consists of several facies. Johnson and Pierce (1990: 29) identify a series of "five depositional facies...grouped into two broad environments: channel and interchannel wetlands" within the Tongue River member of the Fort Union formation in the Powder River Basin, Wyoming. Although the five lithofacies they identified vary in composition, from sandstone to mudstone to carbonaceous shale and coal, the distinguishing characteristic common within each facies is the presence of fossil plant debris. Tongue River Silicified Sediment is also distributed in

formations, and throughout the glacial gravels, of Wyoming and Montana (Anderson 1978: 149), South Dakota (Ahler 1977: 137; Anderson 1978: 149; Keyser and Fagan 1987: 233; Porter 1962: 268), North Dakota (Ahler 1977: 137; Anderson 1978: 149; Keyser and Fagan 1987: 233) and Iowa (Ahler 1977: 137; Anderson 1978: 149; Keyser and Fagan 1987: 233; Porter 1962: 268).

Tongue River Silicified Sediment is an exotic lithic reported occasionally within Manitoba archaeological assemblages (Brandzin 1992; Hamilton *et al.* 1980; Low 1992a, 1992b, 1993; Nicholson 1993, 1994; Nicholson and Malainey 1991). Only one piece (Table 16; Figure 37) of this material (the brownish-yellow variety) was recovered from the study area.

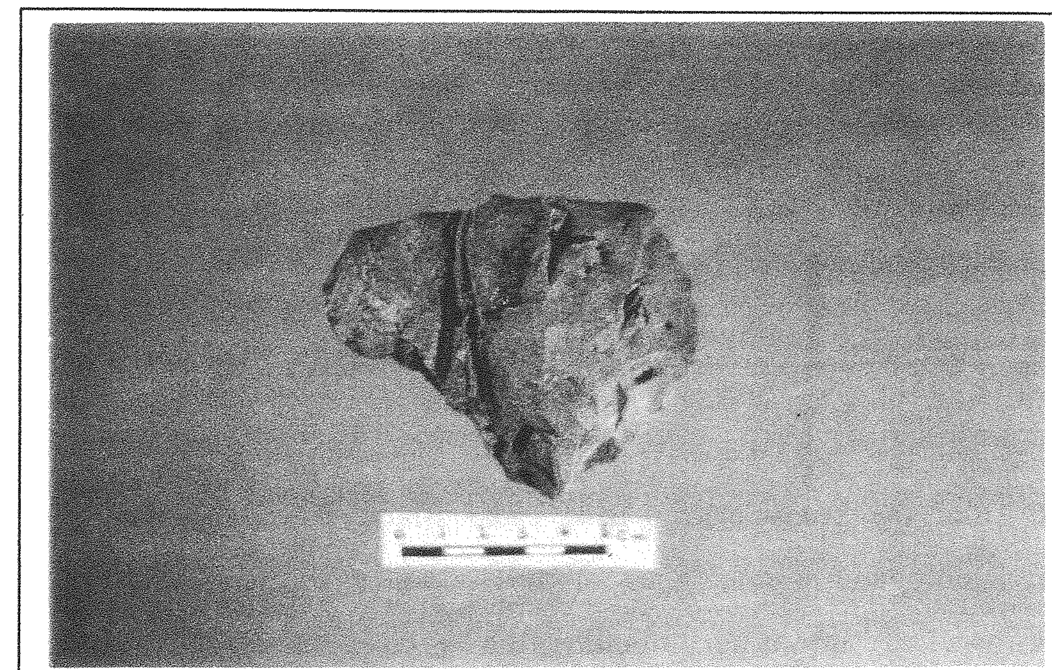

Figure 37: Artifact of Tongue River Silicified Sediment

Bird Lake Black Rhyolite. Rhyolites are composed of microscopically sized grains of orthoclase and quartz with combinations of hornblende, mica or augite (Loomis 1948: 185). The Bird Lake Black Rhyolite comes from its source area of Bird Lake north of Winnipeg in Nopiming Provincial Park, in eastern Manitoba (Figure 3; Greco 1993).

One piece of Bird Lake Black Rhyolite (Table 16; Figure 38) was

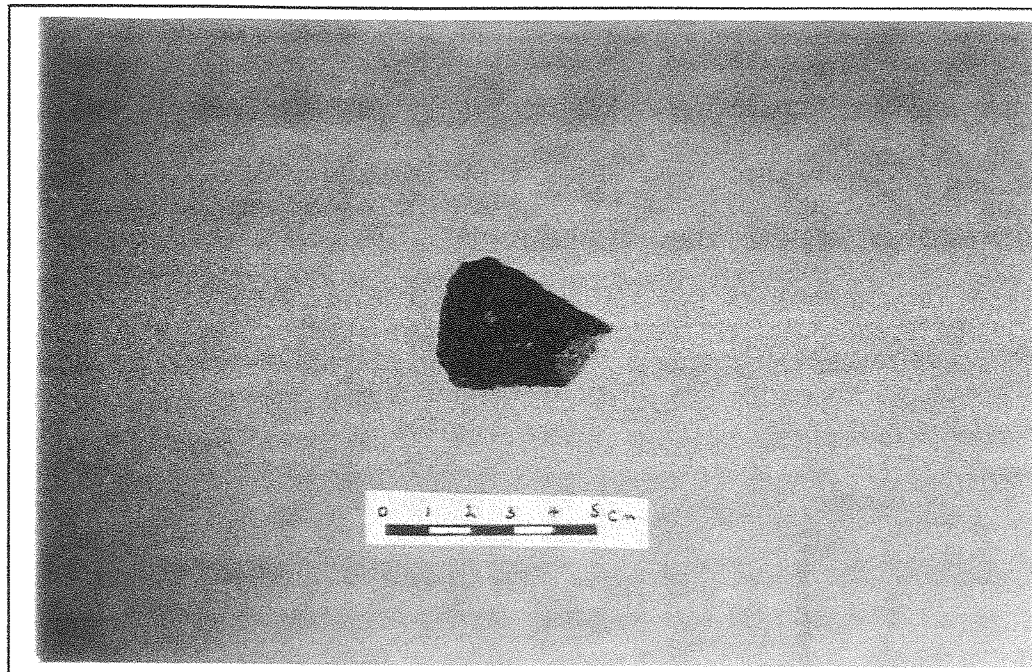

Figure 38: Artifact of Bird Lake Black Rhyolite

recovered from the study area. Bird Lake Black Rhyolite is a rarity in the archaeological assemblages of this vicinity in Manitoba. The author knows of no other documented recoveries of this lithic material within the Tiger Hills locality.

CHAPTER 9 : SUMMARY AND DISCUSSION

Research Results: Quarry or not a Quarry?

Past authors (Leonoff 1970; Pettipas 1970; Syms 1969) have indicated that raw lithic material, from beach deposits, moraines, outwash, stream and river beds, within southern Manitoba, have been utilized prehistorically as a source of raw lithic material. Several authors (Nicholson 1986; Syms 1969) have noted that many lithic artifacts in southern Manitoba archaeological assemblages appear to be derived from local sources. However, no one has considered the possible extent to which the collection of raw lithic material may have taken place within the study region or, for that matter, southern Manitoba overall, although the north and east localities within Manitoba have long been known quarry sources.

The surfaces of the various lithic sites surveyed by the Brandon University field crew were littered with typical quarry materials. These materials included high frequencies of cores, core fragmented debitage and miscellaneous irregular pieces of lithic material. There was a small percentage of tools relative to the overall collections.

Table 21 is a summary of the recovered artifacts collected from the study area. This table clearly demonstrates that the lithic collection areas display the appropriate proportions of cores and core-reduction debitage to tools that are consistent with quarry locales (Ahler 1986; Losey; 1971; Holmes 1919).

Table 21: Summary Table

Site	Relative % of Cores
Sandhill Site DiLv-14 (S-6)	56.57
Sandhill Site DiLv-14 (S-13)	51.52
Sandhill Site DiLv-14 (S-52)	80.38
Killdeer Site DiLv-16	57.14
Deleurme Site	64.31
Valenta Site	66.67
Deleurme East Site	75.68
Merganser Site DiLv-15	79.63
Pelican I Site DiLv-17	54.55
Pelican II Site DiLv-18	62.50
N. Smith Site	100.00

Site	Relative % of Debitage
Sandhill Site DiLv-14 (S-6)	39.78
Sandhill Site DiLv-14 (S-13)	46.30
Sandhill Site DiLv-14 (S-52)	17.72
Killdeer Site DiLv-16	39.94
Deleurme Site	34.73
Valenta Site	33.34
Deleurme East Site	24.32
Merganser Site DiLv-15	20.37
Pelican I Site DiLv-17	45.45
Pelican II Site DiLv-18	37.50

Site	Relative % of Stone Tools
Sandhill Site Locale S-6	3.65
Sandhill Site Locale S-13	2.17
Sandhill Site Locale S-52	1.90
Sandhill Site DiLv-14	2.58
Killdeer Site DiLv-16	2.92
Deleurme Site	0.96

Despite the frequency of quarry type material within the study area, the question remains, "Can we identify any of these lithic collection areas as prehistoric lithic quarries?"

One lithic collection area in particular, the Sandhill Site, has all the distinguishing characteristics necessary to interpret it as a large and heavily utilized quarry. A total of 58.18% of the recovered lithics from the Sandhill Site were cores, with 39.01% associated debitage, for a total recovery of core-related artifacts comprising 97.19% of the total materials (Table 21). The Sandhill Site recoveries also consisted of a total lithic tool recovery of only 2.8% (Table 21). These numbers can only mean that the Sandhill Site was utilized as a prehistoric quarry.

The term quarry, therefore, is used here to indicate that this locale was subjected to long term, intensive, extraction of raw lithic material. There are no outcrops or bedrock from which material was collected, but rather, all material occurs as loose clasts within a regional glacio-fluvial deposit. Concentrated surface areas of the study area are also still covered with a large amount of culturally unworked lithic material that ranges from pebble to cobble in size.

The Killdeer and Deleurme sites also displayed evidence of extensive prehistoric lithic collection, as do six of the smaller lithic collection locales. These sites indicate that prehistoric quarrying was taking place in varying levels of intensity throughout the study area and demonstrates that raw lithic collection was obviously not a casual endeavor within this region.

Site Formation Processes

It is noteworthy, that the nine sites listed within this thesis are all contained within one glacio-fluvial outwash deposit in the Tiger Hills of southern Manitoba. This has been verified through test-pitting and by mapping the site coordinates for these quarries. This discovery provides the qualitative means for establishing a predictive model that could be used to locate further quarries.

It is very possible that there may be many other large raw lithic collection areas located within any of the many glacio-fluvial deposits of southern Manitoba (Figure 39). These glacio-fluvial deposits may have provided a natural resource for extensive collection of lithic material prehistorically. If in fact, any of these untested areas contain chert-rich collection areas as expansive as those already discovered, then lithics may have been a primary prehistoric resource of this region.

The shallow soils and the known amount of erosion within the study area would have provided an ideal environment for the collection of raw lithic materials. As previously noted, Collins (1975:19) indicated that where raw lithic material occurs on the surface the process of extraction is not necessary. For, example, rather than having to dig for lithics they could have easily been collected on the surface. In this instance, selective collection is the only acquisition activity required for raw material. This would particularly have been true several thousand years ago when surface soils were probably of a lesser thickness than they are today.

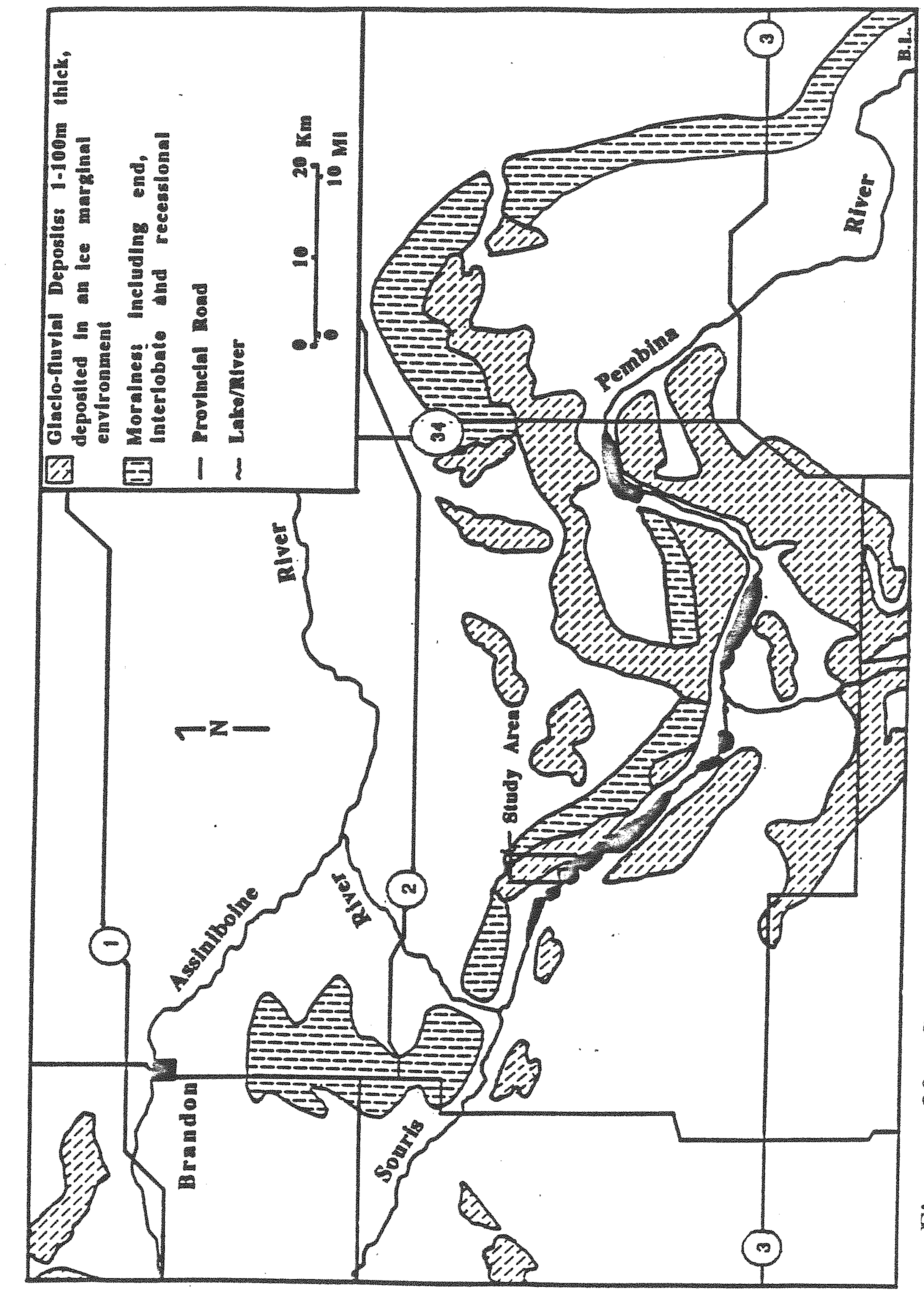

Figure 39: Southern Manitoba Glacio-fluvial Outwash Deposits

Settlement: Types, Patterns, Systems and Distribution Links

Previous literature (Nicholson 1988, Nicholson and Kuijt 1990; Ray 1974) relating to models of prehistoric settlement and subsistence within the Pembina Valley, has concentrated solely on the available ecological resources of that region. These interpretations are based on the climate of southern Manitoba and the perceived technology of the groups inhabiting this region at that time. Ray (1974: 32) states that,

> during the long winters, the parkland zone must have been the most suitable for occupation on the basis of the availability of food and shelter. During warmer months of the year, regional variations in food resources would have existed, but were probably less significant. Food was relatively easily obtained at that time.

There can be no doubt that prehistoric human occupants coming into what is now the southern Manitoba region would have found a habitat rich in natural resources. Bountiful lakes, rivers, streams and ponds located in an area of interspersed riverine and grassland environments abound throughout southern Manitoba. These areas were prehistorically, as they are today, a resource rich ecological zone. However, it is now apparent that this region also contained an abundant lithic resource in proximity to occupational and hunting locales within southern Manitoba. This factor has been largely overlooked by previous research within Manitoba.

The combination of raw lithic and rich ecological resources within the Pembina Valley would have made this an ideal region for long term human occupation. Evidence in support of this statement comes from the density of archaeological sites recorded within the Pembina Valley as well as throughout southern Manitoba.

External Connections

The recovery of KRF, TRSS and Bird Lake Black Rhyolite suggests several possible external connections. The presence of these exotics within the study area provides clues to population trade and mobility patterns for Manitoba overall.

One link is made with North Dakota to the south. This is based on the recovery of several pieces of KRF. The only primary source area for KRF (Figure 3) is within the central portion of western North Dakota (Ahler 1986). There was also one piece of a reddish-yellow TRSS recovered. The primary source area for TRSS (Figure 3) is generally believed to be southwestern North Dakota and northwestern South Dakota and adjacent parts of Montana and Wyoming (Ahler 1977; Keyser and Fagan 1987). However, it has also been recovered from stream and glacial deposits as far south as Iowa (Anderson 1971; Keyser and Fagan 1987).

Knife River Flint and TRSS both indicate ties with more southern or south-western regions. In the case of these particular lithic materials they would have had to have been traded or carried into the study area. This interpretation is based on there being no closer sources of these materials within southern Manitoba and on the mechanics of the prior glacial activity. That is, the previous glaciers that covered Manitoba all carried material from the north to the south. Therefore, these materials could not have been naturally transported into the area from the north.

A finely made preform of Bird Lake Black Rhyolite with just the tip missing was recovered. This is a unique piece of lithic material not often recovered within this region and indicates ties with the study area to eastern Manitoba. The source area (Greco 1993) for this material is the Bird Lake locale north of the Winnipeg River in Nopiming Provincial Park, Manitoba (Figure 3). On the basis of the type of tool and since this is the only artifact of this lithic material recovered in this sample it is believed that it was also curated or traded into the Tiger Hills locale.

The presence of exotic lithic material from eastern Manitoba and south of the Canadian/U.S.A border indicates that the Tiger Hills locale was a central passage for groups migrating from one region to another. The recovery of diagnostics within this area, belonging to a wide range of groups, also suggests that this area was within a migration route. Even if pre-contact people did not enter the Tiger Hills with the direct intent of long term occupation the rich ecological and lithic resources would have provided groups moving through this region with an ideal route of passage as they migrated through southern Manitoba. Undoubtedly, many of those early groups found the resources within the Pembina Valley so bountiful that long term occupation, within locales such as the study area, likely became more frequent as resource patterns and lifeways altered.

Having a rich lithic resource base within a bountiful ecological

zone would have been a primary asset for human groups within the Tiger Hills. Lithics, such as SRC, may have also been an asset for groups moving out of the area. It would be interesting to research the movement of lithics like SRC outside Manitoba. This would assist in providing information regarding patterns of trade and migration of human groups that passed through the lithic collection locales of the Tiger Hills.

CHAPTER 10: IMPLICATIONS

This thesis demonstrates that lithic collection within the study area goes well beyond the picking up of the occasional cobble from a stream bed or glacial deposit, as the previous literature would indicate. Evidence presented within this thesis also indicates that many groups in southern Manitoba are represented by large percentages of local lithic materials within their assemblages. These conclusions are supported by the evidence supplied within this thesis regarding artifact frequency within the study area and the density of raw lithic material available within southern Manitoba prehistorically.

Quarries of lithic flaking material within the Pembina Valley region of southern Manitoba have not previously been identified. This is partly due to the lack of work that has been conducted in southern Manitoba. It is also partly due to the lack of work conducted on quarries in general (Losey 1971: 149). As Gramly (1980: 823) puts it "raw material sources are usually thought to be sites not worth excavating."

The lack of archaeological work conducted on quarries has resulted in past archaeological interpretations for southern Manitoba having concentrated on the ecologically rich resource base of the region (as previously noted) and have not taken into account lithic resources. It seems reasonable to assume that overlooking the importance of local raw material sources or dealing with them in a cursory fashion has resulted in a valuable source of data being

missed (Gramly 1980: 824). Good lithic material would have been of fundamental importance to the technological and subsistence strategies of pre-contact people. As this research indicates, raw lithic material played a more fundamental role within southern Manitoba prehistorically than has previously been indicated in the literature.

The recognition and demonstrated presence of regional lithic quarries in southern Manitoba provides new and meaningful information for the region. These quarries, therefore, will have important implications regarding future interpretations of the lifeways and settlement patterns of the region's prehistoric inhabitants and current evaluations of the area now need to be re-examined.

The opportunity of being able to collect lithic material from quarries that existed along travel routes next to localized ecological resources would have been a major asset and benefit to prehistoric inhabitants within any locale (Gramly 1980:832). This pattern of lithic and ecological resource exploitation appears to have been the characteristic pattern within the Tiger Hills. According to Gramly (1980: 831) groups having a local access of raw materials and bountiful ecological resources would not be plagued with the chore of having to transport bulk lithic materials over any great distance.

The research conducted within this thesis indicates that the prehistoric inhabitants of southern Manitoba had the benefit of having workable lithic raw materials bordering an ecologically rich valley trench. It is postulated here, that the rich lithic and ecological resource base of the study area would have jointly made this region ideal for long term habitation and perhaps the quarries may have served as an incentive for groups to enter this area and return frequently. If the lithic quarries within the Tiger Hills have been as extensively used as is initially indicated then they would surely have played a fundamental role in the prehistoric settlement of southern Manitoba.

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APPENDIX

Glossary: Lithic Terminology Pertinent to this Study

Alluvial Fan. Fluvially derived deposits that approximate the gross shape of a fan or a segment of a cone.

Amorphous. This term defines an artifact as having no definite form or classifiable shape. It is principally applied to cores displaying an irregular morphology.

Artifact. An artifact is an item that has been culturally altered, modified, or produced.

Biface. An edge tool that displays flake scars on both faces of the tool.

Bi-polar. This technique involves resting one base of a lithic core on a solid platform and then striking it's opposite end with a percussor which applies force to both ends of the material at the same time. This technique produces flakes with a curved ventral surface.

Blank. A piece of lithic that has been removed from a core, but which displays no specific shape, form or evidence as to its intended final state.

Chopper. Choppers are identified as heavy core tools that have at least one cutting edge allowing the artifact to be utilized for chopping.

Core. A bulk piece of raw lithic material that produces a variety of flakes and blades used in the production of stone tools. A core may be prepared or merely a by-product of stone tool manufacture.

Cortex. This is the natural exterior surface of unworked lithic material.

Cryptocrystalline. Lithic material having distinct particles that are unrecognizable without magnification. These are fine-grained crystalline rocks.

Debitage. This is the residual lithic material that result during the manufacture of stone tools. It results from the various stages of tool production, from the raw material to the finished product, and in an archaeological context it displays the progress and technology of lithic manufacture being employed at a particular site.

End-Scraper. A unifacial artifact that displays flaking along the distal working edges of the tool.

Exhausted. Refers to artifacts, particularly cores, that have been completely exhausted to the point they are no longer utilizable.

Facies. A particular suite of physical, chemical, and biologic parameters, within a sedimentary environment, that operate to produce a body of sediment characterized by specific textural, structural, and compositional properties.

Flake. A piece of cryptocrystalline lithic material of any dimension that has been removed from a larger piece of stone by force (percussion or pressure). A flake serves as the initial planning stage in tool manufacture and may also be produced during subsequent stages of manufacturing.

Fluvial . Relates to the activities of rivers, streams, and associated sediment-gravity flow processes which generate a wide spectrum of deposits.

Formation. A body of rock that is a lithologically distinctive stratigraphic unit large enough in scale to be mappable at the surface or traceable in the subsurface.

Glacio-fluvial. Relates to the fluvial activities generated within or by a glacier.

Homogeneous. Relates to materials of a like substance, nature or structure throughout. That is, composed of parts all of the same kind.

Inclusion. A foreign element within the body of a stone that alters the homogeneity of the lithic materials.

Inorganically Derived Rock. A rock that forms from materials other than that derived from organic matter.

Isolated Platform. A prominent platform that has been isolated from the mass of a lithic.

Knapping. This is the process of fracturing or working lithics during the manufacture of stone tools.

Lithic. Pertains to stone.

Lithofacies. A facies distinguished by physical characteristics such as color, lithology, texture, and sedimentary structures.

Lithology. The study and description of the physical character of rocks. Lithologic characteristics include rock type, color, mineral composition, and grain size.

Member. A lithostratigraphic unit that forms part of a formation. A member is next in rank below a formation.

Multidirectional. Flakes have been removed from the core through impact or applied pressure in several directions.

Organically Derived Rocks. The majority of sedimentary rocks contain some organic constituents derived from preserved residue of plant or animal tissue. In a reducing-environment organic matter may be preserved long enough to become incorporated within accumulating rock sediments.

Percussion. A variety of techniques for applying force that involves flaking with a flaking percursor, thus removing flakes by impact, collision, or concussion.

Percursor. A striking implement such as a hammer stone.

Petrographic. The description and classification of rocks of all types by means of microscopic analysis of thin sections of rock.

Platform. A natural prepared surface area of a lithic that receives the necessary force required to detach a flake.

Preform. An unfinished artifact that displays the first processes of forming and refinement that will later result in a completed tool.

Pressure Flaking. The process of removing flakes from a lithic artifact by direct pressure rather than by percussion.

Provenance. Relating to the study of source-rock determination.

Provenience. Relates to the measured three point position of artifactual material within an excavation unit. Provenience is commonly measured from the north-east corner of the unit as follows: *n* cm below surface, *n* cm west and *n* cm south.

Reduction Flake. An irregular piece of lithic material that displays evidence of having been removed from a core during its reduction, but that has not been further manipulated or utilized.

Rejuvination Flake (Biface). The small flakes produced when an artifact such as a biface is being retouched or resharpened.

Shatter. Those fragments of lithic debitage displaying sharp irregular edges, but no specific morphological characteristics and not suitable for further modification (see Waste Flake).

Side-Scraper. A lithic tool with unifacial beveling on one or more lateral edges to produce a strong cutting edge.

Thinning Flake. A Flake removed during the final thinning stages of stone tool manufacture.

Unidirectional. Flakes have been removed from one platform of a core and in one direction only.

Uniface. A lithic artifact that displays flaking on one face only.

Waste Flake. Non-functionable debitage usually resulting from core reduction.