THE IDENTIFICATION, DISTRIBUTION AND SOURCES OF LITHIC RAW MATERIALS IN MANITOBA ARCHAEOLOGICAL SITES

by

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THIS THESIS IS DEDICATED

WITH LOVE

TO MY PARENTS

ABSTRACT

This thesis examines the question of lithic raw materials, their identification, sources and frequency distribution in Manitoba archaeological sites. A number of common lithic materials are described in terms of their visible characteristics and some are submitted to thin section examination to render a more precise description. Sites in eight environmental regions in the province are sampled and the distribution and frequency of the materials therein are tabulated and may be seen in the appendix. Also the sources of these materials are described from the literature and field examination. The data on raw material frequency and distribution leads to the establishment of two concepts, the area of concentration and the zone of transition. Further, this data is examined within the temporal framework of Paleo-Indian and post Paleo-Indian times. Attempts are made to account for raw material distribution at great distances from the known sources. Trade, migration and gathering are the mechanisms suggested to account for this phenomenon. Lastly, a statement of possible future research suggestions is made.

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To Mr. C. T. Shay, my thesis advisor, for his patience, encouragement and zealousness goes a most heartfelt vote of thanks. His assistance and effort made this thesis a reality.

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INTRODUCTION

This thesis presents the results of research concerning the identification, sources, distribution and frequency of certain lithic raw materials in Manitoba. It originated in an attempt to identify common lithic types and to make inferences regarding trade and population movement in prehistoric Manitoba.

This study developed as the result of a suggestion by Morgan Tamplin, that research directed towards raw materials in Manitoba was needed. The suggestion held some appeal, for some experience with thin section, I had, and I had served on the Glacial Lake Agassiz Survey, which provided a familiarity with the raw materials in the field, and the problems posed by them. This thesis is a result of that experience and research.

PROBLEM

The problem which this thesis was designed to solve consists of several parts. Apart from the three main objectives of the research, (see Objectives), part of the problem was to determine in what way the frequency and distribution of lithic raw material types reflects the archaeology of Manitoba. The other part of the problem was to develop a theoretical framework which could be used to account for raw material spread from the source regions throughout the landscape. Hopefully this framework will have application not only to the Manitoba situation but may constitute a basis for viewing prehistoric trade everywhere.

SIGNIFICANCE OF RESEARCH

The objectives of this study were several in number.

1) To identify the common types of raw material used in Manitoba.

2) To discover possible sources for these raw materials.

3) On the basis of distribution and frequency, to make inferences concerning population movements and trade patterns.

The identification, distribution and source of lithic raw materials which appear in archaeological contexts, is a problem which has had little attention in the literature. Raw material studies as such can be counted on the fingers of one hand. Some studies merely deal with the location of sources.

Studies of the type proposed here have several distinct values. First, it establishes definite types of raw materials, based on the mineralogical attributes and characteristics of the materials. Second, the location of source areas and the distribution of the various material types may yield insights into trade and migration patterns and prehistoric contacts. Such a study may also serve to demonstrate the value of future, more rigorous and detailed studies. Perhaps the greatest relevance of this study lies in the fact that its orientation is rare. It represents a different approach to a problem, often ignored.

REVIEW OF LITERATURE

In the wealth of archaeological literature which has appeared in the past fifty years in North America, it is surprising how little is specifically concerned with lithic raw materials and their distribution. Archaeological monographs do often include the raw materials used in the manufacture of stone tools and also their source if it is known,

It may be noted that a pioneer study of lithic raw materials was carried on by Kirk Bryan, (1950). Bryan examined quarry sources of Albates flint, and other materials which were first described by Holmes, (1894). In California, Treganza and Heizer, (1944), studied raw material quarries.

More recently, in the Old World, interest has turned to obsidian. Cann and Renfrew, (1964:1965) have begun to direct their interests away from mere description toward suggesting trade routes and population movements on the basis of obsidian distribution. These studies make use of exact determinations of the composition of obsidian relating obsidian types to their sources and the spread of material from these sources. These studies perhaps represent the greatest degree to which raw material has been used to reconstruct prehistoric culture.

METHODS AND MATERIALS

The techniques used in order to pursue the problem in question are several in number, including, sampling, thin sections and distribution. The technique of sampling is essential to the pursuit of the problem in question. For this study, the sampling was carried on in the following way. First a selection of work shop sites in Manitoba was made. From these sites, lithic raw materials were classified on the basis of macroscopic identification into common parlance. After this was done for each category of material, a certain percentage was selected for thin section identification.

Several categories of material was submitted to thin section identification. Using the techniques described in Kerr's Optical Mineralogy (1959). The purpose here was to provide an accurate means of identifying rock and mineral types which occur in the archaeological context. Once these lithic materials were identified and classified according to their composition, it was possible to proceed to the next phase of the study.

The next phase of the study employed a means of quantifying data. The distribution of materials from known sites was plotted on maps and charts. It was possible to compute the percentage frequency of each type of material in terms of its frequency on a map. Bar graphs were made showing percentages of material in each region in a comparative study.

The data for this study came from two main sources. The lithic raw materials came mostly from the collections of the Laboratory of Anthropology, University of Manitoba. Other raw materials came from private collections.

The second source of data include geological reports, such as the Memoirs of the Geological Survey of Canada, Manitoba Mines Branch Bulletins and general geological and archaeological references on Manitoba.

CHAPTER I

RAW MATERIALS CHARACTERISTICS

A cursory examination of Manitoba archaeological remains, reveals that a great number of different rock types were used for artifact manufacture. A more detailed examination however, reveals that few types of material hold preference over others. The reasons for this include availability, and ease of workmanship. The purpose of this section is to discuss the characteristics of the common lithic materials used, both in terms of their macroscopic and microscopic characteristics.

The microscopic characteristics of the materials are based on thin sections made and examined by the author, and reference to the works of Moorhouse, (1959) and Kerr (1959). The terminology used to describe the raw materials throughout this thesis have only archaeological significance. In other words, the terms used to distinguish the materials were coined by archaeologists. It is hoped however that the description of the characteristics of the materials will lend some geological significance to these terms.

Petrography presents several conflicting opinions concerning certain members of the class of silica minerals. Chert for example, is defined in different ways by different researchers. For the sake of uniformity and to reduce confusion, terminology will be defined and used consistently. The following section is devoted to the terminology used in the study. These are the most widely ascribed to definitions in the literature.

> Chert: a rock composed of microcrystalline quartz. It occurs in a wide variety of forms and colors, being found in limestones, dolomites and argillites. It also occurs as pockets and interbeds with pillow lavas and tuffs (Moorhouse 1959:383).

> Chalcedony: a fine grained quartz with a conspicuous fibrous microstructure visible in thin section (Frondel 1962: 195-223).

These two terms are the ones most often confused in the literature and also appear to bear several conflicting meanings.

RAW MATERIALS

Knife River Flint

The so-called Knife River Flint or brown chalcedony was a widely distributed and popular material for artifact manufacture in prehistoric Manitoba. Perhaps its two most attractive features which led to its popularity were its concoidal fracture and its ease of workability.

Macroscopic Appearance: (Fig.1-3)

There is a wide range of variation within the type of material known as Knife River Flint. Its texture ranges from microcrystalline to cryptocrystalline, and its luster varies from a waxy on old fractured surfaces to a more shiny luster on newly fractured surfaces. Its color ranges from dark brown, (10 YR 2/2 to 3/2) to light brown, (10 YR 3/3 to 5/2). A white or light grey calcareous patination often forms on weathered surfaces. The brown color of the flint appears to be due to the presence of dispersed,extremely fine grained organic material. Samples with the best developed internal sedimentary structure are lightest in color because the organic material is less dense.

In thin section Knife River Flint is colorless with optical extinction being parallel to the length of the chalcedony fibers. Examined samples of this material reveal an internal sedimentary structure consisting of irregular layers of light and dark material. Some of these layers contain a cellular structure indicating that they are silicified plant fragments. (Figure 1). In some cases the cellular structure appears to be plant epidermis. Hand specimens also reveal a layering.

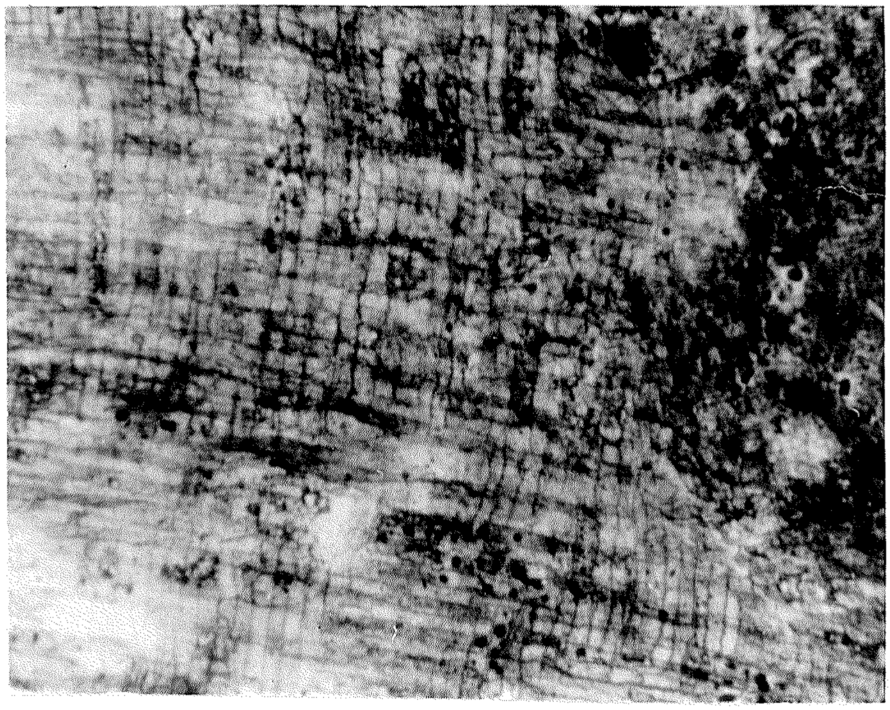

Fig.1 ------ Knife River Flint in thin section, showing cellular structure and plant epidermis.

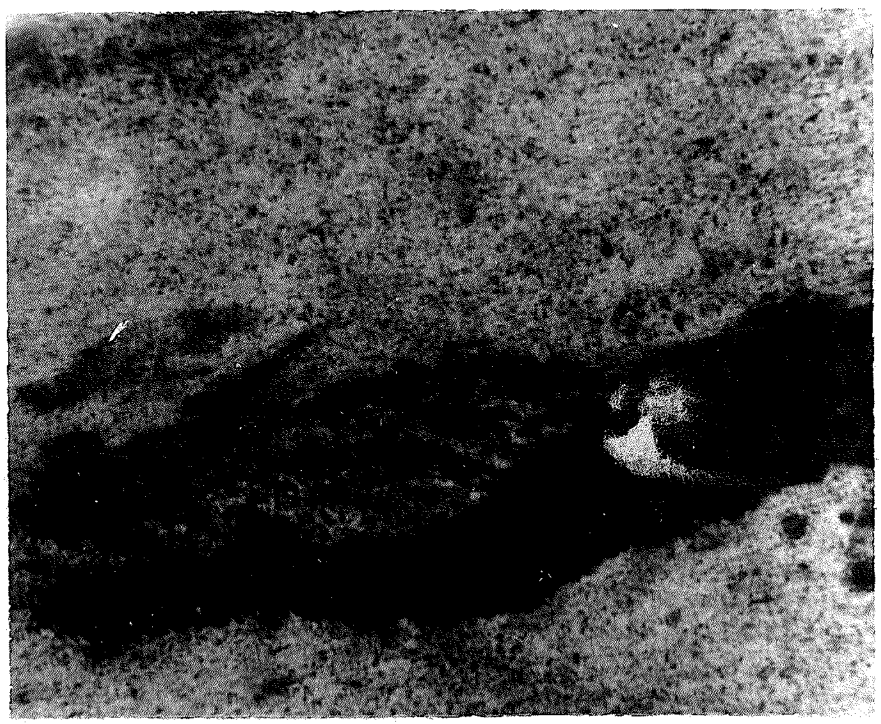

Fig.2 ----- Knife River Flint in thin section, showing internal sedimentary structure, and alternating light and dark bands.

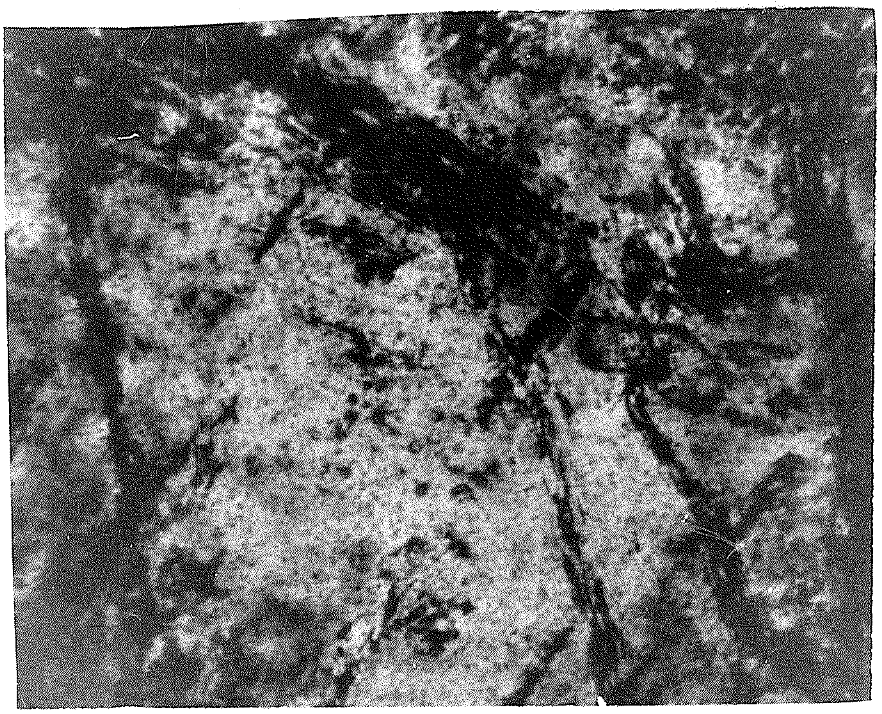

Fig.3 ---- Knife River Flint in thin section showing detrital plant remains.

Arenaceous Chert

A range of materials has turned up in many south-western Manitoba sites in the form of large bifaces and crude chopping tools. This material has been referred to under the synonyms of psuedoquartzite, (Claydon n.d.) and orthoquartzite, (Porter personal communication). The material varies in color from pale red to pale brownish-red in color. A grey colored variety of this material has also been observed. It is of medium-coarse texture, with holes and impressions of plant stem and leaf fragments. The material is very hard and has a sub-concoidal fracture which makes fine workmanship impossible.

Two types of silicified sediment have been identified from South Dakota, (Porter 1962:268). These are known as Tongue River silicified sediment and Bijou Hills silicified sediment. Whether the Manitoba materials discussed above can be included in either of these categories has not yet been determined but would make an interesting project for future work.

In thin section this material consists of small sub-angular and rounded sand grains with a chalcedony or opal cementation. Fracture lines would thus probably travel through the cementing material and around the sand grains. The reddish color is probably due to hemitite.

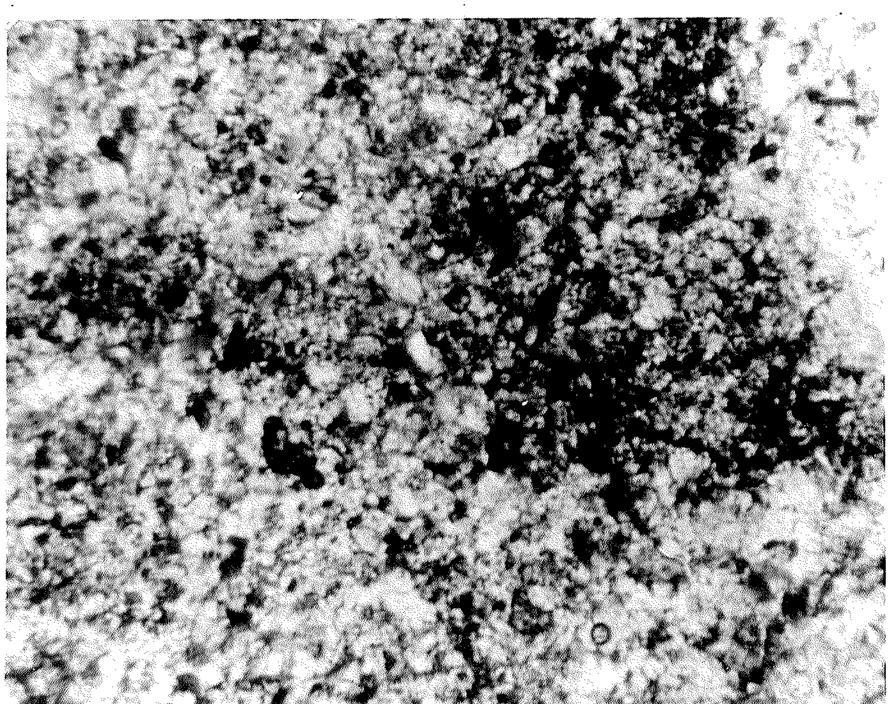

Fig.4 ----Arenacous Chert,(silicified sediment) in thin section

Swan River Chert

Swan River Chert refers to an extremely common raw material in the northwestern half of the Province. In fact, it is so common that in many sites north of Dauphin, it comprises at least 70% of all lithic remains. Swan River Chert displays wide variation both in surface texture and color, sometimes within the same hand specimen or cobble. It is not uncommon to find three or four different colored bands within one piece of material. The usual range of color is from cream white through to medium grey, pink to deep rust, (jasperoid), pale yellow to deep orange. The stone has a regular concoidal fracture.

Luster ranges from glossy to waxy to dull in appearance. Swan River Chert also has considerable variation in texture from coarse crystalline to crypto-crystalline, within one piece. In some cases, pockets of clearly visible quartz crystals may be seen in the cortex, while the newly fractured surface shows a highly waxy and extremely fine texture.

In thin section the composition of Swan River Chert was found to be quartz with chalcedony as a cementing medium. Large radial crystals are visible with fine chalcedony fillings, (Figure 4). It was impossible to determine the exact nature of the coloring materials, but iron oxide, (Fe_2O_3) may be responsible for the dark reddish "jasperoid" which is included within the range of Swan River Chert.

Bakers Narrows Chert

Bakers Narrows Chert is a term used to denote three distinct types of rock found at the Bakers Narrows Picnic Site, (LAS 394). Because of the difficulties in preparing thin sections no adequate microscopic examination was made of these materials. This heading includes three materials; white limestone chert, a black banded material and a greenstone.

The first is a dull whitish limestone chert. It is dense and well silicified. It has a calcareous patination composed of fragments of shells and a calcareous cementation. The material displays a concoidal fracture. Dark banded material which is the most popular, is dark and dense with a rust-colored iron-oxide patination. The material is banded with irregular flowing wide light bands. It is probably a fine grained felsite or related rock. The third type of material has been termed greenstone because of its dull greenish appearance. The correct terminology for this material is unknown. It is medium grained, of dull greenish color with a sub-concoidal fracture.

Selkirk Chert

Macroscopically, it is a limestone chert from the Selkirk member, Ordovician limestone. It is white to cream in color, with some mottling. Most of the material is hard and dense while some poorer quality has degenerated into what resembles chalk. This poorer quality material may also be the result of incomplete silicification. It is medium to fine grained with a good concoidal fracture. Selkirk Chert was not examined in thin section.

Eastern Silicifieds

These materials consist of a black or dark green groundmass interlaced with thin bands. It is hard, smooth and fine grained with a concoidal fracture. No thin sections were made of this material.

Cat-Head Chert

Cat-Head Chert is a limestone chert of the Cat-Head member, (Baillie 1952). It occurs in a variety of mottled colors, white, cream, tan, red and grey-white banded. It is a very hard material with a good concoidal fracture.

Other materials occur in Manitoba sites, but the ones described here are the most common.

CHAPTER II

RAW MATERIAL SOURCES

One major concern of this thesis was the location of possible source areas for the various types of lithic raw materials found in Manitoba archaeological sites,(see Fig.6) In locating sources, several types of data were examined. Geological reports were valuable in that they proved a comprehensive summary of the general geology of an area, which might suggest possible raw material sources. Secondly, these reports noted natural outcrops which could then be located easily for field examination. Previous archaeological work also proved valuable, as some sources of material had been located during surveys. Finally, informants added to our information about source regions. Perhaps the greatest single aid in locating source areas was the idea that greater amounts of material would be found closer to the source and that quantities would diminish with distance from the source. With this concept in mind, the researcher proceeded to sample the available sites and sort the material from each site into types. These types were then weighed and recorded as a percentage of the total site inventory. The percentages were then plotted on maps to indicate the relationship between quantity and distribution and its correspondence to geographic distance. In this manner, a probable source area could be located by referring to geological reports or by field investigations.

Source areas of lithic raw materials were divided into two types; local and regional sources. Local sources are small in extent usually exploited by small groups of people in a restricted area. A regional source is one which serves a wide geographic area. Obiously, the distinction between regional and local sources is based solely on geographic extent. It may well be that there is little or no justification for making such a distinction, except that it provides a useful tool.

There also are several varieties of sub-types of sources. These sub-types may be either regional or local. These are as follows:

1) Quarry Sites: natural outcrops of material-bearing matrix which show obvious signs of having been utilized in the past. Such signs may be scatters of flakes, cores, or cortex near the matrix or outcrop.

2) Stream and River Beds: often suitable materials are transported great distances by river action, and cobbles

or pebbles, rounded by water action are gathered and utilized.

3) Natural Outcrop: differs from quarry site in that, there are no obvious indications of utilization. It existed as a potential if not actual source of raw material.

4) Scatters: random pebbles or cobbles or suitable material thinly deposited over a wide area. The method of transportation may have been glacial or stream action.

These four are the major types of source areas with which this thesis is concerned. Undoubtedly other types of source areas may be defined, but for the present task, the four mentioned above should suffice. It should be re-emphasized here that any of the above mentioned sources represent only possible sources unless otherwise stated. The sources discussed here represent what is available today, and it is assumed what was available in the past. Therefore, I assume that these sources could have been used and I make no greater claim. In some instances there is evidence for the prehistoric use of a natural outcrop or occurrences as a source of raw material. In the following section, each major raw material type will be examined in terms of its possible sources.

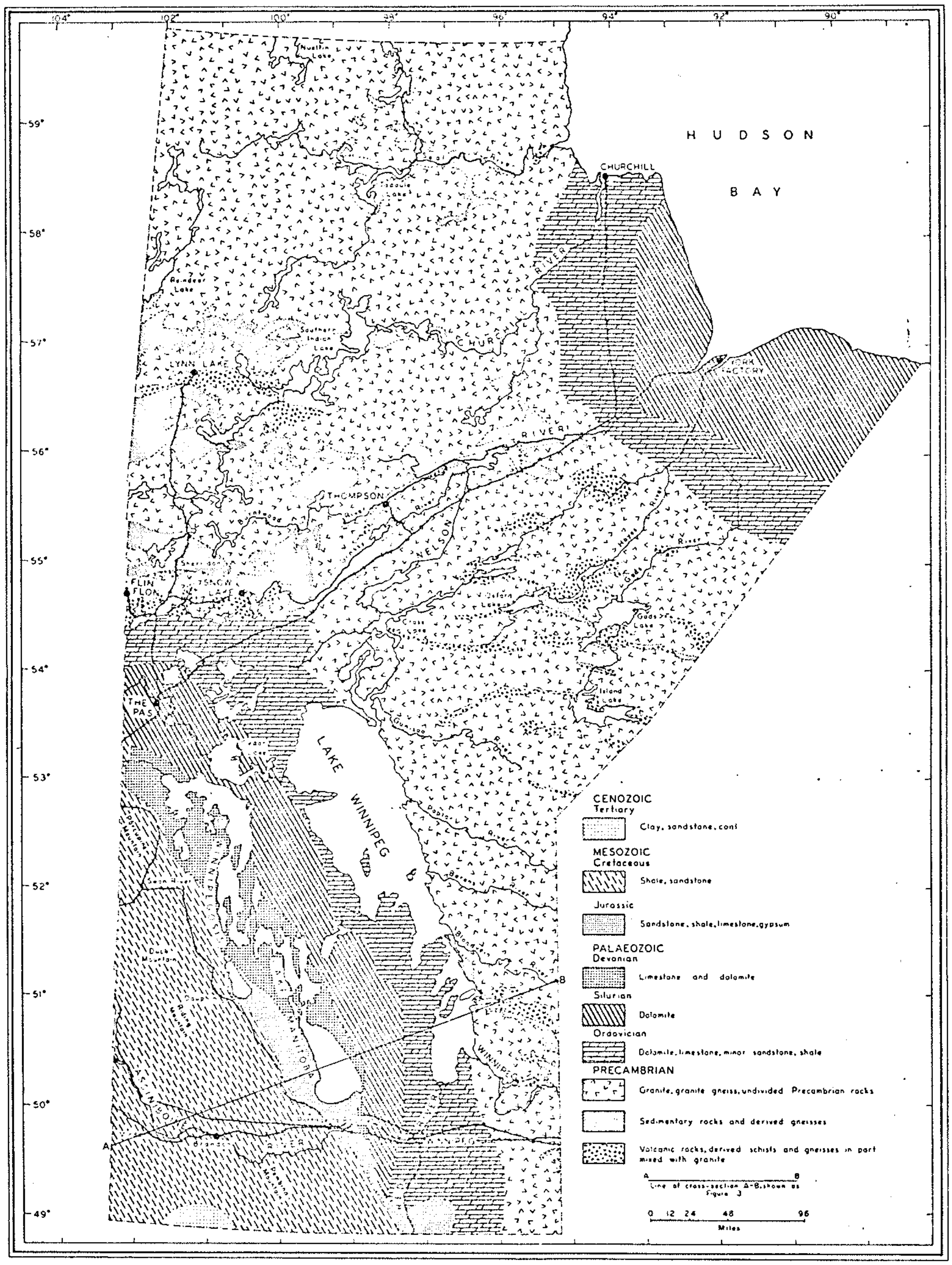

FIGURE 5 GENERAL GEOLOGY OF MANITOBA
(from Davies et al, 1962)

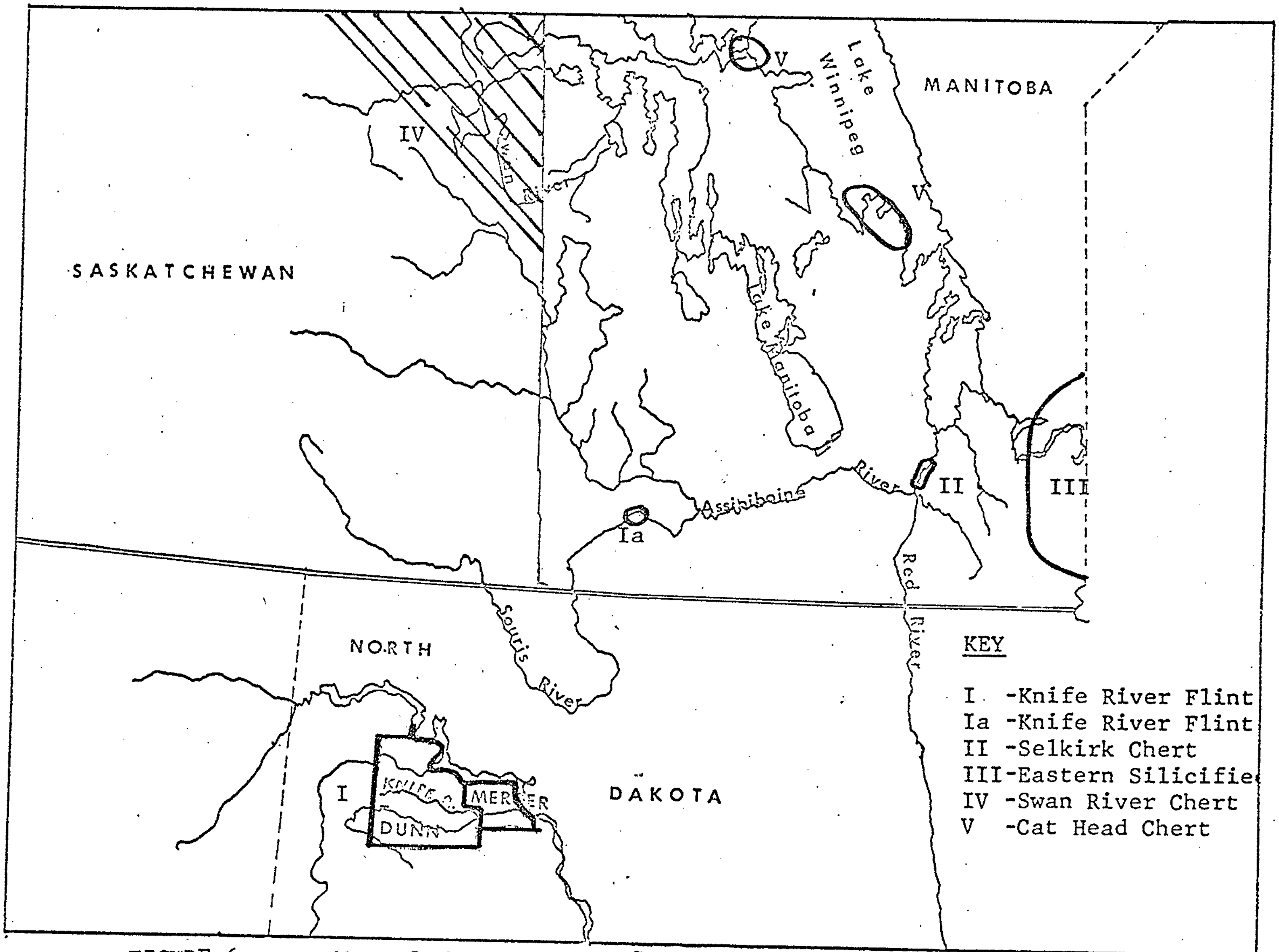

FIGURE 6 Map of the Known Lithic Raw Material Sources

KNIFE RIVER FLINT

Knife River Flint was an extremely popular raw material in the south-western portion of Manitoba, and to a lesser extent in the south-east. Two possible sources of this material have been hypothesized. They are, the Souris gravels near Souris, Manitoba, (Hlady 1965), and certain quarries in North Dakota, (Claydon n.d.).

Pieces of brown chalcedony, identified as Knife River Flint have been found in sufficient quantities in the gravels of the Souris River, near the town of Souris, to be considered as a primary source of this material in Manitoba. I have seen a large sample of the Souris gravels and note the presence there-in of brown chalcedony, agate and other materials commonly used in artifact manufacture. The samples of Knife River Flint from the Souris gravels are generally small, (½-1 inch in diameter), platey and bear a dense white patination.

It is my opinion that while the Souris gravels could have been exploited for Knife River Flint in prehistoric times, they do not represent the primary source of such material as has been suggested by Hlady (1965) and Vickers (personal communication). The reasons for this will be discussed later.

The occurrence of Knife River Flint in the Souris gravels undoubtedly has its answer in the pre-glacial drainage of the Knife River, North Dakota. The pre-glacial drainage pattern of the Knife River shown in Lemke (1960Plate 14), includes areas in Mercer County which are rich in Knife River Flint. This material and others in the area were probably transported northward by river action. The pre-glacial Knife River is closely parallelled by the Souris River Channel today. Thus, much useable material was transported geologically prior to the advance of Pleistocene glaciers. This would account for the presence of such material in the vicinity of Souris, while glacial and stream erosion would explain its exposure.

Recently, Dr.Lee Clayton of the North Dakota Geological Survey, has found at least twenty-eight quarries for Knife River Flint in North Dakota; five in Mercer County, and twenty-three in Dunn County. According to Clayton, the largest single quarry is eighty acres in extent. The total area covered by all twenty-eight quarries is about two hundred and fifty acres. Each quarry consists of numerous pits that are uniformly and closely spaced. The pits are round depressions, about twenty feet in diameter and three to four feet deep. There are an average of thirty pits to the acre. The quarries occur on hill tops or on hill slopes, generally thirty to forty feet from the valley bottom. These pits are not natural features, nor were they dug by nineteenth century settlers, because of the well developed soil present in the bottoms. The abundant litter of artifacts and chipping detritus indicates that the quarries were dug by Indians.

Quarried material occurs as subangular pebbles, cobbles and boulders as large as two feet in diameter. The flint litters the hill slopes and is found in alluvial slope wash and residual lag deposits of Pleistocene and recent ages. At the quarry sites, the slope wash and residual lag consists almost entirely of cobbles and boulders of Knife River Flint. This material also occurs in other areas of western North Dakota, where it appears in Pleistocene and recent gravels locally eroded from older formations.

In Manitoba, extensive use was made of Knife River Flint. Of the two possible sources of the material, the most extensively used probably was the North Dakota Quarries. The reasons for this assumption are several.

1) The nodules of Knife River Flint found in a 25 lb., sample of gravel from the bed and banks of the Souris River are, from my observations, generally of poor quality for flint knapping. Of the total 25 lb., sample there were two stream rounded pebbles of Knife River Flint, neither of which exceeded 1.25 inches in diameter.

On the other hand, samples of Knife River Flint from the Dunn and Mercer County quarries vary in quality from poor to excellent. Most of the detritus found in sites in the south-western portion of the province, is of good to excellent quality.

2) Recently, evidence has been brought to light, near the town of Treherne, supporting the hypothesis that pieces of Knife River Flint were rough-worked into a convenient shape and size at the source and then distributed throughout either by special expeditions or by trade, (Leigh Syms, personal communication). The supporting evidence consists of a cache of "blanks." These items are pieces of Knife River Flint of good quality and uniform size. The average size of these dozen or so pieces is, 3 to 4 inches in length by 1 1/2 to 2 1/2 inches in width. Thickness is between 3/8 to 3/4 of an inch. These "blanks" were found in a pile in a farm field near the town of Treherne, Manitoba.

The first question which may arise concerning these "blanks" is, "in what way, if any is there any indication of source"? The answer is none. However, the quality of all the flint pieces is higher than has been seen in the Souris Gravels, and so suggests the North Dakota quarries as the source.

An argument may be made for the selective use of the Souris gravels. In fact, the "blanks" may be selected pieces from Souris. Although a possible explanation, this seems unlikely because if true, large pieces of Knife River Flint of good quality would surely be found in the Souris gravels. At present, no such pieces have been found. It must also be remembered, that if large cobbles of the material do exist in the Souris gravels, it must have been in such a situation so as to be available during prehistoric times. The presence of Knife River Flint in quantity in a contemporary gravel operation under ten feet of alluvium does not mean that this material was accessible in prehistoric times.

3) Chert and flint pebbles battered around by stream action may, after a while, contain stress lines which will not yield a normal characteristic concoidal fracture upon impact, (M.Tamplin, personal communication). In fact Mr.Tamplin, claims to have attempted to work stream-worn flint nodules, only to have them shatter completely in his hands. If this is true, then much of the Souris material may have irregular stress lines and thus be unsuitable for artifact manufacture.

These are the three reasons which favor the idea that the major source of Knife River Flint is the North Dakota quarries of Dunn and Mercer Counties as opposed to the Souris gravels of Manitoba. Some use of the Souris gravels was undoubtedly made, but not as a major source.

Cat-Head Chert

A popular material used at the Tailrace Bay Sites, near Grand Rapids, Manitoba, is the so-called Cat-Head Chert, which derives its name from the Cat-Head member of the Red River formation of dolostone of Ordovician Age, (Baillie, 1952). Cat-Head Chert is found in exposure of the Cat-Head member. This dolostone formation is well exposed at Cat-Head point on the west shore of Lake Winnipeg. The measured section at this location is forty-three feet in thickness and is divided into three lithological units, which may be described as follows (Baillie, 1952:50-51).

> Unit 1.
>
> Dolostone, light yellowish grey to very pale yellowish brown, finely saccharoidal laminated appearance, in beds up to 30 inches thick, contains abundant irregular chert nodules as much as one foot long. Nodules are more abundant, along the bedding planes, but may occur within the beds. Laminations are sometimes continuous through the chert nodules but may be curved around it. This unit has a maximum thickness of 11 feet 8 inches.
>
> Unit 2.
>
> Dolostone, light yellowish grey, saccharoidal to medium crystalline, in 5 to 12 inch beds, contains some finely sub-fragmental beds that show an indefinite lamination, contains chert nodules that are less abundant in the fragmental beds. This unit has a thickness of 12 feet.

Unit 3.

Dolostone, light yellowish grey, slightly mottled to yellowish grey, medium saccharoidal to medium crystalline, in beds 2 to 3 feet thick, contains scattered nodules of chert and disseminated flakes of hematite, uneven texture that results in an irregular weathered surface, some fossils and fossil fragments. This unit has a thickness of 12 feet.

Natural exposures of Cat-Head Chert occur at Cat-Head and MacBeth Points on Lake Winnipeg. Also inland, there are outcrops about six miles north of the village of Riverton.

A large quantity of Cat-Head Chert was found at the Tailrace Bay site, near Grand Rapids, (Mayer-Oakes in press). Although the exact location of the source for this raw material is unknown, there are several possibilities. There are exposures of the Cat-Head Member at Howell and Robinson Points, north of Grand Rapids. Also, at the foot of the Cross Lake Rapids, a cliff about fourteen feet high and extending about two hundred feet along the west side of the river contains a lens of nodular chert within the dolostone. The chert lens is 10 inches thick and thins out rapidly (Baillie 1951:22).

To the author's knowledge, no other natural exposures of the Cat-Head Member occur and none of the exposures noted above have been definitely identified as quarry sources. They are only suggested as possible sources of Cat-Head Chert.

Selkirk Chert.

Selkirk Chert derives its name from the Selkirk Member of the Red River Formation of Ordovician dolomitic limestone (Baillie, 1952). It has been referred to as Lockport Chert, White Chert, or Red River Chert. The author urges acceptance of this term because it provides a somewhat sounder base for naming raw materials, in this case, a chert derives its name from the geological unit in which it is found. This too will add to the uniformity of future raw material classification and terminology.

The Selkirk Member consists of a yellowish grey to pale yellowish brown mottled fossiliferous fragmental dolomitic limestone in beds one to three feet thick. The mottled areas are pale yellowish brown or greyish orange and are composed of many small rhombs of dolomite in a calcitic matrix. The ground mass has a fragmental texture and consists largely of fossil fragments. Generally the mottled areas have a tubular shape and are connected, yielding a tapestry-like effect. Nodules of chert are common and in some cases they are weathered to a white soft chalky material, particularly in the upper beds (Baillie 1952:17).

Good exposures of the Selkirk Member are rare in Manitoba. However, in the southern half of the province, the member is exposed at a few localities. The exposures at Lockport, near Lower Fort Garry on the banks of the Red River and near East Selkirk, contain considerable chert. Major archaeological sites in this riverine area shows a preponderance of Selkirk Chert (MacNeish 1958; Hlady n.d.; Vicker n.d.) The above mentioned exposures were probably available readily, for Indians living in this vicinity.

A brief reconnaisance of these three locations revealed that at Lockport, no exposure of limestone is visible today. Along the Red River near Lower Fort Garry, limestone may in fact be exposed, but the high water level of the river prevents it from being seen. Near East Selkirk, I did encounter an abandoned white historic quarry. There would also probably have been a natural exposure there in prehistoric times. Samples of small chert nodules and large nodules in a dolostone matrix were collected.

To the north, there are several exposure of the Selkirk member along the shores of Lake Winnipeg. These localities are Dancing Point, Carscallen Point, Clark Point, Selkirk Island, Robinson Point and Howell Point Baillie 1952:17). The extent to which any of these sources were used is unknown.

Swan River Chert.

By far the most common lithic raw material appearing in archaeological sites in Manitoba, has been called Swan River Chert, because it is found in such great quantity in the Swan River Valley. The tremendous quantity of the material in this locality suggests that the source must be near by. However, no source of this material has ever been found in Manitoba. Hence it is impossible to name it according to its appropriate geological formation. Large quantities of a material indistinguishable from "Swan River Chert" have turned up in the Red Deer River in Saskatchewan and other rivers and creeks in the vicinity, (Mackie and Meyer, personal communication). In fact, there seems to be a band of Swan River Chert in river beds covering a wide geographical area, almost 200 miles west from the Manitoba-Saskatchewan boundary and 100 miles north and south of Red Deer River. The greatest concentration of Swan River Chert lies in the Swan River Valley between the Porcupine Hills and the Duck Mountains. This forms a natural land or water transportation route from the Saskatchewan prairies.

Eastern Silicified Materials.

In most sites, east of the Red River and particularly those in the Whiteshell Forest Reserve, several types of raw materials occur.

The material generally resembled chert but is in reality not true chert. The Whiteshell region has several outcrops of silicified Pre-Cambrian materials which would probably be suitable for artifact manufacture, (Davies 1954,1957; Springer, 1949, 1952). Maps of the sources of these rocks are included here.

I have provided, up to this point, information concerning raw material characteristics and sources. The object now shifts to the distribution of these raw materials within Manitoba. In order to render this task easier and less confusing, I have divided the province into eight environmental regions. The boundaries for some of these areas are arbitrary, while others are dictated by the physiography. The purpose of these areas is no more than to provide convenient units in which to consider raw material distribution.

CHAPTER III

ENVIRONMENTAL REGIONS

To facilitate describing and interpreting the raw materials I have divided Manitoba into eight environmental regions, based upon 8 drainage basins. This division follows that of Tamplin (personal communication). Each area is characterized in part by the fact that it represents the drainage for that area. They range in size from 1,050 square miles to 13,000 square miles.

A-EASTERN AREA

The Eastern Area has as its boundaries, the Red River on the west and the Ontario boundary on the east. On the north it is bounded by the Winnipeg River and on the south by the International Boundary. The Eastern Area is situated within two large drainage systems. The Red River system drains that portion of the area east of the Red River and west of the Brokenhead River. The remainder of the area lies within the Winnipeg River drainage.

Physiographically the Eastern Area is composed of the Precambrian Drift Plains to the north and the

Southeastern Section to the south (Weir 1960, Plate 1). Altitude varies from 700 to 1500 feet with relief ranging from 8 to 25 feet. In the vicinity of the Red River, the surface is a lacustrine plain with elevations ranging from 850 to 1200 feet. The surface is a gently undulating till plain. Above 1200 feet, the terrain is made irregular by morainic ridges. At lower elevations the topography is marked by beach ridges and wave-cut terraces. Low boggy areas are scattered throughout the eastern section.

Geologically the Eastern Area reflects two major periods, the Precambrian in the eastern half and the Ordovician in the western half of the area. The Precambrian section consists of undivided Precambrian rocks with a large area of granite and granitic gneisses and small outcrops of volcanic rocks and undifferentiated basic intrusives. The Ordovician bedrock consists of limestone dolomite with some sandstone and red shale.

There are three main soil zones in the Eastern Area. Moving from west to east, there is a zone of black fine-textured soils followed by a black grey-wooded soil zone and at the eastern extremity, a wide band of grey-wooded podzolic soils. The range of vegetation types in the Eastern Area varies from sparsely wooded grassland in the west to mixed woods and coniferous forest to the east. The sparsely wooded grassland belt contains scattered groves of willow and aspen, while the mixed woods belt contains, mixed stands of broadleaf and coniferous species, chiefly spruce and aspen.

B-ASSINIBOINE DRAINAGE

The Assiniboine Drainage Area is a vast territorial expanse extending from the Red River on the east to include the Campbell strandline on the west. Its northern boundary is an arbitrary horizontal line extending west from the southern tip of Lake Manitoba at 50^{o} latitude. The Assiniboine Drainage Area lies entirely within the Red-Assiniboine River Basin which ultimately flows north to Hudson Bay.

The Assiniboine Drainage area is in the eastern half of a lacustrine plain merging into a gently undulating till plain westward. There are three notable features of the area: 1) the lower Assiniboine Delta to the east, 2) the Interlake-Westlake Plain,& 3) the Tiger Hills. Within the area elevations vary from700 to 1400 feet. The Interlake-Westlake Plain surface deposits consist of highly calcareous glacial till modified by wave action. The dominant soil types are Rendzina, Degraded Rendzina and organic soils. The Upper Assiniboine Delta has undulating to rolling relief with shifting sand dunes. Its eastern escarpment has been dissected by numerous streams. Surface deposits include lacustrine, aeolian sands, outwash and recent alluvium. The dominant soil types are black and dry sandy Regosols.

The Tiger Hills are composed of morainic deposits. Soil types are Rendzina and organic soils. Subsurface geology of the Assiniboine Drainage area reveals rocks of Jurassic or younger age. From east to west these bands are: 1) Amaranth Formation of dolomitic limestone, red shale and gypsum, 2) Swan River Formation of sand, sandstone and shale, 3) Vermilion to Ashville Formations of grey and calcareous shales, limestone and bentonite, 4) Riding Mountain Formation of grey and green-gray shale and siliceous shale.

Surface deposits of the area include lake clays and silts in the east and large areas of sand and sandy loams to the west. The Tiger Hills are covered with glacial drift composed of shale and limestone with granitic materials included. This region is largely true Tall grass Prairie to the east with wooded grassland and patches of broadleaf, lowland forests of elm, ash and maple to the west.

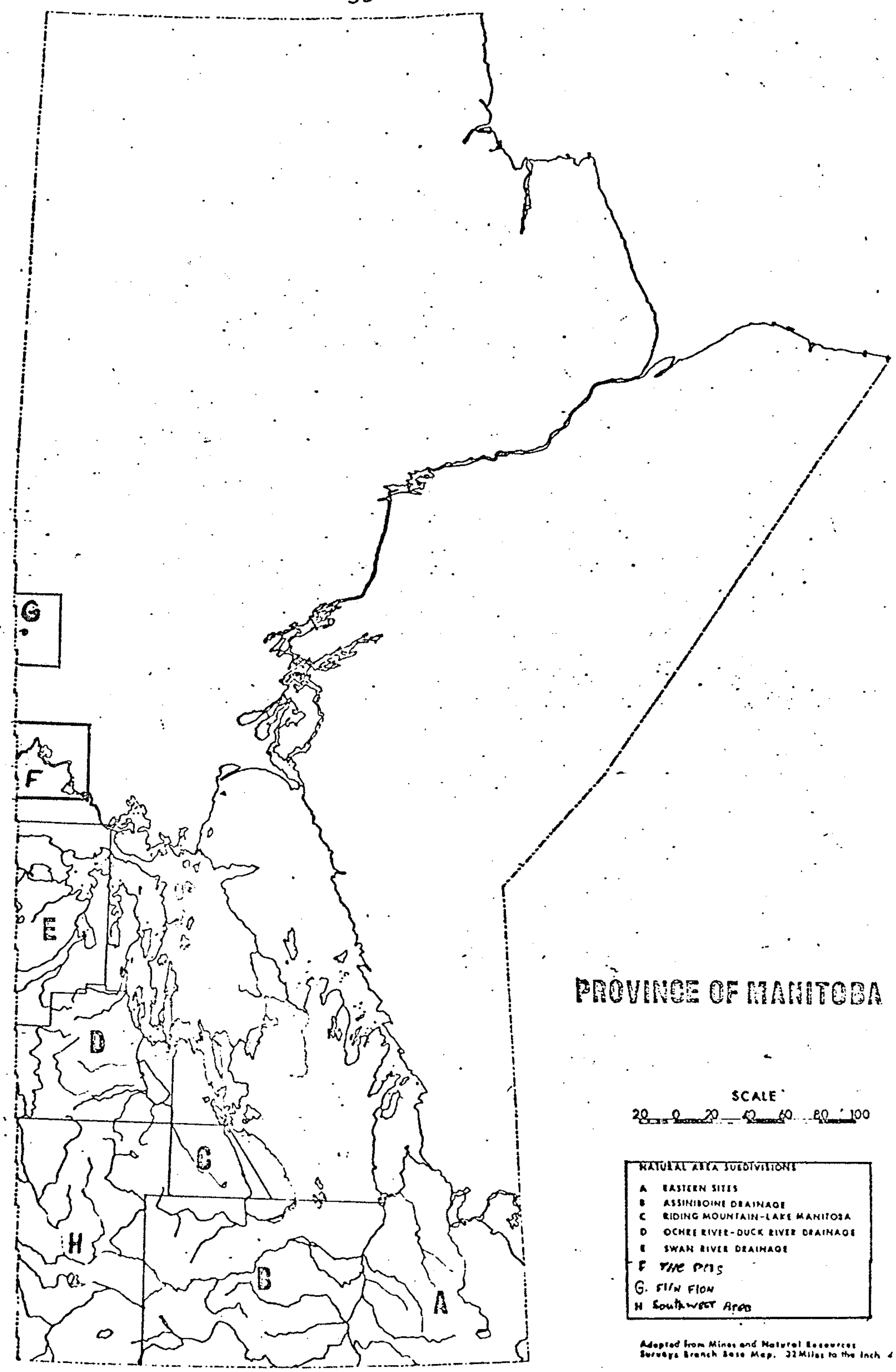

Figure 7 ENVIRONMENTAL REGIONS OF MANITOBA

C-RIDING MOUNTAIN-LAKE MANITOBA REGION

The Riding Mountain-Lake Manitoba region is the smallest environmental region under consideration in the province. Lying north of the Assiniboine Drainage, its northern limit is the "narrows" of Lake Manitoba. On the east, it is bordered by a diagonal line dissecting Lake Manitoba in a north-west - south-east direction; on the west, the eastern end of Lake Dauphin forms the boundary.

This region lies within the Lake Winnipeg-Nelson River drainage basin that drains into Lake Manitoba. It lies wholly within the Interlake-Westlake Plain, where the elevation ranges from 500 to 1000 feet. Micro-relief consists of low parallel beach ridges with a north-west to south-east orientation. These beach ridges follow this orientation westward from the present shores of Lake Manitoba. Small marshes are scattered throughout the area. Surface deposits consist of highly calcareous glacial till modified by wave action.

The subsurface rocks of the Riding Mountain-Lake Manitoba region are essentially the same age as those in the Assiniboine region to the south. From east to west there is: 1) Amaranth formations of dolomitic limestone, red shale and gypsum, 2) Swan River formation of sandstone, sand and shale, 3) the

Vermillion River to Ashville formations of dark grey calcareous shales, limestone and bentonite. The natural vegetation of the region is predominately wooded grassland with areas of broadleaf forest and mixed woods to the east. Dominant soils are Rendzina, degraded Rendzina and organic soils.

D-OCHRE RIVER-DUCK RIVER REGION

To the east, the Ochre River - Duck River region is bounded by a line extending north and south from the eastern tip of Dauphin Lake. Its western limit is the Manitoba-Saskatchewan border. The northern boundary is the northern boundary of the Duck Mountain Provincial Park. Its southern boundary is the northern limits of the Southwestern region. This area is also part of the Lake Winnipeg-Nelson River Basin. The main physiographic features of the Ochre River-Duck River region are, from east to west: the Interlake-Westlake Plain, the Duck Mountain and the Valley River Plain. The elevation of the region varies from 600 to 2727 feet at the top of Mt.Baldy in the Duck Mountains. In the Duck Mountains the area is rolling and hilly with surface deposits consisting of ground and moraine.

The subsurface geology depicts the northward extension of Jurassic or latter deposits with the western half of the region composed of the Riding Mountain formation of grey and grey-green shale and siliceous shale. Natural vegetation of the area consists almost entirely of mixed woods of broadleaf and coniferous species, chiefly spruce and aspen. There are also small patches of broadleaf forest. The dominant soils are grey wooded and grey-black soil.

E-SWAN RIVER DRAINAGE REGION

This region extends from the northern boundary of the Duck Mountain Provincial Park to the junction of the Saskatchewan River and Cedar Lake in the north. Its western limits are the Manitoba-Saskatchewan border and its easterly limits, Lake Winnipegosis. The Swan River Drainage region lies within the confines of the Lake Winnipeg-Nelson River Basin.

The Swan River Drainage region includes four physiographic sub-divisions: the Interlake-West Lake Plain, the northern slopes of the Duck Mountain, the Swan River Plain and the Porcupine Mountain. The Interlake-Westlake Plain and the Duck Mountain have already been discussed. The Swan River Plain has a flat to undulating relief. Surface deposits are composed of lacustrine clays, silts and sands and also recent alluvium. Dominant soils include grey-black and black with meadow associates. The Porcupine Mountain is similar in relief and surface deposits to the Duck Mountain. Dominant soils for this region are grey wooded and grey-black soils. The subsurface geology of the Swan River Drainage region consists of a small portion of the Vermillion River to Ashville Formations, the Swan River Formation and limestone and dolomite of Devonian and Silurian ages. The natural regional vegetation consists of Mixed Woods and northern coniferous forest of black and white spruce, balsam fir.

F-THE PAS-SASKATCHEWAN RIVER REGION

This small region surrounding the Town of The Pas, includes areas of the Pasquia and Saskatchewan Rivers which contain excavated archaeological sites. The approximate elevation of the region is 850 to 900 feet. The region is situated in the Saskatchewan delta with a flat to slightly undulating glacially scoured relief. Surface deposits consist of deltaic deposits of clay, silt and fine sand overlying glacial till. An arcuate end moraine, (The Pas Moraine) divides the delta into eastern and western sections. Silurian dolomite bedrock underlies the entire region. Natural vegetation cover includes extensive bog areas with conifer forests on the uplands. Main soil types are alluvial (regosol) and organic soils.

G-FLIN FLON REGION

The Flin Flon region is the territory surrounding the town of Flin Flon. The region is ice-scoured upland located within the Precambrian Drift Plain. Relief is rolling to hilly. Surface deposits consist of varying amounts and thicknesses of glacial drift with abundant rock outcrops. Bogs and lakes cover a high percentage of the surface.

The rocks of the region are predominately volcanic and undifferentiated basic intrusives. Andesite, basalt, derived schists and gneisses, diorite, gabbros and arkose are among the common rocks found. A small segment of the region consists of sedimentary rocks, greywacke, quartzite, arkose and conglomerate slate. Characterizing the natural vegetation is Northern coniferous forest with patches of mixed woods. Dominant soil types are, grey wooded, brown podzolic, podzol and organic soils.

H-SOUTH-WESTERN REGION

The South-Western Region is that corner of Manitoba bounded by the Saskatchewan and International boundaries to the west and south respectively. To the east is the Assiniboine Drainage Area, and to the north is the Duck River-Ochre River region.

The region is included within the Red-Assiniboine River Basin. It is composed of several physiographic divisions.

1) Minnedosa-Reston Till Plain, 2) Souris Plain, 3) Boissevain Till Plain, 4) Northern part of Turtle Mountain. The entire area is part of the Riding Mountain formation of grey and grey-green shale and siliceous shale.

The regional relief varies from flat to hilly depending upon what portion of it is being considered. Relief is greater in the Minnedosa and Turtle Mountain areas. Morainic and lacustrine deposits make up the predominant material of the region.

Natural vegetation is grassland, varying between tall grass prairie and sparsely wood grassland. Dominant soil types are shallow black, grey-wooded soils and regosols.

CHAPTER IV

RAW MATERIAL DISTRIBUTION BY REGIONS

This section will present the distributional data of raw materials by environmental region throughout the province. The temporal aspect is considered in two sections, Paleo-Indian and Post Paleo-Indian. This is necessitated because of the lack of any clear cut differentiation of the sites after the Paleo-Indian period.[1]

A - EASTERN REGION (Table 1:Figure 9.)

Within the Eastern region twelve sites have been selected to illustrate raw material frequency and distribution, (see Map). These sites located by the Lake Agassiz Survey, are generally along the major rivers, notably the Brokenhead River and tributary streams. This is because the survey followed the rivers. Bedrock of the eastern portion of the region is part of the Pre-Cambrian shield and therefore it might be expected that raw materials would be of a general igneous or plutonic origin. The bedrock of the western section is limestone of Ordovician age. Raw materials found at archaeological sites within the Eastern region reflect the subsurface geology to a great extent, as well

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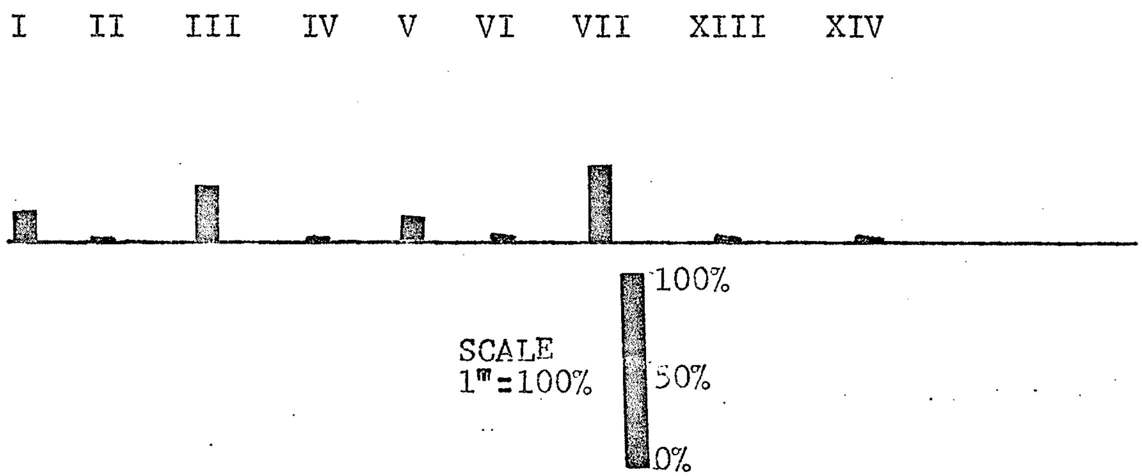
[1] See summary of Manitoba prehistory, page 65

as trade and or population movement from the west. The materials found include, basalt, Selkirk Chert, Swan River Chert, quartz, Knife River Flint and various silicified rocks in significant amounts. The location of the majority of the sites away from the sources may account for the variety of raw material types found there.

TABLE I
A- Eastern Region (n= 12)



(see key in Appendix, page 94)

Three material types that are most significant in the region are basalt, Swan River Chert and Selkirk Chert. Peoples using basalt probably travelled to the east for this and also for the fine grained Eastern Silicified materials. Swan River Chert, which is most concentrated in the Swan River Valley, also has a wide geographic distribution. Its presence may be accounted for by trade. Selkirk Chert is present in the Ordovician limestone bedrock on the bluffs of the Red River. The Larter site, situated on the western side of the bank of the river's second terrace yields Selkirk Chert almost exclusively. The presence of this material farther to the east may be explained by the gathering activities of its users and their personal migration.

Knife River Flint, an extremely popular material in the western part of the province, appears in only small amounts in the Eastern region. There are two significant observations which were made about Knife River Flint, First, it is rarely found as chipping detritus in sites of the Eastern region. Second, at some sites within the Eastern region, projectile points and scrapers are made exclusively of Knife River Flint. The first of these observations can be understood in part by analysing the second. Knife River Flint is a very fine grained, easily worked, high quality material, which may have been greatly prized. Its sources, be they in Manitoba or the Dakota s are quite far from the Eastern region. Possibly this material was so highly prized that its use was reserved for projectile points and other small items, and none but the smallest pieces were discarded. Although no points of Knife River Flint were found in the twelve sites used for the study, they have been found in other sites in the region, such as the Larter site (MacNeish 1958).

Archaeologically the Eastern region is quite rich. Encompassing time from McKean to the present, (and perhaps earlier than McKean), the region yields a wide variety of raw material types. There seems to have been a merging of peoples and /or traits from the West, with those of the East. Through time, Selkirk Chert, due to its local sources remained popular. Materials from the Shield also reflect continuous utilization. Western materials, Knife River Flint and Swan River Chert, probably were brought into the Eastern region at a later time than the McKean tradition but they persisted until historic times albeit in limited quantity. This persistence may be explained by a net-work of trade relationships. Raw materials from the west might have been transported from the plains regions, down tributary streams to the Assiniboine River. The confluence of the Assiniboine and Red River, might have served as a trade center in prehistoric times as it did in historic times. From here, exotic materials could be funneled into the east. The portion of the Eastern region near the Red River serves as a transition zone for raw materials. Here, there might have been exchanges of goods and materials with people to the west. Also the Red River serves as a source of Selkirk Chert which appears in limited quantities.

Future research in raw materials is needed in this region. Unpublished work and survey indicated a wealth of sites, and a variety of cultural materials in this region.

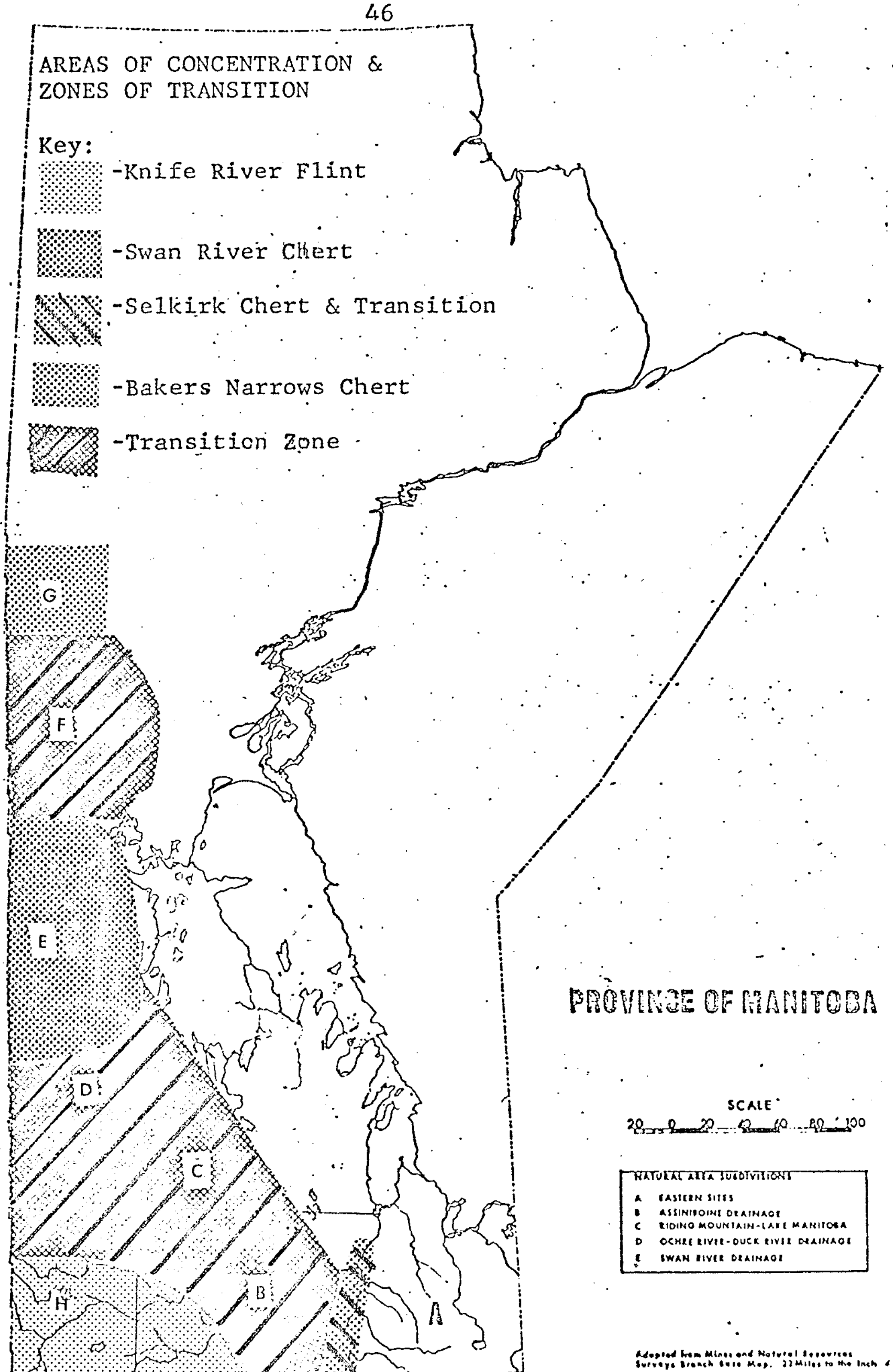


FIGURE 8. RAW MATERIAL DISTRIBUTION

Area of Concentration- 50% or more of one material
Zone of Traonsition - Several types of material, at least 20% each.

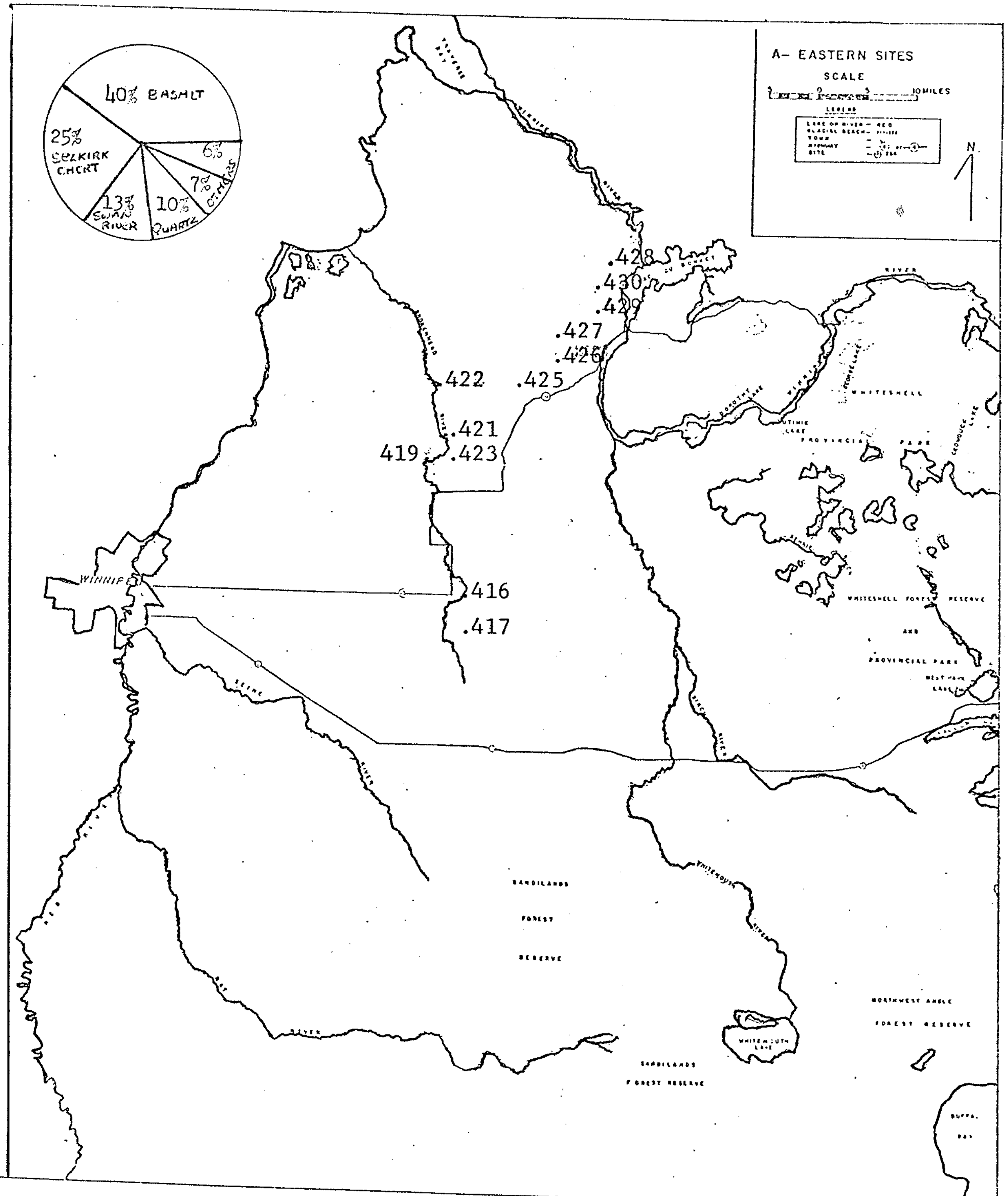


FIGURE 9. EASTERN REGION
(no's refer to L.A.S. sites)

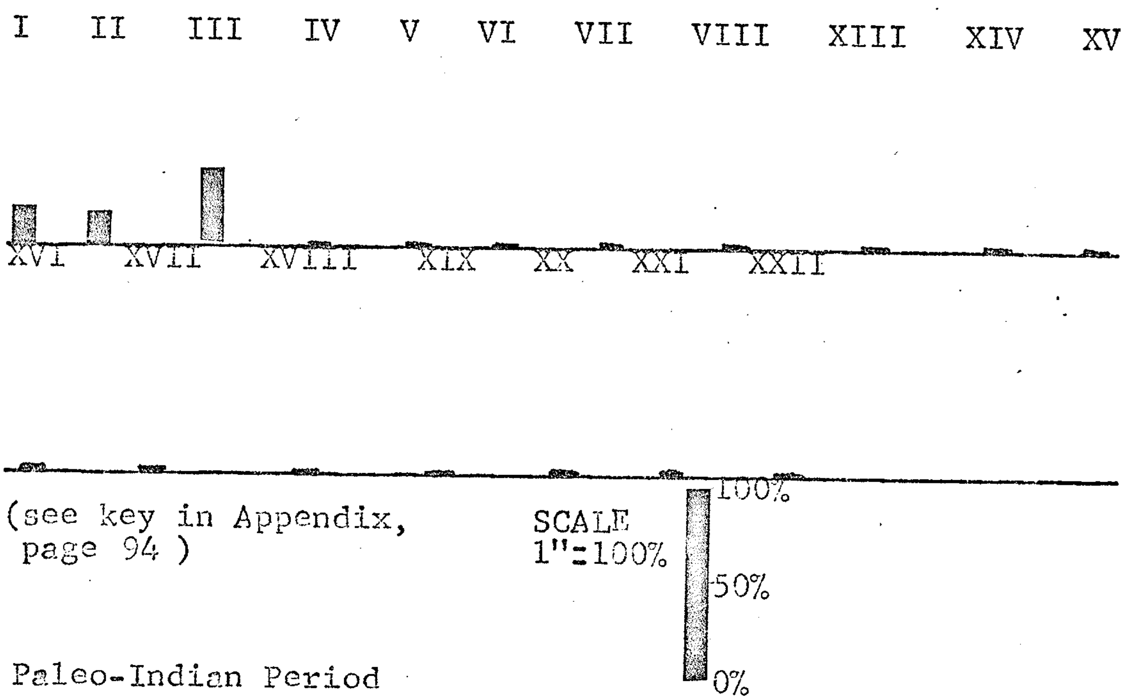
The possibility exists, that this region may represent a converging point for culture from the Great Lakes, the Plains and the South.

B - ASSINIBOINE DRAINAGE REGION (Table II: Figure 10)

This large area is poorly represented archaeologically. Much work has been done by Mr. Chris Vickers and Mr. Walter Hlady, but it is largely unreported and unpublished.

TABLE II

B- Assiniboine Drainage Region (n= 3)



(see key in Appendix, page 94)

Paleo-Indian Period

There are nine documented Paleo-Indian points from this region (Pettipas 1967: Steinbring, 1968). Knife River Flint was used in six of them, (62.5%), while Swan River Chert was used for the remaining three points.

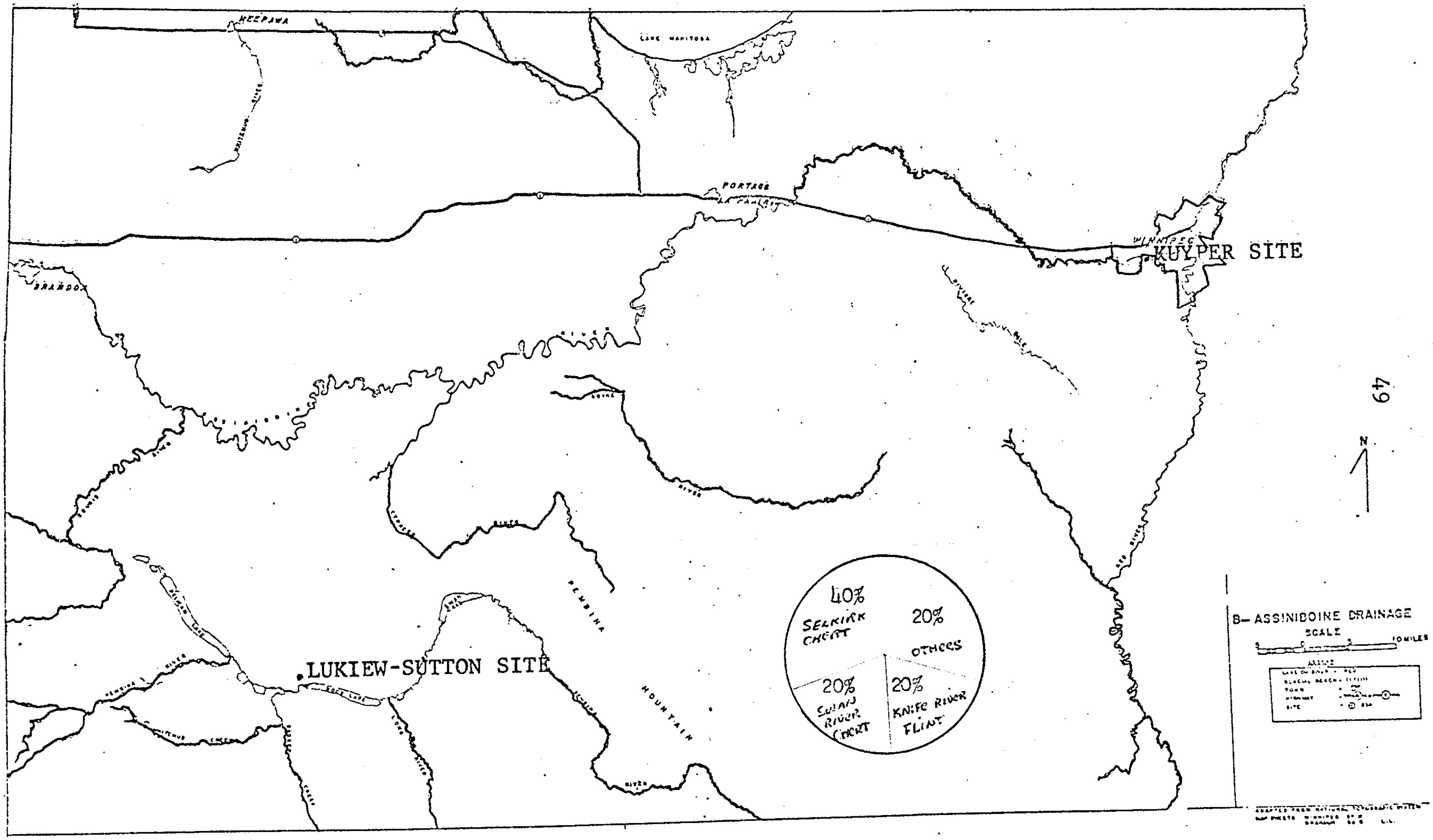


FIGURE 10. B- ASSINIBOINE DRAINAGE REGION

This region is within the area of concentration for Knife River Flint. (see Fig.8)

Post Paleo-Indian

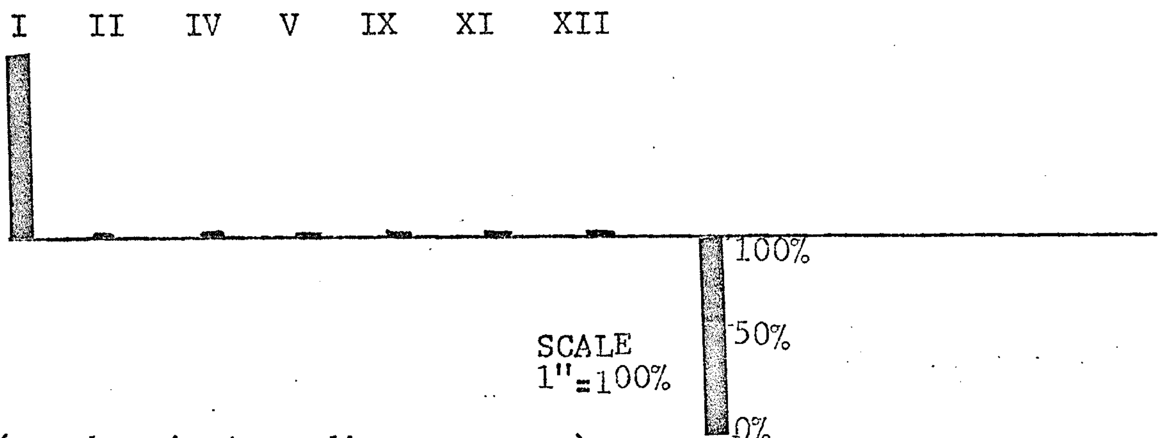
McKean Lanceolate was the first point style to appear after Paleo-Indian in this region. Hanna, Duncan, Oxbow, Besant, Plains and Prairie Side-Notched, are all represented. Vickers has suggested (personal communication) a well established mound complex, but to date there has been little systematic investigation. One site, the Richards Kill Site is a Besant phase site, (350 A.D.) near the town of Killarney (Hlady 1967). The vast majority of the ninety-four points and point fragments from the site were of Kinfe River Flint. This seems to support Syms hypothesis (Syms 1969) that Knife River Flint came into its own as a popular material during Besant and later times. The Kuyper site, near Headingly, was collected by the author and Gary Dickson during the summer of 1969. A surface site, it displays a wide range of material types, from the north, south and east. No cultural affiliation or sequence of habitations have yet been assigned to the site.

C- RIDING MOUNTAIN- LAKE MANITOBA
D- OCHRE RIVER-DUCK RIVER REGION (Table III: Figure 11)

These regions, considered together here due to the small size of C region, closely parallel the Swan River region (E), in raw material frequency. In terms of workshop debris, Swan River Chert comprises about 90% of the material. Knife River Flint, quartz, grey chert and others make up the remaining 10%. This region is probably the outer limits of Swan River Chert dominance.

TABLE III

C-D Riding Mountain-Lake Manitoba: Ochre River-Duck River Region (n= 17)



(see key in Appendix, page 94)

There are twenty-seven documented Paleo-Indian points from the Ochre River - Duck River region, (Pettipas, 1967). The frequency of material used in the manufacture of these points is approximately the same as the Swan River region. Swan River Chert was used in 70.3% of the Paleo-Indian points, Knife River Flint in 25.9% and a limestone chert in 3.8%.

Projectile point types from later periods consist of McKean lanceolate, Oxbow, Prairie side-notched and

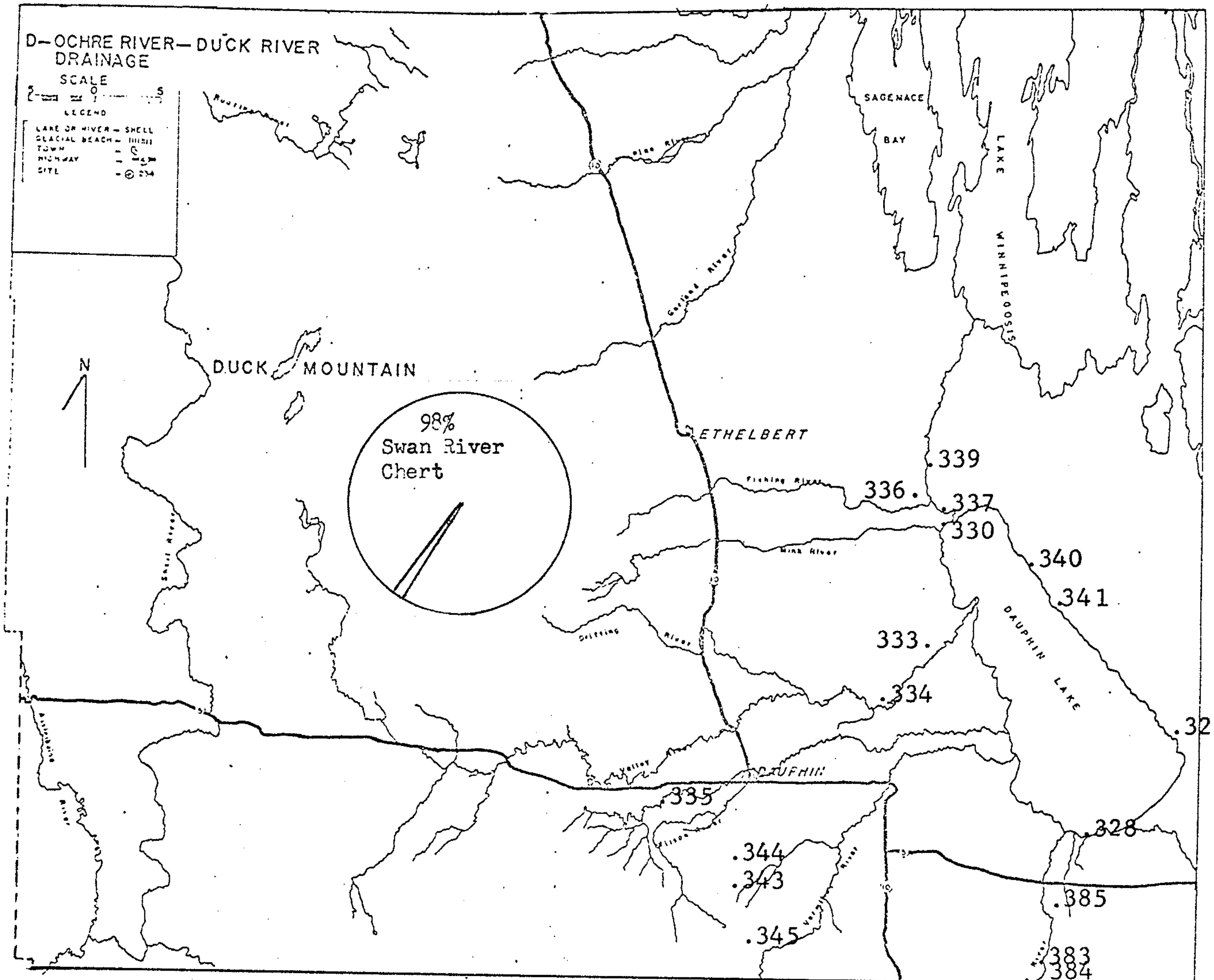


FIGURE 11. D- OCHRE RIVER-DUCK RIVER REGION
(no's refer to L.A.S. sites)

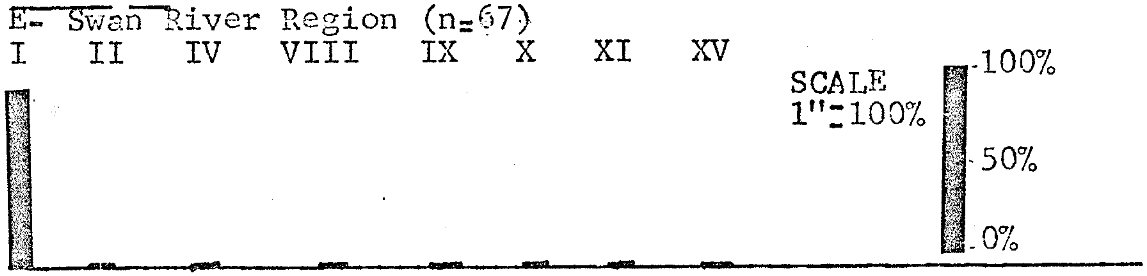
several unidentified fragments. Of the sample of thirty-five points, 85% are made from Swan River Chert, 9% from grey chert and 6% from Knife River Flint. All of these points are from the surface situations and cannot be tied to a time sequence with any great degree of certainty.

The use of Swan River Chert to such a great extent in this region probably reflects either a southward movement of people from the Swan River Valley or a gradual increase and spread of population from that area. Knife River Flint seems to decrease in usage during post Big Game Hunting times.

E - SWAN RIVER REGION (Table IV)

The Swan River region is archaeologically the richest area in Manitoba. Sites, mostly workshops, are densely distributed along rivers and streams. At most of the sites in the region there are great quantities of lithic debris, mostly Swan River Chert. The entire Swan River region was not checked for sites by the Lake Agassiz Survey, due to a lack of time and the inaccessability of most of the area. Within the areas covered, sites concentrate near rivers and near Swan Lake.

TABLE IV
E- Swan River Region (n=67)



(see key in Appendix, page 94)

The Swan River region has been regarded as an "area of concentration" because the dominant raw material type occurs in a percentage greater than 80%. In fact it is greater than 95%. Only small quantities of other material types occur at all in the Swan River region.

If we examine known projectile point types, we see that although Swan River Chert was the preferred material type, Knife River Flint was also used for points. Workshop debris rarely yields Knife River Flint.

The Big Game Hunting Tradition in the Swan River region is well represented by seventy-eight projectile points. These points were made of only three materials: Swan River Chert, Knife River Flint and Quartzite. Swan River Chert was used in 75.5% of the sample, Knife River Flint in 21.7% and the remaining 2.8% were made of Quartzite. This would seem to indicate that Knife River Flint was being brought into the Swan River region at an early date, probably from the south. After supplies of Knife River Flint were exhausted, local material was apparently substituted.

The McKean Complex in Manitoba is best represented in the Swan River Valley. Syms, (1969) has recently suggested that the Complex probably entered Manitoba from the west. This is supported by two lines of evidence. First, McKean shows its greatest density in the west.

McKean components are found along the Saskatchewan River in Saskatchewan, but are rare in the eastern and south-eastern parts of the province. McKean components are also rare in north-eastern Montana, South Dakota and North Dakota. Raw material distribution for McKean projectile points also supports the hypothesis of western migration. Syms, (1969), points out that most McKean points are made from Swan River Chert or Selkirk Chert. Knife River Flint is rarely used, even though it is a superior flaking material. If migration had taken place through the Dakota's and eastern Montana, the use of Knife River Flint would likely become common and continued for occupation in Manitoba, but this is not the case. Syms' hypothesises that the McKean Complex entered Manitoba from the west, possibly through the Saskatchewan River and rivers in the general area.

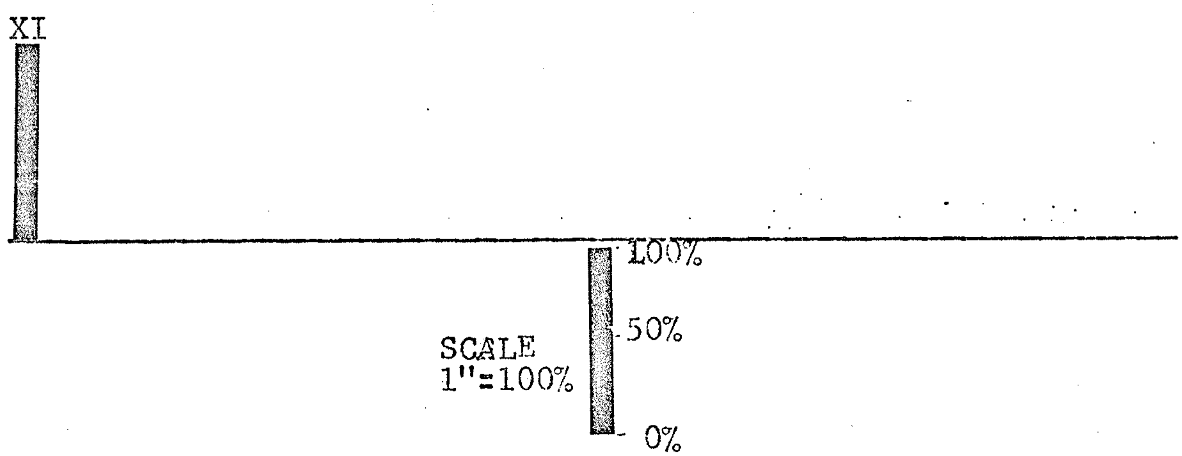
The archaeological sequence of the Swan River region after McKean times has not been systematically investigated. In general terms most of the same projectile point types are found there as in areas to the south. Of the thirty-one points turned up by the Agassiz Survey, raw material type frequencies correspond very closely to those of Paleo-Indian times. Swan River Chert is used in 77.4% of the points, Knife River Flint in 12.8% and the remaining 9.6% is represented by Grey Chert.

G - FLIN FLON REGION (Table V)

The Flin Flon region, archaeologically is one of the least explored areas in the province's western portion. I had the privilege of being on a research team which surveyed and excavated in the area in 1967. In addition I spent a week in the region, conducting survey and test excavations in the summer of 1969.

TABLE V

G- Flin Flon Region (n= 4)



(see key in Appendix, page 94)

The Flin Flon region is considered as an "area of concentration" by virtue of the fact that about 99% of the material found there is "Bakers Narrows Chert" a name derived from the Bakers Narrows Picnic Site where the material was first encountered. There are three materials in this category. The most prolific (95%) is a black banded material of probable volcanic origin. A coarse grained, greenish stone is also found in the region in small amounts. Lastly, there is a grey-white chert which is used more frequently in later times.

The raw material which has been noted from the Flin Flon region was found in a site whose lowest levels are probably attributable to the "Shield Archaic" complex, (Tamplin, personal communication). Clearwater Lake Punctate pottery is found in the upper levels along with side-notched points of undetermined type, but of comparatively recent age.

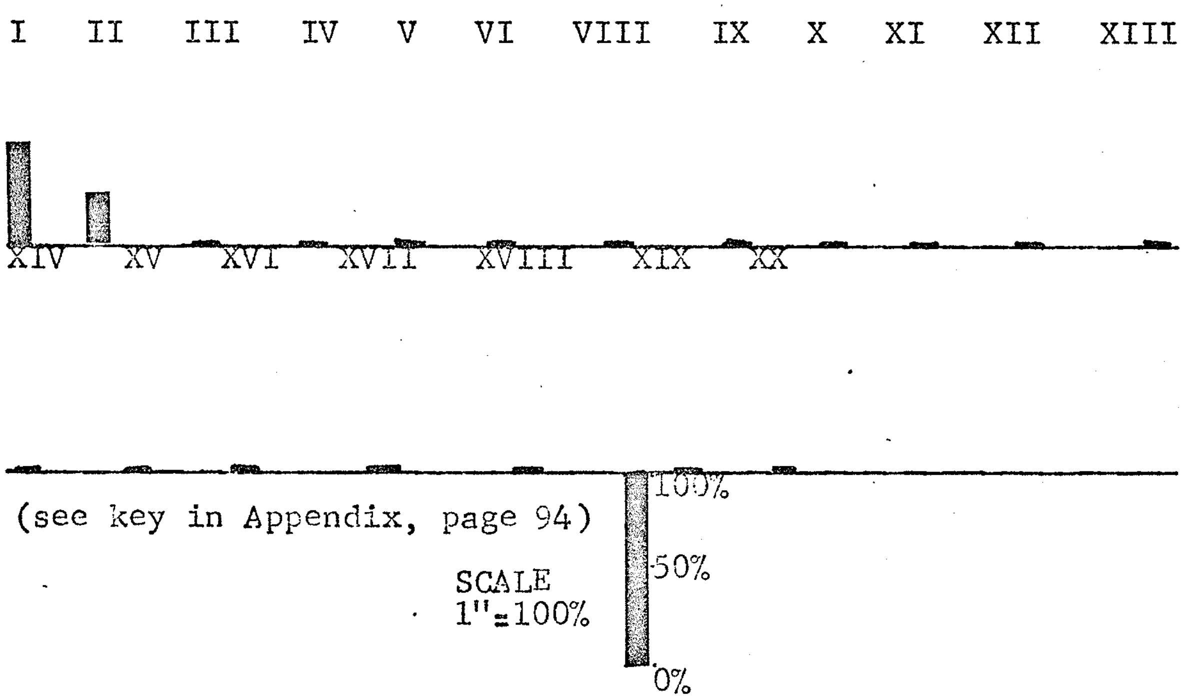
An attempt was made to locate the source of this black banded material, in the summer of 1969. A reported quarry source was checked by boat but was not located. A boat survey of the western reaches of Lake Athapapuskow was carried out, and several sites were located but no quarry source for the material. This black banded material has also turned up to the south in the Pas-Saskatchewan River Region, (F) in The Pas Site, (LAS,407). Little more can be said regarding the distribution of the black banded material. Because of the rugged nature of the landscape, in the Flin Flon Region, its numerous lakes and dense and rocky land surface, population movement was probably restricted to rivers and lakes. The black banded material probably represents a local material which was not widely distributed. The same may be said for the other types of Bakers Narrows Chert.

H - SOUTH-WEST REGION (Table VI)

The South-west region is archaeologically one of the lesser known regions in the province. This is unfortunate because the South-western region may well hold the key to "early man" and later prehistory in Manitoba. Because of the lack of material from the South-west in the Laboratory of Anthropology collections, only a few materials were examined. The Lake Agassiz Survey did not provide material for the South-western region, instead the author had to rely upon the Avery Site material, (Joyes, 1969).

TABLE VI

H- Southwest Region (n=6)



(see key in Appendix, page 94)

Paleo-Indian

It is difficult to make any general statements regarding Paleo-Indian in the South-western region for two reasons. First, there are few described occurrences of Paleo-Indian points known to the author. Second, the area is archaeologically little explored. The earliest remains in the region are two Folsom points from the Moncur site near Boissevain. Plano forms have been found in the region, most notably Alberta, Plainview and Midland. Scottsbluff and Eden styles have been reported near Carberry, the eastern border of the region, (Steinbring, 1967). Raw materials used in the manufacture of these points seems to be predominately Knife River Flint. All of the points are made of Knife River Flint, with the exception of one. This Plainview point is made of Swan River Chert.

Post Paleo-Indian

The Post Paleo-Indian period in the South-west includes McKean complex points, Pelican Lake, Besant, Avonlea and several varieties of Plains Triangular and late side-notched points. In Syms, (1969), sample of McKean points from the region, the raw material was predominately Swan River Chert. Based on this observation together with others, Syms' hypothesises that McKean peoples moved into this region from the north.

The Avery Site near Rock Lake is a multi-component site having materials ranging from Duncan and Hanna points to late side-notched styles, (Joyes, 1969). The predominant material used is Knife River Flint comprising about 65% of all points. The second most popular material is Swan River Chert at 25%. Also present at the Avery Site are white chalcedony, (probably a white petrified wood), silicious siltstone and rhyolite. Joyes, (1969), points out that the variety of lithic raw material increases in later phases.

Duncan and Hanna points at the Avery Sites are few in number, but are made of 66.5% Knife River Flint and 33% of Swan River Chert. All later points follow this percentage breakdown fairly closely. Knife River Flint is used in 67.2% of all points, Swan River Chert in 21.2% and Silicious Silstone in 5.5% with the remaining 6.1% being of other materials. A look at other tool types reveals similar percentages for these materials. These percentages point to the idea that after McKean times, Knife River Flint began to be used in greater frequency for both projectile points and other stone tools. More information in tabular form on raw material distribution may be seen in the appendix.

CHAPTER V

RAW MATERIAL AND MANITOBA ARCHAEOLOGY

This brief discussion of cultural traditions in Manitoba serves as a background to a discussion of raw material frequency within a regional chronological framework. The cultural traditions used in this discussion are those of Willey, (1966). For a recent summary of Manitoba prehistory, see Mayer-Oakes, (1967). (See Table 7 p.65)

Big Game Hunting

There is substantial evidence for the presence of peoples of the Big Game Hunting Tradition in Manitoba, perhaps as early as 10,000 B.C. An excellent review of Paleo-Indian in Manitoba appears in a work by Pettipas, (1967). This date of 10,000 B.C. is an estimate based on the presence of point styles of known date from elsewhere. One Clovis point has turned up in the western part of the province, (Steinbring, personal communication). In southwestern Manitoba, several Folsom points, (Pettipas, 1967) have turned up. Agate Basin, Midland, Scottsbluff and other Plano-styles are quite common in some areas, notably in the Southwest and Swan River regions. Plano cultures of the Big Game Hunting Tradition were effective in Manitoba at least until 3000B.C

Archaic: 3000 B.C. to 500 B.C.

The Archaic tradition is not well known in Manitoba due primarily to a lack of concentrated research. Manitoba seems to lie in a path of convergence of several Archaic complexes. The McKean Complex is characterized by McKean point styles dating from 2500-3000 B.C. in Wyoming. Also, there are several examples of a style known as Pryor which may well antedate McKean, (Syms,1969). Within Manitoba there are also Boreal Archaic influences from the east and Great Lakes. J.H.Steinbring has been carrying out extensive investigations into Old Copper material in Manitoba. Old Copper is found near McCreary, in the Whiteshell along the Winnipeg River and in central and southern Manitoba.

Woodland 500 B.C. to 1700 A.D.

The Woodland tradition can be recognized in Manitoba, in the form of ceramics and mounds. The earliest ceramics, Laurel ware, can be tentatively dated at 500 B.C. in Manitoba, (MacNeish,1958). Its origins could come from Minnesota or the Great Lakes area, or as Wright, (1967) suggests from Asia. Laurel is followed by Black Duck and Selkirk wares respectively. Other types and variations on the themes of Black Duck and Selkirk occur.

Manitoba has a small number of mounds in the southern half of Manitoba, both burial and monumental. Adequate study of these mounds has not been made to determine temporal position or cultural affiliation.

The prehistoric occupation of man was not total during the past 12,000 years. During Big Game Hunting times, 3,000 to 10,000 B.C. Manitoba was sparsely occupied. Until about 7,000 B.C. when Glacial Lake Agassiz began to drain, the central portion of the province was unoccupied. There is reason to believe that these early hunters lived on or near the active beaches of Lake Agassiz. Plano style points have been found near the Campbell beaches, but none of these points are in direct association with the Campbell beach, (Pettipas,1967).

During Big Game Hunting times, the Southwestern region of Manitoba seems to have been sparsely inhabitated. This region was available for habitation during all phases of Lake Agassiz. The apparent rarity of Early Man evidence may reflect the state of archaeological research in that region.

By 6,000 B.P. the eastern corner of the province was free of water. However, occupation of this area during these times and later to 3,000 B.C. was not likely except along the river system. The reason for this was the wet, swampy nature of this region.

In Post Big Game Hunting times, the dispersion of people throughout the province seems to have uniformity with the exception of the Interlake area, which is sparsely populated. Projectile point styles have uniform distribution throughout the eight regions dealt with in this thesis.

The southern portion of the province displays the widest variety of cultural traditions of any part of the province. There is a continuum from Big Game Hunting to historic times. Archaic cultures such as Old Copper are manifest along with a Woodland mound complex. There is some evidence of Hoewellian and Mississippian contact. In the Southwest Mandan pottery has been found (Vickers, personal communication). The northern portion, although less varied still contains many rich sites. One of the largest sites in Manitoba, The Pas Reserve site is a stratified site containing Archaic point styles, Laurel ceramics and later Black Duck and historic materials. With this brief discussion of Manitoba archaeology, we can now proceed to a consideration of raw material distribution and frequency within the framework of Manitoba archaeology and environmental regions.

MANITOBA CULTURAL UNITS

EASTERN AREA	ASSINIBOINE DRAINAGE	OCHRE RIVER DUCK RIVER	SWAN RIVER	THE PAS SASK. RIVER	FLIN FLON	SOUTH WEST	DATES
Historic	Historic	Historic	Historic	Historic	Historic	Historic	A.D. 1800
			Selkirk(?)		Selkirk		
	Selkirk					Selkirk	A.D. 1500
Selkirk							A.D. 1300
Manitoba	Manitoba	Manitoba	Manitoba				A.D. 1100
						Manitoba	
				Clear Water Lake	Clear Water Lake		A.D. 900
	WOODLAND						
							A.D. 700
						Avonlea	
							A.D. 500
	Besant	Besant	Besant	Besant			
					?	Besant	A.D. 300
							0
				Laurel		Pelican Lake	
Anderson Larter					Shield Archaic		500 B.C.
		ARCHAIC					
Whiteshell ?	Hanna Duncan McKean	McKean Oxbow	McKean			Hanna Duncan McKean Pryor	1000 B.C. 2000 B.C.
					?		
Old Copper Boreal Archaic							3000 B.C.
						Late Paleo Indian	4000 B.C.
Paleo-Indian	Paleo-Indian	Paleo-Indian	Paleo-Indian				6000 B.C.
							7000 B.C.
		PALEO INDIAN				Folsom	8000 B.C. 10,000 B.C.

Adapted from: Joyes 1969
MacNeish 1958
Mayer-Oakes 1967
Steinbring 1966

TABLE 7 MANITOBA CULTURAL UNITS

CULTURAL IMPLICATIONS

I have already examined the characteristics and sources of the common raw materials and made some general interpretations. The environmental regions have been described and their archaeology reviewed. The next step would seem to be the integration of data with certain hypotheses in order to interpret raw material distribution within the regions in terms of prehistoric trade and population movements.

The presence of a lithic raw material in a region may be accounted for in a number of different ways. These explanations can be divided into two categories, natural agency and human agency.

1) Natural Agency

A raw material may occur in a region because it forms part of a rock outcrop, part of the river gravels or part of the glacial drift. A prehistoric group merely makes use of this material as it finds it.

2) Human Agency

There are at least four ways in which human agency can explain the distribution of a raw material. These are migration, trade, gathering and shifting residence patterns.

Migration is a population movement from one area to another. When people migrate, they bring a certain material part of their former habitat with them. In this way stone materials may be transported and distributed far from their source through migration.

Trade in the sense referred to here may be defined as "reciprocal traffic, exchange or movement of materials or goods through peaceful human agency." (Renfrew 1969:152). Renfrew divides trade into two types. The first involves material commodities whose natural distribution is limited. The second type involves the distribution of products, which through technical superiority are more efficiently produced in a limited area. The most common type of trade during prehistoric time and which this thesis seeks to examine is the former type. Renfrew (1969), claims that trade must be proven quantitatively; it cannot be assumed. Here he means that material must occur in quantity in order to demonstrate trade. In my view trade cannot be conclusively proven, although strong circumstantial arguments can be presented to support the hypothesis of trade. The one criticism of the argument can only be the lack of clear-cut artifactual evidence. The presence of marine shells in Archaic Glacial Kame sites in the Upper Great Lakes has always been attributed to trade with a coastal people. However, Glacial Kame people could have travelled in expeditions to the sea coasts to gather their precious shells. The same arguments may be used for trade in raw materials in Manitoba. The fact that a material is present in quantity is not conclusive proof of trade as Renfrew seems to suggest.

Gathering is the third possible way of distributing materials through human agency. There are at least two types of gathering: expeditional and yearly-round gathering. Expeditional Gathering refers to the practice of sending an organized expedition to a distant source for the expressed purpose of gathering a desired material. This explanation could account for the presence of a particular raw material far from its source. Yearly-Round Gathering occurs when a group can travel to a source of raw material at least once in its normal yearly travels. The gathering of the material is then an integral part of the group's subsistence activities.

Finally, a fourth mechanism which may be used to account for raw material distribution, is the concept of shifting residence patterns. The raw material user may be required to seek a spouse in a hunting band other than his own. An example of this type of behavior has been noted by Dunning, (1959:65 ff), among the Northern Ojibwa. Usually an unmarried male came into the band, married, lived uxorilocally for a year or longer and then returned to their original bands. This practice of shifting residence patterns may serve as a mechanism for raw material distribution. Males from one band may move great distances to another band in search for a wife. They may bring with them raw material particular to their region alone. Thus a new raw material would appear in another region.

These four mechanisms together should account for the presence of a material in a given region. It should be pointed out that in fact, more than one explanation could be used with regard to a raw material. In other words, a group of people could be using a material which occurs locally in limited amounts and also be trading for the same material. As to which of the various alternatives: gathering, trade or migrations were responsible for a raw materials distribution is dependent upon a number of factors. These may include value of raw material to the user, population density within the distribution area, distance to the source, area of a group's hunting territory and the availability of adequate substitute materials. No doubt there are others, but these factors seem to be paramount. A particular combination of factors at a given time will result in one combination of alternatives being chosen.

A particular raw material may be held in high regard by a group of people for several reasons. This desireability or value will mean that there will be a concerted effort to obtain that material regardless of the distance or difficulties involved.

Availability of an adequate substitute material will also determine whether or not it would be necessary for a group to go to the trouble of obtaining a raw material. If a substitute material can be found locally, then there would be no need to obtain the original material.

The means that a group uses to obtain a material will be dependent in part on their distance from the source of that material. The farther a group is from the source of a desired item, the greater the likelihood that trade is the means of obtaining the item. In other words, if an item is found naturally at great distances from its potential market, trade will more likely be the means of obtaining the item, than if it occurred close by its market.

In the case of marine shells in Glacial Kame sites, the distance between the sources of the shells and the sites is at least fifteen hundred miles. In view of this great distance, trade is the easiest way to account for the occurrence of the shells. On the other hand, in the case of the Old Copper Culture, most raw material was obtained from Isle Royale, a few hundred miles at the most, from the greatest concentrations of

Old Copper sites. It is possible that for people living within fifty to one hundred miles or so from the raw material source, copper was obtained by gathering during the yearly round and that trade was unimportant. The relationship between distance from the source and methods used to obtain a material may be seen in Table 8.

Finally the density of the population within the distribution area will affect the alternatives used to secure raw matrial. If an area is densely populated, then expeditions to the raw material sources will be less likely than if it is lightly populated. In areas of dense population a gathering expedition might encounter hostile groups which bar the way to the raw material source. Expeditions might be viewed as trespassing and might lead to hostilities by the other group. Trade relations would most likely be established with neighbors close to raw material sources as a peaceful alternative.

The degree to which any group at a given time period gathered exotic raw material is contingent upon population density. Generally speaking, in Beardsley's terms, (Beardsley et al 1956), the change from restricted wandering to semsedentary wandering is partly influenced by increasing population density. Although increased population means more efficient use of resources, it is probably also reflective of smaller territories. This increasing sedentariness and smaller hunting territories in turn mean greater distance to material sources. This factor along with the chances of inter-group hostilities increase the likelihood of trade relationships developing.

The area of a group's hunting territory also influences the method used to obtain raw materials. If a source of raw materials is within a group's yearly hunting territory, then the material would most likely be gathered by the group itself and distributed by them. If the source is outside the hunting territory, then two alternatives are open: expeditions and trade.

The average size of the hunting territory of a band of fifty people varies between one hundred and five hundred square miles, (Stewart 1955:149). The specific size would depend upon type of terrain, game supply, population density and many other factors. It is safe to assume that average foraging area was probably about five hundred square miles, during late Archaic times.

The next section will consist of an examination of lithic raw material distribution in light of the ideas about trade, migration and gathering presented above.

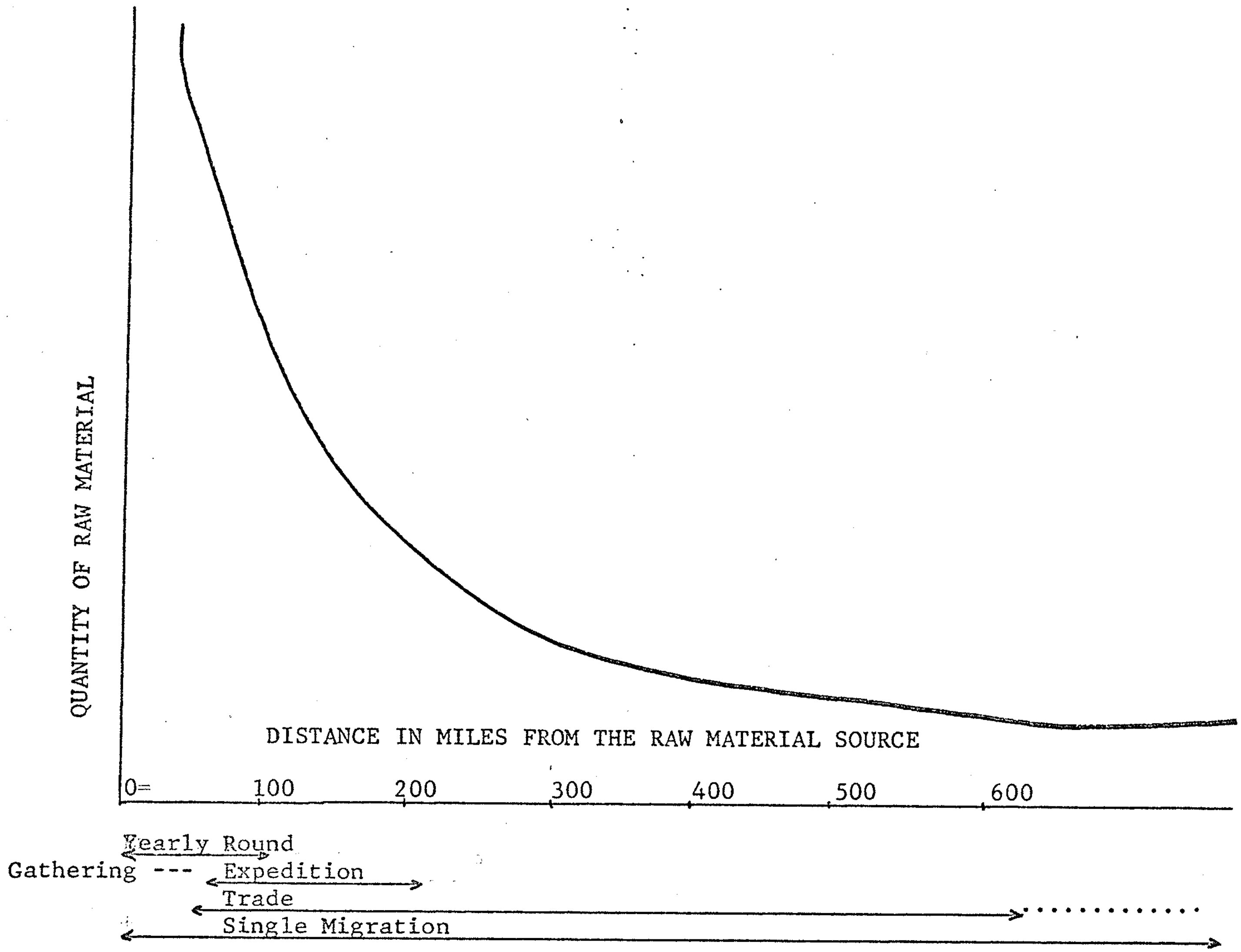


TABLE 8. GRAPH OF VARIABILITY OF DISTANCE TO QUANTITY OF MATERIAL AND METHODOF RAW MATERIAL DISTRIBUTION

RAW MATERIALS IN MANITOBA PREHISTORY

Knife River Flint

Earlier in this thesis, I discussed the two potential sources of Knife River Flint for Manitoba, the Souris gravels and the North Dakota quarries. I also mentioned reasons for believing that the majority of Knife River Flint in Manitoba came from the North Dakota quarries. There is no need to review that argument here.

Knife River Flint is present in significant quantities in the southern part of Manitoba, in the South-western region, Assiniboine Drainage and Eastern regions. The part of this material which originated in North Dakota was more than likely introduced into Manitoba by trade. Pieces collected from the quarries at Dunn and Mercer Counties, North Dakota, are of fairly uniform size and bear evidence of workmanship. Similar pieces have been found in a "cache" near Treherne, Manitoba.

The Dunn and Mercer county quarries are approximately one hundred miles from the International boundary and three hundred to four hundred miles from the northern limits of Knife River Flint in Manitoba. This great distance would in Post Paleo-Indian times, pose a barrier to widespread population movement by hunting and gathering bands. If we assume that the average hunting territory was five hundred square miles, then the North Dakota quarries were outside of the range of yearly wandering of peoples in most of Manitoba. Groups of people desiring Knife River Flint probably participated in regular trading relationships with suppliers of that material to the south. Calculated group movements were necessary to meet the supplier at a given location or series of locations in order to make the exchanges. These locations may have been at specified spots along rivers, or near the confluence of major streams. Streams or rivers seem the most likely because they are often used as travel routes when travelling in unfamiliar territories.

Another reason which seems to favor trade is the overall distribution of Knife River Flint. Although not sufficiently documented overall, Knife River Flint is found within a five hundred to seven hundred mile radius of central North Dakota. If the North Dakota quarries were a major source of the material within this large area, then one must assume a large scale effort in quarrying and shaping of blanks and for cores for distribution. Also, it seems most likely that a single group had a control over the source area. Trade relationships based on the desire for a material controlled by one group may be seen in the ethnographic record, among the Pygmies of Ituri forest (Putnam, 1948).

The nature of the quarries and their number within a limited area reflects the large scale quarrying operation which must have been carried out to fill the demand for this popular material over such a wide area. The quarry pits have much detritus scattered around them. Large chunks of the matrix were removed and the material was prepared for distribution either in the form of blanks, pre-forms or as cores.

It is impossible to know the exact nature of the trading relationships. However, it may be imagined that the trading relationship was organized as follows: the group who quarried the material might in the extent of their travels, distribute a quantity of that material to one or more groups living to the north. Each recipient of Knife River Flint would in the course of their travels, deposit chipping detritus and artifacts throughout their territory. During Paleo-Indian times the initial presence of Knife River Flint in Manitoba may be explained by population movement northward. Paleo-Indians probably carried this material with them as they entered the most northern limits of its distribution, the Swan River region. If demand for the material persisted, trading relationships were established with groups to the south. However, in the majority of cases, Paleo-Indian hunters switched to a local material at the exhaustion of Knife River Flint.

From the end of the McKean tradition up to white contact, Knife River Flint continued to be traded into and distributed throughout southern Manitoba. When the traded supply occasionally ran out, secondary sources of Knife River Flint such as the Souris gravels may also have been exploited. One observation here, is that as the farther east or north from the source, the less often Knife River Flint is found as chipping detritus, (Vickers, personal communication). This is because this highly prized material was not often wasted. The northern and eastern limits of the significant appearance of Knife River Flint also marks the raw material "zones of transition." In these zones, there is an intermingling with other raw material types for different source areas, in particular, region B and C.

Swan River Chert

The range of materials known as Swan River Chert is one of the most widely distributed materials in Manitoba. In the section dealing with sources, it was pointed out that Swan River Chert was probably gathered from the Red Deer and other nearby river beds in Saskatchewan. It was used to a great extent in the Swan River Valley and was moved south throughout the rest of the province.

It is felt that Swan River Chert was distributed throughout the Swan River (E), and Ochre River-Duck River (D) regions, by the most direct means, gathering. Bands of hunters personally obtained the material and used it. They may have exchanged it for other raw materials or goods with people to the south, thus accounting for its wide distribution. The material made a significant appearance south of its heartland during McKean times and later. Another explanation for the spread of Swan River Chert is its presence in the glacial drift and beach and morainic deposits to the south.

There is no evidence of Swan River Chert being traded or moving in some other way south of the International Boundary. Joyes, (personal communication), reports material similar to Swan River Chert turning up in Wyoming. This may represent a direct movement from the Swan River - Red Deer River sources or a movement east from the Rockies as is suspected for Swan River Chert.

Eastern Silicified Materials

This raw material category is distributed throughout the Eastern Region, as far west as the Red River. Its exact sources are unknown, except that it is found in the Shield rocks of the region. The material might have been distributed by groups during their yearly round. The western limits of the Eastern region are only sixty to eighty miles from the Shield lands. Within the course of a year's hunting activity, a group might pass into the Shield region and obtain this raw material. Its greatest frequency is close to the Shield, while it occurs in small quantities near the Red River.

Bakers Narrows Chert

These three materials have a restricted distribution due to the severity of the region, which limits extensive travel. The most probable explanation for its distribution is also gathering, either during the yearly round or by expedition. The sources, although unknown, are probably outcrops on the lake system of the region. Thus, the groups would not be too far from a source at any time and could secure the material as needed.

Other Materials

There are other materials such as quartz and quartzite which are found in Manitoba sites in small quantities. These have been discussed elsewhere in this thesis. No sources of these materials have been found. Without this knowledge, it is difficult to say anything concerning the method of distribution of these materials. Future research as to source locations will yield more information about these questions.

CHAPTER VI

SUGGESTIONS FOR FUTURE RESEARCH AND CONCLUSIONS

It is obvious that work on lithic raw materials is far from complete. To my knowledge, this thesis has been a first attempt to deal with the problem in central Canadian archaeology. As such, research in this topic suffers from many inadequacies. These are, a lack of supporting material, the absence of adequate description of material sources in the literature, and the inconsistent application of terminology to raw materials. Hopefully out of this work will emerge several lines of investigation and practices for future field workers. Some of the possibilities for future research are as follows.

The consistent use of terms applied to raw material identification is the first necessary step. It is meaningless to the researcher, when reading archaeological reports to see a variety of terms applied to the same material or vice-versa. The consistent use of terms has ramifications for other areas of research.

The search for local raw material sources should always be made. When a field party is working in an area, excavating or conducting a survey, part of the time should be spent looking for possible raw material sources. This could be done with the aid of geological maps and descriptions of the area. If such a potential source is found, it sould be photographed, described and samples taken.

A section devoted to raw material frequency and distribution should be included in all site and survey reports. This approach used in conjunction with consistent terminology should become standard practice in the writing of reports. The frequency and distribution of certain raw materials within a site or a region may reveal certain significant facts about the region's culture and history.

Future research could be directed toward the examination of existing collections, such as those of Vickers and Hlady. The past work of these two men has been tremendous and if a concerted effort could be made to examine these collections, many useful inferences could be made.

Specific research projects could be carried out. A field survey of the Red Deer River and related areas in Saskatchewan should be carried out. Its purpose would be to examine the sources of Swan River Chert and take samples. An examination of the Souris River sources of Knife River Flint would prove valuable. Samples of the Souris Gravels could be examined for amounts of Knife River Flint present, the sizes of the material and frequency. Also the immediate area could be checked for workshops. The West Hawk and Falcon Lake should be checked for quarry sources. Bands and outcrops of a black cherty silicified material have been reported in these areas, (Springer,1952: Davies, 1954) and should be investigated. More microscopic examinations should be made of lithic materials. This will result in the positive identification of more material types and will further encourage uniform and consistent terminology. More advanced statistical analysis could be applied to data concerning raw material distribution and frequencies. It is possible that further interesting relationships may be discovered between various rock types and regional archaeology, relationships concerning population movement and trade. Lastly, a valuable addition to our knowledge of potential raw materials for the prehistoric Indian could be made in the form of lithological analysis of various deposits. For example, the gravels of the Souris and Assiniboine rivers could be analysed, as could the gravels of beach ridges and deposits of glacial till and outwash. These deposits were perhaps explooted prehistorically although little data exists regarding their composition. This data should be provided.

Conclusions.

This thesis has done several things. Perhaps its single most significant contribution to Manitoba prehistory has been in the nature of an initial attempt to treat lithic raw materials in a meaningful fashion. This serves to point out the value of raw material studies to the archaeologist. A second general contribution has been the establishment of what I hope will become uniform designations for raw materials. Lastly, a significant contribution was the development of a theoretical framework with which to examine trade in any area.

This study also had several major findings. First, each type of raw material considered was found to have an area of concentration and a wide distribution. Knife River Flint is most frequently found in the South-western region and diminishes in quantity to the east and north. Swan River Chert has its highest frequency in the Swan River region, and diminishes away from this center. Selkirk Chert has a limited distribution near the Red River, but is found there in great quantities. Each of these areas of concentration are connected by a transition zone which contains intermingling of many types of raw materials.

Source areas were also examined. It was concluded that Swan River Chert most probably derived from the Red

Deer River- Swan River area. Knife River Flint was pinpointed to large scale quarries in North Dakota and possibly also occurs in the Souris gravels of Manitoba. Selkirk Chert is found to outcrop on the banks of the Red River. Sources for other materials common in Manitoba archaeological sites were not located.

This study has shown that a consideration of the frequency, distribution and sources of lithic raw materials has a place in the archaeology of any region. I feel that the systematic study of raw materials, can lead to many valuable inferences of interest to the prehistorian. Refinement in research techniques and the introduction of new hypotheses will no doubt increase the efficiency of such studies. I hope that this thesis will serve as a starting point for research along the lines outlines here and that such research will enrich the picture of Manitoba prehistory.

APPENDIX

LITHIC RAW MATERIAL TABULATIONS, BY PERCENTAGE AND WEIGHT
SURFACE COLLECTIONS ONLY
AREA: EASTERN SITES "A"

SITE DESIGNATION	SELKIRK CHERT %	SELKIRK CHERT WT.	SWAN RIVER CHERT %	SWAN RIVER CHERT WT.	GREY CHERT %	GREY CHERT WT.	EASTERN SILICIFIEDS %	EASTERN SILICIFIEDS WT.	QUARTZ %	QUARTZ WT.	KNIFE RIVER FLINT %	KNIFE RIVER FLINT WT.	BASALT %	BASALT WT.	GREY-GREEN SILICIFIED %	GREY-GREEN SILICIFIED WT.	ARGILLITE %	ARGILLITE WT.	TOTAL %	TOTAL WT.
LAS. 416	21.0	81.5	63.9	247.0					10.0	41.0							5.0	17.0		386.5
LAS. 417	59.3	67.4					7.0	6.8			1.2	1.8			32.7	37.0				113.0
LAS. 419	.9	1.0	4.8	4.3	.9	1.0	25.0	24.0	28.1	27.0	9.2	8.5			31.2	30.1				95.9
LAS. 421	1.0	4.0							4.0	20.0			84.3	416.0			10.7	53.0		493.0
LAS. 422									70.8	68.0			29.2	28.0						96.0
LAS. 423							24.0	15.0	76.0	50.0										65.0
LAS. 425											100.0	7.5								7.5
LAS. 426					100.0	20.5														20.5
LAS. 427	100.0	89.0																		89.0
LAS. 428	100.0	18.0																		18.0
LAS. 429	100.0	151.2																		151.2
LAS. 430													100.0	69.0						69.0

LITHIC REMAINS AT THE EASTERN AREA SITES

LITHIC RAW MATERIAL TABULATIONS, BY PERCENTAGE AND WEIGHT
SURFACE COLLECTIONS ONLY
AREA: OCHRE RIVER-DUCK RIVER REGION "D"

SITE DESIGNATION	SWAN RIVER CHERT		GREY CHERT		BAKERS NARROWS CHERT		QUARTZ		KNIFE RIVER FLINT		SLATE		PETRIFIED WOOD		TOTAL
	%	WT.	%	WT.	%	WT.	%	WT.	%	WT.	%	WT.	%	WT.	% WT.
LAS. 328	41.5	171.7	58.5	241.6											413.3
LAS. 329	99.7	3660.9							.3	7.1					3668.0
LAS. 330	99.6	190.2					.4	.7							190.9
LAS. 333	97.4	2168.4	2.6	56.5											2224.9
LAS. 334	100.0	220.4													220.4
LAS. 335	93.1	10113.8	.09	10.4			.35	38.2			6.4	692.6			10855.0
LAS. 336	100.0	332.1													332.1
LAS. 337	95.5	1107.0					4.5	41.0							1148.0
LAS. 339	100.0	1299.7													1299.7
LAS. 340	93.1	980.2	6.9	72.0											1052.2
LAS. 341	99.7	1076.7	.3	2.8											1079.5
LAS. 343	93.0	2401.2	4.3	111.5									2.7	60.2	2572.9
LAS. 344	99.9	9807.3					.1	5.0							9812.7
LAS. 345	99.9	10889.4			.1	90.1									10979.5
LAS. 383	100.0	4598.5													4598.5
LAS. 384	100.0	1177.7													1177.7
LAS. 385	100.0	917.9													917.9

LITHIC REMAINS AT THE OCHRE RIVER-DUCK RIVER SITES

LITHIC RAW MATERIAL TABULATIONS, BY PERCENTAGE AND WEIGHT
SURFACE COLLECTIONS ONLY
AREA: SWAN RIVER REGION "E"

SITE DESIGNATION	SWAN RIVER CHERT		GREY CHERT		QUARTZ		KNIFE RIVER FLINT		QUARTZITE		PETRIFIED WOOD		LIMESTONE		TOTAL	
	%	WT.	%	WT.	%	WT.	%	WT.	%	WT.	%	WT.	%	WT.	%	WT.
LAS. 236	100.0	791.0														791.0
LAS. 237	98.0	3553.4			1.5	40.5					.5	10.1				3604.0
LAS. 238	98.3	3368.4	.9	31.3	.8	28.9										3428.6
LAS. 240	100.0	6326.6														6326.7
LAS. 241	100.0	12262.8														12262.8
LAS. 242	100.0	1524.9														1524.9
LAS. 243	100.0	5019.7														5019.7
LAS. 244	99.3	21927.9	.6	147.8	.02	6.3										22082.0
LAS. 245	100.0	6368.7														6368.7
LAS. 246	100.0	26.9														26.9
LAS. 252	100.0	395.0														395.0
LAS. 262	100.0	964.8														964.8
LAS. 263	99.5	2562.0	.5	12.7												2574.7
LAS. 264	100.0	3011.7														3011.7
LAS. 265	100.0	5215.4														5215.4
LAS. 268	100.0	2812.5														2812.5
LAS. 274	99.8	5304.6	.1	7.6												5312.2
LAS. 275	98.8	10419.0	.4	43.9	.6	63.8										10526.7
LAS. 277	100.0	2612.0														2613.0
LAS. 281	100.0	196.3														196.3
LAS. 282	100.0	4664.6														4664.6
LAS. 283	100.0	808.6														808.6

LITHIC RAW MATERIAL TABULATIONS, BY PERCENTAGE AND WEIGHT
SURFACE COLLECTIONS ONLY
AREA: SWAN RIVER REGION "E"

SITE DESIGNATION	SWAN RIVER CHERT		GREY CHERT		QUARTZ		KNIFE RIVER FLINT		QUARTZITE		PETRIFIED WOOD		LIMESTONE			
	%	WT.	%	WT.	%	WT.	%	WT.	%	WT.	%	WT.	%	WT.	%	WT.
LAS. 284	100.0	1771.3														1771.3
LAS. 285	100.0	453.9														453.0
LAS. 286	100.0	359.9														359.9
LAS. 287	100.0	591.2														591.2
LAS. 288	100.0	645.0														645.8
LAS. 289	100.0	109.9														109.9
LAS. 290	100.0	249.0														249.0
LAS. 291	100.0	6600.2														6600.2
LAS. 292	100.0	2170.4														2170.4
LAS. 293	100.0	100.9														100.9
LAS. 294	100.0	891.3														891.3
LAS. 295	14.2	469.7											85.8	2869.8		3339.5
LAS. 297	100.0	2861.2														2861.2
LAS. 301	100.0	4165.4														4165.4
LAS. 309	99.0	2790.9	1.0	16.2												2807.1
LAS. 310	100.0	6129.7														6129.7
LAS. 313	98.4	5054.8	.9	42.4			.1	6.8	.6	23.6						5127.6
LAS. 314	98.0	11134.8	1.9	22.4			.1	2.2								11159.4
LAS. 315	100.0	1855.6														1855.6
LAS. 316	100.0	474.6														474.6
LAS. 317	100.0	486.8														486.8
LAS. 318	100.0	246.2														246.2

LITHIC RAW MATERIAL TABULATIONS, BY PERCENTAGE AND WEIGHT
SURFACE COLLECTIONS ONLY
AREA: SWAN RIVER REGION "E"

SITE DESIGNATION	SWAN RIVER CHERT		GREY CHERT		QUARTZ		KNIFE RIVER FLINT		QUARTZITE		PETRIFIED WOOD		LIMESTONE		TOTAL	
	%	WT.	%	WT.	%	WT.	%	WT.	%	WT.	%	WT.	%	WT.	%	WT.
LAS. 319	100.0	1807.1														1807.1
LAS. 320	100.0	913.3														913.3
LAS. 321	100.0	3436.5														3436.5
LAS. 322	100.0	2361.0														2361.0
LAS. 323	100.0	7649.0														7649.0
LAS. 324	100.0	549.4														549.4
LAS. 325	100.0	1174.2														1174.2
LAS. 326	100.0	1494.9														1494.9
LAS. 327	100.0	364.7														364.7
LAS. 401	95.8	2971.2	.2	6.9					3.9	121.1						3099.2
LAS. 403	100.0	2241.4														2241.4
LAS. 404	100.0	27296.7														27296.7
LAS. 410	93.7	156.0	1.0	1.5			5.3	8.9								166.4
LAS. 411	100.0	611.1														611.1
LAS. 412	100.0	386.8														386.8
LAS. 300/13	100.0	101.6														101.6
LAS. 300/15	100.0	616.6														616.6
LAS. 300/16	100.0	21.3														21.3
LAS. 300/18	100.0	7.3														7.3
LAS. 300/19	100.0	91.2														91.2
LAS. 300/20	100.0	406.0														406.0
LAS. 300/21	100.0	1258.4														1258.4
LAS. 300/22	100.0	1034.2														1034.2

LITHIC RAW MATERIAL TABULATIONS, BY PERCENTAGE AND WEIGHT
SURFACE COLLECTIONS ONLY
AREA: THE PAS-SASKATCHEWAN RIVER "F"

SITE DESIGNATION	SWAN RIVER CHERT		BAKERS' NARROWS CHERT		QUARTZ				TOTAL	
	%	WT.	%	WT.	%	WT.	%	WT.	%	WT.
LAS. 389	83.6	45.2	16.1	8.7						53.9
LAS. 408			47.9	37.0	52.0	40.2				77.2
LAS. 409	100.0	6.2								6.2

LITHIC REMAINS IN THE SITES IN THE PAS-SASKATCHEWAN RIVER REGION

PALEO-INDIAN POINTS AND THEIR RAW MATERIAL FREQUENCIES

A- EASTERN REGION *

Type of Point	Swan River Chert	Knife River Flint	Quartzite	Limestone Chert	TOTAL POINTS
Agate Basin	1	1	1		3
Raw Material Total	1	1	1		3

Swan River Chert	33.3%
Knife River Flint	33.3%
Quartzite	33.3%
	100.0%

B- ASSINIBOINE DRAINAGE REGION *

Type of Point	Swan River Chert	Knife River Flint	Quartzite	Limestone Chert	TOTAL POINTS
Agate Basin	2				2
Plainview		1			1
Folsom		1			1
Scottsbluff	1	1			2
Hell Gap		1			1
Eden		1			1
Raw Material Total	3	5	0	0	8

Swan River Chert	37.5%
Knife River Flint	62.5%
	100.0%

D- OCHRE RIVER- DUCK RIVER REGION *

Type of Point	Swan River Chert	Knife River Flint	Quartzite	Limestone Chert	TOTAL POINTS
Agate Basin	12	3		1	16
Frederick	1				1
Eden	1				1
Milnesand	1				1
Scottsbluff	1	2			3
Alberta		2			2
Hell Gap	1				1
Plainview	2				2
Raw Material Total	19	7		1	27

Swan River Chert	70.3%
Knife River Flint	25.9%
Limestone Chert	3.8%
	100.0%

E - SWAN RIVER REGION*

Type of Point	Swan River Chert	Knife River Flint	Quartzite	Limestone Chert	TOTAL POINTS
Agate Basin	29	9			38
Scottsbluff	6	4	2		12
Milnsand	4				4
Frederick	2	1			3
Browns Valley	2	1			3
Plainview	6	1			7
Eden	3				3
Midland	1				1
Hell Gap	3	1			4
Alberta	1				1
Cody Knives	2				2
Raw Material Total	59	17	2	0	78

Swan River Chert	75.5%
Knife River Flint	21.7%
Quartzite	2.8%
	100.0%

H- SOUTHWESTERN REGION*

Type of Point	Swan River Chert	Knife River Flint	Quartzite	Limestone Chert	TOTAL POINTS
Alberta		1			1
Plainview	1				1
Midland		1			1
Raw Material Total	1	2	0	0	3

Swan River Chert 33.3%
Knife River Flint66.6%
100.0%

*Adapted from Pettipas, 1967

KEY: To Tables 1-6.

I - Swan River Chert
II - Knife River Flint
III - Selkirk Chert
IV - Grey Chert
V - Quartz
VI - Eastern Silicified
VII - Basalt
VIII- Quartzite
IX - Petrified Wood
X - Limestone
XI - Bakers Narrows Chert
XII - Slate
XIII - Grey-Green Silicified
XIV - Argillite
XV - Granite
XVI - Miocene Chert
XVII - Obsidian
XVIII- Silicified Sediment
XIX - Chert Breccia
XX - Welded Shale
XXI - Rhyolite
XXII - Sandstone

AVERY SITE PROJECTILE POINTS BY RAW MATERIAL

	Knife River Flint	Swan River Chert	Siltstone	Quartzite	Fossilized Wood	Rhyolite	Basalt	Black Chert	TOTAL POINTS
HANNA	2	1							3
DUNCAN	4		1						5
PELICAN LAKE	12	1							13
BESANT	23	2	1	2					28
AVONLEA	22	8	2		1				33
PLAINS TRIANGULAR									
Variety I	5	7	2						14
" II	10	4				1			15
" III	2	6				2	1		11
LATE SIDE NOTCHED									
Variety I	1		1						2
" II		2							2
" III	4	2							6
" IV	3	2							5
" V	14		1					2	17
" VI	6								6
" VII	3		1			1			5
" VIII									
TOTAL	111	35	9	2	1	4	1	2	165

AVERY SITE-SCRAPERS, BIFACES AND DRILLS

Plano-Convex End Scrapers

Knife River Flint	-33	(91.8%)
Swan River Chert	- 2	(5.5%)
Black Chert	- 1	(2.7%)

Prismatic End Scrapers

Knife River Flint	-26	(76.5%)
Swan River Chert	- 6	(17.7%)
Black Chert	- 2	(5.8%)

Lamellar End Scrapers

Knife River Flint	-29	(82.6%)
Swan River Chert	- 1	(2.9%)
Black Chert	- 2	(5.8%)
Siltstone	- 2	(5.8%)

Split Pebble Scrapers

Knife River FLint	- 1	(33.3%)
Swan River Chert	- 2	(66.6%)

Large Scraping Tools

Knife River Flint	- 1	(12.5%)
Swan River Chert	- 6	(75.0%)
Rhyolite	- 1	(12.5%)

Drills

Knife River Flint	- 5	(100.0%)

AVERY SITE SCRAPERS, BIFACES AND DRILLS (cont'd)

Crescent Shaped

Knife River Flint	- 4	(57.1%)
Swan River Chert	- 2	(28.6%)
Black Chert	- 1	(14.3%)

Ovate

Knife River Flint	- 3	(22.5%)
Swan River Chert	- 9	(70.0%)
Quartzite	- 1	(7.5%)

Oval

Knife River Flint	- 1	(33.3%)
Swan River Chert	- 1	(33.3%)
Quartzite	- 1	(33.3%)

Lanceolate

Knife River Flint	- 1	(33.3%)
Swan River Chert	- 1	(33.3%)
Rhyolite	- 1	(33.3%)

Rectangular

Knife River Flint	- 3	(100.0%)

Biface Fragments

Knife River Flint	-13	(56.0%)
Swan River Chert	- 2	(8.8%)
Black Chert	- 1	(4.4%)
Siltstone	- 3	(13.2%)
Rhyolite	- 3	(13.2%)
Limestone	- 1	(4.4%)

Irregular Shapes

Knife River Flint	- 2	(66.6%)
Rhyolite	- 1	(33.3%)

Adapted from Joyes, 1969

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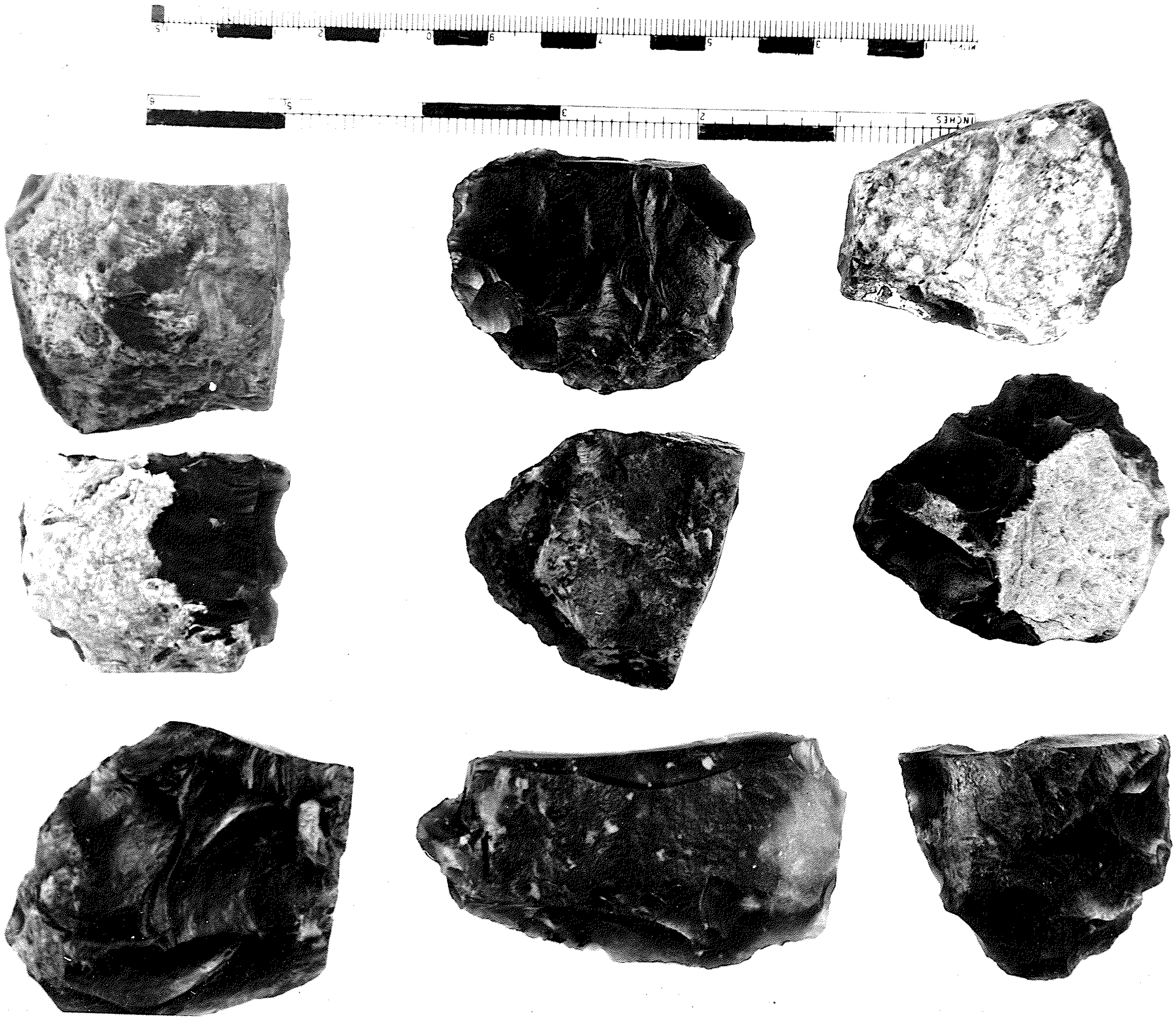
FIGURE 1. TREHERNE " BLANKS" (natural size)



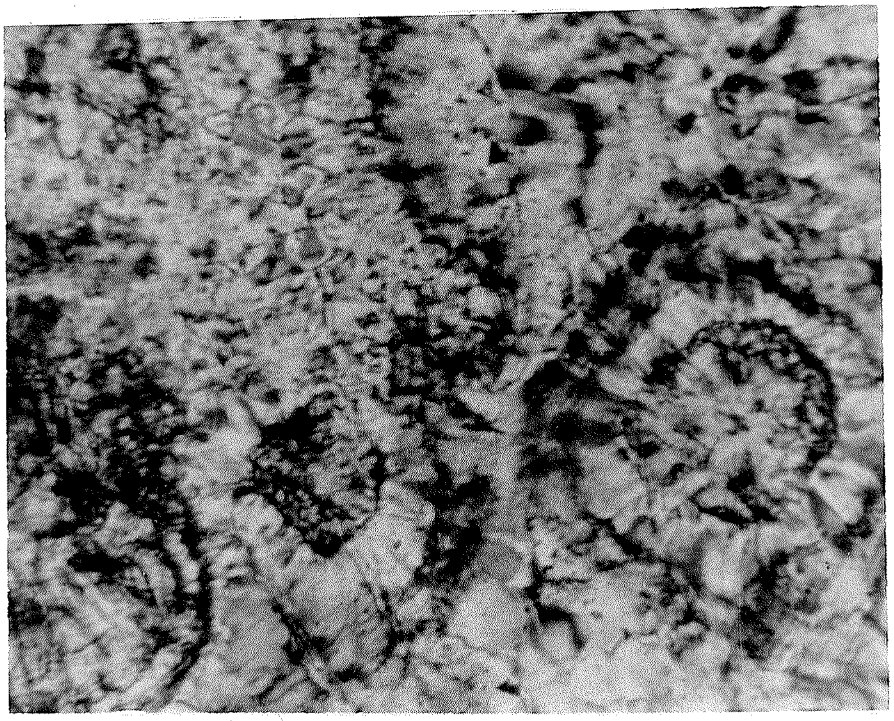


Figure 12. Swan River Chert in Thin Section.