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CONTRIBUTIONS TO PLAINS PREHISTORY

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David Burley
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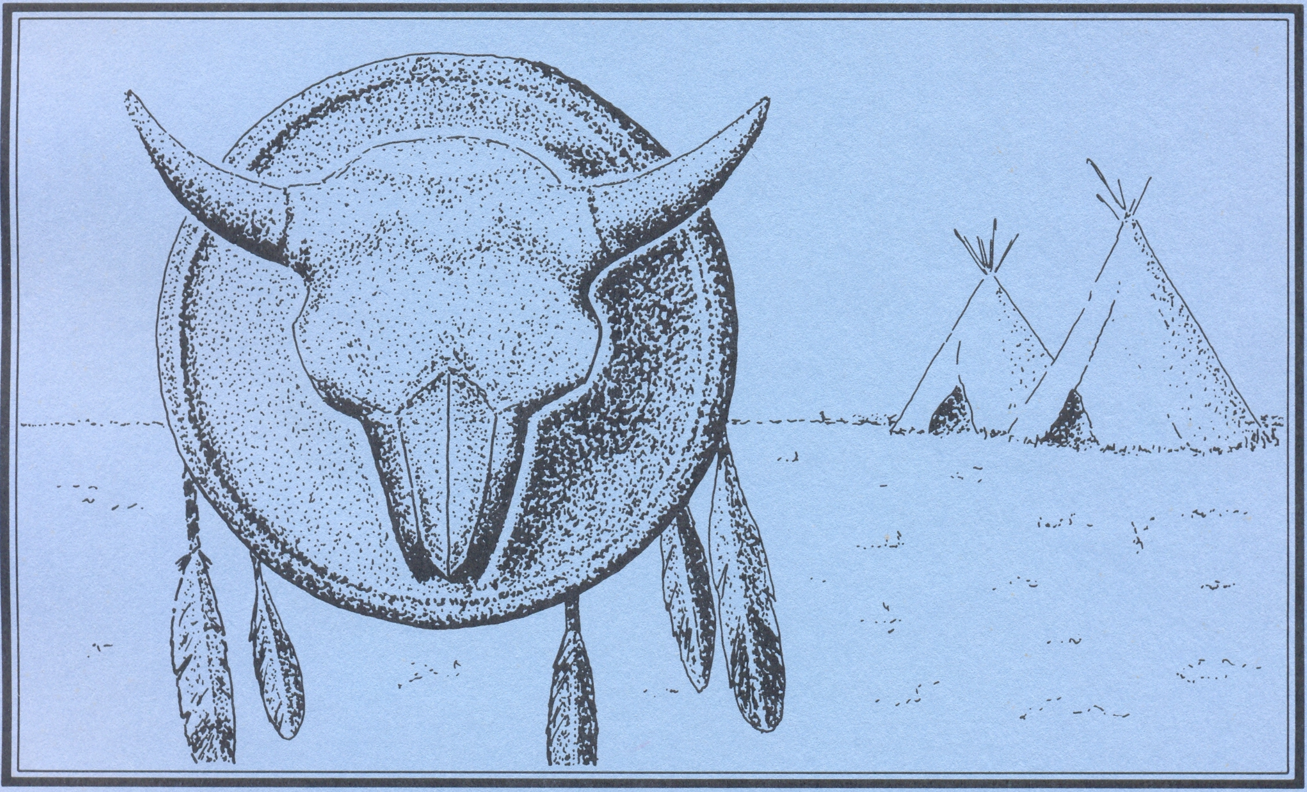

Alberta
CULTURE

CONTRIBUTIONS TO PLAINS PREHISTORY:

THE 1984 VICTORIA SYMPOSIUM

Edited by

David V. Burley

Archaeological Survey of Alberta

Occasional Paper No. 26

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INTRODUCTION

By
David Burley
Archaeological Survey of Alberta

Despite the fact that the Plains ecological region covers a considerable segment of the Canadian West and that several universities with archaeology programmes are situated therein, the participation of Plains prehistorians at the annual meeting of Canadian archaeologists has been less than substantial. In part, I suspect this may be related to the small numbers of active archaeologists working on the Canadian Plains as well as the natural tendency to expend one's conference efforts in regional participation where the most effective feedback can be gained. Occasionally, a thematically focused symposium has been organized for the Canadian Archaeological Association's annual meeting. These, generally, have met with considerable success as witnessed by Miller's 1980 session on Oxbow which was published in the Canadian Journal of Archaeology. On the whole, however, few Plains papers are contributed, and only a very small sample of those ever go beyond the fifteen to twenty minute site report format.

To the majority of the Canadian archaeological community, Plains prehistory is probably characterized as a study with common consensus of chronology, point typology, "cowboy" methodologies and few new insights in the past two decades. Those who are working on the Plains realize the fallacy of these characterizations. While perhaps not as widely publicized as many of the principal debates in American archaeology, problems of taxonomy, typology, theoretical focus and field methods are constantly being brought under scrutiny. As well, exciting new data with important interpretive insights into Plains prehistory are being recorded with each passing field season. It was with this in mind and the feeling that it should be brought to the attention of the Canadian archaeological community that the 1984 Plains prehistory symposium was organized for the 17th Annual Canadian Archaeological Association meeting in Victoria, British Columbia. The initial intent was to focus on recent culture historical developments; the breadth of the proposed papers led to the session taking on a much wider scope.

As testimony to my opening remarks on the presumed lack of interest in Plains prehistory, the symposium was assigned a room barely large enough to seat the participant cast. This was the case despite a full day session, the participation of international scholars and the presence of H. Marie Wormington and Richard G. Forbis as discussants. With people literally hanging from the rafters and the windows, the problem was alleviated in the afternoon through the ousting of one of those ever present resource management symposia that had been given a meeting room designed to seat two hundred or more.

The session papers have been edited for publication and are presented herein. These papers have been prepared by a wide variety of individuals from "budding" graduate students to senior professionals. They include a broad range of topics cross-cutting problems of method, theory and data interpretation. New data are provided and, in some instances, old data are evaluated. To say the least, contributions in this volume are an eclectic collection of papers that, I would argue, are representative of the study of Plains prehistory as it exists today.

As editor of the volume I accept any criticism for the inclusion of at least two papers that deal with areas peripheral to the Plains. The content of these papers, however, is directly relevant and no apologies are offered. Similarly, the mixing of method, theory, data presentation and debate as opposed to the more popular focus on tightly defined thematic issues is neither justified nor defended. These papers are what they are and I am sure that the reader will find them useful referents in their own research.

Finally, I would like to acknowledge my sincere gratitude to Professors Wormington and Forbis for their participation in the symposium as discussants and their offering of valued insights into the problems identified in this volume. Through their research on the northwestern Plains, they have provided much of the baseline data and interpretation crucial to our understanding of the Prehistoric Period as it exists today. Their research legacy has set a standard to which future generations of Plains archaeologists may only aspire.

NORTHERN PLAINS CULTURE HISTORICAL SYSTEMATICS

By
B.O.K. Reeves
University of Calgary

INTRODUCTION

Over the past fifty years, a number of basic classificatory schemes have been proposed to order Northern Plains archaeological phenomena in time, space and culture. These schemes generally involve tripartite divisions of time based on major horizon markers, and have met with varying degrees of success and acceptance by the archaeological community. This reflects not only the utility and applicability of the schemes on a region-wide basis, but also their "visibility" in the published literature.

The principal objective of this paper is to present a brief historical overview of the major schemes, and an assessment of their utility in ordering Northern Plains culture history outside the Middle Missouri horticulture area.

BEGINNINGS

The first researchers to propose cultural taxonomic schemes were Duncan Strong (1933), Waldo Wedel (1940), and John Champe (1946). In 1933, Strong divided the sequence into the Historic, Protohistoric and Prehistoric Periods (Figure 1). He included Signal Butte, which was the only excavated preceramic site known at the time. Later, Strong (1935) placed Signal Butte and other sites within the McKern midwestern taxonomic system. He assigned them a "focus" and "aspect" status within what he termed the "Early Hunting Phase of the Great Plains Culture".

Subsequently, Wedel (1940) subdivided Strong's Prehistoric Period into the Late Prehistoric Woodland Pattern and the Preceramic Pattern. In 1949, Wedel undertook a cross-correlation of Preceramic Plains cultural phenomena using Signal Butte, Pictograph Cave and Ash Hollow

NORTHERN PLAINS			NORTHWESTERN PLAINS		
STRONG 1933	CHAMPE 1946	WEDEL 1949	WEDEL 1961	MULLOY 1952	
HISTORIC	HISTORIC	HISTORIC	HISTORIC	HISTORIC	
PROTOHISTORIC	PROTOHISTORIC	PROTOHISTORIC	PROTOHISTORIC		ca. A.D. 1700/1800
PREHISTORIC	LATE PREHISTORIC WOODLAND	CERAMIC	NOMADIC BISON HUNTERS	LATE PERIOD	ca. A.D. 100
	PRECERAMIC	LITHIC: INTERMEDIATE	POST ALTITHERMAL HUNTERS AND GATHERERS	MIDDLE PERIOD	ca. 1000 B.C. / ca. 3000 B.C. / ca. 5500 B.C.
		LITHIC: EARLY MAN	EARLY BIG GAME HUNTERS	EARLY PERIOD	ca. 10000 B.C.

Figure 1. Northern and Northwestern Plains classificatory schemes (1933-1961).

Cave. At that time, these constituted the three principle stratified excavated sites. Later, Wedel (1961) also proposed three basic adaptive patterns: Early Big Game Hunters, Post-Altithermal Hunters and Gatherers, and Nomadic Bison Hunters (outside of the Middle Missouri area). In this work, Wedel utilized Mulloy's (1958) scheme (discussed below) when referring to individual cultural periods of the Northwestern Plains.

The only other major scheme to be employed in the early era of Plains research was that developed by John Champe in 1946. In his monograph on Ash Hollow (Champe 1946), he developed a regional scheme for Western Nebraska. This divided the sequence into the Lithic, Ceramic and Historic Periods. The Lithic was further subdivided into the Early Man and Intermediate Periods.

MULLOY'S NORTHWEST PLAINS PERIODIZATION

William Mulloy first proposed his trinomial scheme of the Early, Middle and Late Periods for the Northern Plains in his 1952 publication (Figure 1). Since then, it has been the taxonomic system employed by most Northern Plains archaeologists in one version or another. In his dissertation, Mulloy (1958) changed the terminology to the Early, Middle, and Late Prehistoric Periods (Figure 2). This terminology had earlier appeared in print in his paper on the McKean site (1954).

Mulloy's classification represented the first major attempt, outside of the Middle Missouri area, to correlate complexes and components. By trait list comparisons, he hoped to establish "region wide horizon style complexes...a series of periods...and region wide material cultural items characteristic of each" (Mulloy 1958:140). In his dissertation, he focused on the Late and Middle Prehistoric Periods, subdividing the latter into the Early and Late Middle Prehistoric. In developing his classification scheme, he used such sites as Ash Hollow, Signal Butte, Angostura Reservoir, Ludlow Cave, McKean and the Billings Bison Trap.

<table>
<tr><th colspan="4">NORTHWESTERN PLAINS</th><th>ALBERTA</th><th colspan="2">SOUTHERN MONTANA</th><th></th></tr>
<tr><th colspan="2">MULLOY
1958</th><th colspan="2">WHEELER
1958</th><th>WORMINGTON & FORBIS
1965</th><th colspan="2">MALOUF
1960</th><th></th></tr>
<tr><td colspan="2">HISTORIC</td><td colspan="2">HISTORIC</td><td>HISTORIC</td><td colspan="2">HISTORIC</td><td></td></tr>
<tr><td colspan="2" rowspan="2">LATE PREHISTORIC</td><td rowspan="2">LATE PREHISTORIC</td><td>LATE</td><td rowspan="2">NEO-INDIAN</td><td colspan="2" rowspan="3">LATE* HUNTERS</td><td>ca. A.D. 1700/1800</td></tr>
<tr><td>EARLY</td><td></td></tr>
<tr><td rowspan="2">MIDDLE PREHISTORIC</td><td>LATE</td><td rowspan="2">MIDDLE PREHISTORIC</td><td>LATE</td><td rowspan="2">MESO-INDIAN</td><td>ca. A.D. 100</td></tr>
<tr><td>EARLY</td><td>EARLY</td><td colspan="2">FORAGERS</td><td>ca. 1000 B.C.</td></tr>
<tr><td colspan="2">HIATUS ?</td><td colspan="2">HIATUS ?</td><td>HIATUS</td><td colspan="2">HIATUS</td><td>ca. 3000 B.C.</td></tr>
<tr><td colspan="2" rowspan="2">EARLY PREHISTORIC</td><td rowspan="2">EARLY PREHISTORIC</td><td>LATE</td><td rowspan="2">PALEO-INDIAN</td><td rowspan="2">EARLY HUNTERS</td><td>PLANO</td><td>ca. 5500 B.C.</td></tr>
<tr><td>EARLY</td><td>LLANO</td><td></td></tr>
<tr><td colspan="7"></td><td>ca. 10000 B.C.</td></tr>
</table>

*Includes Mulloy's Late Middle Prehistoric

Figure 2. Northern and Northwestern Plains classificatory schemes (1958-1965).

THEMES AND VARIATIONS

Following the publication of Mulloy's basic scheme, several Plains researchers have revised and "tinkered" with it.

First to modify the classification system slightly was Richard Wheeler (1958) in his unpublished manuscripts on the Boyson, Keyhole and Angostura Reservoirs. He divided both the Early and Late Prehistoric Periods into three stages (Early, Middle and Late), and the Middle Prehistoric Period into Early and Late (Figure 2). Their cultural content corresponded with Mulloy's periods. Wheeler's refinements were of considerable utility, providing "finer tuned" temporal divisions based on horizon style and avoiding the cultural implications such as are inherent in the use of the terms "Llano" and "Plano" for the "Paleo-Indian" cultures (Sellards 1952). However, because his work was never published, few researchers are aware of his scheme, and even fewer have used his classification system. These manuscripts remain an important source of primary data on the Northwestern Plains.

In southern Montana, a number of researchers have modified Mulloy's system in proposing regional Montana schemes. As discussed below, these schemes are confusing, and it is fortunate that they have received limited publication and acceptance.

In 1958, Carling Malouf (1958) proposed a three stage scheme, consisting of Early Hunter, Forager and Late Hunter. The Late Hunter Period was divided into two phases, the first equivalent to Mulloy's Late Middle Prehistoric and the second to Mulloy's Late Prehistoric. Malouf's Early Hunter and Forager units are equivalent to Mulloy's Early Prehistoric and Early Middle Prehistoric Periods, respectively. Later, Malouf (1960) divided the Early Hunter Period into two phases, numbered I and II (Figure 2), equivalent to Llano and Plano (Sellards 1952).

Dee Taylor (1964) combined the Malouf and Mulloy classification schemes. He proposed a three stage scheme: the Early Prehistoric (equivalent to Mulloy's Early Prehistoric), the Middle Prehistoric (equivalent to Mulloy's Early Middle Prehistoric), and the Late Hunter (equivalent to Malouf's Late Hunter). Following the trend, Taylor's student Lou Napton (1966) divided the sequence into: Paleo-Indian or Early Period (equivalent to Mulloy's Early Prehistoric), Middle Period (equivalent to Taylor's Middle Prehistoric), and Late Period (equivalent to Malouf's Late Hunter). The early part of both Taylor's Late Hunter and Napton's Late Period is equivalent to Mulloy's Late Middle Prehistoric.

Hoffman (1961) followed the Mulloy framework, but assigned a variant set of dates, for example, dating the Middle Prehistoric Period as late as A.D. 1600. Finally, in George Arthur's thesis (1966), some consistency with Mulloy's system appears in southern Montana. He used Mulloy's terminology as it was initially devised, i.e., using the terms Early, Middle and Late Periods. Les Davis (1968) also used the scheme in this manner for Northern Montana.

In their seminal work An Introduction to the Archaeology of Alberta, Canada published in 1965, Wormington and Forbis divided the Alberta sequence into the Paleo-Indian, Meso-Indian and Neo-Indian Periods (Figure 2). These periods are stated to be equivalent to Mulloy's tripartite framework. The Paleo-Indian Period or Stage, first coined by Frank H. Roberts and Marie Wormington in the 1930s (Wormington 1957), has become the widespread synonym for the "Early Big Game Hunters" or the "Early Prehistoric". However, the use of Wormington and Forbis' system has never caught on in Alberta. For example, in his review of Alberta archaeology in the Northwestern Plains Symposium, Forbis (1968) follows Mulloy's classification.

Mulloy's system has also been employed throughout Saskatchewan. For example, the Kehoes utilized it when writing for the Northwestern Plains Symposium (Kehoe and Kehoe 1968). In addition, people working with Middle Missouri Preceramic materials have used the system, including Irving (1958) and Neuman (1964).

By the late 1960s, most professionals and amateurs working in the Northern Plains had adopted Mulloy's scheme. In contrast, workers in Manitoba had proposed various frameworks, some incorporating Mulloy's system, others not. For example, the McKern midwestern taxonomy was used by Chris Vickers in the late 1930s (1948) and by MacNeish in the 1950s (1958). In the 1960s, however, Bill Mayer-Oakes (1967) followed the organizational framework of Willey and Phillips (1958).

The first formal scheme for eastern Colorado was one proposed by J.D. Wood in his dissertation (1967). He divided his sequence into two major periods: the Preceramic and Ceramic; each of these was further subdivided into Early, Middle and Late. Wood's Middle Preceramic is equivalent to Mulloy's Early Middle Prehistoric, and his Late Preceramic corresponds to Mulloy's Late Middle Prehistoric.

ACCOUNTING FOR THE ALTITHERMAL

When Mulloy published his preliminary outline (1958), there appeared to be a time gap between the Cody Complex of the Early Prehistoric and the McKean Complex of the Early Middle Prehistoric Period. Mulloy and others suggested that this gap represented a cultural hiatus on the Northern Plains (see Reeves 1973 for a review). Since it correlated in time with the Altithermal, they suggested that the Plains may have been abandoned because of Altithermal desiccation and demise of the bison herds.

Given the data base and the dated sites available at the time, this was the most economic interpretation. However, both Mulloy (1952, 1954, 1958) and Wheeler (1958), who were the first to publish on this problem, cautioned that the apparent hiatus may only be a sampling error. In fact, Wheeler (1958) pointed out that a complete sequence existed in the Central Plains and that it should be present on the Northwestern Plains. It now appears that Wheeler was correct, as indicated by the results of excavations at Mummy Cave (Wedel, Husted and Moss 1968), and at Head-Smashed-In and in the Southern Alberta Rockies (Reeves 1972, 1978). These excavations demonstrated that side notched point using complexes spanned the so-called cultural hiatus.

On the basis of their technology, I placed these side notched complexes within Mulloy's Early Middle Prehistoric Period (Reeves 1969), thereby extending the temporal duration to span the Altithermal. Subsequently, I updated Mulloy's system to accommodate the more recent point types, phases and complexes recognized in most parts of the Northern Plains by the late 1960s (Reeves 1983), and defined the three periods on the basis of projectile point/weapon system technologies. In addition, I also wanted to eliminate the socio-economic biases which other researchers had introduced into Mulloy's system. This was particularly the case with the "Forager" concept associated with the

Middle Prehistoric by Wedel (1961), Malouf (1958) and others. Mulloy had specifically excluded this concept from his original (1952) definition of the Middle Prehistoric.

In my dissertation (Reeves 1983), I proposed two variables be used to define each period: 1) time, and 2) weapon point technologies and stylistic types, since these were easily recognizable and widespread horizon style traits. Thus, the periods were defined as follows (Figure 3): throwing and stabbing spears in the Early Prehistoric (ca. 11,000 - 5,500 B.C.); lighter darts and notched points for the Middle Prehistoric (ca. 5,500 B.C.- A.D. 100); and the bow and arrow for the Late Prehistoric (ca. A.D. 100 - A.D. 1750). Ceramics were excluded from my definition of the Late Prehistoric since, by the late 1960s, they had also been found in terminal Late Middle Prehistoric complexes, specifically, Besant (Neuman 1975; Johnson 1977).

Later (Reeves 1973), I subdivided the Early Middle Prehistoric (Figure 3) into EMP I (5,500 - 3,000 B.C.), characterized by side notched points, and EMP II (3,000 - 1,400 B.C.), marked by the appearance of lanceolate points, basally notched points, and stemmed points. This further subdivision is of some utility by providing a finer separation of time and by considering the various side notched point complexes as a group. However, it has not been used much by myself or other workers primarily because of the introduction by George Frison of the term "Early Plains Archaic" for these complexes; this will be discussed below.

MUDDLING THE MIDDLE

Recently, workers in Saskatchewan (Epp and Dyck 1983) and Manitoba (Pettipas 1983) have published excellent summary "state-of-the-art" works on the prehistory of their provinces. In the Saskatchewan volume, Dyck (1983) proposed four periods for the Plains (Figure 3): the Pleistocene Hunters (15,000 - 8,500 B.C.), Early Plains Indian (8,500 - 6,000 B.C.), Middle Plains Indian (5,700 B.C. - A.D. 100) and Late Plains Indian (A.D.0 - A.D. 1820). The Late Plains Indian Period includes complexes with side notched arrow points and ceramics as well as Besant side notched atlatl points and ceramics.

NORTHERN AND NORTHWESTERN PLAINS			SASKATCHEWAN	MANITOBA	
MULLOY 1958	REEVES 1973	FRISON 1978	DYCK 1983	PETTIPAS (ed.) 1983	
HISTORIC	HISTORIC	HISTORIC	HISTORIC	HISTORIC	
					ca. A.D. 1800
LATE PREHISTORIC	LATE PREHISTORIC	LATE PREHISTORIC	LATE PLAINS INDIAN	LATE* PREHISTORIC	
					ca. A.D. 100
					ca. A.D. 0
MIDDLE PREHISTORIC: LATE	MIDDLE PREHISTORIC: LATE	PLAINS ARCHAIC: LATE	MIDDLE PLAINS INDIAN	MIDDLE PREHISTORIC	
					ca. 1000 B.C.
MIDDLE PREHISTORIC: EARLY	MIDDLE PREHISTORIC: EARLY II	PLAINS ARCHAIC: MIDDLE			
					ca. 3000 B.C.
HIATUS ?	MIDDLE PREHISTORIC: EARLY I	PLAINS ARCHAIC: EARLY			
					ca. 5500 B.C.
EARLY PREHISTORIC	EARLY PREHISTORIC	PALEO INDIAN	EARLY PLAINS INDIAN	EARLY PREHISTORIC	
					ca. 8500 B.C.
			PLEISTOCENE HUNTERS		
					ca. 10000 B.C.

* Includes the Late Middle Prehistoric Besant Phase

Figure 3. Northern and Northwestern Plains classificatory schemes (1958-1983).

A similar scheme (Figure 3) has been proposed in Introducing Manitoba Prehistory, a volume edited by Leo Pettipas (1983) containing contributions by most Manitoba archaeologists. Mulloy's Early, Middle and Late terminology is retained in this publication, but the Late Prehistoric Period is redefined by the contributors to include Besant.

The revisions by Saskatchewan and Manitoba researchers represent a major change in Mulloy's period concept which was originally defined on the basis of horizon styles. These revisions have extended the system to include cultural complexes cross-cutting the Middle and Late Prehistoric Periods. Since these boundaries document when one weapons system is being replaced by another, some phases will have both arrow and atlatl dart points, such as the Besant Phase, for example. This phase has been assigned by me and most other researchers (e.g., Johnson 1977) to the Late Middle Prehistoric/Late Prehistoric transition. Besant Phase components predating A.D. 400 do have dart points associated with the ceramics, and in later components, both dart and arrow points occur.

The change in weapon types occurred over a period of centuries in Besant, while in other cultural traditions, e.g., Avonlea, new technology was very rapidly innovated. The archaeological result of the latter case is an abrupt temporal transition between the two weapons and associated projectile point types. In Besant, however, there is considerable mixing of weapons systems through time, resulting in some Besant Phase components belonging to the Late Middle Prehistoric and others belonging to the Late Prehistoric (see Reeves 1983 for further discussion).

A similar situation exists in the technological transition between the Early Prehistoric and Early Middle Prehistoric Periods. This transition appears to have occurred over a period of about 250 years, between ca. 5750 B.C. and 5500 B.C. Components dating to this interval contain both lanceolate and side notched points (Reeves and Davis n.d.).

MIXING THE SYSTEMS

In 1978, George Frison (1978) proposed a "new" taxonomic system for the Northwestern Plains area, which is, as he clearly defines it, more or less coincident with the boundaries of the State of Wyoming. As late as 1976, Frison and his co-workers (e.g., Frison et al. 1974, 1976) either used Mulloy's terminology or did not categorize their materials. However, in 1978, he introduced a composite trinomial system comprised of the Paleo-Indian, Plains Archaic and Late Prehistoric Periods (Figure 3). Frison's first stage is after Wormington's definition (1957), the last stage is after Mulloy (1958).

The concept of the Plains Archaic had been used earlier by Mayer-Oakes (1960), Willey (1966) and Wedel (1978). Frison's use of "Plains Archaic" is "for the sake of convenience" (1978:22), as a term referring primarily to the Altithermal Period culture groups, which did not easily fit into Mulloy's scheme. These are defined as the Early Plains Archaic, the Middle Plains Archaic (Mulloy's Early Middle Prehistoric), and the Late Plains Archaic (Mulloy's Late Middle Prehistoric Period).

Frison utilizes the Plains Archaic as a convenient classificatory device, stating that "...while it might be wise to await the accumulation of a more reliable data base before such a model is proposed" (1978:21), he considers it "...a temporary trial and arbitrary chronological model - one that can be later discarded with no feelings of remorse" (ibid.). He argues that it is needed purely for greater ease of reference to these cultures. All "for the sake of convenience" has, unfortunately, complicated Northern Plains chronologies and classifications.

Frison introduced the system in order to place the Altithermal cultures within a systematic framework, since they fell outside Mulloy's original definition of the Early Middle Prehistoric Period. Frison rejected the Early Middle Prehistoric Period on the basis that it was "too gross" a chronological unit and "...requires further breakdown of the period to accommodate data now available for the Altithermal Period" (ibid.). As an aside, it should be noted that I had provided just such a definition in my 1973 paper; this paper was often cited by Frison in his book, but he obviously did not consider my scheme suitable for his use.

Frison reminds readers on numerous occasions that his use of the term "Plains Archaic" in its cultural adaptive sense applies only to the "Northwestern Plains", and that it may not apply elsewhere. His definition of the Northwestern Plains is limited to Wyoming and adjacent drainages. However, the Northwestern Plains as defined by Wedel (1961) over twenty years ago and as conceived by most archaeologists today, encompass not only Wyoming and adjacent drainages, but also the Upper

Missouri and Saskatchewan basins. As a result of this concept of the Northwestern Plains, Frison's system has been adopted and used by some workers for not only the Northwestern Plains as Frison defines it (e.g., Armitage et al. 1982), or for specific areas of the Western Plains, e.g., Colorado (Cassells 1984), but in some cases for the entire northern half of the Great Plains (e.g., Doll 1982; Pollock 1982).

As a result of this widespread, incautious application of Frison's scheme, the overall chronology for the Northern Plains has been complicated by the introduction of the adaptive implications inherent in the term "Archaic". Generally, the Middle Prehistoric Period in the Northern Plains in no way had an Archaic-type adaptation. It is not my intent to deal in detail with the concept of a Plains Archaic Period and its cultural adaptive implications. Criticisms (Reeves and Davis n.d.) of this scheme by others (e.g., Forbis 1968) go back over twenty years, and it is not necessary to reiterate the old arguments. Suffice it to say that if the concept of the Archaic Period is to be used as a cultural adaptive stage on the Plains, it must be extended both forward and back in time to encompass all evidence of generalized adaptive subsistence patterns. These would include such Clovis complex "big game hunting sites" as the Dead Indian Creek Site near Helena, Montana (Davis personal communication 1983), in which some of the principle animal remains are concentrations of butchered yellow bellied marmot bones, or Late Prehistoric sites in the southern Canadian Rockies characterized by a generalized hunting, fishing, fowling and trapping economy (Reeves 1974a, b).

Frison's Late Archaic division is also a source of confusion since some complexes which he includes, such as Besant, may contain ceramics and do not fit within the strict definition. As a result, some workers have classified Besant as "Plains Woodland" (Johnson 1977), while others have termed it "Middle Plains Woodland", based on the ceramic style. This is apparently meant to separate Besant from the Late Plains Woodland which is characterized by side notched arrow points and conoidal pots (Ahler et al. 1981)! Ceramics are such minor artifact components in these complexes that they are rarely found in most sites. The application of a "value-loaded" term such as "Plains Woodland" - implying village horticulture - is as equally inappropriate, in my opinion, as applying the term "Plains Archaic" to these complexes.

MORE MIXING AND MUDDLING

Recently, I read Patricia Robins Flint's dissertation entitled "Northern Rocky Mountains Region: Environment and Culture History", which focuses on southwestern Montana and adjacent areas. The northern boundary of her study area is an east-west line of latitude lying just north of Waterton Lakes National Park, since she includes results from my work (Reeves 1972). Otherwise, I suspect her boundary would be the 49th parallel. She proposes a "new" five fold periodization, as well as some new point types to replace some existing types, for the "Northern Rocky Region Cultural Tradition" (Flint 1982:260-261). These periods are:

Northern Rocky Mountain Prehistoric Period I (12,500 - 8,000 B.C.) - includes Clovis and Folsom.

Northern Rocky Mountain Prehistoric Period II (8,000 - 5,000 B.C.) - includes Alberta, Scottsbluff, Haskett, Birch Creek and other lanceolate types.

Northern Rocky Mountain Prehistoric Period III (5,000 - 2,000 B.C.) - characterized by large side notched dart points - Bitterroot, stemmed indented base, eared indented base (Oxbow), Elko eared variants and eared lanceolate indented base (McKean).

Northern Rocky Mountain Prehistoric Period IV (2,000 B.C. - A.D. 0) - characterized by Hanna stemmed, Northern Rocky Mountain Fishtail (Duncan), corner notched concave base (Pelican Lake) and Northern Rocky Mountain convex base Corner Notched (ibid.:261).

Northern Rocky Mountain Prehistoric Period V - characterized by small notched arrow points - Blue Dome Side Notched, Samantha Side Notched, Mummy Cave Corner Notched and Fine Triangular.

Flint's Periods I and II are simply the old Llano and Plano divisions of the Paleo-Indian or Early Prehistoric, her Period III is the Early Middle Prehistoric, Period IV is the Late Middle Prehistoric, and Period V is the Late Prehistoric. There is nothing new or particularly advantageous in her system. There are some systematic problems and, for a degree granted in 1982, the dissertation is remarkably dated in the sources utilized as well as, of course, essentially ignoring most of the northern half of the Northern Rocky Mountains (i.e., Canada).

CONCLUSION: UNSYSTEMATIC NORTHERN PLAINS SYSTEMATICS

In summary, this discussion has outlined the taxonomic schizophrenia which characterizes Northern Plains systematics today. On one hand, there are the traditionalists and minor tinkerers (such as myself), who utilize Mulloy's basic scheme. In contrast, some workers use Mulloy's traditional terminology but redefine the parameters, while still others propose amalgams of various systems. The latter conglomerations have, unfortunately, been uncritically adopted by the new generation of Plains archaeologists - mostly "Binfordian Babies" who, with their disdain of traditional culture history, refuse to try to understand it and either reject it outright, or use any convenient scheme.

The result is chaotic. I would contend that Mulloy's system not only has historical precedent but, as utilized today, is still the most economical and useful model for periodizing Northern Plains prehistory. As a heuristic ordering device, it provides a basic chronological framework within which workers in the various areas of the Northern Plains and Rocky Mountains can develop more finely tuned regional chronologies of phases, complexes and traditions.

Agreement will be difficult to reach, if at all possible. It may be useful to follow the lead of our European archaeological colleagues by establishing a North American Archaeological Stratigraphic Nomenclature Committee under the appropriate UNESCO Congress (UISPP) to deal with such matters. Such a committee would try to develop a consensus on the appropriate nomenclature for our region, a process the geological disciplines have been involved in for some time.

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EVIDENCE OF THE FLUTED POINT TRADITION IN ALBERTA

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INTRODUCTION

In private collections and institutional storage throughout Alberta there are fairly substantial numbers of projectile points of the Fluted Point Tradition. These comprise a source of archaeological information that has remained virtually untapped. A few of these occurrences have already been reported in print (Wormington and Forbis 1965; Carlson 1983; Gryba 1983; Ronaghan 1983) or in documents with limited distribution (Christensen 1971; McIntyre 1975; Doll and Kidd 1976; McCullough et al. 1981). However, the most extensive survey to date remains that conducted by Wormington and Forbis in the mid-1950s, almost 30 years ago. But this and later surveys by other researchers have all been part of larger general studies which did not focus solely on the Fluted Point Tradition. Other studies, such as the work at the Urkevich site near Drayton Valley (Doll and Kidd 1976), concentrated only on one small area of the province. Until now, there has been little attempt to carry out a province-wide survey of fluted point occurrences as a separate, independent study.

Since 1980, motivated by the discovery of fluted points at the Sibbald Creek site (Gryba 1983) and by Arthur Robert's inventory of Paleo-Indian finds for the revised edition of the Historical Atlas of Canada, Maurice Doll and I have sought to track down and document all known discoveries of fluted points made in Alberta. When the survey is complete, it is likely that over 75 examples will have been documented. This paper is meant to provide a provisional account of the survey to date. Hopefully, it will also generate some reader response regarding other finds or information relevant to this study. A much more detailed descriptive report of the findings will be published upon project completion.

Most of the documented fluted point finds consist of surface recoveries by farmers and amateurs. In some cases, specific provenience has not been recorded and is highly suspect. Still, it is felt that these specimens can yield valuable information about the Fluted Point Tradition, particularly in terms of distribution, local settlement pattern, raw material utilization, and techniques of production. The relatively large number of points, their fairly wide geographic distribution, and the overwhelming reliance on local quartzites and siltstones, suggest that this part of North America supported a resident human population perhaps as early as 11,000 years ago. At the very least, this study will help fill in the map of early Paleo-Indian occupation of North America. There are also obvious implications of this survey for shedding light on broader research questions, notably on the origins of the Fluted Point Tradition, and its north-south connections. This paper presents the preliminary observations.

PALEOECOLOGY

A brief statement on the paleoecology of Alberta is necessary to demonstrate that this part of North America could have supported Paleo-Indian hunters during the period 11,500 to 10,000 years ago. A detailed history of ice movements in Alberta, identifying periods of glacial stagnation or local and temporary re-advances, remains to be worked out (see Vickers, this volume). Radiocarbon dates on organic matter recovered from sediment basins located above the most recent till (18,500 ± 1090 B.P. [GSC 2670] and 18,400 ± 380 B.P. [GSC 2668] at Chalmers Bog near Turner Valley [Jackson 1979] and around 11,600 years B.P. from the Saddle Hills near Grande Prairie [White 1984:7]) indicate that portions of western Alberta were already ice-free at a relatively early time. Dates of 11,400 ± 190 B.P. (GSC 1049) at Lofty Lake east of Athabasca (Lichti-Federovich 1970) and 11,300 ± 170 B.P. from Moore Lake (Schweger et al. 1981:54) suggest that even the east-central part of Alberta was ice-free during the time of Clovis florescence on the Central and Southern Plains. A host of radiocarbon dates (Jackson 1983) indicates that all but the extreme northeastern corner of the province was free of ice by the final days of the Folsom Culture on the Central Plains, at around 10,000 years ago.

Alberta covers a large area and comprises a diversity of physiographic situations, from low, rolling plains to high, rugged mountains. Because of these altitudinal and latitudinal differences, modern environments range from shortgrass prairie in the south to boreal forests, high alpine meadows and snow capped peaks in the northern and western parts of the province. Time-transgressional environmental conditions resulted from changing post-glacial climatic and moisture situations. At the risk of oversimplification, the following passage by Schweger et al. offers a terse summary of the nature of these changing late glacial conditions:

> During glacial times cold xeric-adapted tundra vegetation developed in the unglaciated foothills of southern Alberta. This periglacial vegetation persisted into the late glacial, and expanded northwards as ice recession continued. Rapid warming near 11,300 to 11,200 years B.P. resulted in widespread ice stagnation, and the rapid invasion of arboreal vegetation until boreal forest was established over central Alberta. This warming trend appears to have continued unabated into the early Holocene when drought and evaporation dropped lake levels and enabled prairie vegetation to expand northwards. We would suggest that the period of significant drought began approximately 9,000 B.P. (1981:58).

The basal zone from Lofty Lake, radiocarbon dated at 11,400 ± 190 B.P., contained a pollen assemblage dominated by *Populus*, *Salix*, *Shepherdia* and *Artemisia* and minor amounts of *Picea* (Lichti-Federovich 1970). Lichti-Federovich (ibid.:938) interprets the evidence to represent a forest and shrub community which occupied the area immediately after deglaciation. The marked increase in *Picea* pollen and decline in *Populus* and *Artemisia* around 9,800 B.P. was suggested to represent a rapid replacement of the Late Pleistocene pioneer poplar forest by spruce forest. Lichti-Federovich (ibid.:941) noted this to be a regionally prevalent successional process.

An aspen parkland environment at around 11,600 years ago is suggested by pollen studies carried out at Boone Lake in the Saddle Hills northwest of Grande Prairie (White 1984). However, boreal forest is indicated at Moore Lake, situated just west of Cold Lake, which yielded a radiocarbon date of 11,300 ± 170 B.P. for the basal zone. The pollen assemblage contained high percentages of Populus, Betula and Picea, with only a small occurrence of Pinus (Schweger et al. 1981:54).

The findings of Mott and Christiansen (1981:133-136) at Martens Slough near Saskatoon may reflect conditions that existed along the Alberta - Saskatchewan border in late glacial times. A basal date of 11,070 ± 245 years B.P. (S-1199) was obtained from this site. According to the authors:

> ...shrubs and herb vegetation prevailed from about 11,000 to 10,500 years ago. Spruce trees then invaded the area but were replaced about 10,000 years ago by grassland vegetation which prevailed to the present (ibid.:133).

Ritchie (1978:27) suggests that the replacement of the late glacial forest by prairie-steppe occurred on the southern Plains of Alberta about 10,500 B.P., and then proceeded north.

The existence of tundra-like conditions along the southern Alberta Foothills at the end of the Pleistocene is suggested by palynological evidence dated to well before 11,250 years ago at Fairfax Lake, northwest of Rocky Mountain House (Schweger et al. 1981:50), and around 18,500 years B.P. west of Turner Valley (Jackson 1979:108). At Yamnuska Bog, located at Morley Flats just east of the Bow River's exit from the Rocky Mountains, the basal zone yielded a pollen assemblage indicative of a fairly open environment dominated by Artemisia, Juniperus, Salix, and Populus (MacDonald 1982). The next zone indicated a marked increase in pollen concentration, dominated by Pinus with significant amounts of Picea, and important subdominants such as Betula, Salix, and Alnus (ibid.:29). MacDonald estimates the boundary between these two zones to date to between 11,000 and 10,000 years ago. Fossil remains of Camelops cf. hesternus, Bison bison antiquus and Equus conversidens recovered from the Calgary area, and radiocarbon dated to 11,300 ± 290 years B.P. (RL-757), reflect a somewhat open habitat with a vegetative cover that included broad-leafed trees and grasses (Wilson and Churcher 1978:729).

THE EMPIRICAL EVIDENCE

By the end of the 1984 field season, a total of 60 examples which might belong to the Fluted Point Tradition were examined. More than half a dozen leads remain to be followed up. The only sites to have yielded more than one fluted point are Sibbald Creek, Lake Minnewanka, the Frank Lake area south of Calgary, one of the Johnston localities near Cereal, and the Urkevich site near Drayton Valley. Thirty-five examples represent isolated finds of fluted points, often at sites where later prehistoric material was also recovered.

Obviously, a fundamental problem of this study centres around the difficulty of identifying artifacts recovered in Alberta which can be unquestionably attributed to the Fluted Point Tradition. Figure 1 illustrates a sample of possible contenders of the Fluted Point Tradition found in this province. Because all presently known examples were recovered from the surface or from shallow, mixed contexts, there are the additional problems of demonstrating contemporaneity of technologically similar examples, and of chronological ordering of the different types. There have been no undisturbed fluted point components excavated in the Canadian Plains which might contain the range of point styles produced by a single band of hunters. In addition, the situation is complicated by the fact that many examples recovered from disturbed, surface contexts have been reworked. Still others are fragmentary and lack the diagnostic basal portion. In short, we simply lack reliable evidence which would illustrate the range of variation in projectile points produced by the early Paleo-Indian hunters in Alberta.

However, there are formal and technological differences among fluted points from the same site, while similarities exist among points found at different sites. This is evident among the artifacts recovered from the shallow and poorly stratified Sibbald Creek site (Figure 2), and in surface finds at Lake Minnewanka (Figure 1 c and d) and Drayton Valley (Figure 1 i and j). Technological differences can even be seen on obverse and reverse aspects of the same specimen. The two fluted points recovered from the Sibbald Creek site, for instance, exhibit three different styles of surface treatment: a central channel flake removed subsequent to smaller lateral flakes (Figure 2 a and c), multiple fluting

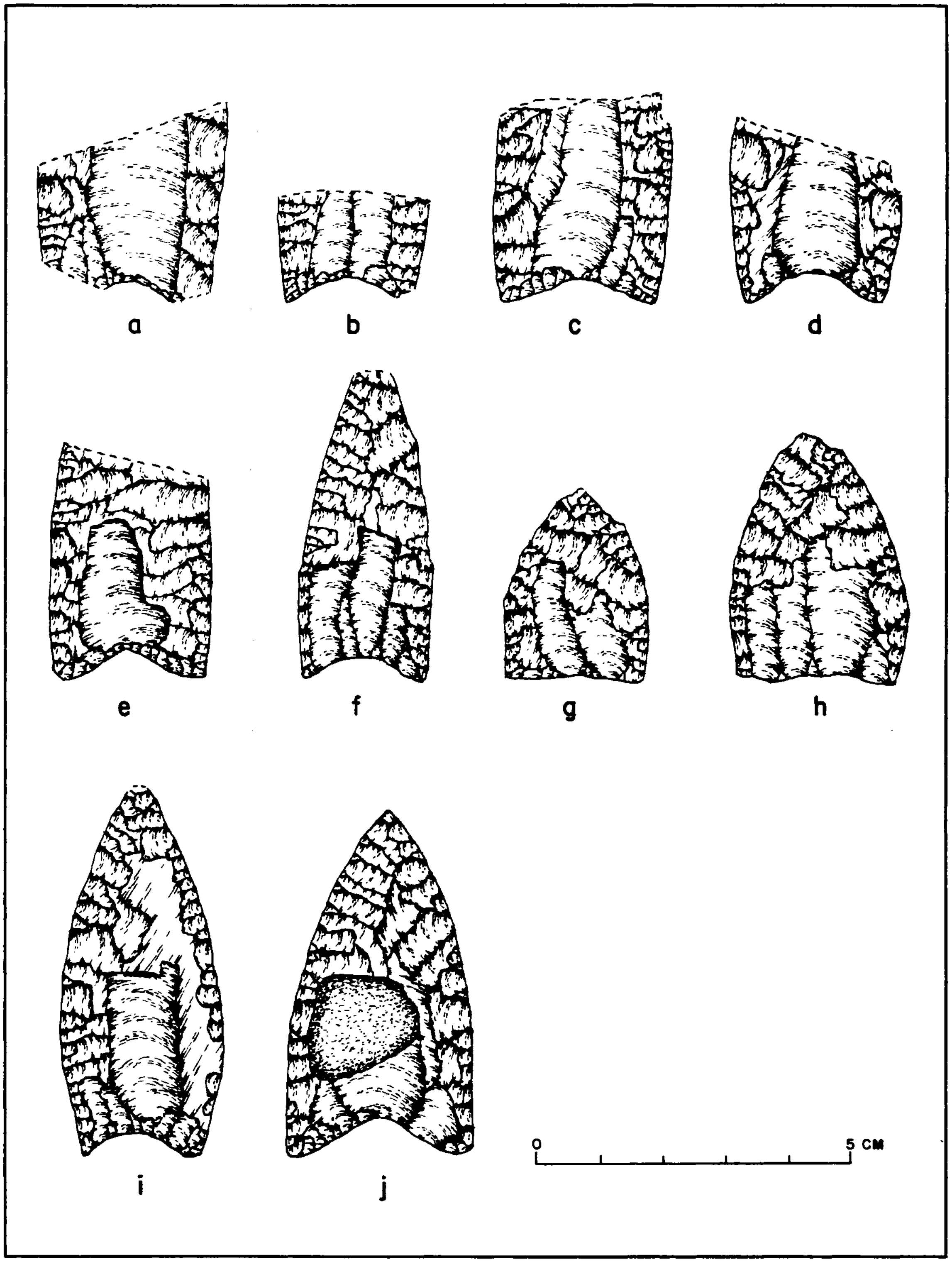

Figure 1. Sample of fluted points recovered from the surface at various locations in Alberta: the Hand Hills (a), High River (b), Lake Minnewanka (c and d), Penhold (e), Red Deer ? (f), Genesee (g), Buffalo Lake (h).

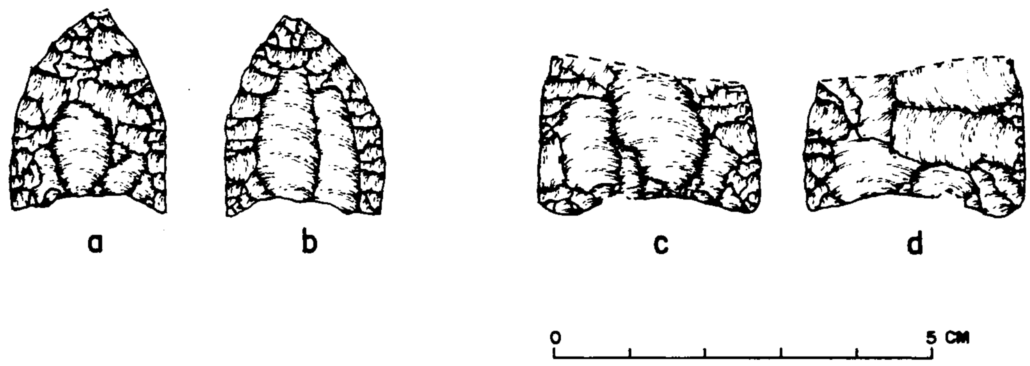

Figure 2: Obverse and reverse aspects of the two fluted points recovered from the Sibbald Creek site illustrating three different styles of surface treatment.

(Figure 2 b), and the lack of any fluting (Figure 2 d). This evidence illustrates some degree of variability in point production. An important factor accounting for technological or formal variations must certainly have been the variable quality and quantity of available raw lithic material. It also is likely, as I have suggested elsewhere (Gryba 1978:17), that hunters in territories peripheral to the Clovis and Folsom core areas were not restricted by social pressures to turn out carbon copies of fluted points but had greater freedom to experiment with different flaking and fluting techniques.

The final shaping of most of the fluted points examined thus far appears to have been accomplished by direct pressure flaking. It is likely that even the channel flakes on most examples were removed by direct hand-generated pressure. However, indirect pressure or percussion may have been used to strike off the channel flakes from both faces of a boldly fluted quartzite specimen found near the Hand Hills (Figure 1 a). None of the Alberta fluted points studied to date in this project have the central basal nipple, a trait present in the regional variant of Folsom points excavated at the Folsom site (Wormington 1957: Figure 7), the Agate Basin site (Frison and Zeimens 1980: Figure 2), the Carter/Kerr-McGee site (Frison 1984: Figure 11a), or on several examples recovered from the surface in southeastern Saskatchewan (Kehoe 1966: Figure 3 f and h).

The range of both formal and technological variations could be expanded further if the unfluted example recovered from Sibbald Creek (Gryba 1983: Figure 30 a) or those from Lake Minnewanka (Carlson 1983: Figure 6.8 k and l) are included as part of the Fluted Point Tradition. The Sibbald Creek example, and several found by Johnston in the Little Gem area of eastern Alberta (Wormington and Forbis 1965: Figure 19 a and b, Figure 20 c), closely resemble the Midland form. The possible Midland contenders from the Little Gem area have previously been described as "Plainview" (ibid.:75), or "Plainview-like" (Pettipas 1980: Figure 7 No. 54).

The overwhelming percentage of fluted points found in Alberta are manufactured from locally derived quartzites and siltstones, rarely of chert or brown chalcedony. Only two Clovis examples made of brown chalcedony have been documented thus far. One of these was found in Lethbridge (Wormington and Forbis 1965: Figure 55), and a multiple fluted specimen was recovered near Cremona, northwest of Calgary. Both specimens display heavy patination. Brown chalcedony may also be represented by a Folsom base portion found near Frank Lake (Figure 1 b), and a midsection of a boldly fluted point recovered from north of Lethbridge. They are patinated white on both faces. Swan River Chert (Campling 1980), quite commonly used by later groups throughout southeastern Alberta, is represented only by the Midland point from Sibbald Creek. No fluted points of this material, or of obsidian, have yet been discovered in this part of the Northern Plains. Ivory or bone points, such as those reported from the Clovis and Folsom levels at the Agate Basin site (Frison and Zeimens 1980), may have been used to supplement those made of stone. Again, no such examples have been reported from Alberta.

COMPARISONS

The Alberta survey for fluted point finds has not yet advanced to a stage where it is possible to present exact or relative numbers of the different styles of fluted points. However, most of the fluted points appear similar to the Clovis style or to the small triangular, multiple fluted forms reported from Alaska and the Yukon (Clark and Clark 1983), and from Charlie Lake in northeastern British Columbia (Fladmark and Gilbert 1984). The latter type has also been recognized in Saskatchewan by Kehoe (1966: Figure 4) who referred to them as "atypical fluted points".

The practice of multiple fluting, observed on some Alberta specimens, is also evident on points reported from the Great Basin (Carlson 1983: Figure 6.8 i) and the Southern Plains (Leonhardy and Anderson 1966: Figures 19 and 20). The basally thinned examples found at the Domebo mammoth kill site have been compared by Leonhardy and Anderson to the Plainview type (ibid.:20-24).

In terms of fine workmanship and boldness of fluting, the Folsom style is represented by isolated finds of point midsections recovered near Champion, the Hand Hills and south of Medicine Hat, and the base portion of a heavily patinated, sharp-eared example found near High River. Wormington and Forbis (1965:152) categorize a fluted point found near Vilna, northeast of Edmonton, as Folsom on the basis of the length of the channel flakes removed (ibid.: Figure 65 b).

The unfluted specimens from the Little Gem area (Wormington and Forbis 1965: Figure 19 a and b, Figure 20 c), and from the Sibbald Creek site (Gryba 1983: Figure 30 a), appear similar to Midland points in both form and technology. The delicate lateral edge retouching present on the point from the Sibbald Creek site is an additional trait very commonly seen on Folsom fluted points reported from the Central and Southern Plains.

GEOGRAPHICAL DISTRIBUTION

Examples of fluted points have been recovered from central and southern Alberta, roughly south of a line extending from Peace River to

Cold Lake. The finds coincide largely with the major extent of cultivated land, which is not surprising, considering that most of the discoveries were made by farmers, artifact collectors, and amateur archaeologists. Along the western part of the province, the distribution extends into the forested foothills at Sibbald Creek and Grande Cache, and into the Front Range of the Rocky Mountains at Lake Minnewanka in Banff National Park. No fluted points are known from the northern belt of farm land located along the lower extent of the Peace River between High Level and Fort Vermilion. Similarly, no fluted points have been discovered in the heavily forested northeastern portion of the province, in spite of many research projects (e.g., Donahue 1976; Pollock 1978; Gruhn 1981), and surveys and excavations that have resulted from highway construction and energy project developments.

The Folsom and Midland examples, with the exception of the boldly fluted specimen found near Vilna, are restricted to southern Alberta, south of a line extending from Sibbald Flat east through the Hand Hills and Cereal district. On the other hand, Clovis and the multiple fluted triangular examples have a wider distribution, i.e., as noted above.

One interesting pattern which has emerged from this study is that the stubby, reworked fluted point forms (Figure 1 g and h; see also McCullough et al. 1981: Figure 17; Ronaghan 1983: Figure 19a) are distributed mainly throughout the central part of the province, from Buck Lake through to Buffalo Lake and Hanna and north to Cold Lake (Figure 3). All of the reworked specimens are made of local quartzites or siltstones. These are lithic materials that are relatively plentiful along lake shores and streams and are readily available during the snow-free period. One interpretation I propose is that sites which have yielded these reworked fluted specimens reflect the winter range of Paleo-Indian hunters. This interpretation is based on the assumption that, because access to raw lithic material from which new points could be manufactured was hindered by snow cover during winter months, it was necessary to resharpen rather than discard damaged or broken points. Adding strength to this hypothesis is the observation made by Fladmark and Gilbert (1984:10) that the incidence of exhaustive resharpening of fluted points is more prevalent in the northeastern part of the continent and in Alaska than it is in the southern part of North America. This

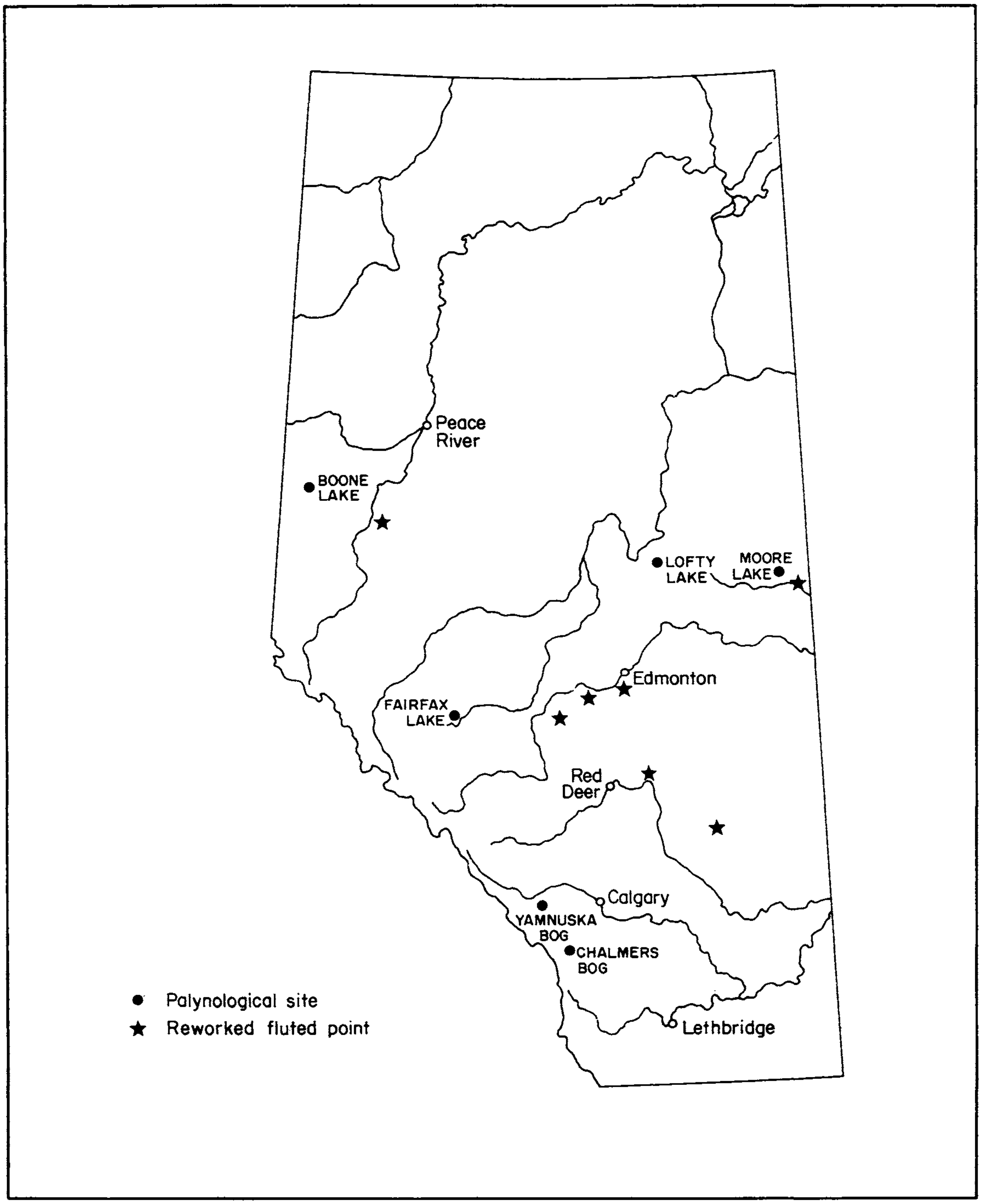

Figure 3. Location of palynological sites mentioned in text, and the distribution of reworked fluted points in the central part of the province.

hypothesis does not negate the probability that other parts of the province, for instance, the Rocky Mountain Foothills, would also have been important wintering areas for early Paleo-Indian hunters.

AGE

There are no radiocarbon dates on Fluted Point Tradition components in Alberta. Age estimates are made by reference to dated sites in other parts of the continent. On the Southern and Central Plains, Folsom components have generally been dated between 10,000 to 11,000 years B.P., while Clovis examples fall in the 11,000 to 11,500 years B.P. range (Haynes 1980:115). In the eastern part of the continent, the Debert site in Nova Scotia produced 13 acceptable dates which averaged 10,600 ± 47 years B.P. (MacDonald 1968:53). This average is supported by two recent dates from the Vail site in Maine, 10,610 ± 330 years B.P. (AA-114) and 10,456 ± 325 years B.P. (AA-117; Gramly, personal communication 1984); the cultural material from this site was quite similar to that reported from Debert.

The discovery of two fluted points near the base of the cultural deposits at the Sibbald Creek site (Gryba 1983: Figure 79) is an indication of the relative antiquity of the Fluted Point Tradition in southwestern Alberta. At Charlie Lake near Fort St. John, British Columbia, bison bones, recovered from the level which is believed to have yielded the reworked, multiple fluted point, gave radiocarbon dates which averaged 10,487 years B.P. (Fladmark and Gilbert 1984:7). The ages of the fluted points reported from Alaska and northern Yukon Territory remain unresolved (Clark 1984).

ORIGIN

In terms of the origin or origins of fluted points, the dispersed and relatively sparse occurrence of fluted points, in comparison to later Paleo-Indian complexes (especially Cody), suggests that the population density in Alberta may not have been very large. Thus, it seems unlikely that Alberta can be considered a place for <u>in situ</u> development. Rather, I would suggest Alberta to be an area which fluted point technology reached by migration of people or through cultural diffusion. Whether the Fluted Point Tradition originated south of the Pleistocene ice sheet, or in Alaska as suggested by Clark and Clark (1983), is a problem which further research may resolve.

CONCLUSIONS

Artifacts of the Fluted Point Tradition found throughout the southern two-thirds of the province provide the best evidence now available for the earliest human occupation of Alberta. The study is incomplete and the results are only preliminary. However, the results do indicate that surface finds, albeit often lacking precise contextual data, could offer a relatively practical source of information on Alberta prehistory. There are obvious deficiencies in the archaeological data base when dealing with the Fluted Point Tradition in Alberta. The most immediate of these is the lack of comparative material in context from local excavated sites.

The occurrence of points similar to the Clovis and Folsom types with respect to form and workmanship, and the occasional presence of specimens made of brown chalcedony, suggest a Central Plains connection for some groups of hunters who occupied Alberta at the end of the Pleistocene. It was suggested that the technological and formal variability seen in many of the fluted points found in this part of North America may have largely been due to the nature of the local raw lithic material used in the manufacture of many of the points, and to the peripheral location of Alberta relative to the core areas of the fluted point cultures of the Central Plains.

The evidence from Charlie Lake in northeastern British Columbia indicates that a small, multiple fluted variety dates to the middle of the range established for Folsom on the Central and Southern Plains. Until stratigraphically sealed fluted point components are excavated in this part of the continent, the age and affiliation of many other examples which do not fall within this category, or within the classic Clovis and Folsom types, will remain open to debate.

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RECENT DEVELOPMENTS IN PALEO-INDIAN ARCHAEOLOGY IN MANITOBA

By
Leo Pettipas
Manitoba Culture, Heritage and Recreation

INTRODUCTION

Since the mid-1960s, the Paleo-Indian prehistory of southern Manitoba has been the subject of ongoing consideration (cf. Buchner 1981; Gryba 1966, 1968; Haug 1981; Hlady 1969; Pettipas 1967, 1976; Pettipas and Buchner 1983; Steinbring 1966). The purpose of this paper is to summarize the "state of the art" as of 1984.

SYSTEMATICS

Most of the Paleo-Indian record from Manitoba comprises surface finds of projectile points. The bulk of these fall into two broad categories: 1) narrow leaf-shaped lanceolate forms, made up of specimens of the Agate Basin, Hell Gap, and Lusk types; and, 2) stemmed forms, including such types as Alberta, Scottsbluff, and Eden. For the sake of convenience, these two groups have been named Sister's Hill and Horner, respectively. These terms are adopted from Henry Irwin's (1971) Paleo-Indian chronology for the Plains region, which was based on Willey and Phillips' (1958) phase-subphase scheme. For the purposes of this paper, the relevant portions of the scheme are as follows:

1. The Sister's Hill Phase includes Agate Basin and Hell Gap subphases.
2. The Horner Phase includes the Alberta and Cody subphases.

The relationship between projectile point types on the one hand and phases and subphases (complexes) on the other was summarized by Irwin and Wormington as follows:

> One or more components make up a complex characterized by a single projectile point type. Both stratigraphy ... and radiocarbon dating ... demonstrate a succession of these types, in time, on the Plains; and while there is variation

> in the projectile points of a type, there is no overlap between the successive categories themselves (1970:24).

Accordingly, the constituent subphases of the period 8500-6400 B.C. are mutually exclusive in terms of time and, as revealed at the Hell Gap site (Irwin-Williams, et al. 1973), are temporally distributed as follows:

Subphase/Complex	Time Correlate
Agate Basin	ca. 8500-8000 B.C.
Hell Gap	ca. 8000-7500 B.C.
Alberta	ca. 7500-7000 B.C.
Cody	ca. 6800-6400 B.C.

Although I use Irwin's terminology, I do not think his subphase distinctions separate out as neatly as the above chronological breakdown implies, if the entire Plains region and peripheries are considered. Nor does the neat one-point-type-per-complex (subphase) relationship bear up under scrutiny when some of the more recent research is taken into account. For example, Cody knives and Alberta and "Plainview-like" points were found in association at the Hudson Meng bison kill in Nebraska (Agenbroad 1978:129). However, the "Alberta Complex" was initially defined on the basis of excavations at Hell Gap, Wyoming (cf. Irwin-Williams, et al. 1973:48). The corresponding index marker for this complex was the Alberta point type; in no way did Cody knives or "Plainview-like" points figure into the Alberta Complex as originally defined. With the recovery of Cody knives and Alberta and "Plainview-like" points together at Hudson-Meng, some rather challenging problems arise for those taxonomists who would see the Alberta, Cody, and Plainview complexes as separable and distinguishable entities.

At the Fletcher site in southern Alberta, Scottsbluff Type I, Scottsbluff Type II, and Alberta points were all considered to have come from the same cultural horizon, in this case, a bone bed (Forbis 1968:5). Brian Reeves (1969:24), one of the excavators at the Fletcher site, subsequently coined the term "Alberta-Cody Complex". Elsewhere, Frison noted that:

> ... a very small number of Agate Basin points recovered in good context [at the Agate Basin site] do demonstrate a slight shoulder that is reminiscent of the Hell Gap point type and this could be used to argue for a direct lineal relationship between Agate Basin and Hell Gap (1982:366).

A similar type of overlap problem concerns Agate Basin, Hell Gap and Lusk points. Of the Angostura (Lusk) points, it has been observed that, " ... the latter are so like Agate Basin points that they would seem to be variants of a single basic type, rather than two distinct types" (Wormington and Forbis 1965:23), a point of view with which I concur. Thus, there would seem to be demonstrable temporal and stylistic overlap between Agate Basin, Hell Gap and Lusk points, to the extent that it is very difficult indeed to separate them as exclusive diagnostics of temporally discrete subphases or complexes.

The same problems apply to the Horner group of point types, but one can also see that temporal overlap exists between the Horner and Sister's Hill expressions. For example, the Olsen-Chubbuck site contains a sizeable number of the Scottsbluff-like "San Jon" points (Wheat 1972: Figure 38) and has a radiocarbon date of 8200 ± 500 B.C. This date is earlier than that determined for certain Plains Agate Basin sites (e.g., Frazier, Brewster, Cherokee Sewer), although there are Horner components on record which clearly post-date these same Agate Basin sites (e.g., Horner, Medicine Lodge Creek, Hell Gap, Lamb Spring). Such evidence suggests that Scottsbluff point variants and Agate Basin points were being manufactured simultaneously on the Central Plains. Radiocarbon dating indicates that the Agate Basin form was being made and used well before the time of the Olsen-Chubbuck bison kill and the advent of the Scottsbluff point; however, if the Olsen-Chubbuck date is correct, it would also appear that the Agate Basin and Scottsbluff points were long-standing contemporaries on the Central Plains. The Olsen-Chubbuck date and those from the Plainview level at Bonfire Shelter (8280 ± 160 B.C., 8150 ± 300 B.C.) are also very close, indicating early contemporaneity between Scottsbluff and Plainview points. Furthermore, the Plainview-like "Frederick" point type is dated to the same time period as the Scottsbluff occupation at Hell Gap, while "Alberta points ... occur in and above the Hell Gap horizon" at Hell Gap (Wormington and Forbis 1965:22; emphasis mine).

With the foregoing in mind, I would suggest that the major weakness of the phase-subphase construct as used by Irwin is that it fails to take into account the significant temporal overlap in point types indicated by radiocarbon dating. The scheme correlates well with the stratigraphic successions observed at the Hell Gap and Blackwater Draw sites, but other data suggest considerable temporal overlap between different point types from within the Plains and peripheral regions. Irwin's scenario makes no allowance for cultural lag or trait persistence that might have led to contemporaneity of different point forms; stylistic change is assumed to have been both rapid and widespread, and the Hell Gap-Blackwater Draw sequence is considered applicable to the entire Plains region (see also Agogino 1968:3-4). The sum total of the Plano archaeological data available to date, however, does not support the view that this sequence "speaks for" all of late Paleo-Indian prehistory of the Great Plains and immediate environs. Indeed, the sequence as found at one site may, theoretically, be completely reversed at another. (This was, in fact, precisely what Frison [1983:120] encountered at the Medicine Lodge Creek site.) The upshot would seem to be that Irwin and Wormington's neat "stacked chronology" of discrete complexes, with their individual and mutually exclusive projectile point markers, is very much over-simplified.

At the same time, I have no difficulty with using Irwin's phase-level terminology, to the extent that each term subsumes several distinguishable point and knife types which are now being found in association with each other. Hence, when I use the term "Horner artifacts", I am including Alberta, Scottsbluff, Eden, Kersey, and stemmed Firstview points and Cody knives. The "Sister's Hill" rubric includes Agate Basin points (and all those considered to be Agate Basin-like), Hell Gap and Lusk points.

I should also acknowledge that my notion of "phase" departs conceptually from that of Irwin. In his scheme, the Horner Phase follows the Sister's Hill Phase. As far as I am concerned, the two can (and do) overlap in time; that is, in the temporal sense, they are not mutually exclusive. To me, a "phase" is basically a period during which something happened -- in the present context, a time when certain related and stylistically similar projectile point types were in use on the Plains. If we are speaking about the stemmed Plano types, we would use the term "Horner Phase" to refer to the corresponding time period. If the narrow, leaf-shaped lanceolate points are the topics of discussion, we would refer to their temporal correlate as the "Sister's Hill Phase". Which phase designator we choose will be a function of which cultural phenomenon we want to discuss. The fact that the phases in question may be contemporaneous does not negate use of the concept as I define it. If we wish to speak of the general time period without reference to either the Horner or the Sister's Hill cultural phenomena, we would use the term "Plano", e.g., "Plano time" or the "Plano Period". In sum, I use Irwin's terminology, but not his concepts.

PLANO PREHISTORY AND LAKE AGASSIZ CHRONOLOGY

From the time that Paleo-Indian prehistory was first being addressed in Manitoba, a major typological-geographical dichotomy was recognized, namely, that Horner points and Cody knives were to be found on and above (i.e., west of) the western Campbell strandline (Figure 1). The confinement of the Horner material to the country west of the Campbell beaches was initially considered a function of inadequate sampling, and it was expected that such specimens would eventually be found within the Agassiz Basin as well (Pettipas 1967:406). This argument was based on the assumption that the dating of the Cody types in the United States at that time was applicable to the Manitoba examples. The Cody time period (6600-6000 B.C.) post-dated the Campbell phase of Lake Agassiz (7900-7500 B.C.), so that Cody people could have moved into the sub-Campbell Agassiz Basin. However, in more recent considerations (1976), I accepted the absence of Horner materials within the Agassiz Basin as a fact. I then hypothesized that the Manitoba Escarpment/Campbell strandline functioned as a socio-cultural boundary between the Horner people, who came to occupy the uplands, and the indigenous Sister's Hill people, who forsook the high country for the Manitoba Lowlands as Lake Agassiz progressively diminished (Figure 2; see also Pettipas 1976:28).

Hlady (1969:4) was prepared from the outset to take the archaeological record at face value; he argued that because the finely flaked Cody points and knives were conspicuous among the prehistoric lithic assemblages of Manitoba, they would have been readily noticed by collectors whenever encountered in the field. He concluded that the absence of these forms from collections originating within the Agassiz Basin, then, was not a function of sampling error, and some other explanation for their absence would have to be found.

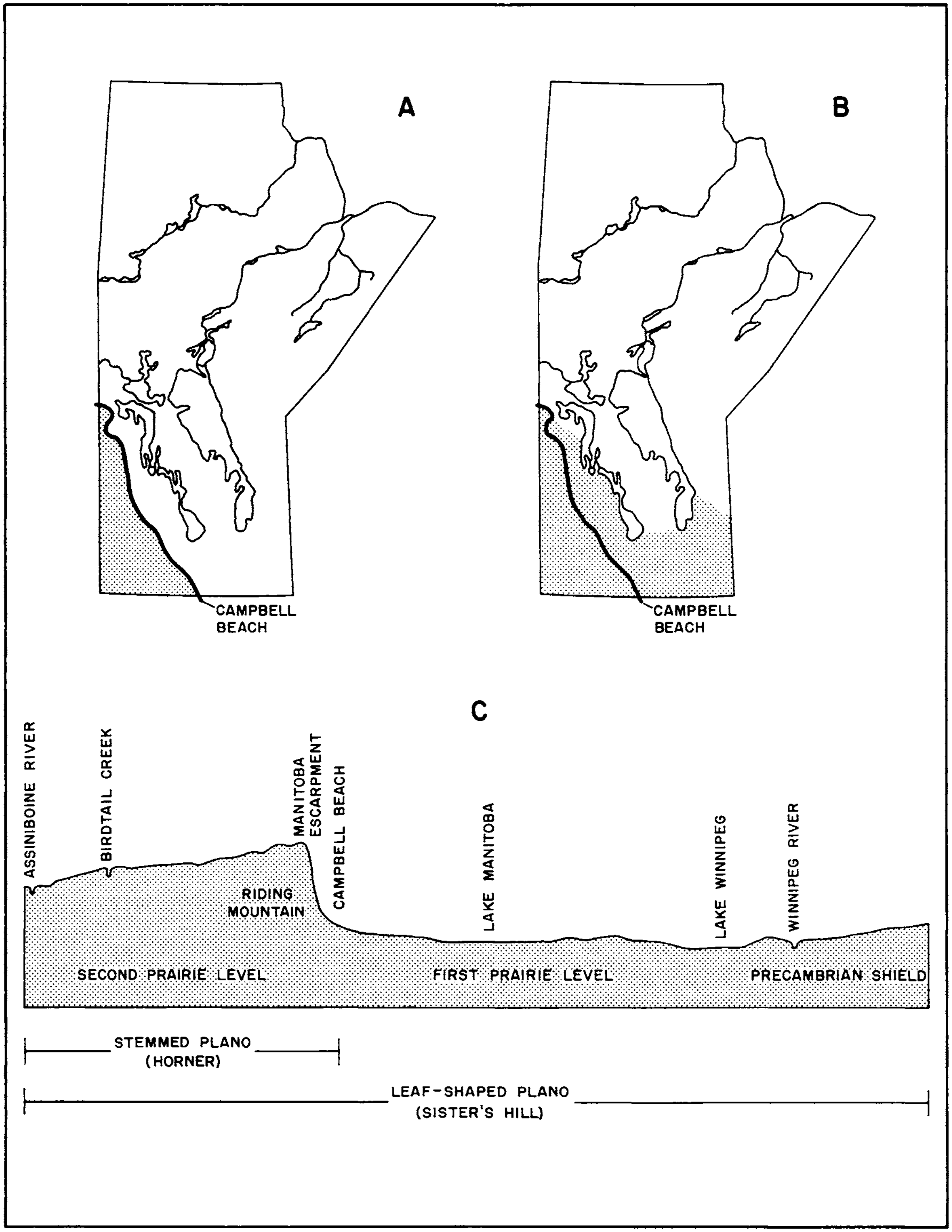

Figure 1. Distribution of Horner (A) and Sister's Hill (B) points in Manitoba. Diagram C shows southern Manitoba in east-west cross-section and corresponding extent of Horner and Sister's Hill point distribution (from Simpson 1982:83).

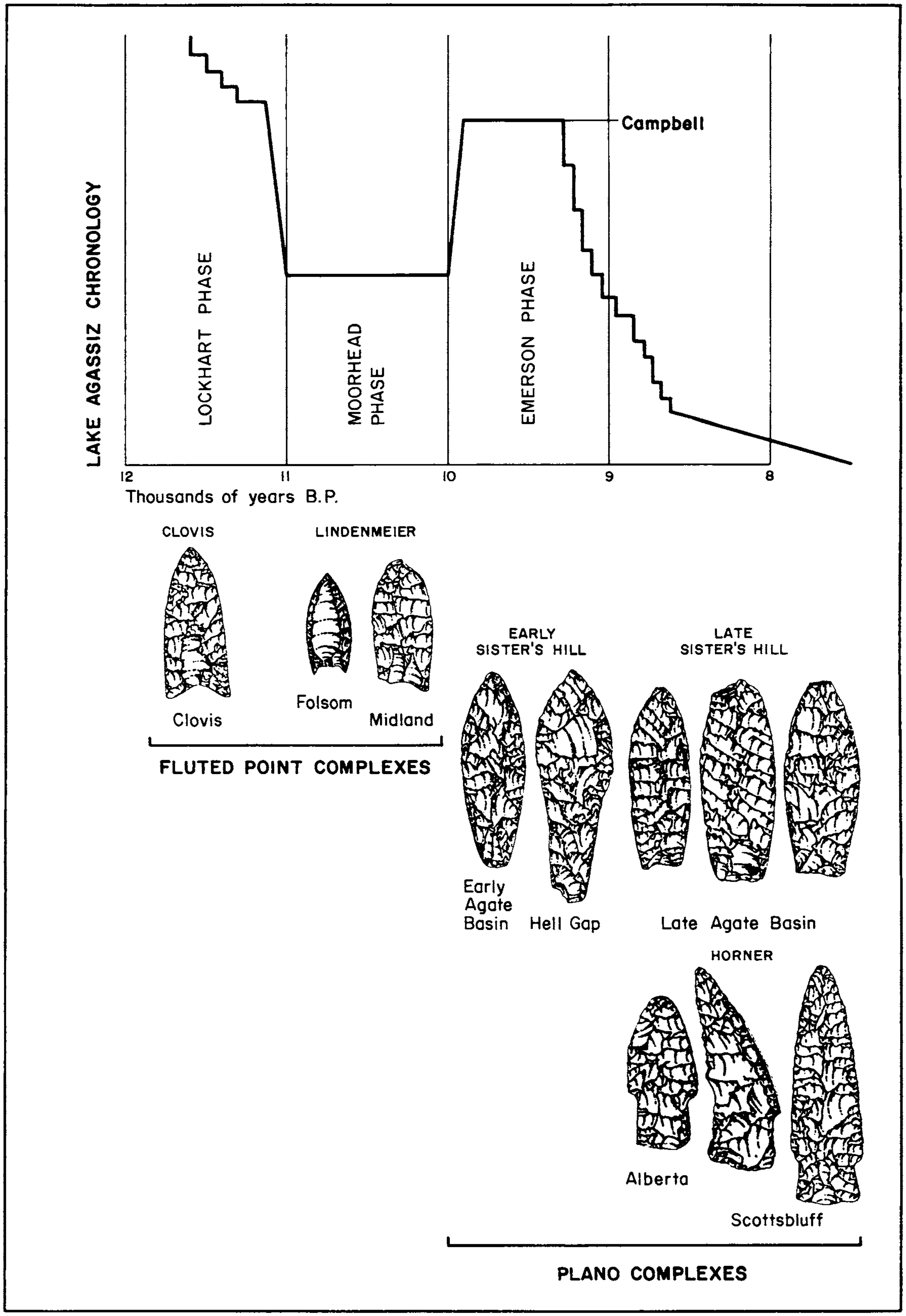

Figure 2. My Paleo-Indian sequence juxtaposed against the current Lake Agassiz chronology (Pettipas 1976; Pettipas and Buchner 1983).[1]

Alan Bryan's (1968:75) point of view coincided with that of Hlady insofar as he accepted the distributional scenario as valid. His explanation involved an assumption earlier rejected by myself, namely, that the Cody occupation of Manitoba coincided with the Campbell subphase of Lake Agassiz which, in Bryan's model, confined the Cody Complex to the area west of the Campbell strandline. By the time the lake had fallen below the Campbell level for the last time, the Cody Complex had run its course in this region of the Plains periphery. He also suggested that the typologically earlier specimens (Agate Basin, Hell Gap) found below the Campbell level were deposited during the low water interval (9000-8000 B.C.) that preceded the Campbell subphase.

Another writer who has attempted to explain the absence of Cody points below the Campbell strandline is Eugene Gryba. He feels that the ground surface within the Agassiz Basin during Cody times, while not actually inundated, was nonetheless sufficiently wet at critical times of the year to discourage any serious, long term occupation of the low-lying landscape of the Swan River Plain by Cody people (Gryba 1976:29).

The most recent writer to address this subject is David Simpson (1982:92) who, like Bryan, feels that the abrupt termination of Horner points at the western Campbell strandline could only mean that Lake Agassiz was present during the time of occupation (Figure 3). Recent developments, in Manitoba and elsewhere, are providing increasing support for the Bryan-Simpson point of view. For example:

1. The presence of well formed Horner points dated to as early as 8200 ± 500 B.C. at the Olsen-Chubbuck site in Wyoming, and the Alberta point-Cody knife association at the Hudson-Meng site in Nebraska dated at 7430 ± 100 B.C., push the Horner "tradition" back to the time of the Campbell subphase of Lake Agassiz. It may well be that the Horner Phase in southwestern Manitoba coincided with, and indeed was restricted to, the Campbell subphase of Lake Agassiz, thereby leading to the absence of Horner points in the Agassiz Basin.
2. A growing body of data from the Kootenay region of British Columbia points to early development of the stemmed point tradition of the Canadian Rocky Mountains. Choquette notes:

> On the east slope of the Canadian Rockies, culture complexes characterized by large stemmed points predate

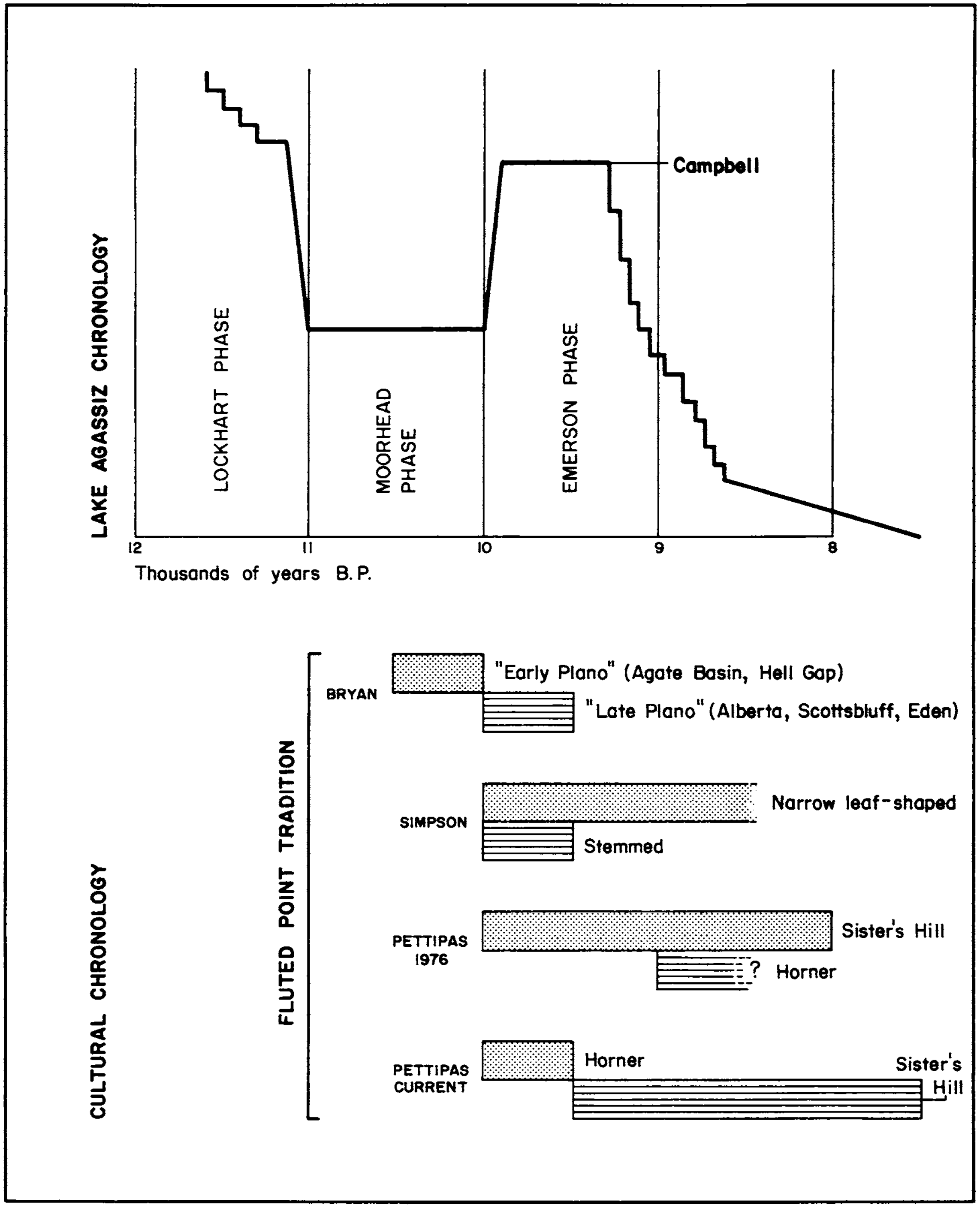

Figure 3. Correlation of four variations of Plano chronology with that of glacial Lake Agassiz.[2]

> Agate Basin components and in the Kootenay region ... Agate Basin-like points occur in geologically more recent contexts than do large stemmed points. Agate Basin points were found stratigraphically above large stemmed points at Fisherman Lake in the MacKenzie Corridor of the Northwest Territories (Millar 1968). Thus it appears that stemmed point users were already present in the western Canadian mountains and the MacKenzie Corridor prior to the northward spread of the Agate Basin form (Choquette 1982:10).

Of like mind is Reeves, who concurs with Wilfred Husted that:

> ... the Alberta-Cody complex exhibits a greater time depth in Alberta. Surface finds of points of this tradition seem considerably more frequent that either the preceding or succeeding complexes, suggesting either a larger population or longer habitation.
>
> One explanation for the abundance of these points is that they represent the first major occupation of Southern Alberta (Reeves 1969:29).

Thus, the Horner "tradition" may have originated in western Canada, and if the people were at all nomadic, it may be that the makers of the derivative Alberta, Scottsbluff and Eden points were in a geographical position to colonize southwestern Manitoba in early Plano times, not the makers of Agate Basin points.

3. In my earlier writing (1967), I assumed that the first Plano people to enter southwestern Manitoba were makers of Agate Basin points because:

   a) Agate Basin points are found there in relative abundance; and

   b) they are the oldest dated Plano points on the American Plains.

   However, radiocarbon dating has shown that Agate Basin points, or forms that appear to have evolved from them, are also comparatively late in western Canada (e.g., 5700 $\pm$ 105 B.C. at FdPe-4 in central Alberta [Doll 1982:ii]). Hence, the Manitoba expressions of this tradition <u>may</u> all be late, rather than early, with the people entering the province <u>after</u> Lake Agassiz began to fall from the Campbell level. If so, the Plano sequence for southwestern Manitoba is the reverse of that found at Hell Gap and Blackwater Draw.

4. The foregoing conclusion draws some measure of support from the Jalowica site, situated well below the Campbell beach near Duck

River, Manitoba (Jalowica 1980). This site produced three Paleo-Indian point forms: Agate Basin-like, Hell Gap, and a type I have named "Manitoba" (Figure 4; see also Pettipas 1972, 1980). All were surface finds, but it is my feeling that they all belonged to the same component. "Manitoba" points have been radiocarbon dated at 6100 ± 240 B.C. in the Big Horn Mountains of Wyoming and at 6600 ± 270 B.C. (RL-873) at DjPo-47 in the Rocky Mountains of Alberta (Driver 1982). Both of these assays postdate the Campbell subphase of Lake Agassiz. Therefore, if the Jalowica finds do indeed represent a single component and if they are essentially of the same antiquity as the dated Wyoming and Alberta examples, there is then some reason to believe that they were deposited after Lake Agassiz commenced its final drainage around 7500 B.C., and not during an earlier low water interval, as was suggested by Bryan (1968:75).

5. In his recent study of the Parkhill site in south-central Saskatchewan, Ebell (1980:i) suggests that the region was occupied by makers of Agate Basin-like ("Parkhill Lanceolate") points between 6500 and 6000 B.C. This is in accord with the growing impression that the Canadian Plains manifestations of leaf-shaped Plano points fall within the more recent end of the narrow leaf-shaped point tradition.
6. The Caribou Lake Complex of southeastern Manitoba (Figure 5), characterized solely by narrow leaf-shaped lanceolate points, has been radiometrically dated at 6080 ± 160 B.C. (OxA-116) at the Sinnock site on the Winnipeg River (Buchner 1983).

EASTERN ORIGINS

It has been known for some time that Agate Basin-like points occur in the Shield country of southeastern Manitoba (Steinbring 1977, 1980:24-52). Initially, it was believed that their presence in the region was the outcome of migration from the east, in particular, from the Thunder Bay district of Ontario, where similar materials are equated with the "Lakehead Complex" (Fox 1975, 1977). This idea was reinforced by the occurrence along the Winnipeg River of artifacts made of "oolitic jasper", also know as "jaspillite" and "taconite". Until recently,

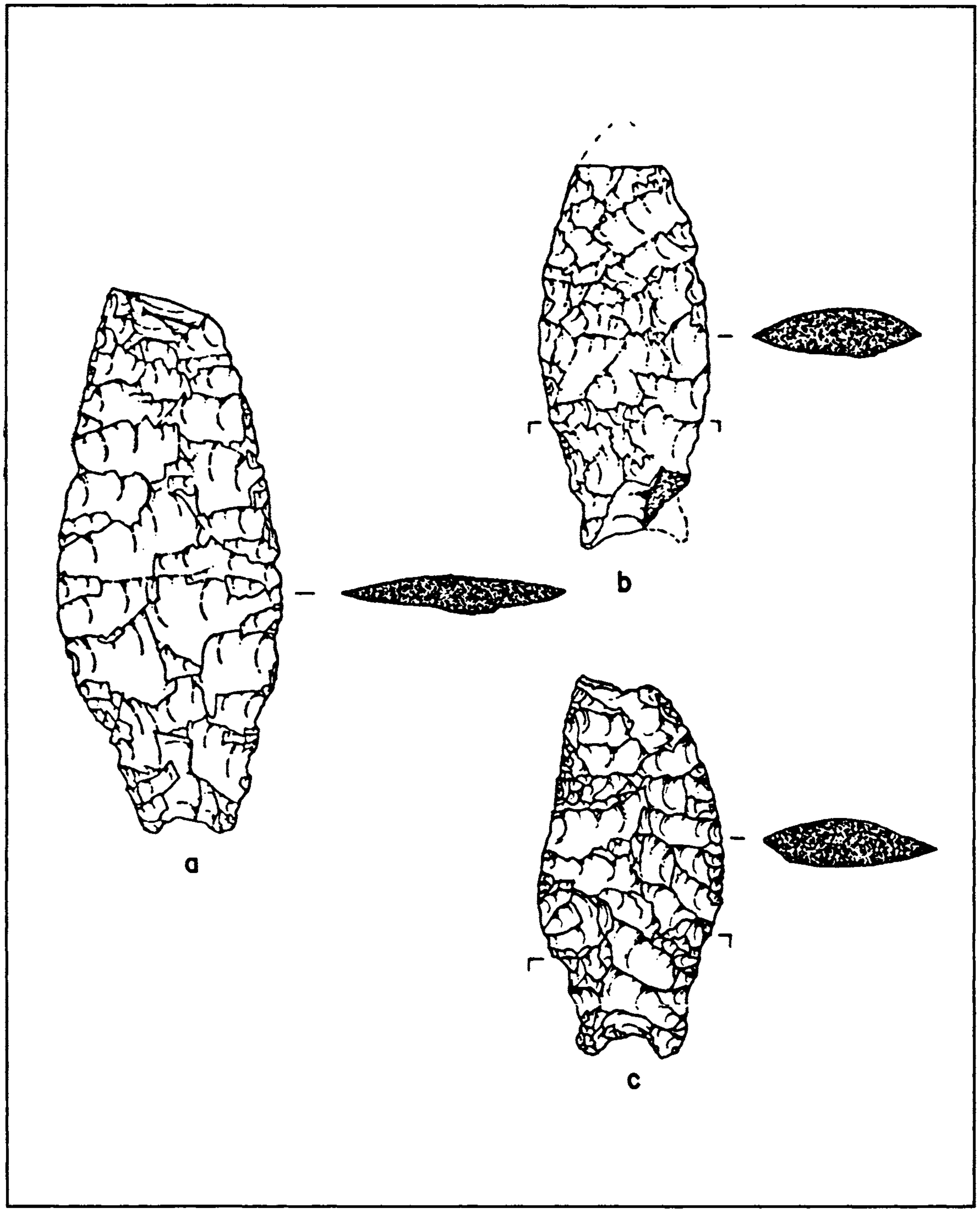

Figure 4. Manitoba points from the Jalowica Locality (A,B) and from the Medicine Lodge Creek site (C). Natural size. (From Pettipas 1980:2, except specimen C, redrawn from Frison 1978:Figure 2.4c).

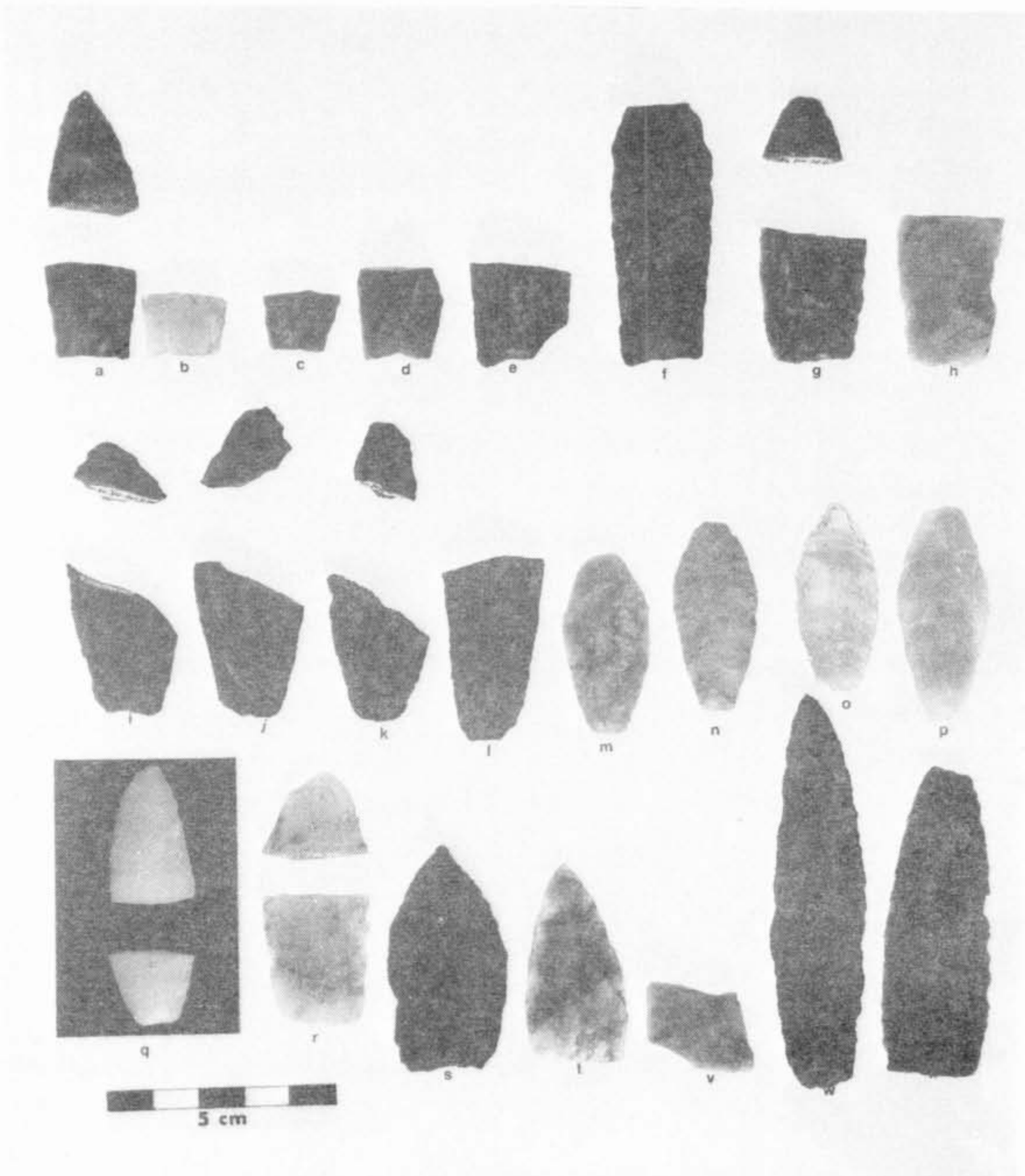

Figure 5. Projectile points and point fragments from the Sinnock site of the Caribou Lake Complex, a Sister's Hill derivative (from Buchner 1981:38).

archaeologists were of the opinion that the only natural source of taconite was the Cummins Quarry site near Thunder Bay (Steinbring 1980:30). It has now been confirmed that another bedrock source of oolitic jasper exists, in the Sutton Hills of extreme northern Ontario (Figure 6), and that the material occurs in the glacial tills of both northwestern Ontario and Manitoba (E. Nielsen, personal communication; see Figure 7). Hence, the artifacts of this material found on the Shield of southeastern Manitoba could conceivably have been made from stone found in local tills. Consequently, the presence of this material no longer automatically implies population migration from the Thunder Bay district.

The above notwithstanding, there is evidence in western Manitoba for some manner of late Paleo-Indian connection with the Upper Great Lakes region. Over 15 years ago, Steinbring (1968:3-12) reported and discussed the implications of the "McCreary" point recovery. The artifact was of the basic narrow, leaf-shaped, lanceolate projectile point form (Figure 8); of particular significance, however, is the fact that it is made of native copper. In the summer of 1983, a second McCreary point was found near Birch River, Manitoba. Unlike oolitic jasper, the material from which the McCreary points were made could not have come from any of the residual tills of Manitoba; its origins <u>have</u> to lie somewhere in the upper Great Lakes region.

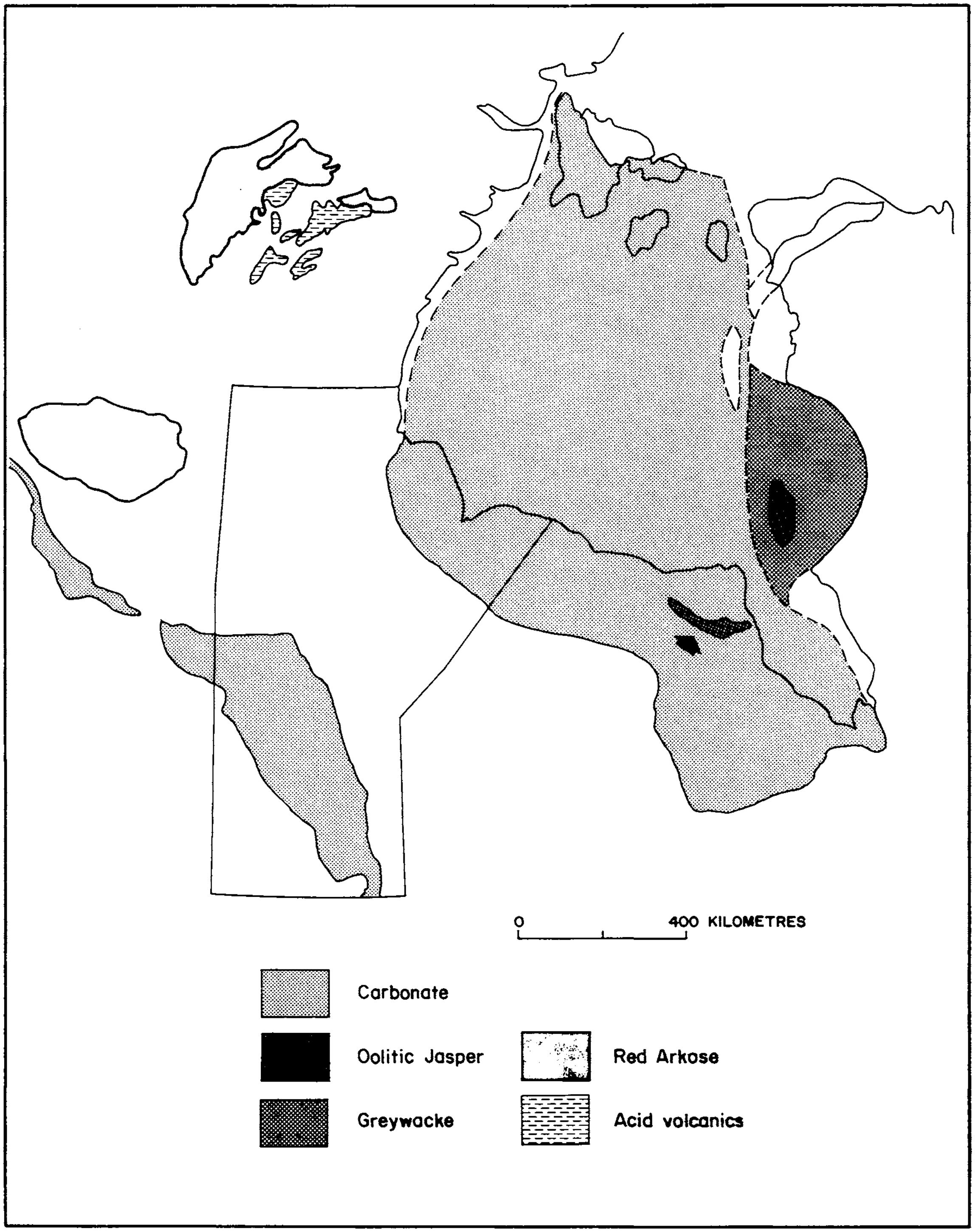

Figure 6. Erratic source areas (arrow showing location of the Sutton Hills in northern Ontario). Courtesy of Dr. Erik Nielsen, Manitoba Energy and Mines.[3]

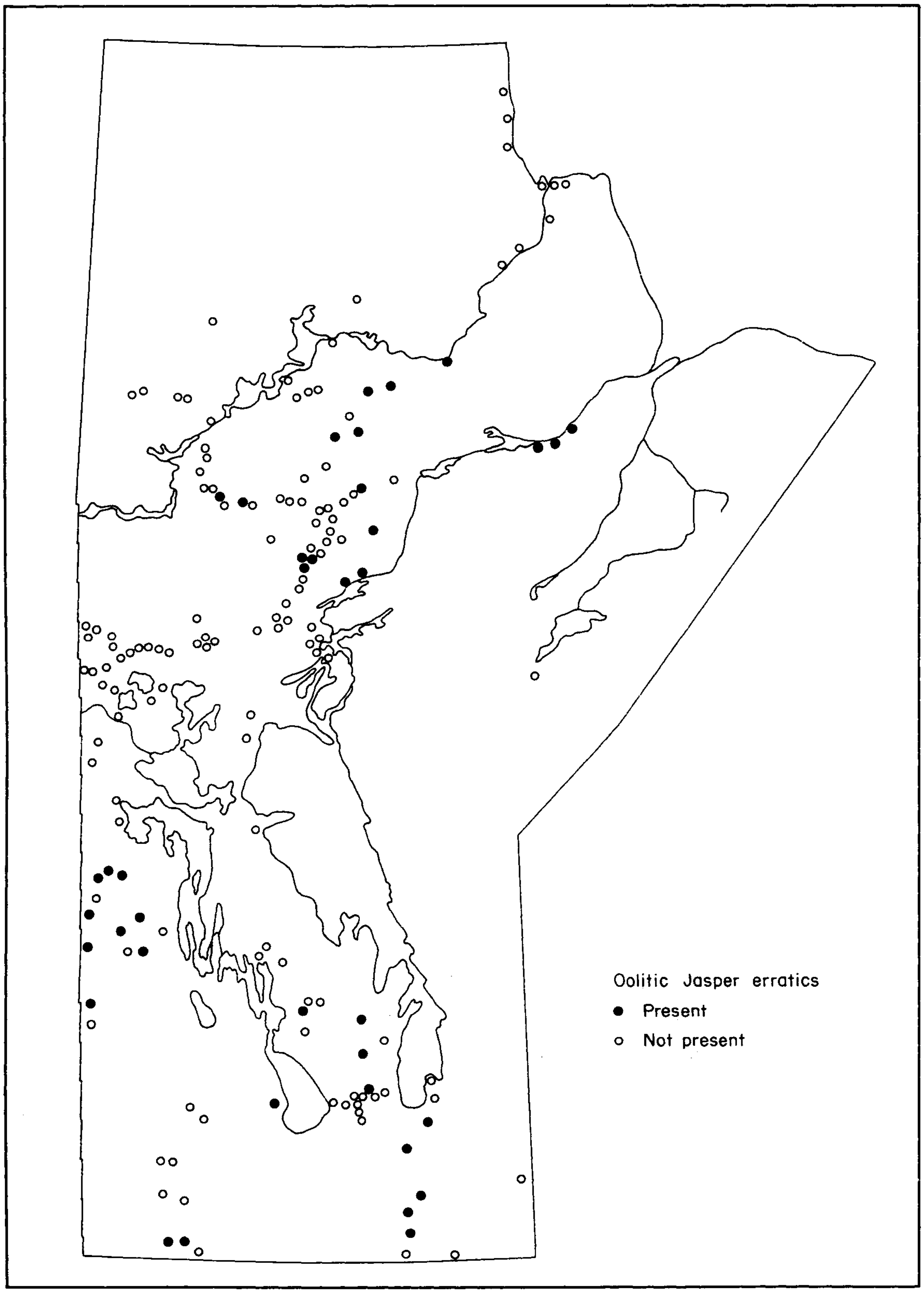

Figure 7. Distribution of sites sampled for taconite in Manitoba.
Courtesy of Dr. Erik Nielsen, Manitoba Energy and Mines.

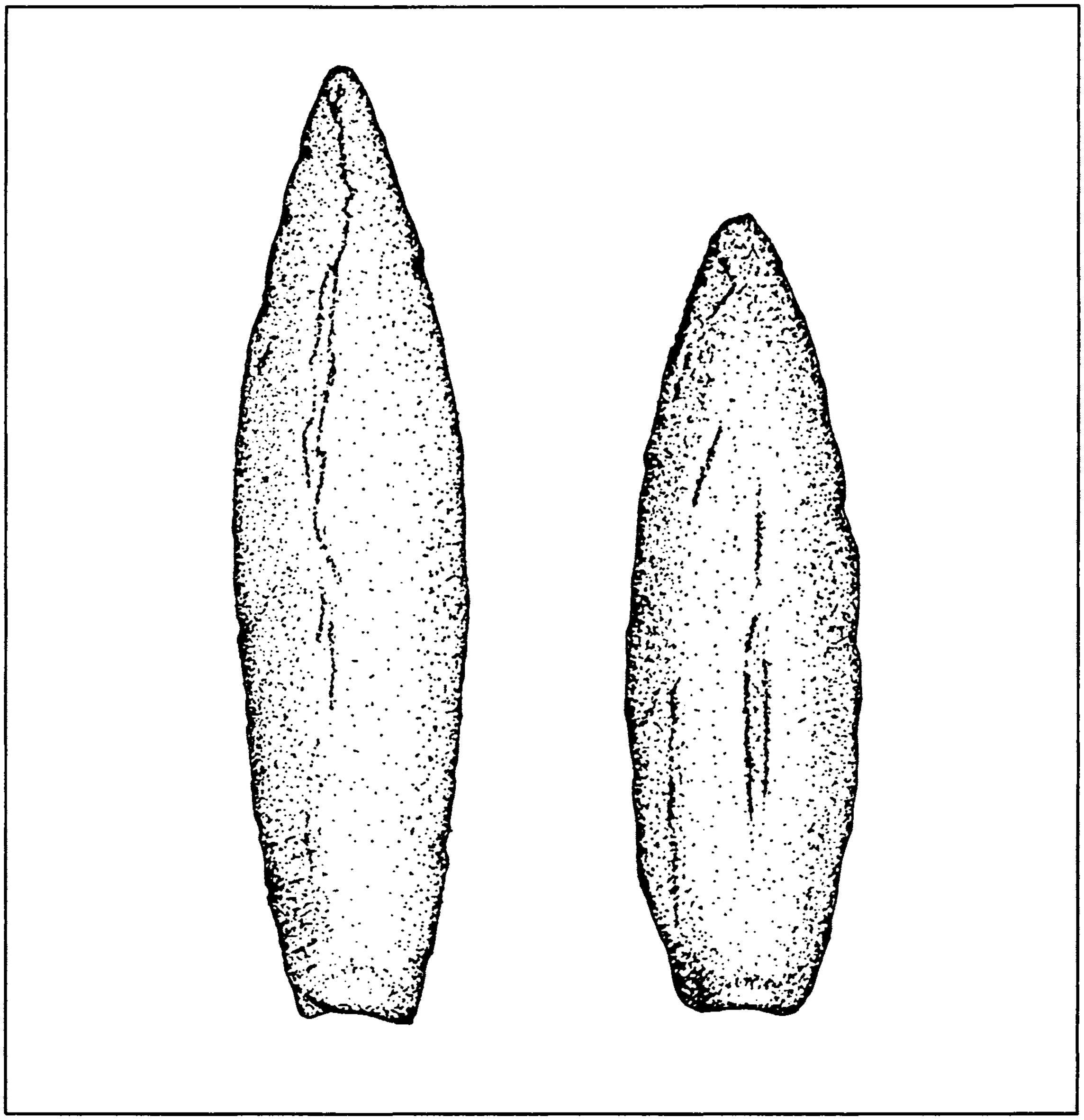

Figure 8. Drawing of the original McCreary copper point specimen (left) and a counterpart from the Wedgewood Farm site, Little Suamico, Wisconsin (from Steinbring 1970:57).

SUMMARY

In sum, given the weight of both concrete evidence and considered opinion at the present time, I suggest that the most reasonable reconstruction of Manitoba's Plano prehistory available to date can be summarized as follows:

1. The first Plano people entered Manitoba after the commencement of the Campbell subphase of Lake Agassiz, ca. 8000 B.C.
2. These earliest Plano immigrants into Manitoba made stemmed (Horner) points, not leaf-shaped lanceolate (Sister's Hill) points.
3. These early Horner point makers occupied southwestern Manitoba during the Campbell high water subphase of Lake Agassiz (Figure 9; see also Simpson 1982:92).
4. The Horner point makers left the province before Lake Agassiz began to fall from the Campbell level, and hence were not in a position to occupy the basin as it became available to human habitation (Figure 10).
5. At some point after Lake Agassiz commenced its final, post-Campbell decline, people making Sister's Hill points entered Manitoba, presumably from the west or southwest, and spread throughout the basin as the lake progressively diminished in size (Figure 11).
6. Although the presence in Manitoba of artifacts made of taconite can no longer be used as evidence of eastern origins, the discovery of two McCreary points made of native copper indicates definite ties to the southeast.

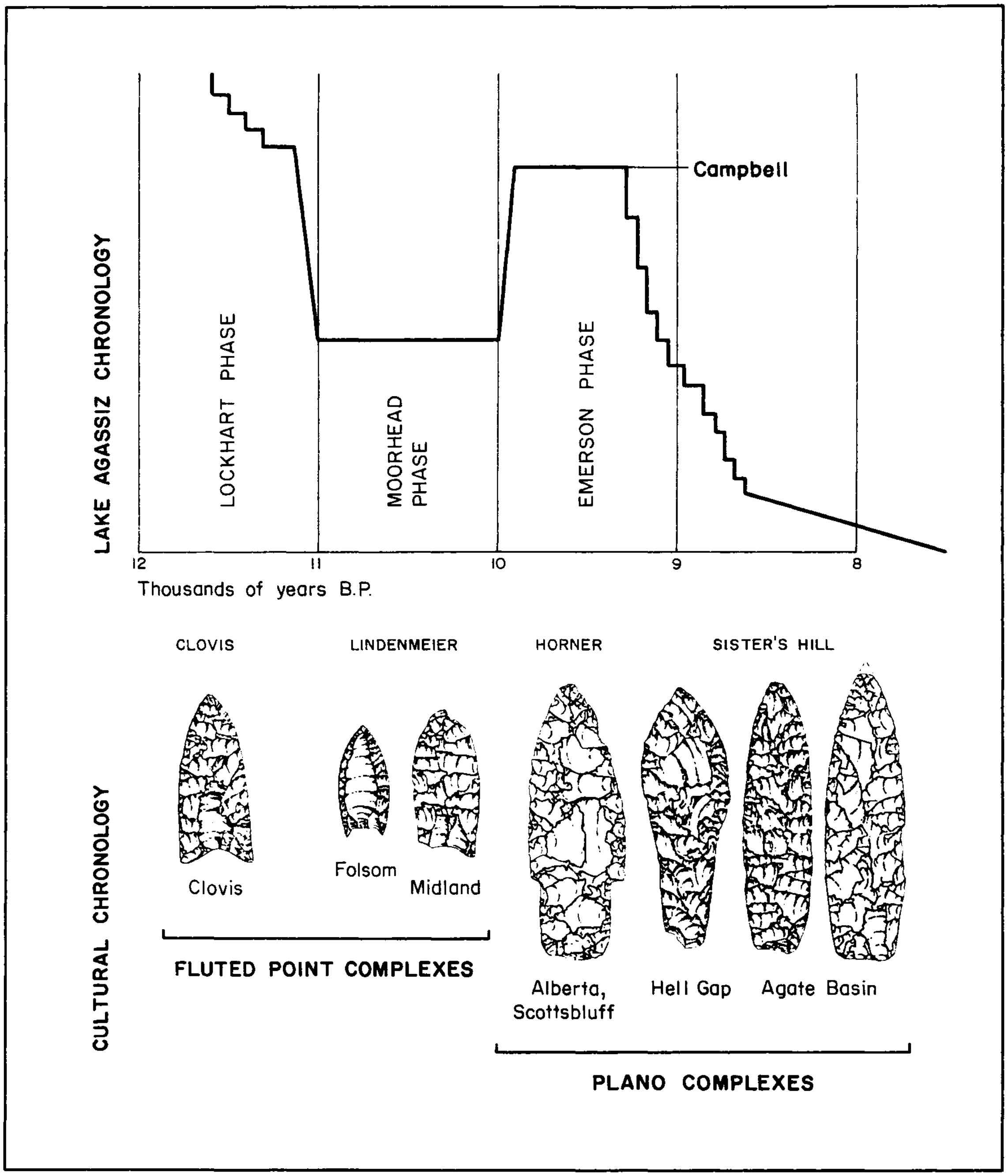

Figure 9. Revised Paleo-Indian sequence for southern Manitoba, showing the proposed correlation between the Horner (Alberta, Scottsbluff) cultural phase and the Campbell subphase of glacial Lake Agassiz; Sister's Hill (Hell Gap, Agate Basin) equates with the post-Campbell subphases.

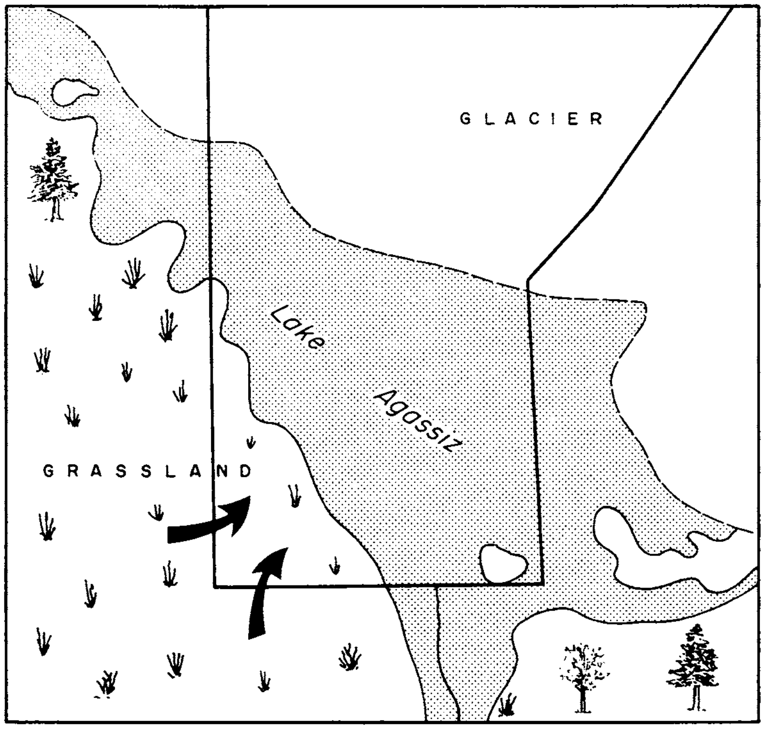

Figure 10. Movement of first Plano people into Manitoba (makers of Horner points and Cody knives), at a time when Lake Agassiz stood at the Campbell level.

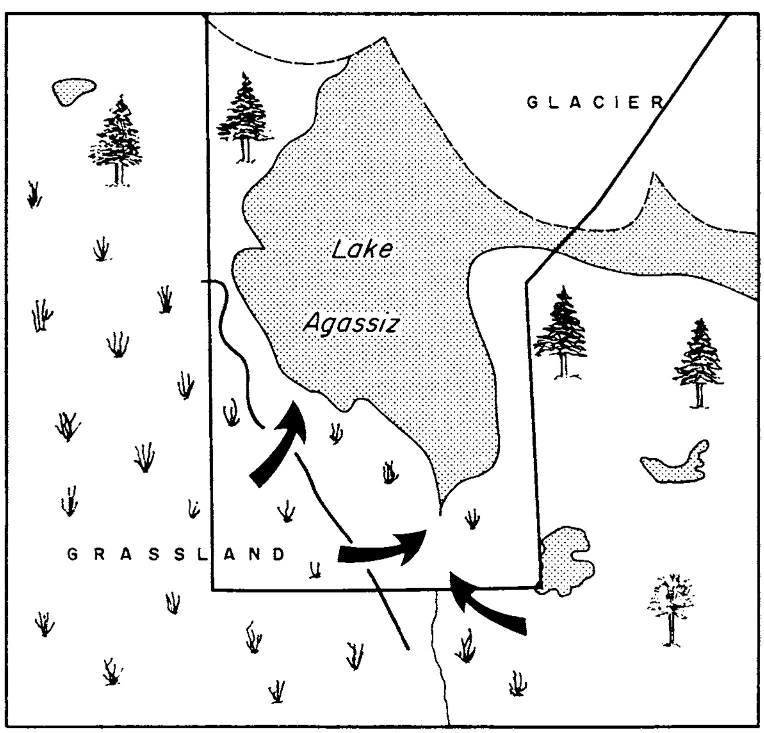

Figure 11. Movement of the makers of Sister's Hill points into Manitoba after ca. 7300 B.C.

ENDNOTES

1. Figure 2: Note the correlation here between the Campbell subphase of the "Emerson" geological phase and the "Early Sister's Hill" cultural phase. The problem with this scheme lies in the difficulty of explaining why Horner material fails to turn up in the drained Agassiz Basin. The "explanation" offered by me in 1976 made some rather heavy demands upon the limits of credibility!

2. Figure 3: Bryan equates the "Early Plano" (Narrow Leaf-shaped, Sister's Hill) material with a major low water phase of the lake, hence their observed occurrence within the Agassiz Basin. They are followed in time by the "Late Plano" (Stemmed Point, Horner) peoples who occupied Manitoba during the Campbell subphase of Lake Agassiz and hence were restricted to that portion of the province west of the Campbell strandline.

   Simpson's concept is similar to Bryan's in that it also has the Stemmed Point people occupying the province during the Campbell subphase of Lake Agassiz. However, Simpson has the Leaf-shaped Point folk in Manitoba at the same time. When the lake finally drained, only the Leaf-shaped Point people colonized the basin.

   My 1976 scenario draws upon the "domino" model. The first Plano people to enter Manitoba did so during Campbell times, and they were makers of leaf-shaped (Sister's Hill) points. Around the end of the Campbell period, the Stemmed Point (Horner) people moved into southwestern Manitoba and replaced their predecessors, who spread across the Agassiz Basin as it became progressively drier, aided and abetted, perhaps, by pressure from the immigrants. The model that I currently favour correlates the Horner Phase with the Campbell subphase of Lake Agassiz, with Sister's Hill following afterward as the lake drained.

3. Figure 6: Raw material could have been transported from the Sutton Hills into Manitoba by the westward-moving Labrador Ice Flow.

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NEW PERSPECTIVES ON AVONLEA: A VIEW FROM THE SASKATCHEWAN FOREST

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INTRODUCTION

Recent studies in the mixedwood forest of northern Saskatchewan (Figure 1) have produced data on various aspects of Avonlea people, although they are regarded primarily as a Plains oriented group. The mixedwood forest is the southern segment of the boreal forest. Two major reconnaissance surveys conducted by the Saskatchewan Research Council (Meyer 1977; Wilson 1982; Burley et al. 1982) along the main Saskatchewan River and the lower North and South Saskatchewan rivers have served to document the presence and spatial distribution of Avonlea peoples in this northern locale (Figures 1 and 2). In addition, both small and large scale excavations conducted recently at a number of sites in the western and eastern sections of the province have provided data on the temporal range and assemblages of these northern Avonlea peoples, their subsistence patterns and the season(s) during which they occupied the woodland. Data, although limited, also exist for the formulation of tentative hypotheses regarding regional variations and inter-group relationships with forest oriented peoples, such as Laurel. Of primary concern in this paper is the documentation of Avonlea peoples in the mixedwood forest and consideration of related interpretative problems.

Traditionally, Avonlea peoples have been viewed as Plains oriented. They were bison hunters *par excellence* who occupied the Plains between A.D. 200 and A.D. 800. Avonlea assemblages are characterized by delicate, well made projectile points and distinctive pottery.

Various speculations and theories regarding the origins of Avonlea have been proposed by a number of people. Davis (1966) stated that Avonlea appeared to be an intrusive complex. Kehoe (1966) hypothesized that they were Athapaskan invaders, moving in from the north at about A.D. 650. Husted (1967) discounted the Athapaskan theory and suggested

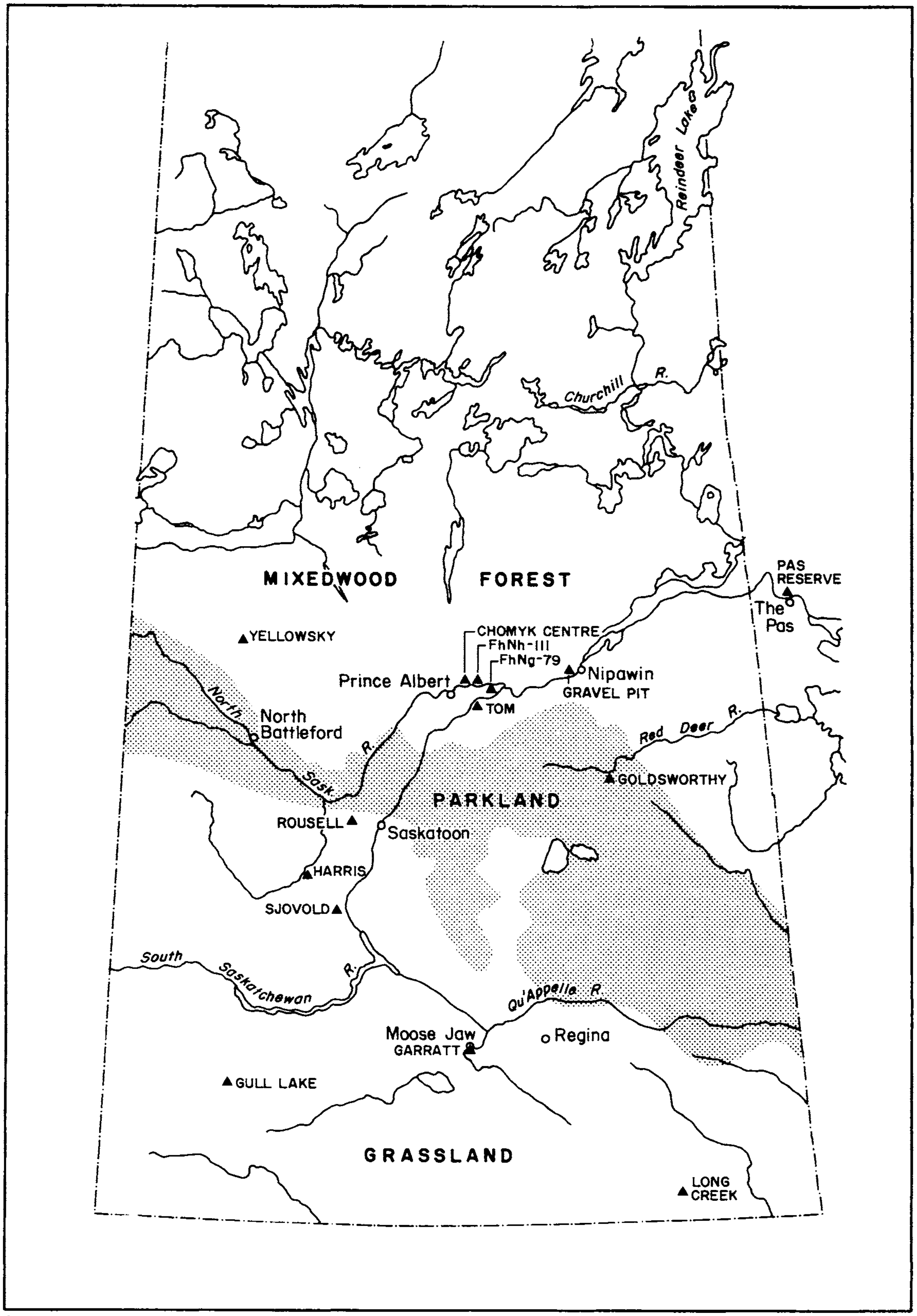

Figure 1. The locations of some Avonlea sites in Saskatchewan.

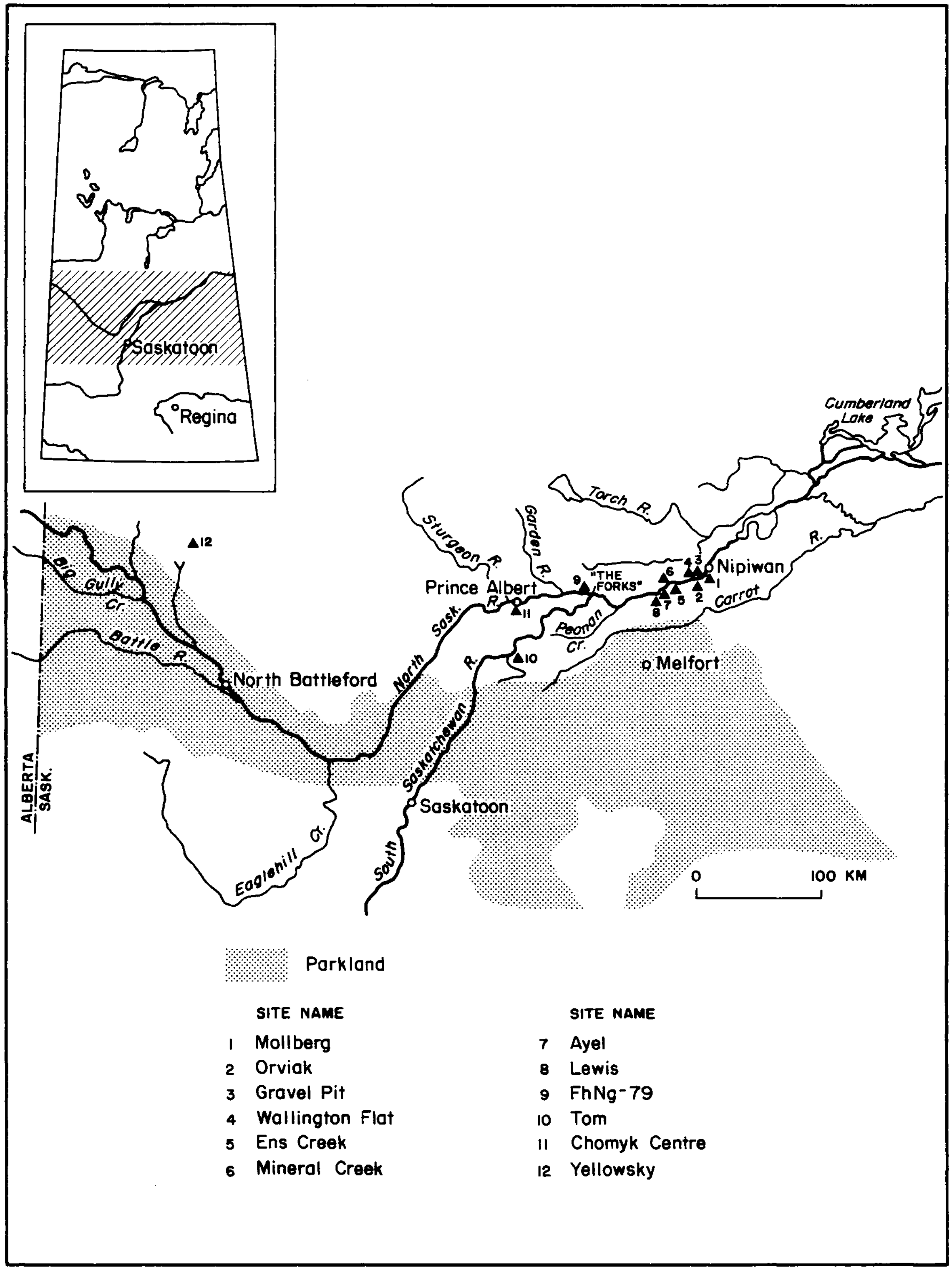

Figure 2. The locations of Avonlea sites in the mixedwood forest in Saskatchewan.

Siouan origins from the eastern woodlands, an idea also supported by Morgan (1979). Reeves (1983), supported by Byrne (1973:459), proposed an alternative hypothesis -- an *in situ* development of Avonlea from the preceding Pelican Lake Complex. The Athapaskan theory has been generally dismissed by many, but both the eastern woodland origin and the *in situ* development hypotheses are considered viable.

SPATIAL AND TEMPORAL DISTRIBUTIONS

Originally, Avonlea sites appeared to be concentrated on the grasslands in southern Saskatchewan, Alberta and northern Manitoba, with a scattering of sites in southwestern Manitoba, north-central Manitoba and northern Wyoming. However, recent data have extended the distribution of Avonlea northward into the mixedwood forest, westward into eastern British Columbia (Choquette 1974 in Reeves 1983) and southward into Wyoming (Figure 3; Table 1).

In central Saskatchewan (Figure 2), two Avonlea sites, Gravel Pit (FhNa-61) and Yellowsky (FjOd-2), have been excavated; test excavations have been conducted at two others, Wallington Flat (FhNa-112) and Mineral Creek (FhNc-53). Avonlea materials have also been recovered from other sites in central Saskatchewan such as Ayel (FhNc-30), Mollberg (FhNa-1), Lewis (FhNc-32), Ens Creek, Orviak (FhNa-73; Meyer et al. 1984), Number 56 (FhNg-79), Chomyk Centre (FhNi-62) and Tom (FgNi-17; Wilson 1982:801-803).

In the Manitoba forest, The Pas Reserve site (FlMh-1), a multicomponent site including Avonlea, has been excavated (Long and Tamplin 1977). In Alberta, work conducted at the Dry Island Buffalo Jump (ElPf-1) and the Strathcona site (FjPi-29) has revealed Avonlea materials in the Parkland (Bruce Ball, personal communication 1984).

Dates have been obtained for a number of these northerly sites and, compared to those from the Plains, they tend to be later. Several examples may be cited, including Gravel Pit - A.D. 1135 (Klimko n.d.); Yellowsky - A.D. 1230 (Wilson-Meyer and Carlson 1984); The Pas Reserve - A.D. 975 (Long and Tamplin 1977:48); Dry Island Buffalo Jump - A.D. 650 and A.D. 1200 (Bruce Ball, personal communication 1984). At

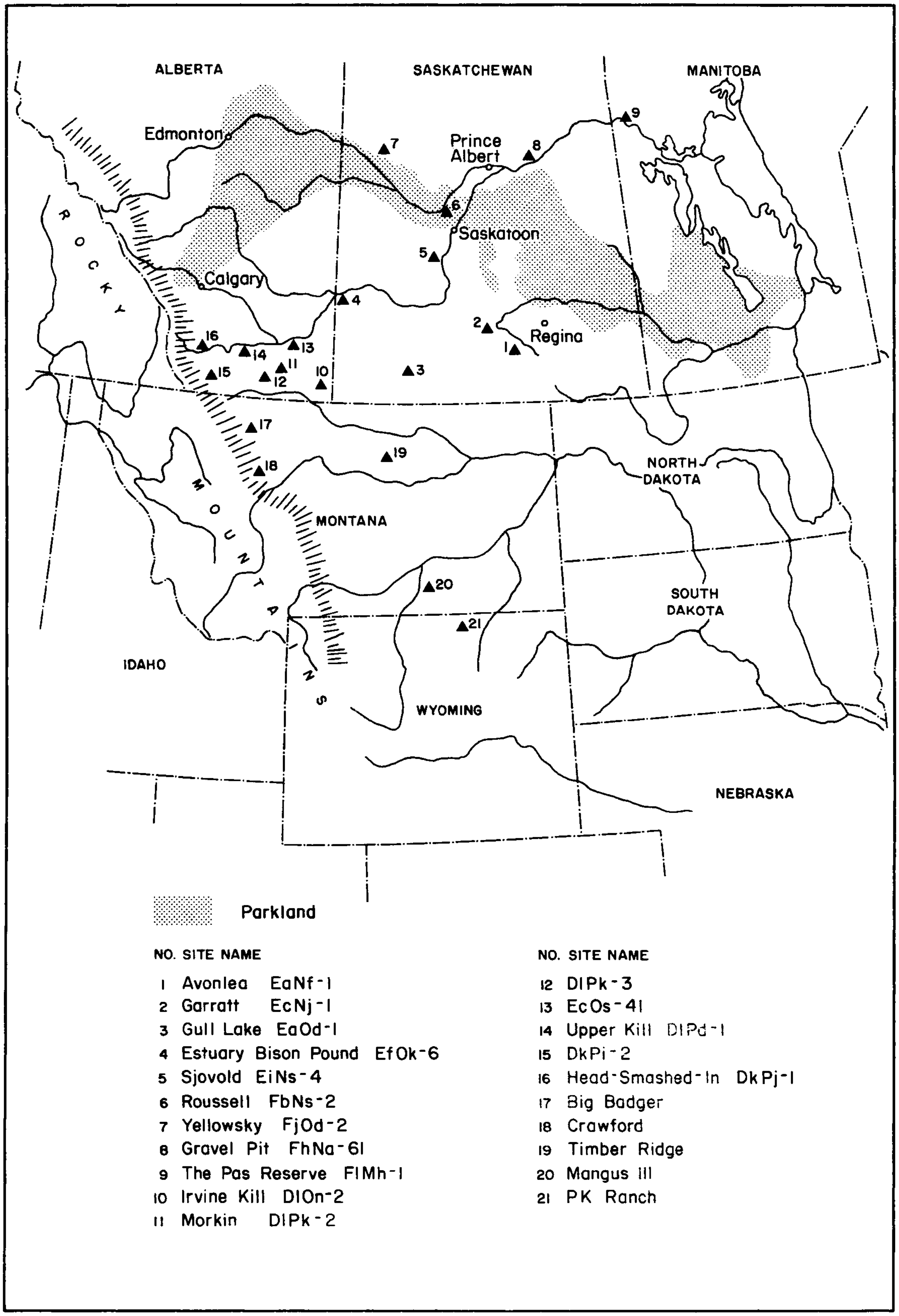

Figure 3. The locations of dated Avonlea sites (refer to Table 1 for dates).

Table 1. Avonlea radiocarbon dates.

No.[1]	Site Name	Date
1	Avonlea (EaNg-1)	A.D. 450±100 (Kehoe and McCorquodale 1961:186)
2	Garratt (EcNj-7)	A.D. 500±70; A.D. 670±60 (Morgan 1979:246)
3	Gull Lake (EaOd-1)	A.D. 210±60; A.D. 660±65; A.D. 730±80 (Kehoe 1973:43)
4	Estuary Bison Pound (EfOk-6)	A.D. 930±80; A.D. 760±165; A.D. 880±70 (Adams 1977:38)
5	Sjovold (EiNs-4)	A.D. 570±190; A.D 575±195 (Dyck 1983:111)
6	Roussell (FbNs-2)	A.D. 765±70 (Wilmeth 1978:107)
7	Yellowsky (FjOd-2)	A.D. 1230±135 (Wilson-Meyer and Carlson 1984:57)
8	Gravel Pit (FhNa-61)	A.D. 1135±135 (Klimko n.d.)
9	The Pas Reserve (FlMh-1)	A.D. 975±150 (Long and Tamplin 1977:52)
10	Irvine Kill (DlOn-2)	A.D. 770±140 (Brumley and Rushworth 1983:151)
11	Morkin (DlPk-2)	[2]A.D. 1280±95; [2]A.D. 1250±90; [2]A.D. 1155±85; A.D. 760±130; A.D. 745±90 (Byrne 1973:630)
12	DlPk-3	A.D. 625±120 (Brumley and Rushworth 1983:152)
13	EcOs-41	A.D. 1010±110 (Brumley personal communication 1983)
14	Upper Kill (DlPd-1)	A.D. 1095±90 (Byrne 1973:630)
15	DkPi-2	A.D. 1320±110 (Brumley and Rushworth 1983:151)
16	Head-Smashed-In (DkPj-1)	A.D.950±110; A.D. 910±140; A.D. 90±120; A.D. 305±130; A.D. 110±90 (Reeves 1978:162)
17	Big Badger	A.D. 450 (Johnson 1970:4)
18	Crawford	A.D. 250 (Johnson 1970:4)
19	Timber Ridge	A.D. 150; A.D. 650 (Davis 1966:103)
20	Mangus III	A.D. 640±100 (Johnson 1970:4)
21	PK Ranch	A.D. 1050±240 (Reeves 1983:266)

1. See Figure 3.

2. Authors uncertain of association.

Head-Smashed-In, a representative Plains site, the dates range from ca. A.D. 90 to A.D. 950 (Reeves 1978). However, in southern Alberta late dates have also been produced and, therefore, a termination date of A.D. 900 to 1100 has been suggested for the southern Alberta Plains and foothills (Reeves 1983:16).

Overall, the temporal and spatial distributions of these sites tend to suggest a northward and westward expansion or movement from eastern or southeastern loci, as hypothesized by Husted (1967) and Morgan (1979). No doubt additional information will add further insights into Avonlea origins and expansion.

SEASONAL MOVEMENT AND SUBSISTENCE

The northerly location of Avonlea related sites poses some research questions regarding the seasonal movements and subsistence base of the Avonlea peoples. The importance of the parkland in the economic round of the Plains Indian has been detailed by Ray (1972, 1974), Arthur (1975), Syms (1977) and Morgan (1979). Ray (1972:112) indicates that, historically, the parkland was the area of contact between people who were seasonal occupants of the boreal forest and others who were seasonal occupants of the grasslands. The contact of these two groups in the parkland, according to Ray (1972:107, 111-112), took place in the winter when the bison were in the area in search of shelter from harsh weather conditions on the grasslands. During the remainder of the year, the two groups occupied their respective areas, the forest and the Plains.

The presence of Avonlea peoples in the Saskatchewan River valley may reflect the warm, dry conditions of the Scandic climatic period and a northward expansion of the Plains bison range. However, evidence to date from the Gravel Pit and Yellowsky sites indicates a spring or summer occupation of the southern edge of the mixedwood forest by Avonlea peoples -- not a winter occupation. This is based primarily on faunal remains, especially the presence of fish, and the production of ceramics, believed to be a "warm season craft" (Pettipas 1980:150).

Employing the above data and presuming that Ray's basic premise of seasonal cycles applies to the prehistoric context, Meyer (1983a) postulated the following subsistence/settlement pattern model of seasonal movements of plains/parkland and parkland/boreal forest peoples:

1. the occupation of the southern forest in spring and summer, with autumn travel to the parkland wintering ground. This would involve the northernmost bands of expanding grassland/parkland peoples;
2. the occupation of the southern forest in spring and summer, with autumn travel to wintering grounds deeper in the forest. This would involve forest adapted groups.

The most important faunal resources for the two areas would be elk in the mixedwood forest of central Saskatchewan and bison on the Plains. Beaver, muskrat, waterfowl and fish, especially the latter, were also available in the forest.

Occupations of the mixedwood forest probably represent short seasonal excursions by people from their core residences. In the case of Avonlea, the core residence would be to the south and west in the parkland or northern grassland (Meyer 1983a). This would fit Syms' (1980:123) model of a secondary or tertiary occupation area, wherein groups utilized an area either regularly for subsistence for shorter periods than the core area, or for short periods for trading activities. Although, as Meyer (1983a:11-12) notes, the Saskatchewan River valley in itself is sufficiently productive to form a core area, the evidence to date suggests that this was not the case and that the region represented a fringe area.

CERAMIC INDICATORS OF INTER-GROUP RELATIONSHIPS

Archaeological evidence of contact between Avonlea and forest adapted people exists. Evidence of contact with Laurel is found at the Gravel Pit site, where Laurel pottery techniques such as coiling and ceramic decorations such as exterior bosses are found in an otherwise typical Avonlea component. Laurel represents a western Great Lakes cultural complex with a generalized subsistence strategy. Laurel sites occur widely in the boreal forest of central Canada and are best known in northwestern Ontario and Manitoba (Meyer 1983b:3). In Saskatchewan, Laurel tends to be concentrated in the eastern part of the forest (Meyer 1983b:3-4).

Avonlea contact with forest oriented Blackduck groups is found at The Pas Reserve site in Manitoba, indicated by Blackduck decorative techniques on ceramics (Tamplin 1977:140). The Pas Reserve site is of particular interest and importance as it represents the most northerly Avonlea component in the forest area. Apart from its inclusion here as indicating possible inter-group relationships, it will not be discussed further, because Tamplin's identification of Blackduck pottery is tentative (Meyer et al. 1984).

There is no evidence of Avonlea contact with forest oriented groups at the Yellowsky site and this appears to be representative of the area west of the Forks of the Saskatchewan (Meyer 1983a).

At the Gravel Pit site, Laurel contact and influence are primarily indicated by the ceramics, as noted previously. Eight vessels were recovered during excavation along with three side notched and one triangular unnotched Avonlea projectile points and two Avonlea preforms (Figure 4; Klimko n.d.). Two of the vessels exhibit attributes which appear to be of both Avonlea and Laurel origins. Avonlea vessels from the grasslands encompass a range of variation, including:

1. net impressed, fabric impressed, parallel grooved or plain exterior surface finishes;
2. punctates, cord wrapped tool or cord impressions as decoration on the exterior of the rim or on the lip surface (Meyer 1982; Morgan 1979; Fraley and Johnson 1981; Dyck 1983); and,
3. a conoidal shape and manufacture using "patch building or paddle-and-anvil" technique (Hanna 1983:13).

Vessels 2 and 3 both have exterior textile impressions, heavily smoothed, and have been decorated with a single row of exterior bosses with interior punctates. Vessel 3 was made by coiling, but the method of manufacture for Vessel 2 could not be determined. One other vessel is coiled but is typically Avonlea in other characteristics such as net impressions. Vessel 1, which has the largest reconstructed section of the eight vessels, is considered to be Laurel. It is characterized by the use of exterior bosses with interior punctates and coiling, although the exterior is not as smooth as is normally the case with Laurel (Meyer,

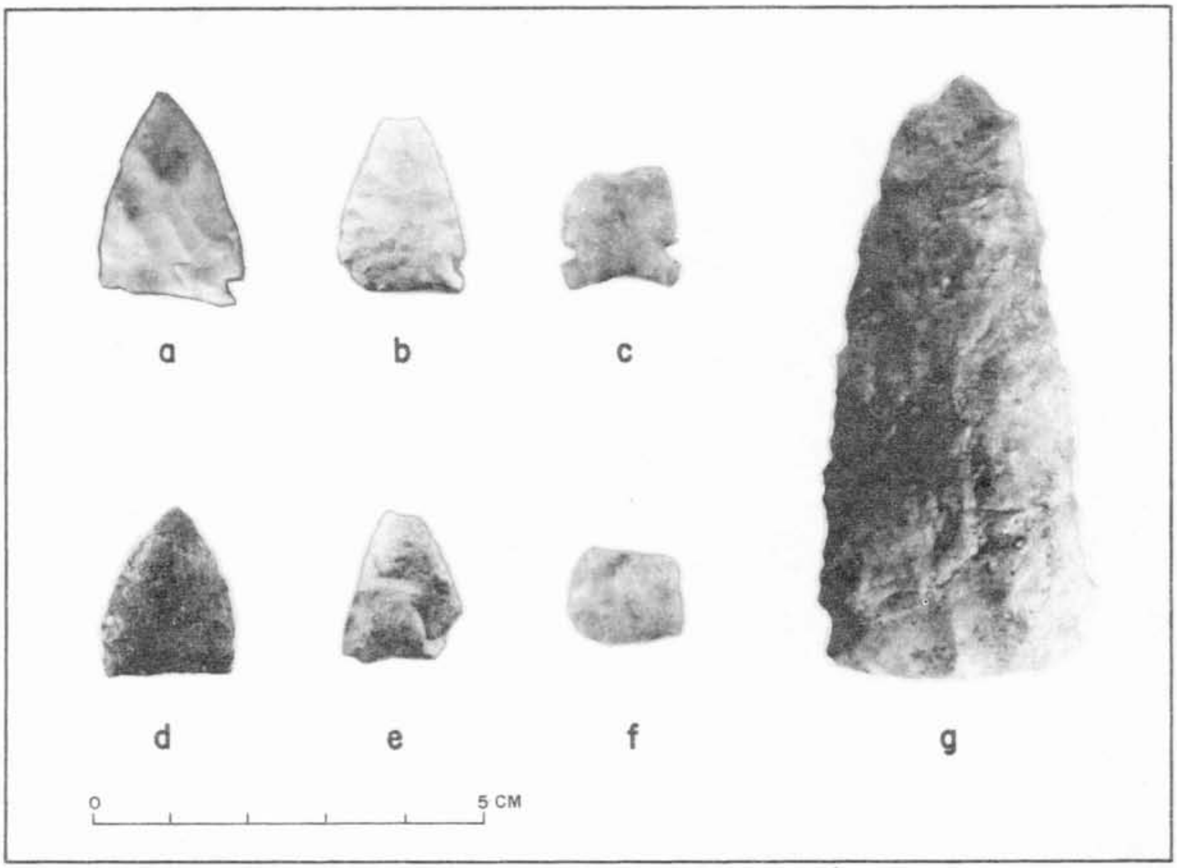

Figure 4. Avonlea projectile points, preforms and adze blade recovered from the Gravel Pit site.

personal communication 1984). However, there are Laurel vessels from northern Saskatchewan and Manitoba which are equally rough. Examples come from the Limestone Point site (GeMn-4), Jimmy Sewap site (GeMm-3) and the Slippery Rock site (GiNa-27; Meyer 1983b:10,14,17).

Coiling was also observed on a number of sherds from the Yellowsky site. No other traits associated with Laurel are evident, and it seems that coiling was a technique known to, but selectively employed by, Avonlea potters in the north. However, the overall occurrence of coiling in Avonlea is extremely low. For example, at the Yellowsky site only ten sherds out of ca. 1300 had coil breaks. Conversely at the Gravel Pit site, sherds from the coiled vessels, excluding Vessel 1 -- the Laurel vessel -- composed approximately 94% (212 of 225 sherds) of the ceramic collection. Therefore, by virture of the frequency of coiling and the decorative techniques employed at Gravel Pit, a more intensive Laurel contact and influence is indicated. This interpretation is strengthened by the presence of one vessel identified as Laurel.

In short, the Avonlea ceramics from the Saskatchewan forests reflect little influence from neighbouring groups. Only in eastern Saskatchewan, where Laurel is present, is there evidence of interaction.

HYPOTHESES REGARDING INTER-GROUP RELATIONSHIPS

The analysis of the Gravel Pit ceramics, conducted by Hanna (1983), indicated both a merging of Laurel and Avonlea construction and decorative techniques and the partial acceptance of Laurel production patterns. The explanations proposed to account for the mix of technology and decoration incorporated the following factors: (1) the peripheral location of the area to both Avonlea and Laurel; (2) the age/sex structure of the group; (3) inter-marriage; and, (4) the presence or absence of peer pressure. Hanna concluded that:

> ...intermarriage, which would bring together women from two different ceramic traditions, occurring within a somewhat atypical social situation, which might reduce the usual conservativeness of potters and/or the effects of peer pressure, might produce the mix of technology and decoration observed in the Gravel Pit ceramics (1983:45).

Hypotheses regarding inter-group relationships are primarily based on ceramic analysis and are presumed to reflect the exchange of women as wives between groups. At the Gravel Pit site, evidence of exchange or borrowing of ideas between Avonlea and forest oriented (Laurel) males is more tenuous. A triangular chipped adze blade of Swan River Chert (Figure 4) was recovered from excavation, and shale, slate or basalt adze blade preforms or fragments were collected from the surface of a field north of the excavated area. Adze blades are not noted in Avonlea assemblages on the Plains. However, they are associated with forest oriented groups, such as Laurel, and are believed to represent male woodworking activities. Ground adze blade fragments, although not numerous, have been found in association with Laurel at the Wapisu Lake site (GkLs-1; Tisdale and Jamieson 1982:89) and at the Notigi Lake site

(Wiersum and Tisdale 1977:392), both located in north-central Manitoba. MacNeish (1958:127), in his Nutimik focus which includes Laurel related materials in southeastern Manitoba, describes a polished stone adze blade found in Level 3 at the Cemetery Point site.

The adze blades in the forest assemblages are ground from fine grained materials, such as slate, shale and basalt and are not flaked from siliceous rock such as chert. Therefore, it appears unlikely that a person accustomed to making adze blades of shale or basalt would attempt to flake one from chert; however, it might be speculated that an Avonlea individual who was aware of the concept, but unfamiliar with the technical details, might attempt to do so. It may be further speculated that, in this case, contact between males may have been limited, entailing the exchange of ideas or concepts but not specific technologies.

The above data, relating to ceramics and adze blades at the Gravel Pit site, provide evidence that Avonlea and Laurel interaction occurred in this region and indicate substantial Laurel influence on the Avonlea group.

REGIONAL VARIATIONS IN LITHIC OCCURRENCES

Variations in lithic materials used, especially for points, have also been noted for Avonlea sites in the Plains. Based on their work at the Avonlea type site, Kehoe and McCorquodale (1961:186-7) concluded that the Avonlea people there were not familiar with Knife River Flint (brown chalcedony), which is found in North Dakota and neighbouring states, and depended upon local sources of stone for tool making. However, a large percentage of Knife River Flint was recorded for the Avonlea layer at the Garratt site in southern Saskatchewan (Morgan 1979:336). Recently, I have carried out additional work at the Avonlea type site and preliminary analysis indicates a significant occurrence (about 11%) of Knife River Flint in the assemblage, including points and debitage. This indicates that these Avonlea people were familiar with this material and obtained it either through trade or by travelling to the quarries. On the other hand, in southwestern Manitoba and southeastern Alberta, Avonlea points of Knife River Flint are rare (Syms 1977; Reeves 1983).

Present data from the northern Saskatchewan sites, particularly Gravel Pit and Yellowsky, indicate that a variety of local material was used, such as Swan River Chert (over 70% at the Gravel Pit site), quartzite, and silicified sandstone (approximately 60% at the Yellowsky site; Wilson-Meyer and Carlson 1984). No Knife River Flint was found at the Yellowsky site, while a number of flakes were found at Gravel Pit (Klimko n.d.; Wilson-Meyer and Carlson 1984). It appears that the Avonlea people at Gravel Pit and Yellowsky generally utilized and depended upon local lithic sources.

SUMMARY AND CONCLUSIONS

The discovery of Avonlea sites in northern Saskatchewan has initiated various research concerns with respect to temporal and spatial distributions, seasonality and subsistence strategies, inter-group relationships, and regional variations in lithic occurrences. The distribution of the northerly Avonlea sites and the dates obtained thus far indicate a northward expansion of Avonlea peoples into the mixedwood forest, possibly from an eastern or southeastern locus. They appear to persist fairly late in this region, with dates of ca. A.D. 1100 to A.D. 1200.

With respect to subsistence strategies in this northern locale, Meyer (1983a) has postulated a subsistence/settlement pattern based on Ray's (1972) basic premise of seasonal cycles. Meyer's model of the seasonal round consists of utilization of the mixedwood forest in spring and summer by groups using both the grassland and parkland, such as Avonlea, and forest adapted groups, such as Laurel. In autumn and winter, these groups would travel to their respective core areas -- the northern grasslands or parkland for Avonlea and deeper into the forest for Laurel. Faunal data from the Gravel Pit and Yellowsky sites lend support to this model, since they represent a spring or summer occupation of the mixedwood forest by Avonlea peoples.

Inter-group relationships between Avonlea and forest oriented peoples such as Laurel, are best represented at the Gravel Pit site. Contact is indicated by the mix of ceramic technology (coiling, net impressions, and plain, smoothed vessels), decorative techniques (exterior bosses with interior punctates) and the presence of an unground adze blade. Laurel influence on the Avonlea assemblage at this site appears to have been considerable, affecting items produced by both men and women. Evidence of similar contact between Avonlea groups and forest adapted peoples has not yet been found in the area west of the Forks of the Saskatchewan River.

Variations have also been observed in lithic materials for Avonlea sites located in the Plains of southern Saskatchewan, especially with respect to the presence of Knife River Flint (brown chalcedony). In the initial research at the Avonlea type site, Kehoe and McCorquodale (1961) noted an absence of Knife River Flint and a dependence upon local sources. Analysis of the Avonlea component at the Garratt site (Morgan 1979), however, revealed a large percentage of Knife River flint in the assemblage. Recent work carried out at the Avonlea type site revealed a lower, yet significant percentage of Knife River Flint, thus indicating that these people were familiar with the material.

The northern Avonlea sites excavated to date contain very little Knife River Flint, and material recovered from these sites reflects a dependence on local lithic resources. Differences noted in raw material utilization, ceramic production and decoration, and inter-group relationships within the Avonlea Complex may represent regional variations as a result of temporal and spatial factors.

Generally, the presence of Avonlea sites in the mixedwood forest, together with evidence of interaction with forest oriented peoples, are interpreted as seasonal excursions into the area and reflect the flexibility of the Avonlea peoples in their ecological and socio-cultural adaptations.

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THE IMPORTANCE OF THE QUARTZITE COBBLE INDUSTRY IN PLAINS CULTURE HISTORY: A VIEW FROM SOUTHWESTERN SASKATCHEWAN

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INTRODUCTION

A significant percentage of northwestern Plains assemblages consist of quartzite artifacts and debitage (see Bonnichsen 1977). While its numerical abundance undoubtedly relates to the availability of this particular material type, quartzite has been argued to be the preferred material for certain tool types (Eyman 1968, 1972). Not only is it an extremely durable material but it is found in larger nodules than cherts from the same deposits, particularly on the Canadian Prairies, where most lithics are derived from glacial tills. Larger tools, in particular those subjected to heavy use, are almost invariably fashioned from this material. Despite these facts, published studies dealing specifically with quartzite as a raw material are rare (but see Toll 1978; Dawe 1984).

With funding from the Saskatchewan Research Council, I recently began a systematic study of the quartzite cobble industry as it is represented in archaeological collections from southern Saskatchewan. Two objectives were defined for this study. The first and principal objective was to establish a typology for the various products and bi-products of quartzite cobble lithic technology. The second objective was to identify the potential for detecting cultural and/or chronological differences in the uses of quartzite cobbles. Previously, Johnson et al. (1972), Schneider (1972), and others (e.g., Ahler 1977; Chapman 1977), have successfully isolated temporal/cultural changes in lithic debitage types and various debitage attributes on the Plains. The initial phase of this study demonstrated that there were several different strategies for reducing quartzite cobbles. Thus, it was hypothesized that the potential for cultural variability within quartzite cobble assemblages does exist.

In order to examine this, the second study objective was pursued through an analysis of the quartzite debitage from four tipi ring sites in southwestern Saskatchewan. The results of this latter investigation form the basis for this paper.

COBBLE REDUCTION STRATEGIES

In archaeology, the term industry commonly refers to, "... a gross artifact category defined by shared material and technology" (Sharer and Ashmore 1979). The quartzite cobble industry is considered separate from the chipped stone industry due to the special constraints this material source places on the lithic craftsmen (Sherri Deaver, personal communication 1983). One of the principal limitations is that cobbles provide no natural platforms from which to initiate flake production. This limitation is then compounded by the toughness of quartzite.

There are, however, a number of different strategies for exploiting quartzite cobble lithic sources. The selection of a particular strategy must have been based on cobble size, cobble shape, and the desired products. Figure 1 outlines the postulated cobble reduction strategies and the associated products.

The classification framework developed for this study utilizes the natural morphology of cobbles. A cobble can be viewed as having three axes, two faces, and one continuous edge. By specifying the location of the platform and the direction of flake removal in terms of these variables, ten core types were developed:

1. Split Cobble Length - the cobble is split in half along the longest axis. Both ventral faces of the resulting cobble halves are generally flat and featureless.
2. Split Cobble Width - the cobble is split in half along the width axis.
3. Truncated Cores - the platform is located at the junction of the edge and one face and the direction of flake removal is along the thickness axis. Truncated cores have multiple platforms located along a single platform edge.
4. Centre Impact Cores - this category comprises all cores with the platform located near the centre of one cobble face. It is possible

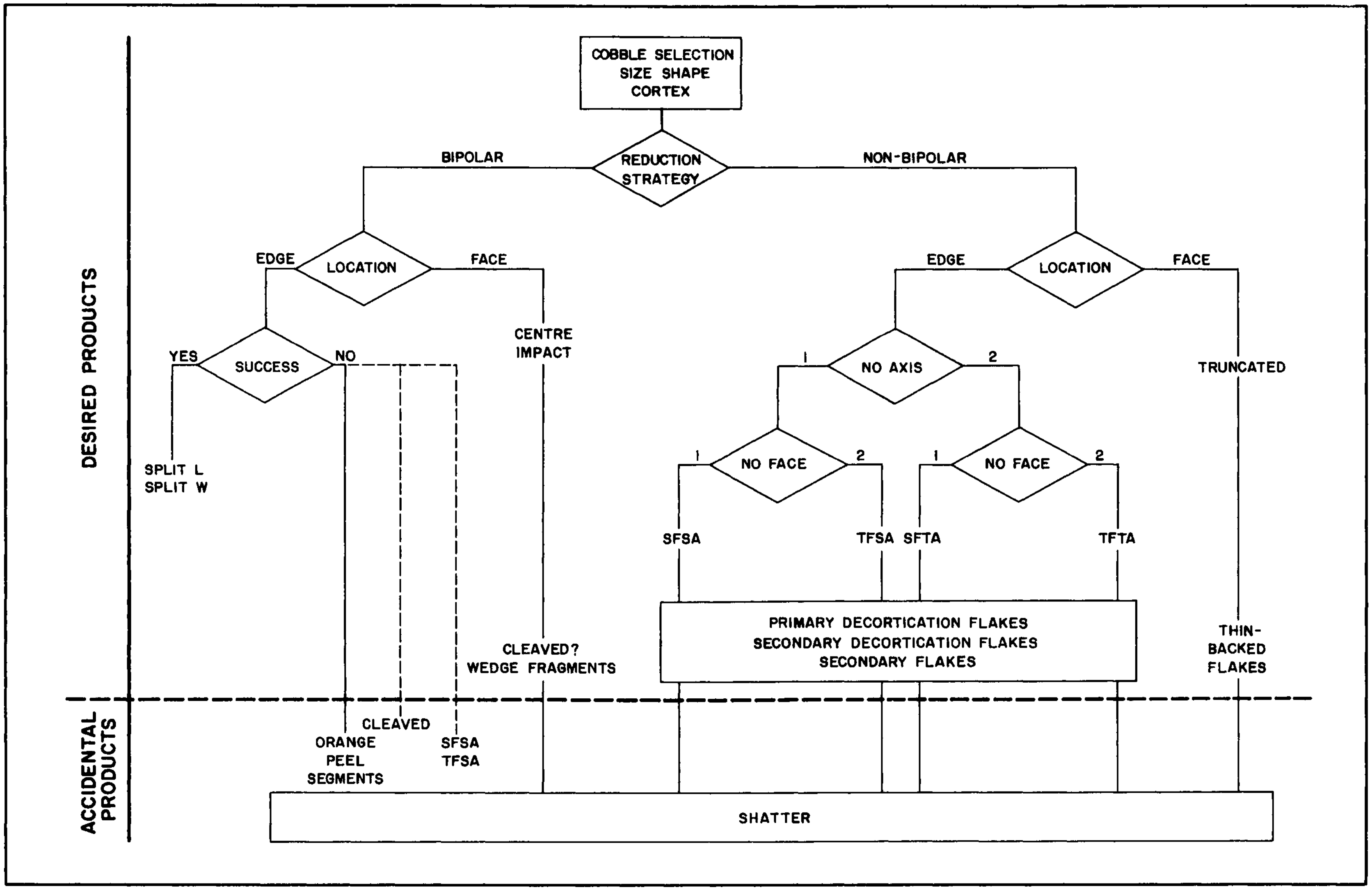

Figure 1. Postulated cobble reduction sequence.

that this core type represents the remains of anvils. Three outcomes of centre impact cores have been recognized:

a) the cobble is cleaved (see 9 below);

b) the cobble fragments into triangular segments;

c) the cobble fragments into irregular fragments.

5. Single Face Single Axis (SFSA) Cores - the platform is located along the cobble edge and the direction of flake removal is along a single axis. Flake removal is confined to one face of the cobble.
6. Two Face Single Axis (TFSA) Cores - same as above, but flake removal takes place from both faces.
7. Two Face Two Axis (TFTA) Cores - several platforms are located along the edge and flake removal takes place across both faces and along both axes.
8. Single Face Two Axis (SFTA) Cores - same as above, but flake removal is confined to a single face.
9. Cleaved Cores - this is a provisional core type. It refers to cobbles that are split through either their length or width axis (core types 1 and 2 are split through the thickness axis). Split cobbles (types 1 and 2) have broad split surfaces with the same length/width as the original cobbles. Cleaved cobbles, on the other hand, have a narrow split face, with a width equal to the thickness of the original cobble. It is possible that this core type represents a failed attempt at splitting the cobbles.
10. Split/Cleaved - this is also a provisional category. Cobbles are split and then the split halves are cleaved. Both operations leave platforms.

Selected representations of these core types are presented in Figure 2.

The debitage from the four sites considered in this study was classified into seven categories. Five of the categories - primary decortication flakes, secondary decortication flakes, secondary flakes, thinning flakes, and shatter - are not new and thus require no definition here (see Crabtree 1972). The remaining two debitage types are:

1. Thin-Backed Flakes - these are thin, crescent shaped flakes with a rim of cortex extending from the platform down both lateral edges. These flakes were struck from truncated cores.

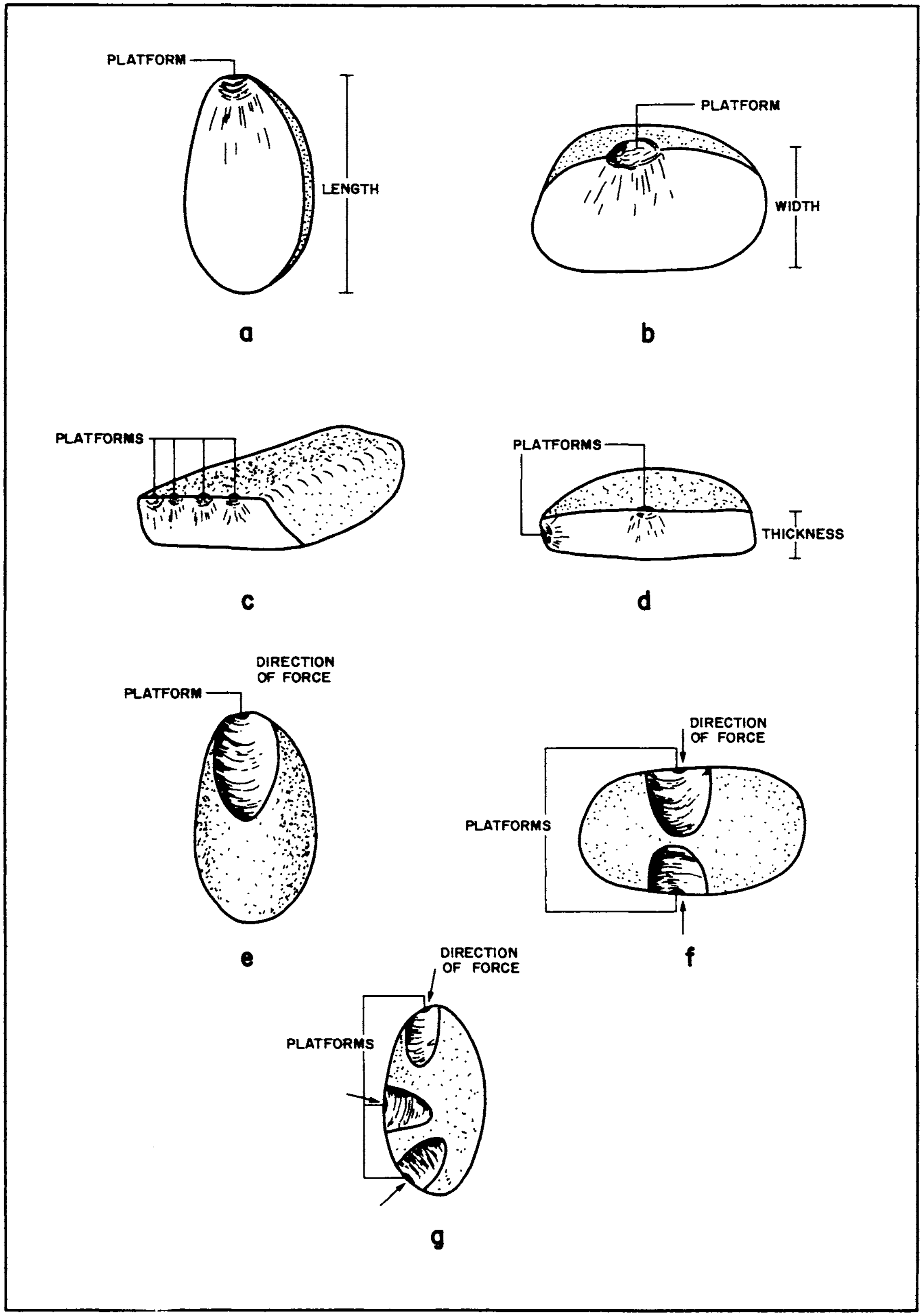

Figure 2. Idealized Core Types: a, b - split cobbles; c - truncated core; d - cleaved core; e, f - SFSA core; g - SFTA core.

2. Orange Segments - these are cortex backed core fragments with triangular cross-sections. They are a product of failure during bipolar percussion. It has been suggested that these forms result from the over application of force (Crabtree 1972), or from trying to split cobbles with circular cross-sections (Bonnichsen 1977).

These cores and debitage types have resulted from the application of three basic cobble reduction stategies. The first strategy is bipolar percussion. The successful application of this strategy resulted in the production of large cortex backed flakes. These flakes were used without further reduction as "teshoa" (split cobble scrapers), or they could have been reduced into more formal tool categories.

The second strategy involved truncating the cores using hard hammer percussion. This strategy produced thin-backed flakes which were suitable for use as small cutting and scraping tools. In addition, the exhausted truncated cores closely resemble cobble choppers, and some were undoubtedly used for this purpose. One of the problems inherent in identifying cobble core tools is that platform preparation and maintenance resulted in a considerable amount of damage along the platform edge. This damage can be confused with tool use.

The third basic strategy involved removing flakes from one or both faces of the cobble. This strategy resulted in the production of primary and secondary decortication flakes. Most of these flakes would have been used in unmodified form, since few were large enough to have been reduced further.

In addition to these basic strategies, a number of minor strategies were used. At this time, it is not definitely known how many of the remaining core forms represent failed attempts at reduction, or other uses, such as the centre impact cores which may have been used as anvils. Similarly, the products of the remaining reduction strategies are known with less certainty.

THE SAMPLE

The four assemblages examined in this study are derived from surface collections of four tipi ring sites located within the Frenchman River valley in southwestern Saskatchewan (Figure 3). All were investigated

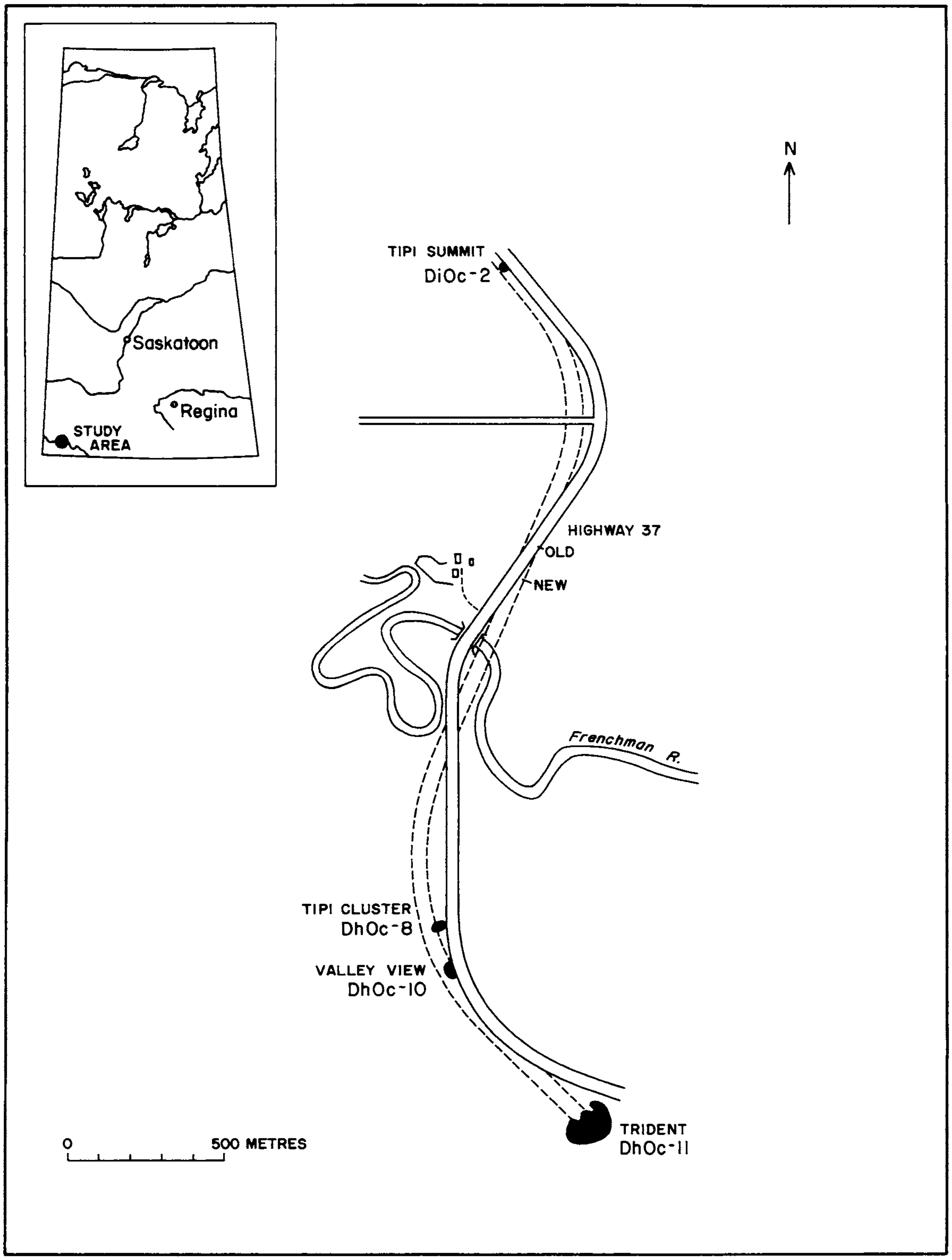

Figure 3. Location of the four investigated sites.

during a mitigation oriented study of ten archaeological sites affected by the re-alignment of Highway 37 (Finnigan 1983), funded by Saskatchewan Highways and Transportation.

The Frenchman River is a tributary of the Milk River. It is underfit within a broad glacial spillway that was formed some 17,000 years ago (Christiansen 1979:923). The present environment is part of the xeric mixed prairie community described by Coupland (1960:152). However, the environment within the valley itself is more diverse, and provides conditions suitable for willow, buffalo berry and dogwood, along with white poplar, Manitoba maple, and green ash in more sheltered areas. Historically, the area supported bison, mule deer, antelope, and wapiti.

The sides of the valley are littered with quartzite cobbles that have been derived from the Cypress Hills Formation (Vonhof 1965). It is assumed that the majority of lithic reduction sites in the valley are a result of the exploitation of this lithic source. It should be noted that the Cypress Hills Formation also contains cherts but in a much lower percentage than quartzites (Vonhof 1965:35).

Tipi Summit, the most northerly of the sites, is located approximately 700 m north of the Frenchman River. There are three intact tipi rings at this site and an associated lithic scatter. One hundred and twenty artifacts were collected from the surface. A hearth at the site has been radiocarbon dated to 1590 $\pm$ 80 years B.P. (S-2242) or about A.D. 360 (uncorrected date).

The Tipi Cluster site is located 700 m south of the Frenchman River. In addition to surface lithic scatter, there are four intact tipi rings and one partially disturbed ring. One hundred and sixty-eight artifacts were collected from the surface. This site has been radiocarbon dated at 1425 $\pm$ 295 years B.P. (S-2241) or approximately A.D. 525 (uncorrected date).

The Valley View site is located 800 m south of the Frenchman River. There are two intact tipi rings and a small surface scatter of lithic artifacts. Sixty-six artifacts were collected from the surface. In addition, excavations at these rings produced two Pelican Lake projectile points. No radiocarbon dates were obtained from this site.

The Trident site, the final site examined here, is located on the south valley summit. The closest water source is a slough located 300 m to the south. Although a large portion of the site has been cultivated, several tipi rings are still present along the field edge. Unlike the other sites where a 100% collection of surface artifacts was made, here, a 10% systematic sample was collected. This sample consists of 728 specimens, including two Pelican Lake projectile points. Again, radiocarbon dates were not obtained from this site.

To summarize, two of these sites can be assigned to the Pelican Lake Phase on the basis of projectile points. This phase has been dated from 3300 to 1850 years B.P. in Saskatchewan (Dyck 1983:105). The remaining two sites are assigned to a later time period, approximately 2000 to 1150 years B.P., which encompasses both Avonlea and Besant (Dyck 1983:113,122). Based on an examination of the industries and, in particular, the stone circles (Finnigan and Johnson n.d.), I would speculate that these two sites both belong to the Avonlea Phase.

RESULTS

When comparing the site assemblages, the most notable difference occurred in the percentage of quartzites relative to fine grained silicates. For the two Pelican Lake sites, quartzite comprises 87% and 90% of the lithic assemblages. For the later sites, quartzite accounts for 98% and 100% of all lithic artifacts. Since it is assumed that most of the lithics are derived from the same valley surface deposits, it is a reasonable hypothesis that this difference, approximately 10%, is due to cultural factors. The alternative hypothesis, that all four samples are from the same population of artifacts, was rejected in a chi-square test at a confidence level of 0.95 (x^2=115.37 with 4 degrees of freedom).

Inter-site differences were noted in four of the ten core categories (Table 1). The percentages given below are derived by averaging the two site values in each group. Split width cobbles account for 9.4% of the later assemblages and only 1% of the Pelican Lake assemblages. Centre impact cores account for 18.4% of the Pelican Lake site assemblages and only 1.9% of the later sites. SFTA cores were more numerous in the later sites (5.7% vs. 1.0%), while cleaved cores were marginally less abundant in the later sites (5.7% vs. 6.8%). However, there was some overlap in two of the four categories (see Table 1).

TABLE 1. Distribution of core types by site.

	TRIDENT		V VIEW		TIPI SUM		TIPI CLT	
CORE TYPE*	N	%	N	%	N	%	N	%
SPLIT LENGTH	18	19.8	5	41.7	9	20.5	3	33.3
SPLIT WIDTH	1	1.1	0	0.0	4	9.1	1	11.1
TRUNCATED	22	24.2	3	25.0	15	34.4	1	11.1
CENTRE IMPACT	18	19.8	1	8.3	0	0.0	1	11.1
SPLIT TRUNCATED	1	1.1	1	8.3	5	11.4	0	0.0
SFSA	16	17.6	0	0.0	3	6.8	0	0.0
TFSA	1	1.1	2	16.7	3	6.8	1	11.1
TFTA	6	6.6	0	0.0	1	2.3	0	0.0
SFTA	1	1.1	0	0.0	2	4.5	1	11.1
CLEAVED	7	7.7	0	0.0	2	4.5	1	11.1

*See text for explanation of core types.

The sample sizes were insufficient for statistical comparisions of metric observations in all four sites. Number of cases per core type per site was one or zero in the majority of instances. The limited metric data that could be obtained are presented in Table 2. The most useful variable for comparison is weight since this was collected for both complete and incomplete specimens. The Pelican Lake sites generally seem to have lighter split cobbles and heavier truncated cores than the later sites.

The ratios of length to width in both split cobbles and truncated cores were compared. The Pelican Lake assemblages show a tendency toward more circular cores for both categories (the width is approximately equal to the length). The later sites show a tendency towards more elongated split cobbles and truncated cores.

Some quantitative differences between the two groups of sites were evident in five of the debitage categories (Table 3). The later sites contain more primary decortication flakes, more secondary decortication flakes, more secondary flakes, and more thinning flakes (38% vs. 17%).

TABLE 2. Mean metric values for cores.

	TRIDENT				VALLEY VIEW			
CORE TYPE*	L (mm)	W (mm)	Th (mm)	WT (g)	L (mm)	W (mm)	Th (mm)	WT (g)
SPLIT L	59	91	25	216	88	62	31	287
SPLIT W				351				
TRUNC	108	87	57	620	126	114	73	1450
CEN IMP	103	106	86	457				1134
SPLIT TR				313				232
SFSA	99	77	49	449				201
TFSA				102				
TFTA	90	66	45	351				
SFTA				405				
CLEAVED				197				

	TIPI SUMMIT				TIPI CLUSTER			
CORE TYPE*	L (mm)	W (mm)	Th (mm)	WT (g)	L (mm)	W (mm)	Th (mm)	WT (g)
SPLIT L				396	211	77	45	338
SPLIT W				3	133	76	48	462
TRUNC				74	124	81	53	477
CEN IMP				348				
SPLIT TR				284	89	73	33	189
SFSA					80	69	39	284
TFSA				199	89	77	49	331
TFTA								1775
SFTA				174				816
CLEAVED				133				812

*See text for explanation of core types.

TABLE 3. Distribution of debitage types by site.

	TRIDENT		V VIEW		TIPI SUM		TIPI CLT	
DEBITAGE TYPE*	N	%	N	%	N	%	N	%
P D FLAKES	40	6.6	6	12.0	18	15.4	11	10.3
S D FLAKES	52	8.5	4	8.0	33	28.2	13	12.1
SEC FLAKES	45	7.4	7	14.0	22	18.8	15	14.0
THIN FLAKES	4	0.7	0	0.0	1	0.9	1	0.9
ORANGE PEEL	6	1.0	0	0.0	4	3.4	2	1.9
THIN-BACKED	15	2.5	9	18.0	10	8.5	5	4.7
SHATTER	447	73.4	24	48.0	29	24.8	60	56.1

*See text for explanation of debitage types.

These later sites also contain marginally more tertiary flakes and orange segments. The Pelican Lake sites contain a higher percentage of shatter (71.4% vs. 39.7%).

In terms of metric observations of debitage, there were complete sets of measurements for only two categories: secondary flakes and thin-backed flakes (Table 4). The secondary flakes from both Trident and Valley View are relatively small in size and have a low length/width ratio of 1.2. The secondary flakes from the later sites are larger and they are much longer than they are wide (length/width ratio of 2). A similar observation holds for the thin-backed flakes, but there is some overlap between the two groups of sites. The overall mean length/width ratio for Pelican Lake debitage is 1.39 compared with 2.33 for the later group. Using a T test for the difference of the means, the null hypothesis that there is no difference can be rejected at a 0.95 level of confidence.

TABLE 4. Mean metric values for debitage.

DEBITAGE TYPE*	TRIDENT L (mm)	TRIDENT W (mm)	TRIDENT Th (mm)	TRIDENT WT (g)	VALLEY VIEW L (mm)	VALLEY VIEW W (mm)	VALLEY VIEW Th (mm)	VALLEY VIEW WT (g)
P D FLAKE	66	49	21	81				106
S D FLAKE	50	37	17	46				99
SEC FLAKE	36	26	11	17	31	29	13	29
THN FLAKE				45				
ORG PEEL				204				
THIN-BACK	50	39	18	54	85	58	28	105
SHATTER				48				40

DEBITAGE TYPE*	TIPI SUMMIT L (mm)	TIPI SUMMIT W (mm)	TIPI SUMMIT Th (mm)	TIPI SUMMIT WT (g)	TIPI CLUSTER L (mm)	TIPI CLUSTER W (mm)	TIPI CLUSTER Th (mm)	TIPI CLUSTER WT (g)
P D FLAKE	59	44	21	56	159	65	32	97
S D FLAKE	54	42	21	34	137	55	29	84
SEC FLAKE	40	25	14	14	105	44	24	39
THN FLAKE								1
ORG PEEL				82				234
THIN-BACK	50	35	54	19	189	58	33	84
SHATTER				15				38

*See text for explanation of debitage types.

INTERPRETATIONS

There are several interesting trends in these data that require further elaboration. First, the differences in preference for quartzite between the Pelican Lake and the later sites deserves comment. The other lithic assemblages encountered during the Highway 37 study were comprised of 93% to 100% quartzite, with a mean of 96.8% (Finnigan 1983). Since the percentage of quartzite in the Pelican lake assemblages is well below this average (88.5%), it is suggested that this represents cultural selection rather than sampling error.

This study also suggested that the basic Pelican Lake technological strategies for utilizing quartzite cobbles involved splitting them lengthwise by bipolar percussion (22%), or more rarely widthwise (1%), truncating the cores (25%), and shattering the cores with a centre impact (18%). Considering only the definite derivatives of bipolar percussion, i.e., the split cobbles, the use of bipolar percussion comprises only 23% of the Pelican Lake lithic reduction strategy.

These reduction techniques produced a large amount of shatter (71%). Lithic reduction beyond the removal of the primary decortication flakes was limited in the Pelican Lake techniques; the combined categories of secondary decortication, secondary, and thinning flakes comprise only 17% of the total debitage sample. Using the averaged artifact distribution as a model of Pelican Lake reduction strategies, the null hypothesis that the same strategies were being followed in the later sites was rejected for both in a chi-square test (x^2 = 293 for Tipi Summit and 46 for Tipi Cluster, at 0.95 level of confidence).

The later Avonlea and/or Besant reduction strategies resulted in marginally more cobbles split lengthwise (23%), more split widthwise (9%), more truncated cores (30%), and significantly fewer centre impact cores (2%). These strategies are marked by a lower percentage of shatter (40%), and a much higher percentage of secondary decortication, secondary, and thinning flakes (38%).

Using these percentages as a model of the later sites reduction strategies, the assemblages from both Pelican Lake sites were compared to it in a chi-square test. At a 0.95 level of confidence, this distribution was rejected for the earlier Trident site (x^2 = 405).

However, possibly due to its small size, the Valley View assemblage was not significantly different from the later sites ($x^2 = 12$).

In both sets of comparisons, the greatest deviation from the model distributions is found in the frequency of debitage. Using the Pelican Lake model, the expected frequency of shatter from the later sites is 157 pieces, while the observed quantity is 89. Similarly, using the model for the later sites, the predicted number of secondary decortication, secondary, and thinning flakes from the Pelican Lake sites is 250, and the observed number is 112.

Several hypotheses can be advanced to explain these differences. Regarding the high percentage of shatter at the Pelican Lake sites, there are two possibilities:

1. The Pelican Lake cobble reduction strategies had a higher failure rate and thus produced more shatter.
2. More shatter was transported away from the later sites for reduction elsewhere.

Although large pieces of shatter could be reduced further, in general, shatter was abandoned when produced. Therefore, it does not seem reasonable that a large percentage of shatter was being transported away from the later sites.

At least two different explanations can be advanced for the differences in the abundance of other debitage types:

1. Cobble reduction was carried further at the later sites, producing more debitage.
2. More debitage was transported away from the Pelican Lake sites for further reduction.

The latter hypothesis is difficult to prove or disprove. Looking at the first hypothesis, it is useful to examine the ratio of cores reduced on one face to cores reduced on both faces. The assumption is made that cores with flakes removed from both faces (TF) have been reduced further than cores with flakes removed from only one face (SF). For the two later sites, the ratio is 0.8 TF cores per SF core, while for Pelican Lake sites, the ratio drops to 0.5. This observation lends some support to the first hypothesis.

The higher percentage of cherts at the Pelican Lake sites is not inconsistent with these observations. If one is less successful at reducing quartzite cobbles, then it becomes necessary to exploit other lithic sources. However, on the basis of the present sample, this proposition can not be considered more than pure speculation. Obviously, a larger sample of dated assemblages will need to be collected and analysed.

CONCLUSIONS

The preliminary results of this study demonstrate that cultural and/or chronological differences in quartzite cobble reduction strategies are present between the Pelican Lake sites and the later sites. Much additional research will be required to establish the cause or causes of these differences. Moreover, it is clear that a much larger comparative sample is required. These findings, nevertheless, have important implications for archaeological research on the northern Plains. Assuming that some chronological/cultural information can be salvaged from quartzite cobble assemblages, more effort towards temporally defining this industry is both needed and justified. With further study, it should be possible to reach some understanding of the many small lithic scatters that make up a significant percentage of grassland archaeological resources.

ACKNOWLEDGEMENTS

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NORTHERN PLAINS PREHISTORY: THE LATE PREHISTORIC PERIOD AS VIEWED FROM THE H.M.S. BALZAC SITE (EhPm-34)

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INTRODUCTION

The Late Prehistoric Period on the northern Plains is probably best known from a series of kill sites with stratified cultural remains from either the Old Women's or Avonlea phases (Forbis 1962:56-123; Kehoe 1973; Reeves 1978:151-174). These multiple occupation sites often exhibit compression and mixing of the phases, a problem that tends to complicate interpretations. Such is not the case at the H.M.S. Balzac site (EhPm-34), a multicomponent stratified camp containing multiple discrete occupations from both phases.

The Balzac site was identified in 1978 during a Historical Resources Impact Assessment (Reeves and McCullough 1978). Limited work in conjunction with that project identified the stratified nature of the site, but a lack of diagnostic artifacts left the question of the periods of use unresolved (Maltin and Van Dyke 1979). Subsequent pipeline construction necessitated additional archaeological work at the site. In 1982, the Archaeological Survey of Alberta funded a research program aimed at defining the nature of the natural and cultural stratigraphy in an area of the site not impacted by the previous projects.

This paper provides a descriptive overview of the excavations, material culture and current interpretations of the Balzac site. The primary intention is to bring these data to the attention of those researchers involved in the later prehistory of the northern Plains.

ENVIRONMENTAL SETTING

The Balzac site is located one mile north of the City of Calgary (Figure 1). It is situated on both sides of Nose Creek, a tributary of

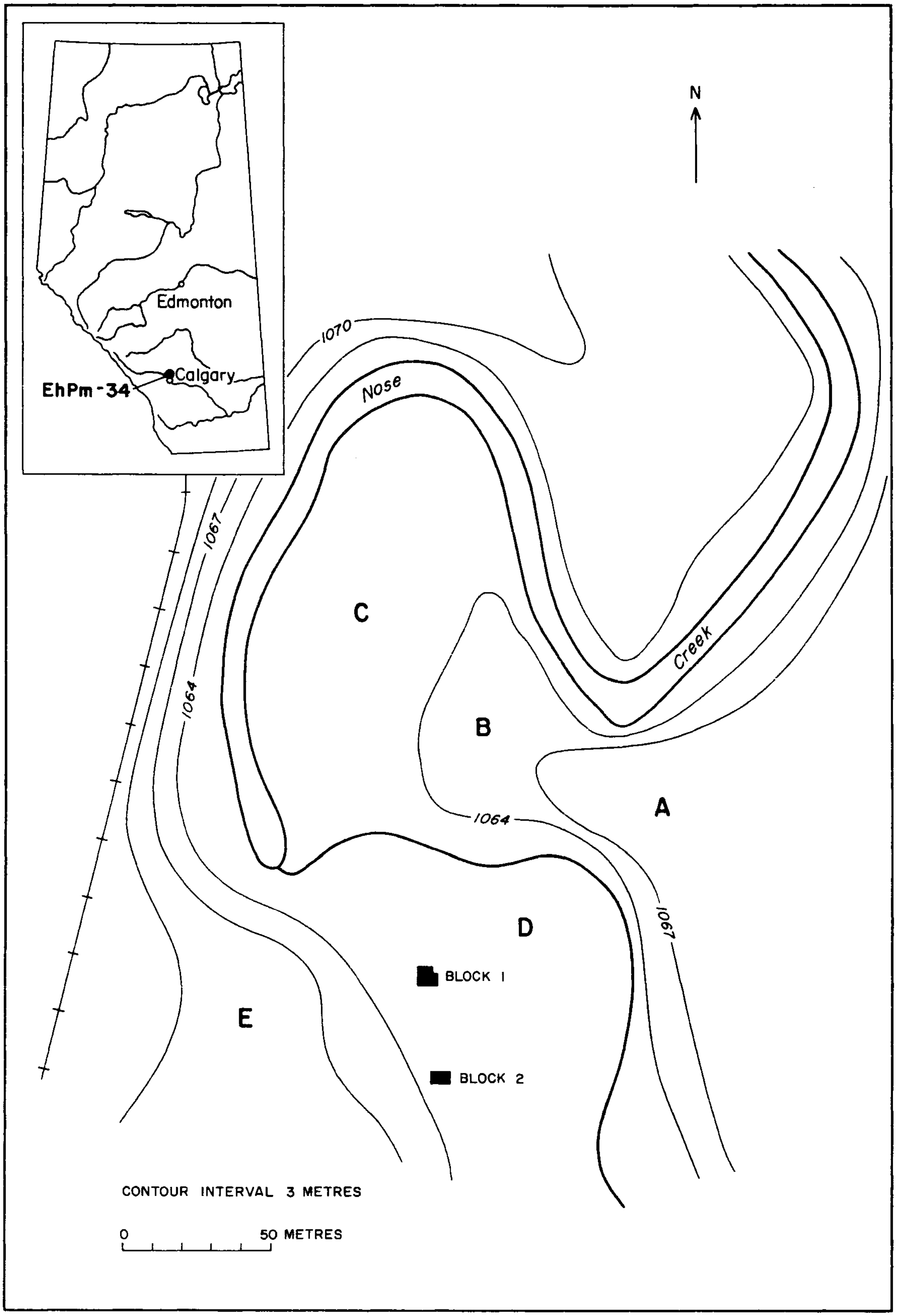

Figure 1. Balzac site location and area designations.

the Bow River, approximately 10 miles upstream from the confluence of the two waterways. Nose Creek is underfit within a well defined glacial spillway that is approximately 500 m wide and 30 m deep. Downstream from the site these dimensions remain fairly constant, but the prominent definition of the spillway is lost as it broadens dramatically north of the site. In the immediate vicinity of the Balzac site, Nose Creek is further confined to a secondary channel about 75 m wide and 3 m deep that is downcut into the underlying Paskapoo Formation sandstones. Thus confined, the creek has assumed a relatively broad S-shaped meander consistent with a relative ingrade stability and a limited flow regime. Five topographically defined areas contain cultural remains (Figure 1): the floodplain on either side of the creek (C and D), spillway bottoms on either side (A and E) and an intermediate terrace on the east side of the creek (B). Of concern in this paper are those floodplain areas adjacent to the creek which are subject to periodic overbank alluvial deposition of sand, silts and clays.

NATURAL STRATIGRAPHY

The nature and periodicity of overbank flooding in conjunction with recurrent occupation of the area by prehistoric peoples has resulted in multiple occupations with relatively discrete cultural levels. The separations of the various cultural occupations reflect deposition under two different geomorphological situations: an aggrading point bar and an infilled oxbow or thalweg. The first situation is characteristic on the northeastern portion of the floodplain which slopes from the valley side to the creek. Buried soils exhibit a similar degree of slope, suggesting a continuity of the basic sedimentary profile. Development of individual A horizons shows a distinct shift from the thin, poorly developed regosols that are present towards the bottom of the profile to the thicker and better developed horizons at the surface that might well be classified as Chernozemic.

The southwestern side of the creek exhibits a series of thin, poorly developed regosols separated by varying thicknesses of alluvial sediments. These horizons are generally horizontal or show a slignt dip from the creek to the valley side and can be classified as Cummulic

Regosols. These distinctly different profiles have resulted in differing cultural stratigraphies in the two areas.

CULTURAL STRATIGRAPHY

In the southwestern portion of the site, cultural materials are associated with each of the individual regosols, although the types and amounts of material vary considerably. Two blocks, consisting of 40 m^2 (Block 1) and 24 m^2 (Block 2), were excavated near the western valley wall (Figure 1). Although the stratigraphy in the two areas is similar, they are separated by at least 30 m distance, and a correlation of cultural horizons has yet to be adequately demonstrated. However, counts of individual regosols seem comparable. Within Block 1, Old Women's style points are associated with the fifth, sixth, seventh and possibly eighth regosol or A horizon (Figure 2), while similar points are associated with the third, fourth, fifth, sixth, seventh and eighth horizon (Figure 3) in Block 2.

Avonlea style points are associated with the tenth through thirteenth regosol in Block 1, while in Block 2, they occur in the tenth, eleventh, thirteenth and fourteenth regosol and, by inference, within the twelfth as well. The ninth regosol in both units contained no identifiable points or other materials that would allow assignment to a specific phase. The second regosol in Block 2 contained a metal trade point.

The cultural stratigraphy for the northeastern portion of the site is radically different from that noted for the southwestern portion of the site. Old Women's and Avonlea materials are both restricted to single horizons that approach or exceed 10 cm in thickness, in contrast to 1 to 2 cm thick regosols noted in the southwestern portion of the site. Beneath the Avonlea horizon, individual buried soils begin to show a marked decrease in thickness. A Pelican Lake-like point was recovered from the second horizon beneath the Avonlea component, and beneath that horizon, are four regosols with cultural materials but lacking diagnostic artifacts.

Five radiometric dates are available for separate levels from Block 2: the fourth and sixth regosols (Old Women's; Figure 3, Levels 4 and 6a), the eleventh and thirteenth (Avonlea; Figure 3, Levels 14 and 18),

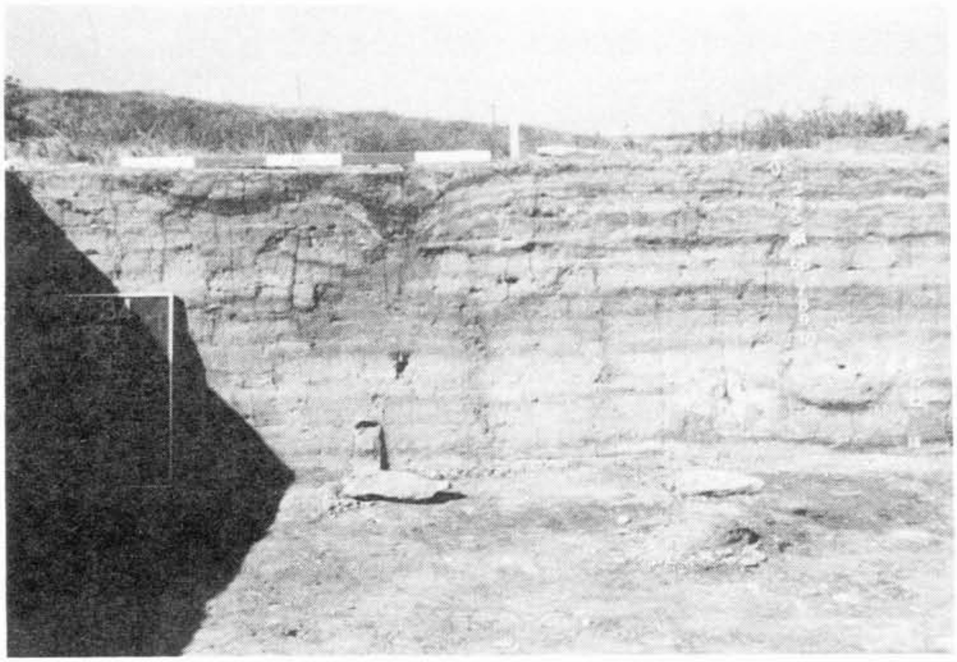

Figure 2. West profile, Unit 4, Block 1. Levels 1 through 14 are present. Each includes a regosolic A horizon and associated C horizon.

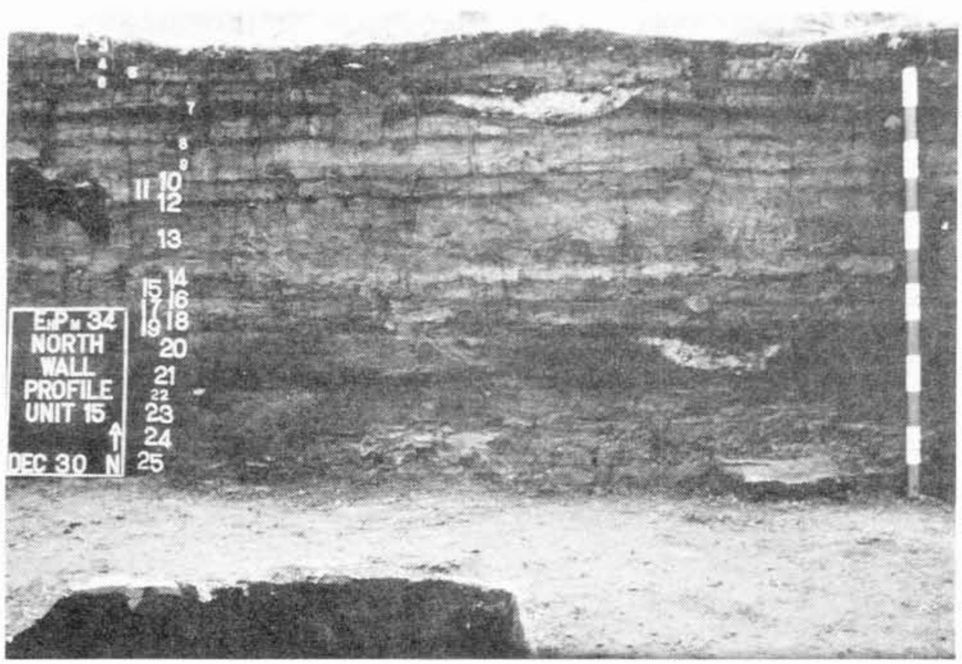

Figure 3. North wall profile, Unit 15, Block 2. Twenty-four horizons are present. Levels 1 through 7 represent regosolic A and C horizons while subsequent regosolic A horizons are identified as 8, 10, 12, 14, 16, 18, 21 and 25.

and the seventeenth regosol (unknown; Figure 3, Level 25). The upper three levels were dated on charcoal recovered from hearths, while the lower two were collagen dates on butchered bone. The Old Women's dates are modern for the fourth regosol (Beta 6440) and 320 ± 50 B.P. (Beta 6441) for the sixth. The Avonlea dates are 1280 ± 50 B.P. (Beta 6442) and 1540 ± 50 B.P. (Beta 6443) for the eleventh and thirteenth regosols, respectively. The date from the lowest level is 1010 ± 50 B.P. (Beta 6444). This date would place it later than the two previous Avonlea dates from horizons located stratigraphically above it; these latter dates both fall within the normally accepted range for Avonlea materials in this area. Thus, the lowest level date has been rejected but the specific cause for its contamination is not known, although groundwater is a possibility.

CULTURAL MATERIALS

Materials recovered from the two block excavations consist of over 7,000 lithic items, in excess of 75,000 faunal fragments, numerous ceramic sherds, many kilograms of fire modified rock and other associated items. The following discussion is concerned only with these materials recovered from the block excavations.

LITHICS

The lithic assemblage exhibits a wide variety of material types, most of which are available locally. Trade and/or population movement may be inferred from a few obviously non-local items, including obsidian and quartz crystal. Sources for the obsidian potentially may include Obsidian Cliff in Wyoming to the south or various sources in the northwestern United States or central British Columbia. The closest source for the quartz crystal lies in the Rocky Mountains to the west of the site.

Local material types include various quartzites, silicified wood, mudstones, siltstones and various cherts. Quartzites are generally of excellent quality and are characterized by a high content of silica cement that results in increased flake control. Silicified wood is a commonly used material but suffers from laminar shatter which restricts its potential for tool making.

The most obvious difference in lithic use between the Old Women's and the Avonlea components lies in the relative use of obsidian and quartz crystal. While obsidian is used heavily during the Old Women's Phase, its use by Avonlea Phase peoples is virtually nonexistent. A reverse pattern of use is apparent for quartz crystal, which is restricted almost exclusively to Avonlea components. While exceptions to this pattern do exist, they are minor and may well represent some form of disturbance. Most other materials do not show this restricted pattern of use except for silicified wood, which is used heavily in the Old Women's components, and is only marginally present in the Avonlea levels. Finally, the use of quartzite for tools also shows rather distinct differences. Within Old Women's tool assemblages, quartzite constitutes 10% or less of the total, while on Avonlea floors, use ranges from 10 to 28%, with a definite skew toward the upper end of the range.

The tool assemblage of 444 items includes assorted points, bifaces, wedges, scrapers, and retouched flakes. These tools constitute 6% of the total lithic assemblage, a figure that is constant in both block excavations. Assorted cherts comprise almost 50% of the total tool assemblage, while siltstones account for almost 25%, and quartzites and silicified wood total approximately 10% each. The remaining portion of the tool assemblage is divided between obsidian, quartz crystal and other assorted materials.

Retouched flakes of various kinds are the largest tool category and comprise 33% and 29% of the tool sample recovered from the larger and smaller block excavations, respectively. Bifaces and fragments are the second largest category, representing 27% and 29% of the sample. Complete bifaces constitute slightly less than one third of those totals.

Projectile points are the third largest tool category, representing 19% of the sample in both areas. Assorted end and side scrapers exhibit certain differences. Scrapers as a whole constitute 11% and 8% of the total assemblage from the large and small block excavations, respectively. Seven percent of the scrapers from Block 1 are side scrapers, while 6% from Block 2 are end scrapers. Differential use of materials is also suggested, with siltstones and pebble cherts most commonly used for end scrapers, while side scrapers tend to be made of quartzite.

Wedges are the next largest tool type, comprising 8% and 4% of the small and large excavated assemblages, respectively. Specific statements concerning distribution are inappropriate since almost half of the sample is associated with a single Old Women's occupation.

The remaining tool types consist of cores, core fragments, drills, gravers, a hammerstone and a chopper. These tools comprise less than 7% of the total and, in the case of the last two items, represent a minor element, in contrast to the often fairly large samples from many other sites, especially kill sites.

Debitage analysis indicates that tool resharpening was a common activity, while primary manufacturing debris associated with core reduction is extremely limited. This is supported by the small percentage of cores, core fragments and decortication debitage recovered.

FAUNA

Faunal remains constitute the principal cultural material recovered, numbering in excess of 75,000 items; most of these are bison. Heavy butchering characterized by few complete elements and extreme fragmentation is the general rule. Few skulls or other axial elements are present. When found, they are generally represented by mandibular or spinous process fragments.

Limb elements are common, but different portions of the various elements remain. Heavy butchering or selective removal has almost completely eliminated the proximal ends of the femur, tibia and humerus. The distal end of the femur is also generally absent. Although the ulna, radius and metapodials are more complete than the other limb elements, they are rarely whole. Remaining lower limb elements, when present, do not exhibit the fragmentation noted for the upper portions.

Butchering marks are not overly common. Much of this apparent absence can probably be attributed to the fragmented nature of the sample. Thus, the more common occurrence of butchering marks on the metapodials is seen as a product of less heavy processing rather than solely as a consequence of heavy butchering. One of the most common signs of butchering is a groove across the mid shafts of the metapodials, possibly resulting from skinning.

Taphonomic processes have also affected the sample. Most noticeable are the signs of gnawing, largely by carnivores but also by small rodents. Scooping of the ends of a few limb elements is obvious but certainly not common. More common but still rare is the presence of paired puncture marks, sometimes with matching marks on the opposing side of the element, suggestive of canine puncture marks. This occurs most often on vertebral processes, ribs and scapula fragments. Scoring of other elements and minor gnawing by rodents are also evident.

Possible biasing of the sample may be attributed to fluvial action. However, this is thought to be of minor importance. Factors which would appear to argue against considerable disturbance include articulation of faunal elements, conjoinability of butchered fragments, and the lack of apparent differential sorting of various sized faunal elements, lithics and fire cracked rock.

Bison bone dominates the assemblage, although other species are represented. Other ungulates include deer and antelope. Small mammals are represented by various canids, badger and beaver. Also present are a small number of avian fauna. Mollusc shell is present in almost every occupation. This latter item could represent a possible food source but various factors would appear to argue against this interpretation. Assuming a fresh water derivation for the shell, the lack of molluscan species along Nose Creek (presently, and presumably in the past), as well as the distance from the Bow River where a potential source exists, would seem to argue against a possible food source.

The majority of bone tools consist of various spatula and awl-like forms made on fortuitous green bone breaks with little or no additional modification other than smoothing and polishing. This modification probably has occurred as a result of use. A more structured approach to bone tool manufacture is suggested by the deep V-shaped grooves on a few scapulae and distal metatarsal fragments. The latter items are likely associated with the manufacture of toothed fleshing tools. A single example of this tool type together with discarded remains from the manufacture of similar items were recovered from three of the Avonlea floors in the smaller excavation.

The sequence of manufacture of toothed fleshing tools, based on the recovered items, begins with the removal of the distal portion of the metatarsal by cutting through the posterior portion of the cortex into the cancellous cavity just proximal to the articular condyles. Downward pressure separates the two sections creating a bevelled edge on the anterior surface that thickens toward the proximal end of the element. The bevelled face is then planed down to the desired thickness. The recovered tool bears parallel grooves at right angles to the longitudinal plane of the bone, indicating the direction of the planing motion used as well as suggesting that a granular material, possibly sandstone, was used. The final step involves incising the grooves or teeth which extend onto both faces on the recovered specimen.

Other possible bone tools include worked beaver incisors and badger mandibles. Beaver is represented at the site by fragments of at least two incisors. Both are clearly worked on the inner or lingual surface. The use of beaver incisors as chisels is documented for forested areas to the west, north and east (Wright 1972:98); a similar use is possible in this instance. Badger mandibles have been suggested as tools at the Hartell Creek site (Murray, Smith and Reeves 1976:45), and such may be the case here given the similarities in periods of use, site settings and apparent occupational activities.

CERAMICS

Ceramics are present on floors associated with both phases, but the quantities are not particularly large. Temper in both phases consists of crushed granite or coarse sand. Individual grains range in size from 1 to 4 mm. Production in both reducing and oxidizing atmospheres is indicated by external firing rims in the latter up to 3.5 mm in thickness. Exterior decoration is limited. Old Women's materials usually possess smoothed exterior and interior surfaces with faint suggestions of grooved exterior impressions, possibly from a cord wrapped paddle. A single rectangular punctate was noted on a rim sherd recovered from an Old Women's floor. In contrast, the exterior decoration on Avonlea ceramics suggests deep, irregular impressions, possibly cord impressed. Sherd thicknesses seem to show a bimodal distribution, with

Avonlea materials falling into the 7.5 to 9.7 mm range, and Old Women's ceramics ranging from 7.9 to 12.5 mm, with a definite skew toward the upper end of the range. A small number of rim sherds were recovered from both phases, but show little variation in addition to the decorated rim sherd previously discussed, other than a slightly thickened flange or ridge on the Old Women's ceramics.

OTHER MATERIALS

A single shell bead, a fragmentary shell pendant, a grooved bone bead, and a ground and perforated tooth are other artifacts of note. The shell for the production of the bead and pendant is most likely of local freshwater derivation as opposed to being fossiliferous. This is supported by both its excellent preservation and the presence of numerous other seemingly unmodified pieces. At least one of the unmodified pieces conceivably could have been employed as a scraper, suggested by step fracturing along one of the edges.

The bone bead is approximately 7 mm in length with a small groove encircling it medially. Possible manufacture on a canid metapodial is suggested by the thickness of the item.

The final item of note is a small oval tooth fragment approximately 15 mm long and 5 mm wide. The edges have been intentionally formed and smoothed, and a groove has been incised across the width of the enamelled surface. The obverse, dentine side contains three small drilled holes with stepped profiles.

FEATURES

Assorted features have been identified and include a number of hearths, a few pits and possible structural remains. Hearths are generally basin shaped, 50 to 75 cm in diameter and 5 to 20 cm in depth. One hearth, from an Old Women's floor, follows the same pattern but has a single ring of stone around the rim.

Hearth fills are characterized by quantities of charcoal, ash, burnt and unburnt bone, fire modified rock and other cultural materials. Reuse of the features is suggested by internal stratigraphy consisting of interdigitating layers of the various materials and soil. The presence of a 2 cm thick band of ash and burnt bone covering an area in excess of 10 m^2 may also be indicative of cleaning and reuse of a hearth. Hearth fills from Block 2 have been retained for later study.

Excavated pit features exhibit a rather narrow width to depth ratio. A variety of materials including ash, charcoal, fire modified rock and bone were recovered from these features and, in most cases, seem to represent discarded materials.

Possible structural remains are present on two of the Avonlea floors and include an area of patterned sandstone slabs (Figure 4), possibly a stone circle, as well as a parallel linear arrangement of bone, fire modified rock and scattered lithics. The function of this latter pattern is unclear.

Figure 4. Avonlea floor, level 14, Block 2. Possible stone circle indicated by sandstone slabs in photo.

SEASONALITY

The main seasonal indicators are foetal bison bones. This sample is small and usually represents only a single animal on any given floor. While the presence of a single foetal individual on any floor is an ambiguous seasonal indicator, the recurrent presence of these on multiple floors implies winter to early spring occupation.

Two seeds may also be used to infer seasonal use as well as possible function of the site. They have tentatively been identified as chokecherry (*Prunus virginiana*) and wild plum (*Prunus americana*). Both mature in the fall of the year and various ethnographic references mention that they were eaten fresh or dried for later use (Hellson and Gadd 1974:104; Gilmore 1977:35-36). The pulp and pits of chokecherries were pounded and mixed with meat and fat to form pemmican (ibid.).

CONCLUSION

The H.M.S. Balzac Site is a deeply stratified habitation site that was occupied on a fairly continuous basis for at least the last two millenia. In general, the available radiometric dates, together with the number of natural depositional events and associated cultural events, suggest that periodic flood cycles sufficient to entrain sediments and bury the site occurred at 150 to 250 year intervals over that period. The nature of the deposition, together with the associated cultural remains, thus allows the examination of cultural continuity and change for the period of concern.

Functionally, the site served as a campsite and processing area, probably for a closely related kill site presumed to be somewhere in the area. Intra-site activity patterning is suggested by a number of artifact distributions and may have been consistent through time, on both horizontal and vertical planes. Factors which suggest such patterning are most apparent on the Avonlea floors. First, ceramics are present on all Avonlea floors in the Block 1 excavation, while none were recovered from the comparable floors in the smaller excavation. Second, the Block 2 excavation resulted in the only evidence of bone fleshing tools, recovered from three of the Avonlea floors. The distribution of these artifacts would seem to argue for some continuity of use of specific portions of the site through time. On a more general basis, the distribution of cultural remains in the smaller excavation exhibits an approximately eight fold increase in the number of items per square metre over the larger excavation. This distribution difference remains fairly consistent through time in both the Old Women's and Avonlea floors.

The Balzac site can also be viewed in terms of how it compares stratigraphically to other sites of similar age in the area, such as Head-Smashed-In, Old Women's jump and the Hartell Creek site. At Head-Smashed-In, multiple Old Women's and Avonlea floors are present and are directly comparable to those at H.M.S. Balzac. This sequence can be further expanded to include Pelican Lake, although the nature of that period of use at Balzac is poorly understood. Besant occupations are apparently absent at both sites.

In contrast, the Old Women's jump contains the Old Women's floors but lacks the Avonlea floors. Radiometric dates for the Besant occupations at the Old Women's jump fall at the lower limit for the dated Balzac Avonlea floors. An overlap of the occupations of the two sites is thus likely.

Similarities between Balzac and the Hartell Creek site, a campsite located approximately 30 km east of Calgary, are quite remarkable (Murray, Smith and Reeves 1976). The physical settings are identical in many ways, and the sequence of use for the northeastern portion of Balzac is comparable to that recorded for Hartell Creek. The Balzac Avonlea components are more poorly represented, while the sequence of Old Women's floors is similar. Pelican Lake occupations are present at both sites, while a Besant occupation occurs only at Hartell Creek.

Stratigraphy aside, artifact comparisons can also be made. The Old Women's phase definition, as suggested by Reeves (1978), consists of a similar pattern of tool forms, including elongated bifaces. In addition, the Avonlea floors exhibit material type similarities. Most notable is the preference for materials that originate in the Rocky Mountains. A notable difference is the presence of silicified wood in the Avonlea components at Balzac. This material was absent at Head-Smashed-In. Kehoe (1973) did note the extensive use of the same material at the Gull Lake site, however, suggesting variations in material availability. The most obvious variation in raw material use at Balzac is the presence of obsidian on Old Women's floors and quartz crystal on Avonlea floors. As noted earlier, these are mutually exclusive.

Forbis (1962) defined a number of different point types at the Old Women's jump, and various authors have subsequently used his sequence. A comparison of the points recovered at Balzac reveals a similar distribution through time, from High River to Pekisko style points as one proceeds up through the sequence from the lowest Old Women's floors. Nanton style points comprise only a minor portion of the Balzac assemblage, while they were a major part of the assemblage at Old Women's jump. Washita style points are absent from the Balzac site assemblage. However, a small sample size may account for the differences noted.

Ceramics, present on both Avonlea and Old Women's floors, are quite similar in construction with the exception of the surface finishing techniques. The most noticeable difference is that the Avonlea ceramics contain no indication of the parallel grooved ware present at various sites in Montana and southern Saskatchewan, including the Avonlea type site (Olga Klimko, personal communication 1984).

The H.M.S. Balzac site affords an opportunity to examine cultural change over the last two millenia on a fairly time specific basis. Questions concerning the relationships between the groups that used the two point styles can be considered, but a hiatus between the groups of occupations renders specific questions concerning the period of interface unanswered at this time. Despite this problem, the site is one of the best Late Prehistoric campsites presently known. It affords a unique opportunity to examine cultural changes as well as indications of site patterning that continue through time and possibly across stylistic boundaries for the majority of the Late Prehistoric Period.

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INVESTIGATIONS AT A BESANT STONE RING SITE (32OL270) IN CENTRAL NORTH DAKOTA

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INTRODUCTION

Archaeological site 32OL270 is a stone circle site of eleven stone rings with accompanying lithic scatter and buried features. It was occupied intermittently from ca. 1780 to 860 years B.P., or A.D. 170 to A.D. 1090. Some portions of the site have been disturbed and destroyed by industrial construction. The remainder of the site is within the impact zone of proposed mining operations. The site was first recorded and tested by Historical and Archaeological Surveys, Inc. (1982, 1983). Because of the site's potential to yield significant information on stone circle use and Plains Woodland occupation, the North Dakota Office of Historic Preservation approved a mitigation plan of archaeological excavation. Basin Co-operative Services selected GCM Services, Inc. to conduct the mitigation plan; fieldwork was carried out during August of 1983. This paper is a summary of the results of the fieldwork and analysis; the details are presented in Fredlund et al. 1984.

The primary goal of this project was to mitigate the destruction of site 32OL270 by excavation of the cultural deposits and thorough description of the cultural materials recovered and features observed. Quigg and Brumley (1984) have discussed specific data which they felt were essential to the analysis of stone ring sites, and these served as a guideline and minimum level of recording. Secondary objectives were to answer questions regarding the occupations of the site, such as how the occupations relate to the local cultural environment, how this site relates to other sites on the Northern Plains, and how the occupants used the stone circles and other features at the site.

PHYSICAL SETTING

Archaeological site 32OL270 is located on the southern edge of the Missouri River trench in central North Dakota (Figure 1). The site is on a relatively flat bench within the "river breaks" physiographic zone adjacent to a small hardwood draw or coulee containing a perennial spring. The immediate area of the site provides an ecotonal situation with the hardwood coulee, the adjacent upland prairie, and the breaks zone of the Missouri River.

The general terrain, including the Missouri River trench, was sculpted after the retreat of the Pleistocene glaciers. The soils are mainly developed in loess. The two dominant soils at the site are Linton series which are typical of prairie soils (Mollisols) in subhumid environments. Excavation was confined to the A1 and Bw horizons. Cultural materials were almost totally within the Bw horizon and no materials (other than those displaced by rodents) were found in the BC horizon. There was no discernable cultural or natural stratigraphy to separate cultural materials in the Bw horizon.

The glacial gravels contain a wide variety of lithic types, many of which were of significance to the prehistoric human populations. Among the latter are Tongue River Silicified Sediment (TRSS), cherts, agates, and quartzites. Below the glacial till is the Paleocene Fort Union Formation which contains sandstones, silts, clay, and coal. Below Fort Union is the Paleocene Cannonball Formation. Exposures of the Cannonball are lower in the valley of the Missouri River and are not significant to the geology of the site area (U.S. Dept. of the Interior, Bureau of Land Management 1973, 1976).

The physiography of the site area, the river breaks, is dissected, often steep terrain caused by erosion of the upland prairie. This results in a range from relatively flat, mixed grass prairie benches to steep drops. Within the breaks zone, are draws and coulees with creeks which generally originate at springs near the uplands-breaks junction. These draws and coulees are wooded with a variety of deciduous trees and many brush species; they are important to the ecology of the area because they provide water and shelter for animals and contain a variety of plant species. Some of the more important ones are green ash (*Fraxinus*

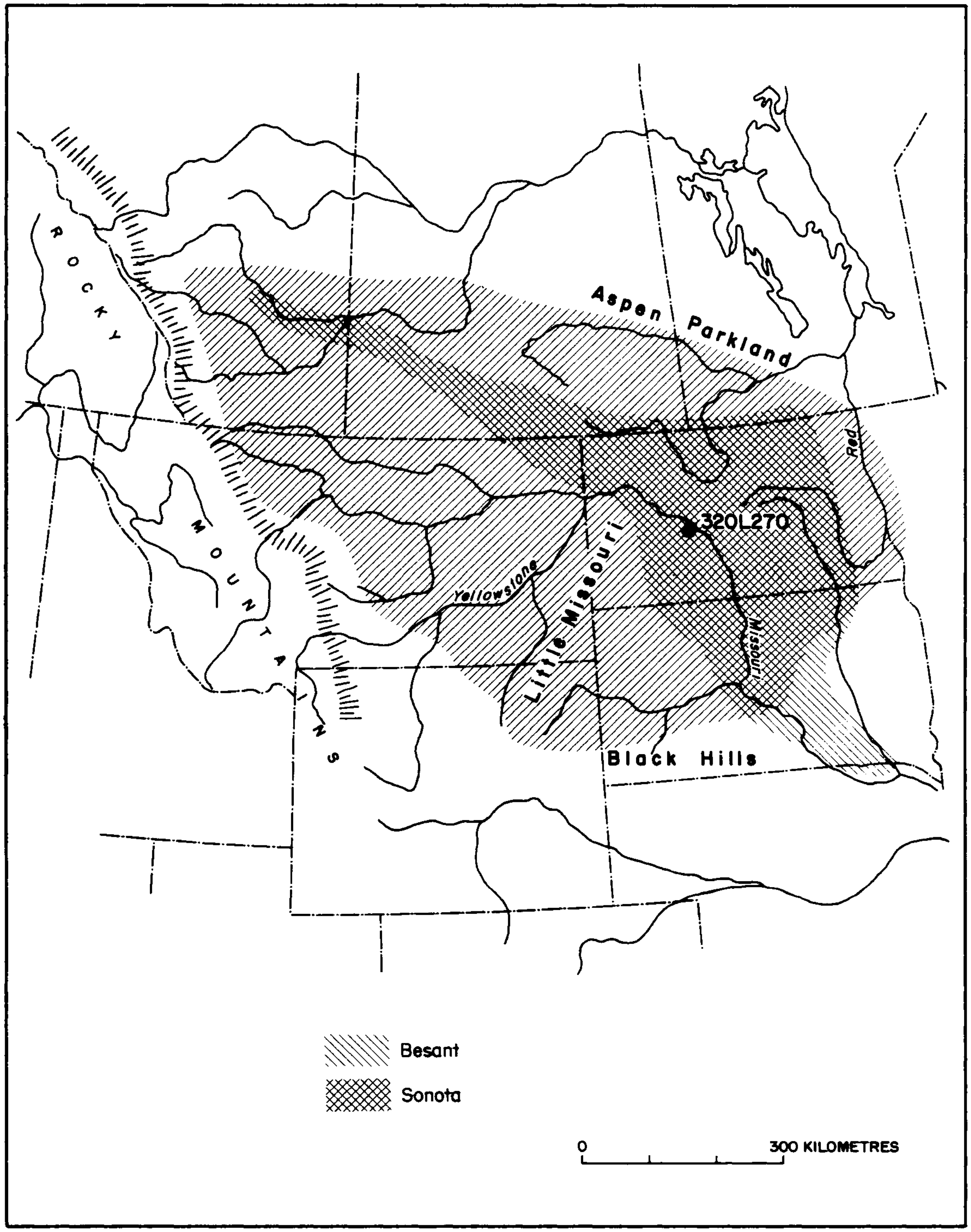

Figure 1. Map showing location of site 32OL270 within North Dakota and its relationship to hypothesized distributions of Besant and Sonota complexes as defined by Syms (1977).

pennsylvanica), American elm (Ulnus americana), box elder (Acer negundo), snowberry (Symphoricarpos sp.), chokecherry (Prunus virginiana), buffaloberry (Shepherdia argenta), wild plum (Prunus americanus) and hawthorn (Cretaegus sp.). The hardwood coulees are of particular significance to the general ecology of the area because they:

> ...provide shelter for animals during severe climatic conditions, provide nesting and roosting habitat for birds, and browse plants for foraging. The coulees, grassy slopes and ridges provide shelter, nesting and escape cover, and food from berry-producing shrubs for upland game birds. Nesting cover along the heads of drainages and dense woody stands of shrubs are used intensely by sharptail grouse. The grassland ridges are good reservoirs for rodent populations that serve as hunting areas for various carnivorous and avian predator species. The intermingled areas provide an "edge effect" for wildlife feeding in the fields and resting in the brushy coulees (U.S. Department of the Interior, Bureau of Land Management 1973:18a-20).

As is evident by the cluster of sites near 32OL270 and at most hardwood draws or coulees along the breaks-upland prairie junction, these locations were significant to human groups. At the head of the draw above the site, for example, is a bison trap; on the ridge above is a lithic scatter with a probable burial cairn; and across the coulee is another stone circle site with lithic material and buried cultural features.

Climate was relatively consistent during the span of occupation at 32OL270 (Figure 2). The short term, disruptive influences which affected bison and other faunal and floral species were primarily fire and severe drought. Bison herds, if migratory as suggested by Syms (1977) and Morgan (1979), would probably have been in the area in the spring/summer/fall months with some small herds probably wintering in the river valley. Changes in moisture levels on a short term basis (10-20 years) might affect the numbers in the herds but probably not the pattern of bison movement. Although short term climatic shifts did undoubtedly occur in central North Dakota, effects on the ecology and, in turn, on the transitory human populations were probably relatively minor.

Within 300 km of the site are several major geographic-ecological zones which could be exploited by a human population on a scheduled basis (Figure 1). These include the aspen parkland to the north, the

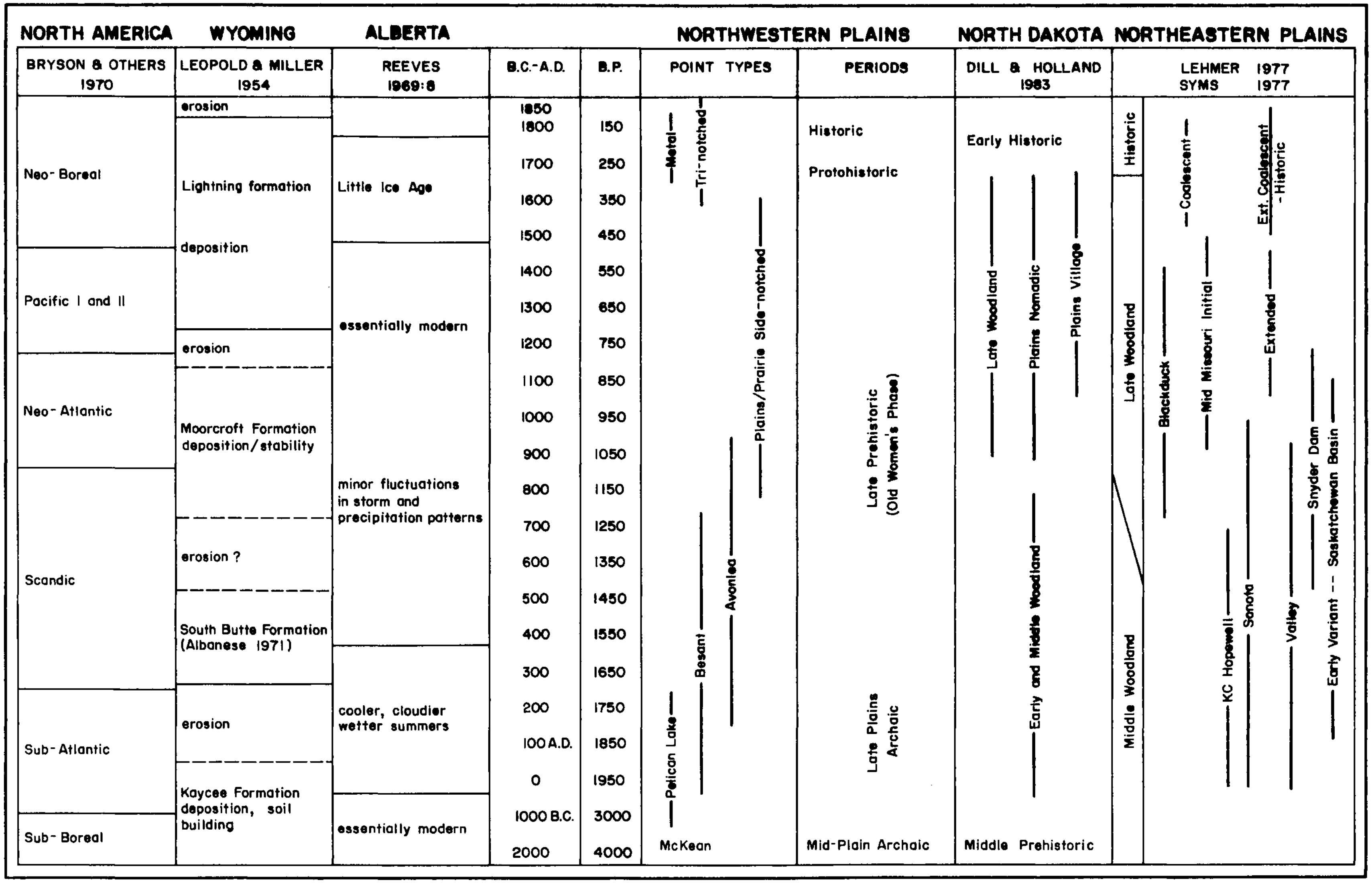

Figure 2. Environmental and cultural history of central North Dakota from 4000 years ago to the present.

conifer-hardwood forest to the east, the forests and mountainous ecotones in the Black Hills to the southeast, and the juniper-ponderosa pine breaks of the Little Missouri River to the west. Besides different floral resources, these areas contain a variety of preferred lithic materials including Yellowstone agate and cherts in the Yellowstone River gravels near Glendive, Montana; cherts and quartzites in the Black Hills; porcellanites in western North Dakota and eastern Montana; and Swan River Cherts in southwest Manitoba. Of particular significance and in similar environment as 32OL270 are the Knife River quarries 100 km to the west.

In summary, the environmental setting of 32OL270 provides: an ecotonal environment at the juncture of the upland prairie, wooded draw, and river breaks ecozones; a ready supply of water and wood from the adjacent hardwood draw; lithic materials (TRSS, agate, cherts, quartzite) on-site for stone tool manufacture; a superior lithic material (Knife River Flint) in reasonable proximity to the west; daily access to the four physiographic zones (valley bottom, terraces, breaks and upland prairie) of the Missouri River trench, each zone providing somewhat different fauna and flora; and probably greater stability of ecosystems within the Missouri Trench than out on the open prairie because of the shelter offered by the valley complex (Morgan 1979).

METHODS AND TECHNIQUES

Excavation plans and research goals for 32OL270 were based on survey results, preliminary testing (Historical and Archaeological Surveys, Inc. 1983) and background knowledge of the archaeological context of the region. Test excavation and auger testing revealed intact cultural deposits in most of the stone circles. Based on the amount of material recovered during testing, two stone circles were selected as being most likely to yield sufficiently dense distributions of cultural materials to meet research objectives.

There were two stages to the fieldwork program. The first was excavation of the two rings; the second was mechanical stripping of the site to locate and excavate features outside the two rings. Excavation was designed to identify in detail all activity areas, features and artifacts associated with the rings and to maximize the recovery of all potentially useful material for analysis. The primary cultural level was between 10-15 cm to 20-25 cm below surface. Excavation of the rings consisted of a 9 x 9 m ($81m^2$) block unit enclosing each ring. Each 9 x 9 m unit was excavated in 1 x 1 m sections according to three natural levels, each approximately 10 cm thick $\pm$ 5 cm. Level II, the cultural level, was hand troweled in the rings and around the ring rocks. Outside the rings, this level was skim shoveled, since there was a significantly lower amount of cultural material. Hydraulic techniques were used to screen all soils from Levels II and III within the rings, while a power screen was used for the soils outside of the rings.

The objective of the second stage of work was to investigate intra-site patterning of hearth features, storage pits and other buried features. Mechanical stripping exposed the majority of the site below the sod. A total of 30 features were located as a result of mechanical scraping and hand augering; twenty-two of these were excavated.

A Caterpillar scraper, or "paddlewheel", was used for sod removal. A road grader, also brought to the site, proved to be a poor choice because of the numerous glacial boulders in the soil. The operator of the scraper developed a technique for extracting the boulders from the ground with minimal soil disturbance. An archeologist walked beside the machine to aid the operator in adjusting the depth of the cutterbar so only about 5 cm of soil was removed. All stains, bone fragments, tools, etc., were flagged for further examination after the scraping was completed. Several hundred of these flagged locations were tested with a soil probe to determine if they were cultural features, isolated occurrences, or due to rodent disturbance. Of those determined to be cultural features, a selected sample was excavated. These excavated features included large dumps, hearths, and bone uprights.

MATERIAL CULTURE

FEATURES

The term feature, as used here, represents those cultural manifestations best described as individual entities. These include 11 stone rings, 10 hearths, 12 refuse dumps, seven bone uprights, one lithic reduction area, four post molds, two atypical rock cluster features, and several groups of chalk pebble clusters.

Physical Characteristics of the Stone Rings

The most obvious features at 32OL270 are the stone rings which undoubtedly demarcate dwelling units. Both of the rings selected for excavation (Rings 4 and 9) were measured, and the rocks were counted, weighed and lithologically typed (Tables 1 and 2). During excavation, it was discovered that the east side of Ring 9 was connected to a second ring (9B), and it was impossible to differentiate which stones belonged to which ring in the area of joining. Since Ring 9B was constructed of relatively few stones, it was decided to consider all of the stones in this portion as part of Ring 9. This was thought to have the least effect on skewing the data on the numbers and weights of the stones in the two rings.

At both Rings 4 and 9, there were several stones that were not considered part of the stone alignments and, therefore, are not included in the following ring statistics. These stones may have at one time been part of the stone rings but for any number of reasons were moved out of the alignments. Such stones were located both inside and outside of the rings.

The rock alignments of Rings 4 and 9 were similar. The number of rocks varied by eight, and in total rock mass, they were within 18% of each other. Granite was the major rock type, and TRSS was second; the number and mass of granite and TRSS rocks were almost the same in each ring. The average width of the rock alignments in the rings was within 20 cm of each other. The major difference was that Ring 9 was connected to another ring, 9B, as noted. Rock weight distribution in Ring 4 was skewed to the northeast, while in Ring 9, the weight was greatest in the southeast (Figure 3). If the assumption is made that greater rock weight is placed on the windward side of a tipi, the weight distribution at 32OL270 indicates that the winds during the occupation were easterly. For central North Dakota today:

> The most frequent and the highest wind speeds occur out of the northwest quadrant, especially in the colder months. During the

Table 1. Descriptive statistics for Rings 4 and 9.

Categories	Ring 4		Ring 9	
outside diameter	8 m N/S x 7.7 m E/W		7.2 N/S x 6.8 m E/W	
inside diameter	6 m N/S x 5.4 m E/W		5 m N/S x 5 m E/W	
average width of rock alignment	1 m		0.8 m	
number of rocks in alignment	160		168	
total weight	1148 kg		1400 kg	
range of rock weights	0.1 kg to 41 kg		0.1 kg to 70 kg	
average weight	7.2 kg		8.3 kg	
total weight of rocks by quarter of circle:	NE1/4	400 kg	NE1/4	408 kg
	SE1/4	237 kg	SE1/4	467 kg
	SW1/4	266 kg	SW1/4	299 kg
	NW1/4	245 kg	NW1/4	226 kg
		1148 kg		1400 kg

Table 2. Listing of rock types, number, weights and mean weights in Rings 4 and 9.

Rock Type	Number	Weight	Mean Weight
Ring 4			
granite	100	766.0 kg	7.7 kg
TRSS	44	324.0	7.4
chalk	4	6.0	1.5
rhyolite	4	34.0	8.5
sandstone	2	16.0	8.0
basalt	2	1.0	0.5
mica schist	2	1.0	0.5
slate	2	0.13	0.07
	160	1148.13 kg	7.17 kg
Ring 9			
granite	104	928.0 kg	8.9 kg
TRSS	41	368.0	9.0
chalk	11	49.0	4.5
basalt	3	24.0	8.0
quartzite	5	26.0	5.2
slate	4	5.0	2.5
	168	1400.0 kg	8.3 kg

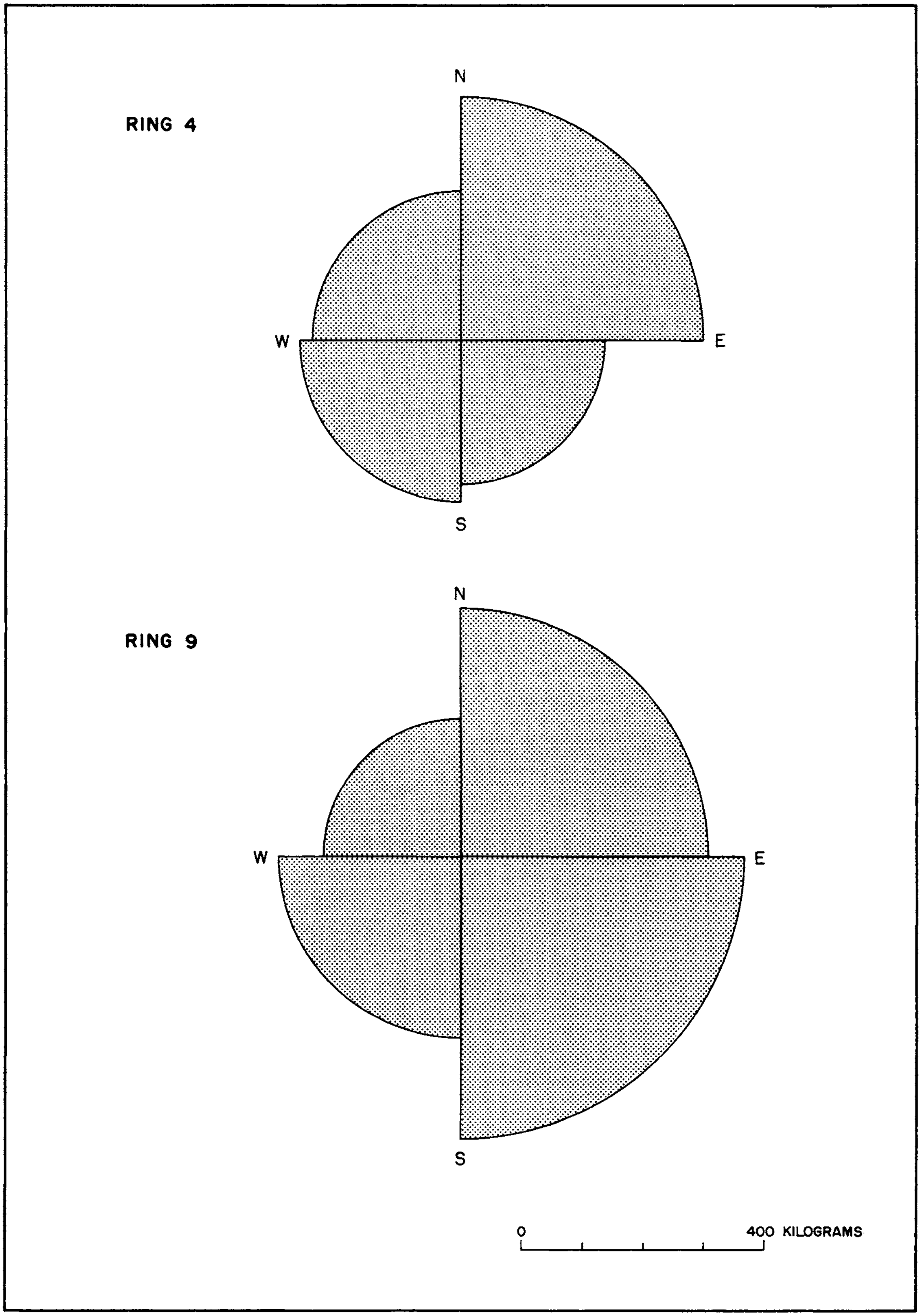

Figure 3. Circle graphs of rock weights in each quarter of Rings 4 and 9.

> warmer months, the frequencies of wind direction are more uniform than during winter with the most frequent and fastest winds bearing from the southeast quadrant. Mean annual wind speeds vary among four stations 8.2 knots at Minot to 11.9 knots at Dickinson (U.S. Department of the Interior, Bureau of Land Management and State of North Dakota, n.d.:115-116).

Southeasterly winds currently prevail during the months of April through August and, assuming similar conditions in the past, the two stone rings may have been occupied during that season.

The arrangement of the rings across the site suggests that there is no ordered arrangement in ring location (Figure 4). However, we do not know if all the rings have been discovered (e.g., more may exist outside the scraped area), or whether some have already been destroyed; furthermore, it is not known whether the rings were all constructed or used at one time.

Refuse Dumps

Of the 20 refuse dumps identified, 12 were excavated. These dumps were characterized as flat, 5-10 cm thick layers of burned and unburned bone, ash, tools, lithic debitage, fire cracked rock and occasional pot sherds. Materials found in the dumps were similar to materials found in hearths, and all but two are within 10 m of a hearth (Figure 4). It is suggested that the dumps reflect activities that took place in the hearths. On the basis of the dump contents, the main activity is inferred to have been marrow extraction by burning and/or boiling the bones. It would appear that, following the cooking activities, the hearths were regularly cleaned out and the contents dumped at selected locations around the site.

There are two clusters of refuse dumps. One, about 14 m north of Ring 9, included six dumps, one of which was excavated. This was Feature 29 which contained only two types of refuse: fire broken granite cobbles and bison bone fragments, suggesting that this represents material from stone boiling of bones. The other cluster of refuse dumps was 6 m west of Ring 4. Of the four dumps, one (Feature 21) was excavated and was found to contain tools and lithic debitage as well as rock and bone.

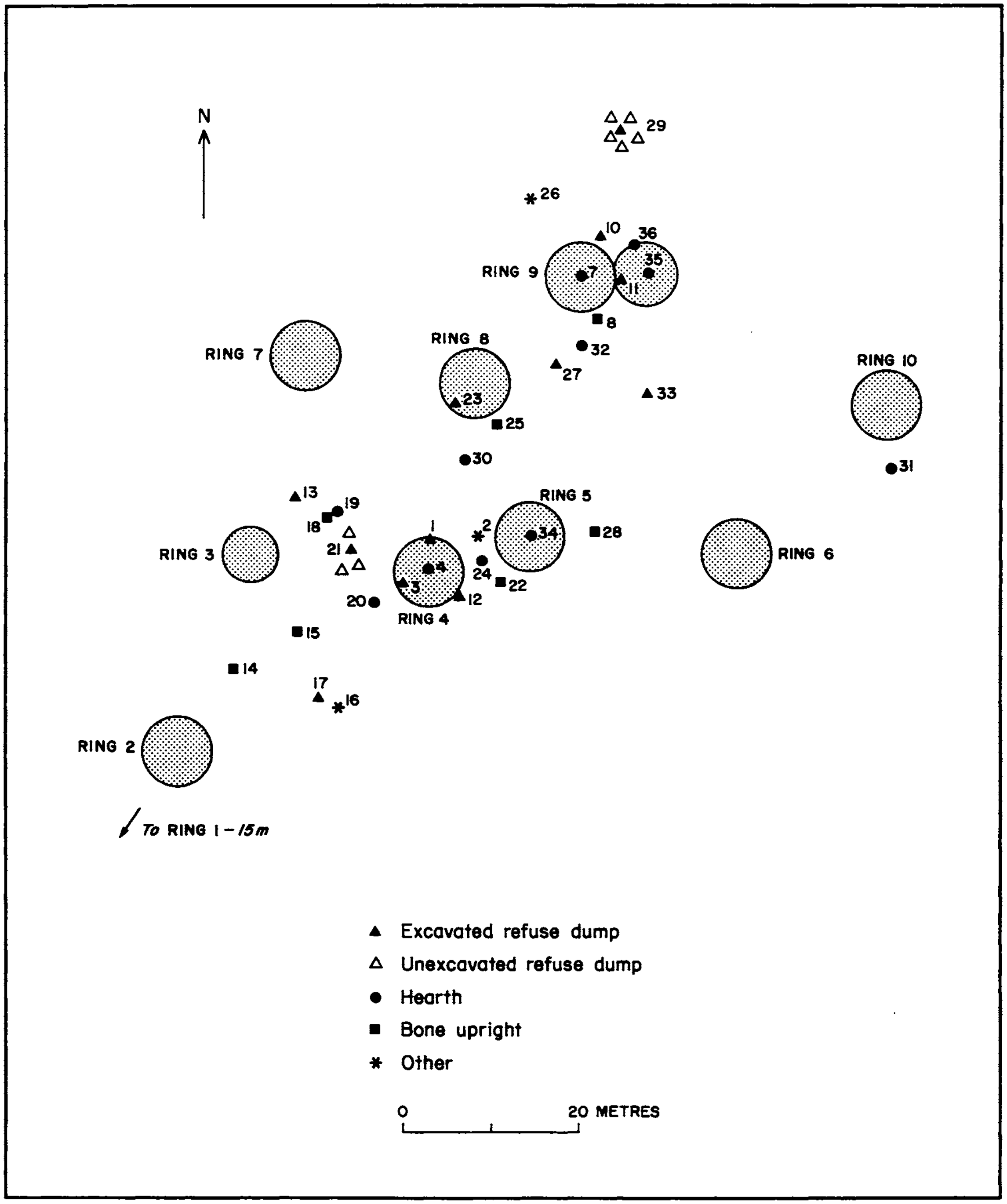

Figure 4. Map of 320L270 showing locations of rings and features.

Four refuse dumps were dated by radiocarbon. Three of the dumps were within the time frame of the later occupation of the two rings (A.D. 800-1200). One refuse dump had two dates, modern and A.D. 290; both these dates are questioned because of the small amount of carbon processed.

Bone Uprights

At 32OL270, there were seven bone upright features. Bone uprights are a characteristic feature of Besant and Sonota sites (e.g., Van Hoy 1982; Reeves 1983; Gruhn 1971; Neuman 1975), although they are also reported from sites dating to other periods (e.g., Keyser 1979). Six of those at 32OL270 had the following characteristics: they were located outside rings; they contained one split fired granite cobble; bones were placed with the articular surface up; only bison bones were used; there was no battering or modification on the bones other than splitting; and the pits had straight sides. The seventh bone upright feature consisted of a single bison scapula which appeared to have been pounded into the ground.

It is presumed that the bone uprights were used as stakes or wedges for stakes, possibly to anchor tipis. Four were found within 4 m of a ring, and all but one are less than 6 m from a ring (Figure 4). Six bone uprights were located south to southeast or east to northeast of the rings, supporting the idea of the need to bolster the tent for southeasterly winds.

All of the dates on bone uprights at the site suggest that they represent one period of occupation based on the accepted range of radiocarbon dates. Five of the dates cluster around A.D. 550 and one (from charcoal) is A.D. 250.

Hearths

Eleven hearths were excavated; four were in the centres of stone rings, one was in the peripheral rocks and five were outside of rings but within 4 to 6 m of a ring (Figure 4). All hearths but one were within 10 m of a refuse dump. There were eight refuse-filled hearths which were shallow pits; those inside the rings were slightly deeper than those outside. All exhibited some oxidation rind around the pit, inferring that they had been fired at least eight hours (based on experimental hearths built at the site). The other three hearths varied in that one was filled with stones and the other two did not have excavated pits. The contents of hearths inside and outside the rings differed in that those outside contained more unburned than burned bone.

Feature 31, near Ring 10, was somewhat anomalous in that it is the largest hearth pit at the site (72,000 cc), and the granite rocks in it exhibited greater thermal alteration than at any other hearth. These features, plus the fact that Ring 10 and Feature 31 are somewhat isolated from the main site area may indicate a specific separate activity or a different occupation.

The general lack of charcoal in the hearths at 32OL270 in most cases permitted only a single date at best. All hearths contained cracked granite cobbles, with weights ranging from 3 g to 5 kg. Three hearths associated directly with the rings were dated at A.D. 1050, A.D. 880 and A.D. 820. The other hearth dates were earlier, and represent one of the earlier occupations of 32OL270 (Table 3).

Table 3. Feature locations, radiocarbon dates and type.

Feature No.	Ring and/or Unit Number	Date	Type of Feature
1	Ring 4-53N/40E	1070+100 B.P.; A.D. 880 (Beta-7307) (charcoal)	refuse dump
2	Ring 4-51N/44E	no	FCR cluster
3	Ring 4-48N/36E	860+80 B.P.; A.D. 1090 (Beta-7957) (bone)	refuse dump
4	Ring 4-49N/39E	no	hearth
5	Ring 9-78N/57E, 78N/56E, 79N/56E	no	lithic reduction area
6	Ring 9-80N/56E	no	post molds
7	Ring 9-81N/57E, 81N/56E	900+80 B.P.; A.D. 1050 (Beta-7958) (charcoal)	hearth

Table 3 (continued)

Feature No.	Ring and/or Unit Number	Date	Type of Feature
8	1 m SE of Ring 9 72N/59E	1310+100 B.P.; A.D. 640 (Beta-7959) (bone)	bone upright
9	Ring 9-82N/57E	no	post molds
10	Ring 9-85N/58E	no	refuse dump
11	Ring 9-81N/60E	no	refuse dump
12	Ring 4-47N/43E	no	refuse dump
13	6 m NE Ring 3 57N/24E	no	refuse dump
14	6 m NE Ring 2 39N/18E	1450+100 B.P.; A.D. 500 (Beta-7960) (bone)	bone upright
15	13 m W Ring 4 43N/24E	1780+60 B.P.; A.D. 170 (Beta-7775) (charcoal)	bone upright
16	6 m W Ring 4 37N/26E	no	unknown
17	35N/28E	no	refuse dump
18	5 m E Ring 3 54N/27E	no	bone upright
19	6 m NE Ring 3 55N/27E	1470+80 B.P.; A.D. 489 (Beta-7961) (bone)	hearth
20	4 m S Ring 4 44N/32E	1740+110 B.P.; A.D. 200 (Beta-8588) (bone)	hearth
21	6 m W Ring 4 49N/30E	no	refuse dump
22	1 m S Ring 5 48N/48E	no	bone upright
23	Ring 8-63N/44E	no	refuse dump

Table 3 (continued)

Feature No.	Ring and/or Unit Number	Date	Type of Feature
24	3 m E Ring 4 51N/46E	no	hearth
25	2 m S Ring 8 60N/46E	1450±70 B.P.; A.D. 500 (Beta-8145) (bone)	bone upright
26	4 m N Ring 9 89N/51E	no	TRSS cluster
27	8 m S Ring 9 70N/54E	no	refuse dump
28	4 m E Ring 5 50N/58E	1430±70 B.P.; A.D. 510 (Beta-8146) (bone)	bone upright
29	14 m N Ring 9 99N/60E	1210±100 B.P.; A.D. 740 (Beta-8590) (bone)	refuse dump
30	6 m N Ring 4 59N/42E	no	hearth
31	4.6 m S Ring 10 56N/92E	no	hearth
32	4 m S Ring 9 73N/56E	no	hearth
33	10 m S Ring 9 67N/57E	1660±110 B.P.; A.D. 290 (Beta-7776) (charcoal)	refuse dump
33	10 m S Ring 9 67N/57E	Modern (Beta-7962)	refuse dump
34	Ring 5 52N/51E	1070±150 B.P.; A.D. 880 (Beta-7963) (charcoal)	hearth
35	Ring 9B 81N/63E	no	hearth
36	Ring 9B 85N/61E, 84N/61E	1070±100 B.P.; A.D. 880 (Beta-8147) (charcoal)	hearth

Other Features

A number of other features were excavated, including clusters of crinoidal limestone or chalk cobbles (Figure 5). The chalk cobbles appear to have been gathered and purposely placed on flat rocks. Experiments with the cobbles indicated that they did not retain heat well and broke when placed in water; thus, they were probably not used for stone boiling. The most reasonable explanation would seem to be that they were used for paint.

Other features at the site included one cluster of fire cracked granite rocks which appeared to have been dumped after burning in another location, a shallow pit filled with ashy soil, a cluster of heat treated TRSS cobbles and flakes, and four post holes inside Ring 9.

ARTIFACTS

Specific cultural material associations with the features were not distinctive. Only ceramics appeared to have been more generally associated with refuse dumps. One simple stamped incised sherd was found in Feature 1 (a refuse dump) in the peripheral rocks of Ring 4. A radiocarbon date from this feature, 1070 B.P. (A.D. 880), is somewhat early for Middle Missouri in central North Dakota. Other sherds from the site were cord roughened and classified as Plains Woodland. There were no rim sherds or decorated pieces.

Stone tools from the excavated units consisted of 50 Besant projectile points and fragments (Figure 6), two corner notched Pelican Lake-like points, 17 end scrapers and fragments, one drill tip, an ulu-like knife, 13 retouched flakes (classified as possible spokeshaves, side scrapers or gravers), one mano-hammer stone, one chopper implement, one metate, and one edge ground granite spall. These tools suggest that the inhabitants of the site were not conducting extensive food preservation activities. Rather, it seems that the major activities carried out at the site were general tool maintenance and manufacture. Projectile points, end scrapers and retouched flakes were generally clustered within Rings 4 and 9. This distribution suggests that both points and end scrapers were being reworked and possibly refitted onto shafts.

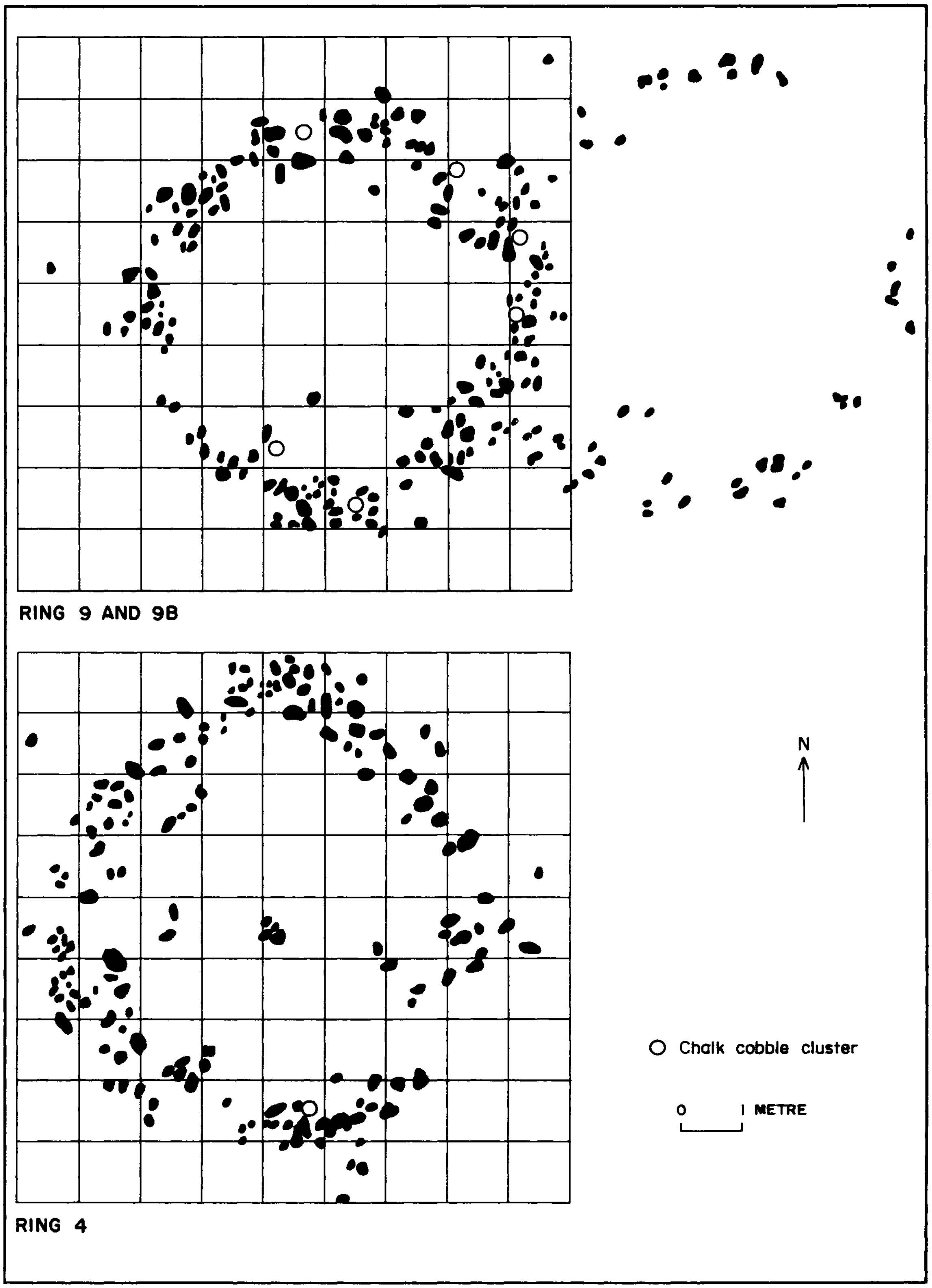

Figure 5. Locations of chalk cobble clusters within Rings 4 and 9.

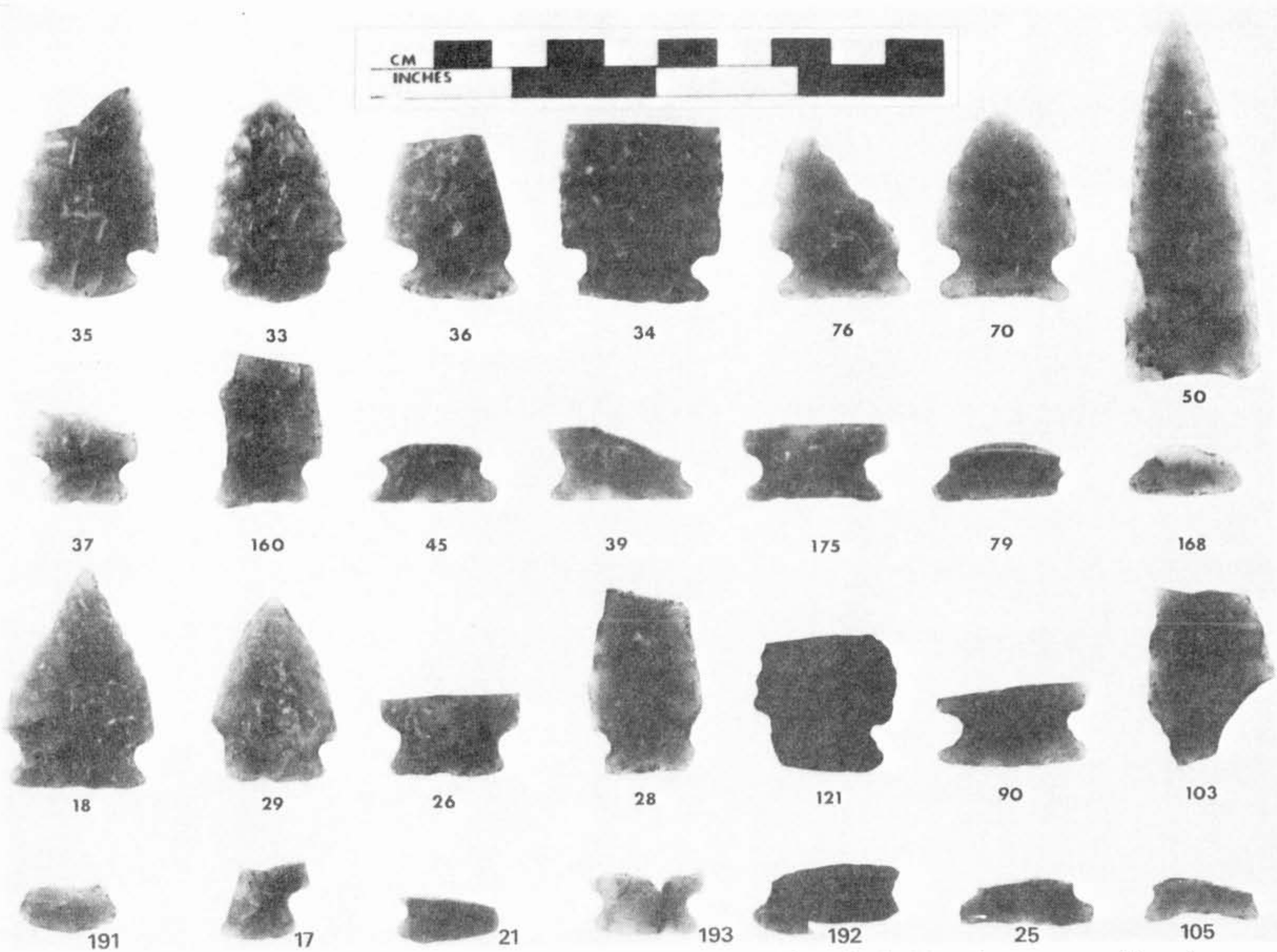

Figure 6. Projectile points from 32OL270; top two rows - Ring 9, bottom two rows - Ring 4.

LITHIC TECHNOLOGY

Both excavated rings contained large quantities of lithic debitage, 5289 in Ring 4 and 9382 in Ring 9. The distribution of lithic debitage from the two excavated rings indicated that the lithics were, essentially, spatially intact and confined to the interior ring areas. This permitted some inferences to be made regarding the technology employed for various lithic materials at the site. Tongue River Silicified Sediment (TRSS) and Knife River Flint (KRF) accounted for the majority of lithic materials. KRF made up 94.7% of the lithic assemblage in Ring 4 and 69.4% in Ring 9. Minimal use was made of TRSS in Ring 4 (3.2%), while in Ring 9, TRSS accounted for 25.3%. Other material types in the rings included two varieties of pseudo-quartzites, an orange dendritic chert, Yellowstone agate (or a very similar agate), and a white quartzite. Probably only the KRF and the white quartzite were imported into the site, since the other materials occur in local glacial and alluvial gravels.

KRF (as well as agate and chert) manufacturing debris indicates that there was an emphasis on bifacial reduction activities and that bifacial preforms and spalls were brought to the site for later reduction. Large numbers of distinctive notching flakes were found in both rings, indicating projectile point manufacture with KRF. TRSS and the pseudo-quartzites, on the other hand, show a very different technology and use. Numerous primary reduction flakes indicate large nodules were reduced on site. Pressure flakes of TRSS and quartzites were rare. Of particular interest in TRSS reduction was the preparation of "faceted-ground" platforms. Because of the type of raw material, this type of preparation helped to prevent the platform from being crushed or broken by the hard hammer blow.

FAUNAL AND FLORAL REMAINS

Faunal remains at the site were predominantly bison, with representation of elk, probably antelope, and a canid. Much of the bone was broken into small pieces and not identifiable, and a considerable amount was burned and calcined. The broken nature probably indicates that bones were being processed for their marrow content. Bison bones were from adults, sub-adults and juveniles, and one specimen was from an infant. The elements were generally leg bones, indicating that most of the carcass was probably left at the kill site.

Floral remains in the features and in the excavated units consisted largely of charred seeds of Chenopodium. Chenopodium (lambs quarter) in its young state is known to have been used as a food source by both Indians and Euro-Americans. Seeds of Chenopodium have been reported in archaeological context in the Middle Missouri area (e.g., Nickel 1977; Haberman 1982).

TEMPORAL CLASSIFICATION OF 32OL270

Radiocarbon dates indicate that human groups intermittently occupied the site area from ca. A.D. 100 to A.D. 1190 (span of dates at one sigma; Table 3), with two primary periods of occupation. Based on the radiocarbon dates, two possibilities can be suggested for the primary occupations: 1) the outside features and bone uprights represent an early Besant occupation (an average date of A.D. 360-540), while the activities in the interior of the rings and the features associated with the rings represent a later Besant occupation of the site (average date of A.D. 884-1090); or 2) the outside features, bone uprights and interior ring artifacts represent an early occupation (A.D. 360-540), while only the features associated with the rings (hearths and refuse dumps) represent the later occupation. Although there are various ways to interpret the radiocarbon dates, there are certainly at least two clusters of dates, suggesting two major episodes of occupation.

"Intrusive" elements at the site are historic trade beads which indicate historic activity on or near the site, and two Pelican Lake-like projectile points. These latter elements might be indicative of occupation of nearby sites during Pelican Lake times, or indicate that the Pelican Lake variety of point was held over later in time than generally thought. In any event, there is not enough indication of Pelican Lake activity or historic activity at the site to warrant further discussion of these elements.

The first occupation represented by the early cluster of dates is within the time span generally accepted for Besant on the Plains. Reeves (1983) discusses Besant dating but makes no distinction between Besant and Sonota. Reeves gives the temporal span of Besant as A.D. 100 to 900 in the Middle Missouri area and from A.D. 200 to 800 in the western Plains. Syms (1977) indicates that Sonota Complex dates range at 1 sigma from 100 B.C. to A.D. 1000. The first major episode of activity at 32OL270, based on averaging the dates, fits comfortably within the time frame, i.e., A.D. 450 (A.D. 360-540 at 1 sigma and A.D. 270-630 at 2 sigma).

The second episode of activity at 32OL270 is unquestionably affiliated with features associated with Rings 4, 9, 9B and 5. The average radiocarbon date from the hearths and refuse dumps affiliated with the rings is A.D. 994 $\pm$ 100 with a range from A.D. 884 to A.D. 1094 at 1 sigma and A.D. 794 to A.D. 1194 at 2 sigma. The inclusion of the single Middle Missouri sherd in a refuse dump within the rocks of Ring 4 also adds support for the reality of the later date.

The problem here is to identify the time of the occupation that resulted in the relatively intact living floors, clearly associated with Besant point manufacture and repair. The options, of which there are minimally two, are listed below. Because of the wide range of radiocarbon dates, it could be assumed that occupation of the site was intermittent for a thousand year period; however, the intense use of Rings 4 and 9 occurred only once. Two main scenarios can be described as follows:

1. <u>The Early Occupation</u>. This first episode of occupation would have occurred between A.D. 100 to A.D. 850 (the range of radiocarbon dates at 1 sigma) or A.D. 360 to A.D. 540 (the average of the dates at 1 sigma). This occupation would involve covered dwelling units, cooking most meals outside, dumping hearth refuse considerably outside the dwelling units, and use of bone uprights. The central hearths could have been used at this time and cleaned out, with the resultant pits reused during the later occupation. If the Besant lithic activity resulting in the Besant living floor was conducted in the rings at this time, the assumption must be made that post-occupation soil deposition and sod formation was such that the living floor was sealed and later occupants did not disturb it.

The Later Occupation. This occupation would involve use of the rings as dwelling units with minimal or no superstructure. The radiocarbon dates for this occupation range (at 1 sigma) from A.D. 700 to A.D. 1190, or A.D. 884 to A.D. 1094 (averaged at 1 sigma). The hearths within the rings and in the rocks of the rings (Feature 36) date to this time period, as do the refuse dumps in the peripheral rocks (Features 1 and 3). Activity was apparently relegated to the rings themselves, and outside hearths were not part of the pattern of living. Refuse was dumped close to the dwelling structure, i.e., in the ring rocks. This group maintained ties with Middle Missouri Tradition, as indicated by the single pot sherd in the refuse dump (Feature 1).

The most attractive features of this scenario are that there appears to be a different pattern of use of the site at the later time, the Middle Missouri pot sherd fits comfortably with the late occupation dates, and the Besant-Sonota time frame is not stretched. The main disadvantage is that there is a lack of evidence of activity within the rings during the later occupation.

2. The Later Occupation Including the Besant Living Floor. The dates and the scenario are the same as the later occupation in Scenario 1 with one exception: the Besant living floor provides a full range of activities in the ring during the last occupation. The disadvantages of this scenario are that it places Besant technology relatively late in time and precludes the association of bone uprights with Besant technology (unless the early and late dates are ignored in the statistical manipulation of the radiocarbon dates). It also mixes Besant with Middle Missouri pottery. The advantages are that it removes extensive inner ring activity from the earlier occupation which appears to have emphasized activities outside the rings, or dwelling units, and it provides a single unit of activity in the rings.

The authors favour the second scenario for discussion purposes. The interpretations presented below will be based on that model. However, all possible scenarios should be considered, since they have considerable impact on the final interpretations of the site, the use of the rings and the intra-site and intra-ring patterns.

INTRA-RING PATTERNS AND ACTIVITIES

Some tentative interpretations about intra-ring arrrangements and activities can be made, based on the excavations of Rings 4 and 9. The living floor represented by the lithic debitage and associated features can be interpreted as a single episode, based on three lines of evidence: 1) there is no indication of any change or break in the technological or spatial pattern(s) in the lithic assemblages of either ring; 2) there are small clusters of debitage throughout the ring interiors that would have been easily disturbed if much activity had occurred immediately after the flintknapping episodes; and, 3) there are relatively consistent cluster patterns of tools (e.g., end scrapers and projectile points) in both rings, and a distinctive clustering of definable lithic materials (e.g., pseudo-quartzite) in certain areas of Ring 9. All of these factors indicate a unique situation at 320L270 that is rarely found in archaeological assemblages - an essentially undisturbed, potentially reconstructable living area within a dwelling unit.

The central hearth in Ring 9 was dated at A.D. 1050, while two refuse dumps within Ring 4 ring rocks were dated at A.D. 880 and A.D. 1190. Both rings contained large quantities of lithic items. These factors may suggest approximately contemporaneous use of these two rings; however, there are differences in terms of lithic debris and arrangement within the rings.

Ring 4 is 6 m in interior diameter, 1 m larger than Ring 9. Ring 4 had a granite cluster just outside which implies the use of the stone boiling technique by the ring occupants. The central hearth in Ring 4 had far less oxidation around the edges, suggesting that it was burned less. Refuse dumps occurred within the ring rocks of Ring 4, while refuse was dumped some distance away from Ring 9. Both rings have outside, apparently associated, hearths and refuse dumps to the east.

Ring 9 had two significantly different features. The first is the attached second ring, 9B. A hearth within the ring rocks of Ring 9B was dated at A.D. 880, suggesting an approximately contemporaneous association with Ring 9.

The other feature set of significance to the interpretation of activities in Ring 9 is two pairs of postmolds. Each pair of posts is approximately 1 m northeast and 1 m southwest of the central hearth. Because the posts are too small (6 cm in diameter) to be a superstructure support, it seems conceivable that they were placed to provide support for a rack, or other contrivance, over the fire.

ARTIFACT DISTRIBUTION

In Ring 4, the distribution of KRF and TRSS flaking debris suggests that there might have been different locations used for knapping, shaft repair and maintenance. Flintknapping and tool maintenance activities were generally conducted in the central to southeastern portion of the ring (Figure 7). Projectile point fragments, notching flakes, knives, and end scrapers are generally found in areas with greater quantities of pressure flaking debris (Figure 8). This clustering is indicative of tool maintenance, particularly retooling hafted implements.

The distribution of artifacts in Ring 9 indicates two distinct clusters (see Figures 9 and 10). One in the north-central area of the ring is similar in content (KRF) and pattern to that in Ring 4. The second area is in the southwest portion of the ring and contains TRSS primary and secondary reduction flakes. The distributions of the different types of raw materials and types of reduction debris and artifacts suggest different types of tool making in the two main lithic concentrations (Figure 11). The northern area generally has finer materials and more secondary reduction and pressure flakes, indicative of tool maintenance, while the southwest area has larger flakes and coarser materials. This suggests that the latter area was used for making expedient tools of easily obtained materials.

In both rings, there are areas where there is relatively little lithic debris. In Ring 4, the northeast area contains few lithic remains, while the southwest area contains relatively little debitage, but considerable numbers of broken projectile points. In Ring 9, the extreme eastern and western margins of the ring contained less lithic debris. It is likely that these areas were used for sleeping or other activities.

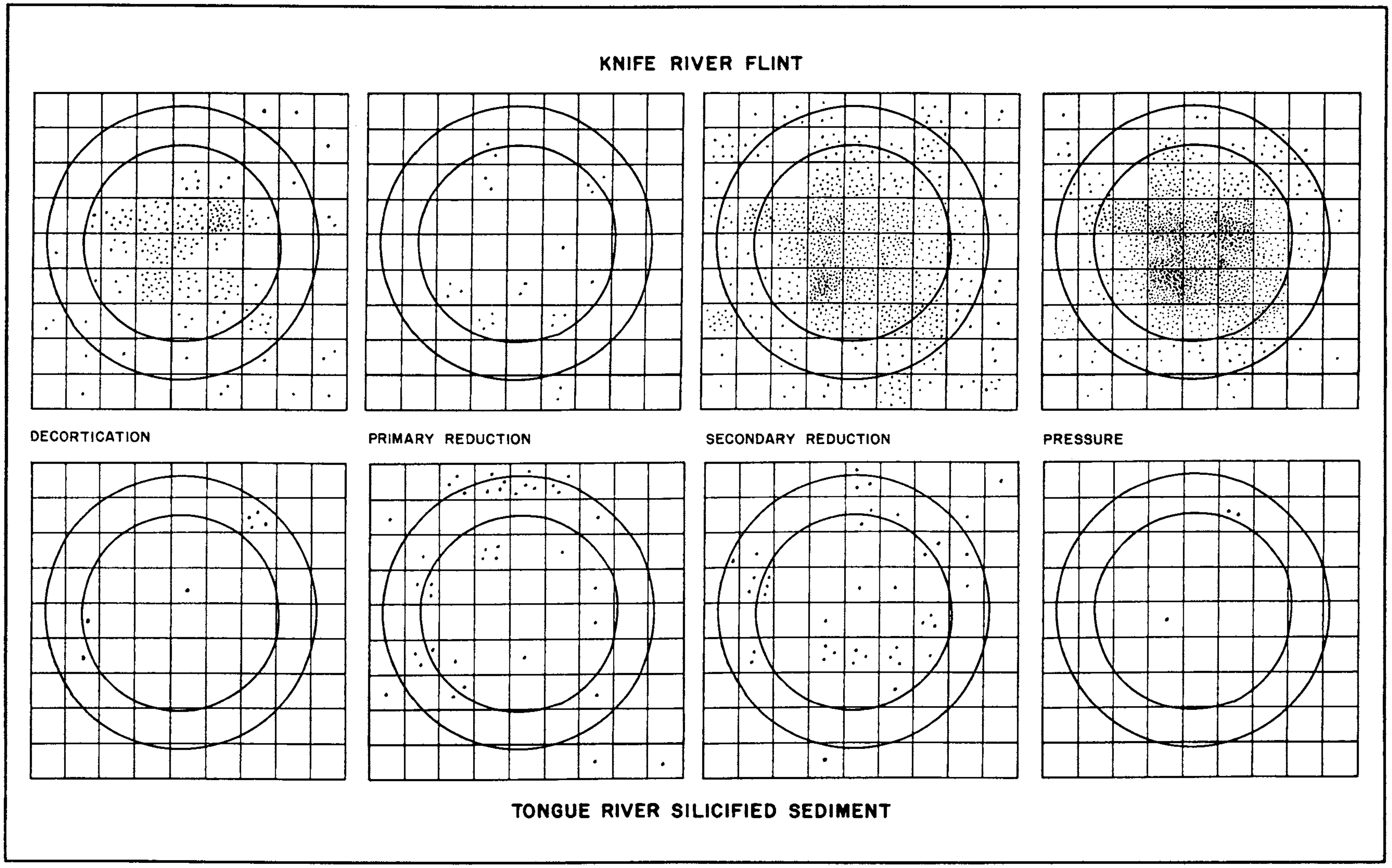

Figure 7. Distribution of diagnostic lithic debris in Ring 4, by raw material and flake type.

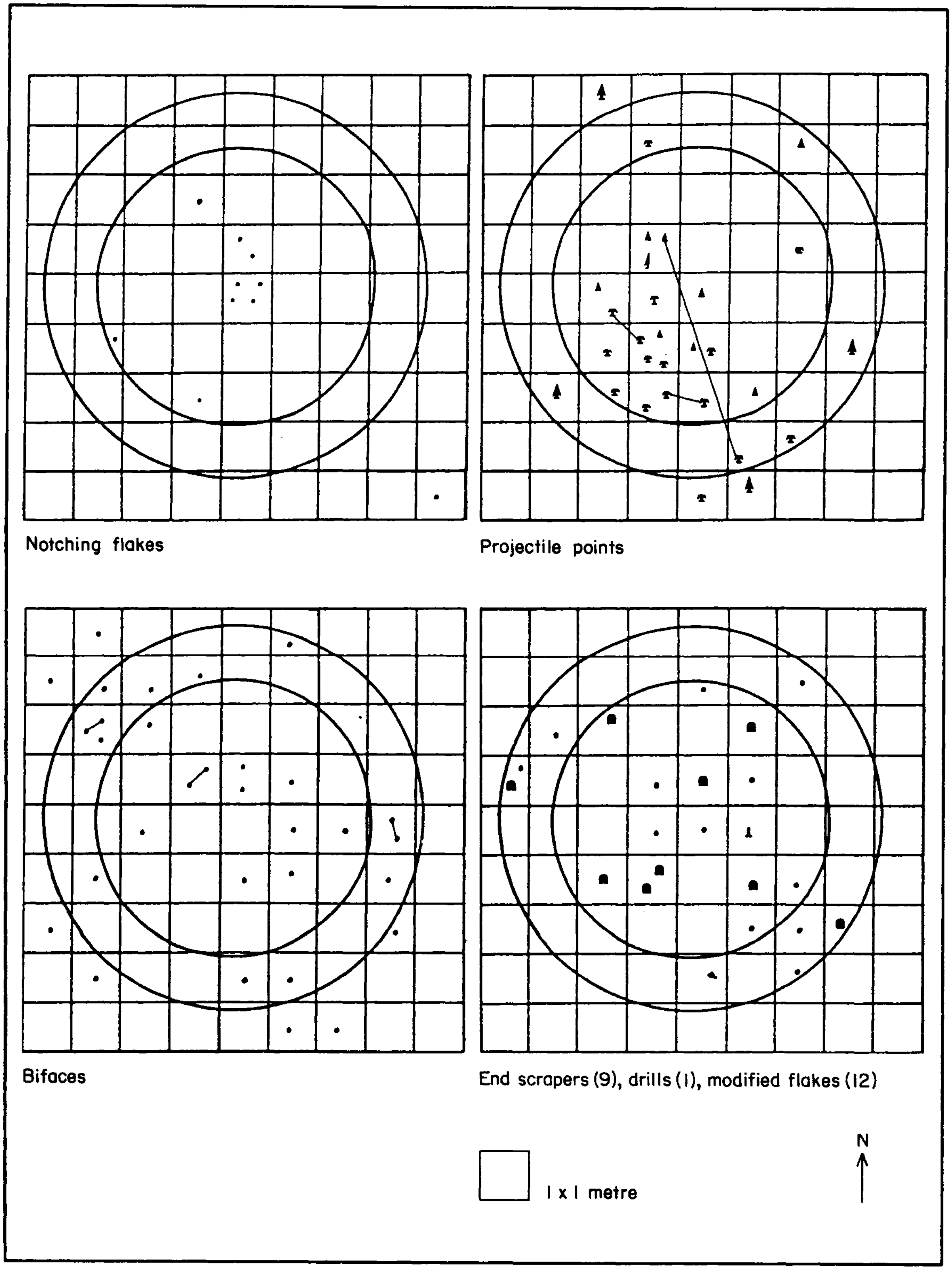

Figure 8. Distribution of selected tool categories and flakes in Ring 4.

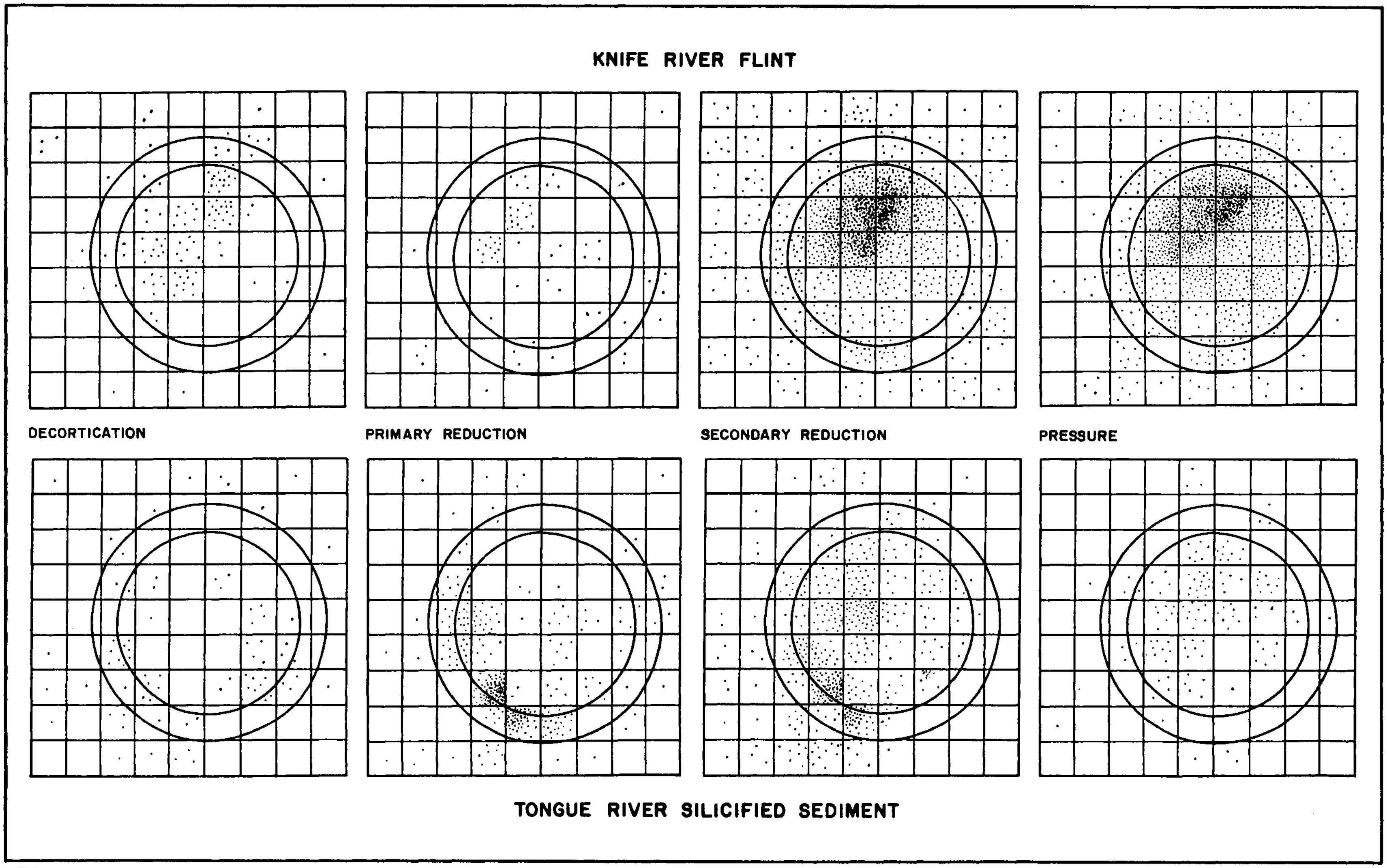

Figure 9. Distribution of diagnostic lithic debris in Ring 9, by raw material and flake type.

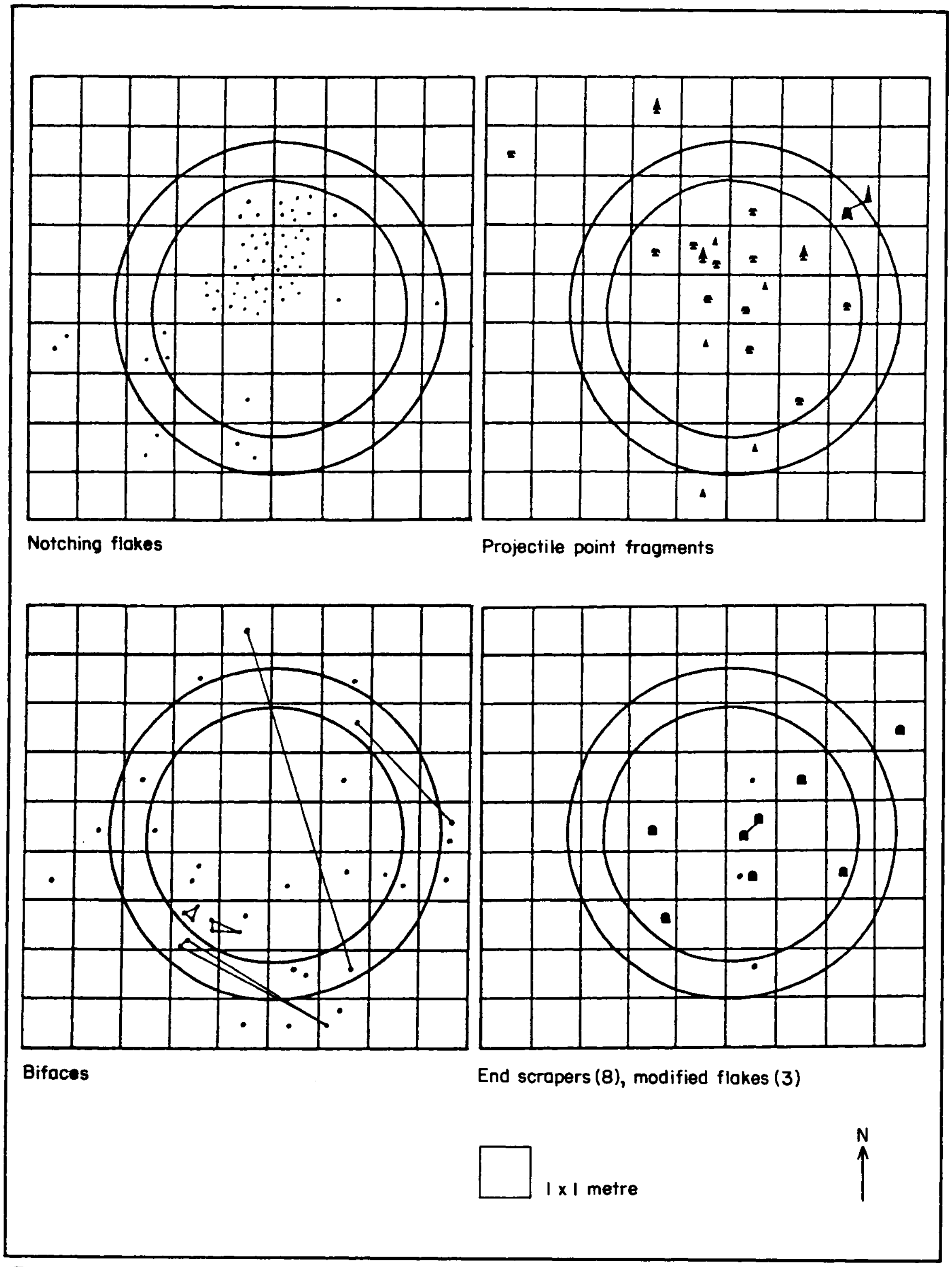

Figure 10. Distribution of selected tool categories and flakes in Ring 9.

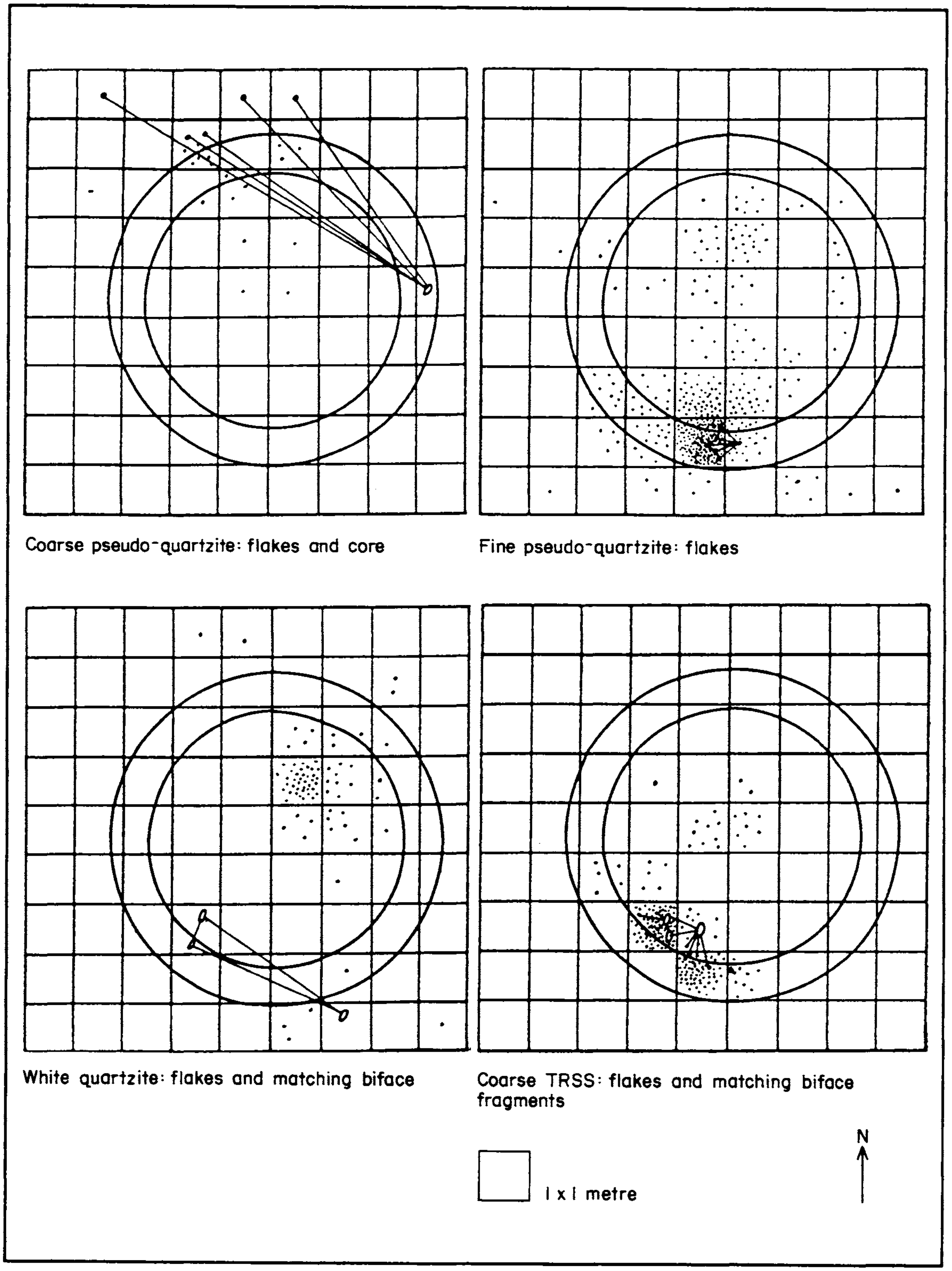

Figure 11. Distribution of selected lithic debris and biface scatters in Ring 9.

SEASONALITY OF OCCUPATION

Although there is no strong evidence for occupation of 32OL270 in any one season there is some data suggestive of summer occupation. Faunal remains were predominately bison; the ages represented were adult, juvenile and infant. The lack of foetal elements in this mixed age assemblage suggests a summer occupation since most bison would have calved by the end of June. Bison migratory patterns, as suggested by Syms (1977) and Morgan (1979), would place large herds on the open Plains of central North Dakota in the summer months, thus providing the food resource for the site occupants. However, this migratory pattern has been challenged by Hanson (1984) who has compiled evidence to indicate that small and large herds of bison would have been in central North Dakota at all seasons of the year.

The distributions of rock weights and bone uprights for the two excavated rings are generally skewed to the east. At present, spring and summer winds generally come from the southeast in this area. Assuming a similar pattern in the past, it is logical that the windward side of the dwelling would require extra support. Alternatively, the existence of features within the ring rocks may be indicative of an open air or partially covered dwelling, which would only be reasonable in the warm summer months.

The presence of Chenopodium seeds suggests summer occupation since the seeds would be available during June. However, seeds can also be stored and used anytime. In addition, pollen from a variety of plants was recovered, possibly indicating use of these plants during the pollinating time of late spring and early summer.

The final piece of evidence for seasonality is inferential, based on ethnographic accounts of the settlement pattern of the historic Mandan-Hidatsa. These accounts indicate that these groups wintered in the valley bottoms and spent the summers in the surrounding breaks.

REGIONAL ASSOCIATIONS

The placement of 32OL270 within the Plains Woodland Tradition and temporal period is supported by almost all attributes of the site.

Further placement of the site into the Sonota Complex or Besant Phase requires some discussion. The radiocarbon dates place the early occupation perfectly in line with other Besant affiliated sites. The later occupation is just within the late end of the range of variation of dates as given by Syms (1977), i.e., 100 B.C. to A.D. 1000 at 1 sigma.

BESANT VS. SONOTA: A DISCUSSION

Reeves' (1983) Besant Phase includes all sites, and thus traits, of Sonota. Approximately six of the ten traits Reeves lists are common to 32OL270. These six are: presence of Besant projectile points, few discrete types of bifaces, numerous dorsally finished end scrapers, cord roughened pottery, excavated basin-shaped hearths (without rock filling), and bone uprights. The placement of 32OL270 in the Sonota Complex described by Neuman (1975) and Syms (1977) gains support from the abundance of Knife River Flint, cord-roughened pottery, a tendency toward long, not squat, projectile points, and a dependence on bison and possibly elk. There is no burial mound (although there is a mound on the ridge above the site), and there is also no evidence of waste of KRF lithic material.

The analysis of 32OL270 revealed several problems with the trait lists by both Syms and Reeves. First, projectile point form varies considerably at the site as a result of reworking points. Length of points is known for only a few of the artifacts because the discarded points are fragments, generally basal fragments.

The use of KRF in western and central North Dakota is common to almost all sites at all time periods, since proximity to the quarries provided a ready supply of good quality knapping material. The glacial and alluvial gravels contained a supply of cobbles of coarser materials, TRSS and quartzites, for expedient tools. At 32OL270, there was evidence of conservation of KRF, apparently used exclusively for hafted tools. There was no evidence of a conservation technology for local materials, since little time was necessary to produce the desired expedient products with the local TRSS and quartzite.

Bone uprights are reputed to be both a Besant and a Sonota characteristic. At 32OL270, bone uprights have a cluster of dates that fit either the Besant or Sonota period, A.D. 550. Bone uprights are also found in Late Prehistoric sites, e.g., Boarding School bison kill (Kehoe 1967), Stendahl site (Rushowick 1975), and Kremlin site (Keyser 1979). There was perhaps a greater reliance on these features during Besant times, but it is also possible that excavators have not always recognized them. Furthermore, even when they are recorded, the descriptions are generally poor, and comparison with other bone upright features is difficult.

The concept of affiliating Sonota with burial or effigy mounds as a secondary activity (mortuary or socio-religious), must also be considered, yet should not be expected at all sites. There are certain scheduled and seasonal activities which probably do not relate to the mounds. Besant affiliation with stone circle sites is not uncommon. However, Sonota is not noted as using stone circles for dwellings.

SUMMARY

Evidence from 32OL270 indicates that the human groups using the Besant technology were sophisticated hunters with a distinct tool kit that was carefully maintained. Pottery apparently varies in significance since the amount of pottery in Sonota and Besant sites varies from a few sherds, as at 32OL270, to an abundance of a variety of pottery, as at Seltzer (Neuman 1975). Bison was the primary food resource, and its remains were processed for bone marrow and bone grease. The seasonal round involved movement with, and an anticipation of, bison movement patterns. At 32OL270, there is no indication of mass bison killing; rather, the materials imply a conservative approach to complete utilization of all parts brought back to camp. The general lack of elements other than limb bones suggests that there was no need to bring less desired elements back to camp.

The primary occupation of 32OL270 took place during the Plains Woodland Period. The lithic technology has been classified as Besant on the basis of the projectile point styles. However, as discussed above, the site could represent an example of a campsite for the eastern version of Besant, known as Sonota. The participation of the occupants of 32OL270 in the Sonota Complex as defined by Syms (1977) is feasible in the context of his Co-Influence Sphere Model, which allows realistic variation for seasonality and other changes through time.

IMPLICATIONS FOR TESTING STONE RING SITES

One of the goals of the work at 32OL270 was to examine methods of dealing with stone ring sites. Based on the results from the excavations, several methodological hypotheses can be suggested. These can be tested by careful design of archaeological testing at other stone ring sites.

Hypothesis 1. Features (e.g., hearths, bone uprights, refuse dumps) outside the rings at stone ring sites will be between 3 and 6 m from the outside circumference of the rings.

Justification: Seventeen of the 24 features located outside the rings at 32OL270 were within 6 m of the outside perimeter of the rings, and all of the hearths and bone upright features were located within 6 m of the rings. All but one of the hearths was between 4 and 6 m. Being able to determine a probable "feature zone" limits the areal extent of testing and increases the probability that any features present outside the rings will be found.

A Suggested Test: This hypothetical "feature zone" can be determined at stone ring sites by drawing two concentric circles extending 3 m and 6 m beyond the ring rocks (Figure 12). Since rings are not usually circles but ellipses, the outside dimensions have to be averaged. Hearths and areas of high cultural material densities are usually associated. Hearths can be located by soil probing, thus eliminating the need for large test excavations.

Hypothesis 2. Four 0.5 m x 0.5 m test units within the ring will provide an evaluation of the cultural contents of the ring.

Justification: Four smaller tests in strategic locations of a ring will be preferable to a 1 m x 1 m test or smaller soil probes. The possibility of placing a single test in an empty place in the ring could cause a distorted interpretation of the potential of the recoverable

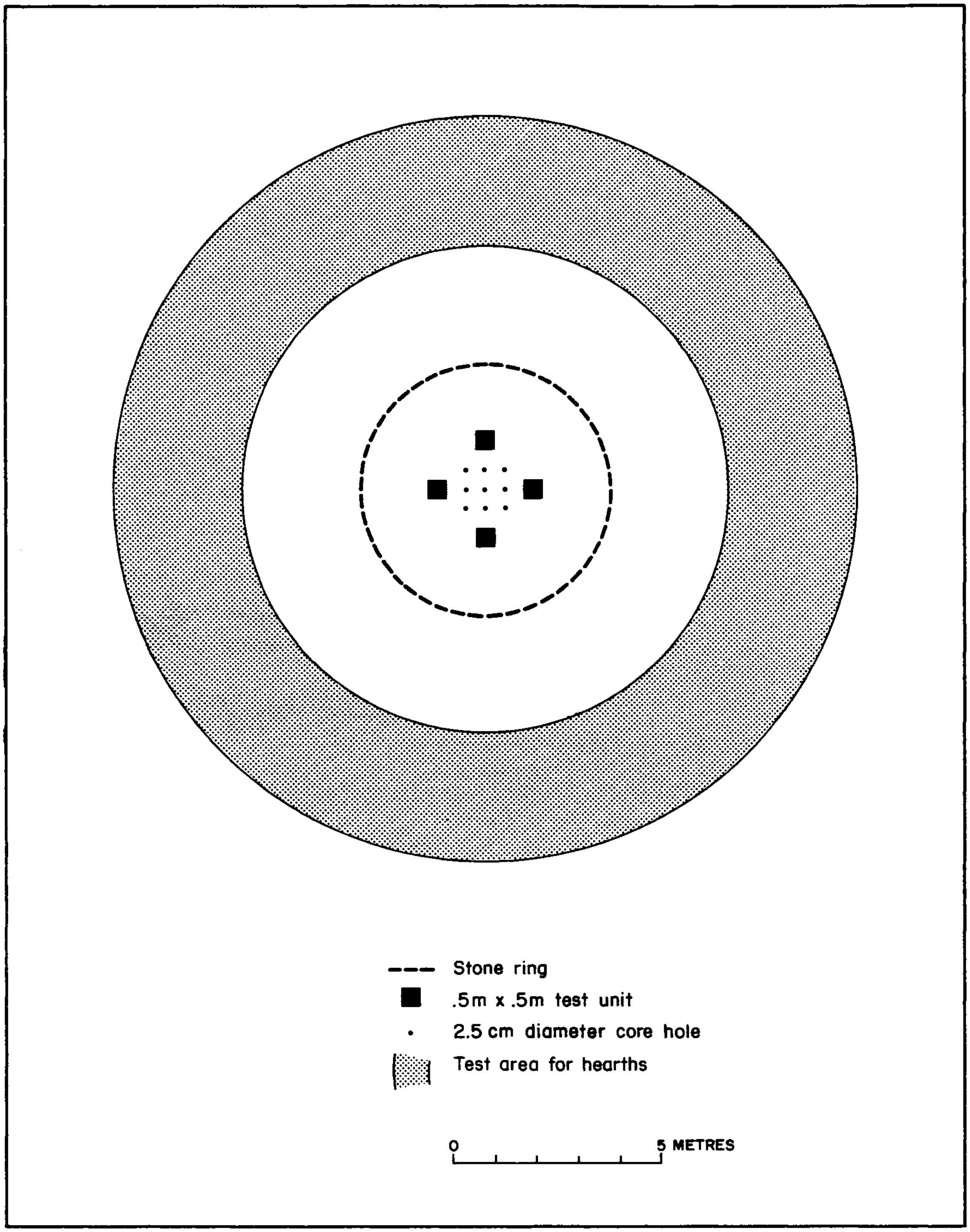

Figure 12. Map of proposed testing strategies for stone rings.

information in a particular ring. Further, these smaller units are less likely to cause problems during lithic analysis should the ring be excavated later.

A Suggested Test: In order to increase the odds of locating cultural remains, these four tests should be 1 m from the centre of the ring in a north/south and east/west pattern. In order to test for a hearth, systematic transects of 2.5 cm soil cores should be placed in the area centring the four test units (Figure 12).

Clearly, it is the height of inductive reasoning to take the results from one site and generalize that similar feature distributions and probable activity areas exist at all stone ring sites. It is simply suggested that the above approach be tested at other stone circle sites.

ACKNOWLEDGEMENTS

Lynn Fredlund was principal investigator, Dale Herbort, project director and Gene Munson, field supervisor. Work was conducted under Basin Cooperative Services contract #00204. Dale Herbort conducted the lithic analysis, Gene Munson recorded and analyzed the features, while Lynn Fredlund was responsible for the overall discussion and interpretation. The following outside consultants were enlisted: Beta Analytic of Coral Gables, Florida conducted the radiocarbon dating; John Rittel, graduate student in paleontology at the University of Montana, Missoula, conducted the faunal identification and bone analysis; identification of seeds and pollen was done by Linda Scott of Palynological Analysts, Montrose, Colorado and Linda Shane, University of Minnesota; Ann Johnson, National Park Service, Denver, conducted a comparative analysis of the small ceramic sample; soils and stratigraphic interpretation was by John E. Foss, North Dakota State University, Fargo; and data analysis consultation was supplied by Kathy Kitto, instructor at the Montana College of Mineral Science and Technology, Butte.

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QUANTITATIVE AND GRAPHIC ANALYSIS OF ARTEFACT DISTRIBUTIONS: A TRIAL APPROACH TO THE STUDY OF HORIZONTAL AND VERTICAL ARTEFACT DISTRIBUTIONS IN NON-STRATIFIED SITES

By

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INTRODUCTION

In the Spring of 1982, the Department of Archaeology at the University of Calgary, in conjunction with the Archaeological Survey of Alberta, initiated a four year research project at the Strathcona site (FjPi-29), as part of an on-going field school. This 5,000 year old lithic workshop is located on the east bank of the North Saskatchewan River near Edmonton, Alberta (Figure 1). One of the principal objectives of this project, which is currently in its third year, is to analyse the horizontal and vertical distributions of artefactual remains across the extant portion of the site.

The Strathcona site lacks apparent cultural stratification despite the fact that multiple occupations spanning the past five thousand years have been identified through typological analysis (Driver et al. 1982; Ives 1980; Newton and Pollock 1979; Pyszczyk 1981). This is similar to many sites in the Northwestern Plains which suffer from compressed stratigraphy. Thus, the methods developed to deal with the problem at the Strathcona site may be useful in investigations of Plains sites.

Initial attempts to isolate natural or cultural strata at the Strathcona site through plotting of vertical artefact distributions (e.g., Pyszczyk 1981) have all revealed essentially uniform artefact densities throughout the excavation profiles. It should be noted however, that the majority of these studies have been based on subjective, rather than quantitative, procedures. Furthermore, the data used in these studies likely comprise a biased sample as they were obtained from judgementally derived excavation units restricted in distribution to specific "high yield" areas within the defined borders of

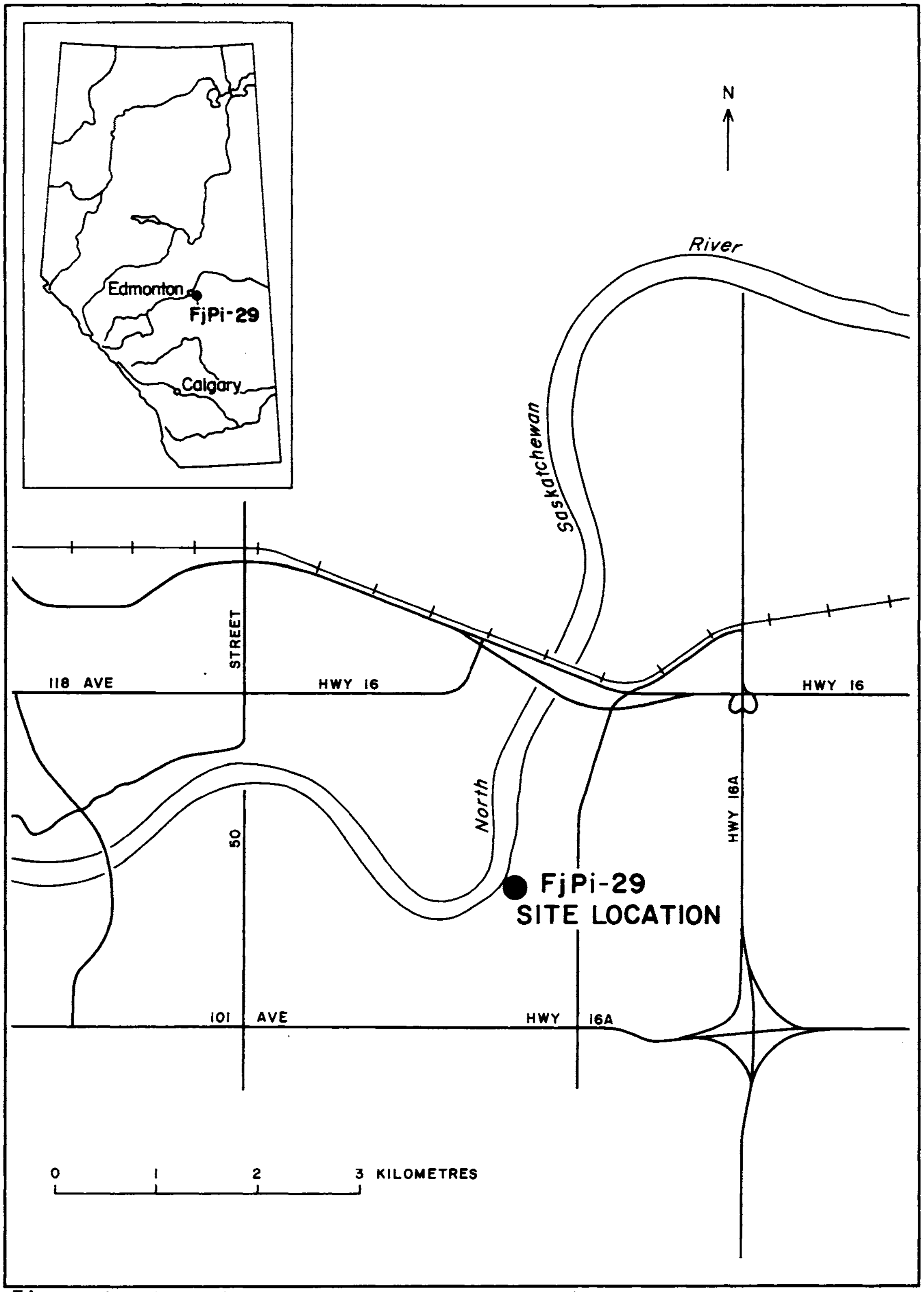

Figure 1. Location of the Strathcona site (FjPi-29).

the Strathcona site. There are limited grounds to suspect, therefore, that the inferred lack of cultural stratigraphy at FjPi-29 may be more apparent than real.

The four year research plan currently being implemented at the Strathcona site calls for a multi-stage cluster sample. The objective is to provide excavation data representative of the site as a whole (Helmer 1983). As of the 1983 field season, a total of 42 1 x 1 m units yielding approximately 4900 artefacts have been excavated (Figure 2). This represents approximately one third of the total sampling units to be examined. Although the sampling strategy is as yet incomplete, sufficient information has been obtained from a variety of areas across the site to begin trial analyses. These analyses are argued to be somewhat less subject to sampling bias than has been the case in the recent past.

For the past eight months, we have been exploring various quantitative and graphic approaches to the study of vertical and horizontal artefact distributions at Strathcona using a number of programs available on the University of Calgary's mainframe Honeywell computer system. Preliminary results from 1982 and 1983 field season data suggest that we have been successful in developing a proto-type technique for studying vertical artefact distributions. While not capable of isolating cultural components per se, this technique is capable of demonstrating patterning and variability in vertical artefact distributions across the site. These, we feel, can be tentatively equated with changing patterns of site use through time.

The intent of this paper is to briefly describe the various quantitative and graphic procedures used in the analysis of the Strathcona data and to summarize some preliminary results we have obtained to date. We shall conclude our presentation with a discussion of the strengths, weaknesses and perceived utility of these procedures for assessing non-stratified sites in the northern Plains, parklands, and elsewhere.

METHODS

Our approach to the study of vertical artefact distributions at Strathcona ultimately comprised two stages. The first stage involved a

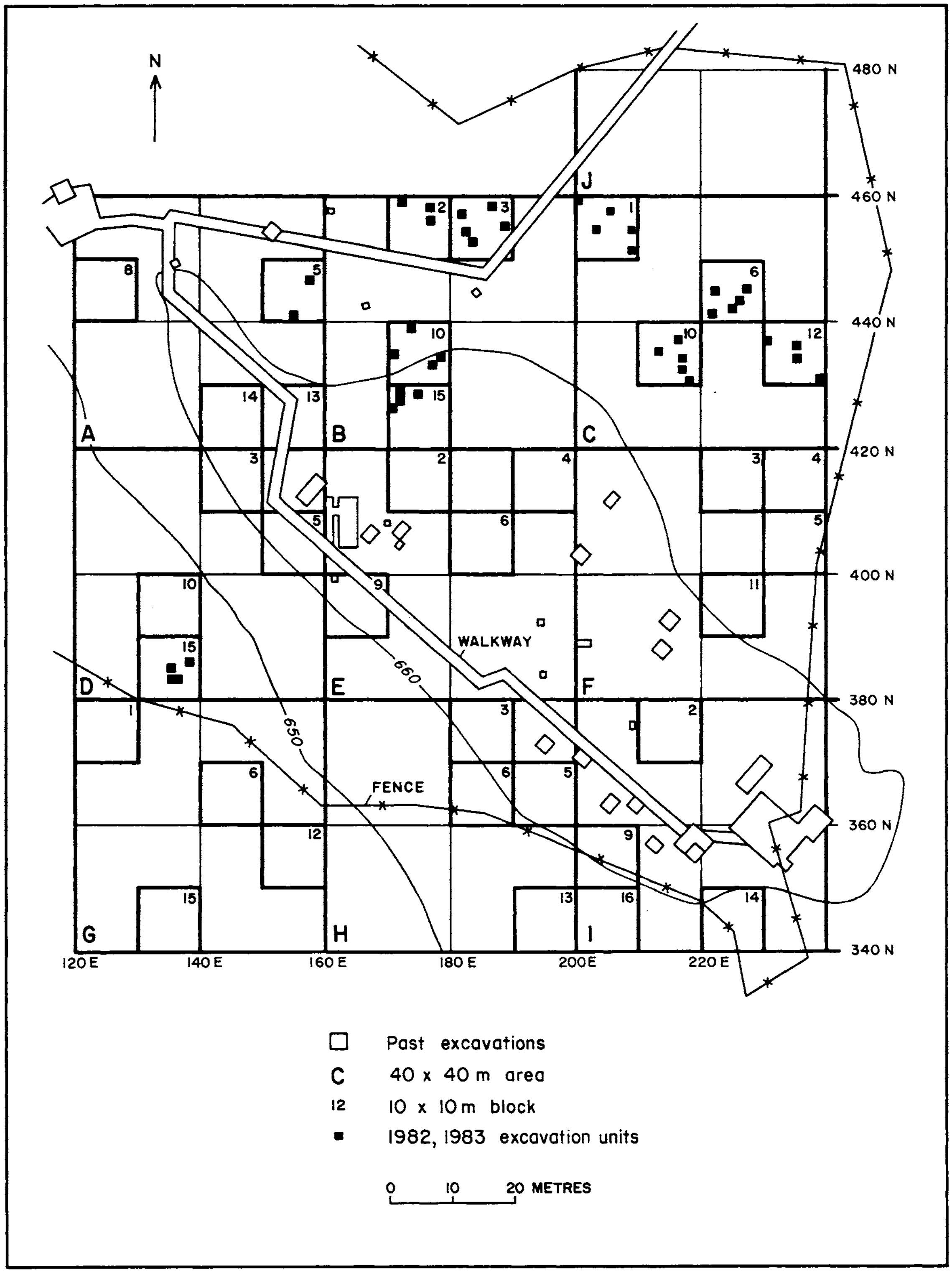

Figure 2. Map of FjPi-29 showing the sample areas and excavation units.

quantitative analysis to identify inherent patterning and/or variability in the vertical distribution patterns of artefacts across the site. The second stage involved graphic analysis utilizing computer contour mapping procedures in order to visually illustrate the relationships revealed by quantitative manipulations. This latter stage is not analytical per se, but demonstrative.

Since the investigation was unabashedly exploratory in nature, our approach to the study of vertical artefact distributions at FjPi-29 proceeded through a series of steps with the results of each step suggesting the appropriate direction (or directions) that the following steps should take. As a result of this approach, the convention of summarizing methods and results in discrete sections shall be precluded in this paper. Instead, we shall describe the procedures followed and the preliminary results obtained in the order that each analysis was conducted.

Prior to undertaking this study, assumptions had to be made about the comparability of the data base. Individual 1 x 1 m units at FjPi-29 were excavated in arbitrary 5 cm levels. Depths of individual units across the site have varied from a minimum of six levels to a maximum of fourteen levels. The majority, however, fall between eight and ten levels (Table 1).

For the purposes of our analysis we have had to assume that each of our arbitrary vertical levels is coeval across the site; e.g., Level Four in all units pertains to the same approximate depositional event. Although admittedly untested, we have some reason to believe that this assumption is not unreasonable. A contour map of the modern surface of FjPi-29 (based on Depth Below Datum readings from the 42 sampled units and created using the SURFACE II computer mapping program [Sampson 1978]) compared with a similar map of the sterile clay horizon which lies at the base of all the units shows remarkably similar topography for the two surfaces (Figure 3). Although not conclusive, the apparent relationship between surface and sub-surface topography suggests that our arbitrary vertical levels may indeed be comparable.

The first step in our quantitative analysis was to calculate frequency distributions reflecting artefact densities by 5 cm level for each of the 42 excavation units in our sample. This was accomplished

Table 1. Raw artefact frequencies by unit per level.

		LEVEL													
COORDINATES	TOTAL	1	2	3	4	5	6	7	8	9	10	11	12	13	14
460N 200E	119	0	0	3	17	20	24	22	25	7	1	0	0	0	0
460N 205E	105	0	9	13	17	18	21	27	0	0	0	0	0	0	0
456N 202E	132	0	2	10	21	28	20	46	5	0	0	0	0	0	0
456N 208E	118	1	2	21	16	11	25	42	0	0	0	0	0	0	0
452N 208E	104	0	7	20	14	22	25	16	0	0	0	0	0	0	0
431N 212E	39	2	5	3	5	8	8	7	1	0	0	0	0	0	0
433N 213E	41	1	1	5	9	2	2	2	10	7	2	0	0	0	0
436N 212E	29	1	2	3	3	2	4	5	6	0	0	0	0	0	0
438N 215E	58	0	1	2	7	10	8	13	3	2	12	0	0	0	0
435N 213E	28	0	0	3	1	3	0	7	0	9	10	0	0	0	0
437N 234E	223	0	6	19	37	35	36	39	17	16	17	1	0	0	0
435N 234E	166	0	15	18	24	28	28	45	3	3	0	2	0	0	0
432N 239E	130	41	49	20	16	3	1	0	0	0	0	0	0	0	0
438N 230E	123	8	13	11	7	20	12	18	12	13	4	5	0	0	0
444N 225E	10	0	3	2	1	0	0	2	2	0	0	0	0	0	0
446N 222E	93	2	7	16	23	22	14	9	0	0	0	0	0	0	0
446N 226E	107	0	19	10	5	17	20	36	0	0	0	0	0	0	0
443N 225E	64	2	4	13	10	5	9	9	12	0	0	0	0	0	0
442N 221E	73	3	5	8	18	9	10	20	0	0	0	0	0	0	0
455N 188E	56	4	1	5	6	7	6	11	5	11	0	0	0	0	0
456N 188E	51	1	2	1	9	11	6	3	0	10	3	4	1	0	0
453N 182E	30	4	11	4	5	3	3	0	0	0	0	0	0	0	0
457N 181E	51	2	3	3	7	4	4	3	8	8	9	0	0	0	0
459N 186E	74	1	1	5	25	6	10	3	3	8	5	3	4	0	0
429N 171E	217	12	20	41	49	37	33	23	2	0	0	0	0	0	0
427N 170E	310	5	45	48	99	55	46	11	0	0	0	0	0	0	0
428N 171E	242	4	12	31	64	38	46	8	0	0	0	0	0	0	0
430N 171E	241	13	23	45	31	41	38	5	2	0	0	0	0	0	0
429N 174E	279	5	21	34	53	30	35	37	49	15	0	0	0	0	0
435N 178E	131	2	7	29	25	30	29	9	0	0	0	0	0	0	0
440N 174E	144	0	9	17	21	36	44	17	0	0	0	0	0	0	0
434N 177E	225	7	28	52	42	49	47	0	0	0	0	0	0	0	0
433N 170E	212	6	38	23	41	24	25	37	16	2	0	0	0	0	0
459N 177E	52	10	7	8	3	7	3	3	1	3	2	1	0	1	2
460N 172E	38	3	3	10	11	5	3	3	0	0	0	0	0	0	0
457N 177E	62	5	14	10	4	9	12	2	2	4	0	0	0	0	0
447N 157E	347	8	11	32	31	46	50	55	52	39	23	0	0	0	0
441N 154E	244	17	22	38	41	30	33	20	23	11	9	0	0	0	0
383N 135E	47	0	2	3	2	4	5	6	7	7	8	1	1	1	0
385N 132E	52	14	1	4	2	9	4	6	7	3	2	0	0	0	0
386N 139E	37	6	2	1	5	1	1	4	8	1	4	1	3	0	0
383N 136E	35	1	5	4	1	5	4	0	7	5	0	0	2	1	0

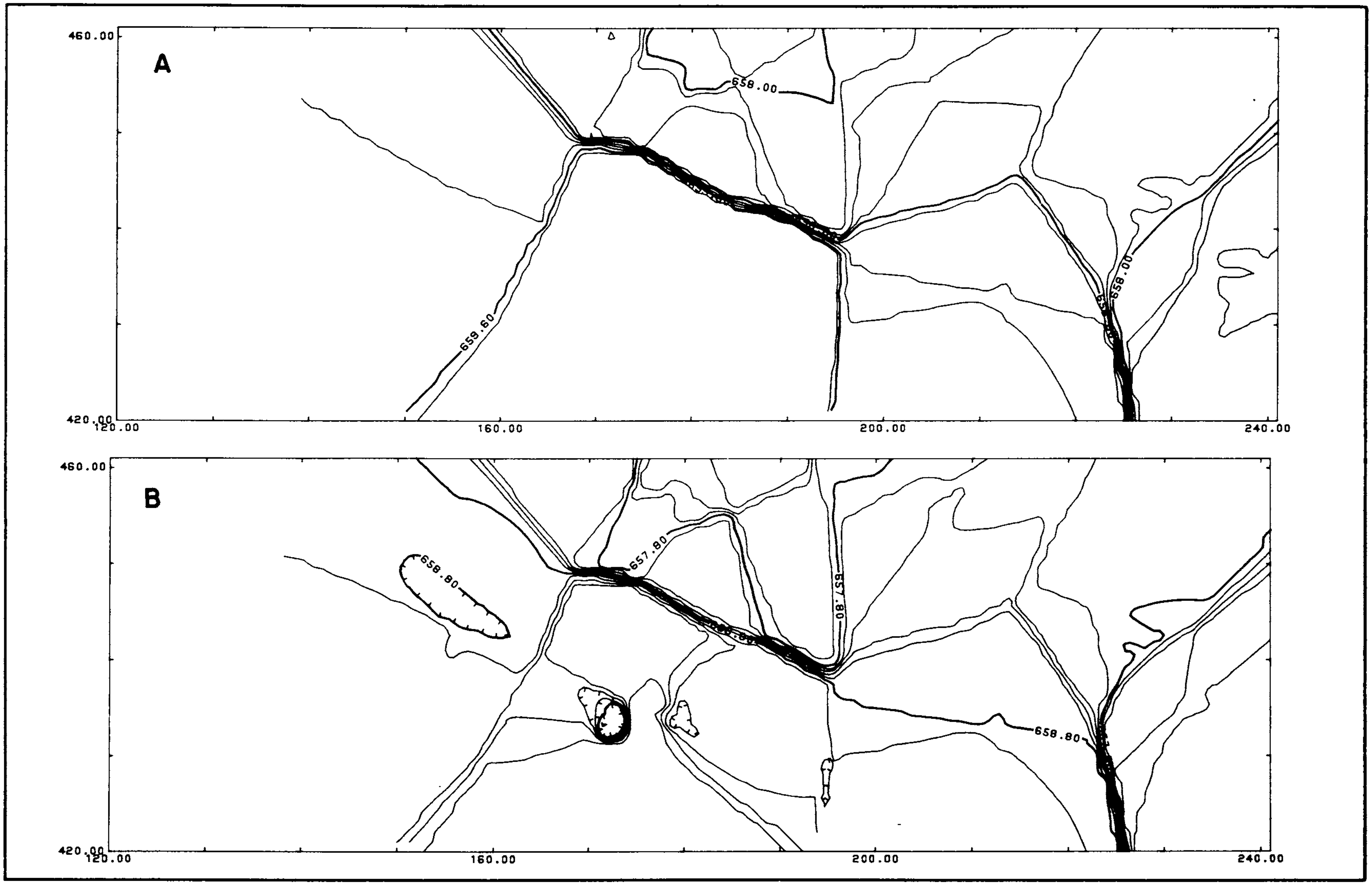

Figure 3. Contour maps of the ground surface (A) and the top of the underlying sterile clay (B) at FjPi-29.

using the FREQUENCIES routine available in SPSS (Nie et al. 1975). Visual inspection of the 42 histograms produced by this procedure indicated that vertical artefact distributions are highly variable and that prior assumptions concerning the uniformity of these distributions are erroneous insofar as the site as a whole is concerned.

The next step was to determine if any of the 1 x 1 m sample units share comparable distribution patterns which set them apart from the others. The procedure selected for this analysis was a correlation co-efficient (r) using the PEARSON CORR routine from SPSS. However, artefact frequency distributions for individual units were first converted to Z- scores, in order to standardize our data. This step is meant to remove the biasing effects of comparing samples of widely varying sizes.

The correlation matrix generated by the PEARSON CORR routine was visually inspected to determine if strong correlations (i.e., $r > 0.8$) exist between some units and not others. Such was found to be the case, indicating that both patterning and variability occur in the vertical distribution of artefacts.

The correlation coefficient matrix does not reveal if these shared distribution patterns have spatial integrity, i.e., whether or not excavation units within specific areas of FjPi-29 share similar patterns which set them apart from other areas of the site. Therefore, to determine the extent of spatial relationships, a cluster analysis was conducted on the Z-score data files for each of the 42 1 x 1 m units. The procedure employed was the HIERARCHY routine which is contained in the CLUSTAN statistical package (Wishart 1978). The Ward's Method option was selected to calculate the required similarity matrix.

This analysis successfully identified three discrete clusters (Table 2; Figure 4). The unit composition of these clusters shows reasonably consistent spatial integrity (Figure 2). Cluster I is comprised of 16 units, concentrated largely in the northeast part of the site. Cluster II, a rather large group (22 units), contains a majority of units located near the west-central border of the upper terrace. Finally, Cluster III is comprised of three units from the northern periphery of the site and one unit from the extreme east edge. These results indicate that there may be horizontal distribution patterns of artefacts at FjPi-29, as well as vertical patterns.

Table 2. Assignment of excavation units to clusters.

Cluster	Case Number (see Figure 4)	Coordinates	Area	Block
I	37	447N 157E	A	5
	20	455N 188E	B	3
	23	457N 181E	B	3
	29	429N 174E	B	15
	1	460N 200E	C	1
	15	444N 225E	C	6
	18	443N 225E	C	6
	6	431N 212E	C	10
	7	433N 213E	C	10
	8	436N 212E	C	10
	10	435N 213E	C	10
	14	438N 230E	C	12
	39	383N 135E	D	15
	40	385N 132E	D	15
	41	386N 139E	D	15
	42	383N 136E	D	15
II	38	441N 154E	A	5
	21	456N 188E	B	3
	24	459N 186E	B	3
	35	460N 172E	B	2
	30	435N 178E	B	10
	31	440N 174E	B	10
	32	434N 177E	B	10
	33	433N 170E	B	10
	25	429N 171E	B	15
	26	427N 170E	B	15
	27	428N 171E	B	15
	28	430N 171E	B	15
	2	459N 205E	C	1
	3	456N 202E	C	1
	4	452N 208E	C	1
	5	456N 208E	C	1
	16	446N 222E	C	6
	17	446N 226E	C	6
	19	442N 221E	C	6
	9	438N 215E	C	10
	11	437N 234E	C	12
	12	435N 234E	C	12
III	34	459N 177E	B	2
	36	457N 177E	B	2
	22	453N 182E	B	3
	13	438N 239E	C	12

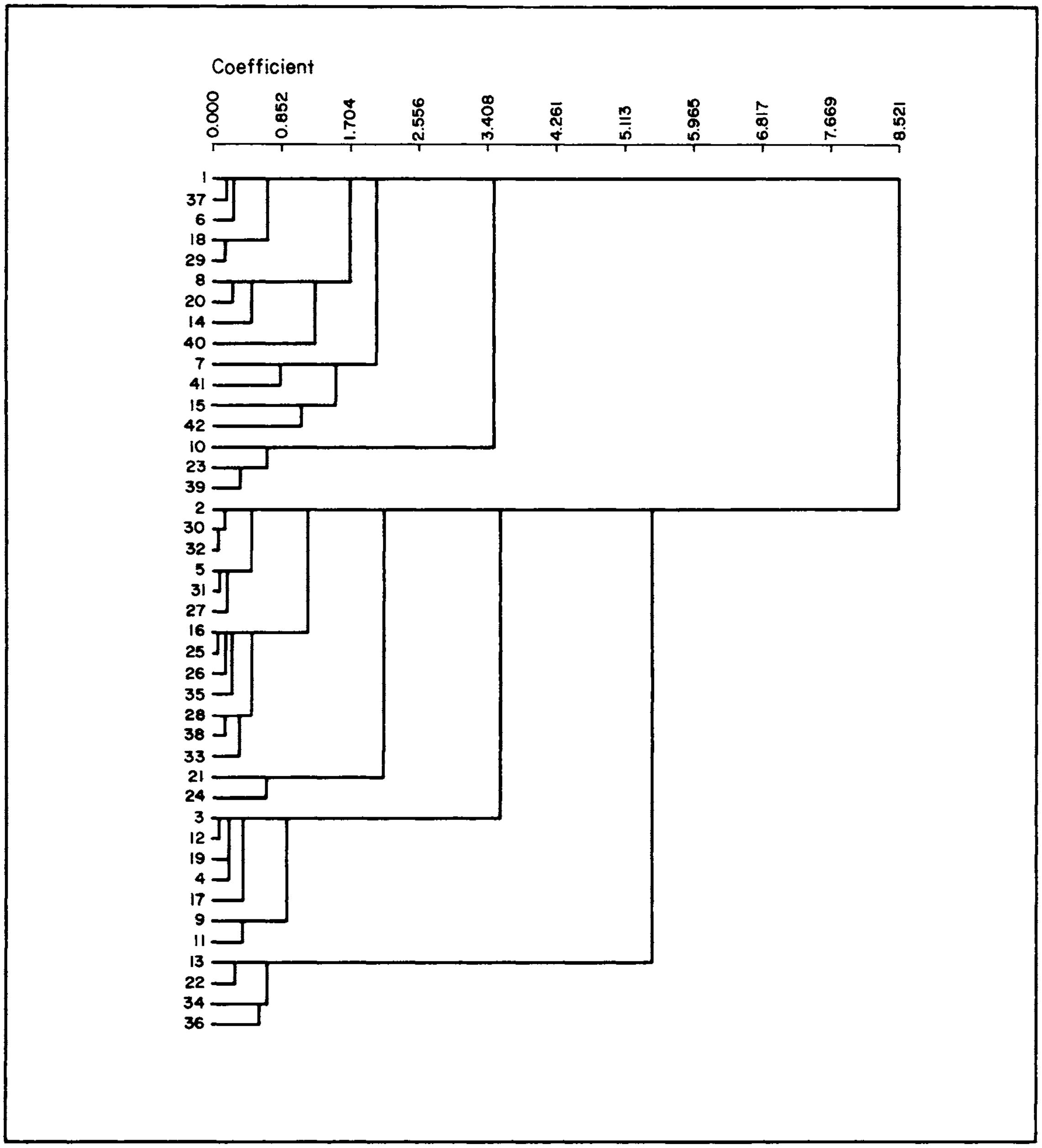

Figure 4. Cluster diagram of excavation units at FjPi-29.

One drawback of the cluster analysis is that it does not provide information on the structure of the frequency distributions shared by the units grouped together in each of three clusters. Our attention, therefore, shifted to developing graphic methods of displaying the relationships identified by the preceding quantitative procedures.

One technique that we used for graphic illustration was to create a series of histograms reflecting the combined artefact frequencies by level of all units within a given cluster. The resultant graphs clearly demonstrate the differences which exist between clusters. Cluster I (Figure 5A), for example, displays a frequency distribution reflecting initial low artefact counts in Levels One and Two, a steady increase in densities until Level Eight and a subsequent sharp drop thereafter. Cluster II (Figure 5B) is characterized by low artefact densities in Levels One and Two with a steady increase to Level Four. From Levels Four through Seven, artefact densities are uniformly high but drop sharply in Level Eight. Finally, Cluster III (Figure 5C) reflects a frequency distribution which sees peak densities occurring in Levels One and Two and a steady decline thereafter.

Remembering that the clusters under consideration are by and large spatially discrete, the variation apparent in the graphs suggests that there have been changes in the intensity of site use (as reflected by relative artefact densities) across the surface of the site through time. In Cluster III, for example, the composite frequency distribution indicates that these peripheral areas may have only been extensively utilized during the latter part of the prehistoric period - at a time corresponding to the deposition of Levels One and Two.

Unfortunately, these histograms have no inherent spatial dimensions themselves, although they do provide a schematic view of shared vertical artefact distributions within clusters which can be compared with the observed distribution of units comprising each of the groups. Thus, they are of little direct use for actually demonstrating the inferred shifts in intensity horizontally across the site. Therefore, to find some means of graphically displaying the horizontal distributions of the vertical patterns defined by our quantitative analysis, we began to explore other graphic options.

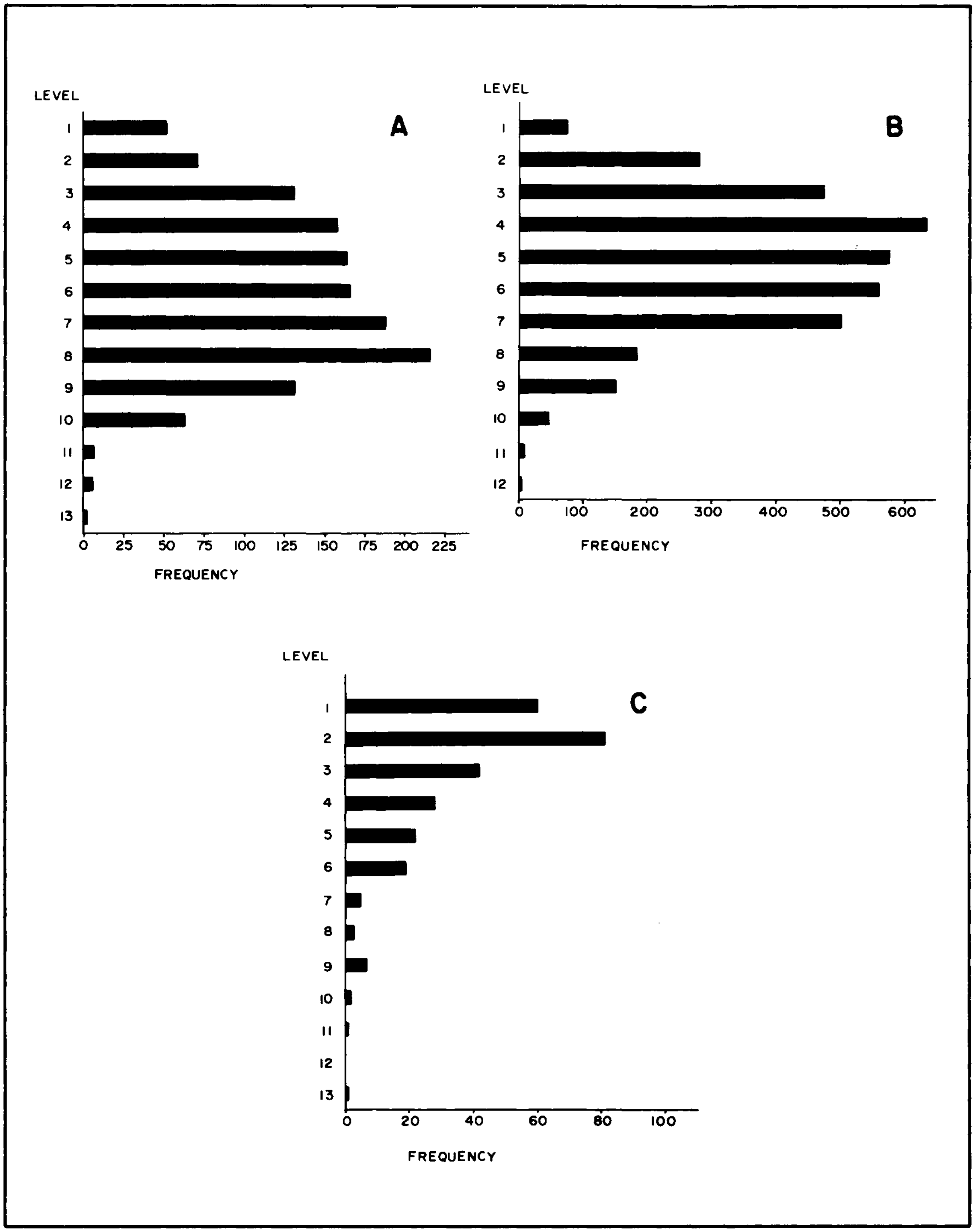

Figure 5. Composite vertical artefact frequency distributions for Cluster I (A), Cluster II (B), and Cluster III (C).

The SURFACE II computer graphics program was chosen because it is capable of depicting data distributions based on extrapolations from a series of sample data points using a distance-weighted formula to create regularly spaced values over the area in question. These distributions are portrayed as either simple contour maps or block perspective diagrams. SURFACE II is therefore ideally suited both to the manipulation of the information recovered by the multi-stage cluster sampling of FjPi-29 and to the portrayal of the horizontal distributions of artefacts by individual 5 cm level across the site.

SURFACE II was first used to create a contour map of relative artefact densities across the sampled portion of the site based on combined assemblage totals from individual 1 x 1 m units (Figure 6). This map clearly illustrates a high degree of horizontal variation in relative artefact densities over the site; however, three peaks can be discerned. A major concentration occurs in the west-central portion of the site near the west terrace edge. A second major artefact concentration is located along the east periphery of the site, along the edge of a poorly drained seasonal swamp. Finally, a minor peak can also be recognized as a plateau in the north-central and northeast part of the site. These distributions support the notion of variablility in the intensity of use over the surface of the Strathcona site.

The next step was to produce a series of contour maps portraying relative artefact densities by 5 cm level horizontally across the sampled portion of FjPi-29. These maps were then used to construct a composite picture of changing artefact distribution patterns through vertical profiles. The ten maps produced by SURFACE II reveal substantial variation in horizontal distributions by level. In Level One (Figure 7), artefact densities are highest along the east periphery of the site. In Level Two (Figure 8), densities remain high along the east periphery but also begin to rise in the west-central area. By Level Three (Figure 9), it is clear that the highest artefact concentrations occur along the west-central terrace edge. In Level Four (Figure 10), densities continue to rise dramatically along the west terrace edge relative to other parts of the site. This trend continues through Levels Five and Six. In Level Seven (Figure 11), overall artefact densities decline and three peaks can be easily identified - one on the west terrace, one in the north-central

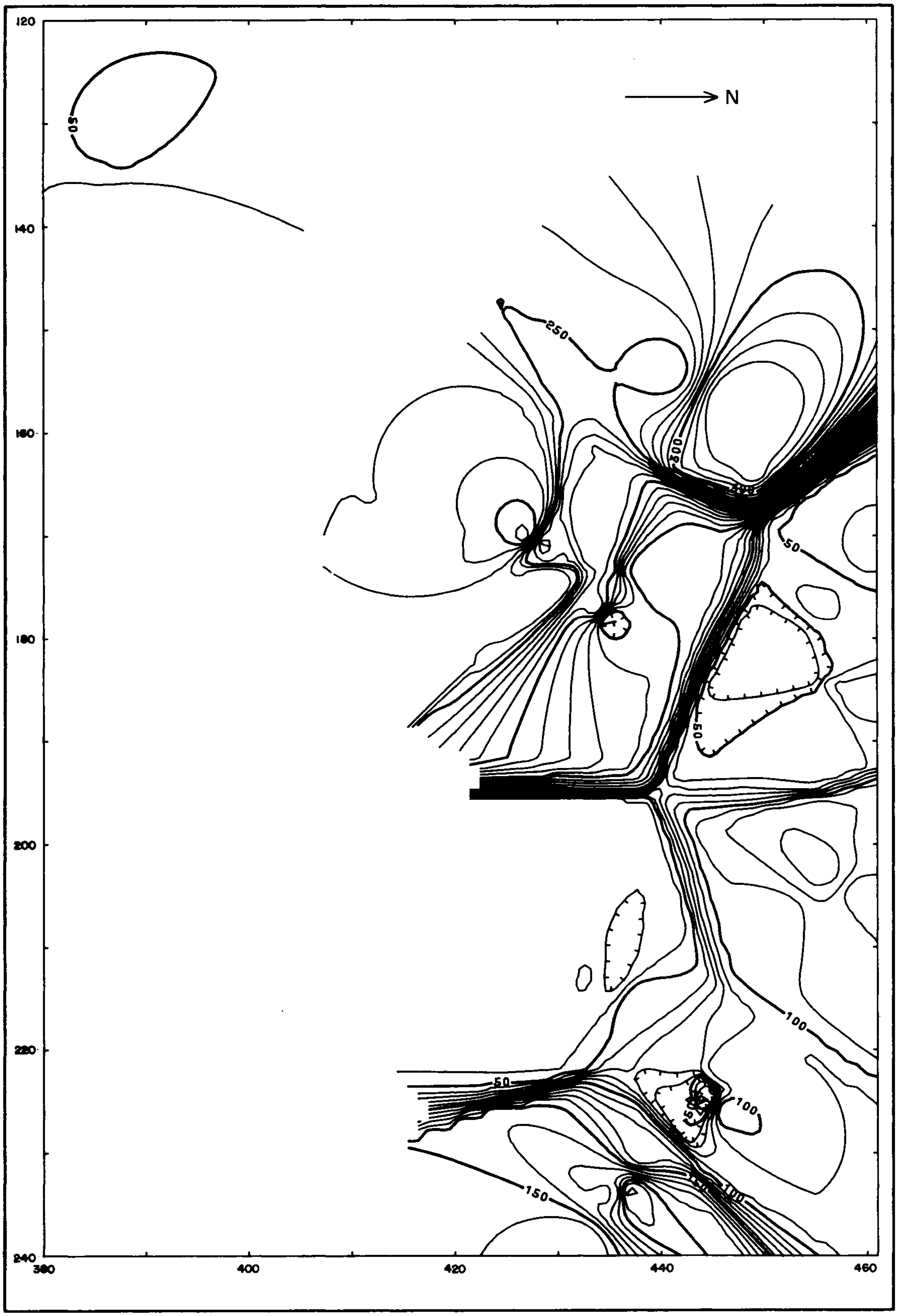

Figure 6. Contour map of horizontal artefact density distributions for all artefacts.

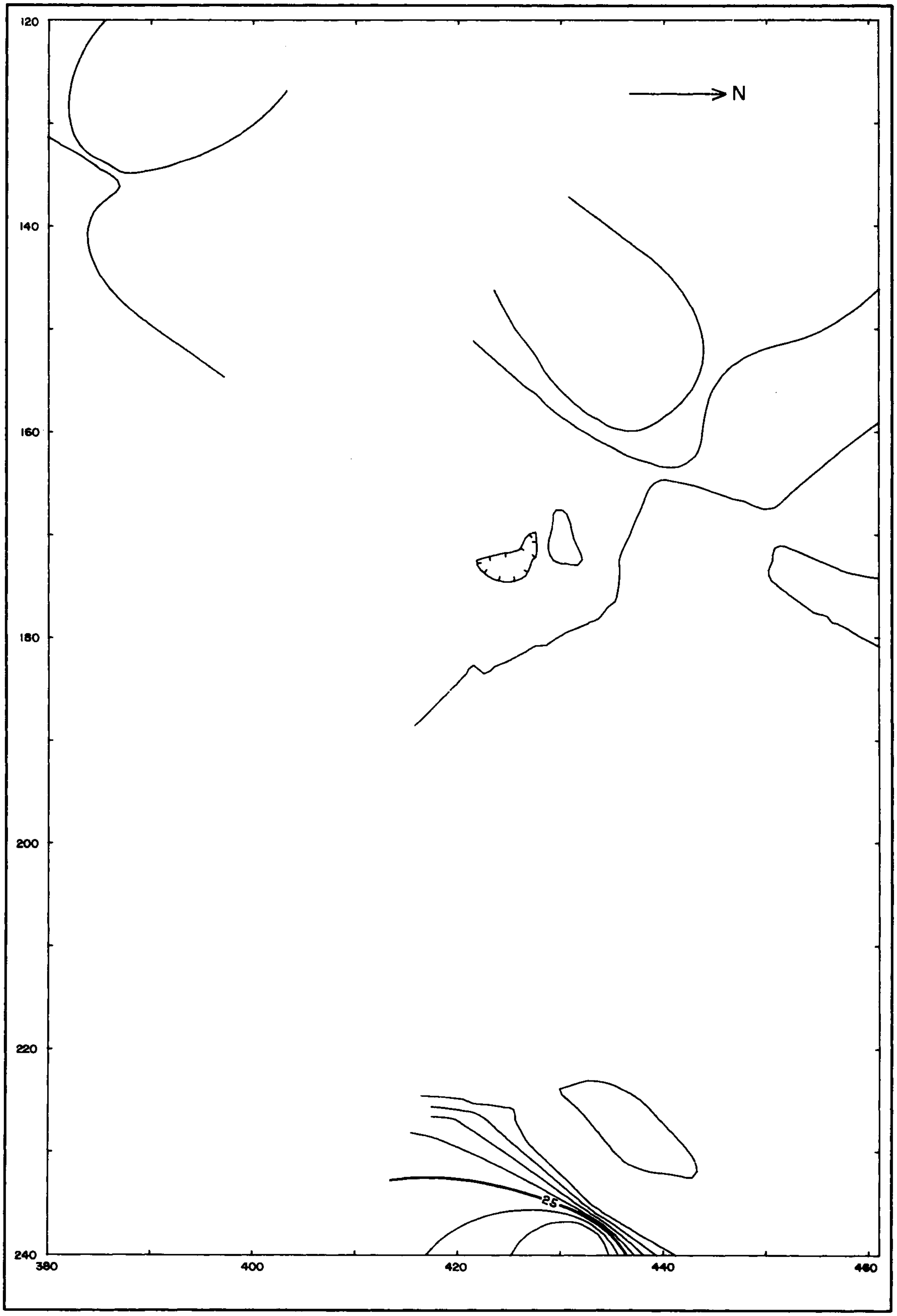

Figure 7. Contour map of horizontal artefact density distributions for Level One.

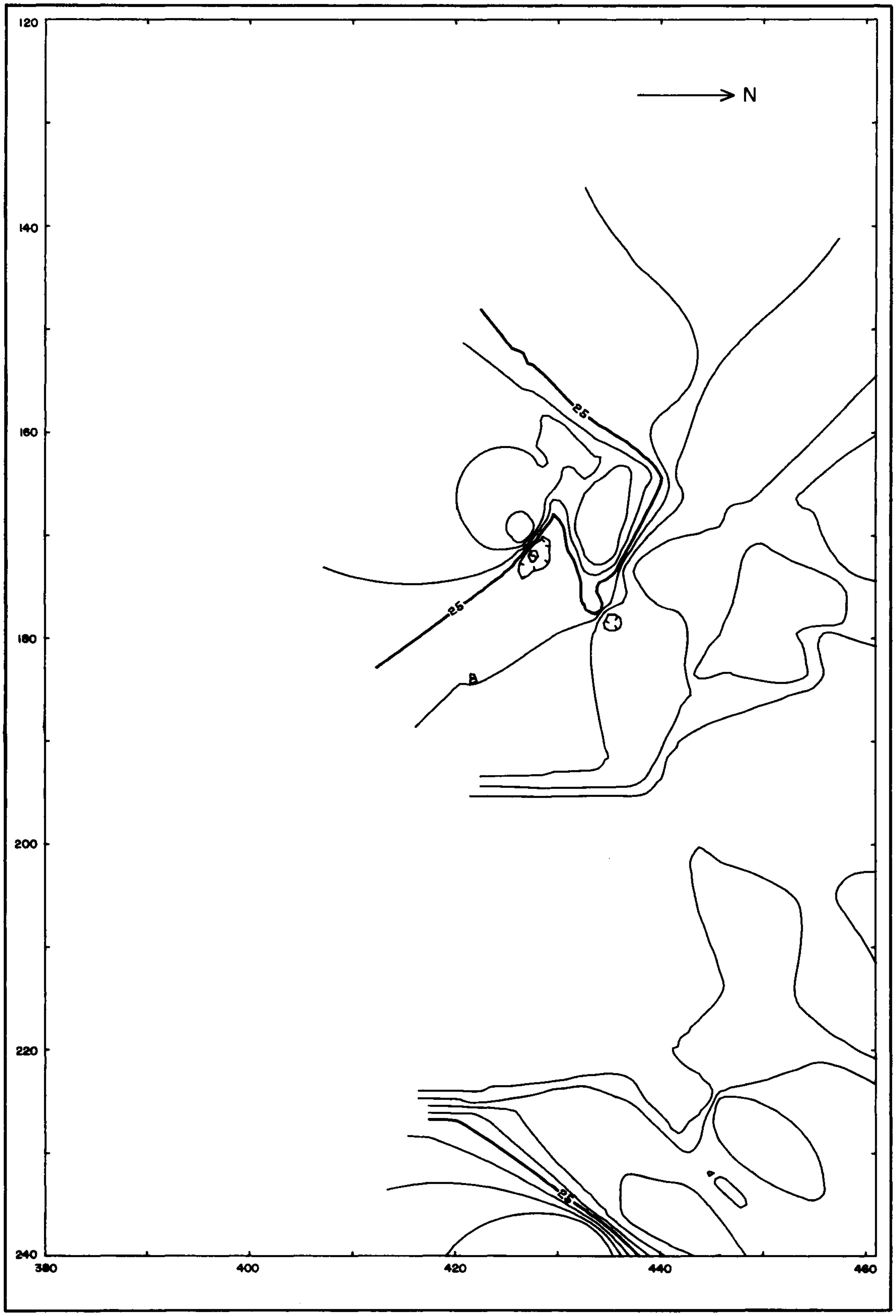

Figure 8. Contour map of horizontal artefact density distributions for Level Two.

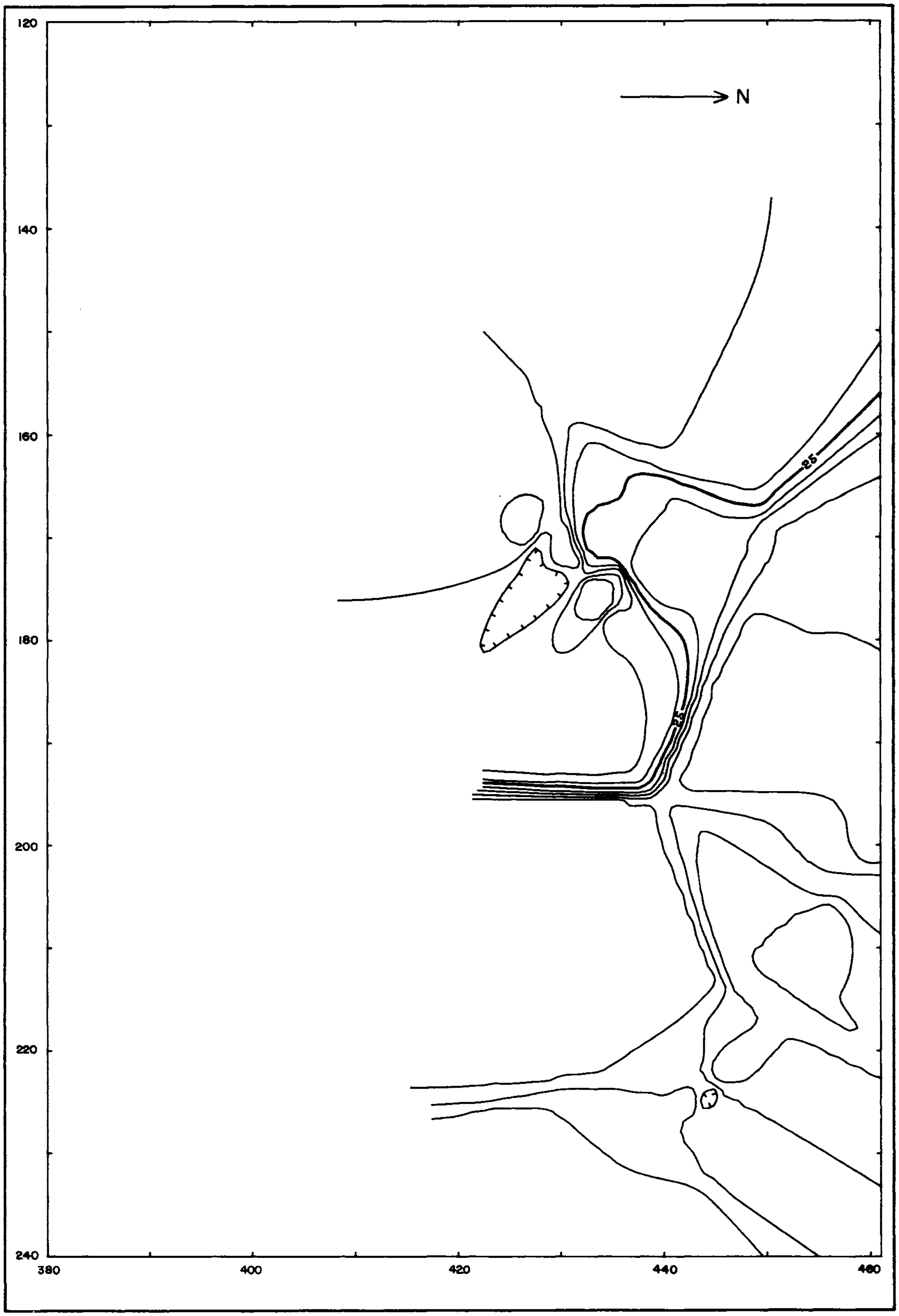

Figure 9. Contour map of horizontal artefact density distributions for Level Three.

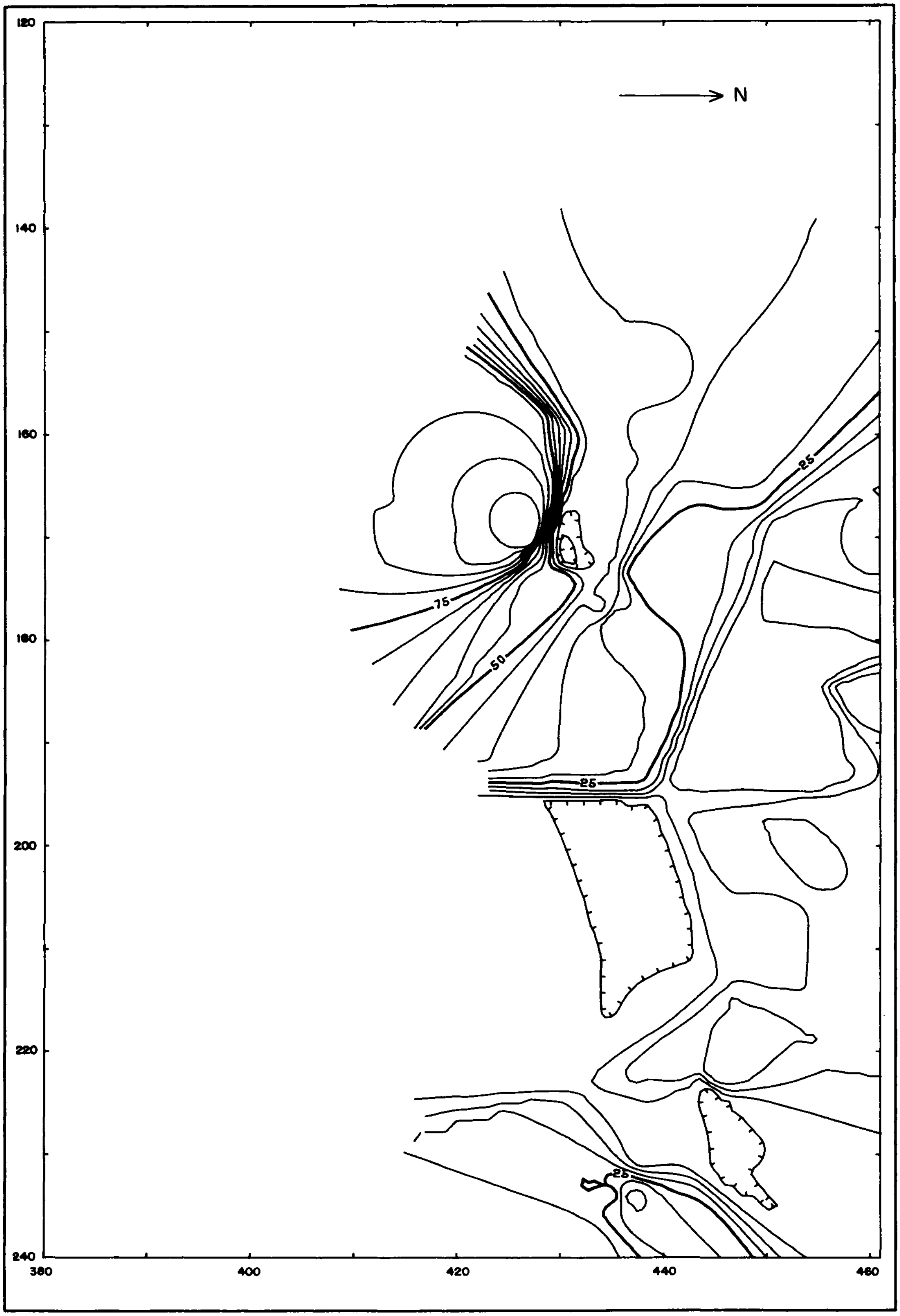

Figure 10. Contour map of horizontal artefact density distributions for Level Four.

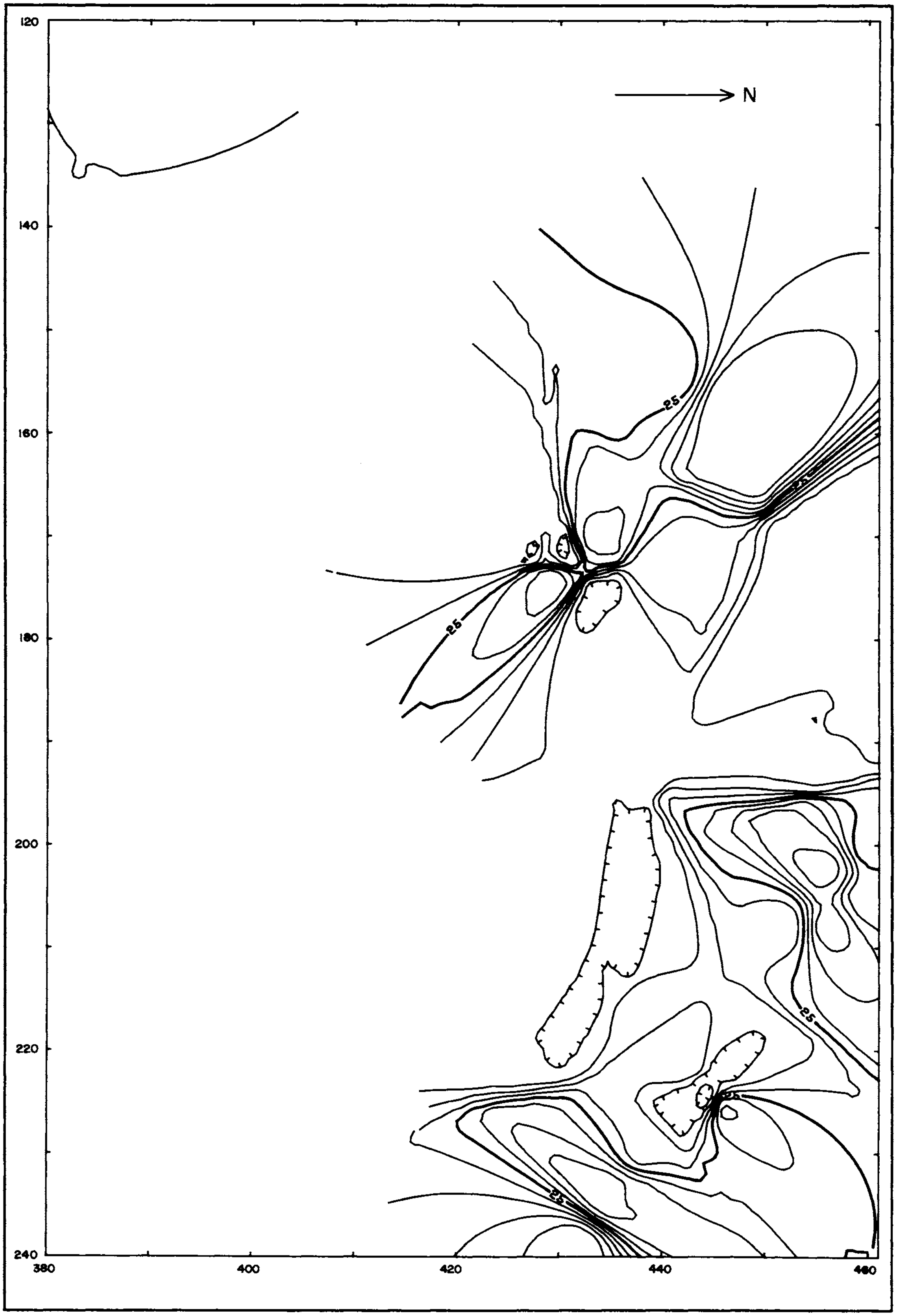

Figure 11. Contour map of horizontal artefact density distributions for Level Seven.

part of the site and a third along the east periphery. In Level Eight, relative densities decline further and concentrations shift back to the northwest periphery of the site (Figure 12). This trend is continued in Level Nine and Level Ten.

The maps produced by SURFACE II clearly demonstrate that the intensity of site use at FjPi-29 varies both vertically and horizontally. These maps also reveal that the focus of site use appears to have shifted several times throughout its occupation. However, of greater significance, is the fact that the artefact distribution patterns revealed by the SURFACE II graphic analysis compare quite favourably to the patterns inferred from the histograms of the clusters. In other words, we were successful in our efforts to devise a means of graphically illustrating relationships defined through quantitative analysis.

DISCUSSION

Despite the fact that FjPi-29 lacks apparent cultural stratification, the preceding analysis has successfully demonstrated that regular variations in vertical artefact distributions do indeed occur. Translating these variations into their possible behavioral contexts, we can present the following tentative propositions about changing patterns of site use through time:

1. During the most recent occupations of FjPi-29 (represented by Levels One and Two), cultural activities appear to have been concentrated along the east periphery of the site.
2. During the middle period occupations (those associated with Levels Three through Six), activities centred on the west terrace edge of the Strathcona site. These occupations correspond to the heaviest use of the site as measured by relative artefact densities.
3. During those occupations of FjPi-29 corresponding to the deposition of Level Seven, activity was distributed much more broadly over the site than was the case with previous occupations. This might suggest that the early occupations at the Strathcona site may have been the most extensive.
4. During the very earliest occupations at FjPi-29 (those corresponding to Levels Eight through Ten), use of the site appears to have been

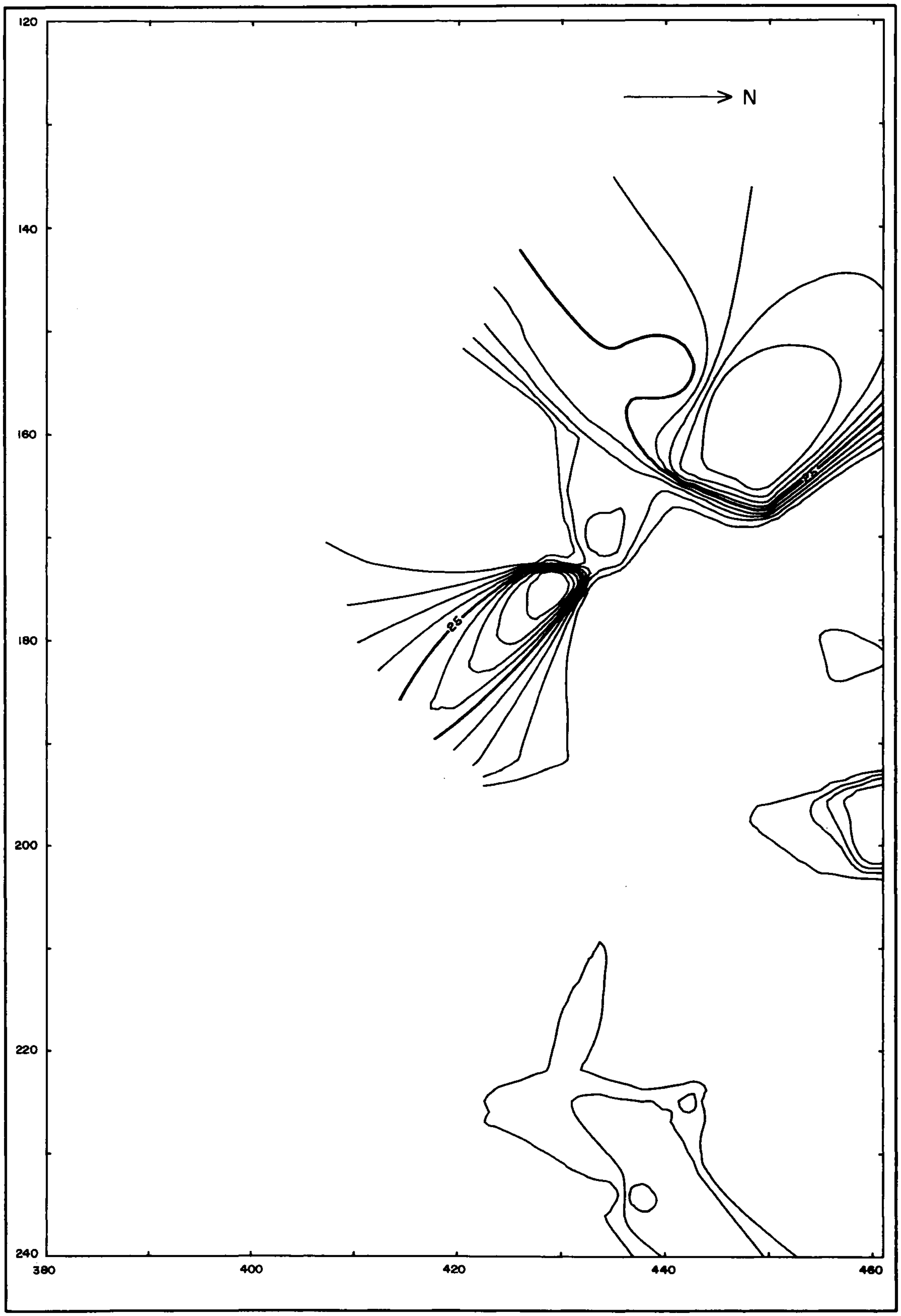

Figure 12. Contour map of horizontal artefact density distributions for Level Eight.

light and sporadic. Most activity is associated with the west terrace edge.

These interpretations are based on the trial analysis of sample data and therefore quite likely subject to re-interpretation. We do not mean to equate the identification of changing patterns of site use through time with the isolation of specific cultural components. The approach summarized in this paper does not entirely resolve the problem of interpreting sites without cultural stratigraphy - nor was it meant to. However, this approach has had initial success in demonstrating patterning and variation in vertical artefact distributions which may correspond to changes in site use through time. We have therefore achieved a level of understanding about the nature of archaeological deposits contained within the Strathcona site hitherto not possible by conventional analytical means.

The results to date have obviously been very encouraging. However, there remains considerable room for improvement to strengthen the reliability of the research design. Indeed, several methodological revisions immediately come to mind:

1. The contour maps created by the SURFACE II graphics package are based on raw artefact frequencies by 1 x 1 m unit. Due to the considerable variation in total numbers of artefacts per unit, a more accurate assessment of artefact density distributions might be achieved by running the appropriate computations on standardized Z-scores.
2. All of our analyses were conducted using artefact counts by arbitrary 5 cm excavation levels. This potentially imposes restrictions due to the variation in total numbers of levels between units. As an alternative, it would be feasible to identify a standard number of levels and to re-organize frequency distributions for individual units accordingly. Given the demonstrated relationship between surface and basal clay topography discussed earlier, such re-organization should not bias the results.
3. Variations in site use through time have been tentatively identified using a cluster analysis of artefact frequency distributions and the graphic analysis of artefact distributions by 5 cm level. However, the observed relationship between vertical patterns and their horizontal distributions is largely inferential. To more accurately

assess the validity of this relationship, a series of cluster analyses could be run on artefact frequencies (or Z-scores) for each arbitrary level across the site. The resulting clusters should exhibit spatial integrity within levels and variability between levels.

4. One aspect of the SURFACE II mapping programme that we have not as yet explored is its predictive capabilities. Since SURFACE II relies on the interpretation of regularly spaced values from sample data points, it should be possible to use the output of this programme to predict assemblage characteristics from un-sampled portions of the study area. To test this potentially useful aspect of SURFACE II, we did not test one of our 40 x 40 m sampling areas during the 1984 season. Units from the sampling areas on either side will be used to conduct an analysis similar to the one outlined in this paper. Predictions concerning the vertical and horizontal distribution patterns in the unsampled area will be made on the basis of this analysis and subjected to testing through excavation during the 1985 season.

CONCLUSIONS

We are of the firm belief that the techniques described herein have a great deal of potential in Northwestern Plains archaeology. In particular, this approach should prove to be a useful method for analysing controlled surface collections from ploughed sites to identify potential activity areas. Such applications are currently being explored by historical archaeologists in the southeastern United States (Lewis 1977; South and Widmer 1977). It is our intention to explore the further possibilities of horizontal and vertical artefact distribution analysis using the sample data obtained from the Strathcona site by the University of Calgary's Archaeological Field School.

ACKNOWLEDGEMENTS

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THE ELLIS SITE (EcOp-4): A LATE PREHISTORIC BURIAL LODGE/MEDICINE WHEEL SITE IN SOUTHEASTERN ALBERTA

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INTRODUCTION

The Ellis site is located on the Suffield Military Reserve, some 31 km north of the City of Medicine Hat in southeastern Alberta (Figure 1). It is situated on a small, isolated point of prairie jutting out into, and overlooking, the valley of the South Saskatchewan River (Figures 1,3). The Ellis site consists of two small stone cairns, 13 stone circles or "tipi rings", along with a single medicine wheel. This medicine wheel is composed of a central stone ring from the margins of which 10 or 11 stone lines radiate outwards in various directions for a distance of from 14.4 to 19.2 m (Figure 2).

The Ellis site was discovered and recorded in 1971 by W.J. Bryne (1971) while evaluating the archaeological resource potential of the Suffield Reserve and the effects of proposed long term military training activities. In 1972, this military training was initiated, and an archaeological salvage program was developed to mitigate its effects. This initial mitigation program ran from 1972 to 1975, inclusive. Beginning in 1976, and continuing to the present, archaeological survey and mitigation work has been conducted on the Suffield Reserve in conjunction with oil and gas development activities. To date, as a result of both programs, over 1,650 archaeological sites have been located and recorded on the reserve and over 90 sites subjected to detailed mapping and/or excavation.

Investigations were initially carried out at the Ellis site in June of 1974. This involved excavation of seven 2 x 2 m test pits (total 28 m^2) in various areas throughout the site (Figure 1). Although general descriptive information on the cultural features comprising the

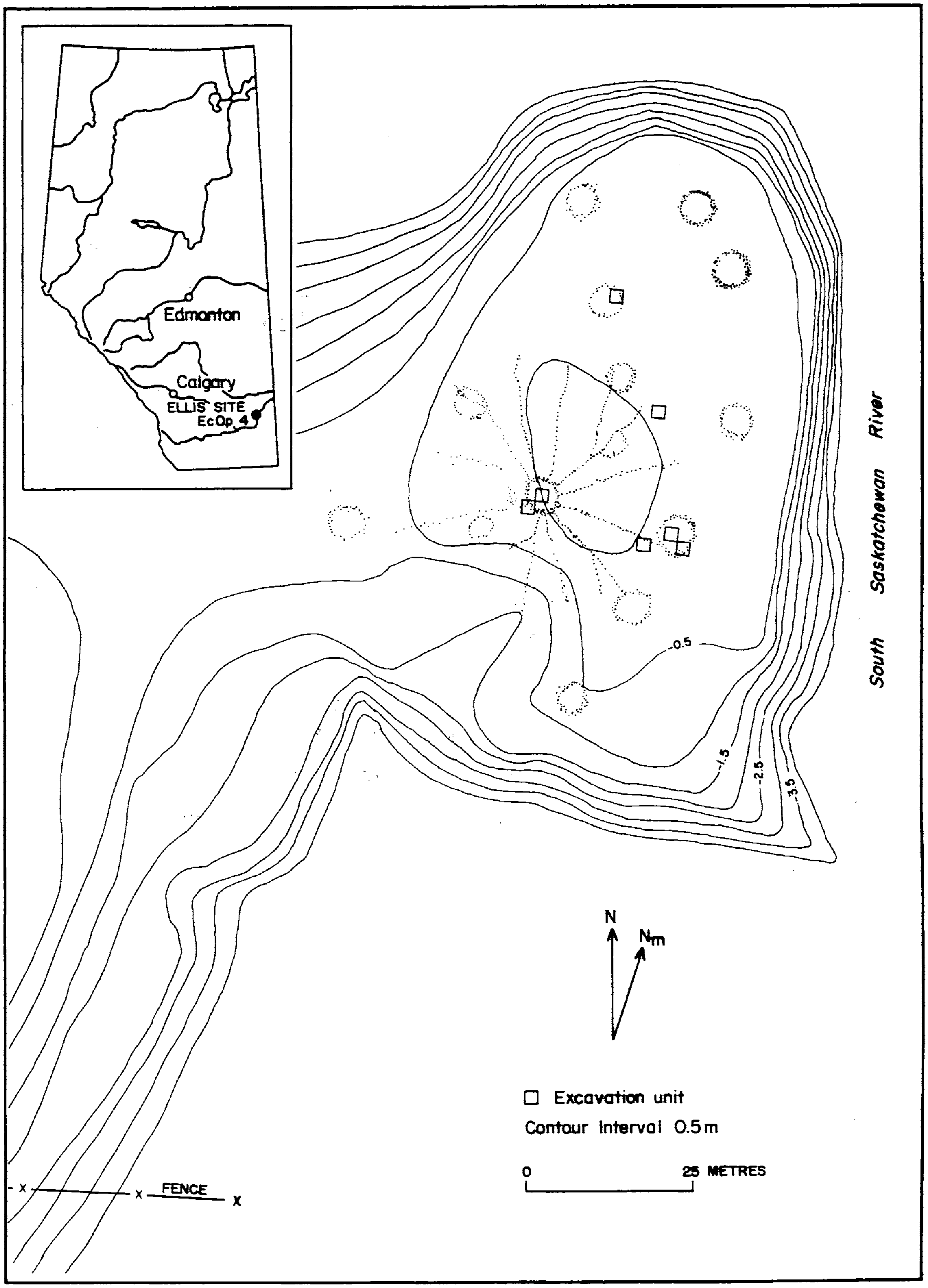

Figure 1. Location and map of the Ellis site.

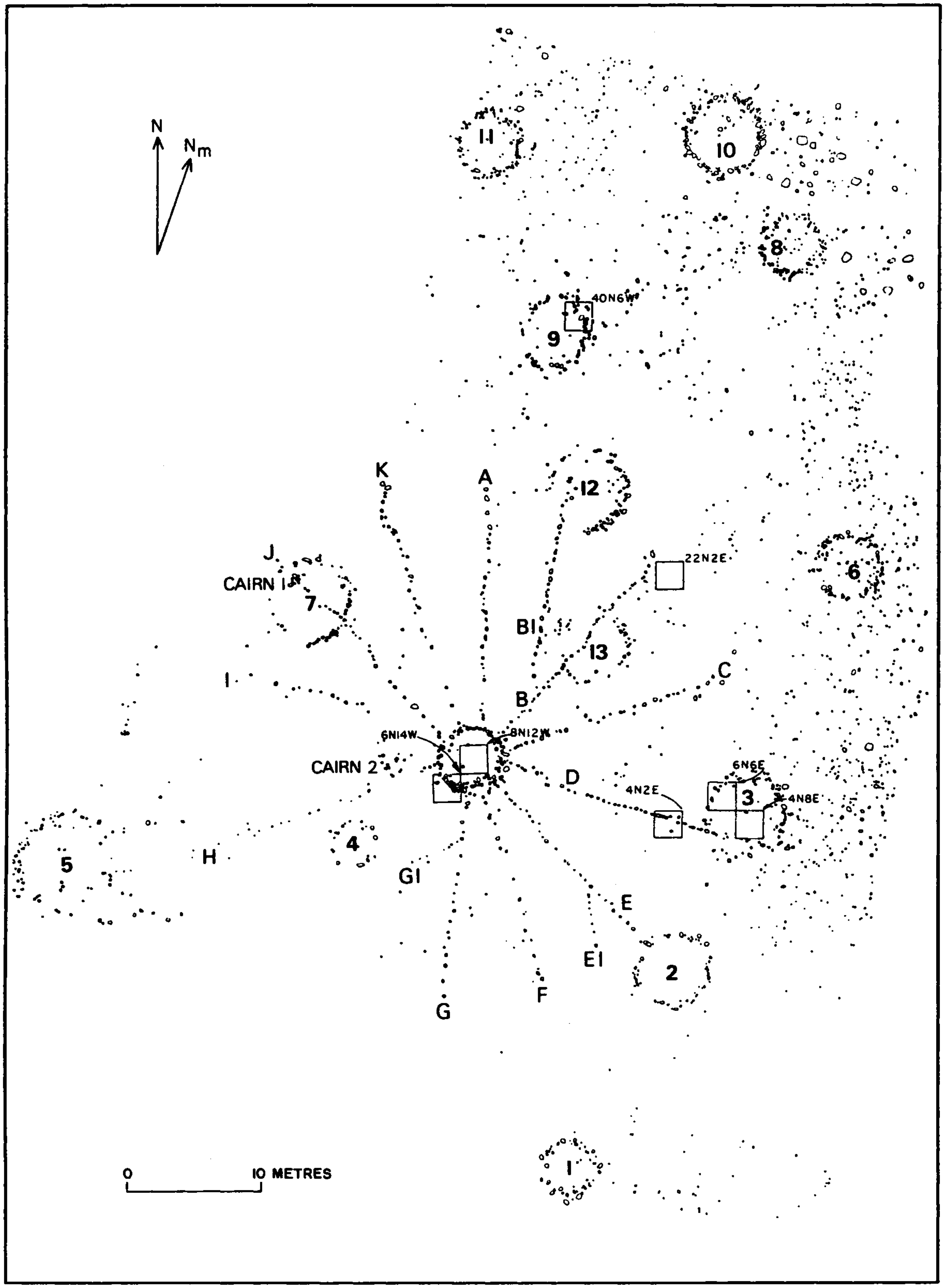

Figure 2. Detailed map of cultural features and excavation units.

Figure 3. Aerial view of Ellis site, looking northeast.

site was gathered in 1974, detailed mapping of the site and features was not conducted at that time.

In 1975, I guided Dr. Richard Forbis and John Eddy to the site so that Dr. Eddy could make a transit survey of the spokes comprising the medicine wheel. These observations were to be used to investigate whether the spokes of the medicine wheel were astronomically aligned. Eddy (personal communication, 1977) subsequently determined no significant alignments were present.

In 1976, the site was visited again as part of a program funded by the Archaeological Survey of Alberta. The objectives of this program were:

> (a) to field examine all reported "medicine wheel" sites currently on file with the Archaeological Survey of Alberta, (b) to evaluate their status as "medicine wheels", and (c) to prepare detailed topographical maps of selected sites (Walde 1977:93).

EcOp-4 was one of the sites selected for detailed mapping, and the following procedures were employed:

> The mapping program itself followed standard survey techniques wherein the following significant information pertinent to each site was collected: (a) the site was first located within the local topography, next (b) the dimensions and positions of the elements characterizing the complex were mapped, and finally, (c) the precise astronomical orientation of each site was obtained (Walde 1977:94).

A problem with these maps is that they do not show the actual number and locations of the individual stones comprising each element in the site. It appears that points were plotted along the margins of the features, and then the number and position of stones between these plotted points sketched in. They must in fact be considered no more than detailed sketch maps.

Therefore, in the summer of 1980, a crew under my direction resumed work at the site. This involved detailed mapping of the entire site area, of all cultural features present, and of the previously excavated test units (Figures 1,2). This paper summarizes and discusses the results of investigations carried out in 1974 and 1980.

DESCRIPTION OF SITE AREA

The Ellis site is located within the shortgrass prairie region of the eastern Alberta Plains at an elevation of approximately 607 m a.s.l. (Sharp 1972:36; Atlas of Alberta 1969:9). Surficial deposits in the moderately rolling prairie surface within, to the west of, and to the north of, the site area consist of hummocky moraine. An extensive area of aeolian sand deposits several square miles in size begins less than a quarter mile southwest of the site area. Eroded slope deposits blanket the walls of the South Saskatchewan River valley, bordering all but the west margins of the site (McPherson 1972).

The slopes of the South Saskatchewan River valley are extremely steep within the site area, and for a distance of some 2 - 3 km north and south along the valley edge. The prairie surface at the site is located approximately 80 m above the river. In the immediate site vicinity, there is no valley bottom, with valley walls dropping directly into the river. Access to the river from the prairie surface at the site is extremely difficult for both man and animal (Figure 3).

Vegetation at, and in the vicinity of, the site consists of short prairie grasses, prickly pear cactus, and small amounts of sagebrush. The nearest woody vegetation of any extent is to be found along other sections of the South Saskatchewan River valley in the aeolian sand areas southwest of the site. In both locations, this consists of small to relatively extensive stands of large cottonwood, as well as smaller shrubs such as chokecherry and willow.

EXCAVATION AND MAPPING PROCEDURES

During the 1974 field season, seven 2 x 2 m test units were excavated in various areas of the site (Figure 2). Initially, in establishing the location of these test units, a datum point was defined at the south end of the site. Then, over the entire site, a 2 m grid was laid out with axes oriented in relation to true north-south and east-west. Each of the seven excavated test units was designated according to the location of its northeast corner from datum (e.g., 6N-6E). Each unit was subdivided into quadrants and all but one were excavated by trowelling; test pit 22N-2E was excavated by shovel shaving. Each test pit was excavated in 5 or 10 cm arbitrary levels (Table 1), and all matrix was passed through a 1/4" mesh screen. Detailed notes were taken on each level and select floor plans were drawn.

During the 1980 mapping program, a second grid oriented to magnetic north was established over the entire site. Each grid unit was 8 m on a side. Utilizing the "tipi quik mapping procedure" (Smith 1974; Dau 1981), a drawing was made of each 8 m square block at a scale of 1:40. All surface stones greater than 5 cm in diameter were mapped. During the course of mapping, each 8 m square grid block was carefully examined, and all observed surface cultural material was collected. Later, each grid block drawing was reduced in scale and drafted into a final site map at a scale of 1:80. Also during the 1980 mapping program, a generalized topographic map of the site area was drawn, with the excavation grid datum serving as the "0" elevation point. Figures 1 and 2 are the results of this mapping program.

CULTURAL AND NATURAL STRATIGRAPHY

Excavation within the site area indicated the presence of three stratigraphic units (Figure 4). Mantling the southern portion of the site surface is a light brown unit of aeolian silt and sand, designated Unit 1. Where present, Unit 1 is no more than 8 to 10 cm in vertical extent.

Beneath Unit 1, and forming the ground surface in the northern and eastern portions of the site, is a medium brown clayey to silty deposit apparently of colluvial origin, and largely derived from the local till deposits (designated Unit 2). Unit 2 is quite stoney, particularly in the test units along the north and east margins of the site. Within Units 6N-14W and 8N-12W, Unit 2 contained considerably fewer stones and was more siltly and sandy. In the northern area of the site and along its eastern margin, where Unit 2 forms the ground surface, the soil matrix of the unit has been moderately deflated, forming a gravelly surface. The surface distribution of Units 1 and 2 can be generally determined by examining Figure 2 and noting the distribution of

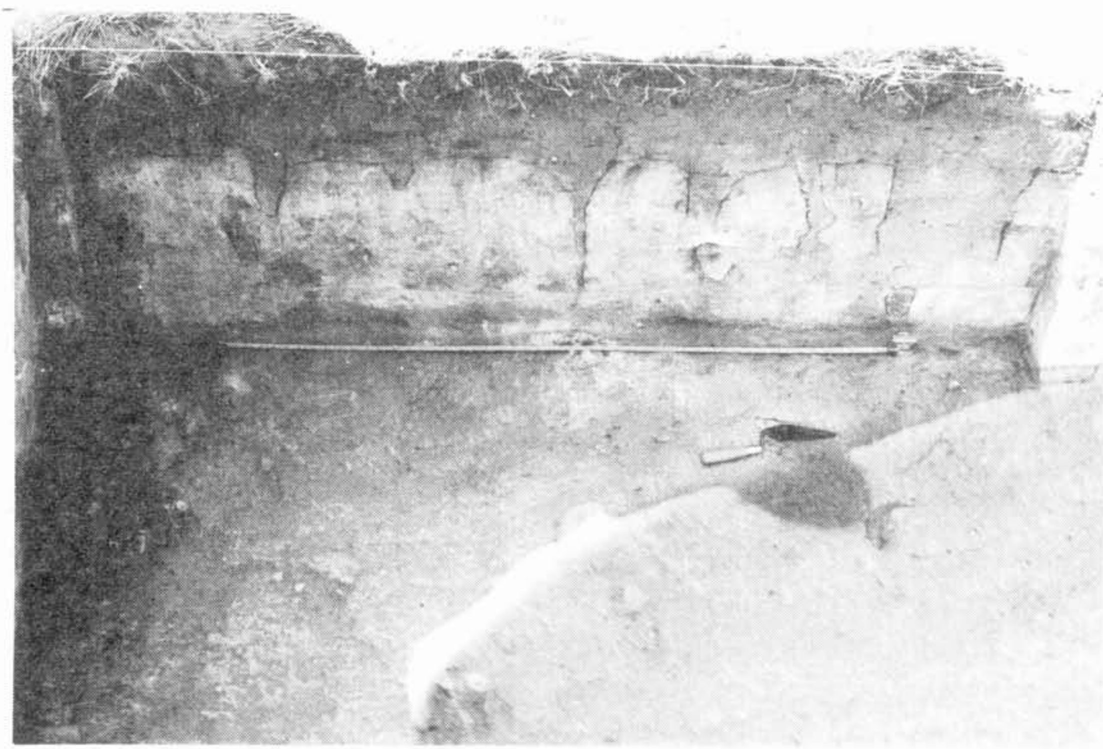

Figure 4. Unit 24N-2E, west wall profile at 70 cm B.S. Note extensive rodent disturbance.

unpatterned stones not forming part of cultural features. Areas containing numerous unpatterned stones largely reflect the surface location of Unit 2, while areas containing little or no such stone are covered by Unit 1. Unit 2 has a vertical extent of from 15 to 25 cm in tested areas of the site and is underlain by light grey to whitish, unmodified tills (Unit 3); the latter unit is generally similar to Unit 2 in texture but somewhat more clayey and stoney. All seven test units were excavated into the upper few centimetres of Unit 3. A deep test in Unit 22N-2E penetrated well into Unit 3.

Recovered cultural material was concentrated in the upper 10 cm of Unit 2, with fewer quantities found (in decreasing order) in: the lower portions of Unit 2; the upper portion of Unit 3; and finally within Unit 1 (Table 1). Although other lines of evidence indicate a series of temporally separate cultural events occurred at the site, it is felt that the stratigraphic spread of cultural material is not a reflection of these events, but rather of the moderate to extensive rodent disturbance noted in tested areas throughout the site (Figure 4). Probably all cultural material was originally deposited in a single 10 to 15 cm band within the upper portion of Unit 2. For the purposes of analysis and interpretation, all material recovered from each pit (from all depths) is considered as a single unit and is assumed to be associated with the surface stone feature to which it is most closely situated. Materials collected from the site surface are considered collectively as a single unit.

DESCRIPTION OF OBSERVED AND RECOVERED CULTURAL MATERIALS

CULTURAL FEATURES

Cultural features at the site consist of the single medicine wheel and its associated stone spokes, 13 simple stone circles or tipi rings, and one definite and one possible stone cairn (Figure 2). None of the stones comprising the features show evidence of recent disturbance or displacement. The average depth of burial of stones comprising the medicine wheel and tipi rings range from 6.75 to 12.90 cm. Figure 2 indicates the designations assigned to various cultural features and

Table 1. Summary of excavated depths, arbitrary levels and recovered cultural material.

4N - 2E (Spoke D)		4N - 8E (Stone Circle 3)		6N - 6E (Stone Circle 3)		6N - 14W (Medicine Wheel)		8N - 12W* (Medicine Wheel)		22N - 2E		40N - 6W (Stone Circle 9)	
Level (cm)	# Items	Level (cm)	# Items	Level (cm)	# Items	Level (cm)	# Items	Level (cm)	# Items	Level (cm)	# Items	Level (cm)	# Items
0-5	0	0-5	2	0-6	3	0-5	0	0-5	3	0-10	21	0-5	33
5-10	0	5-14	76	6-10	14	5-10	1	5-10	52	10-20	28	5-10	248
10-15	6	14-20	186	10-15	56	10-15	4	10-15	30	20-30	1	10-15	6
15-20	6			15-20	54	15-20	4	15-20	17	30-40	0	15-20	0
20-25	6			20-25	26	20-25	20	20-25	3	40-50	0		
25-30	3					at 31	1	25-30	9	50-60	0		
30-35	1							30-35	0	60-70	0		
Total	22		264		153		30		114		50		287

* Includes 66 human skeletal fragments but not wooden stake

their components within the site. Terminology and procedures employed in summarizing stone circle data are defined in Brumley et al. (1983).

<u>The Medicine Wheel</u>

The medicine wheel is fairly centrally located and consists of a stone ring with a mean inside diameter of 3.56 m and a mean outside diameter of 5.32 m (Tables 1-3; Figures 1-3). The longest inside axis is oriented from NE to SW. Radiating outward from this ring are 11 stone lines or spokes, designated A through K. As well, three lines (B,E,G) have secondary spokes or "branches". Spoke I is spatially separated at its proximal end from the ring of the medicine wheel and also from adjacent spoke J. This may be its original form, or it may originally have been connected to either the ring of the wheel or to Spoke J. Table 2 summarizes various dimensional attributes of individual spokes. It should be noted that because of the imprecise way in which such structures are built, observations on dimensions such as presented in Table 2, must be considered approximate in nature. Probably no two researchers would ever totally agree on how or where such observations should be taken, and which stones should or should not be included.

Spokes A,B,C,E1,F,G,G1,H,I,K have what I will call simple terminations. That is, their terminal ends are not demarcated in any way. Spoke B does, however, pass through Stone Circle 13 and terminates well beyond it. Spokes B1,D,E and J terminate at or within tipi rings. Depending on how one interprets the placement of stones, spoke D may also end within Stone Circle 3 or extend totally through it to terminate just beyond. Spoke J ends within Stone Circle 7, and its terminus is also marked by a small cluster of stones, possibly a cairn (Cairn 1).

One could argue that the spokes were intentionally constructed in such a way as to link these various tipi rings to the medicine wheel. However, placement of individual stones within the tipi rings suggests that this is not the case. Stone Circles 12 and 13 definitely appear to have had stones removed from them and used to construct adjacent spokes. Stone Circles 3 and 7 may have been damaged in a similar manner, but to a lesser extent. This strongly suggests that Stone Circles 12 and 13, and possibly 3 and 7, were constructed prior to, and are not contemporaneous with, the medicine wheel. The asymmetrical alignment of Spokes B1 and D

Table 2. Ellis medicine wheel site individual stone spoke data summary.

INDIVIDUAL SPOKE	A	B	B1	C	D	E	E1
DATA CATEGORY							
Spoke Length[1]	17.2	18.0	15.6	16.8	17.2	16.8	4.4
Spoke Angle (TN)[2]	2°	42°	11°	71°	91°	138°	175°
Total No. of Stones	35	51	38	32	40	31	8
Mean No. of Stones Per Metre of Length	2.03	2.83	2.43	1.90	2.30	1.84	1.82

INDIVIDUAL SPOKE	F	G	G1	H	I	J	K
DATA CATEGORY							
Spoke Length[1]	14.4	14.8	4.0	19.2	10.0	15.6	18.4
Spoke Angle (TN)[2]	164°	188°	248°	252°	289°	329°	344°
Total No. of Stones	19	20	7	19	14	28	34
Mean No. of Stones Per Metre of Length	1.32	1.35	1.75	0.99	1.40	1.79	1.85

1. Spoke length and angle calculated in relation to line connecting extreme proximal and distal points.
2. TN = True North

Table 3. Select stone circle observations.

OBSERVATION/FEATURE	MEDICINE WHEEL	SC 1	SC 2	SC 3	SC 4	SC 5	SC 6	SC 7	SC 8	SC 9	SC 10	SC 11	SC 12	SC 13
Mean Inside Diameter	3.56	3.12	4.64	4.72	2.80	5.50	3.76	5.52	3.66	4.36	4.62	3.76	4.82	4.50*
Mean Outside Diameter	5.32	4.92	6.16	6.60	3.82	7.88	5.72	7.08	4.96	5.86	6.60	5.20	6.90	6.23*
Inside Diameter Long Axis Orientation	NE-SW	N-S	NE-SW	E-W	N-S E-W	E-W	N-S	N-S	E-W	N-S	E-W	E-W	N-S	Ind
Stone Count/Rank North Sector	12/3	7/4	5/2	9/4*	2/4	14/8	8/3	4/4*	8/2	5/2	14/5	17/7	4/2*	Ind
Stone Count/Rank Northeast Sector	12/4	8/6	9/6	18/8*	4/7	9/5	22/7	8/5*	18/7	13/7	24/8	16/6	7/5*	Ind
Stone Count/Rank East Sector	16/6	7/5	15/8	17/7*	1/3	5/2	18/5	14/7*	12/3	19/8	21/7	14/4	21/7*	Ind
Stone Count/Rank Southeast Sector	20/8	8/7	8/5	11/6*	3/5	6/3	23/8	18/8*	13/5	8/6	9/2	17/8	24/8*	Ind
Stone Count/Rank South Sector	12/5	9/8	7/4	8/3*	1/1	4/1	8/2	8/6*	21/8	8/5	13/4	15/5	8/6*	Ind
Stone Count/Rank Southwest Sector	18/7	5/2	2/1	10/5*	1/2	6/4	9/4	4/3*	13/4	8/4	9/1	6/1	5/3*	Ind
Stone Count/Rank West Sector	8/2	3/1	13/7	6/2*	3/6	14/7	6/1	2/1*	8/1	3/1	15/6	11/3	4/1*	Ind
Stone Count/Rank Northwest Sector	8/1	7/3	5/3	6/1*	4/8	13/6	19/6	3/2*	16/6	8/3	12/3	6/2	6/4*	Ind
Total Number of Stones	106	54	64	85*	19	71	113	61*	109	72	117	102	79*	Ind
Mean # Stones/Sector	13.25	6.75	8.00	10.63*	2.38	8.88	14.13	7.63*	13.63	9.00	14.63	12.75	9.88*	Ind
Mean # Stones/m of Circumference	9.48	5.51	4.39	5.73*	2.16	4.11	9.57	3.52*	9.48	5.26	8.06	8.64	5.22*	Ind
Average Depth Burial	12.90	11.5	11.75	10.25	11.5	12.13	9.75	11.33	9.00	9.50	9.50	6.75	9.50	10.00

* Indicates observations possibly or probably inaccurate due to construction of wheel. Ind = Indeterminate

to associated Stone Circles 12 and 3 seems to further argue that spoke/tipi ring associations are fortuitous and not intentional.

The angular spacing between primary spokes varies from 15 to 64 degrees (Table 2). Spokes are most widely spaced to the west and southwest. Although it is assumed here that the various spokes are contemporaneous with one another and with the central ring of the medicine wheel, no definite evidence was noted to support this proposition.

The Tipi Rings

Aside from the central ring of the medicine wheel, 13 stone circles are present within the site area (Tables 1,3,4; Figures 1-3). The size and configuration of these circles, as well as associated cultural materials, indicate that these structures are tipi rings, that is, rings of stone used to hold down the edges of aboriginal lodges (see Kehoe 1960; Quigg and Brumley 1984). These structures show considerable variation in both overall size and in the number and directional placement of stones comprising them. No structural or stratigraphic evidence was noted to indicate whether or not these tipi rings are contemporaneous with each other or the medicine wheel. Previous discussion has suggested that Stone Circles 12, 13 and possibly 3 predate construction of the medicine wheel. Aside from the attached spokes, the central ring of the medicine wheel is well within the range of structural variability exhibited by these tipi rings.

The Stone Cairns

Two clusters of stones within the site are considered here as cairns (Figure 2). Both cairns are single tiered; that is, stones form a single layer and are not stacked on top of one another. Cairn 1 consists of a cluster of nine stones forming the terminus of Spoke J. Cairn 1 has a maximum length of 1.5 m (NE-SW) and a width of 0.9 m (NW-SE).

Cairn 2 consists of a loose cluster of 19 stones situated immediately west of the ring of the medicine wheel, between Spokes H and I. Cairn 2 has a maximum length of 2.3 m (NE-SW) and a width of 2.1 m (NW-SE). There is a gap within Spoke H where it passes by Cairn 2. This strongly suggests that the stones comprising the cairn were derived from stones

Table 4. Cultural material summary.

TEST UNIT	FEATURE ASSN.	F.C.R.	BONE	COBBLE CORES		PEBBLE CORES		COARSE DEB.
				C	M-F	C	M-F	
4N-2E	Spoke D	0	1	1	0	0	0	0
4N-8E	SC-3	0	1	0	0	0	0	5
6N-6E	SC-3	0	0	1	0	0	0	8
6N-14W	M. Wheel	1	18	0	0	0	1	1
8N-12W	M. Wheel	0	0*	0	0	0	0	2
22N-2E	-	3	0	0	0	0	0	7
40N-6W	SC-9	18	56	0	0	0	0	8
Surface	-	1	0	4	2	0	2	5
Total		23	76	6	2	0	3	36

TEST UNIT	FEATURE ASSN.	MED/FINE DEB.	COARSE M.R.S.T.	MED/FINE M.R.S.T.	OTHER TOOLS	TOTAL
4N-2E	Spoke D	18	1	0	B(1)	22
4N-8E	SC-3	251	3	3	PP(1)	264
6N-6E	SC-3	138	3	1	ES(2)	153
6N-14W	M. Wheel	9	0	0	**	30
8N-12W	M. Wheel	45	0	1	Wooden Stake (1)	49
22N-2E	-	37	1	0	ES(1), PP(1)	50
40N-6W	SC-9	202	1	2		287
Surface	-	57	11	3	B(3), PP(2)	90
Total		757	20	10	B(4), PP(4), ES(3), Wooden Stake (1)	945

B = Biface
PP = Projectile Point
ES = End scraper
C = Coarse
M-F= Medium-Fine
FCR= Fire cracked rock

*Does not include 66 human skeletal fragments recovered
**Does not include wooden peg in ring wall

originally in the spoke. If so, Cairn 2 reflects a later use episode at the site.

CULTURAL ASSEMBLAGE

Human Skeletal Remains

Within Unit 8N-12W, situated in the central portion of the medicine wheel, 66 fragments of human skeletal material were recovered from 5 to 20 cm below surface, with the majority recovered from 8 to 15 cm B.S. (Tables 1,4; Figure 5). After examining the sample, Beattie (1984) indicated that it consists of 21 identifiable and unidentifiable long bone fragments, 24 identifiable and unidentifiable skull fragments, 19 unidentifiable bone fragments and 2 teeth. Beattie suggested that the material represents the remains of one adult male of old age (ibid.).

Within the various quadrants of Unit 8N-12W, these bone pieces show specific areas of concentration, with 18 (27%), 41 (62%), and 7 (11%) pieces in the SE, SW, and NW quadrants, respectively. No human skeletal material was found in the NE quadrant. Identifiable cranial fragments dominate the SW quadrant sample, while long bone fragments predominate in the SE. Equal numbers of both cranial and long bone fragments were found in the NW quadrant. No evidence of a burial pit was noted. The depth of burial of the majority of bone fragments corresponds closely to that of the base of the stones comprising the medicine wheel (Table 3). This suggests that the materials were deposited on the ground surface in the interior of the structure at or near the time of its construction. Although badly fragmented and scattered, apparently as a result of extensive exposure prior to burial, the spatial patterning of various skeletal parts is suggestive of an extended or flexed primary inhumation oriented, from head to foot, in a SW to SE direction.

Faunal Remains

A limited quantity of non-human faunal remains was recovered from the Ellis site during excavation (Tables 1,4). With the exception of one piece from Unit 4N-2E and some pieces from 40N-6W, they are very small, unidentifiable fragments of bone scrap. However, the general wall

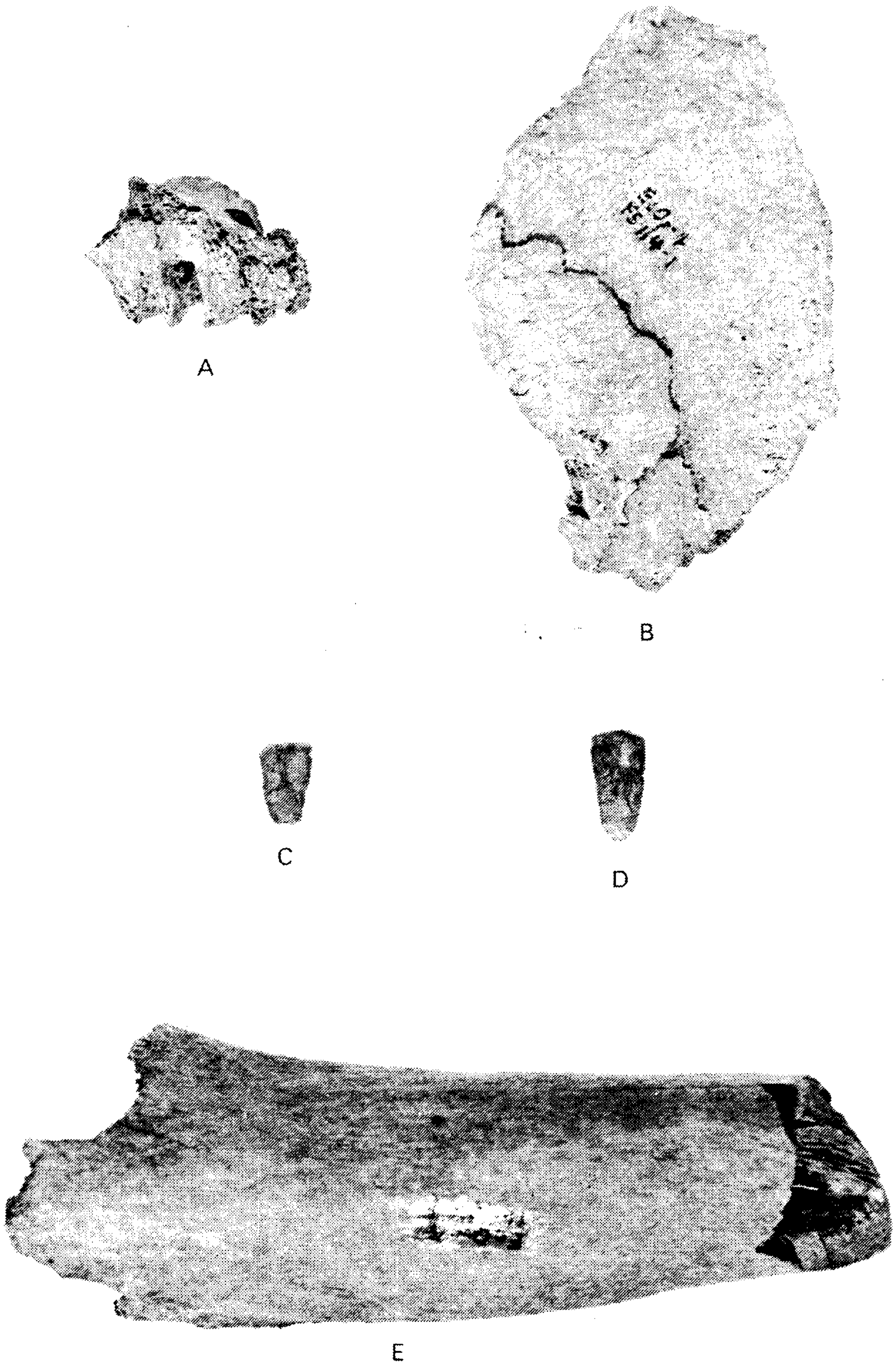

Figure 5. Select human skeletal elements. Specimen No.: A(96), B(114-1), C(88-2), D(104-2), E(100-1).

thickness of these fragments suggests that they are from a large animal and are most consistent with observed fragments of known bison bone.

The single piece from Unit 4N-2E is a small medial rib fragment, again from a medium to large animal, probably bison. The 56 pieces of bone material from 40N-6W are all small fragments of the ascending ramus of a single bison mandible.

Lithic Materials

Projectile Points

Of the four projectile points recovered from the Ellis site, only one (31-1) can be considered associated with a particular feature (Table 4; Figure 6). Specimen 31-1, associated with Stone Circle 3, is a side notched projectile point which falls into Forbis' (1977:52) Irvine variety. Key characteristics of this variety are: 1) basal edges are present and meet both the notches and the base at angles; and 2) base is narrower than body by more than 1 mm. At the Old Women's Buffalo Jump, Irvine points were found in layers 9 to 14, which Forbis (1962) suggests date to between A.D. 600 - A.D. 1200. At the Gull Lake site in southwestern Saskatchewan, Kehoe (1973:58) notes that Irvine points are younger than about A.D. 750.

Specimen 205, found on the site surface, falls into Forbis' (1977:52) Paskapoo variety, characterized by: 1) basal edges present and meet both the notch and the base at an angle; 2) the height of the basal edge is greater than the height of the notch opening; and, 3) equal base and body width (within 1 mm). Forbis (1977:55) suggests an initial age for Paskapoo points at the Old Women's Jump of A.D. 1100 and feels that they extend into the historic period.

The remaining two specimens from the Ellis site are very poorly made specimens which are commonly referred to as flake points. Both are made on thin pieces of debitage, modified into their final form by marginal primary flaking along the margins of both surfaces. The crude, unfinished nature of the specimens suggests that they reflect discarded preforms. In size, they are consistent with arrow points of the Late Prehistoric Period. They are too poorly manufactured to be meaningfully compared to defined point types and varieties.

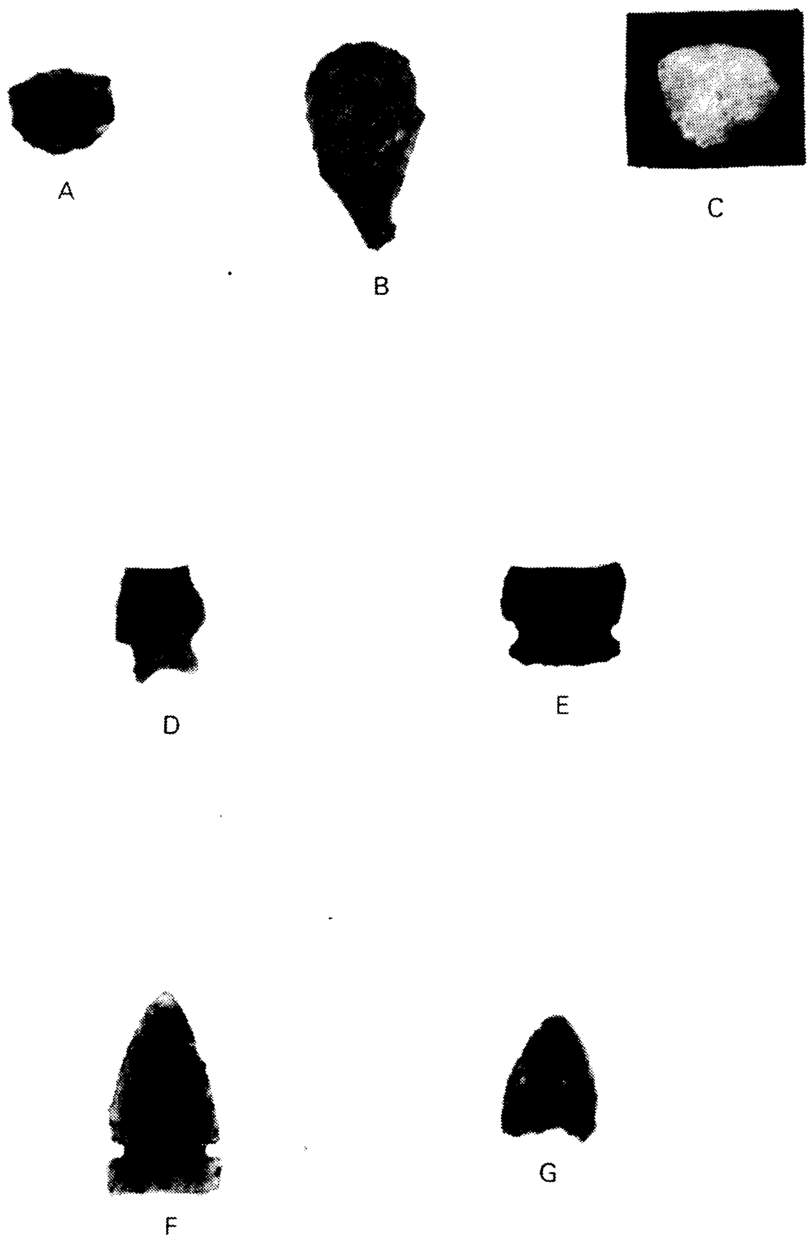

Figure 6. End scrapers and projectile points. Specimen No.: A(75-1), B(3-1), C(55-8), D(55-9), E(31-1), F(205), G(174).

Bifaces

Four bifaces were recovered (Table 4; Figure 7), three of which were found on the site surface. Specimen 155 is very poorly produced, consisting of a large piece of coarse debitage with marginal primary flaking on one surface and marginal to extensive primary flaking on the other. The original preform shape of the specimen has been only minimally altered in subsequent modification. The remaining three specimens are characterized by overall primary flaking covering both surfaces. Marginal secondary flaking is present along the edges of one surface of Specimen 130.

Specimen 130 appears to represent a well finished stone knife, while Specimen 155 appears to reflect a very crude, coarse specimen intended to serve a cutting function as well. Specimens 17-1 and 131 may be bifacial preforms or completed knives.

End Scrapers

Three end scrapers were recovered, all made on locally available medium to fine grained cherts (Table 4; Figure 6). Two of the specimens were associated with Stone Circle 13.

Marginally Retouched Stone Tools

Marginally retouched stone tools (MRST) are defined here as chipped stone tools characterized by marginal primary flaking present along one or more edges. Flaking is generally limited in extent and its production has not resulted in major modification to the shape of the preform upon which it is produced. MRST are extremely variable in terms of such features as overall size, number of retouched edges, length of retouched edges and location of retouched edges (Brumley 1981:9.2).

A total of 30 specimens, representing 3% of the total assemblage, were recovered (Table 4; Figure 8). MRST are usually made on quartzite and secondarily on local Swan River Chert. Specimens do not appear concentrated in any particular area of the site. MRST are interpreted as largely reflecting simple knives intended for use in slicing meat into long, thin strips for cooking by stone boiling or open air drying. The low frequency of fire cracked rock suggests that open air drying was the predominant method employed.

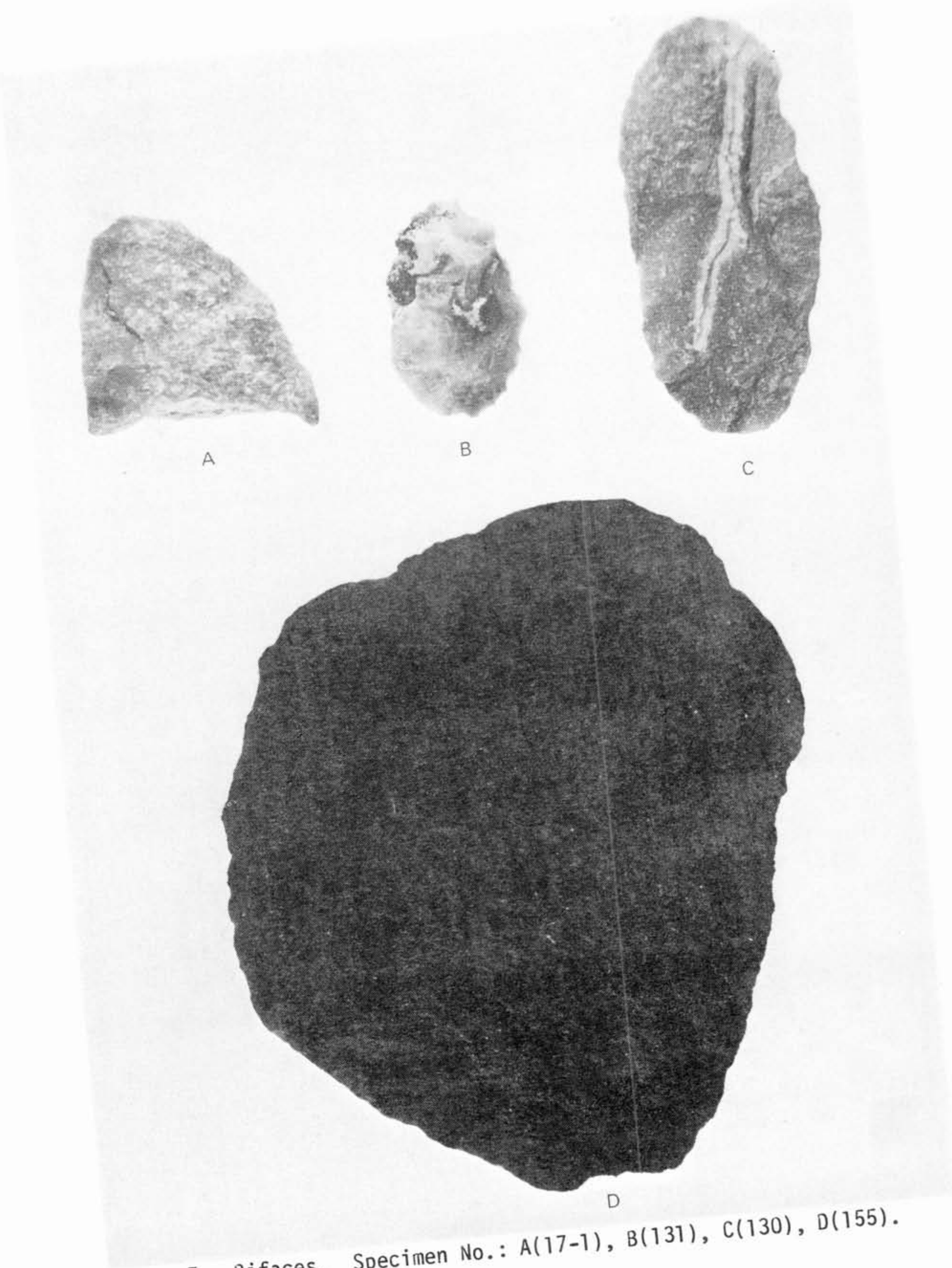

Figure 7. Bifaces. Specimen No.: A(17-1), B(131), C(130), D(155).

Figure 8. Select marginally retouched stone tools. Specimen No.: A(55-1), B(42-6), C(62-1), D(63-1).

Cores

Eleven chipped stone cores were recovered at the site (Table 4; Figure 9). These specimens are grouped into three categories, differentiated on the basis of size (i.e., cobble and pebble) and raw material category (i.e., coarse or medium to fine material). All specimens appear to reflect utilization solely for the production of flakes and display no evidence of use for chopping or cutting. All but one of the cores is made on locally available material. One pebble sized specimen is made on what appears to be Banff Chert, probably derived from the mountains or foothills of south-central Alberta.

Debitage

A total of 793 pieces of debitage, comprising 84% of the total assemblage, was recovered (Table 4). The bulk of the sample was recovered in association with two features, Stone Circles 3 and 9, and is made of locally available medium to fine grained materials.

Heat Fractured Stone

Heat fractured stone, or fire cracked rock (FCR) was apparently produced as a by-product of stone boiling and is presumed to reflect one aspect of food processing and/or preparation. Twenty-three pieces of heat fractured stone were recovered, representing 2.4% of the total assemblage (Table 4). Eighteen of the 23 pieces were recovered from Unit 40N-6W, situated within and adjoining Stone Circle 9.

Pigment

During excavation of Unit 6N-14W, which straddles a segment of the wall of the medicine wheel, small traces of a faint red material were found between the innermost rocks of the stone circle wall. No samples of adequate size for collection were obtained. The material may not be cultural in origin, or it may represent the remains of a pigment used aboriginally. This material is not included in Tables 1 and 4.

Wooden Items

During excavation of Unit 8N-12W, situated within the ring of the medicine wheel, the top of a partially decomposed wooden post was

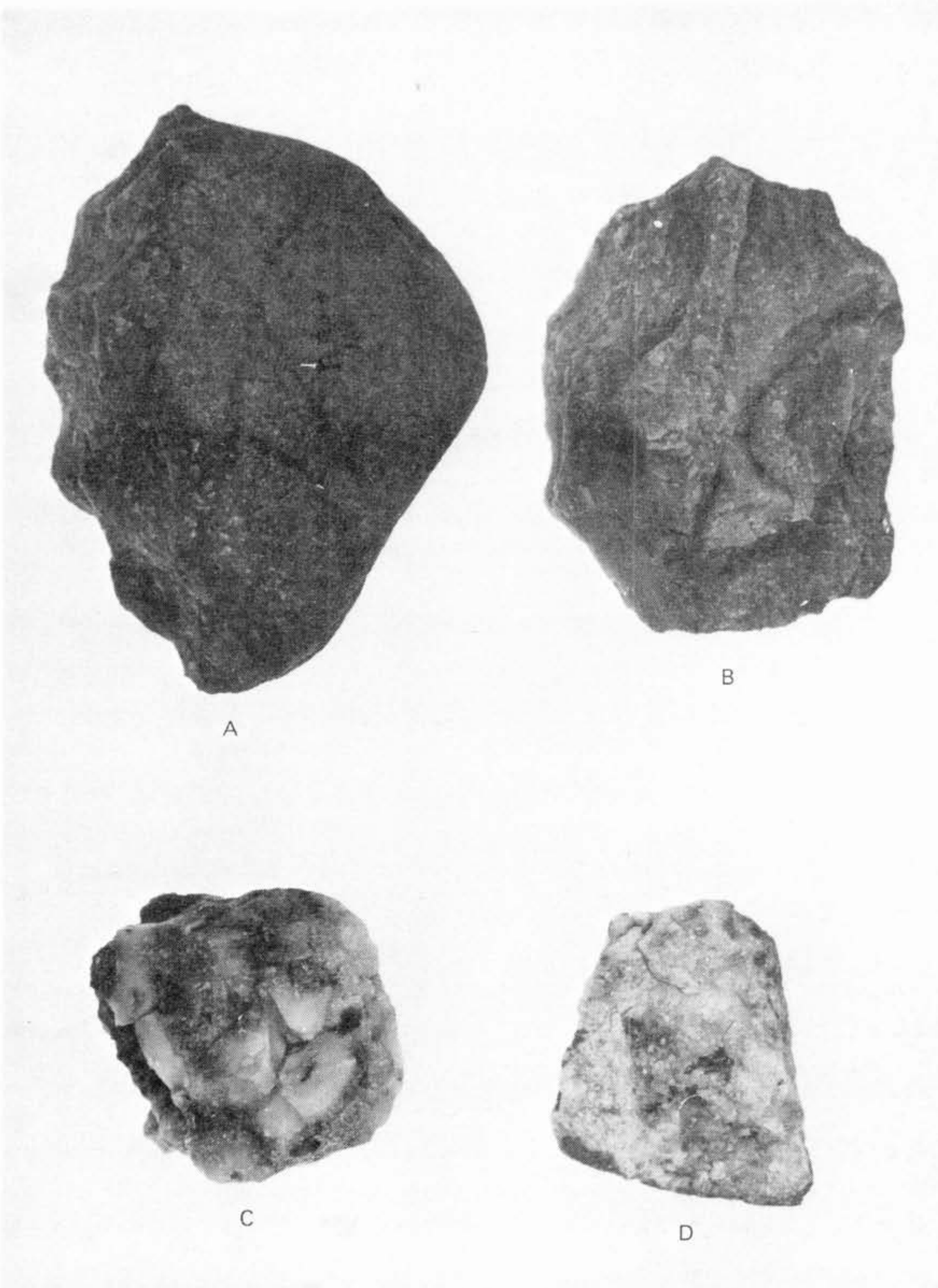

Figure 9. Select cores (3/4 actual size), Specimen No.: A(161), B(177), C(171), D(147).

encountered (Figure 10) in the northwest portion of the southeast quadrant at a depth of 23 cm B.S. Originally, the post was apparently some 5 cm in diameter with intact portions of its outer surface covered by a light turquoise blue pigment. The post had apparently been driven downward into the ground at a pronounced angle, resulting in a top to bottom orientation of NE-SW. The base of the post extended to a depth of 36 cm B.S., for an overall length of approximately 13 cm. The last few centimetres of the bottom end had clearly been sharpened to a point by an axe or an axe-like implement.

Portions of the post and attached pigment were sent to the Canadian Conservation Institute for analysis; the following verbal report was given:

> The wood is "white Oak". The species is impossible to determine because all white oaks are so similar in cellular anatomy. There are no white oaks endemic to that region so it must be an import of an artifact or the wood itself.
>
> The pigment is a dye-like pigment, which is an organic

Figure 10. Unit 8N-12W at 31 cm B.S. Pointed post <u>in situ</u>, looking N.W.

> pigment bound to a base. The base has been identified by X-ray diffraction as borium sulfate... (Mary-Lou E. Florian, Conservator, Canadian Conservation Institute, personal communication August 17, 1976).

The remaining fragments of the post were submitted for radiocarbon analysis and yielded an age of 450 ± 160 B.P. (Beta-8948) or a MASCA corrected date of A.D. 1430 ± 160.

A second piece of badly decomposed wood material about 2 cm in diameter, and of possible cultural origin, was found in Unit 6N-14W. This unit straddles a segment of the medicine wheel's ring wall. The wood was horizontally situated in the southwest portion of the northwest quadrant of the square, among and beneath stones comprising the ring wall. The item extended from 25 cm B.S. to a basal depth of 36 cm below surface. It was not possible to determine if this decomposed wood stain represents a wooden stake or a decomposed root. However, its association with the ring wall and proximity to the wooden post in Unit 8N-12W suggest it is of cultural origin. During excavation of a small pit to cross-section this wood stain, an isolated flake was encountered at 36 cm B.S., apparently in a disturbed context.

DISCUSSION AND INTERPRETATIONS

CULTURAL AND TEMPORAL ASSOCIATION

As noted previously, structural characteristics of the spatially associated medicine wheel, stone circles and cairns suggest that the features are not all contemporaneous, but represent an unknown number of temporally separate events.

Typological comparison of the four projectile points recovered, as well as the single radiocarbon date from the wooden post in the medicine wheel, suggest occupation of the site during the post-Avonlea Late Prehistoric period, dating in this region from ca. 1300 - 800 B.P. to the historic period. A strong case can be made on the basis of ethnographic data, presented below, for the contemporaneity and association of the medicine wheel with the human skeletal remains, pigment, and wooden items found spatially associated. As such, the MASCA corrected date of A.D. 1430 ± 160 probably relates to construction and use of that feature.

GENERAL SITE ACTIVITIES

The tipi rings and associated cultural material from the Ellis site are consistent with other stone circle sites in the region (Brumley n.d.). They probably reflect a series of short term occupations by small aboriginal groups engaged in bison hunting. The cultural assemblage suggests an emphasis on food processing, tool manufacture and tool rejuvenation. Meat processing is probably much more significant than indicated by the small quantity of faunal remains recovered. Research in the region (Brumley 1983) suggests that exposed prairie locales such as the Ellis site are generally unfavorable for bone preservation. The lack of woody fuel and the site's exposed location suggest that the site was occupied during the temperate period of the year - probably anytime from mid-spring to late summer or early fall.

The primary feature of interest at the Ellis site is the medicine wheel and associated cultural materials. An examination of relevant archaeological and ethnographic references indicates that this material almost certainly represents a burial lodge as recorded for the historic Blackfoot and other Plains groups. Thus, prior to interpreting the Ellis medicine wheel, it is appropriate to first review a number of archaeological, ethnological and historic references relating to: 1) medicine wheels in general; 2) medicine wheels similar to that at the Ellis site; and, 3) death lodge burials.

MEDICINE WHEELS IN THE PLAINS

The following discussion is from Brumley (1985).

The term medicine wheel has been used since late in the 19th Century to describe a wide variety of aboriginal surface stone structures found on the Northern Plains. Because of their form, they are believed to have served a ceremonial, non-utilitarian function. An examination of the anthropological and archaeological literature suggests that the term was first employed in reference to the Bighorn Medicine Wheel, located atop Medicine Mountain near Sheridan, Wyoming (Simms 1903; Grinnell 1922). This structure consists of:

> ...large stones and slabs forming an irregular circle seventy-five to eighty feet in diameter, with a two-and-one-half-foot gap on the east. At the center was a smaller circle of piled slabs, twelve feet in outside diameter and three feet high, from which twenty-seven or twenty-eight lines of closely set stones radiated spoke-fashion to the outer ring. Within the larger circle and adjoining it on the west side, Grinnell recognized a stone-walled U-shaped structure nine feet long by five feet wide, opening toward the center with which its sides were connected by two spokes. Four or more low, oval or circular constructions, with walls fifteen to eighteen inches high, were spaced irregularly around the perimeter and in contact with it. About twelve feet southwest of the wheel, joined to it by an extension of one of the spokes, was a closed oval structure, nearly long enough for a man to lie down in. The easternmost structure was a covered squarish or boxlike affair which could be entered by crawling through a low opening on its east side (Wedel 1961:268).

As archaeological research advanced on the Northern Plains, other structures, characterized by a variety of stone circle, spoke and cairn configurations, were encountered to which the only vaguely similar documented structure was the Bighorn Medicine Wheel. As a result, the term medicine wheel became a generic category encompassing a broad variety of structures throughout the Northern Plains.

The term medicine wheel is fine as a convenient label for a diverse class of cultural remains which share a few similar attributes of form, and which possibly all reflect non-utilitarian roles. A review of the literature on medicine wheels, however, indicates that many researchers have attempted to compare and relate these various diverse structures simply because they fall into this general class of medicine wheel. This is like discussing aspirin and penicillin together simply because they are both drugs. The result has been to create an extremely muddled picture of just what medicine wheels are and what we do and do not know about them.

Various researchers have presented definitions for the term medicine wheel which were intended to differentiate them from the wide variety of other surface stone features, such as effigies, tipi rings, stone cairns and stone alignments, present on the Plains.

> A medicine wheel may be defined for our purpose as a cairn or circle of stone (occasionally concentric circles) from the center of which radiate a series of rows of other stones. Lithic arrangements of this sort are of infrequent occurrence in the Plains area of Montana and Alberta immediately east of the Rocky Mountains (Kehoe 1954:133).

> Medicine wheels...consist of a central circle or cairn from which lines of stones radiate outward, sometimes to an enclosing circle (Wedel 1961:266).

> Typically, medicine wheels are circles of stones from which several spokes of stones radiate.... The stone circles are generally larger than tipi rings but seldom exceed 30 feet in diameter. Near the centre, there may be a small circle, possibly representing a fireplace. The length of the spokes is usually approximately the same as the diameter of the stone circle. Medicine wheels of historic times characteristically have four spokes; older prehistoric examples often have five, sometimes more (Forbis 1970:27).

> The term "medicine wheel" has been used broadly in the literature to refer to virtually any circle of rock (exclusive of tipi rings) with or without associated cairns and spokes, and has occasionally been used to designate spokes lacking circles or cairns. For the purpose of this thesis, the vast array of isolated effigies, stylized rock alignments, small isolated cairns and small Blackfoot mortuary tipi rings (Kehoe 1954) must be excluded from the concept, even though some may in some way be related to the larger, more elaborate features.
> Included in the term "medicine wheel" are various combinations of large circles or concentric circles of stone, large cairns and lines of rock (spokes) of various and irregular lengths and number. Medicine wheels, then, may consist of circles and/or spokes, either or both of which are in combination with a cairn. Such features are usually located in prominent topographic positions, but they may be found in a variety of locales (Calder 1977:200).

The problem with these definitions is that each will exclude a number of features which the majority of researchers would "plug" into the generic medicine wheel category. A review of the data available on medicine wheels suggests using the following characteristics to formulate a definition:

1. Medicine wheels are largely constructed of unmodified natural stone, with the possibility of some earth intentionally incorporated in the construction of prominent central cairns.

2. All medicine wheels consist of a combination of at least two of the following three primary components:
   a) a prominent, centrally located stone cairn of varying size;
   b) usually one, but sometimes two concentric stone rings of generally circular shape; and
   c) multiple (two or more) stone lines radiating outward from a central origin point, central cairn, or margins of stone ring.
3. A generalized and radially symmetrical arrangement of the above primary components.

The majority of medicine wheels have, in addition, a number of stone structures referred to here as ancillary features, at least spatially associated or incorporated with them. These would include simple stone circles such as hearths and tipi rings, anthropomorphic and zoomorphic figures, and secondary cairns. A search of the published and unpublished literature indicates that all structures which the majority of reasearchers would consider "medicine wheels" are accommodated by this definition. Fifty-nine such structures are known to be present on the Northern Plains (Figure 11). Several additional structures, referred to by others as medicine wheels, are not included here because inadequate information is available for proper identification, and/or the information available suggests that the structures would not be considered as medicine wheels by most researchers.

An examination of the 59 structures considered here to represent medicine wheels indicates that they reflect a broad diversity of form. However, based on the criteria used here, many of the individual features composing those structures can be considered ancillary to a number of primary, basic forms which repeat themselves from site to site. I have attempted to "pull out" these basic forms and use them as a basis for typologically ordering the structures into eight defined subgroups (Figure 12). It remains to be seen whether further research will indicate that all, or even some, of the subgroups defined here are culturally significant categories, or whether they will require further subdivision. However, these subgroups will hopefully provide a logical starting point to begin a meaningful examination of the diversity exhibited by medicine wheels.

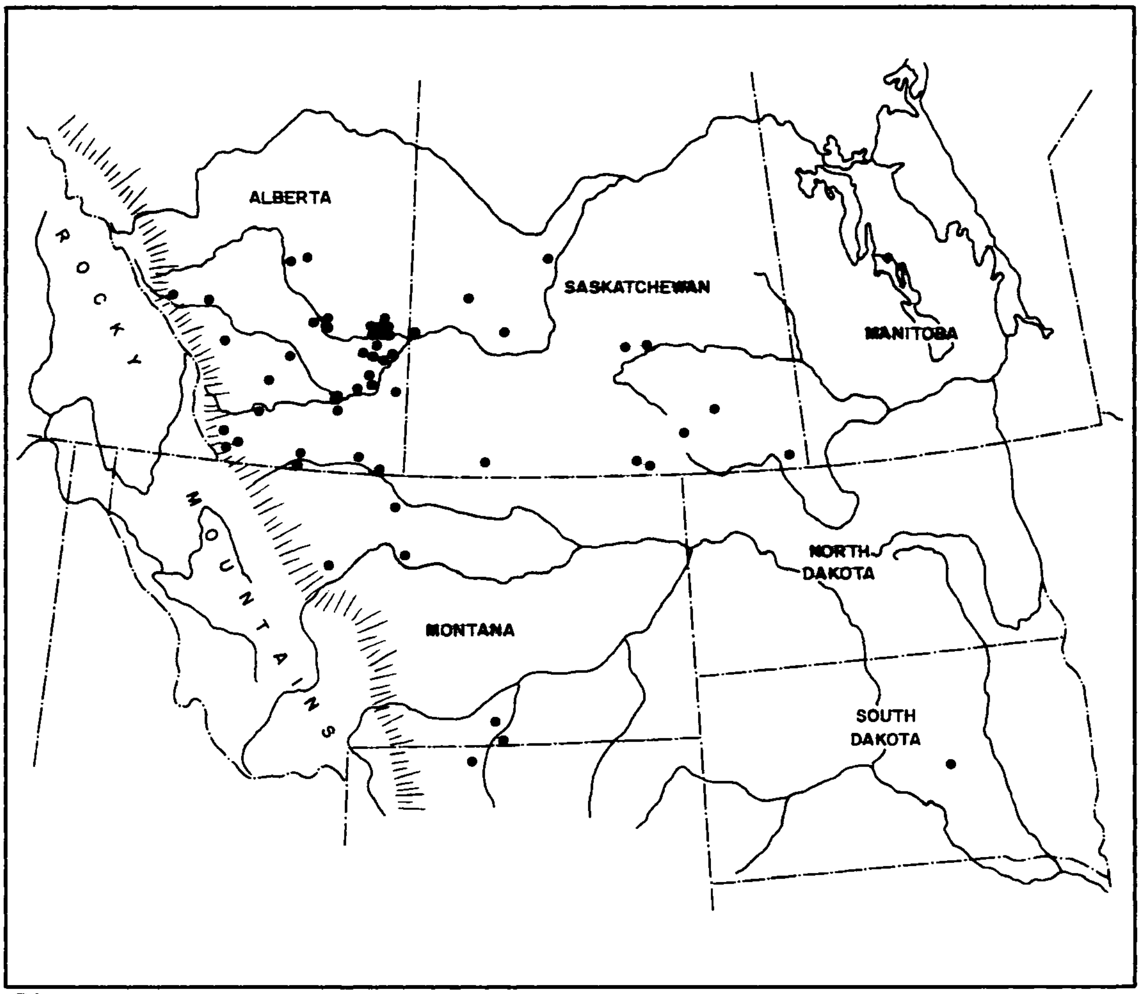

Figure 11. Distribution of medicine wheel sites in the Northern Plains.

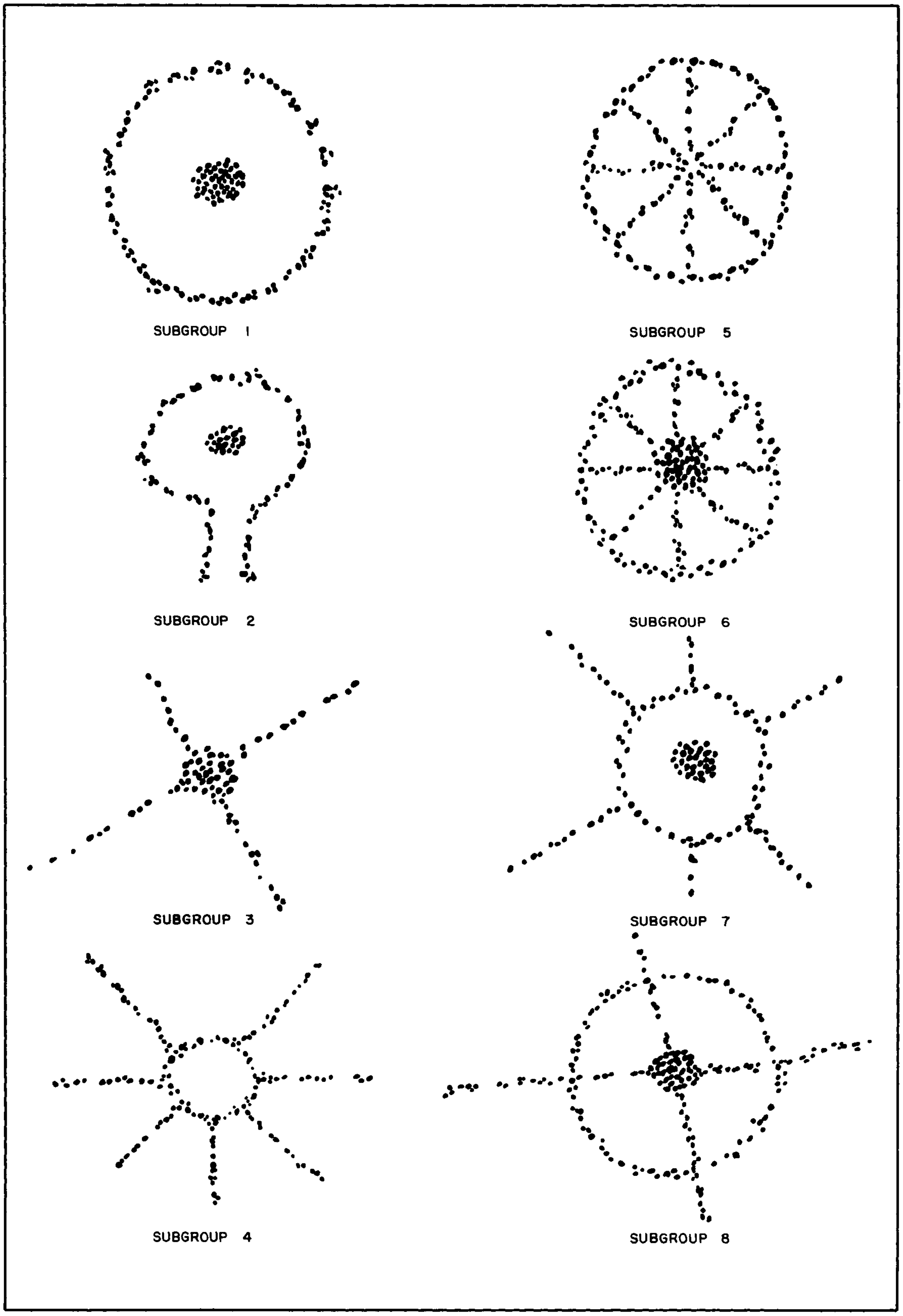

Figure 12. Defined medicine wheel subgroups (from Brumley 1985).

It must be remembered that all medicine wheels are composite structures, each consisting of two or more components. To date, the limited excavation conducted at medicine wheel sites suggests that many are accretional in nature, that is, constructed over a long period of time with various components "added on" through time. Since limited excavation data are available for most sites, the final configuration of these structures is used to typologically group them.

The eight subgroups (Figure 12) suggested here to divide the generic category of medicine wheels are:

Subgroup 1: Features characterized by a prominent stone cairn which is surrounded by a stone ring.

Subgroup 2: Features characterized by a central stone cairn which is surrounded by a stone ring. Extending outward from the ring are two parallel or diverging stone lines which form a passageway oriented towards the center of the structure. The stone lines usually terminate at the ring wall, but may rarely extend a short distance within it.

Subgroup 3: Features characterized by a prominent central cairn from which two or more stone lines extend in various directions.

Subgroup 4: A stone ring which has two or more stone lines extending outward from the margins.

Subgroup 5: A stone ring which is dissected into four or more segments by two or more interior stone lines. No prominent central stone cairn is present.

Subgroup 6: A prominent central stone cairn which is surrounded by a stone ring. Two or more interior stone lines connect the stone ring to the cairn.

Subgroup 7: Features characterized by a prominent central stone cairn which is surrounded by a stone ring. Two or more stone lines extend outward from the margins of the stone ring.

Subgroup 8: Features characterized by a prominent central stone cairn which is surrounded by a stone ring. Two or more stone lines extend outward from the cairn and pass through the ring wall before terminating.

Subgroup 4 Medicine Wheels and Blackfoot Memorials

The Ellis medicine wheel falls into the Subgroup 4 category. Subgroup 4 structures are characterized by a stone ring from the margins of which two or more stone lines extend outward. Seventeen of the 59 medicine wheels are considered Subgroup 4 structures (Tables 5 and 6; Figures 12,13). One site, the Grassy Knoll structure, is very poorly reported and recorded. It is tentatively placed in the Subgroup 4 category, based on the limited data available.

Central stone rings for Subgroup 4 structures range from 1 to 9 m in diameter. The 1 m diameter reported for the Fort Smith medicine wheel located in southern Montana, appears anomalously small in relation to other structures. It is also the only structure whose diameter is smaller than the normal range of tipi rings (cf. Roll 1978; Brumley et al. 1981). The Wilson Russel wheel is characterized by an extremely thick ring wall some 1.25 - 1.75 m in width.

The number of spokes for individual structures ranges from 3 to 18, and spoke length ranges between 1 and 120 m. Ancillary features present at several sites include one or, rarely, two smaller interior stone circles or hearth rings. Several of the structures exhibit bifurcating spokes and spokes terminating in small stone cairns.

Thirteen of the 17 structures are concentrated within the Plains of southern Alberta (Figure 13). The remaining four structures are located in central and southern Montana (n=3) and south-central Saskatchewan (n=1). Four of the 17 structures (Eagle Child, Steel, Wolf Child, and Many Spotted Horses) are historic structures for which Dempsey (1956) has provided detailed information. In fact, Subgroup 4 medicine wheels are the only subgroup for which we have reliable and detailed information regarding their construction and intended use. Working among the Blackfoot of northern Montana and southern Alberta, Kehoe (1954) and Dempsey (1956) interviewed several informants familiar with the structures. Adam White Man, an aged South Peigan, told Kehoe:

> I heard that when they buried a real chief, one that the people loved, they would pile rocks around the edge of his lodge and then place rows of rocks out from his burial tipi. The rock lines show that everybody went there to get something to eat. He is inviting someone everyday. People went there to live off him. Not every chief is treated like that - just the one loved by everybody. I have never seen this type of stone work but I heard of a chief in Canada who was buried like that (Kehoe 1954:33).

> There was a circle of stones used by the Bloods to mark the place where great chiefs or medicine men died. They were bigger than the

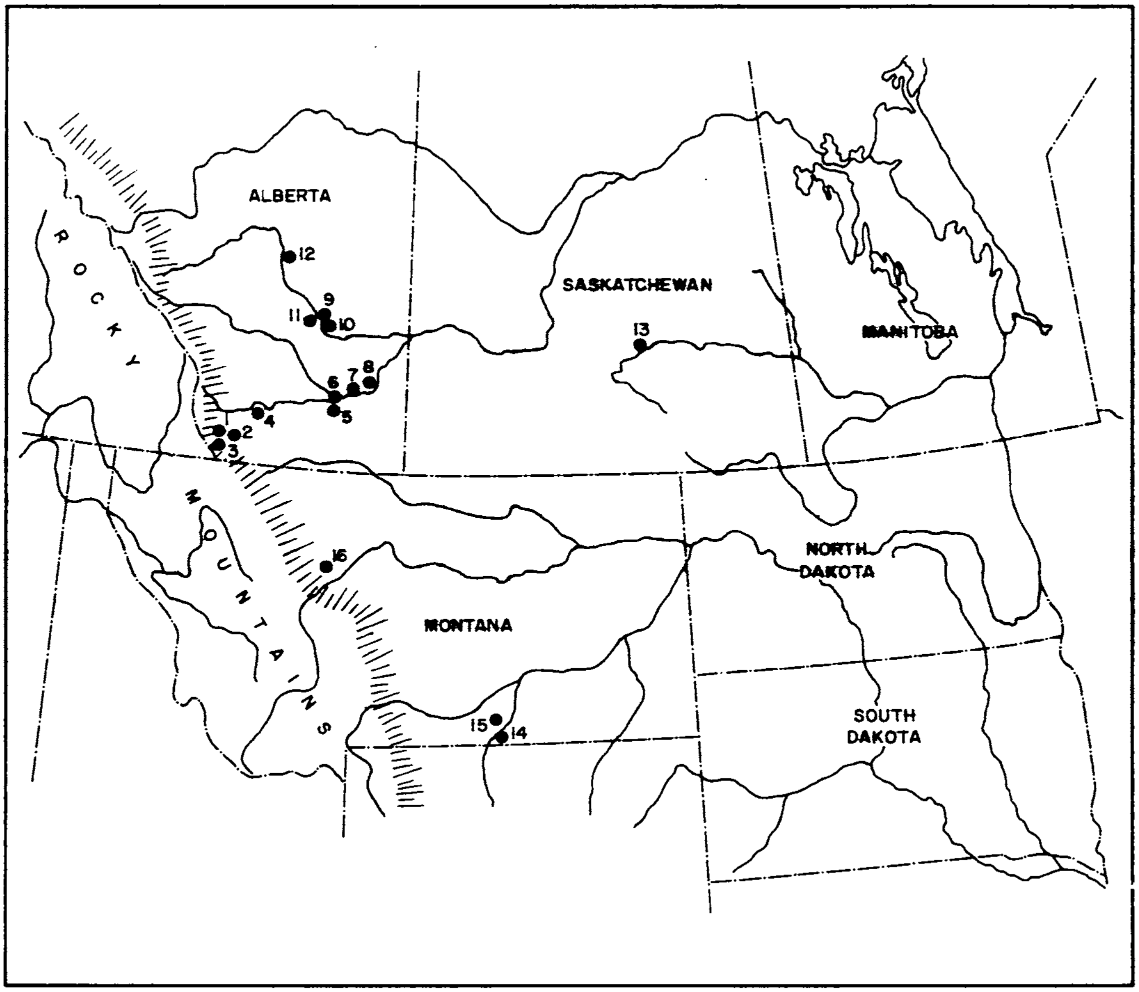

Figure 13. Distribution of subgroup 4 medicine wheels (see table 5 for number references).

Table 5. Summary of subgroup 4 medicine wheels (from Brumley 1985).

SITE NUMBER	SITE NAME	MAP REFERENCE	PHYSIOGRAPHIC SETTING	TOPOGRAPHIC CLASS	RESEARCH STATUS	SITE CONDITION	PRIMARY REFERENCES
None	Eagle Child	Fig.13-1	Ind	Ind	NMA,Unex	Dist	Dempsey (1956); Kehoe (1972); Kehoe & Kehoe (1979)
None	Steel	Fig.13-2	Ind	Ind	SMA,Unex	Und	ASA site form; Dempsey (1956); Kehoe (1972)
DiPi-2	Wolf Child	Fig.13-3	1.3	5	DMA,Unex	Dist	ASA site form; Walde (1976)
DkPf-1	Many Spotted Horses	Fig.13-4	8.2	1	DMA,Unex	Und	Dempsey (1956); Lethbridge Centre (1971); Kehoe & Kehoe (1979)
DlOv-2	Grassy Lake	Fig.13-5	1.3	8	DMA,Unex	Und	Forbis (1960); Wormington & Forbis (1965); Kehoe (1972); Walde (1976); Lethbridge Centre (1976)
DlOw-6	Murphy	Fig.13-6	1.3	8	NMA,Unex	Dist	ASA site form; Quigg (1983)
EaOs-2	Suffield	Fig.13-7	1.3	8	DMA,Unex	Dist	ASA site form; Walde (1976)
EcOp-4	Ellis	Fig.13-8	1.3	8	DMA,Pub	Und	This report
EgOx-1	Suitor #1	Fig.13-9	1.3	8	DMA,Unex	Dist	ASA site form; Lethbridge Centre (1976)
EgOx-1	Suitor #2	Fig.13-9	1.3	8	DMA,Unex	Dist	ASA site form; Lethbridge Centre (1976)
EgOx-29	Suitor #3	Fig.13-10	1.3	8	DMA,Unex	Dist	ASA site form; Lethbridge Centre (1976)

Table 5 (continued)

SITE NUMBER	SITE NAME	MAP REFERENCE	PHYSIOGRAPHIC SETTING	TOPOGRAPHIC CLASS	RESEARCH STATUS	SITE CONDITION	PRIMARY REFERENCES
EgOx-46	Hutton	Fig.13-11	1.3	8	DMA,Unex	Dist	ASA site form
EkPe-3	Ziegenbein	Fig.13-12	2.3	2	DMA,Unex	Dist	ASA site form; Kehoe (1972); Walde (1976)
EeNe-14	Wilson Russel	Fig.13-13	1.3	5	DMA,Unex	Dist	SMNH site form
24BH220	Fort Smith	Fig.13-14	Ind	Ind	DMA,Unex	Dist	Grinnell (1922); Conner (1965, 1967, 1969); Kehoe (1972); Eddy (1976); Brown (1963)
24BH797	Grassy Knoll	Fig.13-15	Ind	Ind	SMA,Unex	Und	Univ. of Montana Archaeological Site Files
24TT67	Sun River	Fig.13-16	Ind	Ind	DMA,Unex	Dist	Newcomb (1967); Kehoe & Kehoe (1979)

ABBREVIATIONS

Physiographic Setting

1.3 located on open prairie surface within 0.5 km of edge of major river valley
2.3 located on open prairie surface atop crest of hill or ridge & greater than 0.5 km from major escarpment edge
8.2 located in central portion of major river valley bottom
Ind Indeterminate

Topographic Class: Indicates the number of separate 25 foot contour lines located within, and in a 0.5 km radius of, the site. Separate but equal elevation contour lines are each counted separately.

Research Status and Site Condition

NMA - no map available of medicine wheel
SMA - sketch map only available for medicine wheel
DMA - detailed map available of medicine wheel
Unex - unexcavated
Exun - excavated - data unpublished
ExPub - excavated - data published
Und - medicine wheel undisturbed
Dist - medicine wheel disturbed to varying extent
Dtd - medicine wheel destroyed

Table 6. Select metric and non-metric data for subgroup 4 medicine wheels (see Brumley 1985).

SITE NUMBER	SITE NAME	STONE RING DIA (m)	NO. OF SPOKES	RANGE OF SPOKE LENGTH (m)	ANCILLARY FEATURES INSIDE STONE RING	ANCILLARY FEATURES OUTSIDE STONE RING
None	Eagle Child	4	4	1-2	Ind	Ind
None	Steel	9	4	Ind	double hearth rings, doorway gap	none
DiPi-2	Wolf Child	6	7	3-7	single hearth ring	spokes formed of small stone piles, depressions (n=20) in vicinity
DkPf-1	Many Spotted Horses	6	4	5-6	double hearth rings, doorway gap	small cairns at terminus of spokes (n=4)
D1Ou-2	Grassy Lake	8	6 or 7	30-97	scattered stones, possibly of cultural origin	small cairn at terminus of spoke (n=1), large cairn to east
D1Ow-6	Murphy	5	4	50-120	single hearth ring	stone circles (n=3), small cairns at spoke terminus (n=4)
EaOs-2	Suffield	4	5	2-6	depression (n=1)	small cairns at terminus of spokes (n=5)
EcOp-4	Ellis	5	10 or 11	14-19	none	stone circles (n=13), small cairn (n=2), bifurcating spokes (n=3)
EgOx-1	Suitor #1	6	8	14-26	single hearth ring	stone circles (n=?), small cairn at spoke terminus (n=8), bifurcating spokes (n=2)

Table 6 (continued)

SITE NUMBER	SITE NAME	STONE RING DIA (m)	NO. OF SPOKES	RANGE OF SPOKE LENGTH (m)	ANCILLARY FEATURES	
					INSIDE STONE RING	OUTSIDE STONE RING
EgOx-1	Suitor #2	4	18	23-33	none	stone circles (n=?) bifurcating spokes (n=2)
EgOx-29	Suitor #3	7	7	19-41	none	stone circles (n=?), bifurcating spokes (n=2), terminal stone cairns (n=5), cairn (n=1)
EgOx-46	Hutton	6	17	2-17	none	terminal stone cairns (n=14)
EkPe-3	Ziegenbein	5	5	5-9	single hearth ring	depression (n=1), spokes formed of small stone clusters
EeNe-14	Wilson Russel	6-7	3	28-30	ring wall heavy band of stone 1.25-1.75 m wide	terminal stone cairns (n=3), cairn (n=1), stone circles (n=?)
24BH220	Fort Smith	1	6	13-19	none	Ind
24BH797	Grassy Knoll	Ind	4 or 5	Ind	none	terminal stone cairns (n=3 or 4)
24TT67	Sun River	7	10	7-13	single hearth ring	terminal stone cairns (n=3), stone circles (n=17)

> tipi rings and had five lines /it had been some years since he had seen one, but was fairly certain there were five/ leading towards the centre like a wheel. In the middle a fireplace was built (Harry Mills in Kehoe 1954:33).

Dempsey (1956) obtained considerably more information regarding this type of structure and documented two that had been:

> ...constructed within this century, and a summer's field work has revealed the date and ownership of the rings, the reason for their existence and has enabled interviews to be made with individuals who actually participated in or witnessed their creation (Dempsey 1956:177).

Dempsey goes on to note that:

> The Blackfoot "medicine wheel" consists of a circle of stones, or "tipi ring" with concentric lines of stones of varying lengths extending away from it in the four cardinal directions...The Blackfoot term for the "medicine wheel" is atsot-akech'. The literal translation is: "from all sides" (atsot), "a small marker of stones" (akeeh') "for posterity" (tuksin). It will be noted that the word merely designates the radiating lines and makes no reference to the tipi ring itself. This conforms with Blackfoot tradition that the lines were merely appendages to existing tipi rings, rather than the whole marker being constructed at one time.
>
> According to informants, "medicine wheels" were used to mark the residence or grave of a warrior chief. There were apparently three such allied uses: for a tipi in which a warrior chief died and was buried; one in which he had been residing at the time of his death but which was not his burial place; and one which was used during his lifetime, but not related to his death. Each may be a variation, or they may reveal a change in the use of these markers over the years (Dempsey 1956:177).

In terms of constructing a medicine wheel around the lodge of a living warrior chief, Dempsey notes:

> If this at one period was the common Blackfoot use of the "medicine wheel", it evidently underwent a change in the late nomadic period, for most modern informants consider these to be solely memorials or death markers (Dempsey 1956:178).
>
> The earliest reference to a Blackfoot "medicine wheel" known to informants is credited to Bull Back Fat, a Blood chief who died in 1842. But according to Jack Low Horn, a reliable Blood informant who supplied this data, the marker did not originate with this chief but "was started in the days when our people used dogs instead of horses" (Dempsey 1956:177).

Both Kehoe (1954) and Dempsey (1956) document references to construction of several such medicine wheels as memorials to specific individuals by the Blackfoot in recent historic times. In addition, Dempsey (1956) provides detailed descriptions of the events surrounding construction of the Eagle Child and Steel medicine wheels in 1931 and 1940, respectively, apparently the last such structures to be built.

Both Kehoe and Dempsey note some disagreement on the part of their informants as to whether the medicine wheel marked the spot where the warrior chief was buried.

> One Gun stated that "when a chief died, he was left in his tipi. After it had fallen down and rotted, anyone travelling past would know that a chief died there because of the radiating lines." Alternately, Rides at the Door, a Blood informant, said that "any stranger passing such a place would recognize that a chief had died there, but the body would not be left there."
>
> It is possible that these two distinct lines of thought are the result of Blackfoot mortuary customs. At times, particularly during plagues or when moving camp, a dead person was left in his sewn-up lodge. On other occasions, he was buried in the trees or on a scaffolding on a high hill. This variation possibly affected the use of the "medicine wheel", with the radiating lines being left at the death lodge if it was used, or at the tipi ring if the chief was buried elsewhere (Dempsey 1956:179).

The historic medicine wheels documented by Kehoe (1954, 1972) and Dempsey (1956) are characterized by either four or five radiating stone lines. Informants provided various responses as to what these stone lines denoted. Laurie Plume, daughter of Steel, told Dempsey that the lines on her father's medicine wheel, "...signify that he was a brave man, a leader who had been to war" (Dempsey 1956:181). Dempsey goes on to note that:

> There was one point about "medicine wheels" upon which all informants were in unanimous agreement: the radiating lines had no religious or symbolical significance. The number "four" is a sacred one among the Blackfoot and often occurs in religious ceremonies and traditional tales. But all agreed that no such symbolism applied here, or if it ever had, all knowledge of it is forgotten. The reply of informant Rides at the Door is typical: "There is no symbolical meaning to the four lines; they just denote his status as a warrior chief." (Dempsey 1956:181).

On the other hand, Jim Weasel Tail told Kehoe:

> ...the lines of rock show the different directions in which they go on the warpath - they were the dead chief's war deeds. If they kill someone, they pile rocks at the end of the rock line. If there is no rock pile present, then they just go to the enemy. Short lines are short trips (Kehoe 1972:184).

As the previously quoted reference by Adam White Man stated, "... the rock lines show that everybody went there to get something to eat. He is inviting someone everyday" (Kehoe 1954:133).

In addition to the evidence presented by Kehoe and Dempsey, Ewers also mentions such structures constructed by the Blackfoot:

> Upon the death of an important leader the sacrifice of horses was coupled with an elaborate ceremony of burial in a death lodge. Among the great chiefs honored with death-lodge burial were Lame Bull, first signer of the 1855 treaty with the United States Government (who died in 1858) and Many Horses, the wealthiest Piegan (who died in 1866). Lesser chiefs and prominent warriors received this honorary burial on a less grandiose scale.
>
> When one of these leaders dies his lodge was arranged on the inside just as it had been when he was alive, with beds and backrests in place and his favorite equipment displayed as it had been when he used to entertain prominent guests in his lodge. His body was dressed in his finest clothing and laid on a bed in the lodge, or preferably on a pole platform erected in the center of the lodge, built high enough to prevent predatory animals from molesting the body. The body was laid upon the platform with feet facing the doorway (east). Then the deceased's close relatives prepared the horses to be killed, decorating them with elaborate and costly riding gear. The dead man's favorite horse was painted with pictographs representing the owner's coups. That horse's tail was braided and tied in a ball, and a feather pendant was tied in it. His mane was braided and feathers were tied in it also.
>
> Everyone in camp attended the funeral. The horses to be sacrificed were led to the door of the death lodge. Each horse in turn was shot with a gun, pressed against its head and fired by a relative of the deceased. After all the horses were killed the riding gear of the dead man's favorite horse sometimes was stripped off and placed inside the death lodge. At other times the people of the camp were privileged to strip the dead horses of their gear for their own use. Green Grass Bull explained the Blackfoot belief that the spirit of the horse joined that of its owner, wearing the gear it bore at the time it was killed. After the horse's spirit had departed the actual trappings had no more value to the dead Indian than did the carcass of the sacrificed horse itself.

> After the horses were killed in front of the lodge, rocks were piled in lines extending outward from the death lodge in the four cardinal directions. Each pile of rocks represented one of the departed leader's coups. Usually these death lodges were erected in out of the way localities at some distance from camp. Occasionally the lodges were looted by passing enemy war parties. But none of the valuable articles in the death lodge were disturbed by members of his camp for fear the dead man's spirit would haunt them. The bodies of the dead horses were left to decay where they fell (Ewers 1955:286-287).

Death Lodge Burials

The burial practices documented by Kehoe (1954, 1972), Dempsey (1956) and Ewers (1955) are but a variation of the custom of lodge burials. Lodge burials appear to have been most commonly practiced by the Blackfoot. However, the custom was apparently practiced by a number of other Plains groups as well, including the Gros Ventres or Atsina (Cooper 1957:26,458-459), the Assiniboine (Denig 1930:573) and the Sioux (Curtis in Zoll 1975:27).

Ethnographic accounts provide considerable detail on the nature of these practices. For the Blackfoot, Grinnell noted:

> His lodge would be moved some little distance from the camp, and set up in a patch of brush. It would be carefully pegged down all around, and stones piled on the edges to make it additionally firm. For still greater security a rope fastened to the lodge poles, where they come together at the smoke hole, came down, and was securely tied to a peg in the ground in the centre of the lodge, where the fireplace would ordinarily be. Then the beds were made up all around the lodge, and on one of them was placed the corpse, lying as if asleep. The man's weapons, pipe, war clothing, and medicine were placed near him, and the door then closed. No one ever again entered such a lodge. Outside the lodge, a number of his horses, often 20 or more, were killed, so that he might have plenty to ride on his journey to the Sand Hills, and to use after arriving there. If a man had a favorite horse, he might order it to be killed at his grave, and his order was always carried out. In ancient times, it is said, dogs were killed at the grave (Grinnell 1961:97).

Uhlenbeck noted for the Peigan:

> The dead were taken home. They /the/ dead were laid across the horses. They put the rich ones inside of their own lodges. In the forests their lodges were put up. There they were put inside, when they were killed. Their horses /the horses of the dead/ were killed /near them, that they might

accompany their masters/, and all the things that belonged to them were put in there /in the lodges/. All their horses, that were not killed, had their tails and manes cut. Their mothers had their little fingers chopped off. And their wives had also their little fingers cut. Their sisters had also their little fingers cut. They /the women/ would cut their legs /just skin deep/. They would cut off their hair. The widow suffered most /of all/. The father of the dead married man struck himself. He struck himself with arrows. That he might suffer more, that man would cut also his upper legs. He had his hair all cut off. The companions of the dead one all suffered in the same way....

Long ago old men and old women doctored the sick persons...If the sick person died, he was wrapped into buffalo-robes and cow-skins. He was put up aloft /on top of/ the mountains. When there were no mountains, he was tied to bent trees. That was the way, /that/ common people were buried. And when the chiefs and the chiefs' children got sick, they were doctored by everybody. When they died, the chiefs were dressed up /in their finest clothes/. They wore shirts of weasel-tails and human hair. Their leggings were just the same /weasel-tails and human hair/. Some of them had scarlet paint all over their faces. Some others had yellow paint all over their faces. When it was a young man, the dead person was dressed in the same way. When it was a girl, her dress was buckskin. It was with elk-teeth. There where they died, their lodge was put up; it was fixed up inside /just as if people were going to live there/. A man and a young man had willow-pillows put on each side of them /one at the head, and one at the feet/. The same way a girl was laid down. They were put in the lodge, their faces were not covered up. We said /in the case of/ those, that were laid that way,...a dead man's lodge (Uhlenbeck 1912:21, 53-54).

Of the Assiniboine, Denig observed:

Very brave and formerly renowned warriors sometimes requested not to be interred in any way, in which case they are placed inside their lodge propped up, in a sitting posture, dressed and painted, the door of the lodge is closed tight, and the outside around the lodge inclosed by a hedge of thick branch and dirt to prevent the wolves from entering, and the whole is thus left on the plains.

In the course of time the lodge rots away, the wolves enter, and the bones are scattered about or carried away by them. This is the manner in which the Chief Wah-he-muzza, or The Iron Arrow Point, ordered his obsequies to be performed, giving for his reason that he wished to remain above ground in order to see and hear his children all the time and to have the spot rendered remarkable by his being there.

The death of ordinary Indians is attended with like results, though if not warriors of note they are merely enveloped in their ordinary clothing and blankets or skins

> with their implements, but no horse is killed over their grave. When women die their favorite dogs are killed and all their tools for scraping and dressing hides, with their pillow and porcupine quills, are enveloped with them. If she be the wife of a chief or man of importance she is also wrapped in scarlet cloth, formerly in painted skins. There is as much mourning and distress observed on the death of their children, perhaps more, than when grown. On these occasions often some one of the parents destroy themselves, and all other Indians are very attentive to them for several days until the most violent grief is over. Should anyone offend the parent during this time his death would most certainly follow, as the man, being in profound sorrow, seeks something on which to wreak his revenge, and he soon after goes to war, to kill or be killed, either of which being immaterial to him in that state.
>
> The reason the implements are deposited in the grave is that they are supposed to be necessary to his being in the world of spirits. It is a very ancient custom, perhaps coeval with their existence.... Bodies are never interred in a sitting posture, though that manner is sometimes observed when deposited in the lodge above ground and the posture preserved by stakes driven in around the body with forks on the end supporting the different members and equilibrium (Denig 1930:573-574).

For the Sioux, Curtis noted, "Burial tipis were sometime used, a notable instance being the tipi of the dead in the valley of the Little Bighorn, in which, after the Custer fight, were laid side by side as if asleep, the bodies of some of the fallen Sioux" (Zoll 1975:27).

THE ELLIS SITE MEDICINE WHEEL

Site Function

The similarities between the Ellis medicine wheel and the ethnographic accounts of Blackfoot memorials to warrior chiefs, and Plains Indian death lodges, are striking and irrefutable. The analogues provided by these accounts appear to be specific rather than generalized in nature.

The central ring of the Ellis medicine wheel is simply a tipi ring which was used to secure the cover of a burial lodge. The stone spokes were attached to the central ring as a mark of respect and honor to indicate that the deceased was a renowned warrior. The painted wooden stake located just southwest of ring centre probably represents a wooden tie-down stake used to secure a rope looped around the apex of poles atop the lodge. The fact that it was painted may simply indicate that such items were well made and used repeatedly or curated until broken and, as such were decorated for adornment. The wooden stain found in the ring wall, if cultural, may represent a wooden peg used in conjunction with stones to secure the lodge cover. The body of the prominent warrior was probably laid on a bed made up at the back of the lodge opposite the doorway. Distribution of the skeletal elements tentatively suggests a head to food orientation of southwest to southeast. The flecks of pigment noted among the stones of the central ring may reflect painting the face and/or body of the corpse. Alternatively, the pigment could reflect all that remains of perishable painted items left as grave offerings.

Four lines of evidence indicate that the lodge was oriented with its doorway to the northeast. First, lodges were commonly situated with their doorway facing away from prevailing wind. Prevailing winds in the site area are from the southwest. Secondly, ethnographic accounts indicate that, for most Plains groups, the place of honor was opposite the doorway. The aforementioned accounts of death lodge burials indicate that this place of honor is where the body would most likely be placed. The majority of skeletal elements at the Ellis site were found southwest of ring centre. Thirdly, ethnographic accounts indicate that the floor plan of the Plains tipi was in fact oval to egg shaped in outline, with its long axis running through the doorway. The inside diameter long axis orientation for the Ellis wheel is NE to SW. Finally, historic statements regarding the location of interior tie-down stakes indicate that they were located in the centre of the lodge, or near the centre, offset toward the direction of prevailing winds. The painted wooden stake at the Ellis site, interpreted as such a tie-down, was located southwest of centre.

Although badly fragmented, the human skeletal elements from the medicine wheel are well preserved. This is in contrast to the few pieces of badly weathered ungulate bone material found elsewhere at the site and conflicts with the writer's suggestion that greater quantities of ungulate material were originally present at the site, but have since totally disintegrated. This differential preservation of human versus non-human skeletal material may reflect the different conditions under which these two bone samples were interred. Observation indicates that long exposure on the ground surface, with direct exposure to sunlight, is the primary factor influencing bone deterioration in the region. Recent surface bone found in low, heavily grassed, and thus shaded, swale areas is much better preserved than associated bone on immediately adjacent shortgrass prairie locales. At the Ellis site, the lodge cover would have protected the human skeletal elements from the sun for some time, even in a partially deteriorated state. Also, the partially deteriorated lodge may have formed a depositional trap for fine wind borne silt and sand grains, which would have resulted in more rapid burial of the skeletal elements.

Age and Cultural Association

The radiocarbon date on the painted wooden post fragments from the medicine wheel suggests a MASCA corrected date of A.D. 1430 $\pm$ 160 (A.D. 1270 to A.D. 1590) for the medicine wheel and burial. Attempts to relate prehistoric cultural remains to specific historic tribal groups are fraught with difficulties and potential pitfalls. Forbis (1963) has reviewed the various approaches developed to attempt such efforts and some of the problems associated with each. Although I fully appreciate Forbis' concerns, the evidence presented in this paper strongly supports the conclusion that the Ellis site, together with most other Subgroup 4 medicine wheels, was constructed by the historic and prehistoric Blackfoot. Three lines of evidence support this conclusion:

1. Death lodge burial was practiced by a number of Plains Indian groups. However, the practice appears to be most common among the Blackfoot.
2. The Blackfoot are the only group known to add stone lines onto the tipi ring of a death lodge (forming Subgroup 4 medicine wheels) as a sign of respect to honor a prominent warrior or for any other reason.
3. Fourteen of the 17 Subgroup 4 medicine wheels, including the Ellis wheel, are situated within the historic territory of the Blackfoot. Of the three structures falling outside this range, two exhibit structural differences in their central ring, indicating that they probably do not represent tipi rings. The central ring of the Fort Smith medicine wheel has a diameter of approximately 1 m. The

central ring of the Wilson Russel wheel has ring walls varying from 1.25 to 1.75 m in width. The remaining structure, the Grassy Knoll wheel, is too poorly documented to even be sure it is a medicine wheel.

GENERAL DISCUSSION

The results of investigations at the Ellis medicine wheel are relevant to a number of research questions, of which I will discuss but a few. The most obvious bears on our knowledge of medicine wheels. It is felt that the Ellis site has provided a significant link between information gathered on the historic medicine wheels documented by Kehoe and Dempsey and similar archaeological features. It has also demonstrated the utility of a recently proposed typology of medicine wheels (Brumley 1985) as a vehicle for segregation of this diverse category of cultural features into more meaningful units for examination.

If one agrees with the arguments present here, i.e., that the Ellis wheel and most Subgroup 4 structures were constructed by the historic and prehistoric Blackfoot, it follows that we may be able to employ data from their excavation as a means to further bridge the gap between the historic and prehistoric Blackfoot occupying the region. Further excavation of the Ellis wheel, or similar Subgroup 4 wheels which also served as burial lodges, should reveal more items of material culture referable to the Blackfoot. Hopefully, some of this material would be of diagnostic nature, such as ceramics and projectile points, and provide us with other criteria for identifying prehistoric Blackfoot occupations at other types of sites.

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I would like to dedicate this paper to the memory of Lynn Ellis, for whom the site is named. Lynn was a cowboy in the old time sense of the word, and I met him shortly after coming to southeastern Alberta. Lynn, his wife Pat and I spent many an enjoyable hour discussing the archaeology, history and ecology of the region. Lynn provided me with invaluable insights into the human and natural ecology of the region which he gained through a lifetime of working with, and learning from, the land.

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THE ROLE OF LARGE MAMMALS IN LATE PREHISTORIC HORTICULTURAL ADAPTATIONS: THE VIEW FROM SOUTHEASTERN NEW MEXICO

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INTRODUCTION

The Angus site is a late prehistoric horticultural village in the foothills of the Sacramento Mountains in southeastern New Mexico. Analysis of the faunal remains revealed an unexpected increase through time in the ratio of large to small mammals. The purpose of this paper is to explain this interesting change in hunting patterns.

We begin our investigations by examining faunal assemblages from other horticultural village sequences in southeastern New Mexico and elsewhere in the Southwest. Though details differ from case to case, general trends similar to the one noted at Angus appear to be widespread in the Southwest. We considered a variety of climatic, technological, and demographic factors, but rejected all of these as direct causes for the change in hunting patterns. We suggest instead that increased reliance on large animals is more likely a reflection of fundamental changes in the socioeconomic sphere.

To identify which socioeconomic factors are important and how they interact to affect the selection of prey species, we turned to the ethnographic literature on contemporary horticultural societies. These studies demonstrate a close relationship between hunting patterns, village permanence, and level of dependence on cultivated crops. We examined these interrelationships and identified a number of strategies available to horticulturalists to assure them of an adequate intake of protein as their villages become larger, more permanent, and more dependent on cultivated plants.

We conclude this paper by discussing the implications of these ethnographic observations for understanding the socioeconomic changes that were taking place in southeastern New Mexico and elsewhere in the Southwest.

THE ANGUS SITE

The Angus site (LA-2315) was excavated by the Museum of New Mexico as part of a recent highway salvage project. The site is a late prehistoric village located in the eastern foothills of the Sacramento Mountains at an elevation of about 7000 feet. It sits on the north side of the Rio Bonito near its confluence with Crocket Canyon, a short distance upstream from the modern village of Angus, Lincoln County, New Mexico. Spatially, the site consists of two discrete occupational loci: a southern cluster of rectangular pitrooms and a northern cluster of above-ground, slab-based jacal structures.

The chronology of Angus is still under study. Based on ceramics (predominantly Chupadero Black-on-White, El Paso Polychrome, and Three Rivers Red-on-Terracotta), architectural features, and archaeomagnetic dates, the site falls between about A.D. 1100 and A.D. 1300 (Robin Farwell, personal communication 1984). These same data also suggest that the northern above-ground structures are somewhat younger than the southern pitrooms.

The total faunal sample from the site is small (about 4600 specimens), and most of the bones come from the southern pitrooms. Details of the sample, methods of analysis, taphonomic issues, and other such basic data have been presented elsewhere (Speth and Scott 1983) and will not be repeated here. To obtain adequate sample sizes for comparison, all of the fauna from the southern pitrooms was combined into a single composite sample (Table 1); similarly, all of the material from the northern cluster of above-ground structures was combined into a second aggregate sample (Table 2). While less than ideal, these combined samples are at least large enough to permit us to look at major, community-wide changes in the use of animal resources over a two to three century span of time.

SUBSISTENCE CHANGE IN THE SOUTHWEST

The faunal remains from the northern and southern loci of the Angus site are similar in the range of taxa represented (Table 3). Both

Table 1. Faunal remains by taxa from LA-2315-South (all proveniences combined).

Taxon	NISP N	NISP %	MNI N	MNI %
Very large mammal	25	0.7	1	0.5
Large mammal	1279	34.8	3	1.5
Medium mammal	21	0.6	1	0.5
Small mammal	364	9.9	6	3.0
Large artiodactyl	36	1.0	2	1.0
Bison bison, Bison	15	0.4	2	1.0
Bos/Bison	3	0.1	1	0.5
Cervus canadensis, Elk	6	0.2	1	0.5
Odocoileus sp., Deer	365	9.9	10	5.0
Odocoileus hemionus, Mule deer	32	0.9	2	1.0
Odocoileus virginianus, White-tailed deer	7	0.2	2	1.0
Odocoileus/Ovis	70	1.9	6	3.0
Ovis canadensis, Bighorn sheep	6	0.2	1	0.5
Ovis/Capra	--	--	--	--
Antilocapra americana, Antelope	3	0.1	1	0.5
Canis latrans, Coyote	1	0.+	1	0.5
Ursus horribilis, Grizzly bear	1	0.+	1	0.5
Mephitis mephitis, Striped skunk	3	0.1	2	1.0
Urocyon cinereoargenteus, Gray fox	8	0.2	2	1.0
Lagomorpha	69	1.9	2	1.0
Lepus californicus, Black-tailed jackrabbit	142	3.9	13	6.4
Sylvilagus sp., Rabbit	453	12.3	37	18.3
Sylvilagus audubonii, Desert cottontail	24	0.7	11	5.5
Sylvilagus floridanus, Eastern cottontail	18	0.5	9	4.5
Rodentia	49	1.3	7	3.5
Ondatra zibethicus, Muskrat	3	0.1	1	0.5
Neotoma sp., Wood rat	112	3.1	28	13.9
Sciuridae (Squirrels, prairie dogs)	2	0.1	1	0.5
Spermophilus variegatus, Rock squirrel	14	0.4	2	1.0
Cynomys ludovicianus, Black-tailed prairie dog	67	1.8	7	3.5

Table 1 (continued)

Taxon	NISP N	NISP %	MNI N	MNI %
Microtus sp., Vole, meadow mouse	4	0.1	3	1.5
Thomomys bottae, Pocket gopher	41	1.1	10	5.0
Aves	268	7.3	1	0.5
Meleagris gallopavo, Turkey	104	2.8	4	2.0
Accipitridae (Hawks, eagles)	7	0.2	3	1.5
Accipitridae/Falconidae (Hawks, eagles, falcons)	2	0.1	1	0.5
Haliaeetus/Aquila, Bald/Golden eagle	4	0.1	1	0.5
Buteo sp., Hawk	20	0.5	2	1.0
Buteo cf. regalis, Ferruginous hawk	1	0.+	1	0.5
Buteo swainsoni, Swainson's hawk	1	0.+	1	0.5
Buteogallus anthracinus, Black hawk	1	0.+	1	0.5
Falco mexicanus, Prairie falcon	1	0.+	1	0.5
Falco sparverius, Sparrow hawk	1	0.+	1	0.5
Speotyto cunicularia, Burrowing owl	14	0.4	2	1.0
cf. Aegolius acadicus, Saw-whet owl	1	0.+	1	0.5
Corvus brachyrhynchos, Crow	2	0.1	1	0.5
Corvus cryptoleucus, White-necked raven	1	0.+	1	0.5
Corvus corax, Raven	2	0.1	1	0.5
Nucifraga columbiana, Clark's nutcracker	1	0.+	1	0.5
Aphelocoma ultramarina, Mexican jay	1	0.+	1	0.5
Geococcyx californianus, Roadrunner	1	0.+	1	0.5
INDETERMINATE	567			

Table 2. Faunal remains by taxa from LA-2315-North (all proveniences combined).

Taxon	NISP N	NISP %	MNI N	MNI %
Very large mammal	2	0.7	1	3.9
Large mammal	124	46.1	2	7.7
Medium mammal	1	0.4	1	3.9
Small mammal	15	5.6	1	3.9
Large artiodactyl	5	1.9	1	3.9
Bison bison, Bison	1	0.4	1	3.9
Bos/bison	--	--	--	--
Cervus canadensis, Elk	--	--	--	--
Odocoileus sp., Deer	22	8.2	1	3.9
Odocoileus hemionus, Mule deer	2	0.7	1	3.9
Odocoileus virginianus, White-tailed deer	1	0.4	1	3.9
Odocoileus/Ovis	4	1.5	1	3.9
Ovis canadensis, Bighorn sheep	--	--	--	--
Ovis/Capra	1	0.4	1	3.9
Antilocapra americana, Antelope	--	--	--	--
Canis latrans, Coyote	1	0.4	1	3.9
Ursus horribilis, Grizzly bear	--	--	--	--
Mephitis mephitis, Striped skunk	--	--	--	--
Urocyon cinereoargenteus, Gray fox	1	0.4	1	3.9
Lagomorpha	--	--	--	--
Lepus californicus, Black-tailed jackrabbit	5	1.9	1	3.9
Sylvilagus sp., Rabbit	13	4.8	2	7.7
Sylvilagus audubonii, Desert cottontail	--	--	--	--
Sylvilagus floridanus, Eastern cottontail	1	0.4	1	3.9
Rodentia	--	--	--	--
Ondatra zibethicus, Muskrat	--	--	--	--
Neotoma sp., Wood rat	1	0.4	1	3.9
Sciuridae (Squirrels, prairie dogs)	--	--	--	--
Spermophilus variegatus, Rock squirrel	--	--	--	--
Cynomys ludovicianus, Black-tailed prairie dog	3	1.1	1	3.9

Table 2 (continued)

Taxon	NISP N	NISP %	MNI N	MNI %
Microtus sp., Vole, meadow mouse	--	--	--	--
Thomomys bottae, Pocket gopher	2	0.7	1	3.9
Aves	41	15.2	1	3.9
Meleagris gallopavo, Turkey	20	7.4	2	7.7
Accipitridae (Hawks, eagles)	--	--	--	--
Accipitridae/Falconidae (Hawks, eagles, falcons)	2	0.7	1	3.9
Haliaeetus/Aquila, Bald/Golden eagle	--	--	--	--
Buteo sp., Hawk	1	0.4	1	3.9
Buteo cf. regalis, Ferruginous hawk	--	--	--	--
Buteo swainsoni, Swainson's hawk	--	--	--	--
Buteogallus anthracinus, Black hawk	--	--	--	--
Falco mexicanus, Prairie falcon	--	--	--	--
Falco sparverius, Sparrow hawk	--	--	--	--
Speotyto cunicularia, Burrowing owl	--	--	--	--
cf. Aegolius acadicus, Saw-whet owl	--	--	--	--
Corvus brachyrhynchos, Crow	--	--	--	--
Corvus cryptoleucus, White-necked raven	--	--	--	--
Corvus corax, Raven	--	--	--	--
Nucifraga columbiana, Clark's nutcracker	--	--	--	--
Aphelocoma ultramarina, Mexican jay	--	--	--	--
Geococcyx californianus, Roadrunner	--	--	--	--
INDETERMINATE	60			

samples reflect a primary dependence for the hunted portion of the diet on deer, lagomorphs, and perhaps rodents and turkey.

Deer are undoubtedly the most important large mammal at Angus. In fact, their importance is probably significantly underestimated because more than one third of the unidentifiable bone fragments probably derive from deer.

Lagomorphs and, especially, rodents are problematic, because an unknown number of these animals may have died of natural causes within the deposits. Szuter (1982), however, notes that recent rodent burrows examined by mammalogists rarely contain small mammal bones. This suggests that the traditional archaeological assumption that most rodent remains in prehistoric site deposits are intrusive needs closer examination. Most of the small mammals from Angus show no unambiguous signs of human butchering and processing, and relatively few are burned (Table 4). Thus, it is primarily the abundance of small mammals and their documented use as food sources among ethnographically described groups in the Southwest (e.g., Cushing 1920:598-600; Henderson and Harrington 1914:22), that point to their probable use as food by the Angus inhabitants.

Table 3 reveals a rather striking difference between the northern and southern loci at Angus that may reflect a temporal change in the subsistence strategies of the site's inhabitants. The percentages of lagomorphs and rodents are lower in the younger, northern locus, while the percentages of deer and turkey are higher. Taphonomic factors, while not discussed here, have been considered and do not appear to be the principal source of these differences (Speth and Scott 1983). The sample sizes are small, especially from the northern locus, but the change in faunal composition is marked; the trend persists whether NISP (number of identifiable specimens) or MNI (minimum number of individuals) values are used, and the change is in the opposite direction to the one that would be expected if the differences were due primarily to differential attrition or other taphonomic processes.

Obviously, there are factors other than a basic shift in subsistence strategies that might produce the faunal trend seen at Angus. For example, one possible factor could be a change in the seasonality of site occupation. This might alter the relative proportions of large and small

Table 3. Major animal resources at Angus site (LA-2315).

Taxon	LA-2315-South				LA-2315-North			
	NISP[1]	%	MNI[2]	%	NISP[1]	%	MNI[2]	%
Lagomorphs	637	43.7	70	44.6	19	25.7	4	26.7
Rodents	241	16.5	51	32.5	6	8.1	3	20.0
Deer	404	27.7	14+	8.9	25	33.8	3	20.0
Turkey	104	7.1	4	2.5	20	27.0	2	13.3
Bison	15	1.0	2	1.3	1	1.4	1	6.7
Antelope	3	0.2	1	0.6	--	--	-	--
Raptors	53	3.6	15	9.6	3	4.1	2	13.3

1. NISP = Number of identifiable specimens.
2. MNI = Minimum number of individuals.

Table 4. Proportion of burned bones in major taxa from Angus site (LA-2315-South).

Taxon	Burned	
	NISP*	%
Turkey	7	6.7
Large mammals (all)	78	4.2
Indeterminate	21	3.7
Deer	13	3.2
Birds	12	2.8
Rabbits	13	2.6
Lagomorphs	16	2.3
Small mammals (all)	31	2.3
Jackrabbits	3	2.1
Raptors	1	1.9
Neotoma sp.	1	0.9

*NISP = Number of identifiable specimens mammals at the site without necessarily reflecting a fundamental restructuring of the entire subsistence system. Unfortunately, seasonal indicators such as large mammal dentitions, foetal remains, antlers, and others are too scarce at Angus to allow us to determine the season of occupation of either locus.

Another factor which might give rise to spurious patterning in the faunal data is the sequence of trash disposal at the site. Most of the faunal remains at Angus were recovered from pitrooms in the southern locus. While ceramics and other temporally diagnostic materials suggest that the southern structures are somewhat older than the northern ones (Robin Farwell, personal communication 1984), the precise order in which structures, once abandoned, were filled with trash is not entirely clear. Pitrooms in the southern locus may have been abandoned more or less sequentially, so that as structures fell into disuse they were filled with trash from occupied dwellings nearby. However, some of the trash may have been dumped into the southern structures by occupants of the northern locus after the entire southern half of the site had been abandoned. The apparent increase of large mammals might therefore primarily reflect the small sample size from the northern locus, and/or bias stemming from non-random patterns of trash disposal by the site's inhabitants.

Until a more detailed study of the Angus site is completed, the reality of its faunal trend must be regarded as extremely tentative. Nevertheless, the patterning is intriguing, particularly since its direction is the opposite of what we would have anticipated in a regional context of increasing village size, sedentism, and horticultural commitment (Kelley 1966). As a consequence, the Angus case pointed us toward what has proven to be an interesting and productive line of inquiry that we might otherwise not have explored.

Given the limitation of the Angus data, we turned to faunal data recently compiled by Driver (1982) for several other late prehistoric sites in the Sacramento foothills (Table 5). These faunal materials, recovered in excavations between 1950 and 1956 by Texas Technological College (Kelley 1966, 1979), revealed a similar trend toward increasing reliance on large mammals.

Driver tabulated the frequency of taxa recovered from an early Glencoe Phase site (Penasco), a Corona-Lincoln Phase site (Phillips), and

Table 5. Proportions of major taxa at late prehistoric sites in the Sacramento foothills (data from Driver 1982).

Taxon	Penasco Site (Glencoe Phase)		Phillips Site (Corona-Lincoln Phases)		Block Lookout Site (Lincoln Phase)		Hiner 1 Site (Lincoln Phase)	
	NDP[1]	%	NDP[1]	%	NDP[1]	%	NDP[1]	%
Lagomorphs	91	42.9	191	16.5	36	17.4	17	17.7
Rodents	32	15.1	117	10.1	5	2.4	1	1.0
Large mammals (all)	89	42.0	848	73.4	166	80.2	78	81.3
Total	212	100.0	1156	100.0	207	100.0	96	100.0

1. NDP = Number of diagnostic points (see Driver 1982 for explanation).

Table 6. Proportion of lagomorphs and large mammals at Angus site and Gran Quivira.

Taxon	Angus Site				Gran Quivira[1]			
	LA-2315-South		LA-2315-North		Early Phase (A.D. 1300-1400)		Middle Phase (A.D. 1400-early 1500s)	
	MNI[2]	%	MNI[2]	%	MNI[2]	%	MNI[2]	%
Lagomorphs	72	69.2	4	28.6	67	37.2	49	28.0
Large mammals (all)	32	30.8	10	71.4	113	62.8	126	72.0
Total	104	100.0	14	100.0	180	100.0	175	100.0

1. Data from McKusick (1981).
2. MNI = Minimum number of individuals.

two Lincoln Phase sites (Block Lookout and Hiner 1). The early Glencoe and Corona Phases both date to between about A.D. 1100 and A.D. 1200 or 1250. The Lincoln Phase is later, beginning about A.D. 1250 and terminating around A.D. 1400. One of the sites, Phillips, may have been occupied over most or all of the time span of interest to us here; unfortunately, Driver's report, which is a preliminary overview of the data, does not tabulate the material from this site by phase. However, statements in the original report (Kelley 1966) and subsequent reanalyses of the fauna (Driver 1982; Kooyman n.d.) suggest that most of the excavated Phillips remains derive from the later Lincoln Phase, although this phase assignment is very tentative.

The Bonnell site, another important assemblage from the Sacramento Mountains area, is omitted entirely here because the temporal placement of the fauna is unclear. Driver is presently preparing a more detailed report on the materials from Phillips and Bonnell which will clarify the nature of temporal patterning in the animal remains from these important sites.

Although the sample sizes are very small, the faunal remains reported by Driver show an increase in the relative proportion of large mammals similar to the increase observed at Angus (Table 5). It would thus appear that at several localities in the Sacramento uplands during the 13th and 14th centuries, a shift may have taken place toward a greater emphasis on large mammals, especially deer or, in some cases, antelope. A similar and more or less contemporary shift has been documented by Jelinek and others in the Pecos Valley lowlands to the east but, in this case, the shift was toward bison (Jelinek 1967; Collins 1971; Speth, ongoing research at Henderson Pueblo near Roswell). Interestingly, this change in subsistence patterns, at least in the Sacramentos, is paralleled by a dramatic increase in the number of projectile points found (Kelley 1966:63, 153, 157).

The possible causal factors underlying this shift toward larger species are of considerable interest. The increase in importance of bison in Pecos Valley subsistence systems after A.D. 1250 or 1300 has been recognized for many years (Jelinek 1967; Collins 1971; see also Dillehay 1974). Explanations for this shift have been sought largely in terms of changes in local environmental conditions, especially those that may have affected bison numbers in the grassland areas (see discussion in Jelinek 1967). The recognition of a parallel increase in reliance on large species at roughly the same time in the Sacramento uplands suggests a broader and more complex phenomenon, one that may have affected human adaptations over a diversity of habitats in southeastern New Mexico. A satisfactory explanation for the subsistence changes taking place in the Pecos lowlands, therefore, may also have to account for the parallel shifts in the uplands.

A brief search of the southwestern faunal literature reveals that increasing reliance on large mammals by late prehistoric horticulturists is by no means confined to southeastern New Mexico. Haury (1976:114), for example, observes that large ungulates, especially bighorn sheep, increase relative to lagomorphs at Snaketown and elsewhere in the Hohokam area during the Sedentary and Classic periods (i.e., after about A.D. 900-1100). This faunal change coincides, according to Haury (1976:356), with peak population levels and agricultural activity in the Hohokam area.

A small faunal sample from the Point of Pines area in east-central Arizona shows the same general trend (Stein 1962). Between A.D. 1-900 (Circle Prairie, Stove Canyon, and Dry Lake Phases), the proportion of large mammals (deer, antelope, sheep, bison) relative to lagomorphs is about 30%. Between A.D. 1000-1400 (Reserve, Tularosa, Pinedale, and Canyon Creek Phases), large mammals increase to nearly 60%. During the Point of Pines Phase (A.D. 1400-1450), large mammals exceed 70%. Heavy utilization of deer at about the same time has been noted by Olsen at Grasshopper Pueblo, also in east-central Arizona (Olsen 1980).

Using coprolite data, Stiger (1979) documents an increase in the importance of deer in the diet of the inhabitants of Mesa Verde between Basketmaker III (ca. A.D. 470) and Pueblo III (A.D. 1250). According to Stiger, this faunal shift parallels an increase in reliance on horticulture by local populations.

M. Binford et al. (1982) observe a sharp increase in the relative importance of deer and a decline in lagomorphs in the McKinley Mine area of northwestern New Mexico between A.D. 900 and A.D. 1100-1200. The occupational sequence is interpreted as one of increasing local aggregation of population (Nelson and Cordell 1982) and greater horticultural commitment (Toll and Donaldson 1982).

Perhaps the best documented case comes from Chaco Canyon, also in northwestern New Mexico. Here, large mammals, especially deer and antelope, increase steadily in importance relative to small mammals from about A.D. 600 until A.D. 1100 (Akins 1982:28). The shift coincides with increasing population levels and horticultural activity within the canyon. After A.D. 1100, population levels in the canyon fall off and large mammals again decline relative to lagomorphs and rodents.

While the timing of the shift differs from region to region, the few cases mentioned here are sufficient to indicate that increasing reliance on larger mammals is not unique to horticulturists in southeastern New Mexico. The interesting question, of course, is why such a shift should occur. In attempting to answer this question, we will draw heavily on arguments put forward recently by Bayham (1982) in a reanalysis of the fauna from Ventana Cave in southern Arizona. While the specifics of the Ventana case are obviously quite different from the situation with which we are concerned, Bayham's approach is interesting and may help shed light on the late prehistoric subsistence changes taking place in southeastern New Mexico and elsewhere in the Southwest.

Bayham documented a gradual and progressive trend, throughout the 4500 year Archaic and Hohokam sequence at Ventana Cave, toward decreasing emphasis on lagomorphs and greater specialization in deer. This shift was accompanied by changes in the ratio of projectile points to ground stone artifacts, and in other artifactual indicators, all of which pointed to a change in the function of Ventana Cave from a hunter-gatherer base camp during the Archaic to a more specialized hunting station during the Hohokam Period.

Bayham examined a variety of possible causes for the shift in subsistence patterns. Among these he considered changes in the environment that might increase the availability of deer; technological innovations, such as the introduction of the bow and arrow, that might lower procurement costs of large species; changes in the absolute numbers of people in the region that might affect the abundance and distribution of prey species; and shifts in regional settlement and socioeconomic systems that might alter hunting patterns. Bayham rejects all but the last of these factors. As will become evident shortly, we came to very similar conclusions with regard to the changes in southeastern New Mexico.

Concerning environmental factors, Bayham argues that increased specialization on a single large species would be expected if climatic changes led to an increase in the animal's relative or absolute abundance. For the Ventana case, this would require a more or less continuous, unidirectional shift in local environmental conditions over the last 4500 years, a pattern not supported by existing paleoclimatic data.

Bayham also rejects the introduction of the bow and arrow as a sufficient explanation, because the observed changes in subsistence took place gradually and began well before the technological change. He also rejects communal procurement techniques, again because the observed trend is gradual rather than abrupt.

Change in the number of people inhabiting the Hohokam area is also rejected as an explanation for the increased reliance on deer. Archaeological evidence points to increasing populations in the area. According to Bayham, who relies heavily on arguments from optimal diet theory, this should have led to a reduction in local prey populations, and should have given rise to less rather than greater selectivity on the part of the hunters.

Ultimately, Bayham argues that increasing aggregation and sedentarism of human populations during the Hohokam Period led to a reduction in prey populations around major settlements. As a consequence, successful hunting required longer trips, which increased transport costs and favored the taking of prey with the highest return.

To what extent might these arguments help clarify the late prehistoric subsistence changes taking place in southeastern New Mexico? In attempting to answer this question, we will briefly consider each of the four causal factors outlined by Bayham: climatic or environmental changes, technological innovations, human population fluctuations, and socioeconomic changes.

Climatic data for southeastern New Mexico for the period of concern are presently very limited. The available evidence (summarized in Speth 1983, and references therein; see also Hall 1984) points to more favorable conditions during the 1300s, followed by deteriorating, probably drier, conditions after about A.D. 1400. These data suggest that the shift toward greater emphasis on large game did, in fact, begin during a period of relatively improved climatic conditions which may have supported larger numbers of ungulates. However, there are additional data which suggest that the focus on larger species persisted long after conditions in the region had again deteriorated and the availability of large prey species presumably had declined. McKusick (1981), for example, has recently published the faunal data from Gran Quivira, a large late prehistoric and early historic pueblo just north of the Sacramentos. These data (Table 6) clearly indicate that large species dominate the faunal assemblage throughout the 15th century. Ongoing work by Speth at the Henderson Pueblo (13th through 15th century) near Roswell indicates that communal bison hunting not only persisted but actually may have increased in importance as regional conditions deteriorated. It is interesting in this regard that McKusick (1981:64) documents a significant reduction in the body size of adult male antelope taken by the inhabitants of Gran Quivira after A.D. 1400, a trend that may well reflect deterior- ating range conditions in the region. Worsening forage conditions are also indicated by an increase in the rate of tooth wear in bison at this same time period at the Garnsey Kill site to the east in the Pecos lowlands (Speth 1983). While these data are less than ideal, they do suggest that climatically induced changes in the abundance of deer, antelope, or bison are more likely to provide a reason for a decrease rather than the continued emphasis on large species.

There are no obvious technological changes during the period of concern that might reduce the pursuit costs of large mammals. The bow and arrow was introduced to this area centuries earlier (cf. Jelinek 1967; Kelley 1966; Willey and Hughes 1978). While communal procurement techniques might also lead to greater emphasis on larger species, there is no evidence at present to suggest that such techniques were unknown to the inhabitants of southeastern New Mexico prior to the Late Prehistoric Period. Therefore, any increase in large game that might be attributable to communal hunting techniques is not likely to be the result of the sudden discovery of such techniques, but rather the result of increased reliance on communal hunting brought about by other factors. We will return to this issue later.

Changes in the absolute numbers of people in a region can have a marked impact on prey availability. Ignoring for the moment whether the human population is aggregated or dispersed, and holding constant the amount of animal protein in the diet, an increase in the total number of people should lead to a reduction in the abundance of larger prey species, and hence to a decrease in the degree of selectivity or specialization by the hunters.

Unfortunately, we know very little about population trends during the Late Prehistoric Period in southeastern New Mexico. Perhaps the only certainty for the Sacramento area is that sometime prior to European contact, populations began to aggregate into a smaller number of much larger settlements, a trend that culminated in the emergence of extremely large communities like Gran Quivira (cf. Caperton 1981). But to our knowledge, there are few hard data to show that this pattern of aggregation reflects an actual increase in population rather than simply a relocation of people over the landscape (but see Kelley 1966:80).

On the other hand, there is presently no evidence to show that population size decreased during the period of concern. On the contrary, the number and maximum size of Glencoe, Corona, and especially Lincoln Phase sites in the Sacramentos appear to be greater than in preceding periods (Kelley 1966:80). Residential sites of comparable age are also more numerous in the Pecos Valley and in the Mescalero sands area between the Pecos and the Llano Estacado (Jelinek 1967; Collins 1971; Kelley 1966; Leslie 1979). This apparent increase in the number of sites undoubtedly is partly a function of the greater visibility of the younger sites and our ability to place them more precisely in a temporal sequence. Nevertheless, the data are not suggestive of regional population decline. We are inclined to agree with Bayham that the trend toward increasing specialization in large mammals in southeastern New Mexico cannot be attributed directly to a change in the absolute size of regional populations.

Thus, like Bayham, we feel that the increased specialization in large game, seen in southeastern New Mexico, Chaco Canyon, and elsewhere in the Southwest, is most likely a reflection of fundamental changes in the socioeconomic sphere. More specifically, the change in hunting selectivity appears to be linked to changes in community size, residential stability, and degree of horticultural commitment. But why?

ETHNOGRAPHIC DATA

An obvious point of departure for exploring this interesting question is an examination of the ethnographic literature that deals explicitly with hunting strategies of simple horticulturists. As might be expected, this literature is scattered, often anecdotal, and concerned for the most part with groups in tropical forest habitats. Moreover, ethnographic studies deal almost entirely with short time spans, generally on the order of a few months or at most a few years, whereas the changes with which we are concerned in the prehistoric Southwest span decades or centuries. Furthermore, most of the ethnographic literature containing quantitative data on hunting yields derives from Amazonian groups that depend on cultivated crops for more than 70% to 80% of their total calorie intake (e.g., Hames 1980:35; Vickers 1983:455; Hames and Vickers 1983, and references therein). Data relating hunting patterns to differing degrees of horticultural commitment are, unfortunately, almost nonexistent. Despite the obvious limitations of these studies, they will help to identify some of the key parameters that influence prey selection by cultivators.

Perhaps the most obvious aspect of tropical horticultural systems such as those found in Amazonia and Southeast Asia is the need for an efficient source of high-quality protein to supplement diets based heavily on cultivated carbohydrates. For example, manioc and plantains, two of the most important crops in the Neotropics, are extremely low in protein (1-2%, according to Gross 1975:527). Groups such as those in Amazonia that obtain most of their calories from these starchy plants rely heavily on fish and hunted foods for protein. Protein is also obtained from other vegetable sources, but these are often inadequate and are generally less efficient than meat or fish (but see discussion in Beckerman 1979 and Lizot 1977). Maize is higher in total protein than manioc or plantains, but maize protein is low in quality, since it is deficient in two essential amino acids and niacin (Gross 1975:527, 534, and references therein; Reidhead 1976:308-309). Thus, heavy reliance on maize cultivation probably also increases, at least seasonally, the need for an efficient source of high-quality protein (see discussion in Reidhead 1976).

The impact of horticulture on animal habitats must also be considered. Gardening disturbs existing habitats and creates new ones that support higher densities of small mammals than are found in surrounding undisturbed areas (Linares 1976; Hames and Vickers 1982; Fagerstone et al. 1980; Emslie 1981; Neusius 1984). Thus, one consequence of increased horticultural activity may be an increase in the abundance of small mammals available to the local community (i.e., "garden hunting" as described by Linares 1976).

The impact of gardening on the abundance of larger species of game is less clear. Gardens clearly attract larger animals, at least at certain stages in the growth of the crops. This is amply attested to by frequent reference in the literature to crop damage caused by deer, wild pigs, monkeys and other large species (Eder 1978:60; Carneiro 1968a:133, 1983:83-85; Freeman 1955:58-60; Parker et al. 1983:171; Berlin and Berlin 1983:316). These animals are often hunted in the gardens, especially at night where the people have access to flashlights (Hames and Vickers 1983). However, there are few quantitative data which demonstrate that garden hunting significantly increases overall hunting success of large mammals, or that large game biomass is greater in areas with gardens (Peterson 1981; Linares 1976). In fact, most studies suggest the opposite (see, for example, Eder 1978:68; Hart 1978:336; Milton 1984:14-15; Abruzzi 1979; Hames and Vickers 1982; Hill and Hawkes 1983:165; Yost and Kelley 1983:216; Carneiro 1968b:245). Therefore, Peterson's (1981) study of Agta hunting in the Philippines is unusual in this regard. She argues that edge zones along the boundaries between gardens and forest support a higher biomass of large game than surrounding primary forest. Peterson concludes that expansion of horticulturists into Agta territory has been beneficial to Agta hunter-gatherers by increasing the overall abundance of larger prey species.

A more recent study of the Agta by Rai (1982:184-188) disagrees with Peterson's conclusions. Rai argues instead that large game rarely concentrate near garden boundaries, and that, in the long run, horticultural activity is degrading Agta habitat and causing widespread resource depletion.

Several studies from Amazonia support the conclusions reached by Rai, and provide valuable quantitative evidence that the level of game depletion around horticultural communities, especially of larger species, is positively correlated with settlement age. For example, Vickers (1980; see also Hames and Vickers 1982, 1983) studied hunting yields between 1973 and 1975 in the newly founded Siona-Secoya village of San Pablo in tropical northeastern Ecuador. Vickers found that when the village was first established, hunting yields were high (averaging about 25 kg of butchered meat/hunt) and hunters focused on areas close to the village. Large species contributed the highest percentage of total kills and provided most of the total meat yield by weight. During the first two years of occupation, however, hunting yields dropped precipitously (to an average of approximately 15 kg/hunt), and hunters began to travel greater distances and spend more time hunting. Despite the decline in hunting returns during the first two years the village was occupied, large species contributed over 98% by weight of the total meat yield and over 93% of the total kills.

Vickers returned to San Pablo six years later in 1979 and found that hunting yields had declined further (to an average of about 12 kg/hunt), though the rate of decline was slower. His data show that, after six years, returns (by weight) had dropped to about 56% of what they had been during the first two years the village was occupied. He also found that time invested in hunting had increased by nearly 12%, and average travel distance to productive hunting areas had increased by about 18% (from 17 km to 20 km). Large game continued to be the principal focus of hunting and still contributed most of the kills (71%) and total meat yield (93%).

Cuyabeno, another Siona-Secoya settlement which had been occupied continuously for more than 30 years, had even lower returns (averaging approximately 6 kg of butchered meat/hunt) than the 1979 levels at San Pablo, but the per annum rate of decline in hunting yields had leveled off. On the basis of these data, Vickers (1980) and Hames (1980) suggest that hunting returns asymptotically approach an equilibrium level in older settlements, provided that certain conditions are met: available hunting territory is large, populations remain more or less stable, distant hunting zones are periodically rotated, and villages are occasionally relocated.

Once large game close to the village of San Pablo had been depleted, the Siona-Secoya exploited nearby areas primarily for short morning or evening hunts when time constraints from other activities (such as garden clearing) prevented them from engaging in long-distance hunting. Animals taken on these hunts generally were less preferred smaller species which comprised a comparatively small proportion of the village's total hunting returns (Vickers 1980).

Hames (1980; Hames and Vickers 1982, 1983; see also Good 1982 and Baksh 1982, both cited in Harris 1984) studied hunting by Ye'kwana and Yanomamo villagers in southern Venezuela. His data also clearly show the effects of game depletion in the vicinity of villages. Ye'kwana and Yanomamo hunters took a wider range of prey types, including less preferred smaller varieties, close to the village. At greater distances from the village, the range of prey types taken was narrower, and larger species contributed a much greater proportion, in terms of both number of kills and weight. Like the Siona-Secoya, Ye'kwana and Yanomamo hunters exploited the low-yield areas near the village primarily at times when critical gardening activities prevented them from traveling to distant, more productive hunting areas.

Similar trends were observed by Saffirio and Scaglion (1982) in a study of hunting by Yanomamo groups in northern Brazil (see also Saffirio and Hames 1983). They compared the hunting strategies of traditional forest villages with the strategies of two rapidly acculturating villages which had recently relocated permanently along a new highway. Increased residential stability and proximity to the highway has led to greater environmental degradation and resource depletion around the highway villages than around the less permanent forest villages. As a consequence, the highway villages hunt almost three times as often as traditional villages, devote substantially more time per day to hunting (153%) and travel greater distances into the forest to obtain adequate yields. They also take a narrower range of species than the forest villages, focusing particularly on two species: one large (the peccary), the other of moderate size (the spider monkey).

The highway Yanomamo have also altered their hunting techniques in response to resource depletion, by increasing their reliance on communal methods of procurement (Saffirio and Scaglion 1982). Communal techniques are less efficient in terms of kilograms of meat per hour of hunting (.66 kg/hr) than solitary methods (.97 kg/hr), but provide larger total yields. The traditional forest villages employ communal hunting techniques on infrequent occasions (less than 2% of their hunts) when they need large quantities of meat for inter-village feasting. In contrast, the highway Yanomamo have begun to use collective hunting for routine subsistence (more than 17% of their hunts).

The adoption of communal hunting techniques in response to resource depletion is not unique to Amazonia. For example, according to Abruzzi (1979), the use of communal net hunting techniques by various Pygmy groups in Zaire represents a similar response to resource depletion. He states that:

> The larger camps and the cooperative hunting technique employed by the net-hunters, unique among contemporary hunters, may be seen to represent predictable responses to the subsistence pressures that accrue from continued population growth within a fixed, or declining, resource base (1979:185).

The adoption of shotguns by many Amazonian groups has also been cited as a consequence of, as well as a cause of, resource depletion (Hames 1979; Hames and Vickers 1982:375).

Up to this point, we have focused entirely on the hunting strategies of horticulturists who obtain 70% to 80%, or more, of their total calories from starchy cultivated crops. Among these groups, especially those for whom fish are unavailable as a major protein source, large mammals comprise the bulk of their hunted food, by both weight and number of kills. While "garden hunting" obviously provides an important supplementary source of protein, the considerable time and energy invested by these horticulturists in travelling to distant hunting zones to obtain large species reflect the inadequacy of small mammal kills made close to the village.

Ideally, we would like to compare the hunting patterns of a number of horticultural groups, each with a different degree of dependence on cultivated crops. Based on the discussion above, our expectation would be that the percentage contribution of large species would be greater among those groups that rely more heavily on horticulture. (Additional factors that affect hunting selectivity, such as time and labor constraints arising from horticultural activities, will be discussed below.) Unfortunately, comparative data of this sort are almost nonexistent. There are data, however, for two groups of Neotropical hunters and gatherers, the Aché of eastern Paraguay (Hill and Hawkes 1983) and the Maku of northwestern Brazil and southeastern Columbia (Milton 1984). The Aché conduct no horticulture and depend heavily on the wild products of the forest. They hunt almost the same range of animals as those exploited by the Yanomamo and other Amazonian horticulturists (e.g., two species of peccary, deer, monkey, various birds, etc.). Traditionally, Aché hunters, using just bows and arrows, killed mostly small and moderate size prey. Less than 25% by weight of the total meat yield came from large species (Hill and Hawkes 1983:164). This contrasts strikingly with the meat yield (by weight) of Yanomamo bow hunters, of which more than 80% came from large species (Hames and Vickers 1982). Only when the Aché employed shotguns did their take of large animals approach the levels killed by Yanomamo bow hunters (Hill and Hawkes 1983:164).

The Maku are semi-nomadic hunters and gatherers who cultivate a small amount of manioc (Milton 1984). Maku hunting is done mostly with blowguns and bows and arrows, although on occasion they hunt with shotguns. Data provided by Milton (1984) indicate that only about 45% by weight of the meat (excluding insects) taken by Maku hunters is from large species. The contribution of large animals might be reduced further if the kills made with shotguns were excluded.

While far from conclusive, the Aché-Maku-Yanomamo comparisons reinforce the suggestion that horticulturists who obtain most of their calories from a restricted range of protein-poor starchy crops rely more heavily on large animal species than do groups in broadly similar habitats with little or no dependence on cultivated crops.

The time and labor constraints that arise from horticultural activities also play an important role in determining the size of prey sought by hunters. As pointed out earlier, Ye'kwana, Yanomamo, and Siona-Secoya hunters rapidly deplete larger species of game close to their villages. They must then travel further and invest more time in order to reach productive hunting zones. However, the competing demands of garden work and other activities around the village restrict the amount of time hunters can devote to long-distance hunting. Thus, when hunters do engage in long-distance hunting, they focus heavily on species with the highest returns in order to make the trip energetically worthwhile. This is beautifully illustrated by Hames and Vickers (1982) who show that within 4 km of a Yanomamo village, large species comprise only about 35% by weight of kills. Between 5 and 9 km from the village, the contribution of large species rises to about 80% by weight. In hunting zones more than 9 km from the village, where most hunting time is spent, large game comprises more than 88% by weight of the kills.

The observations of Hames and Vickers (1982) fit comfortably with predictions from Central Place Foraging Theory. As observed by Pulliam, "People should be food generalists when hunting and gathering near home (a central place) and become progressively more selective about foods they choose to bring home when they forage farther afield" (1981:67).

Flowers (1983:358) makes the interesting observation that the time budgets of Amazonian groups who depend on root crops such as manioc are less constrained than the time budgets of groups who depend more heavily on seasonal grains such as maize. This suggests that people who rely on manioc are able to engage in long-distance hunting more often and more regularly than those who rely on maize. The seasonal constraints of maize cultivation would certainly appear to be a factor among ethnographically documented southwestern pueblo dwellers who restrict much of their deer hunting to the winter following the harvest (see, for example, Ford 1968).

Other factors also place time and labor constraints on the hunting activities of tropical horticulturists. Included among these are: the level of game depletion in the area; seasonal characteristics of the environment that affect the abundance, distribution, and accessibility of hunted animals (Hames and Vickers 1983); the size and distribution of other competing groups, as well as the overall social and political climate in the region (Chagnon 1968; Hames and Vickers 1983, and references therein).

The ethnographic literature from Amazonia documents a wide range of strategies available to horticulturists to assure them of access to an adequate intake of protein. We have already discussed a few of these, such as increasing the amount of time devoted to hunting; increasing the travel distance to productive hunting areas; focusing on larger, higher-yield species; and adopting communal hunting techniques. Other well documented strategies include seasonal trekking by entire villages to productive hunting areas (Werner 1983, and references therein); periodically relocating villages to gain access to new hunting areas (Gross 1975; Hames and Vickers 1983, and references therein); maintaining "buffer zones" between adjacent communities through inter-group conflict (Hames and Vickers 1983; Ross 1978; DeBoer 1981; Harris 1984; Gross 1975; Durham 1976; Moore 1981; Hickerson 1965); "de-tabooing" species previously considered inedible (Hames and Vickers 1982; Ross 1978; Yost and Kelley 1983:205; Berlin and Berlin 1983:318); trading carbohydrate- and protein-containing items between groups (Milton 1984); shifting crop complexes to include plants that provide more and higher-quality protein (Flowers 1983:389; Hames and Vickers 1982:375; Johnson 1977); increasing reliance, where feasible, on fish and other aquatic resources (Hames and Vickers 1983; Hames 1983:395-396; Carneiro 1968b:245); using domestic animals such as pigs, chickens, and cattle (Johnson 1977; Berlin and Berlin 1983:318); and increasing involvement in external market economies (Flowers 1983:384; Gross et al. 1979).

This list is certainly not exhaustive, but it identifies a number of the most important strategies used by simple horticulturists to maintain adequate protein intakes. Clearly, some of these options are only viable when groups have relatively unrestricted mobility. When residential mobility is reduced, for whatever reason, habitat degradation and resource depletion may increase to the point where the people are forced to adopt other strategies. Most important among these are inter-group exchange of protein- and carbohydrate-rich items, use of domesticated animals, and greater involvement in external market economies.

RETURN TO THE SOUTHWEST

What do these ethnographic observations suggest about the shift toward larger species of game observed in southeastern New Mexico and elsewhere in the Southwest? We very tentatively offer the following scenario: that the shift is primarily a response to socioeconomic changes which led to the aggregation of populations into more residentially stable and more horticulturally based communities. The reasons for the socioeconomic changes are themselves issues of considerable interest, but are beyond the scope of the present paper. Greater horticultural commitment increases the need for efficient sources of high-quality protein, at least seasonally. It also introduces time and labor constraints that necessitate the rescheduling of hunting activities to more restricted periods of the year. Larger and more stable communities also degrade their immediate environs and deplete locally available game, forcing hunters to travel greater distances to productive hunting areas. Together, these factors favor the taking of selectively greater proportions of larger, higher-yield prey, at least initially (see Pulliam 1981:67 for a similar argument from the perspective of Central Place Foraging Theory). Resource depletion may also favor increased reliance on communal techniques for hunting both small and large species such as jackrabbits, antelope, bison, and perhaps deer and mountain sheep. Emphasis on large species should persist as long as population densities remain relatively low and groups relocate their settlements relatively frequently, or as long as competition between adjacent groups maintains buffer zones in which larger prey species are subject to reduced predation pressure.

At some as yet unknown threshold of resource depletion, brought about by reduced community mobility, or by increased horticultural activity, or by a change in the political or demographic environment, other strategies may be favored for maintaining adequate protein intake. One option is to alter one's crop complexes to include plants with higher protein yields. Another is to shift to greater dependence on domesticated sources of animal protein; in the Southwest, the turkey may have become such a resource. Another strategy is to engage in exchange for meat with other populations that have greater access to large game. In the Southwest, the emergence of Plains/Pueblo exchange for bison meat along the eastern frontier provides an example of this option. Inter-group exchange for deer may also have been important. Another option, which may have occurred periodically in the Southwest, is to reduce one's commitment to horticulture, become more mobile, and shift to a more generalized pattern of hunting and gathering. This option, of course, presupposes the existence of relatively unpopulated hinterlands to which people could retreat.

An interesting and somewhat unexpected implication of the line of reasoning outlined in this paper is that the increasing importance of bison in late prehistoric Pecos Valley subsistence systems may reflect a greater commitment on the part of the area's inhabitants to a village-based horticultural economy, not a transitional stage of a group enroute to becoming nomadic bison hunters (cf. Jelinek 1967). Following this line of reasoning a little further, increasing reliance by local villagers on large ungulates may have "preadapted" them to the mutualistic food exchanges that characterized Plains/Pueblo interaction at the time of European contact (cf. Spielmann 1982; Speth and Spielmann 1983).

CONCLUDING REMARKS

The scenario outlined here is by no means the only plausible one to account for the faunal trend that we have documented in southeastern New Mexico and elsewhere in the Southwest. Unfortunately, we presently lack the archaeological data necessary to identify more precisely the changes that were actually taking place. Moreover, we still lack adequate quantitative studies of the relationships between horticultural intensification and hunting strategies in living societies. These relationships must be worked out far more explicitly and precisely before the present scenario can be accepted.

We have tried to squeeze a great deal, perhaps too much, from a small sample of bones. In our defense, we hope that this discussion will encourage others to explore what we feel is potentially a highly productive research direction. It is clear that much remains to be learned about late prehistoric adaptations and culture change in southeastern New Mexico; the research potential of this vast region remains largely untapped.

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PREHISTORIC AND EARLY HISTORIC MOUNTAIN SHEEP PROCUREMENT IN THE CENTRAL ROCKY MOUNTAINS

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Mountain sheep (Ovis canadensis) procurement has an archaeological time depth of at least 9,000 years, as is documented at Mummy Cave in northwestern Wyoming (Husted and Edgar n.d.; Husted 1978). In addition, a prehistoric net designed for entrapment of larger animals (deer, pronghorn antelope and mountain sheep size) was recently found in the Mummy Cave vicinity. From the location, it is believed to have been used for mountain sheep. It is in ideal mountain sheep habitat and is near a present-day sheep bedground. The radiocarbon date, taken from a charred stick that was incorporated into the net, is 8860 ± 170 years B.P. (RL-396).

The net (Figure 1) was made of more than 2 km of two-strand juniper bark (Juniperus sp.) cordage. Its condition would not allow it to be unfolded, but it is probably over 50 m long and about 2 m high. Cordage size varies from less than 1 mm to 5 mm in diameter. It consists of a quadrilateral mesh formed by a series of fixed fishnet knots. Mesh gauge varies from less than 1 cm to over 3 cm, and this appears to be a function of cordage diameter.

This net is larger and of much sturdier construction than rabbit nets commonly found in the Great Basin (e.g., Aikens 1970:130-131). It adds a new dimension to our concepts of mountain-foothill adaptations and establishes a method of mountain sheep, and possibly other larger ungulate, procurement during the late Paleo-Indian Period. This area of Wyoming and adjacent areas of Idaho and Montana are presently, and have been noted in the past as, excellent mountain sheep habitat. Historic accounts claim the existence of mountain sheep in northwestern Wyoming (e.g., Russell 1921) in large numbers. This species demonstrates behavioral characteristics which are quite different from other large species (i.e., mule deer, bison and elk) that have been recorded

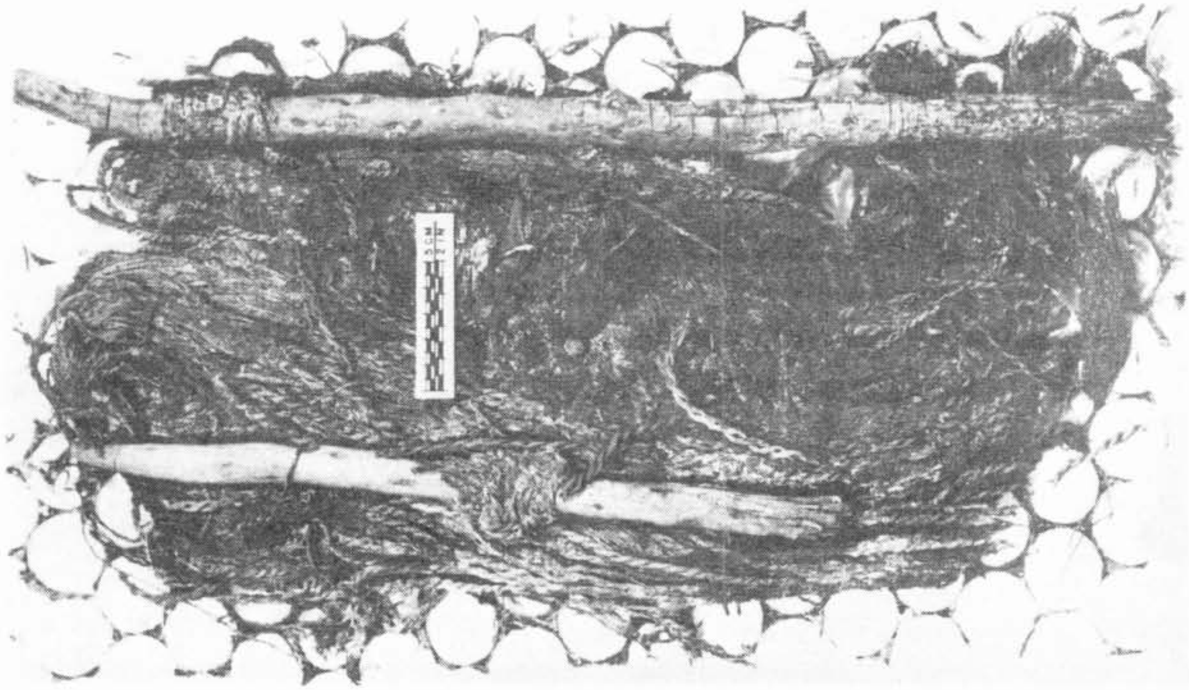

Figure 1. Animal net of late Paleo-Indian age from the Absaroka Mountains of northwest Wyoming.

archaeologically in the same area. Consequently, different procurement methods were required for the maximum return in prehistoric mountain sheep procurement efforts.

Another consideration is that the use of nets involved a system of animal procurement for which these implements and the diagnostic artifacts used in association were of perishable materials. The net is a means of entanglement, and it is easier to kill the animals with a club rather than a projectile point once the animals are tripped up and disoriented. It is, therefore, not unreasonable to propose that widespread mountain sheep procurement was a major part of the subsistence strategy over a large area known to have been good habitat. Other animals, particularly deer, may have been taken with nets over the same period of time with no evidence of diagnostics (such as projectile points) remaining.

There are numerous features in the higher altitudes that are thought to reflect long term human mountain sheep procurement but, unfortunately, most are not dated. These include the remains of drive line systems, corrals, catch pens, and hunting blinds. Some are so old that the wooden parts are gone, while some have varying amounts of the wooden parts still present (Figure 2). Some reflect cooperative ventures, while others appear to reflect more individualistic hunting efforts. They also indicate careful planning and use of topographic features, in order to take advantage of mountain sheep behavior.

The most recent of these mountain sheep procurement operations are the most informative because more is preserved. These are of two main types. One type incorporated large amounts of wood in the construction, some of which is still preserved to varying degrees. These are at and below timberline so that a source of wood is nearby. This type is further divided in two categories; as yet, only hypothetical evidence suggests that one may have developed out of the other. The first category is the "keyhole" type with drive lines converging at a ramp that terminates in a relatively large catch pen (Figure 3a). The other

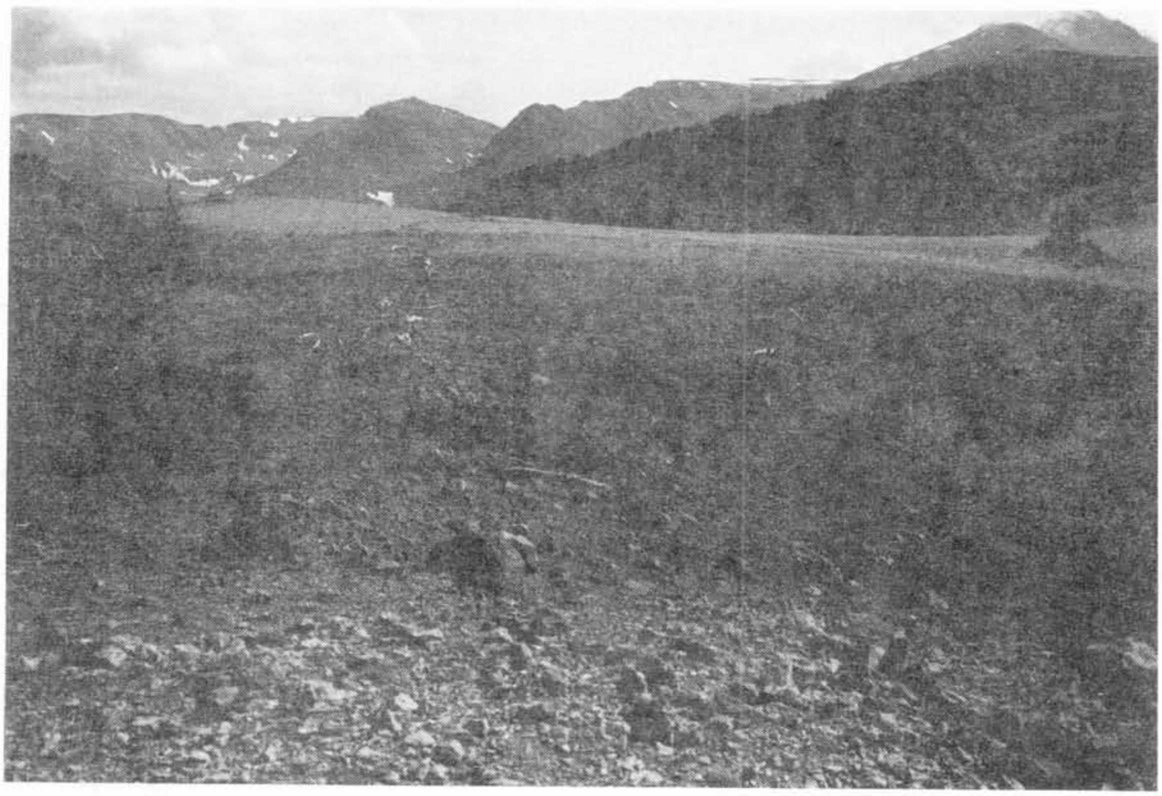

Figure 2. Timberline stone and wood alignment from the Absaroka Mountains, part of an animal procurement system that could be well over one thousand years of age.

Figure 3a. Catchpen of a keyhole type mountain sheep trap.

Figure 3b. Collapsed structure associated with a driveline that is believed to be a shaman's structure.

category consists of similar drive lines except that they lead to a large circling pen instead of a catch pen. Converging fences then lead from the circling pen and up a ramp into long, narrow catch pens (Figure 4).This type of trap has advantages over the former in that better regulation of the number of animals killed at one time is possible. A relatively large herd could have been corralled in the latter trap, and then smaller numbers could have been shunted into the catch pen as needed. A small amount of evidence suggests that the latter type is the most recent. At the Black Mountain trap near Dubois, Wyoming, there is a trap of the circling pen type (Figure 5, bottom) that is believed to have been built at least partly by salvaging timbers from one of the keyhole type (Figure 5, top).

The animals were killed with clubs of which at least three actual specimens are known, two of wood and one of elk antler. There is no

Figure 4. Catchpen for a mountain sheep trap in the Sunlight Basin area of the Absaroka Mountains.

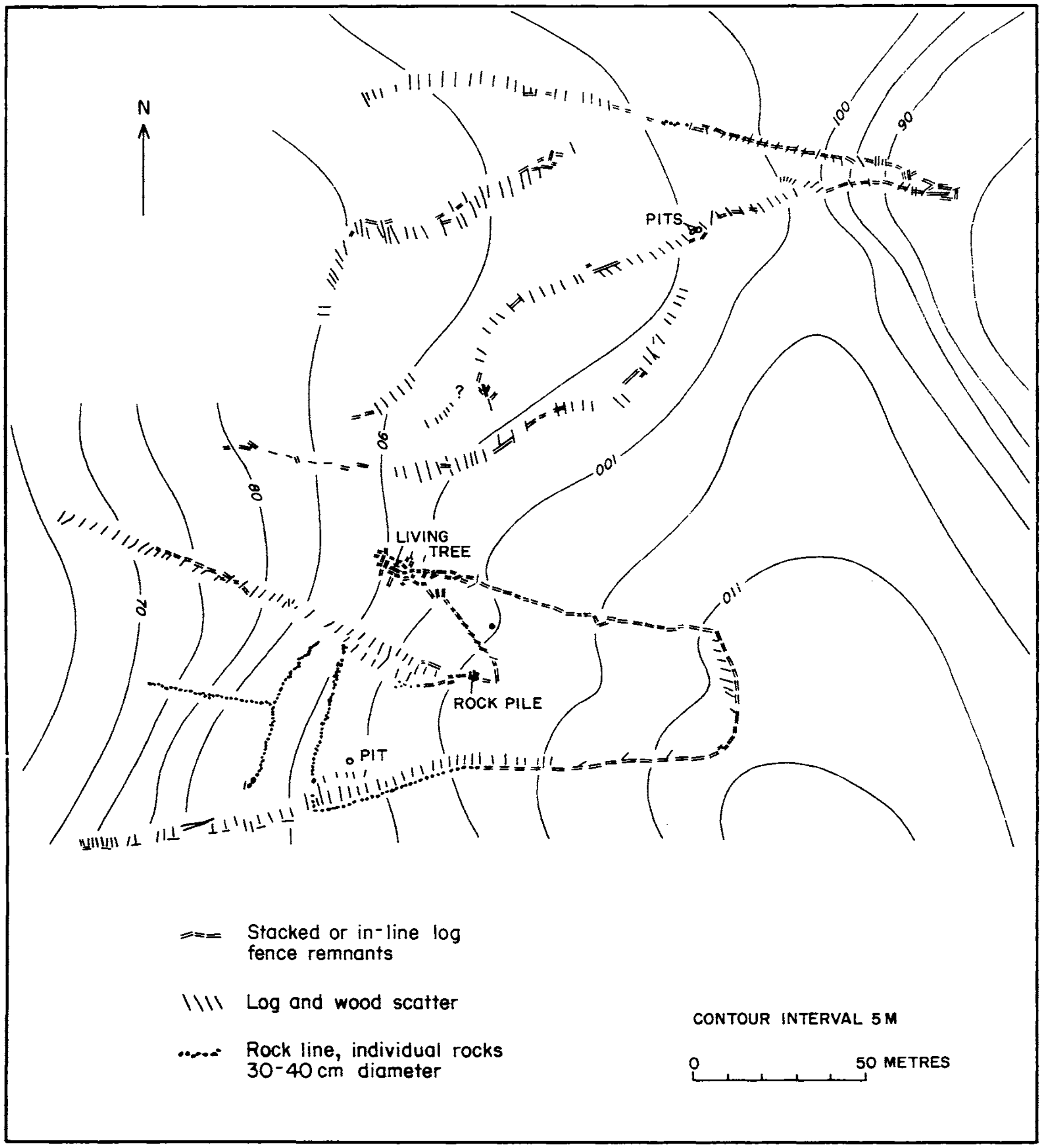

Figure 5. Map of two, and parts of possibly two more, sheep traps at the Black Mountain sheep trap complex in the Absaroka Mountains.

reason to postulate the killing of animals with bow and arrow in the close quarters of the catch pens, even though mountain sheep horn bows are part of the weaponry of the time period and the area; one specimen has been described (Frison 1980). The clubs would have been more efficient at close quarters.

Another group of features associated with the procurement complexes are collapsed structures (Figure 3b) that appear to have no functional relationship to the actual entrapment of the animals. A likely possibility is that these are shaman structures, and that these procurement operations were only carried out with the aid of a mountain sheep shaman in the same way that antelope were trapped in the Great Basin (Steward 1938).

The other major type of mountain sheep traps is found above timberline. The animals frequent large areas of slide rock in their normal movements. Thus, blinds were made by throwing out the loose rock to form a depression that was covered over with small poles transported from below timberline (Figure 6a). The blinds were either put in a series to form communal traps, or were single traps designed for one person to lay in wait for the animals moving from one area to another. There are also some possible shaman structures built of rocks associated with these trap complexes (Figure 6b).

Campsites near the large, communal traps have not yet been found. However, we do know of at least two large campsites in river valleys within a few kilometres of the traps. This suggests the strong possibility that the large traps were operated by hunting groups with spike camps away from the major semi-permanent camps in favorable locations in river valleys. There are the remains of conical and hemispherical wooden structures that may also have been associated with the sheep hunting groups. These are usually well hidden in thick timber and rough terrain. The large campsites also indicate that bison were of more economic importance in the area than formerly thought, and also that there were more bison in the mountains than previously thought. In fact, the last summer's research revealed a large buffalo jump in the Absaroka Mountains that is believed to be of the same age as the Late Prehistoric sheep traps.

Figure 6a. Blind associated with sheep trapping complex above timberline in the Absaroka Mountains.

Figure 6b. Possible shaman's structure associated with the above timberline sheep trapping complexes in the Absaroka Mountains.

Other cultural activity may also have been associated with mountain sheep procurement. Large ram skulls with opened brain cases were placed in trees. In many cases, the trees have grown around the skulls. There is at least one account of these skulls being considered a shrine, with offerings made as hunters revisited the location (Ferris 1940).

It is questionable that the traps were intended for the capture of mature rams. A more likely explanation is that they were designed more to trap ewes, lambs, and immature rams. This is suggested because at least four traps are located in places favorable for taking advantage of large bedgrounds that are commonly frequented by nursery herds rather than mature rams.

The cultural groups involved are believed to have been Shoshonean. The term Sheepeaters is commonly used to refer to these people, but their true status with regard to other Shoshonean groups such as the Wind River Shoshoni is unclear. This area of Wyoming, Montana and Idaho is within the territory exploited by the Wind River Shoshoni (see Shimkin 1947) in historic times. Further research may resolve the cultural affiliations. It is most important at this time to record as much of the perishable data as possible because the wooden structures are rapidly deteriorating.

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CONTRIBUTIONS TO PLAINS PREHISTORY: A COMMENTARY ON THE 1984 VICTORIA SYMPOSIUM

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In the preceding collection of papers, Reeves has reviewed the classificatory schemes currently in use on the Northern Plains. The one that we proposed in 1965 (Wormington and Forbis 1965), which runs through Paleo- to Meso- to Neo-Indian and ends with the Protohistoric and the Historic, has not won general acceptance. The tripartite division is virtually a twin of Mulloy's earlier breakdown into Early, Middle and Late Prehistoric. Most Northern Plains archaeologists combine parts of both schemes. The term Paleo-Indian is widely favoured over Early Prehistoric, but Meso-Indian and Neo-Indian are terms seldom heard. The recent revision proposed by Dyck (1983) -- Early, Middle, and Late Plains Indian -- offers another alternative. Dyck adds a Pleistocene Big Game Hunting Period to the base of his column, while Forbis has used Krieger's Pre-projectile Point Horizon to accommodate finds earlier than those customarily assigned to the Paleo-Indian. Neither term is particularly apt; both could be regarded simply as variants of Paleo-Indian.

It is with the Meso-Indian, or Middle Period, that most of the present confusion arises. In all three of the schemes mentioned above, there is a great deal of latitude for complexes that fall between the Early or Late, or Paleo- and Neo-Indian Periods. None of the schemes carries with it complications of directional change in life-styles, only in time. Essentially, all are based on changes in projectile point types that may (or may not) reflect differences in the weapons to which they were hafted.

Cultural continuity through the Altithermal climatic interval is now generally accepted as a working hypothesis by Northern Plains archaeologists, replacing the concept of a break in occupation. Reeves has proposed dividing Mulloy's Early Middle Prehistoric into E.M.P. I (the Altithermal) and E.M.P. II (the Early Middle Prehistoric as originally conceived by Mulloy). The reasoning is sound, and all gaps are bridged. By using Roman numerals, Reeves has avoided the hazard of coming up with such monstrous labels as Early Early Middle Prehistoric and Late Early Middle Prehistoric.

The term Archaic as a synonym for the Meso-Indian or Middle Prehistoric has taken hold in recent years. It is appropriate for Wyoming (particularly the northwestern mountainous regions), but we are bothered about applying the term to the Northern Plains as a whole. Indeed, the term has filtered into the literature in Montana, Alberta and Saskatchewan, carrying with it implications of a diversified economy which, by and large, remains to be documented for the Northern Plains proper, an area quite distinct from Frison's Northwestern Plains of Wyoming.

As for splitting up the periods, the phase concept has been introduced mainly through the writings of Reeves. Again, phases are essentially based on projectile point types, although occasionally on other artifacts and features as well. Phases have served a useful purpose in refining spatial and temporal boundaries, and in attaining a degree of specificity not achieved before. Unfortunately, sometimes they have been reified into ethnic groups. But in any event, virtually all phases fit comfortably into the periods of all of the proposed tripartite schemes. The exception is the Besant Phase, which is perhaps the best detailed of all. In point types, it is clearly Meso-Indian. However, the presence of ceramics in some Besant sites has led Dyck to include Besant in his Late Indian Period rather than the Middle. Another problem is that Neo-Indian dates for Avonlea are earlier than A.D. 600, the age we proposed originally (Wormington and Forbis 1965), and perhaps erroneously, for the beginning of the period. It is evident that we need many more firm dates, not only for this but all periods.

These difficulties point out the need for archaeologists on the Northern Plains to arrive at a consensus concerning one general classificatory framework useful for present-day purposes. No scheme will last for all eternity, and obviously other classifications will be required for specific goals. But further proliferation of schemes designed for the same ends will serve no useful purpose. Reeves's suggestion for a conference on nomenclature offers one avenue of approach, and general accord at the regional level should prove achievable.

Typology, particularly of projectile points, lies at the heart of Northern Plains classificatory schemes. There are many problems with this typology, some resulting from a lack of knowledge. For example, in early surveys, Wormington recorded points with narrow bases, often stemmed, and noted that similar points were found in the Northwest, but at the time did not recognize similarities between these and other specimens found in California and Nevada -- part of a widespread Western tradition. Recently, Alan Bryan has observed that the western points may have been hafted in socketed shafts rather than split shafts, and that there may be two major technological traditions. It seems possible that both traditions may be manifested in Alberta.

The old problems of the lumpers and the splitters still persist in projectile point typology. The so-called Altithermal hiatus, for instance, could be the result of typological invisibility of some stemmed and notched points inadvertently lumped with types of later age. We suggest that we have found specimens of the Middle Prehistoric which we have not recognized. To establish this as fact, however, we need many more examples that are indisputably Middle Prehistoric in age.

Pettipas has made a very important point in stressing that we must take into account the possibilities of cultural lag and trait persistence. The idea of one point type at one time period may indeed be too simplistic. As early as 1965 we noted that, in Alberta, Alberta and Cody projectile points appeared to be of the same age, but Cody points were more recent in Wyoming. There is a desperate need for more dated sites. And we do need to know more about Agate Basin and Hell Gap, which Pettipas places in his Sister's Hill category. There are problems concerning the relative ages of phases and subphases of the Paleo-Indian Period, and it appears that phases developed elsewhere may not be applicable throughout the Northern Plains.

Gryba's summation of fluted points in Alberta, while admittedly still incomplete, will probably stand as definitive for some time to come. The hopes of finding a good early component on this horizon continue, and the tremendous increase in activity brought about by legal requirements will inevitably pay off. Until then, Gryba's careful survey should be sufficient to satisfy curious archaeologists that Alberta was in a peripheral position for Paleo-Indians in relation to the Plains farther south, and perhaps even to Alaska. We consider it highly unlikely that the fluted point tradition originated in the Northern Plains of Western Canada, although early man may have followed the ice-free corridor in his trek from north to south. Gryba has provided interesting ideas concerning paleoenvironments and the utilization of forested areas.

In order to understand something of the lifeways of prehistoric peoples, we need to know more about the utilization of living areas. The H.M.S. Balzac site, reported by Head, is comprised of multiple floors; the projectile points and associated artifacts and features belong to the Avonlea and Old Women's Phases. It seems strange that so few stratified sites on this time level have been found in Alberta during the past two decades. Few, if any, show the same intensity of occupation as that indicated for the Ross site, which we briefly mentioned in our introduction to Alberta archaeology in 1965. As in the Ross site, the Balzac evidence reflects no dramatic economic shifts through time. Bone and lithic use and artifact styles vary little from one layer to the next, suggesting a fundamentally secure form of man's adaptation to a harsh environment. Probably all of the habitation zones were associated with a nearby buffalo kill.

Klimko has reviewed some recent evidence for Avonlea, and her attention is drawn to contact situations and social interaction with forest oriented Laurel potters. The paper reflects greater emphasis on the environment of prehistoric Plainsmen and their relationships with different groups. The Avonlea question, including a discussion of its status as an actual cultural entity, was recently reappraised at a 1984 symposium of the Plains Anthropological Conference, and the forthcoming publication of the proceedings should provide some answers. Klimko views Avonlea as a widespread complex, but confines herself primarily to dynamics within a restricted northern sector. In this way, she apparently reconciles the approaches of the so-called "Wyoming school" and the "Calgary school", a dichotomy originally proposed by Fredlund in her doctoral dissertation (1981).

In An Introduction to the Archaeology of Alberta, Canada (1965), we devoted only two brief sections to tipi rings, commenting on their abundance in the Northern Plains. At that time, few had been mapped and still fewer excavated. Hot debate raged as to whether the stone circles served primarily to hold down the edges of tipi covers, or whether they served a wider variety of other purposes as well. There was little common agreement even on such elementary considerations as what constituted a tipi ring.

Since then, there has been a concerted research effort on them. The paper by Fredlund et al. exemplifies the finely honed nature of these studies, studies which include contributions by Quigg and Brumley (1984), Finnegan (1982) and others in Canada and the United States. The earlier, surficial investigations were valuable in helping to define variations in shape and size, as well as in defining the location of sites in relation to topographic features, water sources, wind directions and so forth. But with actual excavation, using sophisticated techniques developed expressly for these sites, tipi rings have come into their own. Much can now be said about their function, age, cultural affiliation and variations based on artifact content, activity areas, lithic technology, associated features and radiocarbon dates. Faunal and floral remains recovered from tipi rings offer grounds for statements on subsistence patterns.

Thus tipi rings are no longer subject to pure speculation. Fredlund and colleagues do bring up some issues that still call for further resolution, especially the matter of the nature of the superstructures (if any) associated with the rings. Some questions may prove intractable, but considering the extraordinary advances of the past 20 years, we are optimistic about the prospect of future break-throughs.

Finnegan's analysis of cores and flakes from tipi rings in Saskatchewan is a step toward the cultural identification of lithic scatters. He has provided extremely interesting information concerning the types of lithic materials, and continued studies will no doubt yield critical information in this area. Finnegan's methodology will require further refinement and testing in a multitude of localities, but it is on line with current developments elsewhere in North America.

In 1965, we shied away from identifying archaeological remains with historic tribal groups. We still advocate a cautious approach, and commend the participants in this symposium for harnessing their hunches. Nothing is to be gained by carelessly attaching ethnic labels to simple bone, stone and pottery assemblages. Unless ascriptions can stand the gaff of historical scrutiny, they will only add confusion to literature.

However, Brumley's intriguing case for attributing the Ellis medicine wheel to the Blackfoot is exceptionally convincing. While the case may not stand up in a court of law, Brumley has a powerful argument for the prehistoric Blackfoot occupation of southern Alberta. In this, he has not only relied on the standard plea of coincident distribution, but has refined it and has pointed out direct parallels between the Ellis construction and customary ethnographic practices that are either restricted to the historical Blackfoot or are far more common among them than among other known Plains tribes. It is a report of major interest. While most Northern Plains sites seem much too simple in form and content for Brumley's form of analysis, his ingenuity should nevertheless challenge the interpretive capacities of other scholars to follow his leading wedge. Ultimately, we may be able to speak with some conviction of Northern Plains tribes in prehistory, perhaps even of their physical types.

Speth and Scott depart from the other papers in focusing on New Mexico, not the Northern Plains, and in proposing a theoretical explanation to account for sites which show a change from small game to big game hunting. They suggest that a late shift to bison reflects large and residentially stable communities whose inhabitants had to rely on big game to supply their need for high-grade protien.

In view of the near, if not complete, absence of horticulturists on the Northern Plains, it is obviously impossible to test the hypothesis here. The few sites such as Hagen, Montana, and Cluny, Alberta, would in fact suggest that people who were previously horticulturists quickly moved to dependence on buffalo hunting. Possibly the Speth-Scott model could be rewarding if applied to the Middle Missouri area, and it would be interesting to see if conventional explanations there might not be turned around in some cases.

The emphasis on bison has tended to obscure the importance of other game animals. Frison's paper indicates that mountain sheep had been hunted for some 9,000 years; it is probable that deer and antelope were also utilized. Various finds have been made which provide evidence of methods of hunting and trapping animals. Unfortunately, some of these sites are in jeopardy due to the perishable nature of the structures. It is truly remarkable that a net of such age survives. It is sheer luck when something like this happens, and it reminds us of how much information has been lost and can never be found.

Helmer, Malone and Poplin have developed a novel and promising technique for establishing changing patterns of site use through time and space using statistical, computational and graphic methods. These were used to replace subjective visual inspection, which is often incapable of distinguishing clusters in apparently homogeneous deposits. The method requires a certain competence in the use of computers, but is not highly technical. It may be elaborated to permit the analysis of controlled surface collections from ploughed fields. There are so many visually unstratified sites of this sort on the Northern Plains (and elsewhere) that one must constantly seek to find methods to cope with them. Still in the experimental stage, the technique discussed here is being tested for its predictive value in 1985.

As should be obvious from these comments, there has been substantial progress since 1965, not only in the development of techniques and methods, but also in the interpretive aspects. The roughing out that we did then is fleshing out, adding both completeness and complexity. We have made a beginning in finding answers to some pertinent questions. Our information is still scanty, however. We may be sure that great discoveries lie ahead.

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