THE UNIVERSITY OF CALGARY

THE MAPLE LEAF SITE: AN INTERPRETATION OF PREHISTORIC HUNTING AND BUTCHERING STRATEGIES IN THE SOUTHERN ALBERTA ROCKIES

by

Alison J. Landals

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "The Maple Leaf Site: An Interpretation of Prehistoric Hunting and Butchering Strategies in the Southern Alberta Rockies," submitted by Alison J. Landals in partial fulfillment of the requirements for the degree of Master of Arts.

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ABSTRACT

Reconstruction of prehistoric bison procurement strategies through faunal analysis has resulted in great emphasis on communal kill sites in the archaeological literature. The present study examines a small-scale kill (the Maple Leaf site, DjPo-47) in the southern Alberta Rockies. Analysis of faunal remains and spatial patterning of bone, artifacts, and features in conjunction with stratigraphic interpretations permits the reconstruction of specific small-scale hunting and processing activities.

Miring of bison in a small wetland feature is demonstrated to have been a method of small-group hunting in a seasonal context. Interpretation of small kills in the mountain environment is of importance in the broader context of reconstructing the full spectrum of prehistoric hunting/subsistence strategies in the larger Plains area.

The application of traditional analytic techniques developed from communal kill site studies, while important, is insufficient for interpretation due to the nature of the sample. The application of models developed from ethnoarchaeological research is shown to be a valid method for interpreting small-scale kills.

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Chapter One

Introduction

Bison hunting has been viewed as the primary focus of prehistoric subsistence strategies on the North American plains for the last ten thousand years. The communal aspect of hunting as revealed through large mass kill sites has received greatest attention in the literature for several reasons. Large kill sites are often highly visible and well known, such as Head-Smashed-In Buffalo Jump in southern Alberta (Reeves 1978b), or receive attention due to large deposits of bone being revealed by natural causes such as floods or erosion, as at the Hudson-Meng site in Nebraska (Agenbroad 1978). Large kill sites, particularly jumps, were sometimes used more than once in the past, and the nature of the deposits often results in good bone preservation and the possibility of good stratigraphic control. These sites may yield large samples, which are a necessary prerequisite for many types of faunal studies, particularly of population dynamics such as age and gender (e.g., Frison and Reher 1970; Bedord 1974). Such studies can, in turn, offer insights into the season of kill. Season of kill has important implications for developing local and regional models of subsistence and settlement

patterns, one of the primary goals of modern archaeology. Finally, large kill sites are percieved to offer greater scope for discussing human social behavior, due to the presumed communal, cooperative nature of the activities represented.

As a result of these and other factors, published literature on faunal assemblages in the Plains and adjacent areas has been confined almost entirely to analysis of communal kill sites. A discussion of and exception to this rule may be seen in Johnson and Holliday (1980) and Greiser (1985). A partial list of the more important studies includes: the Casper Site (Frison 1974; Wilson 1974; Bedord 1974), Olsen-Chubbuck (Wheat 1972), Horner and Finley (Todd and Hoffman 1978), the Hawken site (Frison, Wilson and Wilson 1976), Wardell (Reher 1973; Frison 1973), the Vore site (Reher and Frison 1980), Glenrock (Reher 1970; Frison and Reher 1970) and the Agate Basin site (Frison and Stanford 1983).

In a paper discussing the nature of bison death assemblages and communal hunting, Driver states:

> It may well be that the extreme visibility of large scale communal kill sites has led archaeologists to overemphasize the importance of such strategies on the Plains and in adjacent areas. It is worth mentioning that most other hunting strategies have left virtually no trace of kill sites in the archaeological record (1983:151).

Since archaeological evidence for small-scale hunting is rare and perhaps considered to be irrelevant due to the ephemeral nature of both the event and the record it produces, such sites have, for the most part, been unreported in the published literature, if not unrecognized in the field. An analogy might be drawn to the practice of examining projectile points (communal kill sites) and ignoring debitage (solitary or small kill sites). In terms of what percentage of the record these two types of hunting practices may have comprised, this analogy may be quite apt; however, it fails in that archaeologists do not seem to have the ephemeral faunal analog of debitage. This is a direct contrast to ethnographic and historic accounts, which contain numerous references to small-scale, encounter hunting (e.g., Arthur 1975; Roe 1972).

The Maple Leaf site (DjPo-47), located in the Crowsnest Pass of southwestern Alberta (Figure 1) was selected as a suitable site for a study addressing this problem. Data are interpreted to indicate that the formation of this site was a result of a number of small-scale kill and processing events which have been preserved due to the distinctive geomorphological qualities of the landform upon which the site is located. An in-depth analysis of butchering patterns observed in the faunal collection constitutes the primary focus of this

thesis. It is hypothesized that the different set of circumstances involved in small-scale hunting will yield recognizable differences in the patterning observed in the archaeological record from those which have been documented for larger communal kill sites. Although documentation of the observed patterning is the primary focus of research (as well as determining which portions of the patterning can be attributed to human behavior, animal behavior, processes of natural deterioration and inherent characteristics of individual bones), it quickly became apparent that any interpretations would be strongly influenced by overall site interpretation. Thus an initial set of questions relating to baseline site interpretation were developed. Of most importance were 1) How was the Maple Leaf site used throughout its history by prehistoric hunters and their prey? and 2) How does the site "fit" into current archaeological perceptions of subsistence and settlement in the area?

The purpose of this research is two-fold: first, to interpret the Maple Leaf site, specifically the faunal record, and second, to place this research into the larger context of patterned decision-making and resultant butchering patterns in the Plains and adjacent regions.

The Maple Leaf site was selected for study for a number of reasons, including the presence of

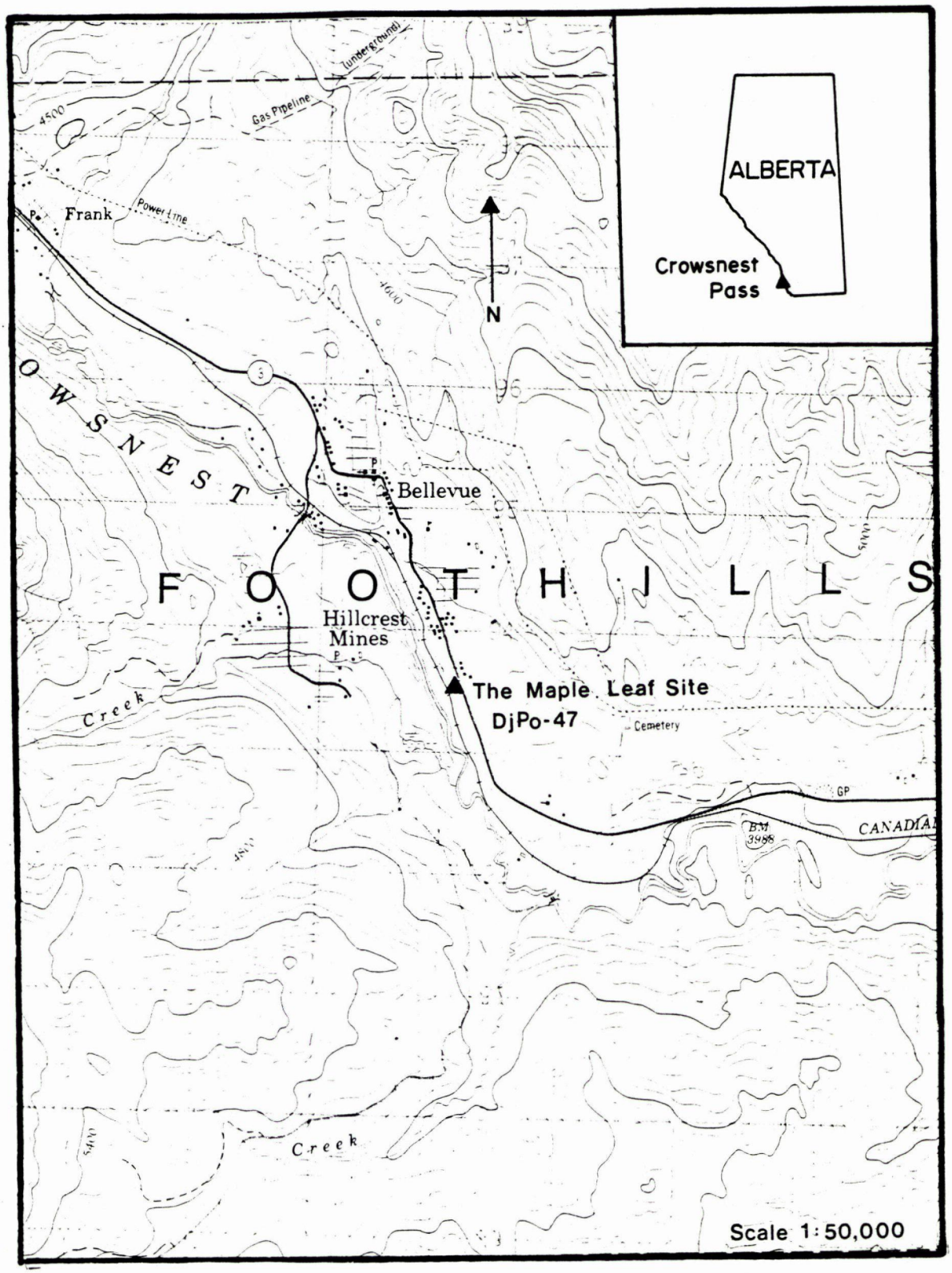


Figure 1 The Maple Leaf Site Location

stratigraphically distinct cultural components dated by typological and radiometric methods from the Early through the Late Prehistoric periods, the collection of a relatively large sample of well preserved bone, the perceptions of previous researchers who felt the sample offered good potential for establishing season of use, and its location within the Crowsnest Pass.

The Crowsnest Pass is the only major mountain valley in Alberta which is not fully or almost completely contained within a National Park, Provincial Park or Forest Reserve. As a result, development in the form of coal mining, logging, growth of towns, and construction of energy and transportation corridors has been ongoing throughout this century. This large-scale and persistent development coupled with Alberta's provincial heritage resource legislation (1973), has resulted in some form of archaeological field research being carried out within the Pass every year from 1972 to date. The combination of salvage oriented archaeology, research projects and field schools has resulted in the Crowsnest Pass becoming archaeologically the best known area of its size in the Province. Sources of interest for this study included a number of graduate theses (Driver 1978; Duke 1978; Ronaghan 1980; Loveseth 1980; Pickard 1981), published and unpublished documents (Reeves and Driver 1978; Graspointner

et al. 1978; Driver 1982; Reeves 1974a and b; Ronaghan 1985), and a large number of consultants' reports (of note to this study is Calder et al. 1976).

Limitations to the study will be considered throughout this thesis, primarily in the methodology section and concluding chapter. Many of these are methodological and/or theoretical in nature and thus require further discussion; however, one limitation worth noting here is the lack of extensive soil analysis. Although soils and pedogenic processes will be discussed, time constraints precluded comprehensive analysis for the purpose of this thesis. While regrettable, this gap is not crucial to the study.

Terminology used throughout for the cultural sequence is that which is in common use in Alberta archaeology, as proposed by Reeves (1969, 1970a) based upon his own research and earlier classificatory systems such as Mulloys (1958). Also used is the system proposed by Driver (1978) for classifying phases within the Crowsnest Pass.

Chapter Two of this thesis discusses the background to the study and its methodology. Chapter Three contains a descriptive summary of the study area and site microlocational factors. Chapters Four through Eight contain component discussions and the bulk of the

interpretations, and Chapter Nine consists of a summary and conclusions.

Chapter Two

Methodology

This chapter will provide necessary background information detailing the sequence of excavations at the Maple Leaf site, results in terms of previously written reports, and explanation of how the primary research for this thesis was undertaken. Terminology for various areas and components of the site will be supplied in conjunction with a series of maps to clarify the various areas of the site for discussions in the succeeding chapters.

Background to the Study

The Maple Leaf site excavations were conducted by a number of different researchers over a four year period. As a result, methods of basic recording, even within one major block, reflect the presence of these different researchers, each with different attitudes towards the site and their reasons for digging it.

The Maple Leaf site was first recorded as a result of an Historical Resources Impact Assessment conducted on Highway 3 in 1973 (Calder et al. 1976). Because the site was threatened by proposed realignment of Highway 3, and

because it appeared to be a relatively rare kill site, it was recommended for test excavation.

Accordingly, in 1975 a testing program was initiated by a private archaeological consulting firm "to determine the extent of site impairment and evaluate intact areas for further excavation" (Calder et al. 1976:64). The site was defined within an area of 180 metres by 30 metres, and was determined to have been extensively impacted by the construction of a small homestead and associated structures, dumping of coal slack from the Mohawk Tipple to the north, and borrowing of soil by local residents for their garden plots. Eight 2 by 2 metre units were placed at various locations across the site.

Of most interest was "Unit 3" which contained a great deal of well-preserved bone and some lithic material in "two to three well separated bone beds" which occurred at 35, 50 and 65 cm below surface (Calder et al. 1976). The uppermost bone bed contained a fragmented atlatl point tentatively identified as Pelican Lake, but the middle and lowest layers contained no diagnostic material. However, a radio-carbon date of 4390 B.C.$\pm$160 (RL-508) was obtained on bone from the lowest bed, which was located just above a horizon identified as Mazama Ash.

Thus, 1975 test excavations revealed that although the site had been impacted in various areas by historic and

recent land use activities, intact areas did exist. The site was of great interest due to: the good preservation of faunal material, the presence of distinct stratigraphic units, the inferred nature of the activities represented (kill or processing), and the age of the lowest bone bed, the oldest kill known in the Rocky Mountains of Alberta at that time.

As a result of recommendations based on this testing program, in August of 1977 further investigations at the site were conducted by the University of Calgary field school (Graspointner et al. 1978). Field school research activities were designed to expose a geological section across the terrace by excavation of a 20 metre long backhoe trench and to expand the sample in the area of the 1975 test, Unit 3. Ten 2 by 2 metre units were completed adjacent to Unit 3 (Figure 2). The two uppermost bone beds as defined in 1975 were initially shovelled out, since "these two occupations were extensively disturbed and in our opinion did not merit further study" (Reeves and Driver 1978:4). Later, a backhoe was used to remove all of the uppermost and most of the middle bed, to facilitate access to the lowest bed. All material from the lowest bed was carefully recorded, mapped and photographed in situ.

The August 1977 excavations were initially designed to stop at the Mazama Ash but excavation of a feature

extending into the ash resulted in the fortuitous discovery of considerable material below the ash. The backhoe trench also contained material below the ash - an unusual, Early Prehistoric projectile point. It became apparent that further testing of the pre-ash levels of the site was necessary.

In the early fall of 1977, further excavations were carried out under a research grant from the Canada Council (Reeves and Driver 1978). Because of a change of on-site directors, recording varied between the summer and fall phases of the 1977 excavations. In contrast to the field school, exact provenience on bone was not recorded, although field notes contain some information on articulating units and distribution of bone by quadrant or half of unit.

All of the ten 2 by 2 metre units in the main excavation area were excavated through the ash to the basal boulder till, and an additional three 2 by 2 metre units were dug. Because the backhoe trench had yielded evidence of two pre-ash components, seven adjacent 2 by 2 metre units and a 1 by 7 metre trench were excavated in the area east of the main trench (Figure 2).

Other activities in the fall of 1977 included an auger test program in which twelve tests were taken to the base of the pre-ash deposits to test for occupation over a wide

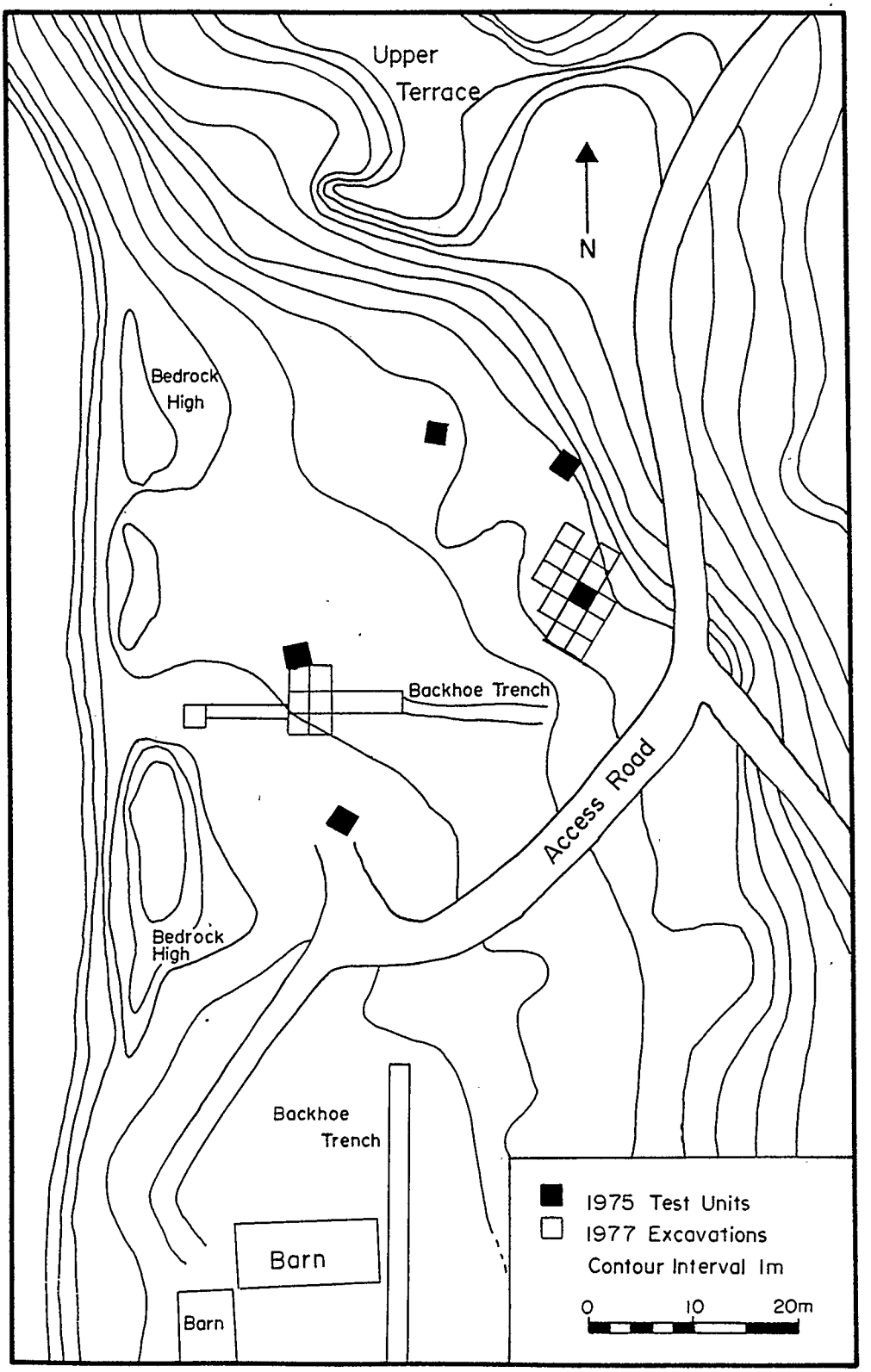


Figure 2. The Maple Leaf Site Excavations: 1975,1977 (after Reeves and Driver 1978)

area of the terrace. A 2 by 2 metre test unit which contained pre- and post-ash components was excavated approximately 175 metres south of the main excavation block. An extensive backhoe trench served to expose a long stratigraphic section between the two areas (Figure 3).

Results of the 1977 field season were presented in two separate reports. The first was a brief summary of the field school activities in manuscript form which was filed with Alberta Culture to satisfy permit requirements (Graspointner et al. 1978). The second report, written by Reeves and Driver (1978) for the Canada Council, included discussions of all material from the summer and fall excavations. Both reports provided views on natural and cultural stratigraphy, lithic and faunal remains, and recommendations for further research. Extensive faunal analysis was not attempted, although both reports contained discussions of perceived butchering patterns, herd composition, method of kill and seasonality. At the time of report writing it was known that further excavations remained to be done and intensive analysis would be counter-productive until a larger sample was retrieved.

Recommendations for further research were based upon several factors. The discovery of below and above ash components at the extreme southern end of the site warranted further excavation. The presence of two possible

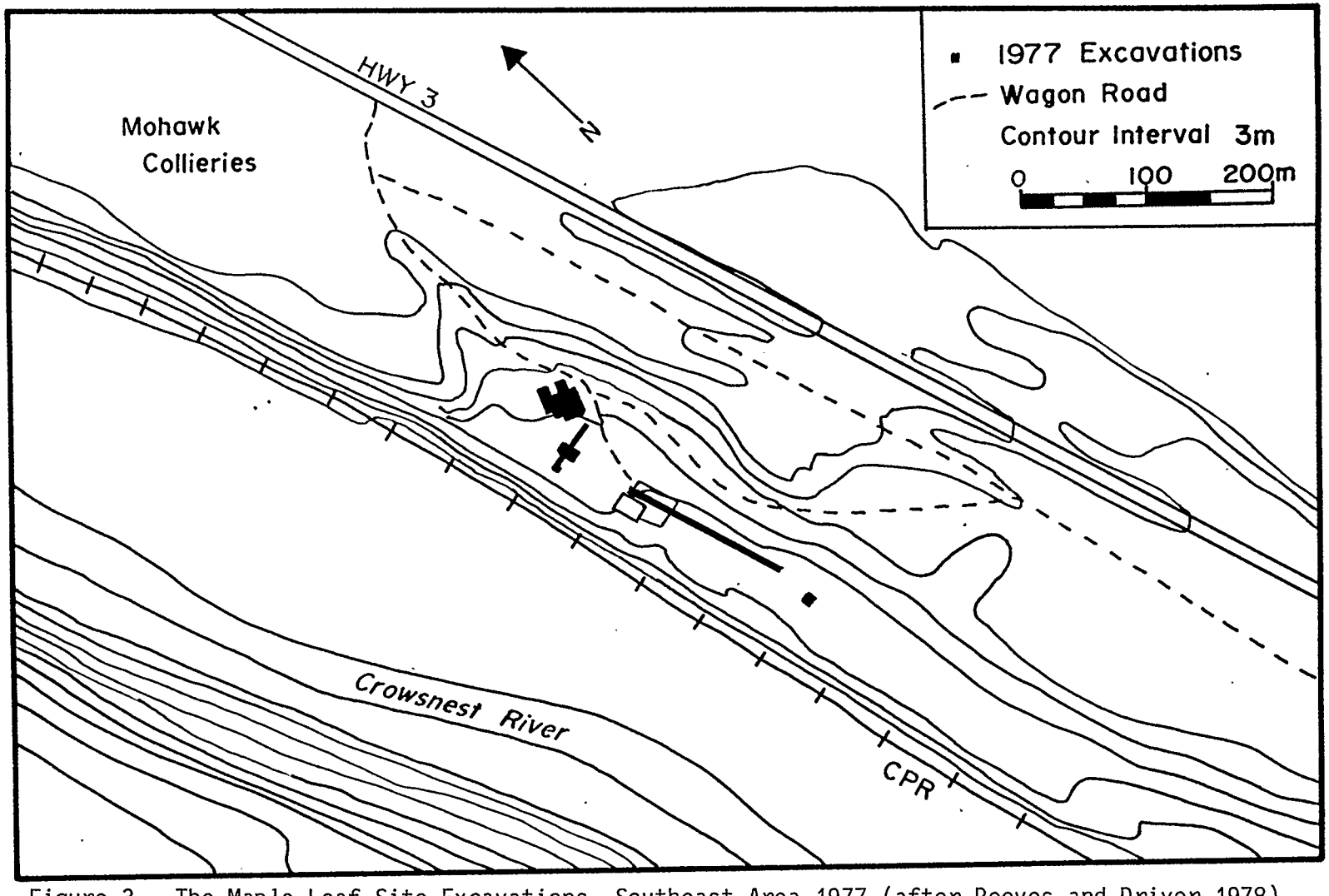


Figure 3. The Maple Leaf Site Excavations, Southeast Area, 1977 (after Reeves and Driver 1978)

post-hole features in the main excavation block, combined with the strong patterning observed in the bone clusters in the post-ash level offered good potential for future studies. Driver (Graspointer et al. 1978) stressed that careful excavation and recording of bone clusters would greatly enhance the interpretive efforts.

In 1978 the last field season at the Maple Leaf site was completed, once again in two distinct seqments. In the main excavation area another University of Calqary field school (in which the author participated as a student) excavated an additional eighteen 2 by 2 metre units to the level of the ash. Excavation methods were meticulous and all cultural material (with the exception of small fragments) was mapped in situ. Three excavation units which had slumped badly over the winter were shovelled out and materials were discarded (Figure 4). Peat deposits became thicker and undisturbed to the north and east, allowing the uppermost bone beds to be recovered from an undisturbed context.

The second segment of the 1978 field season was again completed under the auspices of a Canada Council grant. Twenty-one 2 by 2 metre units were placed in various blocks in the south excavation area. Also those units not excavated below the ash in the main excavation block were completed.

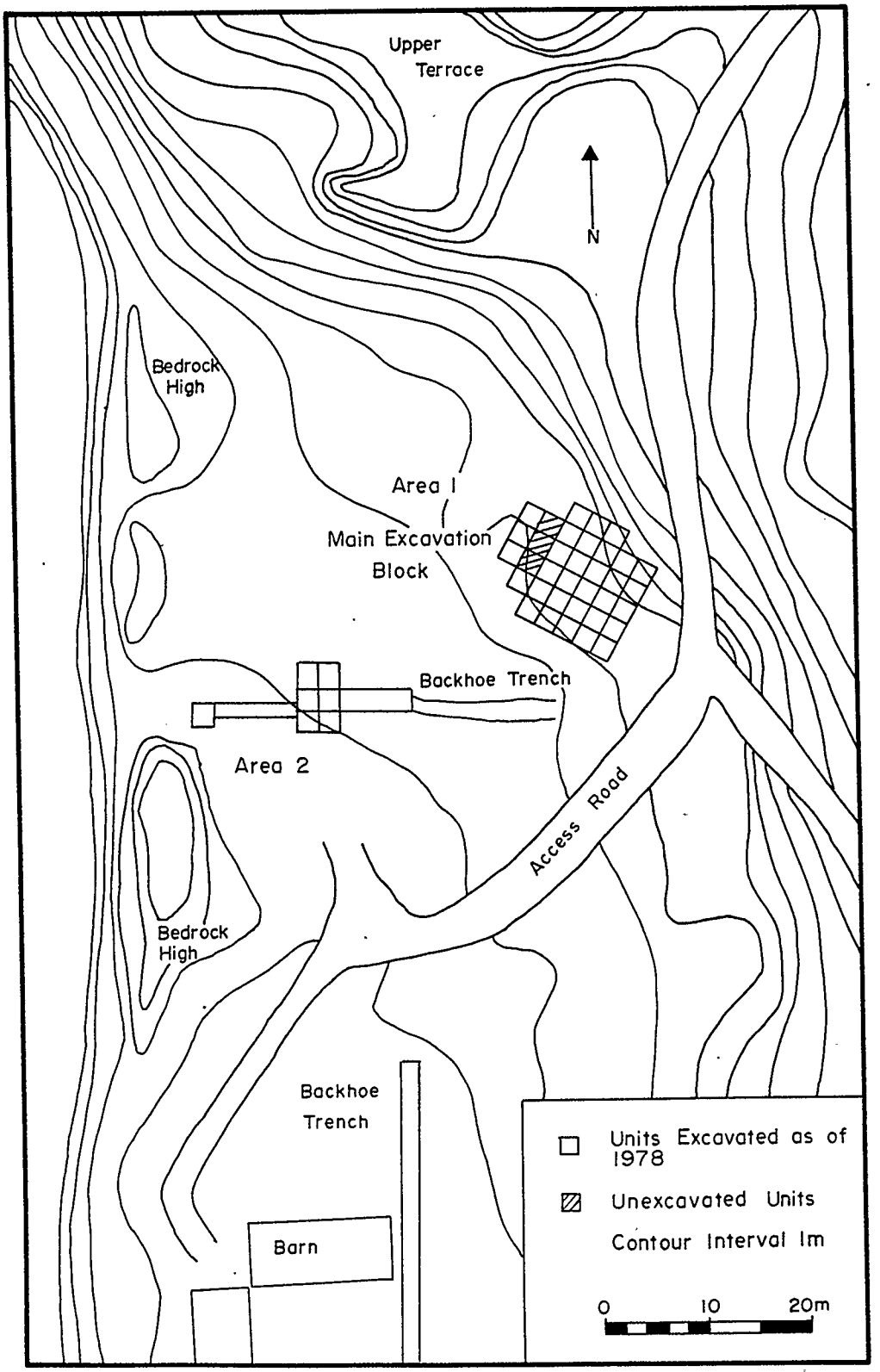


Figure 4. The Maple Leaf Site Main Excavation Area:1978 (after Reeves and Driver 1978)

No report on the 1978 activities has been completed to date, and no further field work has been undertaken.

Summary of Previous Research

Data for this thesis were gathered during the course of salvage, field school and research excavations carried out in 1975, 1977 and 1978. Each progressive year's work built upon prior recommendations and a sizeable sample of various areas of the site was obtained. Although some portions of the uppermost components of the main excavation area were impacted by borrowing, all of the below-ash components and a significant portion of the above-ash components were undisturbed.

Complete level records and notes were obtained by the author, along with photographs, soil profiles, floor plans, transit survey notes, field school diaries, written reports and other data. Difficulties initially encountered due to the different "styles" of recorders were resolved in the course of intensive review and consolidation of several year's work. Provenience data ranged from less than adequate to exhaustive.

This thesis presents the first comprehensive analysis of faunal remains from the Maple Leaf site. In many respects the author's interpretations differ from previous written interpretations (Driver 1978; Reeves and Driver

1978). This is due to a number of factors, including increased sample size, differing levels of intensity of study (preliminary reports vs. thesis research), new methods of analysis (e.g., sexing), and simple differences of opinion (e.g., stratigraphic interpretation) or theoretical stance. In cases where interpretive differences are more than minor, they are addressed in this thesis.

Preliminary Analysis

As was previously stated, all available records from the site excavations were examined as a necessary first step. Some problems were encountered correlating records, but careful re-reading and graphing of the various years research soon cleared up any discrepancies. The careful documentation of field school students was most helpful.

A final map of the excavations was constructed using transit survey notes completed at the end of the 1978 field season. Once the final map was completed it became necessary to standardise terminology. Although previous designations such as "Northwest Site Area - Area A and B" had been used by Reeves and Driver (1978) they were somewhat cumbersome and became confusing after the addition of the 1978 units. Thus, a numeric designation system was arbitrarily imposed which has the advantage of being

consistent and was useful for later computer manipulation of data. Four areas were defined, and each unit numbered from 01 to X within the areas (Figure 5).

Each area was examined as a separate analytical unit. Of primary concern was assigning cultural materials to components. The "tools" used to determine component affiliation included level records, radiocarbon dating, the distinctive natural stratigraphy, presence of diagnostic artifacts, articulating bone clusters, fitting of broken elements and plotting of all faunal material on a series of vertical and horizontal composite plans. Generally, no problems were encountered in any of the four areas with materials from below ash, which were well separated in terms of both vertical distance and depositional matrix. Similarly, the most recent prehistoric levels were for the most part easily distinguished. The only serious difficulties were encountered within the main excavation area (Area 1), where the designations of some material differed somewhat from those defined by previous researchers (Calder et al. 1976; Reeves and Driver 1978). These differences are discussed in Chapter Six.

After each area was examined, an attempt was made to correlate components between areas, which was soon abandoned. Although correlations may exist, especially between Areas (1,2) and (3,4), archaeological evidence was

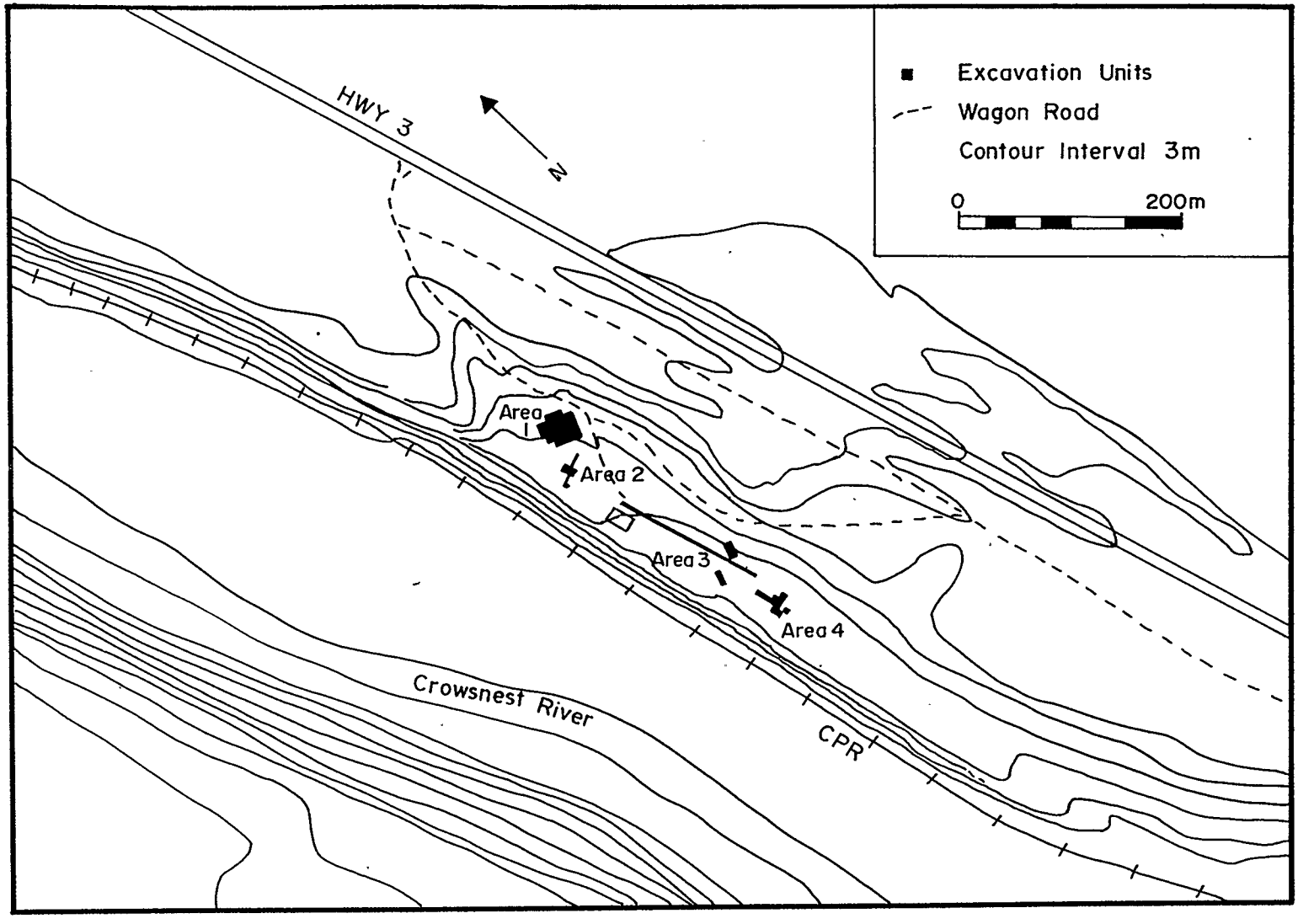


Figure 5. The Maple Leaf Site Final Excavation Plan (after Reeves and Driver 1978)

lacking. It was judged best that each area should be analysed separately.

Faunal Analysis

All of the faunal material from the Maple Leaf site was stored at the University of Calgary, and differences in the treatment of bone from the various field seasons was noted. Bone from 1975 was washed and catalogued by the contracting company. Bone from the 1977 and 1978 Canada Council excavations was still contained in the original field bags and had not been catalogued, washed or treated with preservatives. Materials from the 1977 field school excavations were sometimes still in original bags (unwashed) and sometimes not. None were catalogued, and many had been treated with preservative in the field. The 1978 field school bone was all catalogued, washed and almost invariably soaked in preservative.

Regardless of condition, each piece of bone was re-examined and re-catalogued for this study. Where numbers had been assigned to bone previously and applied to the bone with ink the system was maintained; that is a prefix '78' followed by a number '001' was recorded. Where no number had been previously assigned, a new number was given and the prefix system (i.e., 75, 77, 78) was adhered to.

Each numbered bone (or set of bone fragments) was recorded both on a computer coding sheet and on a file card. The computer coding sheet was modelled after Reeves (n.d.) Head-Smashed-In system, with minor modifications. Pertinent information included catalog number, unit, level, component, species, category (single element vs. fragments), anatomical element, bone unit (see below) side, and various data relating to fusion and approximate age. File cards included exact provenience of bone measured in situ, and specific information on carnivore gnawing, cut marks, pathologies, articulations, etc. Also of note was whether a bone exhibited post-excavation breakage or shovel damage as opposed to prehistoric alteration. When the computer coding sheets were actually entered into a data file the records were streamlined slightly for greater efficiency. Data were categorized primarily by use of the SPSS program "Crosstabs".

The use of "bone units" as a device for cataloguing bone requires some explanation. The term is used in this study to specify particular portions of individual elements with a numeric code - for example, a complete femur is given the number 01, the head of a femur is given the number 02. The "bone units" are based upon a manual developed by Brumley (1980) for the analysis of butchered ungulate remains. The manual contains drawings,

descriptions and code numbers for different portions of the various elements, which are called "butchering units". It has been revised and expanded by Brumley and other researchers, and a 1984 "edition" was used in this study. Various additions were made for this study - for example, there was no code number assigned to the tibia for an element missing only the proximal end. As used in this analysis, the bone units are seen only as a heuristic device, not as necessarily representing any butchering practices. All of the other variables acting upon the record (such as natural deterioration, carnivore activity) must be considered. For this reason the term bone unit was used in preference to butchering unit. However, it is recognised that bones break in different but highly repetitive fashions as a result of a number of factors, which allows the bone unit system to be used - rarely does any bone have more than 50 possible units, and of these 50, only a few occur with great regularity. Which of these bone units may be shown to be a result of butchering will be considered in the interpretations.

Preservation

The condition of the bone upon excavation has obvious implications for this analysis. Preservation of bone at the Maple Leaf site varied a good deal, depending upon the

area and soil matrix. For example, in Area 4 the below ash component was greatly impaired by a variety of natural factors. The thin buried soil below the ash was very close to the water table level, and bone seemed to be very compressed and fractured by natural processes. The combination of these factors made the bone extremely delicate and nearly impossible to conserve. Some of the bone which was identified as to element in the field could not be so identified in the lab, removal and storage having resulted in almost complete destruction. Thus, any reconstructions of the faunal assemblage from below ash in Area 4 must be made with these preservational factors in mind.

In other areas (with different soil matrices) preservation was remarkably good, with even porous bones such as the sternum and patella well preserved. Of most interest is the main excavation area, Area 1. Bone from all of the components of Area 1 seemed to be generally well preserved, with a few cautionary notes. Upon excavation, bone was damp, and at that stage, a trowel could easily dig into the bone and mark it. After a bone was exposed it was usually liberally painted with Glyptal and allowed to dry, after which it could usually be removed in near perfect condition. Many of the bones were etched by roots, and some of the surfaces were altered by natural breakdown.

The state of the bone, and the thick coating of preservatives, could have acted to obscure any fine cutmarks which may have been present. Bone preservation and interpretive implications will be considered in detail in subsequent chapters.

Gender Analysis

Analysis of herd composition has been quite important in archaeological studies of bison kills, due to changes throughout the year in response to behavioral factors such as rut, birth and nursing of offspring. Methods of establishing gender have depended primarily on the presence of skulls (Wilson (1974), Frison, Wilson and Wilson (1976), Speth (1983)), and the application of ratio type statistics to measurements of complete elements such as phalanges (Duffield 1973) and metapodials (Bedord 1974). Recently, a major advance has occurred in the methodology of establishing gender.

Walde's (1985) master thesis, "On Assigning Gender to Post-Cranial Bison Bones", has two advantages, namely: 1) The method can be used on fragmentary samples (proximal and distal ends) of any of the long bones, and 2) Discriminant function analysis is shown to be far more suitable than the previously utilized ratios (see also McCartney 1983). Although the method is new to archaeology and has not been

widely tested by other researchers, Walde's testing procedure will be considered adequate; that is, formulae were developed and tested using animals of known gender and then applied to a series of archaeological samples. The least "successful" equation has a 90% accuracy rate, and several equations correctly grouped 100% of known cases (Walde 1985). Thus Walde's formulae were used to establish gender on all measurable long bones from the Maple Leaf site. Complete metapodials were also tested using Bedord's (1974) and McCartney's (1983) methods. No differences were noted when compared to the results from Walde's formulae, although Bedord's method resulted in more "unknowns". Tables documenting the measurements and results of gender analysis are included in Appendix A.

One theoretical problem with using Walde's formulae relates to the species of the bison under consideration.

> Because the equations derived during the present study use criteria developed from a Bison bison bison sample, it is not possible to justify automatic application of the equations to other species. Indeed, because the variables used in the present study were picked to reflect sexual dimorphism (i.e. size differences) between bison genders and because general body size decreased through time (Peterson and Hughes 1980), it is recognised that at some point females of the larger Bison species will enter the size range of contemporary male Bison, rendering any equations derived during the present study useless after some time level (Walde 1985:30).

Walde went on to test his equations against a variety of metacarpals of various ages, and determined that all bison of over 8,000 years of age were classified as male. No metacarpals between 8,000 and 6,000 years old were included in his study. Thus, he cautions "Potential users of the present formulae are therefore urged to err on the side of caution and apply the equation sets only to material less than six thousand years old" (1985:33).

The analysed sample from Area 1 of the Maple Leaf site contained measurable long bones from immediately above and below the Mazama Ash horizon, dated at 6850 B.P. (Bacon 1983). The oldest date on the material from above the ash (Component 3) is 6340 B.P.±160 (RL-508), consequently that material is just at the limit which Walde established for his formulae. The component immediately below the ash (Component 2) has been radiocarbon dated at around 7200 B.P., and thus extends a thousand years past Walde's limit. However, of the two individuals from this component who were sexed using the formulae, one was clearly male and one clearly female. This result seems encouraging, given that one would expect both to be categorized as male if the animals were beyond the size range of modern bison. A much larger sample would be required to verify these results.

A second, related problem with the use of Walde's formulae is the species designation of Crowsnest Pass bison

in general and Maple Leaf site bison in particular. Driver (1978:35) stated that the species designation of Crownest bison is Bison bison athabascae, thus different at the sub specific level from Plains bison (Bison bison bison). He postulated that mountain bison indigenous to Crownest may have been present within the Pass year round, and the Plains bison may have utilized the eastern portions of the Pass in the winter.

If the size differentiation of the two species was significant, use of the formulae might be problematic. Unfortunately, very little is known about the "mountain bison". Historic accounts have described the mountain bison as both larger and smaller than Plains bison (Meagher 1978:124), although cranial evidence seems to indicate that mountain bison crania are slightly larger than plains bison (Skinner and Kaisen 1947). Wilson discusses the problems of plains vs. mountain bison thoroughly in a 1978 study of possible mountain bison from the Big Goose Creek site (Frison, Wilson and Walker 1978). He suggests the species overlap for the most part, although the older males of the mountain bison fall within the range of Bison bison athabascae, and above the limit for Bison bison bison. Roe (1951, in Meagher 1978) documents historic accounts which concur that the mountain bison was larger, more wary and lived in smaller herds than the plains bison.

Given that Walde's formulae are based on size, it is possible that if mountain bison are larger than plains bison the number of males in a pure mountain bison herd might be overestimated. This is unlikely, since the sub-species differentiation in size would need to be significant. In order to test whether a size difference is in fact present, measurements from the Maple Leaf individuals were compared to those given by Speth (1983) for plains bison. A standard two sample t-test was used to compare measurements from the proximal metacarpal and distal tibia. Data from the proximal metacarpal, which showed slightly more variation, are given in Table 1.

The results of the t-test were such that at the .05 significance level the means of the populations from which the two samples are drawn are the same; that is, there is essentially no difference in the size range of Maple Leaf site bison and the mixed sample of Bison bison bison. Obviously this cannot be taken as conclusive evidence that Maple Leaf bison are plains bison, only that the size range of the sample is not outside the range for modern plains bison. If, as Frison, Wilson and Walker (1978:33) suggest, the two types of bison overlap in size except for the oldest, largest males of mountain bison being larger than the equivalent plains bison, these results are as expected. I believe it unlikely that even if two subspecies were

Table 1. Measurements of the Proximal Metacarpal of Plains Bison and Maple Leaf Site Bison

Plains Bison

		Measurement A	Measurement B
Males	Mean	7.57	4.45
	S.d.	.30	.21
	N	12	12
Females	Mean	6.41	3.83
	S.d.	.25	.30
	N	9	9

Maple Leaf Bison

		Measurement A	Measurement B
Males	Mean	7.73	4.64
	S.d.	.34	.20
	N	11	10
Females	Mean	6.38	3.89
	S.d.	.24	.20
	N	10	10

present there would not be some biological interaction between the groups making taxonomic separation (without good cranial evidence) difficult, if not impossible in an archaeological sample.

In summary, Walde's formulae were used to establish gender for all measurable long bones. Although it is recognised that the species of bison is of primary importance in the success or failure of the method, it shall be assumed that neither the age nor species of the Maple Leaf fauna is beyond the range of correct

application. In no instance does the proximal and distal end of a complete bone yield conflicting reports, and in the case of articulated limbs gender identification is always consistent. As many different formulae as possible were used on each element and none gave conflicting results. Also, the gender composition does not differ greatly from that obtained through use of the admittedly smaller sample of horn cores and complete metapodials.

Age Profiles

Establishing the age profile of bison herds in kill sites had become an integral part of modern plains faunal analysis (Frison and Reher 1970; Reher 1974; Frison, Wilson and Wilson 1976; Frison 1978; Todd and Hofman 1978; Reher and Frison 1980; Wilson 1980a). Tooth eruption and wear patterns are valuable for determining season of kill, nature of kill (catastrophic vs. attritional), life expectancy, environmental variables, mortality rates and for revealing cultural variables inherent in various hunting strategies (Wilson 1980a).

Ageing of individuals within components at the Maple Leaf site was attempted by two methods, neither of which proved completely satisfactory. The first method was that of epiphyseal union; that is, comparing unfused elements in the sample to fusion schedules developed in previous

studies. The standard source for fusion rates is Duffield (1973) who compiled a table of fusion times after Koch's (1935) study of European bison (Bison bonasus). Unfortunately, the rates are not comparable; for example, using Duffield's table the proximal radius does not fuse until the end of the fourth year. Zeimens (1982:214) gives an extremely early date (the end of the first year) for the same event. Until extensive studies of the range of variation in fusion dates for North American bison are compiled this method is problematic. Its utility was also hampered in this study by the small sample of unfused elements recovered from the site. Even when present, unfused elements generally give only a range of possible ages and cannot provide precise age profiles.

Study of dentition, particularly lower dentition, has become the primary method for ageing bison. In order to establish satisfactory age groups a number of criteria must be met. Of utmost importance is a sample of sufficient size with a good range of ages (particularly of young animals) from a seasonally restricted kill. Reher and Frison discuss the methodology of age determination by tooth wear and make these observations.

> After eruption ceases, mandibles are more difficult to age, and their seasonality is essentially undeterminable without good samples of juveniles from the same cohort (Reher and Frison 1980:64).

In the absence of juvenile mandibles, a second method may be used to determine the age structure of a kill population (ibid.). Measurement of molar enamel height can result in clustering of heights around modes representing yearly age groups. If yearly rates of wear can be established and the clustering is sharp enough distinct age groups can be determined, even so precisely as to allow determination of season of kill. Indeed, Wilson (1980a:97) sees enamel height measurement as an important initial analytic step in that the "existence" of seasonality in a catastrophic kill can be demonstrated by periodicity in enamel heights.

Although enamel heights were measured for the Maple Leaf fauna, a major methodological stumbling block was the lack of complete juvenile mandibles from which wear rates could be determined. A second, related problem was the small sample size. Wear rates vary widely in different studies, a factor usually attributed to varying amounts of "grit" ingested. For example, mean wear rates for the Garnsey site bison were 5.96 mm/year (Wilson 1980a:99), for the Vore site were 3.5 to 3.8 mm/year (Reher and Frison 1980:69) and a recent study of a modern herd at Wood Buffalo Park yielded a mean wear rate of 1.7 mm/year (Haynes 1984).

Although the approximate age of individuals was determined for each component, insufficient data were present to define seasonality for most components in most areas of the site. A possible exception is Component Three of the Main Excavation block (Area 1).

Scope of Research

A total of 21,201 individual pieces of bone from the four areas of the site were analysed during the course of thesis research. No firm corelation of cultural levels between areas was possible, and some areas exhibited differential preservation of bone across the site. For these reasons, and due to the large number of bones in the sample, it was necessary to focus interpretation on one area of the site.

The main excavation block, Area 1 (Figure 4,5) was selected for a number of reasons. This area exhibited the best stratigraphic separation of materials, good bone preservation, contained a number of diagnostic artifacts, and had the largest area of contiguous excavation units; 128 square metres in total. 10,312 individual pieces of bone were recovered from this area, by count 39% of the total was identifiable as belonging to a specific element, 19% could only be categorized as rib fragments or vertebral fragments, and 42% consisted of small fragments of

non-identifiable bone. By weight these percentages change significantly: 84% is identifiable as to element, 7% consist of rib and vertebral fragments, 4% is comprised of long bone fragments and only 5% is classified as small, non-identifiable fragments.

Thus, all further discussions of the Maple Leaf site fauna are limited to the sample recovered from Area 1.

Chapter Three

The Physical Setting

This chapter provides a brief introduction to the physical setting of the Maple Leaf site and the surrounding area. This is a necessary prelude to any discussion of the archaeology of the site, however, only a brief overview is intended and relevant sources will be cited rather than discussed at length. Site microlocation is viewed in this study as a direct link to behavioral variables of prehistoric hunters and prey species, and of primary importance to the interpretation of kill sites.

The Study Area

The Maple Leaf site is located on a bedrock terrace immediately above the Crowsnest River. The site is thus situated in the main valley of the Crowsnest Pass within the Front (Livingstone) range. The area which will be discussed was defined to the west by the summit of the Pass, a distance from the site of approximately 30 km along the valley floor. This is a natural boundary, as over the divide the landscape and vegetation changes abruptly, with the valleys becoming more narrow, rugged and heavily forested. To the east of the site the boundary was defined

by measuring approximately the same distance along the valley (30 km) to the junction of the Crowsnest and Oldman River. East of the Oldman, the landscape broadens out from rolling foothills to open plains. Thus, the site is located roughly in the middle of an east/west transect of approximately 60 km defined by the Crowsnest River from its source at the divide (1347 masl) to its confluence with the Oldman (1090 masl). The study area falls within two major physiographic zones, the Rocky Mountains and Foothills of Alberta. The Maple Leaf site is within the Rocky Mountains, but only a few kilometres west of the foothills transitional zone. The area chosen for description is similar to that defined by other researchers (Driver 1978; Duke 1978; Pickard 1981), although it extends further to the east.

Physiography

The physiography of the Crowsnest Pass has been discussed by other researchers (see above). The following section offers a brief description drawn from these sources (primarily Driver 1978), others and personal observations.

The Crowsnest is a low (1357 masl at the summit), east/west trending pass, notable for the extent to which grasslands penetrate deep into the mountains (Reeves 1974a). The north side of the valley is broader and is

characterized by glacial outwash plains, terraces and alluvial fans (Reimchen and Bayrock 1977) with open, dry, grassy south-facing slopes. The southern side of the valley is more rugged, precipitous and heavily treed, largely as a result of surficial geology and aspect.

The presence of the north/south trending mountain ranges acts to constrict the width of the Pass at various locations along its length. Driver (1978:15) describes the landscape delimited by these constrictions as a series of open grassland "basins". From west to east, these extend from Crowsnest Lake to Coleman, Coleman to Frank, Frank to Bellevue, and Bellevue to Burmis. The three westernmost basins are completely within the Rocky Mountains proper, the Bellevue to Burmis basin is transitional to the Foothills zone, and east of Burmis the landscape consists of large, rolling, open grass-covered foothills, and a broader river valley fed by meandering tributary creeks.

Climate

Alberta is located within the Northern Cool Temperate Zone, and has a Continental climate characterized by long cold winters and short cool summers (Longley 1967:53). Winter climate in the Crowsnest Pass and foothills to the east is ameliorated by the high frequency of warm, dry

Chinook winds, which "can cause the temperature to rise or fall as much as 40°F within 24 hours" (Longley 1967:54).

Two Environment Canada climatic recording stations are located within the study area: one at Coleman, within the Crowsnest Pass, and one at Cowley at the eastern edge of the study area in the foothills zone. The Maple Leaf site is located closer to Coleman in distance and physiographic affinity, therefore data from that station for the 30 year period from 1951-1980 will be used in this discussion. The mean temperature for the coldest month (January) is -9.4°±4.1°C, and for the warmest month (July) is 14.6°±1.2°C. The extreme maximum and minimum temperatures for January are 10°C to -39.4°C and for July are 33°C to -3.3°C. Mean total yearly precipitation is 569±110 mm, of which 218.1 mm falls as snow. Peak precipitation is in June, and prevailing winds are westerlies.

Paleoclimate

The Holocene paleoenvironment of southwestern Alberta and southeastern British Columbia has been reconstructed by a number of researchers through the study of fossil pollen (e.g. Christensen and Hills 1985; Ferguson and Hills 1985; Driver, Hills and Reeves 1985; Mott and Jackson 1982; Driver 1978; Bujak 1974), geological deposits and remnant landforms (e.g. Wilson 1983; Jackson, MacDonald and Wilson

1982; Rutter 1972) and pedological analysis (e.g. Wilson 1983; Waters 1979; Reeves 1974a, 1974b, 1975; and Reeves and Dormaar 1972). Of most interest for this research is analysis of a 1977 pollen core from Crowsnest Lake (Driver 1978; Driver, Hills and Reeves 1985) which covers the period from ca. 9000 B.P. until present. The results of this analysis are briefly summarized below.

Deglaciation in the Crowsnest Pass probably occurred relatively early, as a date 13,430±450 B.P. from the Elk River Valley to the west (Ferguson and Hills 1985) would seem to indicate. Following deglaciation a steppe/tundra like vegetation was present, dominated by muskeg and dwarf birch. Forests began to colonise the area by at least 9000 B.P., as the earliest zone of Driver's core (ca. 9000-7000 B.P.) shows that both grasslands and a coniferous subalpine forest were established at that time. The warming trend continued (perhaps with a brief climatic reversal from 8500 to 8000 B.P.) and grasslands expanded from 7500 to 5000 B.P. under the influence of the warmer, drier climate (Altithermal). Since the end of the Altithermal the climate has fluctuated slightly, with colder periods from 5000 to 4000 B.P., 3000 to 1300 B.P., and for the last few hundred years.

Modern Vegetation

The modern and historic vegetation of the Crowsnest Pass has been discussed in detail by Driver (1978) and Pickard (1981). Vegetation is primarily influenced by altitude, climate, surficial geology, soils, slope, aspect and available effective moisture. Within the Crowsnest Pass, Driver defined four broad vegetation communities: grasslands, montane forests, subalpine forests and alpine vegetation (1978:24).

Grasslands are very extensive in the study area, comprising most of the Foothills zone and reaching almost as far west as the divide. Major grasslands are located along the main Crowsnest valley south facing terraces and river bottom. Small, microclimatic/topographic grassland openings are present along some tributary creek terraces, especially on the north side of the valley. Grasslands would have been more extensive during warmer, drier periods in the past (Driver 1978).

The montane community borders the grasslands at higher elevations. Its primary marker is Pseudotsuga menziesii (Douglas fir) and other major species include Pinus contorta (lodgepole pine) and Populus tremuloides (aspen) (Driver 1978:26).

The subalpine community borders the montane community at higher elevations. It is characterized by lodgepole

pine, Picea spp. (spruce) and Abies lasiocarpa (alpine fir). Lodgepole pine is more common at lower altitudes and as a fire successional species, whereas spruce and fir dominate the higher altitudes and form climax stands. Subalpine forest is the most extensive modern vegetation zone within the Pass (ibid.).

Alpine vegetation occurs at the highest altitudes within the study area, and is very restricted in space. Species consist of a variety of grasses, sedges, lichens and wildflowers.

East of Burmis, the study area is primarily submontane prairie grasslands, with fescues and oatgrasses the dominant species (Budd and Best 1964:4). Arboreal species, including Populus and Salix (willow) are most common in the river floodplain, and conifers are sometimes present along high bedrock outcrops.

Fauna

A brief, partial list of modern day fauna and historic species which may have been of importance to prehistoric inhabitants of the study area is given below.

The grasslands of the study area once supported a large population of bison. Driver (1978) states that both "mountain bison" (Bison bison athabascae) and plains bison (Bison bison bison) would have used the area for seasonal

or full-time range. Other ungulates of importance would have been elk (Cervus elaphus), moose (Alces alces), mule deer (Odocoileus hemionus), white-tailed deer (Odocoileus virginianus), mountain sheep (Ovis canadensis) and mountain goat (Oreamnos americanus).

Carnivores would have included: coyote (Canis latrans), wolf (Canis lupus), dog (Canis familiaris), fox (Vulpes spp.), black bear (Ursus americanus), grizzly bear (Ursus horribilis), wolverine (Gulo luscus), cougar (Felis concolor), lynx (Lynx canadensis), bobcat (Lynx rufus), badger (Taxidea taxus) and weasel (Mustela erminea).

Other mammals of importance include the lagomorphs, especially hares (Lepus spp.), and rodentia, including: beaver (Castor canadensis), porcupine (Erethizon dorsatum), muskrat (Ondatra zibethicus), marmots (Marmota caligata) and squirrels (Citellus spp.) (Soper 1964).

Birds of importance would have included various members of the goose, crane, swan, duck, loon, grouse, ptarmigan, hawk, eagle and songbird species (Salt and Wilk 1972). Fish include whitefish, trout, pike, sucker and perch (Paetz and Nelson 1970).

The Maple Leaf Site

The Maple Leaf site is located less than one kilometre south of the village of Bellevue, southwest of the

abandoned coal-mining settlement of Maple Leaf. Bellevue is situated on a broad, open, grassy colluvial terrace (Reimchen and Bayrock 1977), to the north of which is the Livingstone Range (elev. 8364 masl). Just south of the village, the Crowsnest River flows in a narrow, bedrock walled canyon. At the site vicinity the river flows north northwest/south southeast, and the site is situated on an isolated terrace about 15 metres below the level of the broad grassy Bellevue terrace, but above the river by some 20 metres, and separated from it by a sheer sandstone cliff. The terrace is approximately 300 metres long and 50 metres wide (Reeves and Driver 1978:2), and visually it gives the impression of a long, narrow "trough" or "cup" well above the river floodplain, yet almost unnoticeable from the main terrace above it (Plate 1). The site area is very open to sunlight from the south and east, yet sheltered from winds to the west and north. A spring is present at the base of the upper terrace, which forms a small pool of water and localized "mucky" conditions. Driver (1982:266) notes that springs have been active at the site since early postglacial times, creating wet conditions and depositing sediments. Generally, the terrace is open and grassy, although a small stand of mixed aspen and conifers is present along the southeastern portion of the terrace, which is a favored browse and

Plate 1 a) The Maple Leaf Site. View looking east across the Crowsnest River at the site (centre).

Plate 1 b) The Maple Leaf Site. View looking south towards the main excavation area.

bedding area for mule deer. This growth may be a recent response to lack of fires and grazing pressures which would have favored a pure grassland community prehistorically.

Natural Stratigraphy

The stratigraphy of the main excavation area of the site reflects a complex depositional history since glacial times (Figure 6). Since no soil analyses have been undertaken, the following section is based upon the author's field observations and Reeves and Driver (1978).

The basal unit above bedrock consists of a layer of cobbles and boulders interminqled with sands and clays. It probably represents colluvium derived from the Bellevue terrace above the site, deposited in early post-glacial times (Reeves and Driver 1978). Above this boulder pavement is a 20 cm to 30 cm layer of fine clays. Cultural material comprising Component One was located at the interface of this clay unit with the boulder pavement.

Above the clay was a distinctive, culturally sterile band of a white material identified by Reeves and Driver (1978) as marl. The occurrence of a thick (15 cm to 30 cm) band of marl indicates the presence of localized pond conditions at the site, since marl is composed of the shells of aquatic animals and calcium carbonate precipitated in water (Canadian System of Soil

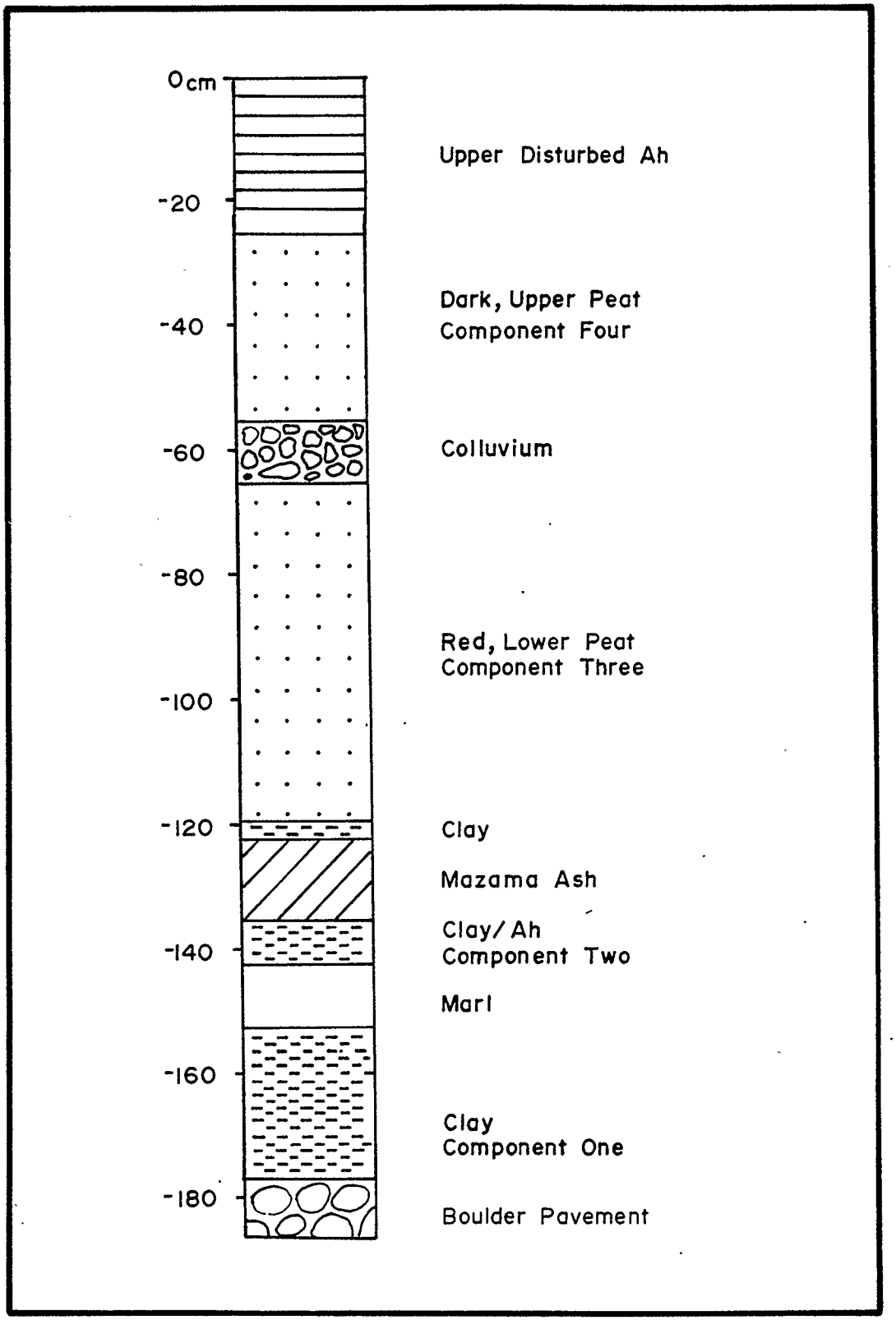


Figure 6. Stratigraphic Profile - Area 1

Classification 1978:29). The marl served to clearly separate cultural materials from Component One and Component Two.

Above the marl was a thin, approximately 5 to 10 cm layer of clay overlain by a discontinuous buried soil which contained cultural material assigned to Component Two. This unit was overlain by a distinctive 10 cm to 20 cm thick band of volcanic ash. The ash horizon varies in thickness across the site, and is probably present as a result of both primary ashfall and some secondary washing or blowing in of material. Mazama Ash has been usually dated at 6600 B.P. (Fryxell 1965) and more recently dated at 6850 B.P. (Bacon 1983), and serves as a distinctive, absolute dated horizon to separate components at the site.

The Mazama Ash is discontinuously overlain throughout the excavation block by a thick to thin (45 cm to 5 cm) band of clay which Reeves and Driver (1978:8) postulated might indicate pond sediments deposited in a short interval after the ashfall. However, examination of the soil profile in upslope areas of the excavation block indicates that this clay band probably originated as a result of long term soil formation processes rather than short term environmental change.

Above the ash is the major cultural material bearing portion of the profile; a very hard, red peat exhibiting

columnar structure and rich in organic material. Peat formation is the result of decomposition of plants in a poorly drained, waterlogged, oxygen poor environment (Pitty 1978:97). The presence of the peat affords an important environmental parameter to site microlocation and human and ungulate use of the area. The peat ranges in thickness across the area, depending upon the location within the excavation block and degree of recent disturbance; in undisturbed locales it varies from approximately 50 cm to 100 cm. Component Three is located within the lower portions of the peat, from about 5 to 50 cm above the ash.

The peat bed is interrupted in the northern portion of the excavation block by a thick colluvial lens of gravels (Figure 6) which originated from the terrace above the site. This gravel unit is very thick in the northern part of the block (about 30 to 40 cm) and gradually pinches out to a thin veneer of pebbles and fine silts further to the south. After the event which deposited the colluvial gravel, peat formation continued, however the upper peat is darker, more friable and has less well developed columnar structure than the lower peat. In the extreme southern and southwestern units there were no traces of the colluvial gravel, but the change in texture of the peat was still noted.

The uppermost prehistoric component, Component Four, was located within the upper peat above the colluvium. This unit was largely disturbed by historic activity in the southern area of the excavation block, and cultural materials from this component were thus largely discarded. The only undisturbed Component Four material was obtained from the extreme northern and eastern units, and thus represents a very limited sample of the whole. For this reason, Component Four will not be considered in this study.

Above the upper peat unit was the "modern" soil zone, which was extensively disturbed by historic activities, to depths of as much as 50 cm below the surface. Fine silty overburden from road construction, coal dust, rotted logs and a disturbed Ah horizon covered with sod formed the upper section of the profile.

Cultural Stratigraphy

The identification of individual cultural units within the natural matrix of the excavation block ranged from a relatively simple task to a very complex one. Components One and Two, located below the Mazama Ash, were well-separated in terms of vertical distance and depositional matrix. Both components were also in effect "sealed", in that the distinctive stratigraphy of the ash

and marl allowed for instant recognition of factors such as rodent disturbance. Thus, no mixing of materials between these components or from higher components took place. It is also assumed that faunal remains from both of these components were buried relatively quickly, given the good preservation of most bone surfaces (although some root etching and a few faint longitudinal cracks suggestive of weathering were noted on Component One and Two bone). Dates of ca. 8500 B.P. for Component One and ca. 7200 B.P. for Component Two have been established. (Dating of the components will be discussed in more detail individually in the following chapters).

Component Three, located immediately above the Mazama Ash, within the peat and below the colluvium, contained the majority of faunal remains and was the primary focus of thesis research. Interpretation and dating of this component proved complex, and is discussed in detail in Chapter Six.

Component Four, located above the colluvium within the upper peat was well separated from lower components but experienced a great deal of historic disturbance. No date has been established for Component Four, which will not be discussed.

Chapter Four

Component One: The Ptolemy Subphase

The earliest component from the Maple Leaf site, dated at ca. 8500 B.P., has been assigned to the Ptolemy regional subphase of the Early Prehistoric Period (Driver 1978). Recovery of cultural material from this component was limited. A total of 526 pieces of bone were analysed, from which by count 55% was identifiable as to element and species, 14% consisted of large ungulate long bone fragments, 4% of large ungulate rib and vertebral fragments and 27% of small, non-identifiable fragments. The assemblage is comprised of faunal remains belonging to three species: mountain sheep (Ovis canadensis), Bison sp. and Canis sp. No lithic artifacts and only a single bone tool were found within the main excavation area. However, in a backhoe trench immediately adjacent to the excavation area, a complete projectile point was found within the same stratigraphic context as Component One materials. Bison bone associated with the point was dated to $8550^{\pm}270$ B.P. (RL-873, Driver 1982).

This point is a well made, lanceolate form, manufactured form a type of brown chert not locally known (Figure 12). It is similar in form to both an unnamed type

described by Frison (1978:38) as a possible variant of Pryor stemmed from the Medicine Lodge Creek site in the Bighorn Basin of Wyoming, dated at 8050±240 B.P., (RL-395) and to a type named "Manitoba" by Pettipas, found in a surface context with Agate Basin like points at the Jalowica site in southwestern Manitoba (Pettipas 1985:49). Pettipas feels that the Manitoba point occurrence post-dates 7500 B.C. (ibid.). It is also similar in form to a point from site 10BY181, and another from site 10BY147 in Northern Idaho (Gough 1984:66,83). Choquette (1984:307) classifies these points within the early part of the Goatfell Complex of the Kootenai region, dating from ca. 11,000-7500 (5000?) B.P. He notes (1982:4) the similarity of this point style to Windust Subphase materials from the Columbia Plateau (Rice 1972). The Maple Leaf site point also appears very similar to a point illustrated by Jennings (1957:93) from the lowest levels of Danger Cave (dated ca. 10,000 B.P.). In a paper summarising the stemmed point traditions in western North America Bryan notes that the distribution and dates for points similar to the Maple Leaf specimen

> ... suggest not only that the style persisted for more than two millenia, but that it was earliest in northwestern Utah and persisted latest in south central Montana, thus constituting an independent confirmation of the general hypothesis that the Stemmed Point Tradition

> originated in the Great Basin and expanded onto the High Plains (1980:94).

Among the species identified in the faunal assemblage are three individuals identified as bighorn sheep, and three individuals identified as bison. A single metapodial attributed to Canis sp. does not permit further discussion beyond noting its presence.

Bighorn Sheep

A minimum number of three individuals identified as Ovis canadensis were found in a small, compact bone feature located at the interface of the fine clay and the basal boulder pavement. The minimum number was assessed on the presence of mandibular teeth from one old and one young individual, combined with the presence of three unfused distal radii (see also Driver 1982). The dentition of the young individual corresponds most closely to that given by Gilbert (1980) for an individual older than 30 months and perhaps very slightly younger than 36 months. A good approximation of season of kill is not possible without more precise studies of dentition and wear rates; however, given a peak lambing date of June 1 (Gilbert 1980:159), a very tentative estimate of spring season, plus or minus several months, may be suggested. The Maple Leaf site is located within the historic winter range of bighorn sheep,

and very close to modern day summering areas on the Livingstone Range. Little concise information on fusion rates for bighorn sheep is available, thus two of the individuals may only be classified as immature, and one as mature. The two immature individuals display very similar states of epiphyseal fusion and are quite close in size; thus both may have been around 3 years old, if either associate with the immature teeth. The mature individual shows heavy wear on the premolars and molars and is likely fully mature to old, rather than newly matured. Driver (1982) presents the data on element representation, cutmarks and bone measurements.

The faunal remains consist of two sets of mandibles, one set of maxillary teeth, three upper forelimb segments, two upper hindlimb segments, and some small rib and non-identifiable fragments. With the exception of one pair of mandibles and one upper hindlimb, all other bones which may be assessed for fusion or articulate with unfused bones belong to the two immature individuals.

Driver (1982:269) states "a plausible interpretation of the bones is that they represent discrete portions of the carcass brought from a kill site for consumption at DjPo-47". He cites the absence of the skull, axial and lower limb elements as evidence for the site not being the kill location and sees the fact that the three carcasses

were segmented in a patterned fashion as evidence for both communal hunting and meat sharing. The results of this analysis also indicate that the site is not the primary kill location, but, the other points of Drivers interpretation, namely that the carcass segments were brought to the site for consumption and that they necessarily represent communal hunting and meat sharing, deserve further consideration.

Binford (1978:60) documented three general types of kill sites among the Nunamiut: piece butchered, head and antlers only, and head, antlers and lower legs only. The kill site from which the Ptolemy subphase sheep originated may have conformed to the third type. Binford interprets the third type of site to be most likely when a) more than one animal was killed and b) transportation of meat from the kill is hindered by a bulk or weight problem. This would be the expected scenario if the sheep were in fact hunted communally at higher altitudes, as suggested by Driver.

Sheep hunting through use of traps has been documented by Frison (1985) in the central Rocky Mountains as an important long term subsistence adaptation. He notes that traps were not likely intended for obtaining mature rams, but were probably used for capturing ewes, lambs and immature rams. The measurements on the mandible of the

mature individual from the Maple Leaf site are very close to those of a modern female, and the population from which the sample was drawn may well have been similar to that cited by Frison as ideal for trapping. However, a distinction should be made between simple trapping and communal hunting of sheep. Driver states "There is some evidence that sheep were hunted communally... It seems unlikely that one hunter could obtain more than a single individual, and at least three individuals are represented" (1982:270).

Frison (1985) documented a number of different strategies for trapping mountain sheep, ranging from small single man blinds to large communal traps. It does not seem at all inconceivable that one or two hunters could kill three sheep, even in a brief one or two day hunting episode. A large scale communal hunt should not be inferred solely on the presence of three sheep.

Driver offered a second piece of evidence for the communal hunting of sheep, namely, that carcasses were disarticulated in a highly patterned fashion and that certain portions were absent, indicating meat sharing. Once again, this does not necessarily follow. The patterned disarticulation of elements is as likely in single dispersed kills as in a larger communal kill. The absence of certain portions of meat and presence of others

may be a function of site type. Driver's interpretation of the site is that it is a location where some of the successful group of hunters brought and consumed "their" share of the kill; in other words the underrepresented meat portions are absent due to 1) being left at the kill and 2) being divided up between other hunters at the kill. Other explanations which shed a different light on hunting practices may also be considered.

A comparison may be drawn between the archaeological assemblage and the modified general utility index (MGUI) for sheep developed by Binford (1978) and applied to Dall sheep in his Nunamiut study. As was expected, when graphed (Figure 7) it was apparent that the Ptolemy assemblage showed no strong relationship to any of the MGUI curves for kill/butchering sites of any season (cf. Binford 1978:79-81), or to the inverse of these curves.

Since the site was obviously not a kill, Driver suggested that the meat had been brought to the site for consumption. With this in mind, the data were graphed against a cull model developed by Binford for hunting camps (Figure 8). This model represents a chain of events in which the sheep were 1) killed and initially butchered, 2) brought back to a hunting camp, 3) culled into portions for immediate use and 4) remaining portions removed to a residential camp.

Table 2. Minimum Number of Individuals (Binford's Method), Ptolemy Subphase

Element	# per Individual	Observed	mMNI	% mMNI
Skull	1	1	1	50
Mandible	2	4	2	100
Atlas	1	0	0	0
Axis	1	0	0	0
Cerv. Vert.	5	0	0	0
Thor. Vert.	12	0	0	0
Lumbar Vert.	6	0	0	0
Pelvis	2	1	0.5	25
Ribs	26	1*	0.1	5
Sternum	1	0	0	0
Scapula	2	2	1	50
Prox. Humerus	2	3	1.5	75
Dist. Humerus	2	3	1.5	75
Prox. Radius	2	3	1.5	75
Dist. Radius	2	3	1.5	75
Carpals	12	8	0.7	35
Prox. Metacarp.	2	0	0	0
Dist. Metacarp.	2	0	0	0
Prox. Femur	2	1	0.5	25
Dist. Femur	2	1	0.5	25
Prox. Tibia	2	1	0.5	25
Dist. Tibia	2	1	0.5	25
Tarsals	6	1	0.2	10
Astragalus	2	1	0.5	25
Calcaneum	2	1	0.5	25
Prox. Metatars.	2	0	0	0
Dist. Metatars.	2	0	0	0
Phalanges	24	0	0	0

* asterick indicates estimate

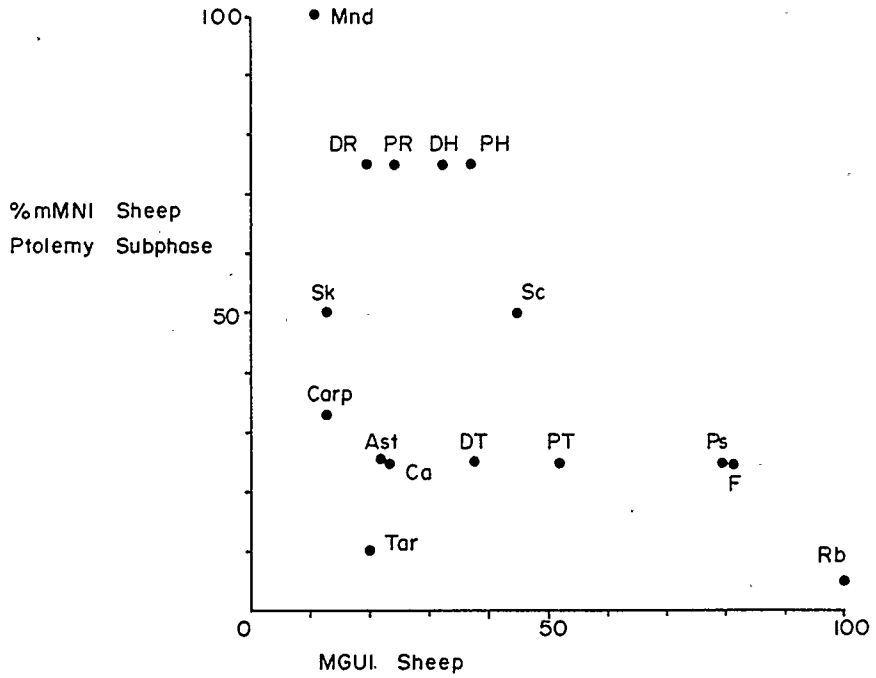


Figure 7. Relationship Between %mMNI Sheep and MGUI

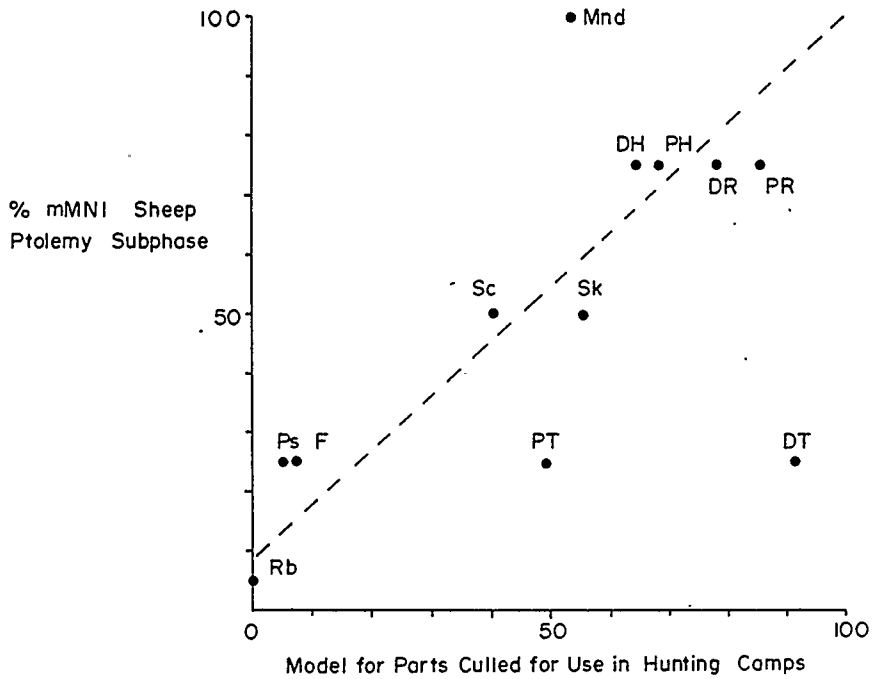


Figure 8. Relationship Between %mMNI Sheep and Cull Model (Binford 1978: 288)

The model for parts culled for use in a hunting camp shows a good fit, with only two elements diverging noticeably from the curve. The mandible is strongly overrepresented, consistent with Binfords findings "... I have previously noted a consistent pattern of unique variability for the mandible" (1978:203). Secondly, the tibia seems to be underrepresented, especially the distal tibia. This may be a result of a problem inherent in the model, in that the tibia is the only long bone with significantly different values for the proximal and distal ends. When an average value for the entire element is calculated, it moves much closer to the value predicted by the model.

Despite the above mentioned variations from the model, the fit is persuasive, especially given the small sample size, the nature of the archaeological record vs. the ethnoarchaeological record, and the underlying sophistication of the model.

Prior to interpreting the Ptolemy assemblage "definitively" as a culled assemblage left at a hunting stand, it was decided as a final test to graph it against the cull model for a camp, i.e., a model developed for a twice-culled sample, initially at the kill, again at a hunting stand. The results were interesting, if not illuminating (Figure 9).

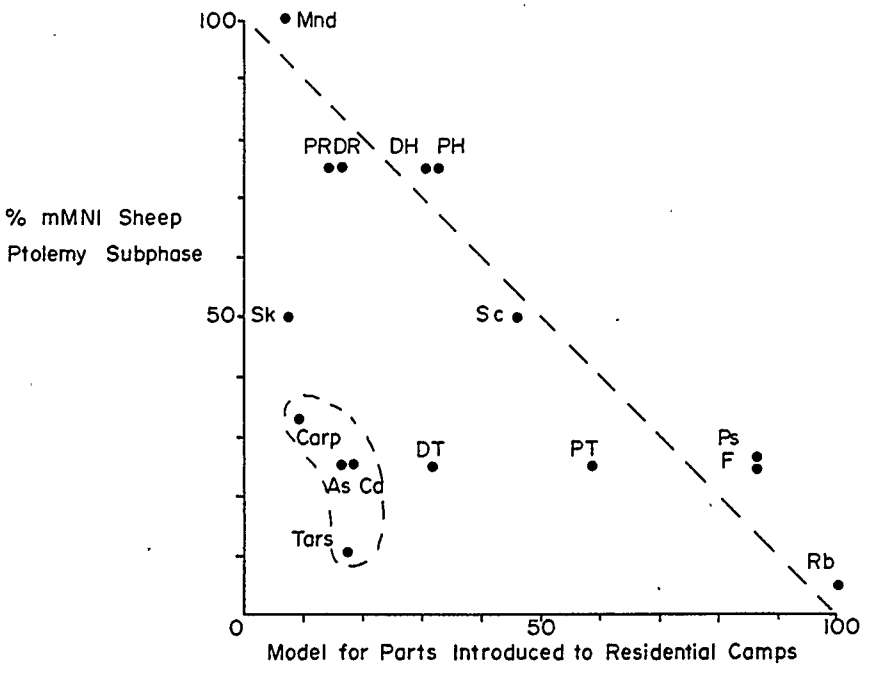


Figure 9. Relationship Between %mMNI Sheep and Model for Parts Introduced to Residential Camps(Binford 1978:289)

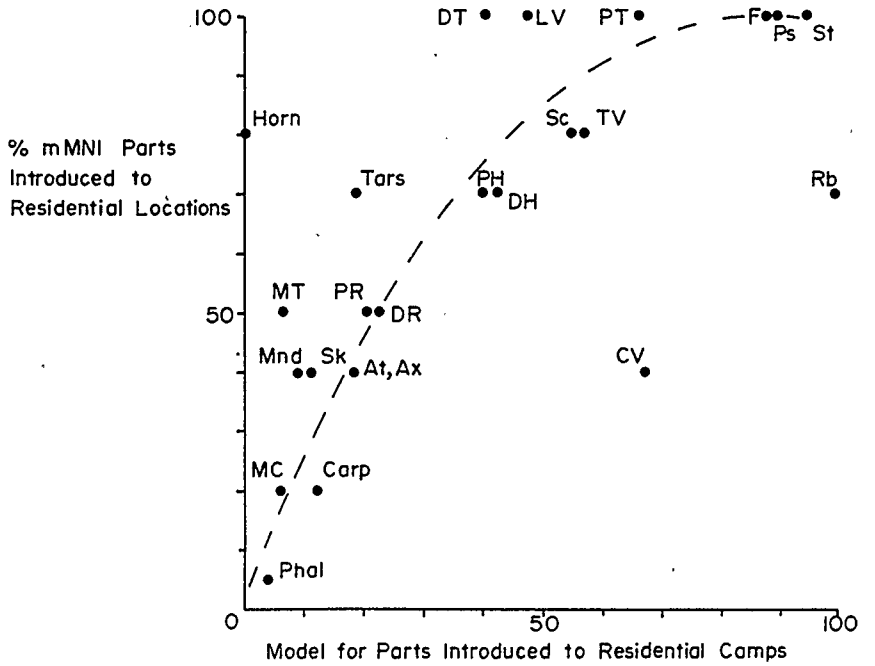


Figure 10. Relationship Between Data for Residential Camps and Parts from Hunting Camps (Binford 1978:292)

A strong linear relationship was defined with a small, tight cluster of divergent elements. The curve defined by the graph is, however, the inverse of that predicted by the model - the elements of lowest utility (after two culls) are favoured over the ones of highest utility. For comparative purposes an example of the expected results are reproduced from Binford below (Figure 10). From the Ptolemy assemblage, only the carpals and skull are anywhere close to the position predicted by the model.

Further graphing of the Ptolemy assemblage against numerous models and examples presented by Binford is possible, but probably not necessary given the nature of the sample and results already gained. The following conclusions may be drawn. First, the assemblage does not represent either a kill site or a camp site as defined by the simple inverse of a kill. Second, a secondary culling strategy based on decision making in terms of the modified general utility of elements is strongly suggested. Third, the fit to the model of a culled assemblage remaining at a hunting stand after initial butchering at a kill and prior to removal to a camp is good.

From these conclusions an alternative interpretation of the site may be considered. Rather than representing the remnants of specific portions of meat allotted to individuals from a communal hunt, the site may have been

occupied as a short term hunting stand. Thus the observed carcass portions would not have been brought to the site for consumption; rather, they were consumed for the upkeep of the hunters in preference to the more choice or "valuable" (in terms of utility) portions which were removed to another location. It should be mentioned, however, that no evidence for cooking was recovered from this component. A single bone tool, a small section of bison humerus shaft exhibiting rounded edges and polish, was recovered in association with the sheep bone. This tool was probably used as a skinning implement or for defleshing skins. Driver (1982:269) suggested it may have been used as an expediency tool during butchering.

Another possibility is that the sheep remains may have been cached at the site, either temporarily or on a short term basis. Portions could have been selectively removed in terms of utility over a period of days or weeks, resulting in the final configuration of elements. Ample material for building a cache (in the form of large cobbles) was present immediately around and throughout the feature, the compact nature of which argues for a well defined disposal unit or cache type feature. Such behavior might be postulated in a winter or early spring kill. It is notable that the elements at the site were not abandoned unutilized - the presence of a number of cut marks

associated with meat stripping or filleting and bone breakage characteristic of marrow extraction indicates utilization of most of the elements.

Finally, coming full circle, there is no evidence that the sheep were not communally hunted and the meat "shared". However, the patterning apparent in the Ptolemy phase assemblage could be equally attributable to a culling strategy based on a highly developed knowledge of differences in utility of various groups of elements, as was demonstrated by Binford for the Nunamiut.

Bison

The bison remains from this component were of a different nature than the sheep remains. Bones identified as bison consisted of very scattered, sparse, fragmentary remains which exhibited significant carnivore damage and some natural deterioration. The minimum number of individuals represented by teeth is three, but when all other post-cranial elements are considered, only one individual may be inferred.

Dental remains are too few to arrive at firm estimates of seasonality or precise age at time of death. Using criteria developed by a number of researchers (Wilson 1974; Frison and Reher 1970; Fuller 1959) a generalized age profile may be established. One individual represented by

an unworn upper third premolar was probably between 2.5 and 3.5 years of age. A second, mature individual of 6 to 7 years is represented by left mandible fragments, the fourth premolar and all molars in full, moderate wear. A third, old individual (perhaps 10 years plus) is represented by extremely worn first, second and third lower molars.

Post-cranial elements represent a single, immature individual - an unfused distal metacarpal and metatarsal and a first phalanx with an unfused proximal end may indicate an animal younger than 3.5 years of age (Duffield 1973). Other elements which may belong to the same individual include a delicate proximal radius, some small carpals and a small astragalus and lateral malleolus.

Other elements not identified as to age include a number of pelvic and sacral fragments, long bone fragments and some small, non-identifiable fragments.

Carnivore gnawing was noted on the shafts and distal epiphyses of the immature metapodials and also on several mandibular fragments. No obvious signs of butchering, such as cutmarks, impact scars or spiral fracture were noted on any of the elements. It is thus extremely difficult to determine whether the assemblage represents an archaeological or natural occurrence. The old age of one individual and relatively young age of another, in combination with obvious carnivore attrition and the

sparse, scattered nature of the remains may point to a natural assemblage built up over time or to a carnivore ravaged archaeological assemblage. No stone tools or features were noted in the main excavation area, although the Early Prehistoric Period projectile point previously discussed was located in association with bison bone in the adjacent backhoe trench. Another projectile point - the midsection of a lanceolate form - and a single chalcedony flake were found in the same stratigraphic context as Ptolemy subphase materials in excavation Area Two. It is likely that at least part of the assemblage is archaeological, given the presence of these artifacts, however little can be said about the nature of the activities represented. Further excavations in the area of the backhoe trench might yield definitive evidence.

Chapter Five

Component Two: The Early Maple Leaf Subphase

Component Two is located stratigraphically just below the Mazama Ash and a radiocarbon date of 7200± 230 B.P. (RL-876) helps to place the component within the Early Middle Prehistoric period. Driver (1978) defines only one subphase for this period, the Maple Leaf subphase, and Component Two falls into the Early Maple Leaf subphase.

A total of 1,150 pieces of bone were recovered from this component. By count, 18% is identifiable as to element, 40% consists of small rib and vertebral fragments and 42% consists of small, non-identifiable fragments. By weight 83% of the total is identified, 10% consists of small rib and vertebral fragments, and 7% consists of small, non-identifiable fragments. With the exception of two canid mandibles belonging to a single individual, all bone has been classified as bison. A single shed antler, identified as Odocoileus virginianus, does not associate with this component but will be discussed at the end of this chapter.

No diagnostic lithic artifacts were found within the main excavation area, but in Area Two of the site in a similar stratigraphic context immediately below the ash a

single projectile point was recovered. Reeves and Driver (1978:12) describe the point as comparable to the Elko Eared Type, which occurs in pre- and post-Mazama Ash contexts. This type is rare in the northern Rockies (ibid.).

Only three lithic artifacts from Component Two were recovered from within the main excavation area. These consist of a small flake end scraper, a chert flake fragment and a rounded pebble hammerstone which exhibits pitting and use wear. This hammerstone would have been suitable for breaking bone open to extract marrow.

A fourth item, which may be artifactual but is most likely a natural occurrence, is a small, very smooth, spherical stone. The stone is rough-textured with a smooth "rind" of material which is spalling off. This outer rind has been identified as pure silica by X-ray diffraction (C. Nahnybida personal communication 1986). It is an isolated occurrence within the deposit, and could have been brought onto the site or formed there naturally.

Bison

The bison remains associated with this component contrast markedly with those described for Component One. Although the bones are not plentiful, they are present in small distinct clusters of articulating elements. No

obvious signs of carnivore activity were noted on any of the remains, which are quite well preserved. The articulation of a number of well preserved long bones allowed for sexing of all limb bones using criteria developed by Walde (1985).

Essentially, the assemblage consists of one right and one left male forelimb, one right and one left male hindlimb, a single female metatarsal, and some fragmentary axial elements (primarily rib shaft fragments) and non-identifiable pieces. Given the configuration of male limb elements, the possibility that all four limbs belonged to a single individual is suggested.

Examination of the bones and their measurements and comparisons to other materials seems to confirm that either a single individual is represented or that the limbs are from different individuals of identical size. The size range of the various elements in comparison to elements from later, post-ash components is worthy of note. While it was expected that the male individual from this component would be larger than males from the post-ash components, this is not the case. Generally, the Component Two male is among the largest, although not the single largest, for each of the measured long bones. A possible explanation may be the age of the Component Two male at time of death. Using criteria given by Wilson (1974) for

maxillary teeth, three upper molars from a single individual were assigned an approximate age of 4.6 years. If these teeth belonged to the male individual, then it would have been newly matured and could have expected greater size with continued aging. The association of the teeth with the limbs is speculative, however. The limb elements which could be assessed for fusion also provided some clues to the age of the individual. The humerus and radius both showed complete fusion, however the distal metacarpal (although nearly completely fused) showed a very faint, intermittent line between epiphyses and diaphyses. The distal tibia and distal metatarsal showed a similar pattern - near complete fusion with only faint intermittent lines visible.

Thus, the individual, although fully mature, would have been a young male, and greater size would be expected in an older individual. Interestingly, the single female metatarsal recovered from Component Two is the largest of all female metatarsals from all components.

Interpretation of the perceived butchering pattern and site type is hindered by the small sample size and unusual composition of the sample. The axial skeleton is poorly represented in the sample, due to its fragmentation as well as lack of specific elements. The skull is represented by small fragments of the frontals, maxilla, horn cores and

teeth. Small mandibular fragments and a single lower premolar are also present. The vertebrae are represented primarily by fragments of transverse and spinous processes and small body fragments. Ribs consist primarily of small mid-sections. Some tiny fragments attributed to the pelvis and sacrum are also present.

The right forelimb is represented by the humerus, radius, ulna, two carpals, metacarpal, fifth metacarpal and a single first phalanx. The left forelimb is represented only by lower elements, a complete set of carpals, the metacarpal and a complete set of phalanges. The radius, carpals, metacarpals and phalanges do not exhibit any signs of butchering, being either present and complete or absent altogether. The humerus and ulna are the only elements which exhibit breakage - the humerus has the proximal one third of the element removed above the deltoid tuberosity and the ulnar shaft is separated from the rest of the element. A few scapula blade fragments may associate with one or both of the forelimbs.

The hindlimb segments both consist of femur, tibia, a complete set of tarsals, metatarsal and some phalanges (missing were one left second and one left third phalanx, and the right third phalanges and one right first phalanx). Some sesamoids are also present. Once again, the limb elements from the tibia down are all complete and

unbutchered. Both femora are essentially complete, however both experienced some damage during excavation and storage. Due to this, it is difficult to establish whether the bones had been butchered - both may have been smashed open just below the head, through the area of the neck.

This configuration of bones, an assemblage dominated by four complete limbs and a single metapodial from a second individual, does not seem to fit any preconceived pattern of a specific archaeological site type. The possibility that the assemblage was produced as a result of carnivore activity or natural death was suggested. If the death was natural and had remained undisturbed, the skull and some articulating axial elements would be expected in close association with the limb elements. Similarly, the degree of fragmentation noted for axial elements would not be expected, even given trampling by other ungulates during the period before burial (Haynes 1981:381).

It is possible that the bison died a natural death and was later scavenged, or was killed by carnivores. Haynes (1981) completed extensive studies on modern day bison kills and scavenging locales of wolves in Wood Buffalo National Park. He notes:

> Splinters of ribs and vertebrae commonly mark the original death sites of the prey animal, and are usually surrounded by bits of hair and rumen and gut contents. The rest of the skeleton may be dragged, partially

> articulated, many metres away (except in the case of adult bison bulls, whose carcasses are seldom moved (Haynes 1981:321).

Haynes also states "The skull of adult bison always occur at or within a few dozen metres of the original carcass site, even when all but a very few other bones remain" (1981:324). Carnivores need not leave any trace of chewing on the skeletal elements of their prey. Haynes documented several cases where carcasses were utilized only for gut, rump, rib-cage and shoulder meat (1981:253) and found that

> Even on well-utilized carcasses, such as moose or bison killed by wolves and fed on by more than one pack for up to three months after the original kill date, whole lower legs may remain articulated from the femoral head or proximal end through the hooves (1981:94).

In summary, given the scarcity of the lithic remains, absence of features and lack of alteration to the bone in a manner distinctly human, it is difficult to characterize this assemblage as archaeological. Similarly, the absence of extensive impact to the bones in a manner definitively recognizable as carnivore related - e.g. tooth marks, punctures, furrowing, scoring (Binford 1981), results in only a tenuous interpretation of a natural kill site. Given the presence of lithic remains and the presence of canid mandibles in association with the bison remains, evidence for the presence of both humans and carnivores at

the site is present; however neither of these need have been contemporary with the kill. If this assemblage is in fact cultural, it may simply represent a situation in which a male bison was encountered, killed, perhaps skinned, and left largely unaltered except for the removal of "choice" portions, such as the organs, tongue, humpmeat and tenderloin (cf. Wissler 1910:42). Such incidents must have occurred many times in the past, and would potentially leave few or no material traces. Scattering of the carcass afterwards could have resulted from carnivore activity or natural causes.

Canid Remains

Two complete, unbutchered mandibles of a single individual tentatively identified as Canis familiaris were present in this component. No other bone identified as canid was recovered. Identification of the canid as dog was done using visual criteria outlined by Gilbert (1980:66), Driver (n.d.) and comparison to specimens of known species. Driver (n.d.) in a study of dog mandibles from archaeological sites in Alberta, defined four types of prehistoric dogs - small, medium, large and extra large. The extra large dog, which he called the Belly River type, occurred in Avonlea and Old Women's phase sites. An individual from the post-ash component of the Maple Leaf

site was also included in this category. The specimen under consideration here had not yet been recovered and as a result was not included in Driver's study; when compared to Driver's results it fits within the Belly River dog range rather than the wolf range.

The probability of wild and/or domestic wolf-dog hybrids complicates the identification of archaeological specimens. Walker and Frison (1982) in a study of Wyoming canids successfully used discriminate function analysis to separate out wolves, coyotes, dogs and large Wyoming canids (assumed to be wolf/dog hybrids). This method depended upon the presence of skulls and cannot be used in this study. Of interest however, is their bivariate plotting of lower premolar and molar tooth row lengths against the length of M_1, after a method outlined by Bokonyi (1975). This proved to be a useful and simple method for distinguishing the various sub-species. When the 7200 year old specimen from the Early Maple Leaf component was plotted against Walker and Frison's samples, it was shown to be larger than Eskimo dogs but smaller than the Wyoming hybrids (Figure 11).

The lack of the skull precludes any further analysis. If this specimen is a wolf/dog hybrid, it is definitely smaller than the Wyoming hybrids. This could relate to the

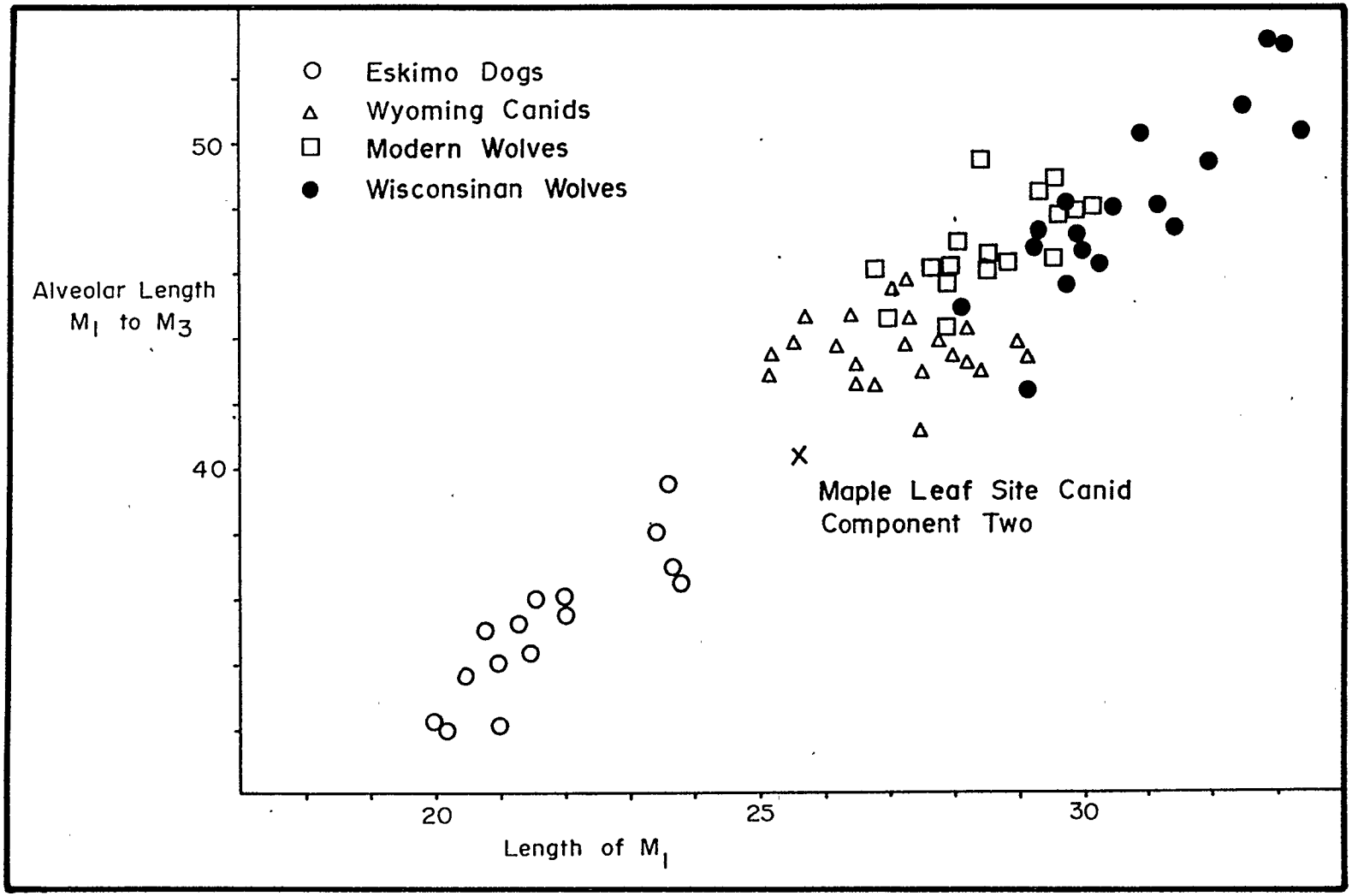


Figure 11 Bivariate Plot of the Molar Row/M_1. Adapted from Walker and Frison (1982).

size of wolves in southern Alberta, or it may indicate that this individual is simply an "extra large" dog.

No cut marks or signs of carnivore damage were visible on the mandibles. The teeth on the left side showed slightly more wear than the right, which were unworn except for a small circle of wear on P_4. The left M_1 exhibited wear on all cusps, as did the left canine.

Deer

A single antler, identified as Odocoileus virginianus (M.C. Wilson personal communication 1985), was found within the marl separating Component One and Component Two, and thus can be dated between ca. 8500 and ca. 7200 B.P. This is the earliest recorded occurrence of white-tailed deer to date in Alberta, but it does not constitute a culturally-related find, since the antler was shed naturally and was found within a culturally sterile marl deposit. Wilson and Hills (1984) reported the only other identified white-tailed deer from Holocene deposits in Alberta, again from a probably non-cultural context - the Hitching Post Ranch assemblage, dated at 3600 B.P. They noted the importance and potential of white-tailed deer as indicators of paleoclimatic conditions, since this species is particularly vulnerable to deep snow and low winter temperatures (Wilson and Hills 1984:365). Since antlers

are shed between December and February, they are indicators of the white-tailed deer's winter range, which would necessarily not be colder or experience harsher conditions than modern winter ranges (1984:370). This interpretation fits well with previously discussed paleoclimatic interpretations of this period as being warmer and drier than modern (Driver 1978; Driver et al. 1985).

Chapter Six

Component Three: Site Formation and Spatial Patterning

Component Three, located within the main excavation area immediately above the Mazama Ash, contained the majority of faunal remains, lithics and features from the Maple Leaf site, and was the primary focus of thesis research. The complexity of the observed distribution of faunal remains and features resulted in major methodological problems. Of primary concern was whether the component represents a single event or short series of events, or if it had built up over a considerable period of time. This question is crucial to any archaeological study, particularly of faunal remains, since many methods of interpretation (and theories) are predicated on the assumption of a single event.

Stratigraphy and Bone Distribution

The matrix containing cultural material assigned to Component Three consists of a very hard, blocky, red peat, immediately above the Mazama Ash and below the colluvial unit (Figure 6). This peat varies in thickness according to its location within the excavation block and the degree

of recent disturbance. Material assigned to the component varied in depth between 5 cm to 50 cm above the ash.

The faunal remains from Component Three, although dense, were not distributed in the form of thick, continuous bone beds such as those illustrated for a number of plains bison kill sites (e.g., Frison 1978:170,226,233). Instead, the bones were present as clusters of elements distributed differentially throughout the peat. In some areas of the excavation block elements would be distributed more or less evenly throughout 45 cm of peat; and elements separated by as much as 20 cm vertically were shown to articulate. In other areas, elements would be densly packed over several metres horizontally and vertically restricted to 10 cm to 20 cm "mini" bone beds. Often single limb bones and articulating limb units in close association would be oriented at very different angles (vertically, horizontally, steeply angled, upside down). Finally, in the extreme southern portion of the excavation block the distribution of elements became extremely dense within and adjacent to a large natural feature.

This feature (Feature 3) consisted of an area where the typical lower red peat was absent; in its place was a depression extending downwards to the boulder pavement, which was filled by a yellow brown sandy/silt which was very rich in shells of various aquatic species (M.C. Wilson

personal communication 1986). This feature was capped by the upper, darker, more friable peat.

This distribution of faunal remains proved problematic. Three informal hypotheses were proposed regarding site formation: 1) It was the result of a series of small events over a long time period, with different clusters of bones representing discrete events; 2) It was the result of a single event or short series of events and differential distribution of material resulted from any or all of the following: a) an uneven original ground surface and "mucky" condition, b) differential burial, perhaps due to trampling, c) processes such as solifluction and cryoturbation; and 3) It was a result of either one of the above or a combination of both, and that post depositional mixing of material had obscured any stratigraphic differences that may have been present.

Since faunal remains were not the only line of material evidence present, a number of other factors had to be considered before accepting or rejecting any of the above hypotheses. These include the use of absolute dating techniques (such as radiocarbon dating) and relative dating techniques, such as projectile point typology. The horizontal distribution of faunal remains, lithics and features was of extreme importance. If the internal structure of horizontal patterning had an intrinsic

coherence that pointed to a single event, the argument would be greatly strengthened. This was especially important in light of the assertion by Reeves and Driver (1978) that a corral structure had been used to entrap the bison. Finally, if a single event was represented, analysis of the faunal remains should indicate such. That is, herd composition, age structures and perhaps butchering patterns should indicate a catastrophic event.

These factors shall be considered individually throughout this chapter and the next. However, prior to examining them, three other points will be considered, which have considerable bearing on ultimate site interpretation: archaeological investigations, bone preservation and palaeotopography.

Archaeological Investigations

At first glance, "archaeological investigations" might not seem a factor to be considered in site formation. Schiffer (1978) as an early champion of the importance of understanding all of the cultural and natural processes responsible for site formation, included archaeological excavation as one of these processes, for two reasons. Firstly, the physical quality of the excavation - how the site is dug - will effect the record. Secondly, how the archaeologist uses the data will have "tangible and

predictable effects on the archaeological record as described by the archaeologist" (Schiffer 1976:35).

Because the main excavation block of the Maple Leaf site was excavated in several stages, it is important to document how views of the stratigraphy have changed from the initial study to the present. In the initial test of the area, Calder et al. (1976:66) stated "Two to three well separated bone beds occur in the organic horizon ... at 35, 50 and 65 cm below surface." From field notes it is possible to ascertain that the uppermost bed was associated with the darker, more friable peat above the colluvium, and the lower two beds with the hard, blocky peat (Calder n.d.). Although the investigators considered the bone beds to be "well-separated" by 15 cm of peat, later investigations in adjacent units showed elements to articulate which were separated by as much as 20 cm in depth.

During the 1977 excavations an additional 13 units were excavated, but the "upper two bone beds" were shovelled out or mechanically stripped, since it was felt that they had been largely disturbed by borrowing of soil. In some areas of the block the criterion used to assign material to the lowest "bed" was simply the depth of the bone in relation to the ash, rather than the presence of distinct, recognizable "beds".

In 1978, excavation of an additional 18 units in areas undisturbed by borrowing did not reveal three bone beds. An upper component above the colluvial layer, and an undifferentiated sequence in the lower peat were all that could be defined in the field.

Finally, extensive plotting of faunal data for this study has failed to reveal the presence of two distinct lower bone beds, as proposed by Calder et al. (1976) and Reeves and Driver (1978) and resulted in the summary of the vertical distribution of bone given at the beginning of this chapter. Thus, all of the cultural material from the lower portions of the peat and from Feature 3 had been combined as a single analytical unit - Component Three - and the material from peat above the colluvium as Component Four. While it is recognised that this decision has increased the possibility for combining events separated in time, it is preferable to the alternative - stratigraphic distinctions which would almost certainly be spurious.

Bone Preservation

During recent years it has been increasingly recognised that speed, agency of burial and condition during burial play a key role in the preservation of faunal remains. "In taphonomic studies we come to understand the sampling processes, the biasing filters which have given us

our record of the past" (Behrensmeyer and Hill 1980:2). In any study of an archaeological faunal assemblage, taphonomic factors must be considered. In Component Three of the main excavation area of the Maple Leaf site it is assumed that burial was relatively rapid and bone preservation generally good. Rapid burial may be inferred for a number of reasons. Haynes (1981:361) discussed a number of factors and environments relative to bison bone deterioration in cold climates, specifically in Wood Buffalo National Park in northern Alberta. His work and that of Peterson (1977, in Haynes 1981) seems to indicate that surface deterioration in the form of longitudinal cracking and exfoliation may be expected to begin between two to five years after death, increase between five to ten years, and increase dramatically from ten to twenty years after death. These rates vary according to season of kill and local conditions of humidity, sunlight and subaerial or subaqueous protection (Haynes 1981:364). The two environments most favourable for preservation are wet/buried (river crossing mucks, pond and lake beds) and moist/sunny/buried (open drying ponds, marshes, wet wallows and drying lake beds).

Based upon the matrix of Component Three (peat and aquatic deposits) and the presumed grassland vegetation and sunny aspect of the site, preservation conditions for

Component Three bone probably correlated with one or both of the above categories. Upon recovery, bone surfaces were remarkably unaltered by weathering, although they were very moist and could easily be marked by a trowel or fingernail. Rapid drying of bone after exposure resulted in numerous longitudinal cracks and necessitated the application of preservatives in the field. Some bone surfaces were altered by root etching, which may have occurred during or soon after burial.

> ... bones in sedge fens or wet meadows, especially those that are shallowly buried under humic sediments within the grassroots zone, will show a great deal of surface etching although they will survive much longer than will unburied bones lying on drier ground. In time the humic buildup in such wet areas may create a relatively thick sediment cover for the bones, and they would eventually lie below the root zone; hence, the process of root acid etching might cease and the bones be preserved for many centuries in their altered state (Haynes 1981:376).

Even porous bones such as the patella and delicate bones such as the hyoid, were well preserved.

Trampling by other ungulates attracted to the site by its moist environment may have been an agency of differential burial. Haynes notes, for example,

> Intensive or routine trampling is common at certain locales, especially in heavy use spots such as the many wallows of the Lake One area, or in traditional river crossings. In these areas, many bones get trampled into

> saturated muds and many articulated carcass parts may even be buried as units (1981:380).

Palaeotopography

The palaeotopography of the Maple Leaf site in general (discussed in Chapter 3) and the main excavation area in particular has important implications for site interpretation. The main excavation area straddles the base of the natural slope at the easiest access point to the terrace at its northeastern periphery (Plate 1, Figure 3). This "access point" has been artificially enhanced due to the dumping of coal slack heaps along the upper terrace edge and construction of an access road to the homestead occupying the southern site area, but would have existed (in less dramatic form) in prehistoric times. Ungulates and other species would not necessarily have used the easiest route to access the landform, but may well have done so, in which case they would pass directly through the area of the main excavation block.

The excavation block itself is located on sloping terrain; the northeastern corner is the highest, and the southeastern the lowest, with a drop in elevation of almost 2 m over 10 m of horizontal distance. This slope would have been as great in prehistoric times, since the Mazama Ash surface also reflects it. In the extreme southeast

section of the excavation area a natural feature was present. Feature 3 consisted of a large, roughly ovate area (Figure 14) within which the peat was absent, having been replaced by a pale yellow sandy fill. This fill is rich in the shells of various aquatic and terrestrial molluscs. The molluscs were identified on a preliminary basis as to genus and species by James White and Michael C. Wilson. Both terrestrial gastropods and aquatic pelecrypods were present.

The land snails included Discus cronkhitei and Helicodiscus sp. The aquatics included Sphaerium sp. and Pisidium sp. Mixing of terrestrial and aquatic molluscs can occur in low lying areas near water bodies, or within waterbodies, as a result of flooding and/or washing in of sediments within waterbodies.

D. cronkhitei has been reported in Banff National Park and has a widespread distribution across the continent (Pilsbry 1948:600). In the east it lives among rotting leaves or grass in wet or humid conditions (ibid.). Wu and Jones (1978:202) summarize evidence for D. cronkeitei in Nebraska and Colorado and conclude that it requires humid or wet surroundings, and usually or always occurs along stream or river banks, close to running water.

Helicodiscus sp. has a variety of habitats depending upon the subspecies, and is distributed widely across North

America. At least one subspecies "lives on decaying wood in shady or humid places, also on damp leaves. It is generally distributed and may be found in leaf siftings and in the drift debris of streams" (Pilsbry 1948:627).

The aquatic pelecypods both belong to the family Sphaeriidae, which has a world wide distribution in fresh water, and includes Sphaerium sp. (fingernail clams) and Pisidium sp. (pill clams). Both occur in a wide variety of perennial aquatic habitats, including: lakes, rivers, streams, ponds, bogs and sloughs (Clarke 1981:361).

From this information, it is possible to infer that Feature 3 consisted of some type of wetland feature, such as a wet, spring-fed bog or small pond. It would have retained water year round, although it probably experienced seasonal fluctuations in water level. Maximum water could probably be predicted in the spring, and given the mountain environment it would probably have been ice-covered for most of the winter. Unfortunately, only the extreme northern edge of the feature was excavated, so its overall size must remain unknown. No trace of the feature was noted in the backhoe trench approximately six metres to the south of the excavation block; thus it may have been a fairly small, localized area with water in it, perhaps creating mucky conditions in the vicinity. It should be noted that bones from within the fill of Feature 3 did not

exhibit the root-etched surfaces so common in the rest of the excavation block. A spring is presently active at the site at the base of this same terrace about 50 m to the south of Feature 3, which creates seasonally mucky conditions.

The nature of the topography in combination with the presence of moisture in the soil has almost certainly affected post depositional bone distribution.

> Objects buried in periodically frozen soils (even to depths greater than two metres) are moved upwards perpendicular to the slope of the ground surface due to the formation of ice lenses in the sediment ... Rod or cylindrically shaped objects move upwards much more than do spheres, especially if their long axes are vertically oriented. Long bones or shaft fragments that are situated lengthwise in occasionally-frozen soils would be heaved upwards at each freezing ... In addition, when the sediments thaw, gravity may cause settling on slopes to be vertical whereas upwards motion was perpendicular to the slope surface ... (Haynes 1981:464).

This movement may be very subtle over long periods of time. Given the ground slope, the probability of a somewhat wet and possibly hummocky, original ground surface, the possibility of trampling, compression, and cryoturbation, it might be unreasonable to expect well preserved "bone beds" in a site such as the Maple Leaf site, even if all of the bone was deposited in a single

event. The differential orientation of associated bones lends credence to this interpretation.

Dating of Component Three

Two methods may be used to establish a date for Component Three: radiocarbon dating and the presence of time-diagnostic projectile points.

Three radiocarbon dates were obtained on bone from this component. The first is a date of 6340±160 B.P. (RL-508). This date correlates well with the positioning of the bone just above Mazama ash, dated at ca. 6850 B.P. (Bacon 1983). A second date, also on bone positioned just above Mazama ash, was 4140±150 B.P. (RL-877). This date is considerably later than the first date, even though the stratigraphic positioning of both samples in relation to the ash was very similar. A final date was obtained on bone from within the wetland feature. This bone was in close association with an Oxbow projectile point, and yielded a date of 4160±150 B.P. (GX-6384a), almost identical to the date of the second sample.

The use of projectile points to date components can be more or less successful, depending upon such factors as the actual point types, how many points are recovered, if more than one variety is present and a number of other factors.

The wide range of variation in Middle Prehistoric point types in the Northern Plains and mountains is well-known, but poorly understood (cf., Reeves 1969; Driver 1978; Wilson 1983).

Driver (1978) defined only one subphase of the Early Middle Prehistoric in the Crowsnest Pass, the Mapleleaf subphase, dating from 7500 to 3000 B.P. The early part of the subphase (7500-4500) B.P. is characterized by associations of Bitteroot, Oxbow and Elko eared points. The latter part of the subphase is characterized by the association of Bitteroot and Salmon River side-notched points with later varieties, such as McKean and Hanna. Driver notes several sites with the early Mapleleaf subphase Bitteroot/Oxbow association in the Crowsnest Pass, including DjPo-47 (The Maple Leaf site), and DjPo-9, a bison kill/processing site where associated Bitteroot and Oxbow points were dated at 4690±130 B.P. (RI-507, Calder et al. 1977).

Ten projectile points were recovered from Component Three: one unclassified variety, two Oxbow points and seven points classified as Bitteroot/Salmon River (Mummy Cave phase) types. All projectile points appeared to be manufactured from locally available lithic material types, with the exception of the Oxbow points, which were exotic. Descriptions of individual points are included in the next

section. The single point which was unclassified is a form which resembles both Bitteroot and Oxbow types slightly but is not similar enough to either to be classified as one or the other.

The association of Bitteroot and Oxbow points with the previously discussed radiocarbon dates does not clarify the dating of the component a great deal. Mummy Cave phase points persist in the archaeological record in the Crowsnest Pass during the period from 7500 to 3000 years ago, and are not well enough understood to allow for more precise age determinations. Similarly, the Oxbow complex was also long lived. At the Sun River site in Montana, less than 160 km south of the Alberta border, Greiser et al. (1985) obtained eleven dates on six Oxbow occupations between 5200 and 2800 B.P.

The two dates of 4160±150 B.P. and 4140±150 B.P., one of which was in association with an Oxbow point, may be seen as good evidence for acceptance of this date. However the single earlier date (6340±160 B.P.) cannot be dismissed, especially given the nature of site stratigraphy and possibility of multiple events being represented. Dating of Component Three is discussed further in the conclusions.

Lithic Analysis

The lithic artifact assemblage from Component Three is small (N=170) but extremely interesting and of importance for interpreting the site. It is immediately apparent that the lithic artifacts from the assemblage represent very specific tasks, relating to killing, butchering, resharpening and tool maintenance and limited hide-scraping. No lithic reduction is represented with one exception - a single quartzite cobble was partially reduced to produce several sharp edged secondary flakes which were utilized and discarded on site. This interpretation has been corroborated by refitting.

Projectile points comprise 6% of the assemblage and other tools (scrapers, a biface and flake cutting tools) form an additional 10% of the total. The most abundant artifact category is retouch/resharpening flakes (N=117/69%), of which 92% (N=108) belong to a single lithic feature which probably represents the resharpening of one or two tools.

One category of lithic remains worthy of note is the large to medium sized unmodified cobbles which were not collected, although they were mapped in the field. These cobbles would have been useful as anvils and/or hammerstones, and were all located in association with clusters of butchered bone. Although they resemble the

cobbles from the basal boulder unit of the site, none of these cobbles were noted from the levels below the ash, and they had a somewhat restricted horizontal distribution within Component Three. The presence and distribution of these cobbles is suggested to be at least partially related to cultural activity (bone marrow extraction) rather than natural phenomena.

Lithic material types were sorted into twenty categories based on visual criteria such as colour, texture, luster, presence of inclusions and comparison to the University of Calgary lithic collection. In general, lithics from the Maple Leaf site proved quite straightforward to type, since there were few overlapping categories and most materials were quite distinct. Fifteen of the twenty lithic types were represented by only one or two artifacts. Table 3 summarizes the lithic assemblage.

The material type count is dominated by a high quality black chert (67%), however this conclusion is deceptive, since most of this material belongs to the previously mentioned single cluster of retouch/resharpening flakes. Similarly, the next most abundant type (coarse-grained grey quartzite at 9%) relates to removal from a single core of several secondary flakes for use "on the spot".

Only three lithic types could be sourced to specific quarries. Eight artifacts (two projectile points, one

Figure 12. Lithic Artifacts (a - g)

a) Projectile Point DjPo-47/115

b) Projectile Point DjPo-47/24

c) Projectile Point DjPo-47/93

d) Projectile Point DjPo-47/54

e) Projectile Point DjPo-47/25

f) Projectile Point DjPo-47/55

g) Projectile Point DjPo-47/82

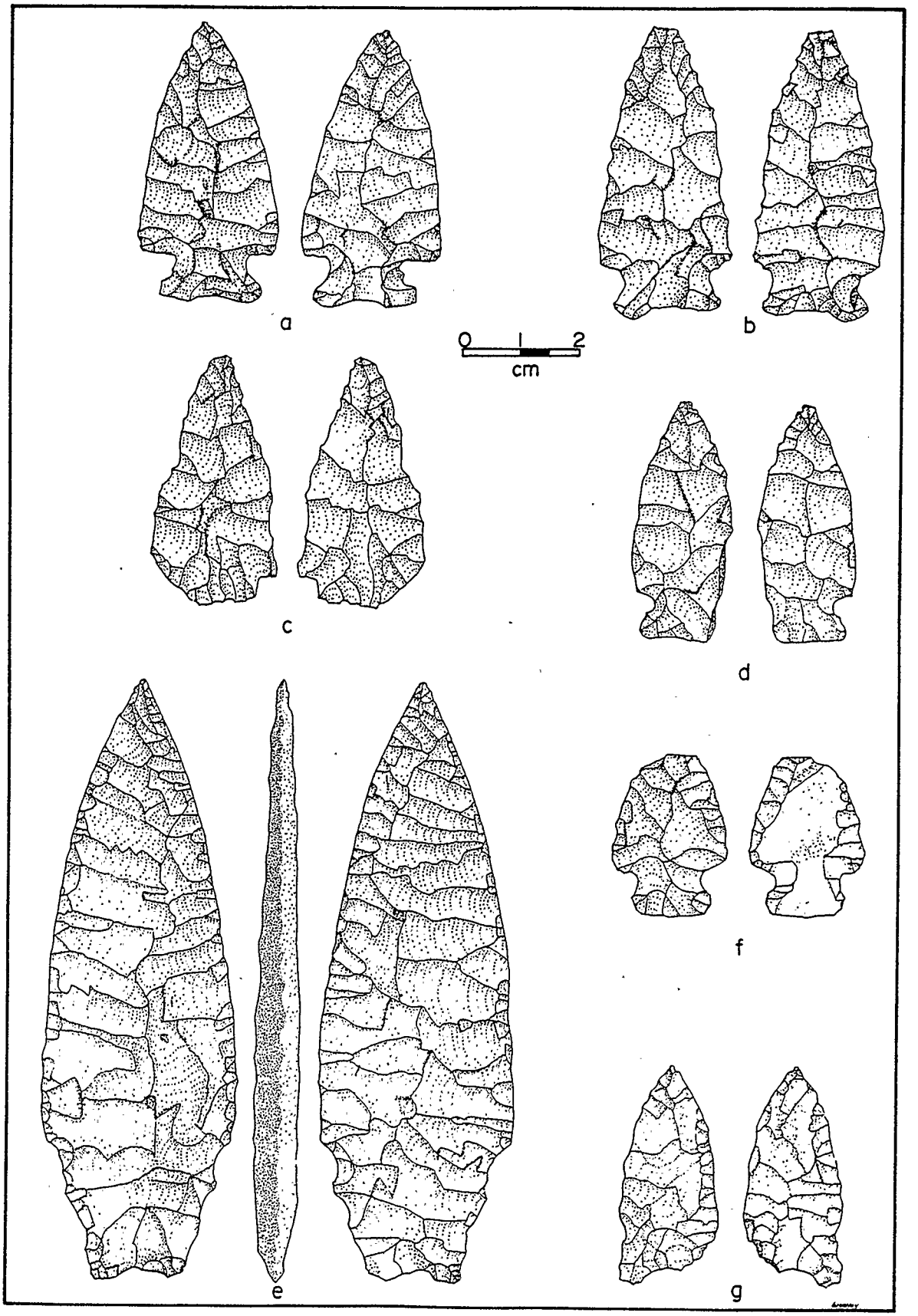

a
b
0 1 2
cm
c
d
e
f
g

Figure 13. Lithic Artifacts (a - k)

a) Projectile Point DjPo-47/35

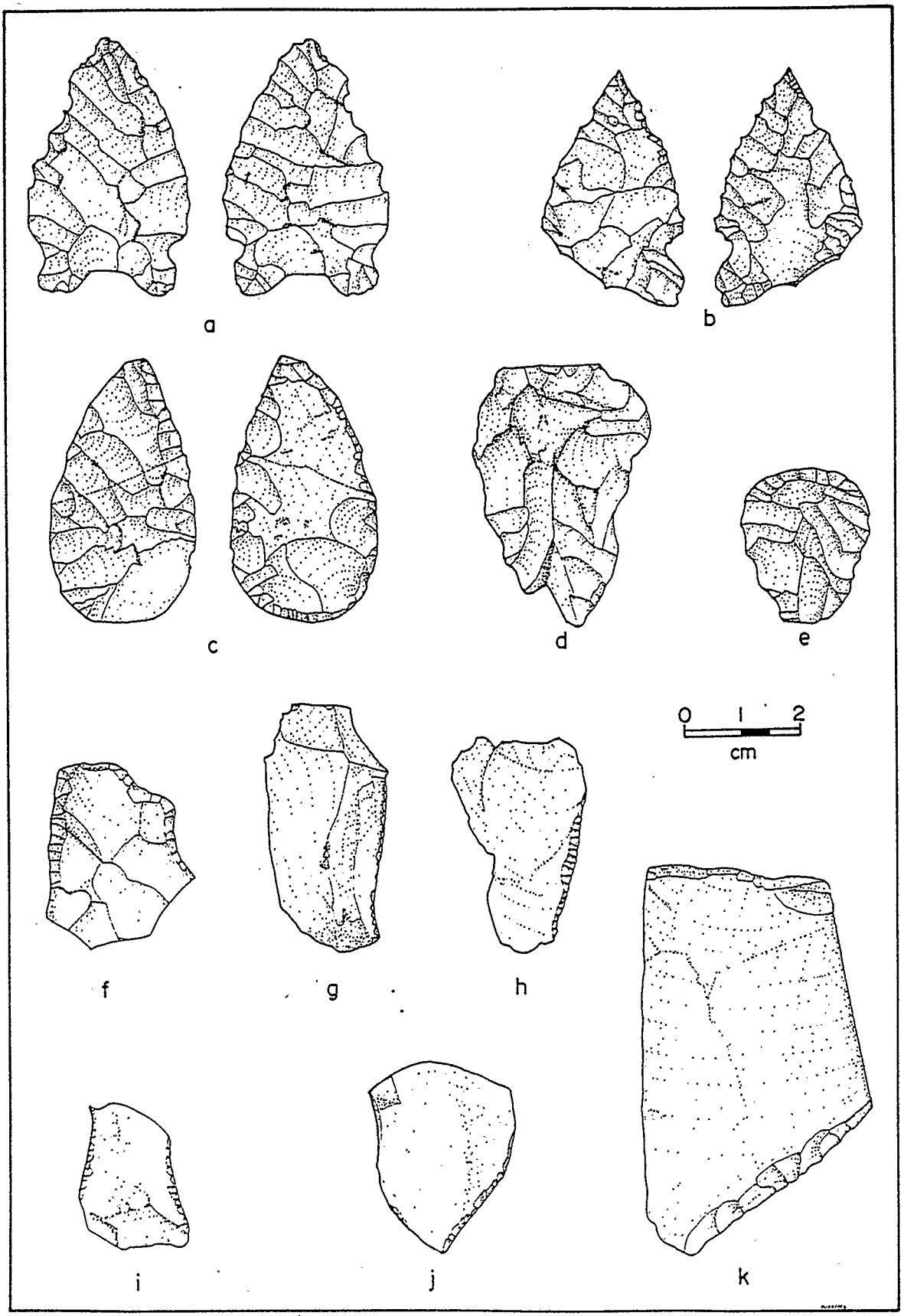
b) Projectile Point DjPo-47/83

c) Biface DjPo-47/98

d) End Scraper DjPo-47/57

e) End Scraper DjPo-47/92

f-k) Retouched and Utilized Flakes (various)


a
b
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0 1 2
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k

Table 3. Component Three Lithic Artifacts

Material Type \ Artifact Type	Formed Tools					Other Tools				Debitage					Totals	
	Bitterroot/Salmon River Point	Oxbow Point	Indented Lanceolate Point	Biface	End Scrapers	Choppers	Core/Chopper	Hammerstone	Retouched/Utilized Flakes	Secondary Decortication Flakes	Secondary Flakes	Thinning Flakes	Retouch/Resharp. Flakes	Shatter	Total	% Total (approx.)
Good Quality Black Chert				1					3		1		108	1	114	67
Poor Quality Black Chert									1				1		2	1
Grey/Brown Chert									2			3	1	2	8	5
Green/Brown Chert					1										1	0.7
Light Grey Chert									2						2	1
White Chert	2														2	1
Etherington Chert	1		1		1				1				4		8	5
Top of the World Chert									1				3	2	6	3
Silicified Siltstone	2														2	1
Knife River Flint		1													1	0.7
Brown/White Chalcedony		1													1	0.7
Obsidian											1				1	0.7
Coarse Grey Quartzite							1		3		5			6	15	9
Fine Black Quartzite									1						1	0.7
Pink Quartzite										1					1	0.7
Fine Grey Quartzite	1														1	0.7
Medium Grey Quartzite	1														1	0.7
Black/Grey Quartzite								1							1	0.7
Quartzitic Sandstone						1									1	0.7
Limestone						1									1	0.7
Totals	7	2	1	1	2	2	1	1	14	1	7	3	117	11	170	100.0
% Total	4	1	0.7	0.7	1	1	0.7	0.7	8	0.7	4	2	69	6	100	

endscraper, one utilized secondary flake and four retouch flakes) were classified as Etherington Chert, a local material obtained from quarry sources on the nearby Livingstone Range (Loveseth 1976). Six artifacts (one flake tool, three retouch/resharpening flakes, and two small pieces of shatter) were identified as Top-of-the World Chert, from the quarries of that name in southeastern British Columbia. Finally, one of the two Oxbow points strongly resembles Knife River Flint. Local materials superficially similar to Knife River Flint have been identified previously in Crowsnest Pass assemblages; however, this specimen is identical to true Knife River Flint. The other Oxbow point is made from a dull brown/white chalcedony which is not locally known. Raw materials assumed to be locally available comprise almost the entire assemblage (N=161, 95%) with the exception of the above mentioned exotics and a single obsidian flake.

Projectile Points (N=10)

A total of ten projectile points from the main excavation block of the Maple Leaf site were analysed. All specimens have been classified as Middle Prehistoric Period points, manufactured for use with an atlatl. Two points may be categorized as Oxbow, seven have been assigned a Bitteroot/Salmon River side-notched affiliation, and a

single specimen classified as an unknown, "indented lanceolate" type. Each point will be described individually below, using terminology as outlined by Reeves (1970b).

Bitteroot/Salmon River Side-Notched Types (N=7)

DjPo-47/115: this finely made, complete point is triangular in overall form, with triangular to excurvate body edges and a very sharp tip. It is symmetrical with obtuse shoulders and rounded, deep notches which have each been worked from opposite faces. The notch/basal edge juncture is rounded and the base is slightly concave. Bifacial retouch is complete over the entire form. The base has been slightly ground. Material type is good quality black Etherington Chert, locally obtainable.

Metrics:		
	Length =	47.8 mm
	Width at Shoulders =	23.8 mm
	Width at Base =	17.4 mm
	Thickness =	5.2 mm
	Weight =	5.8 g

DjPo-47/24: This well made, complete point is identical to the previously described form, although it is not as finely flaked, due to the poor quality of the lithic raw material, a locally available coarse grained silicified siltstone. The tip of the point is blunted.

Metrics:		
	Length =	49.2 mm
	Width at Shoulders =	22.8 mm
	Width at Base =	18.3 mm

Thickness =	6.9 mm
Weight =	6.6 g

DjPo47/93; This specimen consists of a reworked point which was probably initially very similar to the two previous forms. The base has snapped just below the shoulders where it has been retouched, as have both lateral body edges, probably for use as a cutting tool. The material type is the same coarse silicified siltstone that the previous point was made from, and these two points are the only artifacts made from this material type in the assemblage.

Metrics:		
	Length = greater than	42.9 mm
	Width at Shoulders =	21.2 mm
	Width at Base =	N/A
	Thickness =	6.2 mm
	Weight =	4.8 g

DjPo47/54: This incomplete point is triangular in overall form, with triangular to excurvate body edges and a sharp tip. Although the right shoulder, notch and basal edge have been snapped off, it was originally symmetrical with obtuse shoulders and rounded deep notches. The notch/basal edge juncture is rounded and the base is straight and slightly ground. Bifacial retouch is complete over the entire form. Material type is a good quality, fine grained grey quartzite, which is probably locally available.

Metrics:		
	Length =	40.6 mm
	Width at Shoulders =	N/A
	Width at Base =	N/A

Thickness = 4.6 mm
Weight = 3.9 g

DjPo-47/55: This specimen is nearly complete, with only the tip broken. It is triangular in overall form, with triangular to slightly excurvate body edges. It is slightly assymmetrical with obtuse shoulders and rounded, deep notches. The notch/basal edge juncture is rounded and the base is straight and slightly ground. The material type is a white semi-opaque chert with grey mottling. Although not classified as such in the analysis, this lithic material may well be a variant of the locally available Etherington chert.

Metrics:
Length = greater than 30.0 mm
Width at Shoulders = 19.5 mm
Width at Base = 13.4 mm
Thickness = 4.6 mm
Weight = 2.9 g

DjPo47/112: This broken form was lost and may only be described from field school photographs and analysis. It was a large point, with the body snapped off above the shoulders and one shoulder and notch broken off. The shoulders were obtuse, the notches deep and rounded, the notch/basal edge juncture rounded and the base slightly concave. The material type was listed as white chert, and may have been an Etherington variation. Metrics are unavailable.

DjPo-47/23: This broken point consists of the body only, which has been snapped off at the tip and below the shoulders. The body edges are triangular to excurvate and the shoulders are obtuse. Bifacial retouch appears to have been complete over the form. The lithic material type is a grey medium grained quartzite which is probably locally available.

Metrics:		
	Length =	N/A
	Width at Shoulders =	18.9 mm
	Width at Base =	N/A
	Thickness =	6.4 mm
	Weight =	3.3 g

Oxbow (N=2)

DjPo-47/35: This complete point is triangular in overall form, with excurvate body edges and a dulled tip. It has obtuse shoulders with rounded, shallow side notches. The basal edges are rounded and project outwards in the form of "ears". The base is deeply concave. The material type is a brown/white semi-translucent chalcedony which is not locally known.

Metrics:		
	Length =	44.5 mm
	Width at Shoulders =	28.0 mm
	Width at Base =	24.2 mm
	Thickness =	5.5 mm
	Weight =	7.9 g

DjPo-47/83: This broken point is triangular in overall form with triangular body edges and a sharp tip. It appears to have been extensively resharpened, and is

complete except for the snap-removal of one "ear". The shoulders are obtuse, the notches rounded and shallow. The basal edge(s) form "ears" and the base is concave. The material type is a high quality translucent brown chalcedony, which strongly resembles Knife River Flint.

Metrics:		
	Length =	39.6 mm
	Width at Shoulders =	24.4 mm
	Width at Base =	N/A
	Thickness =	4.4 mm
	Weight =	4.3 g

Unknown Type - "Indented Lanceolate"

DjPo-47/82: This incomplete point is an unusual form, which may relate to either the Bitteroot or Oxbow Types. It is lanceolate in overall shape, with excurvate body edges and a sharp tip. It is extensively heat-crazed, and the breakage of the base appears to relate to heat-damage. The body is indented slightly above the base, which is concave, thus forming a very slight "eared" appearance. The material is locally available red Etherington Chert.

Metrics:		
	Length =	37.4 mm
	Width at Shoulders =	-
	Width at Base =	-
	Thickness =	5.0 mm
	Weight =	3.4 g

Biface (N=1)

Only one biface was recovered from the Maple Leaf site, a well-made form which was broken into two pieces,

probably during use. It was recovered within a small feature containing many retouch flakes which probably relate to maintenance of the biface and other cutting tools made from the same material.

DjPo47/98: This biface (diagonally snapped through the body) is symmetrical ovate in overall form and biconvex in transverse section. The ventral surface exhibits complete retouch, and the dorsal surface exhibits retouch across approximately 60% of the face and all of the lateral margins. Material type is a fine grained good quality opaque black chert which is common in Crowsnest Pass lithic assemblages and is most likely locally available.

Metrics:		
	Length =	45.4 mm
	Maximum Width =	25.0 mm
	Thickness =	5.5 mm
	Weight =	7.2 g

End Scrapers (N=2)

Two end scrapers were recovered from Component Three of the site. Both were associated with scatters of other lithic materials, and will be described individually below.

DjPo-47/57: This end scraper is a large poorly made form. It is trianguloid in overall form, with a convex left lateral edge and convex right lateral edge. The distal end is convex to straight, and it is convex in

transverse and longitudinal section. The entire dorsal surface has been modified into a high "dome", and retouch and use wear are visible on both lateral edges as well as the distal end. The material type used is poor quality grey/white Etherington Chert.

Metrics:		
	Length =	45.0 mm
	Maximum Width =	30.5 mm
	Thickness =	15.3 mm
	Weight =	17.8 g

DjPo47/92: This small, well made end scraper is trianguloid in overall form, with convex lateral edges and distal end. It is convex in transverse and longitudinal section, and the dorsal surface exhibits complete retouch. The distal end and right lateral margin exhibit retouch and use wear. The material is a fine grained good quality Green/Brown Chert which was probably locally available.

Metrics:		
	Length =	26.9 mm
	Maximum Width =	22.3 mm
	Thickness =	7.5 mm
	Weight =	5.7 g

Retouched and Utilized Flakes (N=14)

Fourteen flakes exhibiting retouched and/or utilized lateral margins were collected. These flakes were typically thin secondary flakes exhibiting purposeful retouch or use wear along the dorsal and ventral surface of one lateral margin, although several showed retouch along

both lateral margins, and one exhibited unifacial retouch along both lateral margins and the proximal end, and probably was used as a side scraper. However, most of these flakes were probably used as fine, sharp cutting tools. Material types include coarse grey quartzite (N=3), fine quality black chert (N=3), grey/brown chert (N=2), light grey chert (N=2) and one each of Etherington Chert, Top of the World Chert, Black quartzite, and poor quality black chert. With the exception of the Top of the World Chert, and possibly the light grey chert, all lithic materials are likely from local sources.

Choppers (N=2)

The choppers consist of one purposefully manufactured form and one sharp edged slab which exhibits use wear.

DjPo47/28: This chopper consists of a very large primary decortication flake which exhibits bifacial retouch and use wear along its lateral edges. The material type is a locally available quartzitic sandstone.

DjPo47/22: This artifact consists of an angular limestone block which exhibits possible use wear along one edge.

Core (N=1)

DjPo47/36: This artifact consists of a large quartzite cobble which has been unifacially flaked to produce a

number of secondary flakes which were found in close association with the core. Three flakes exhibited slight marginal use wear and several were refit to the core. All of the coarse grey quartzite from the assemblage probably belongs to this single core, which may have been also utilized as a chopper.

Hammerstone (N=1)

DjPo47/99: This artifact consists of a small ovate, flattened module which exhibits pitting and use wear along its periphery. It is too small to be useful for cracking bison bone, and was most likely used as a small finishing hammer for lithic reduction. The material type is tentatively identified as coarse, black/grey quartzite.

Debitage (N=138)

Debitage included a single secondary decortication flake, seven secondary flakes, three thinning flakes, eleven pieces of shatter (mostly very small pieces) and a large number of retouch/resharpening flakes (N=117), most of which belong to a single feature, single material type (N=104 fine black chert).

Horizontal Patterning of Artifacts and Features

The horizontal distribution of lithic artifacts, faunal remains and cultural and natural features provides an important dimension to site interpretation. Discussion of the distribution of faunal remains requires constant reference to results of faunal analysis, and will therefore be included in the next chapter, with only brief comments here. This section will be primarily concerned with the distribution of lithic remains and features.

Figure 14 shows a plan view of the main excavation block (several units at the western edge of the block have been omitted from the study because of recent disturbances in the above ash levels). The location of the pond/spring feature (Feature 3) has been indicated in the drawing by a line representing the extent of the distinctive yellow sandy fill. The "influence" of this feature extends somewhat beyond the actual outline of the fill, as evidenced by the dipping of the peat around its periphery and the dense quantity of bone in the immediate area.

Features 1 and 2 are somewhat similar features which have been interpreted as post-holes (Reeves and Driver 1978). Feature 1 consists of a very regular circular pit 25 cm in diameter which penetrates the Mazama ash and extends down 45 cm from the ash surface. As it extends downwards it widens out considerably, and at the base of

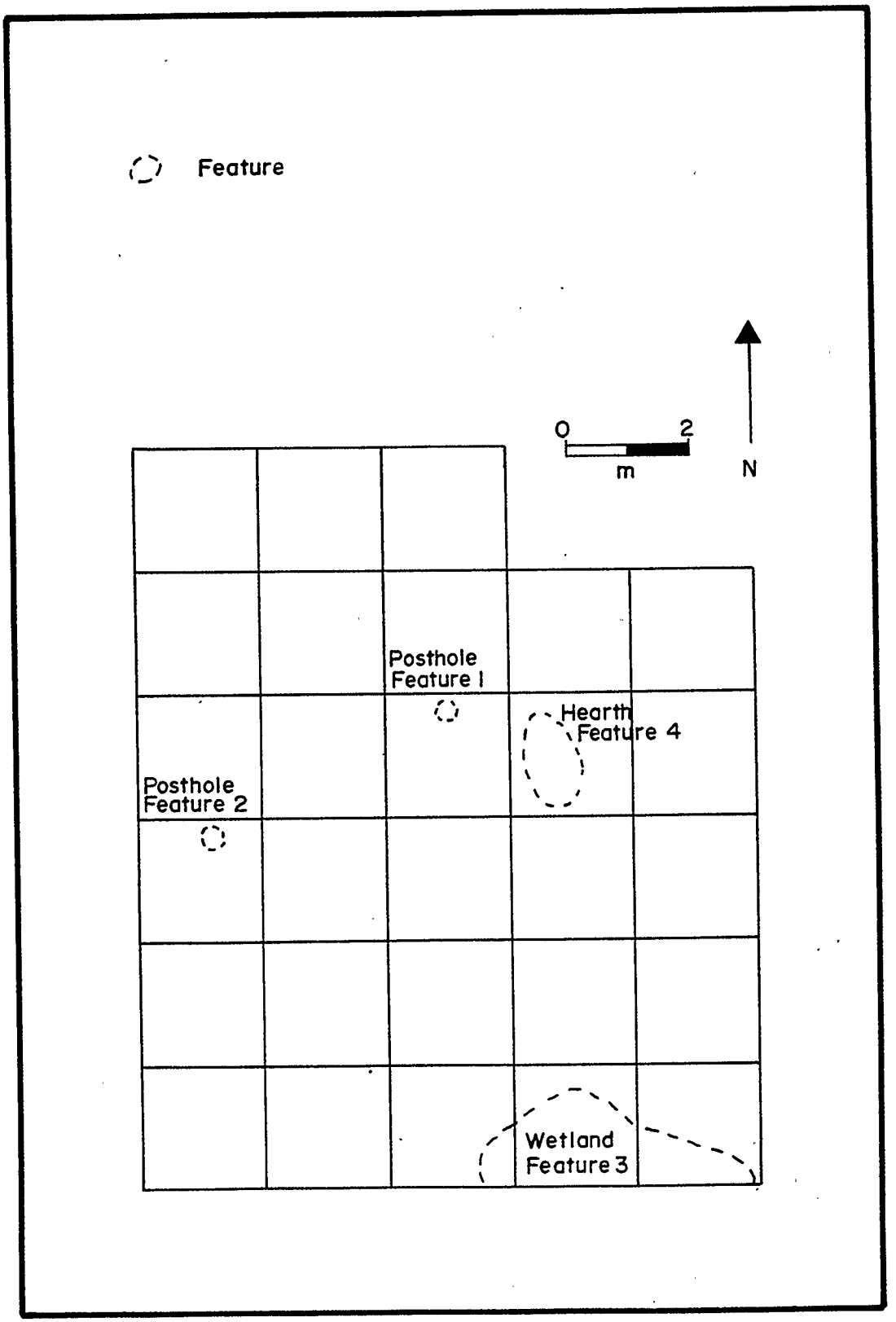

Figure 14. Component Three - Feature Locations

the hole was a large flat rock over which was found a proximal first rib and spirally fractured distal tibia. Feature 2 is a less perfect circle, slightly smaller in diameter (21 cm) which extends 22 cm below the ash, and did not widen out or have stone or bone at its base. Some rodent disturbance was noted in this unit.

These post-holes may be compared to those described by Frison (1971, 1978) for the Ruby site and Muddy Creek site. These sites are both Besant bison pounds, with well defined post-holes. Frison (1971, 1978) does not give actual diameters or average diameters of post-holes, although he implies that the Ruby site poles would have had diameters of 7 inches (18 cm) and photographs (Frison 1971:77-91) which include scales seem to indicate diameters of six to ten inches. He also states that post-holes at the Muddy Creek site were of larger diameter than the Ruby site examples (1978:221). Thus, although large, the Maple Leaf site features do not appear to be beyond the size range for post-holes. Interestingly, Frison notes that at the Ruby site many posts were tightened in the holes by forcing ribs, long bones and flat stones between the posts and sides of the holes. This might explain the configuration of materials found in Feature 1, although the widening out of the feature at depth does not seem consistent with efficient and sturdy construction techniques. Similarly,

the two post-holes are located 8 m apart. This distance seems too great to allow for construction of a sturdy corral as outlined by Frison (1978:216), who suggests a maximum distance of 10 feet (3 m) between post-holes. This concurs with the description of Umfreville from the 1790's that posts were placed 12 feet apart (3.6 m) (Verbicky-Todd 1984:55). However, some descriptions of pounds do not describe as sturdy a structure as Frison believes necessary (e.g. Grinnell 1893:228; Wissler 1910:36; Larpenteur 1898:409, in Verbicky-Todd 1984).

Although Features 1 and 2 may well be post-holes, insufficient evidence to define a corral structure was recovered from the site. The excellent potential of the landform for successful use of such a structure cannot be denied, and an expansion of excavations in the area of the main block could possibly yield further evidence that Features 1 and 2 are part of a drive lane or corral. Alternative explanations will be considered in the conclusions.

Figures 15, 16, and 17, show the distribution of various categories of lithic artifacts and unmodified cobbles in Component Three. The distribution of projectile points is of interest, with half of the points falling within or immediately adjacent to Feature 3 and the rest of the points distributed widely across the northern (upslope)

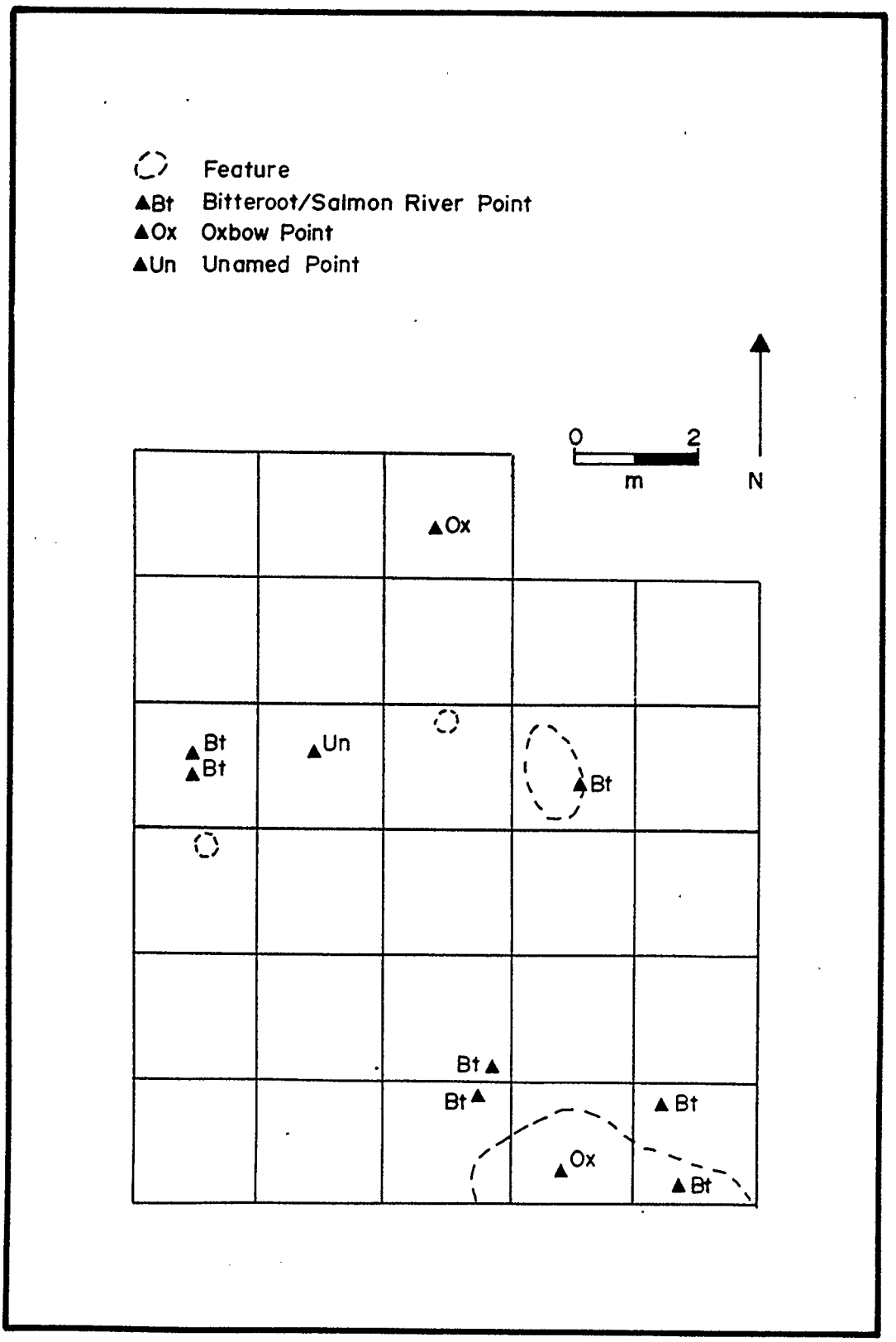

Figure 15. Component Three - Distribution of Projectile Points

portions of the excavation block (Figure 15). Only three points were complete, unbroken specimens; the Oxbow and Bitteroot/Salmon River points from within the Feature 3 fill and a Bitteroot/Salmon River point adjacent to Feature 3.

With the exception of the above mentioned projectile points, no lithics or unmodified cobbles were found within roughly a 5 m arc radiating out from the centre of Feature 3. Lithics were scattered across the northern (upslope) units, associated with two areas of concentration; one dense concentration (Feature 4) east of post-hole Feature 1 and one smaller concentration just north and west of post-hole Feature 2 (Figures 16, 17).

Feature 4 comprised a scatter of reddened unmodified cobbles, charcoal, blackened earth, burnt and unburnt bone and a quantity of lithics. It has been interpreted as a surface hearth (although there were many natural burn lenses in the peat, none resembled cultural features as did Feature 4). Lithics from within the feature included: a reworked Bitteroot point (probably used as a knife), a biface, an end-scraper, four retouched/utilized flake cutting tools, a small hammerstone interpreted as a lithic fabricator, a thinning flake and a cluster of 95 very small, homogeneous retouch flakes which appear to relate to a single event of tool maintenance/resharpening. The

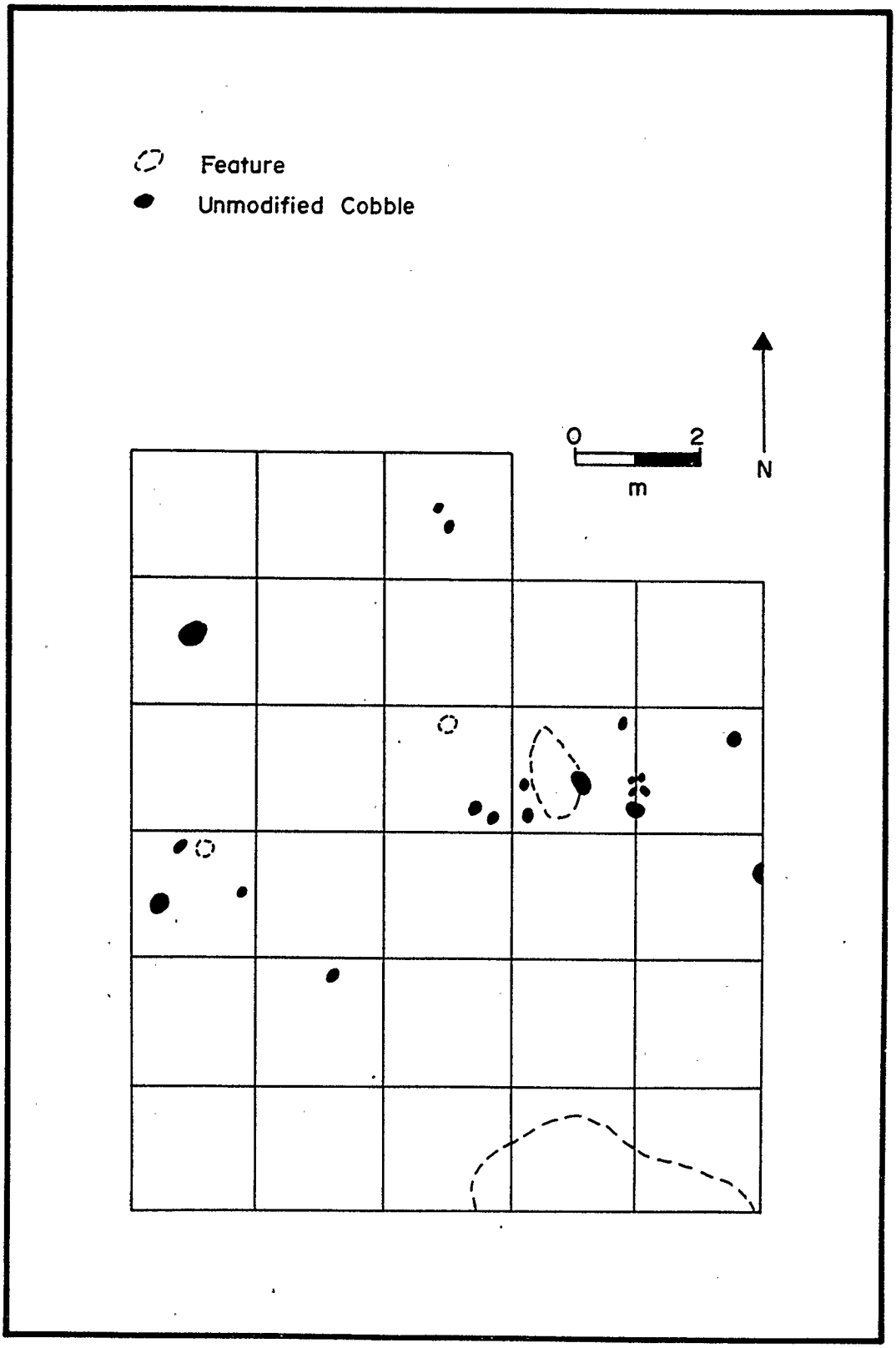

Figure 16. Component Three - Distribution of Unmodified Cobbles

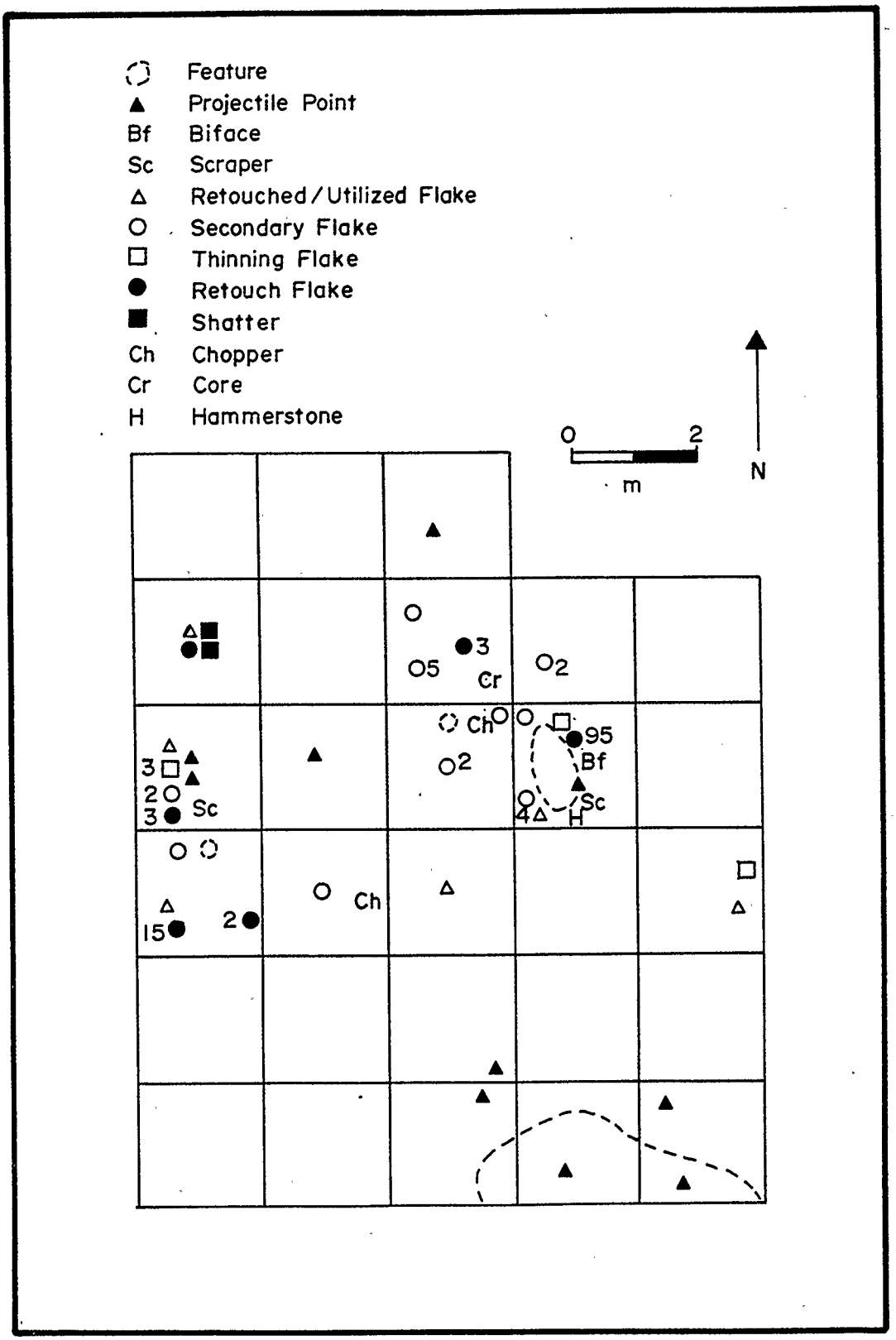

Figure 17. Component Three - Distribution of Lithic Artifacts

retouch flakes, biface and flake tools are all made from a locally available good quality black chert. Immediately to the northwest of Feature 4 were a single large chopper and a quartzite cobble core with associated debitage. As was previously stated, this seems to represent a single event where flakes were struck, utilized and discarded.

The other area of lithic concentration, north and west of post-hole Feature 2, is less well defined since most of the lithic material was recovered during screening. In the general area, however, two broken Bitteroot/Salmon River points, one end scraper, two flake tools, three thinning flakes and twenty one small retouch/resharpening flakes were recovered. Several large and small unmodified quartzite cobbles were also noted in this area.

Summary

Component Three at the Maple Leaf site was contained within approximately half a metre of blocky red peat below a colluvial unit and above Mazama ash. Although faunal remains are well preserved and burial is assumed to have been relatively rapid, well defined bone beds were not apparent. A number of reasons for the observed configuration of bone were suggested, such as multiple events or post-mortem movement of bone. Radiocarbon and typological dating have demonstrated that Component Three

fits within an early Middle Prehistoric timeframe, perhaps of ca. 6300 to 4100 B.P. Projectile point typology and lithic raw material type analysis indicates the possibility of at least two events being represented, one of Oxbow affiliation and one of Bitteroot/Salmon River affiliation. Examination of post-hole features has shown that although Feature 1 in particular strongly resembles post-holes described in the literature for bison pounds, such an interpretation could not be sustained due to insufficient data. The presence of a large feature of aquatic origin in the southern part of the excavation block and the distribution of lithic materials - particularly projectile points, suggests that the site functioned as a natural trap.

Chapter Seven

Component Three: The Faunal Assemblage

A total of 8056 individual pieces of bone classified as bison were analysed from Component Three. From this total, by count 40% was identifiable as to element, 5% consisted of large ungulate long bone fragments, 15% of large ungulate rib and vertebral fragments, and 40% of small, non identifiable fragments. By weight, these figures change somewhat, with fully 84% of the assemblage identifiable as to element, 4% long bone fragments, 7% rib and vertebral fragments and only 5% consisting of small nonidentifiable fragments.

The faunal assemblage from Component Three was analysed as a single unit, notwithstanding the possibility that more than one event was represented. Results of the various analyses, discussion of taphonomic problems, butchering practices and interpretations will follow.

Non-Bison Remains

Although the assemblage was dominated by bison, at least seven other animals were also represented. These include four canids, one badger, one bird and an unidentified small ungulate.

The small ungulate was represented by a single tooth fragment in very poor condition which could not be speciated and probably represents a natural rather than cultural inclusion.

The bird bones include a left tibiotarsus and left distal femur identified as goose (probably Branta canadensis). Both of these bones were found at separate locations within wetland Feature 3, and may not represent a cultural association; however they do support the interpretation of the feature.

Badger (Taxidea taxus) remains include two mandibles and a vertebral body. The right mandible consists of the complete anterior portion, butchered just behind the third molar. All of the teeth (with the exception of a very worn canine) are missing. The left mandible shows an identical butchering pattern. These bones may well represent a scavenging animal killed shortly after a kill event.

The MNI of four canids was based on mandibles and teeth. Other evidence for canids includes a number of skull fragments, several vertebrae, a calcaneum, a pelvis, several long bone fragments, a femur and a tibia. Two first cervicals were present which in very general terms appeared smaller than comparative Canis lupus material and larger than Canis latrans, as did the calcaneum and pelvis.

Unfortunately, one set of mandibles noted in field school records could not be relocated. These were identified in the field as being larger than coyote, more "wolf-sized", and showing very extreme wear on all tooth surfaces. A wolf or domestic dog could equally well be indicated.

A second canid represented by a number of loose teeth and very fragmented mandible sections could also not be speciated, although the teeth seemed to be larger than comparative coyote teeth. One of the other canids has been tentatively identified as Canis familiaris or a wolf/dog hybrid (probably the former). This is the specimen previously mentioned in Chapter 5 classified by Driver as an "extra-large" dog. When plotted against the values given by Walker and Frison (1982) for Eskimo dogs, Wyoming wolf/dog hybrids, and wolves, it falls very close to the Maple Leaf site Component Two canid, intermediate between Eskimo dogs and Wyoming hybrids (Figure 18). The final specimen from this component resembles Canis familiaris on the basis of visual criteria, and when plotted against Walker and Frison's chart, falls into the range of Eskimo Dogs (Figure 19).

Canids are thus the most numerous species after bison in Component Three. Of the four, one may be said to be a large dog comparable to an Eskimo dog, one a probable dog

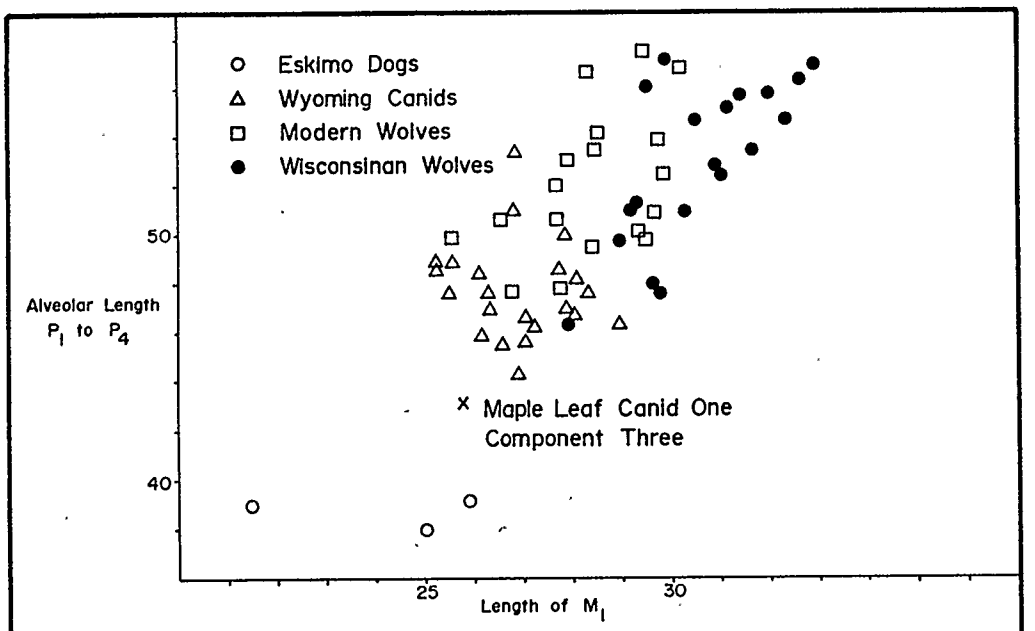

Figure 18. Bivariate Plot of the Premolar Row/M1 (after Walker and Frison 1982)

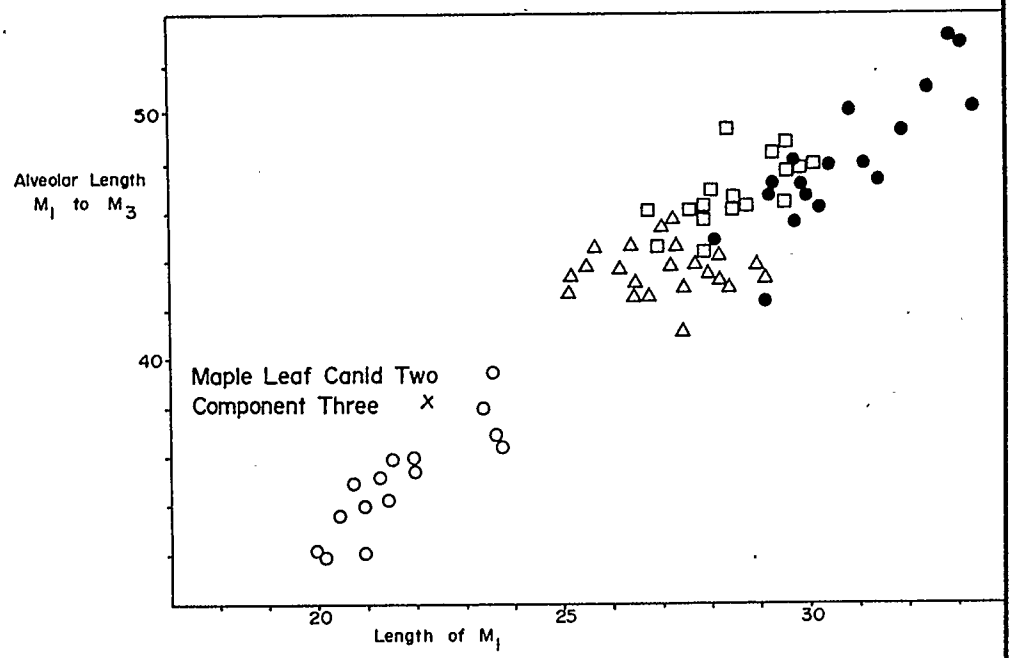

Figure 19. Bivariate Plot of the Molar Row/M1 (after Walker and Frison 1982)

somewhat larger than Eskimo dogs but smaller than Wyoming wolves and wolf/dog hybrids, and the other two can only be categorized as larger than coyote.

Canids are the single most abundant species after bison in most kill sites on the Plains and in peripheral regions. The reasons for this are not fully understood, although they have generally been presumed scavengers attracted to the kill where they themselves were killed (in the case of domestic dogs, an equally feasible explanation might be that the dog rushed into the action before all the bison were dead). No ethnographic accounts of the use of dogs for hunting or driving of buffalo are known (Verbicky-Todd 1984).

Carnivore Activity

Damage to bones obviously inflicted by carnivores was noted within Component Three. This included marks such as punctures, scoring and furrowing (Binford 1981:44). In some instances it was not possible to determine whether damage was carnivore inflicted or occurred as a result of butchering, or both. For example, several humeri were essentially unmarked, except for the removal of the entire proximal end above the deltoid tuberosity. Others had the proximal end removed but preserved evidence on the bone surfaces of the scooping out of the cancellous tissue by

carnivores. These bones also exhibited gnawing on the distal epicondyles and could be easily identified as carnivore modified. In many other instances bone surfaces appeared untouched by carnivores and exhibited classic spiral fractures. These bones were presumed to have been for the most part modified by man, although it is recognized that other agencies may produce spiral fractures on bone (Bonnichsen 1973:16).

Most modification definitely attributed to carnivores was noted on long bones. Axial elements included some rib mid-sections which showed gnawing and tooth punctures, and one slightly gnawed mandible. It is felt that at least some of the rib and vertebral fragments which showed no obvious signs of tooth marks could have been attributed to carnivores, although evidence is lacking (for example Haynes (1981:316) documents "segments of ribs, 15 cm. to 45 cm. long, scattered about" at wolf kills).

Forelimb elements which exhibit carnivore damage include the left and right forelimbs of a single male individual. The right forelimb consists of an articulated humerus, radius and ulna, with only the humerus modified (removal of the entire proximal end and both distal epicondyles). On the left forelimb, the humerus had been reduced to a cylinder and the radius exhibited slight gnawing on the proximal end, with the distal end chewed

away. The ulna was undamaged. Two other humeri exhibiting carnivore damage include a calf to yearling sized humerus cylinder with a scratched shaft and scooped out ends and a female humerus showing some tooth marks on the proximal end and very slight gnawing on the medial epicondyle.

Other forelimb elements which showed carnivore damage were noted, including the radius (N=3), metacarpal (N=4) and phalanges (N=2). None belonged to articulating units of bone, although in several instances nearby undamaged bones probably belonged to the same individuals.

There was less evidence of carnivore modification preserved on the hindlimb. Four femoral fragments (including two cylinders) no tibiae, four metatarsals, one calcaneum and one phalanx had definitely been modified by carnivores. Three of the metatarsals were from two immature individuals and had varying degrees of gnawing off of the proximal and distal ends and deep scratches and scoring on the shafts. All three of these metatarsals were found in the same unit as the carnivore modified left male forelimb, immature humerus, radius and mandible fragments. The single calcaneum which was utilized showed extensive modification - the entire distal end and medial articular facet were gnawed away. This likely represents utilization of the bone in a more extensive fashion than would be expected in simple feeding.

In total, twenty eight instances of bone damage definitely attributed to carnivores were noted. Carnivore damaged bones were scattered over most of the excavation block, with one distinct spatial focus in the area of hearth Feature four. One third of all carnivore modified bone was collected from the single 2 m by 2 m unit containing the hearth (which comprises less than 4% of the total excavated area). Most of this damage consisted of light to moderate gnawing on the ends of the long bones of one adult and two immature individuals. Nearly twice as many carnivore modified bones were from the left side than the right (11 vs. 6).

Speth (1983:62) used the relationship between the percentage of survival of the proximal vs. distal humerus to assess the degree of destruction by carnivores, after a method outlined by Binford (1981:219). The humerus is particularly sensitive to carnivore attrition, thus Binford (1981:218) suggested "that proportional plots of the standardized frequencies for the proximal versus the distal humerus be used as the basic diagnostic technique for assessing the degree of destruction of bone parts an assemblage has suffered."

When Component Three of the Maple Leaf site was plotted against Binford's graph, as was expected given the previous discussion, it did not fall within the "zone of no

destruction" (Figure 20). Instead, it clearly fell halfway between the zone of destruction and no destruction. This result, although ambiguous, was mildly encouraging in that the researcher felt the documentation of the observed damage was sufficient to compensate for distortions in perceived butchering patterns as a result of carnivore activity. In other words, if not "pristine", neither was the assemblage "ravaged". However, the plotting of the locations of carnivore modified bones which revealed the dense concentration around the hearth also revealed another pattern - most of the undamaged proximal humeri were from within the fill of the pond feature. It was decided to totally recalculate the percent MNI splitting the assemblage into two groups - bone from within or closely associated with the pond feature and all other bone. When these two subgroups were plotted in the same fashion the results were definitely unambiguous (Figure 21). The pond assemblage was "pristine", the rest of the material was "ravaged". It should be noted that for this exercise and all other comparisons to Binford's work, his method of determining the MNI has been used, rather than the usual method.

In summary, analysis of known carnivore modification and the distribution of carnivore modified bone has demonstrated that this assemblage has been partially

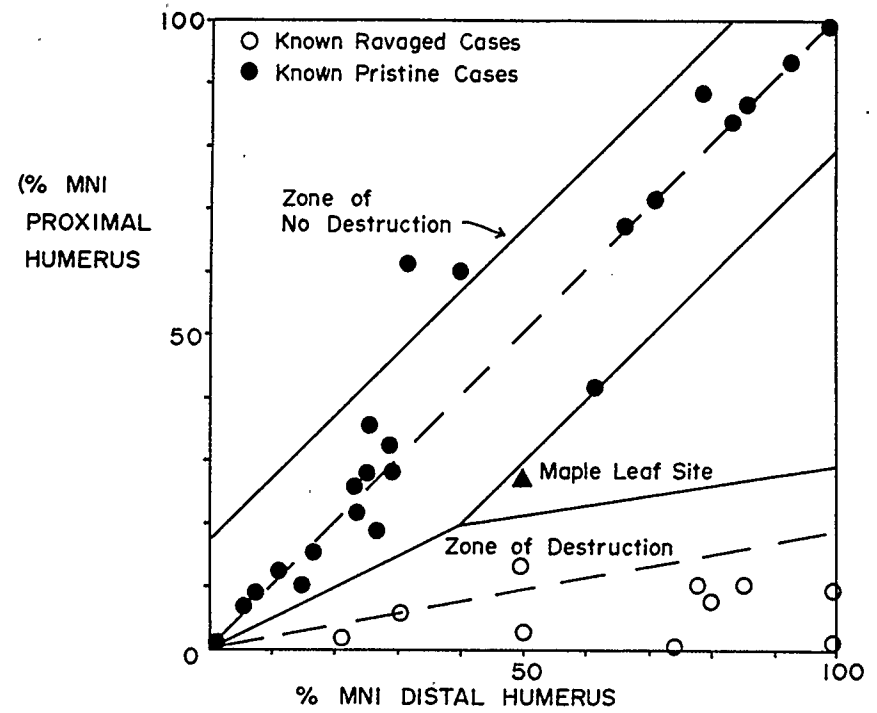

Figure 20. Representation of Proximal vs. Distal Humerus (after Speth 1983), Component 3

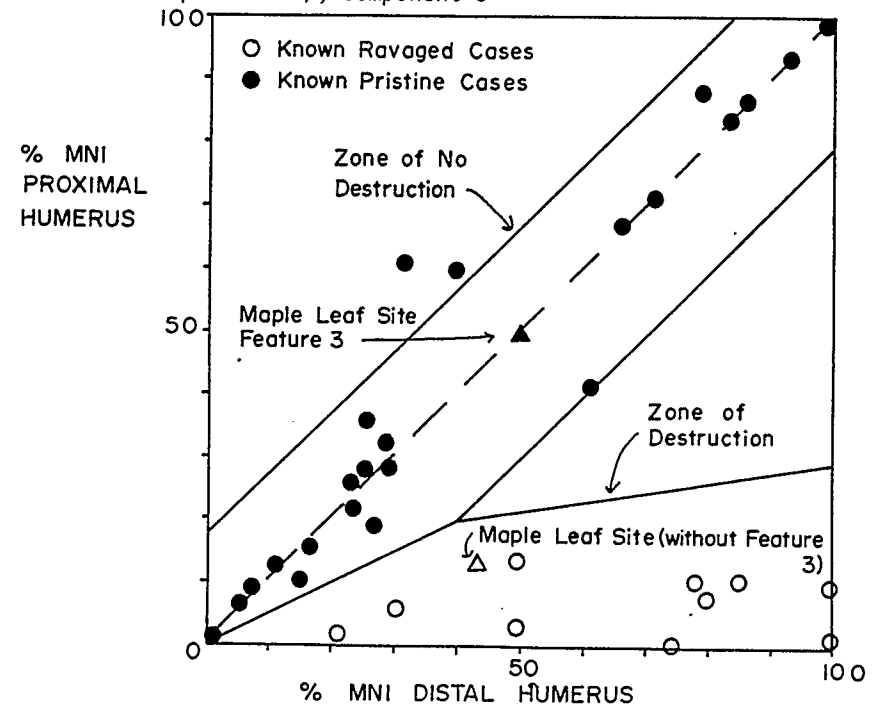

Figure 21. Representation of the Proximal vs. Distal Humerus (Feature3)

altered. This factor makes discussions of perceived butchering patterns and representation of elements much more difficult. The fact that the carnivore activity seems to have a spatial focus around the hearth feature may indicate that most of this activity occurred during or very shortly after human use of the site, and may well indicate the presence of domestic dogs. The lack of extensive carnivore activity in the area of Feature 3 tends to support the interpretation of this feature as a pond or spring. The next logical question is that if the feature inhibited carnivores from utilizing these remains, what effect did it have on humans? This question will be addressed in the following sections.

Age Groups

As stated earlier the ageing of bison by dentition is a well established, successful method for determining age structures and seasonality in catastrophic kills (Frison and Reher 1970; Frison, Wilson and Wilson 1976; Frison 1978; Reher and Frison 1980; Wilson 1980a). Although the success of this method depends upon a large sample of juvenile dentition, Wilson (1980a:97) believes that existence of seasonality may be demonstrated by periodicity in metaconid heights.

The juvenile sample from Component Three of the Maple Leaf site was too small for satisfactory determination of season of kill, although a generalized age structure for the group was obtained, and the limited evidence from the juvenile dentition and metaconid heights does perhaps point to a seasonally restricted event or events.

Only four individuals under three years of age were represented by dentitions. Several deciduous and permanent teeth which were not contained in mandibles or clearly associated with other teeth could have increased this count slightly, but were not used due to problems with overlapping wear categories. Two loose first molars were used to establish age groups for mature individuals on the basis of metaconid heights, but loose second and third molars were not used (again due to problems with overlapping wear categories).

The youngest juvenile was determined to be between .7 and .9 years of age, by comparison to schedules developed by Wilson (1980a), Frison and Stanford (1982) and Frison et al. (1976). Although wear on the first molar was comparable to the .7 estimate, wear on the deciduous premolars was identical to that described by Wilson (1980a:93) for a one year old animal, and by Frison and Stanford (1982) for a .8 to .9 year old animal. Because of the high possibility for error in using one calf to

establish an age group, the broad category of .7 to .9 years was chosen, with a possibility of several weeks error. Given a peak calving date of May 1 (Rutberg 1984:420) this would place the season of kill sometime between January and late April.

Two individuals represented by maxillary teeth fit very closely with Wilson's (1980a:103) 2.0 year category. A fourth individual was represented by lower second and third molars which show more wear than Frison et al. (1976:39) 2.7 year category and fit well within Wilson's 3.0 year category. Thus, of the four juveniles, one may be classified as .7 to .9 years and three others to .9 years. When adult teeth were placed into yearly categories on the basis of wear and metaconid heights, they fit well within a .9 years plus framework, and showed a certain degree of periodicity (Figure 22). Thus, the limited evidence provided by dentition suggests an early spring affiliation.

Three very small fragments of fetal bone were found at widely separated locations across the excavation block. Unfortunately these could not be identified as to element or stage of development (cf. Wilson 1974:147), although the fact that they have preserved at all may indicate late winter to early spring use of the site.

Descriptions of the age groups and metaconid heights are included in Tables 4, 5 and 6. The wear rate on the

Table 4. Age Group Wear Categories

Group 1 - .9 years (N=1)	DP_2 with moderate wear; DP_3 in full wear; DP_4 in full wear with the anterior exostylid worn to a circle, the posterior exostylid joined to the tooth. M_1 is newly erupted with light wear on facets I to IV, other facets and exostylid are not yet in wear.
Group 2 - 1.9 years (N=2)	Not represented by lower molars. DP^3 and DP^4 in full, heavy wear; M^1 in light wear on all facets; M^2 in light wear on facets I to IV, very light wear or polish on the rest of facets, entostyle not yet in wear.
Group 3 - 2.9 years (N=1)	Represented by a single M_2 with all cusps in wear but exostylid not in wear; and a single M_3 with light wear on facets I to IV, very light wear on V to VIII, and only polish on IX and IX'.
Group 4 - 3.9 years (N=0)	This group was not present in the sample.
Group 5 - 4.9 years (N=2)	M_1 in full wear on all facets, exostylid worn to tooth; M_2 in full, moderate wear on all facets, exostylid worn to a circle; M_3 in full wear on all facets with the 3rd cusp only lightly worn to the rest of the tooth, with the exostylid not yet in wear.
Group 6 - 5.9 years (N=1)	Group is represented by a single M_1, based on metaconid height. The tooth is in full wear, heavier than the previous category, with the fossettes still in good condition.
Group 7 - 6.9 years (N=1)	Group is represented by a single M_1, based on metaconid height. M_1 is in full wear, with the prefossette beginning to break-down.
Group 8 - 7.9 years (N=2)	M_1 is in full wear with the prefossette reduced in size but still present; M_2 is in full wear with the exostylid joined to the tooth; M_3 is in full wear with the exostylid worn to a circle.
Group 9 - 8.9 years (N=3)	All premolars are in very heavy wear. M_1 is in heavy wear with the prefossette gone and postfossette reduced, and enamel is above the alveoli. M_2 is in heavy wear with the fossettes reduced in size, and

Table 4. Continued

Group 9 - 8.9 years Continued	enamel just at or above the alveoli. M_3 is in full wear with the exostylid not quite joined to the tooth and the enamel just at or below the alveoli.
Group 10 - 9.9 years (N=1)	P_4 shows extreme wear with the enamel eroded away in places; M_1 shows very heavy wear with the postfossette worn away; M_2 shows heavy wear with the prefossette very reduced in size, postfossette somewhat reduced; M_3 is in full heavy wear with the exostylid joined to the tooth and enamel above the alveoli.
Group 11 - 10.9 years (N=0)	This group was not present in the sample.
Group 12 - 11.9 years (N=1)	M_1 shows complete wear with only small patches of enamel present or no enamel above the exposed root; M_2 is very cupped with both fossettes worn away and very little enamel remaining; M_3 shows very heavy wear with the prefossette almost totally gone and the postfossette very reduced in size.
Group 13 - 12.9 years(+) (N=1)	This group was represented by the maxillary molars of an incredibly aged individual. All molars showed extreme wear with no enamel remaining over the exposed roots.

Note: Cusp terminology used is from Frison, Wilson and Wilson (1976).

Table 5. Age Groups and Metaconid Heights of Component Three Mandibular Molars

Catalog Number	Side	Group	Age	M_1	M_2	M_3
78551 78552	L R	1	.9	- 53.5		
		2	1.9	No examples of mandibular molars		
77318 78608	R R	3	2.9	- -	51.9 -	- 63.5
		4	3.9	No examples		
77551 77538 781100	[L R R	5	4.9	27.4 35.9* 29.5	46.3 50.8* 45.0	58.4 58.3* 54.9
75052	R	6	5.9	22.9	-	-
78973	R	7	6.9	16.8	-	-
75086 75085 78771 78991	[L R [L R	8	7.9	11.4 10.5 8.7 -	24.2 23.4 21.0 -	39.0 41.6 40.2 37.3
78321 781027 77571	L L L	9	8.9	- 9.1 7.4	22.0 19.0 17.0	29.6 35.4 36.5
77057 77058	[L R	10	9.9	9.0 8.6	- 12.9	- 12.9*
		11	10.9	No examples		
77070 77742	[L R	12	11.9	2.9 0.0	- 1.0	10.0 11.0
		13	12.9+	No examples of mandibular molars		

[- square bracket indicates the same individual

* - asterisk indicates unusual wear pathology

Table 6. Average Annual Metaconid Heights, Component Three

Age Group	M_1	M_2	M_3
1	53.5	-	-
2	-	-	-
3	-	51.9	63.5
4	-	-	-
5	28.4	45.6	56.6
6	22.9	-	-
7	16.8	-	-
8	10.2	22.8	39.5
9	8.2	19.3	33.8
10	8.8	12.9	12.9
11	-	-	-
12	1.4	1.0	10.5
13	-	-	-
Average Wear	4.7	5.6	5.9

first molar was 4.7 mm over 11 years. This rate is somewhat higher than rates established for some late period kills such as 3.2 mm for Glenrock (Reher 1970), and 3.3 for Wardell (Reher 1973). However it is lower than the wear rates for the Altithermal Hawken site, 5.3 mm (Frison et al. 1978), the Garnsey site, 5.2 mm (Wilson 1980a) and the Agate Basin component rate of 6.5 mm at the Agate Basin site (Frison and Stanford 1982). This last rate of 6.5 mm for the Agate Basin component may be a miscalculation, since examination of the raw data indicates a wear rate of 5.3 mm (cf. Frison and Stanford 1982, Table 4.8). Wear rates have been taken as indicative of harsh or benevolent climatic conditions by some of the above mentioned authors. Since the wear rate at the Maple Leaf site was 4.7 mm per year, and the sample is so small, no conclusions may be drawn at this time about the relative harshness of the environment as revealed by tooth wear.

Minimum Number of Individuals and Herd Composition

The analysis of dentition yielded a minimum number of 16 individuals. Only four individuals under five years of age were represented by dentition, however at least five immature individuals were represented by distally unfused metacarpals. Thus it is likely that the MNI is at least 17.

Out of the total of 17 individuals, four could not be assigned a definite gender due to the fragmentary nature of the sample. The remaining 13 animals consisted of four males, four females and the five immature individuals. Of the five immature animals only one was in the calf/yearling size range; the rest were larger.

The age group/MNI curve is shown in Figure 23. Although the sample is small, it resembles the expected pattern for a catastrophic, rather than attritional event. The largest category is adult individuals eight to nine years old. Although at first glance immature individuals might seem to be underrepresented, careful examination reveals that this is not the case. Given that the sex ratio split for animals of known gender is 50% male and 50% female, the potential exists for half of all sexually mature animals (three years and older) to be male. Similarly, the possibility that one or two of the females are past the age of calving may be considered. Also of note, in a free roaming herd of bison in Wood Buffalo National Park, Haynes reported

> Aerial counts in November, 1979 showed that only 7.9% of the Area I bison herds and 10.8% of the Area II bison herds were calves, and in February 1980, only 5.8% of Area I herds were calves... (1981:230).

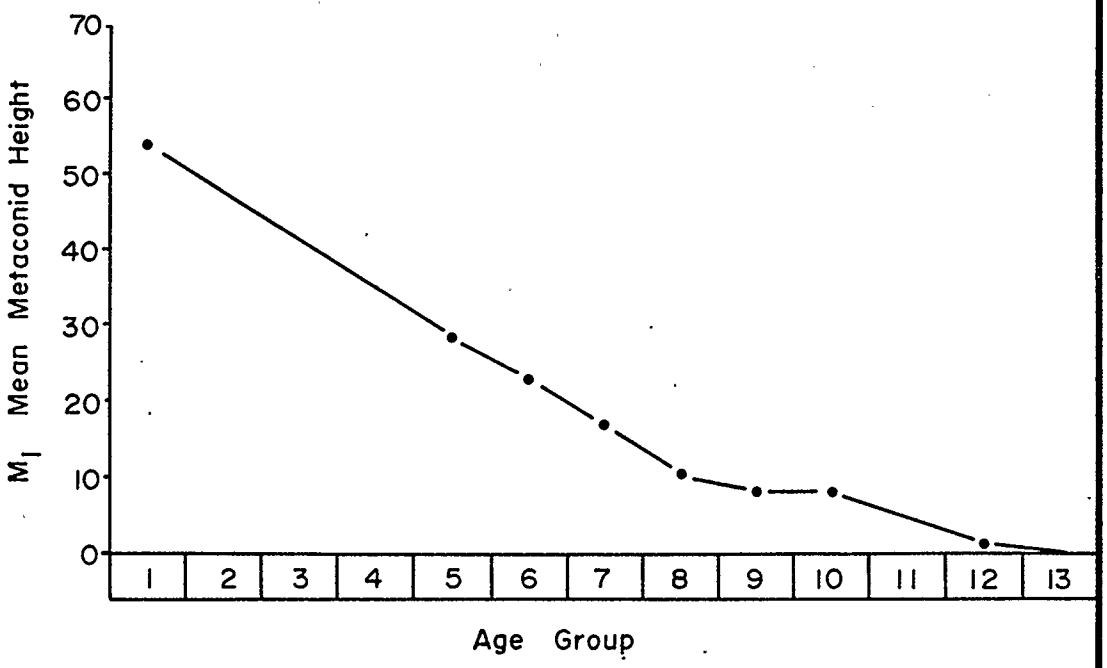

Figure 22. Mean Metaconid Heights vs. Age Groups - Component Three

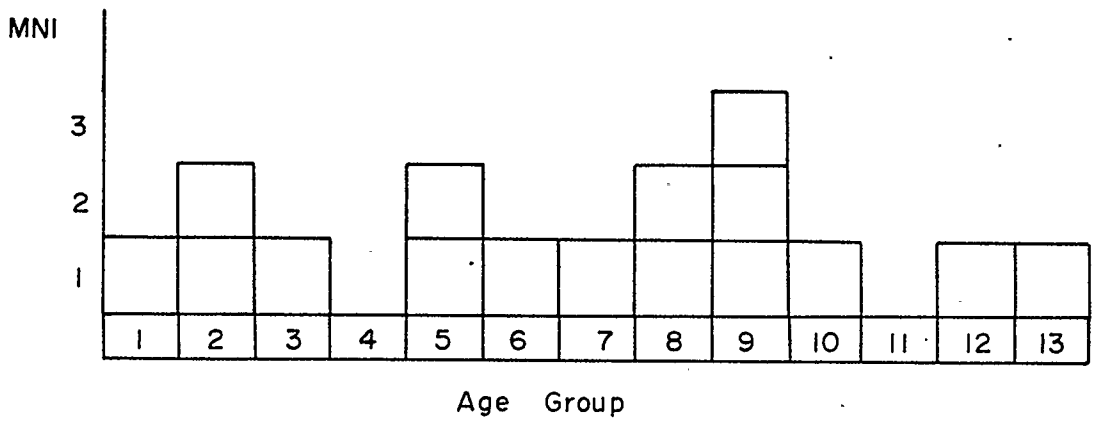

Figure 23. Age Group Distribution - Component Three

Meagher (1978:125) noted that "Although cows theoretically are capable of producing a calf every year, production is much less except with intensive management."

Driver (1983:145) made this same point in a discussion of the underrepresentation of juveniles at communal kill sites. At the Maple Leaf site at least one calf to yearling sized individual was represented, and if the seasonality was early spring, no new calves would be expected. Thus, juveniles (or any age group) are not considered to be underrepresented.

Species

As was noted in Chapter 3, the size range of the post cranial elements showed no statistically significant difference from the size range of a sample of modern plains bison. Species determination without a sample of skulls is impossible, and for the most part only fragmentary specimens were recovered. Of interest, however, is the size range exhibited by male horn cores. It is well known that dwarfing of bison has been continuous (and probably steady) throughout the Holocene. Wilson (1980b) discussed Alberta bison in particular and used tip to tip horn core measurements to morphologically date individual skulls, with marked success. Unfortunately none of the Maple Leaf specimens allow for tip to tip measurements. Wilson

(1980b:84) also noted that horn core length could be used. Accordingly, horn core length on the upper and lower curves, tip to burr (Skinner and Kaisen 1947:145) was plotted for the available Maple Leaf specimens. In addition 13 mature males from the Hitching Post Ranch sample, dated at 3600 B.P. (Wilson 1983), two mature males from the southern Alberta Milan site, dated ca. 9600 B.P. (Shackleton and Hills 1977), and two mature males from the Casper site were included for comparative purposes. Figure 24 shows the positioning of the various samples in relation to each other. The Maple Leaf specimens generally fall into the expected zone based on radiocarbon dates, which would seem to indicate the males of the species were slightly larger than modern B bison bison, at least in terms of cranial characteristics.

Bone Distribution

The horizontal distribution of bone within sites is usually illustrated by a small scale planview drawing of the bone bed. Such a drawing was not completed for the Maple Leaf site due to a) incomplete provenience information for non-field school excavation units, which are scattered throughout the excavation block; b) because the bone analysed from Component Three was not present in the form of bone beds, it was felt that a drawing

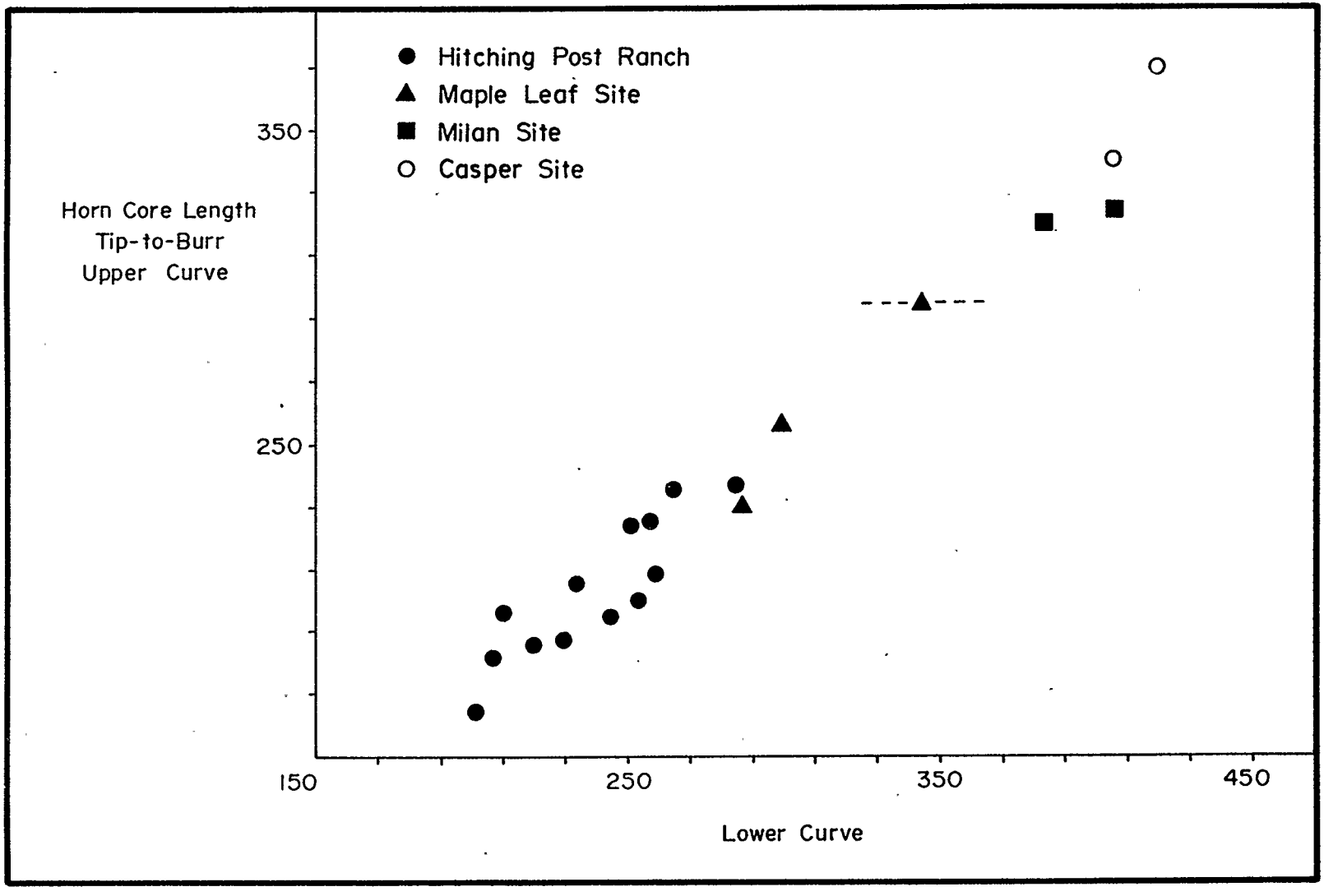

Figure 24. Horn Core Lengths. Data taken from Shackleton and Hills(1977); Wilson(1980b,1983b)

collapsing the bone onto a single plane would be inappropriate and misleading; and c) although such a map might be possible for less dense areas of the block, it would not be able to convey the varying absolute amounts of bone across denser concentrations.

Figure 25 is a very simple choropleth map which shows the density of bone in each 2 by 2 m unit based on weight across the excavation block. It is immediately apparent that most of the bone (by weight) was contained within the wetland feature 3. Two smaller foci correspond in location to the two areas of lithic concentration and the hearth feature in the uphill (northern) portions of the excavation block.

In an attempt to refine and clarify these findings, a computer generated "contour" map of the bone bed was constructed. This map, produced using the software package Surface II (Sampson 1978), was based upon the weight of bone within each 1 by 1 m quadrant. In cases where provenience was only known within the 2 by 2 m unit, the weight was equally apportioned between quadrants. These bone weights were then assigned arbitrarily to the centre of each quadrant and contours in hundreds of grams interpolated between data points. The resultant map gives an "impression" of the relative density of bone across the block, with the highs representing dense areas and the lows

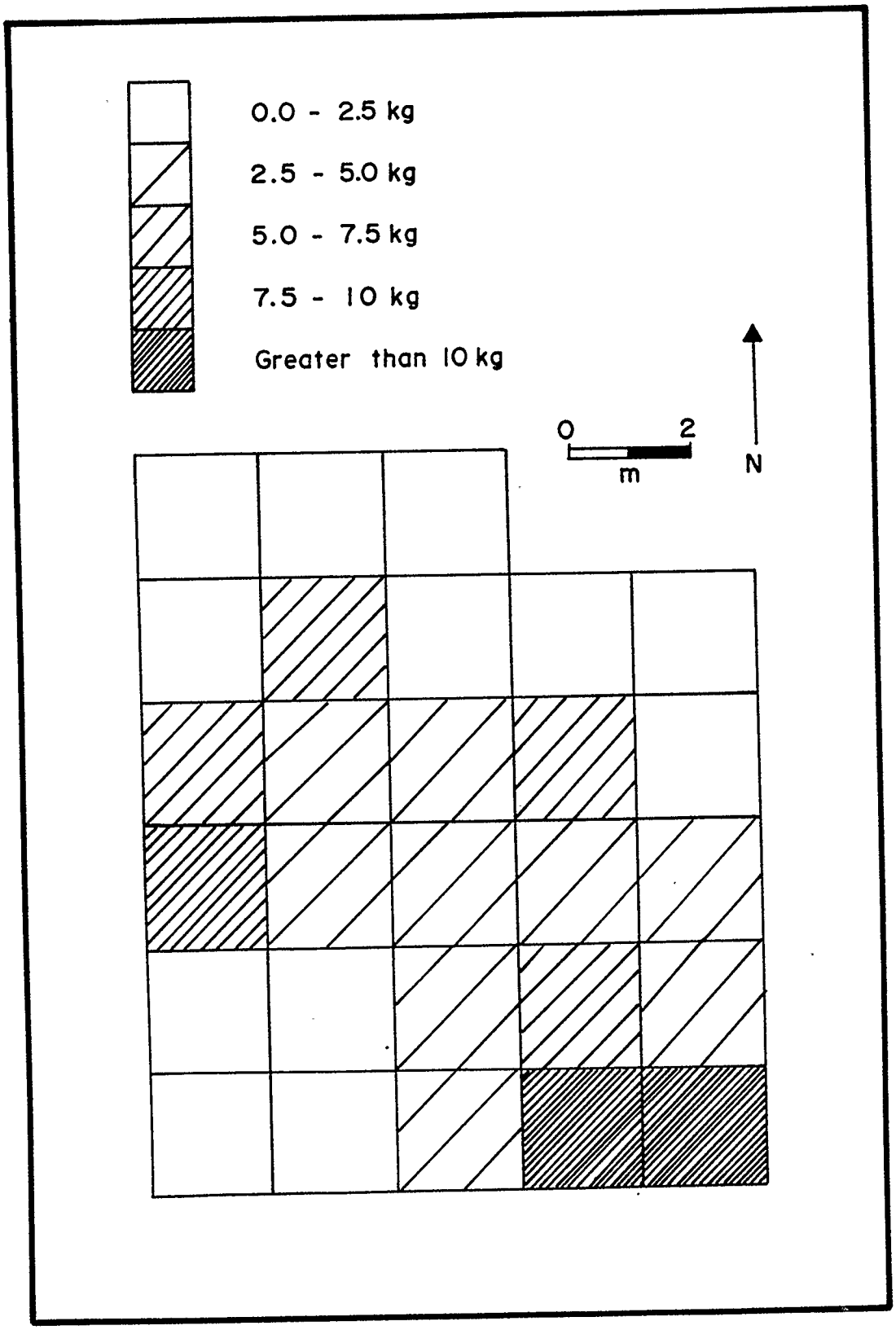

Figure 25. Choropleth Map of Bone Weight - Component Three

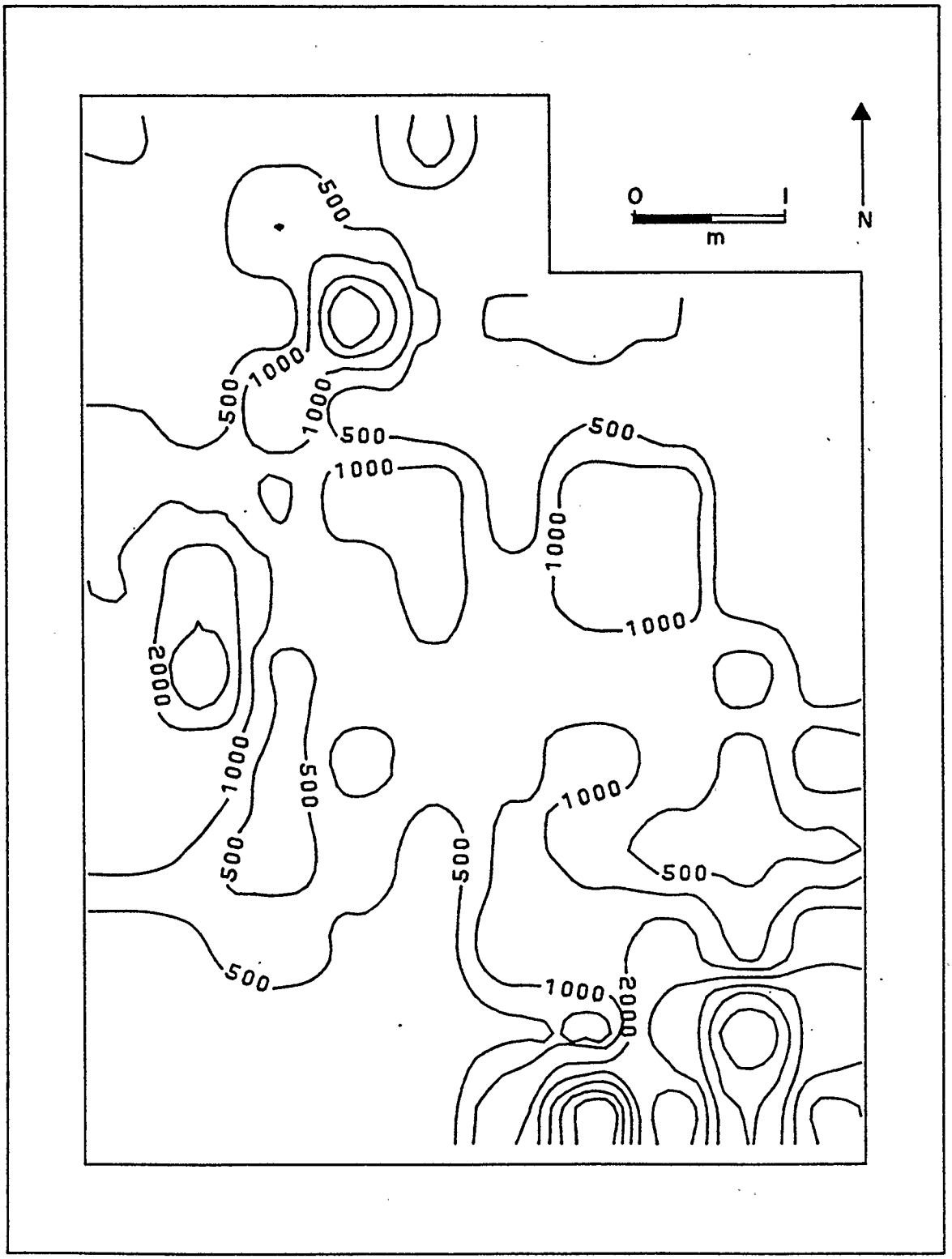

Figure 26. Contour Map of Bone Weight - Component Three

representing sparse areas (Figure 26). Certain contours have been supressed for clarity. Weight was chosen over count as a more accurate reflection of the actual amount of bone. The computer generated map corroborates and clarifies the distribution of bone shown in the choropleth map - by far the most bone is within wetland feature 3, and a less dense area separates it from other locales of intermediate density to the north.

Cut Marks

Because of the degree of root etching, many of the surfaces on bone from Component 3 were obscured. A number of fine, sharp lines noted on the surfaces have been interpreted as trowel marks, which were caused during excavation as a result of the soft condition of the bone prior to stabilization. Only a single bone, a female proximal metatarsal which was not root etched, exhibited clear, unambiguous cut marks. These consisted of two sets of two short, sharp marks spaced very closely together, transversly oriented approximately 1/4 of the way down the shaft from the proximal end, one set on the anterior surface, one on the lateral, medial surface. The bone was spirally fractured midshaft, then possibly utilized.

Butchering Analysis

The following section briefly summarizes the observed patterning of bone representation and modification. Table 7 shows the observed MNI percent representation based on a total of 17 individuals. The percent MNI is also shown graphically in Figure 27. In this study, the MNI is considered to be the minimum number of individuals required to account for the observed representation of bone (Klein and Cruz-Uribe 1984:26). However, for all comparisons to tables, charts, graphs etc. developed by Binford, this method of calculating MNI has not been used. Instead, in the interest of consistent comparisons a second table (Table 8) and graph (Figure 28) have been developed using Binford's method of determining "MNI". I shall refer to this as the "modified MNI" (mMNI).

When the observed vs. expected representation of elements is examined (Figure 27) it may be seen that with the exception of the skull and mandible, the axial skeleton is greatly underrepresented. Although this underrepresentation of the axial skeleton is partially due to the degree of fragmentation of the ribs and vertebrae, this distinction is probably true. The extreme upper fore and hind limbs are also underrepresented compared with the lower limbs. The lower hind limb appears to be slightly better represented than the lower forelimb, but this is

Table 7. Minimum Number of Individuals, Component 3

Element	Observed MNI	% MNI
Skull	11	65
Mandible	13	76
Atlas	5	29
Axis	5	29
Cerv. Vert.	3	18
Thor. Vert.	2	12
Lumbar Vert.	2	12
Pelvis	4	24
Sacrum	2	12
Ribs	1	3
Sternum	0	0
Scapula	4	24
Prox. Humerus	7	41
Dist. Humerus	9	47
Prox. Radius	10	59
Dist. Radius	5	29
Ulna	8	47
Carpals	8	47
Prox. Metacarp.	10	59
Dist. Metacarp.	13	76
Prox. Femur	4	24
Dist. Femur	3	18
Prox. Tibia	3	18
Dist. Tibia	6	35
Tarsals	10	59
Astragalus	10	59
Calcaneum	12	71
Prox. Metatars.	11	65
Dist. Metatars.	9	53
1st Phal.	9	53
2nd Phal.	7	41
3rd Phal.	3	18

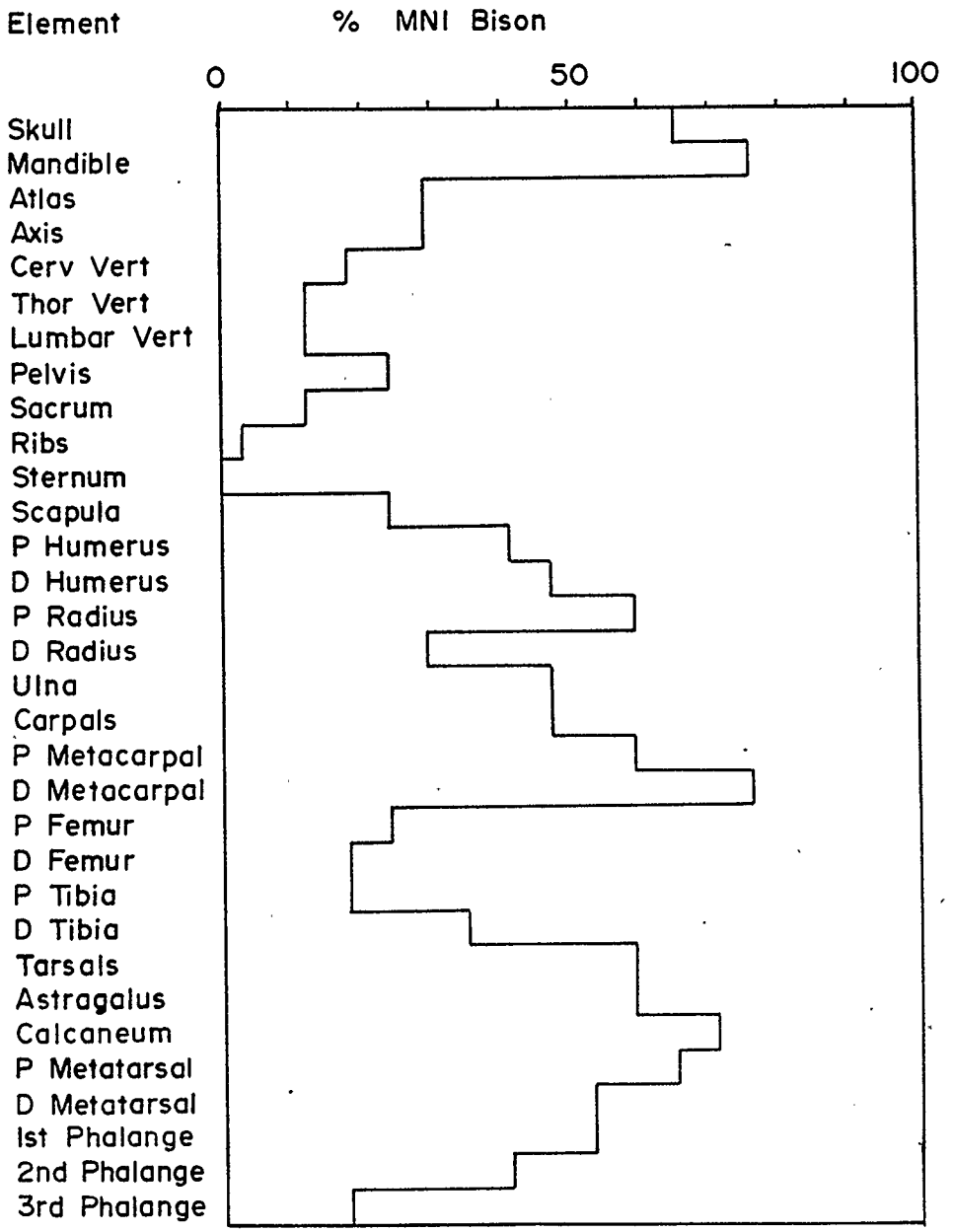

Figure 27 Observed Representation of Faunal Elements Expressed as %MNI - Component Three

Table 8. Minimum Number of Individuals, Component 3, Binford's Method (mMNI)

Element	# per Individual	Observed	mMNI	% mMNI
Skull	1	11	11	100
Mandible	2	20	10	91
Atlas	1	5	5	45
Axis	1	5	5	45
Cerv. Vert.	5	14	2.8	25
Thor. Vert.	14	15	1.1	10
Lumbar Vert.	5	10	2	18
Pelvis	2	6	3	27
Ribs	28	13	0.5	4
Sternum	1	0	0	0
Scapula	2	7	3.5	32
Prox. Humerus	2	6	3	27
Dist. Humerus	2	11	5.5	50
Prox. Radius	2	16	8	73
Dist. Radius	2	10	5	45
Carpals	12	49	4.1	37
Prox. Metacarp.	2	16	8	73
Dist. Metacarp.	2	17	8.5	77
Prox. Femur	2	8	4	36
Dist. Femur	2	5	2.5	23
Prox. Tibia	2	4	2	18
Dist. Tibia	2	9	4.5	41
Tarsals	6	39	6.5	59
Astragalus	2	17	8.5	77
Calcaneum	2	21	10.5	95
Prox. Metatars.	2	19	9.5	86
Dist. Metatars.	2	13	6.5	59
1st Phal.	8	60	7.5	68
2nd Phal.	8	46	5.7	52
3rd Phal.	8	18	2.2	20

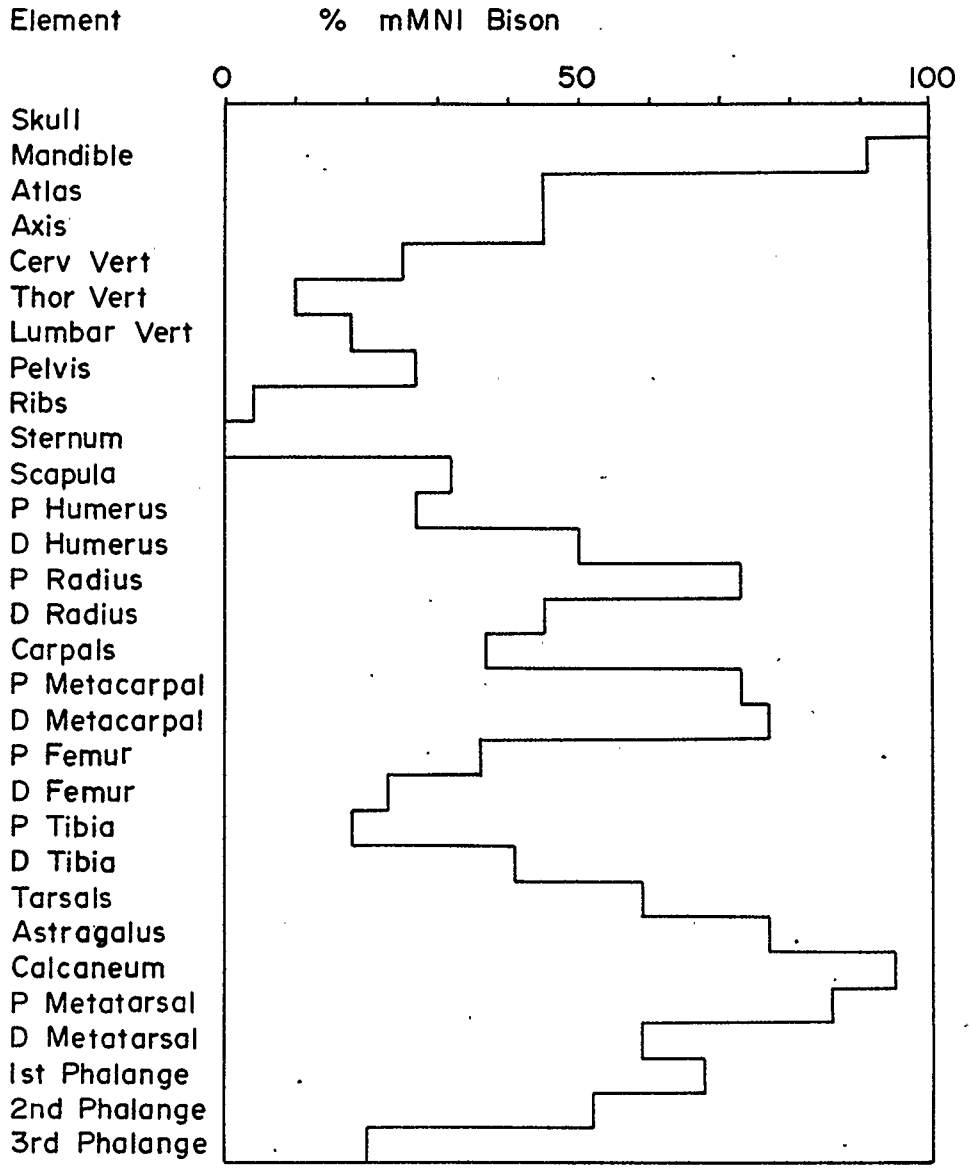

Figure 28. Observed Representation of Faunal Elements Expressed as %mMNI - Component Three

probably due mostly to the differing nature of the carpal vs. the tarsal unit.

In general terms, this component conforms to the expected patterning for a kill site, with the head and lower legs well represented. Each element is briefly discussed below.

The Axial Skeleton

Skull: Skulls from the sample were almost invariably highly fragmented. Most common were pieces of the frontals, meati, maxillae and horn cores. Eight large sections of the occipital portion of the skull, including the condyles, were noted. Of the horn cores which could be sexed and matched, four males and two females (one very old) were identified. Only one near complete skull was recovered, a mature male specimen from within the pond feature. It consisted of the entire skull posterior to the orbits, the portions anterior to the orbits (except for part of the nasal bone and the right maxilla) were missing. Skull elements showed no strong spatial patterning, although four individuals (24%) were found within the pond feature, which accounts for approximately 10% of the total excavated area.

Mandible: The mandible was generally quite fragmented, with only one complete specimen (from within the pond

feature) noted. Most common were various proximal portions and sections containing the cheek teeth. The incisors and to a lesser extent premolars were underrepresented.

Hyoid: No complete hyoids, and only six broken specimens were recovered. Four of the six hyoid fragments were found within the pond feature.

Atlas: The MNI based on the atlas was five. Two were complete, and one near-complete (the lateral margins were removed). The other examples consisted of large fragments of the posterior articular surface. One complete and the near-complete specimen were found within the pond feature.

Axis: The MNI based on the axis was also five. One was complete and one near-complete (spinous process removed). The other three specimens consisted of the dens and anterior articular process only. The single complete axis was found within the pond feature.

Vertebral Column: The vertebral column was underrepresented in the sample. Several hundred small fragments of spinous and transverse processes were noted, and many more were probably included in the unidentifiable fragment category. No strong patterns of groups of missing vertebrae were revealed, although cervicals were slightly better represented than thoracics or lumbars. Cervicals

were usually complete or missing only the spinous or transverse processes. Thoracics usually consisted of complete bodies minus the spine. Cervicals and thoracics showed a more scattered distribution than did lumbars, which were restricted to two distinct clusters of articulating elements and a single first lumbar associated with the lower thoracics. The only near complete thoracics and lumbars were found within the pond feature. Only two caudal vertebrae, both complete, were recovered, and one of these was also found within feature 3. The absence of caudals has often been cited as evidence for skinning (eg. Frison 1970:11).

Sternum: The sternum was not represented in the sample from Component 3.

Ribs: Ribs were underrepresented in the sample. Again, several hundred shaft fragments were noted, but could not be used to establish the MNI, which was based on the head or fragment thereof. Only fourteen ribs (five of which were in feature 3) could be counted using this method, most of them consisting of the head plus zero to five centimeters of shaft.

The Forelimb

Although the scapula more properly belongs to the axial skeleton, it shall be included in the discussion of the forelimb. Generally, from the scapula to the metacarpal element representation increases moving down the forelimb, with the exception of the carpals. Three reasons could explain this: 1) due to their small size and the large number of individual bones in the carpal unit, they have a greater probability for underrepresentation; 2) again due to their small size and variety, fragmentary carpals may be classified as non-identifiable; 3) the distal radius is also underrepresented, which may suggest that this area was a focal point for carnivores or humans; resulting in greater bone destruction.

The phalanges are also underrepresented, decreasing from first to third. This is probably a function of carnivore activity/bone density; Binford (1981:220) demonstrated that in caribou and sheep the first phalanx has nearly twice as high a survival percentage than the third, based on bone density.

Scapula: The scapula was also underrepresented in the sample, with an MNI of four. Of the identified specimens, one was complete, three consisted of the proximal one quarter to one half with the acromion and spine removed,

four of the complete glenoid having been broken through the neck, and the remainder of various small fragments. The right scapula showed a higher degree of fragmentation (NISP=9/MNI=4) than the left (NISP=4/MNI=3). The only complete scapula was found within the pond feature.

Humerus: The MNI based on the humerus is six mature (one female, four males, one unknown/probable male) and two immature. The humerus showed a certain degree of variability in the patterns of modification it exhibited, but much of this variability was probably due to carnivore damage. Two complete (probably matching) male humeri appeared to have been left unmodified, although extreme post excavation trauma may have obscured butchering evidence. Two matching male humeri were modified by carnivores, as was an immature cylinder; masking any possible evidence of butchering. Another humerus cylinder, judging by size to have also been immature, exhibited classic spiral fractures at both ends and no signs of carnivore damage, as did a male humerus with the proximal end removed, possibly through a sharp blow with a chopper. A single male humerus associated with the pond feature was undamaged with the exception of the removal of the lateral tuberosity, a pattern Frison (1970) associated with muscle stripping. The sex ratio of the humerus, four or possibly

five males to one female is of interest - with the exception of a single female humerus from the pond feature, all others belong to males. Similarly, lefts outnumber rights (5:1 proximal, 6:5 distal).

Radius: The minimum number of individuals based on the radius is ten. Adults include three definite males, one probable male and two females. Two immature individuals (one calf to yearling sized) are also represented. The ratio of lefts to rights again favours lefts (10:6 proximal, 5:4 distal), and a large discrepancy was noted in the representation of proximal vs. distal ends (16:9). Four specimens, three of which were lefts, were complete. A common bone unit (N=4) which was probably a result of butchering, was the proximal end plus one quarter to three quarters of the shaft, exhibiting good mid-shaft spiral fracture and no signs of carnivore gnawing. Another very common bone unit (N=10) was the longitudinally split proximal end, consisting of large portions of the lateral or medial articular surface and adjoining shaft, broken in a fashion which indicates splitting when the bone was fresh. Only three cases of modification could be attributed to carnivores - two specimens missing distal ends with spiral fractures midshaft also displayed gnawed proximal ends, and one immature cylinder showed gnawing and

scratch marks on the shaft. An unusual bone tool (Figure 29) manufactured from a left female radius was found on the periphery of the wetland feature. The articulating ulna was present in the immediate vicinity, having been removed and discarded prior to use of the radius as a tool. A very deep groove has been worked at an angle across the ulnar surface of the bone at approximately mid shaft. Many fine striations evince the working of the groove, which has almost a polished appearance, and has actually worn through the cortical surface of the bone at the midpoint of the groove, although the ends of the groove have not "bitten down" into the lateral edges of the bone. The tool in fact appears to have been manufactured, used and worn out on the spot. The spirally fractured distal end also exhibits polish on its tip. The function of this tool is not known. Semenov (1973:189) described and illustrated thong stretchers which have very similar, although not identical signs of use. It is possible that this tool served a similar function, perhaps related to sinew or thong manufacture. Kennedy et al. (1986:72) report a similar modification on a bison radius from DjPo-107, a nearby site, which they suggest was most likely used as an abrader.

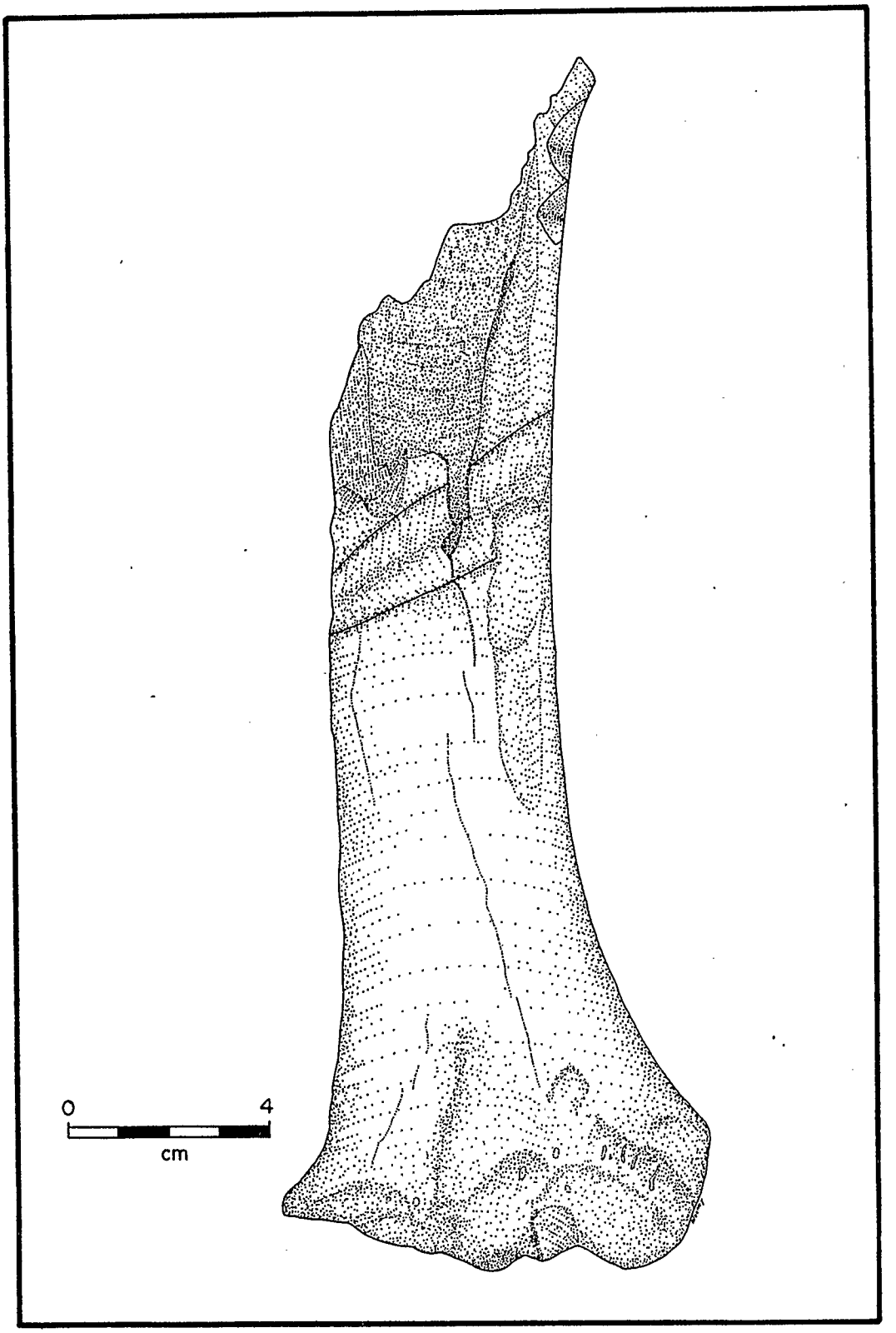

Figure 29. Radius Tool (posterior face of bone)

Ulna: The minimum number based on the ulna was eight, with twice as many lefts as rights represented. Ulnae were not sexed, and none showed definite evidence of carnivore modification. All had been disarticulated from the radii, although most were in close proximity to them. Three specimens were complete (all lefts), two were missing the olecranon cap only, and six were missing the olecranon cap and shaft.

Carpals: A total of 48 carpals were recovered, 30 from the left limb and 19 from the right limb. Carpals were essentially unbutchered and showed no carnivore modification, being either present and complete or absent altogether. The pisiform had the lowest representation, which may relate to its position within the carpal unit.

Metacarpal: The metacarpal is the best represented forelimb element, giving a minimum count of thirteen individuals; four males, four females and five immature individuals. Ten specimens were complete and unbutchered (six males, three females and one immature), and the three complete female elements all were associated with the pond feature. Seven of the ten complete bones were lefts. Although complete metacarpals were predominately male, only two modified bones were identified as male, and one of these was carnivore modified. Five of the fragmentary

specimens were female and four were immature. The majority of the modified metacarpals consisted of proximal or distal ends with varying degrees of adjacent shaft (from one quarter to three quarters) exhibiting classic spiral fractures. One immature cylinder was carnivore altered. Other carnivore modified bones consisted of three spirally fractured left distal ends with slight gnawing on the condyles. As with the other forelimb bones, lefts outnumbered rights (10:6 proximal, 11:6 distal).

Phalanges: Although fore and hind phalanges were separated during analysis, they are combined in this discussion, since no differences between them were noted. Essentially, phalanges were left complete and unbutchered. Almost invariably, incomplete bone units were due to shovel damage, post-recovery damage or, rarely, carnivores. Only three phalanges exhibited alteration - two seconds with slight gnaw marks and one first which was split transversly. The phalanges were very underrepresented in comparison with the rest of the forelimb, probably as a result of carnivores.

The Hindlimb

The hindlimb, particularly the upper hind, was less well represented than the forelimb in the sample, although from the tarsal unit down the limb the representation is

very comparable. Unlike the forelimb, which showed a stronger percentage of male elements, the hindlimb shows more equal proportions of males/females, or, as in the tibia, more females. Similarly, the consistent tendency for more lefts than rights to be present in the forelimb was not recognised in the hindlimb.

Pelvis: The pelvis was very underrepresented in the sample, yielding a minimum count of four individuals (four lefts, two rights). The pelvis units which were present were most commonly fragments of the acetabulum with a small portion of the adjacent shaft. Only three complete acetabulums (severed from the rest of the element through the shafts) were noted. The sacrum was also very underrepresented, yielding an MNI of 2. One bone unit consisted of the first three sacral vertebrae with the spine removed, one consisted of a small body fragment of the first vertebra, and one consisted of the crest and bodies of the last two vertebrae. No patterning was noted in the distribution of pelvic fragments.

Femur: The femur was the most poorly represented of all the limb bones due to simple absence and high fragmentation. The MNI was four; one male, one female, one immature and one unknown. The degree of fragmentation of this element makes discussion of butchering difficult.

Only two elements (from units adjacent to the pond feature) were nearly complete, missing only the greater trochanter. This pattern has been associated with muscle stripping during the butchering process by Frison (1978:315). In nearly every other instance femoral elements were found in small scatters of shaft, proximal and distal fragments, or isolated occurrences of head or shaft fragments. In two cases femur cylinders can be directly related to carnivore attrition. The single most common bone unit consisted of the head separated from the rest of the element (N=6).

Patella: Only a few small fragments of bone identified as patella fragments were noted. Low frequency representation of patellae has been associated with their use as handholds during muscle stripping (Frison 1970:14)

Tibia: The minimum number of individuals based on the tibia is six; four females, one male, and one immature individual. Although no obvious signs of carnivore alteration were observed, three cylinders (including matching left and right elements from the calf to yearling sized individual) were noted. Only three complete tibiae, two females (from within the pond feature) and one male were recorded. The most common bone unit (N=7) was the distal end with up to one half of the adjacent shaft, showing spiral fracture. Two of these elements exhibit

slight polish on the ends and could possibly have been used as tools (Figure 30).

Astragalus: The MNI calculated on this element is ten. All astragali were complete and unbutchered. The only altered specimen consists of a lateral half which appears to have been broken by shovel damage.

Calcaneum: The MNI based on the calcaneum is twelve. Most commonly it was complete and unbutchered (N=10), and the next most common bone unit was missing only the tuber calcis (N=4) or lateral articular facet (N=4). Several of these bone units were due to shovel damage. Only one bone was carnivore altered - a calcaneum on which the entire distal end and medial facet were totally gnawed away, with deep tooth marks and scoring over the remaining surfaces. This damage is more consistent with scavenging or boredom gnawing than simple utilization for meat.

Tarsals: The remaining tarsals were equally well represented and almost invariably complete and unbutchered.

Metatarsals: The minimum number of individuals represented by the metatarsals was eleven. Five bones were complete (two male, two immature and one unknown). Gender analysis revealed the presence in total of four males, four females, two immatures and two unknowns. The most common bone unit

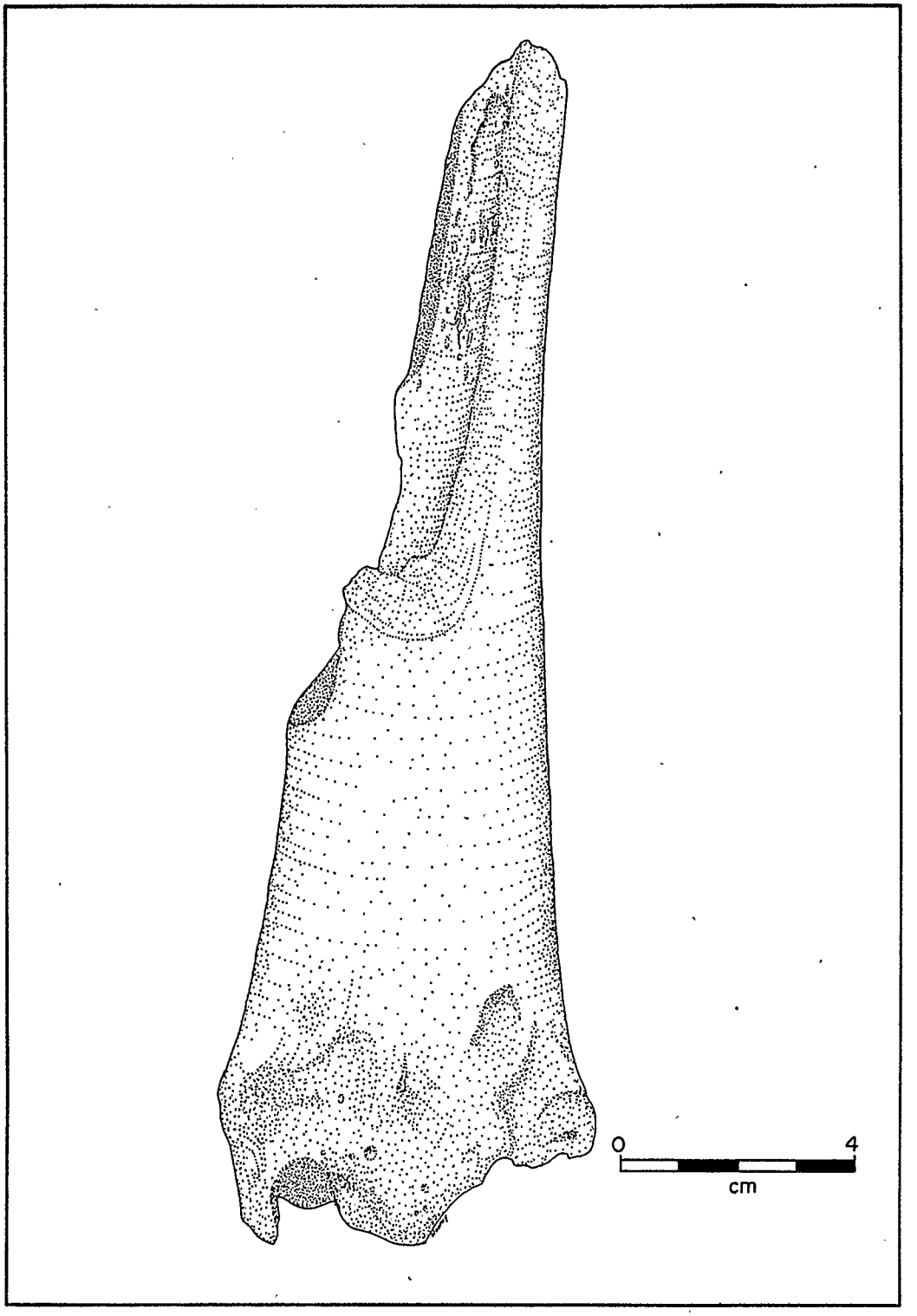

Figure 30. Spirally fractured Distal Tibia (anterior view)

was the proximal (N=7) or distal (N=7) end with one quarter to three quarters of the adjacent shaft, spirally fractured. Other units consisted of small proximal or distal end fragments. Carnivore damage was noted on the distal ends and shafts of the metatarsals of two immature individuals and slight gnawing on the distal condyles of another individual.

The Butchering Sequence

Very few of the faunal elements in this component were present as articulating units, although many clusters of closely associated bones, such as forelimb elements, were shown to have once articulated. In several cases disarticulation was probably a result of taphonomic processes, rather than butchering. For this reason, and due to the extensive carnivore damage noted on many bones, and the lack of cutmarks, it is difficult if not impossibly to postulate a primary butchering sequence similar to those outlined by Frison.

Summary

Component Three at the Maple Leaf site contains evidence pointing to the presence of at least seventeen bison. Although the sample is small, age determination does not preclude the possibility that a catastrophic event

or series of events is represented. Secure determination of season of kill is not possible without a large sample of juvenile dentition; however the very limited evidence provided by dentition and fetal bone is consistent with a late winter to early spring use of the site. It is highly unlikely that a single event is represented by the assemblage. The variability in radiocarbon dates, diagnostic lithic artifacts, the nature of the bone bed itself and the sex ratio of the adult individuals in the assemblage (50% female/50% male), all suggest that at least two events, and possibly more, are represented.

The condition of the bone, although generally good, may not have been sufficient to preserve any fine cut marks which may have been present. Articulating butchering units were rare, perhaps due to taphonomic processes. Although many individual bones were broken in a pattern consistent with human butchering; the assemblage on the whole was shown to have been adversely effected by the activities of carnivores at or shortly after the time of the kill. This activity masks interpretation of the human activity, especially primary butchering, upon the bones. A distinct spatial focus of bones positively identified as carnivore modified was noted in the area of hearth feature four. Based upon the high incidence of preservation of the proximal humerus within the wetland feature, bones from

this feature were determined to have been relatively unimpaired by carnivores.

Tables of the observed vs. expected representation of elements based on a minimum of seventeen individuals were constructed. Although the skull and lower legs were well represented, as would be expected at a kill site, the axial skeleton was underrepresented, as were the upper fore and hindlimbs. While the absence of the upper limbs may be predicted on the basis of removal of the choicer meat and marrow portions (and also the absence of the ribs and hump), it would have been expected that more of the vertebral column and pelvic units should have been present at the site, since these elements are bulky and were often abandoned at the kill (e.g. Speth 1983; Ziemens 1982; Frison 1976, 1973, 1970). A possible explanation for the observed patterning of elements may be a result of sampling. The wetland feature was only present within the extreme southeastern corner of the excavated area; and it is possible that only a small portion of the feature was excavated. It has been demonstrated that carnivores were not able to utilize the remains within the feature to the same extent as they could bones from outside the feature. Similarly, the most complete skull, hyoid, mandible, atlas, axis, other vertebrae, ribs and scapulae were all found within Feature 3 (although it did not show stronger

representation of pelvic or sacral fragments). It is possible that the wetland feature represents the nexus of the kill and primary butchering, and that already segmented carcass portions were dragged uphill to higher ground, where they were further stripped of meat and utilized for marrow in secondary butchering locales. These locales are represented by scatters of lithic material, denser concentrations of bone, the presence of large unmodified cobbles and a hearth feature. If the above scenario is correct, then the assemblage from the Maple Leaf site represents at least two phases of culling by humans; perhaps three phases if domestic dogs were being fed on site. Much of the decision making would have been in terms of intangibles, such as difficulty of retrieval of meat from the kill spot, although this very factor might make decision making in terms of general utility more (rather than less) important. However, any attempt to judge the assemblage as a whole and categorize it as a "kill" or "processing" site would be doomed by oversimplification. Other factors which might have bearing on the above interpretation are differential treatment of the carcasses of males and females, and the somewhat unusual patterning of right and left fore limbs noted within the excavation block.

The next chapter considers the above interpretation in light of evidence provided by consideration of general utility and bone distributions.

Chapter Eight

Component Three: Interpretation

Butchering analysis at large communal kill sites on the Plains has been facilitated by the preservation in some sites of "butchering units" (consistent configurations of articulating elements) from which butchering sequences may be constructed; the presence of cut or chopper marks on bone; experimentation using stone and bone tools; and studies of the ethnographic record (Frison 1978:314). The picture that has emerged has been primarily influenced by Frison's meat stripping model, a very efficient method of stripping long segments of meat suitable for drying by chopping through muscle insertion points and using stone or bone tools to continue the stripping process. Evidence for this type of butchering has been provided from the Glenrock, Wardell, Casper, Vore and Agate Basin sites, as well as many others (for a summary see Frison 1978). Recently, Binford (1981) has challenged this model as being a post-hoc accomodative strategy, rather than "intellectually independent" of the arguments about butchering, that is

> ...the arguments generated by Frison as to the actions responsible for patterning in the faunal remains observed at Plains bison sites were

> invented to accomodate a particular set of observations (Binford 1981:291).

Binford has offered "middle range theory" (tools for giving meaning to observations of interest) developed from his work among the Nunamiut to attempt to explain butchering as a decision making process in terms of complex behavioral variables interacting with the general utility of elements (Binford 1978, 1981).

While data from the present study are of limited use in discussing the meat stripping issue, it is felt that the controversy exists mostly in Binford's mind, rather than among most Plains researchers. However, a simple recitation of the supposed butchering pattern based on the model developed from communal kill sites is deemed inadequate for the present study. The butchering model developed from large communal kill sites is one of single season processing of very large amounts of meat for (mobile) storage, not for utilizing smaller amounts of meat for immediate or short term consumption. Binford found very different patterns in faunal element representation in sites where meat was being dried, frozen or used immediately, and seasonality was a major consideration.

For this reason, comparisons to several of Binford's models developed for caribou have been undertaken. Other researchers have used the utility indices developed

specifically for caribou on samples of bison with some success (e.g. Speth 1983), and Binford himself does not hesitate to apply caribou index information to bison, on the assumption that all ungulates will have broadly similar utility ratios. Still others have found the concept to be of no value in understanding bison butchering; McCartney, for example (1983:39) cites the greater size of bison in relation to caribou as necessitating carcass reduction into meat packages (minus bone), which would essentially invalidate the model. Kooyman (1981:12) pointed out that relative marrow cavity size varies a great deal between different elements in the two species; for example, the absolute size of phalanges and mandibles in caribou renders them unattractive as marrow bones, whereas in bison they may well be "worth" the effort. The stated ethnographic preference for bison ribs and hump meat and the greater weight of meat associated with the thoracic vertebrae may well result in the utility of the thoracics being underestimated (Kooyman 1981:22; Speth 1983:88). Finally, the significant size difference between male and female bison, and differing levels of nutritional value in male and female animals at different seasons of the year complicates Binford's clear cut correlations, as has been demonstrated by Speth (1983).

The Modified General Utility Index

The modified general utility index (MGUI) is a standardised number assigned to each skeletal element based on its proportion of meat, marrow and grease, and adjusted in accordance to its skeletal position in relation to other elements (Binford 1978). When the MGUI is plotted on a graph an idealized curvilinear curve represents the relationship between frequency of parts and utility. In a kill site, it would be expected that parts of the highest utility would be absent (e.g. femur) and parts of the lowest utility present (e.g. skull). Within this range different strategies may be practised - a bulk curve would emerge when parts of high and moderate values were selected, a gourmet curve when only high value parts were chosen. These curves fit data for the Nunamuit kill sites of different seasons extremely well, with one exception (see Binford 1978:80). In the summer, kills took place at widely dispersed locales on an "encounter" rather than "migration" basis, and all transport of meat was done on foot or with pack dogs, rather than by snowmobile or sled. Similarly, meat was not invariably returned to a residential camp alone, but used for upkeep of the hunters and their dogs. As a result, greater dismemberment of articulating elements occurred. On this basis, it might be predicted that non-communal prehistoric kill sites would

display more similarity to the less clear cut pattern of the dispersed summer kills.

Figure 31 shows the data from Component Three of the Maple Leaf Site plotted against the MGUI. Although the curve generally follows the predicted outcome for a kill site, it is not particularly strong. In terms of butchering, it seems to show a "gourmet" strategy - selection of parts of the highest value, and abandonment of parts of low and moderate value (keeping in mind that the MGUI of the ribs and thoracic vertebrae should probably be increased). This forms an interesting contrast to Speth's (1983:90) plot of the Garnsey site, which exhibited a "bulk" curve.

In the previous Chapter it was suggested that this assemblage might be divided into two subgroups: material from within the wetland feature, representing the kill, and material from without, representing a processing area. With this in mind, the material from within the wetland feature was plotted separately (Table 9, Figure 32). The resultant curve was somewhat different, with the extreme ends of the curve becoming slightly more "kill-like", and the relationships in the middle of the curve somewhat unclear. The forelimbs and lower hindlimbs might be considered to be slightly over-represented, although it is

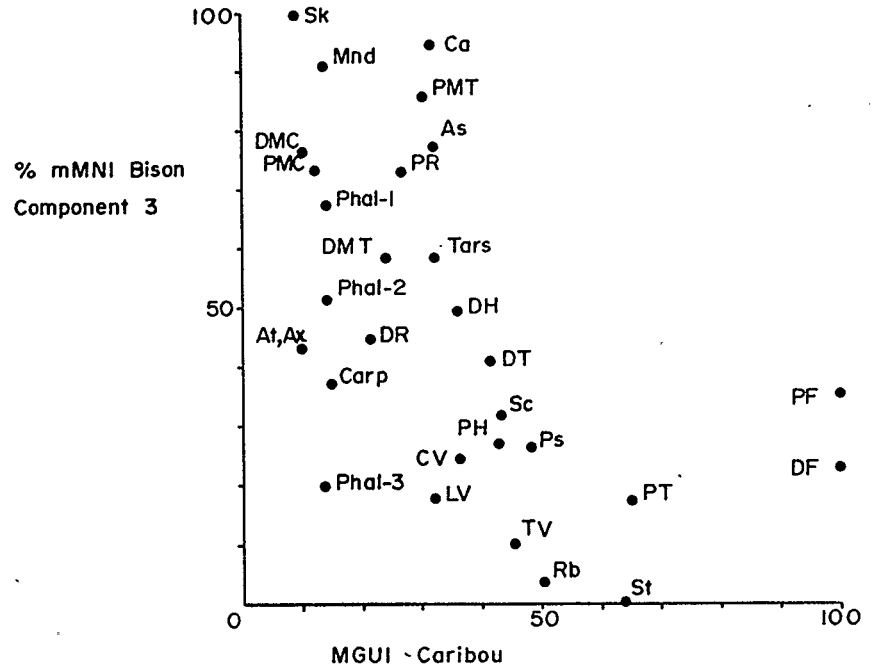

Figure. 31 Relationship Between %mMNI Bison (Component 3) and MGUI

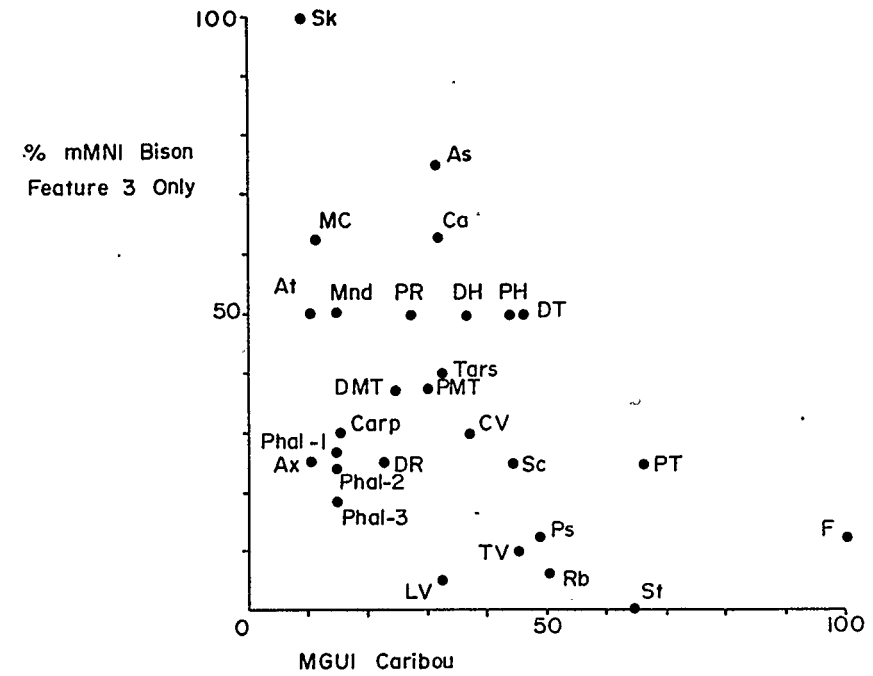

Figure 32. Relationship Between %mMNI Bison (Feature 3) and MGUI

Table 9. Minimum Number of Individuals (Binford's Method)
Component 3, Feature 3 Only

Element	# per Individual	Observed	mMNI	% mMNI
Skull	1	4	4	100
Mandible	2	4	2	50
Atlas	1	2	2	50
Axis	1	1	1	25
Cerv. Vert.	5	6	1.2	30
Thor. Vert.	14	6	0.4	10
Lumbar Vert.	5	1	0.2	5
Pelvis	2	1	0.5	12
Ribs	28	7	0.2	6
Sternum	1	0	0	0
Scapula	2	2	1	25
Prox. Humerus	2	4	2	50
Dist. Humerus	2	4	2	50
Prox. Radius	2	4	2	50
Dist. Radius	2	2	1	25
Carpals	12	14	1.2	30
Prox. Metacarp.	2	5	2.5	62
Dist. Metacarp.	2	5	2.5	62
Prox. Femur	2	1	0.5	12
Dist. Femur	2	1	0.5	12
Prox. Tibia	2	2	1	25
Dist. Tibia	2	4	2	50
Tarsals	6	10	1.6	40
Astragalus	2	6	3	75
Calcaneum	2	5	2.5	62
Prox. Metatars.	2	3	1.5	37
Dist. Metatars.	2	3	1.5	37
1st Phal.	8	9	1.1	27
2nd Phal.	8	8	1	25
3rd Phal.	8	6	0.7	19

difficult to make valid statements due to the weakness of the curve.

In plotting the second subgroup (all of the assemblage except Feature 3) it was decided to graph it against a culling model. The model selected was one developed for the Kongumuvuk Pass hunting camp; a mountain pass site utilized for summer caribou hunting. Because the season of use was summer, butchering decisions could not be influenced by considerations such as removing meat to a residential camp by snowmobile, and the type of hunting was encounter rather than migration hunting. Prey was thus culled at the kill and culled at the hunting stand for both immediate use and packing away, and dogs were also being fed. "This is the first collection from a field camp presented in which dog consumption, human consumption and possibly processing for packing were combined" (Binford 1978:269). The fit of the data from the Maple Leaf site (Table 10) to this model was impressive. Figure 33 shows the Maple Leaf data and Figure 34 reproduces the actual fit of the Kongumuvuk site to the model for comparative purposes. With a single exception the Maple Leaf site fits the outcome predicted by the model as well or better than the Kongumuvuk site - even down to the idiosyncratic representation of the femur, a pattern Binford attributes to limited immediate consumption of choice parts. The

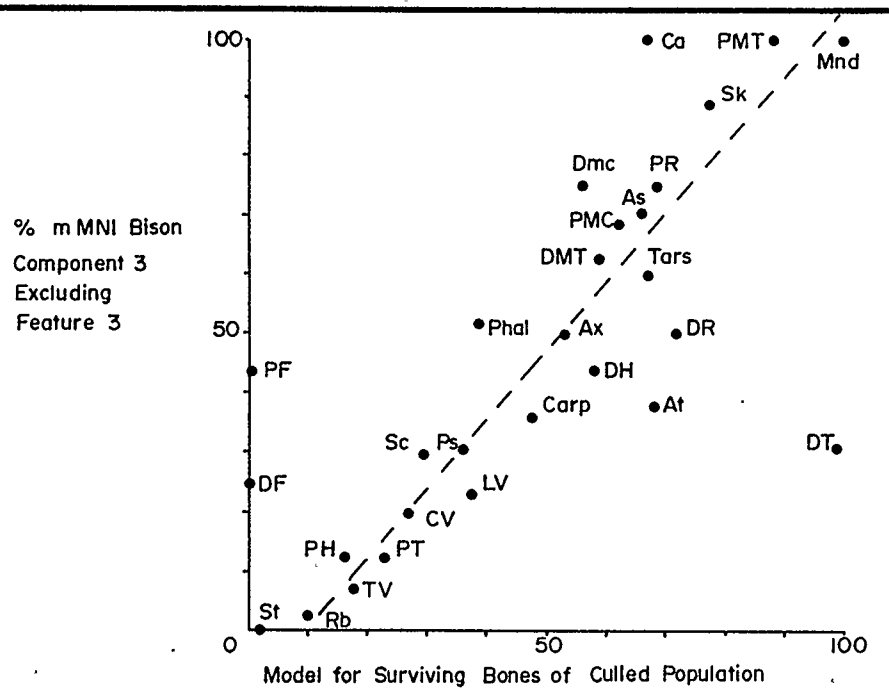

Figure 33. Relationship Between %mMNI Bison and Cull Model (Binford 1978:276)

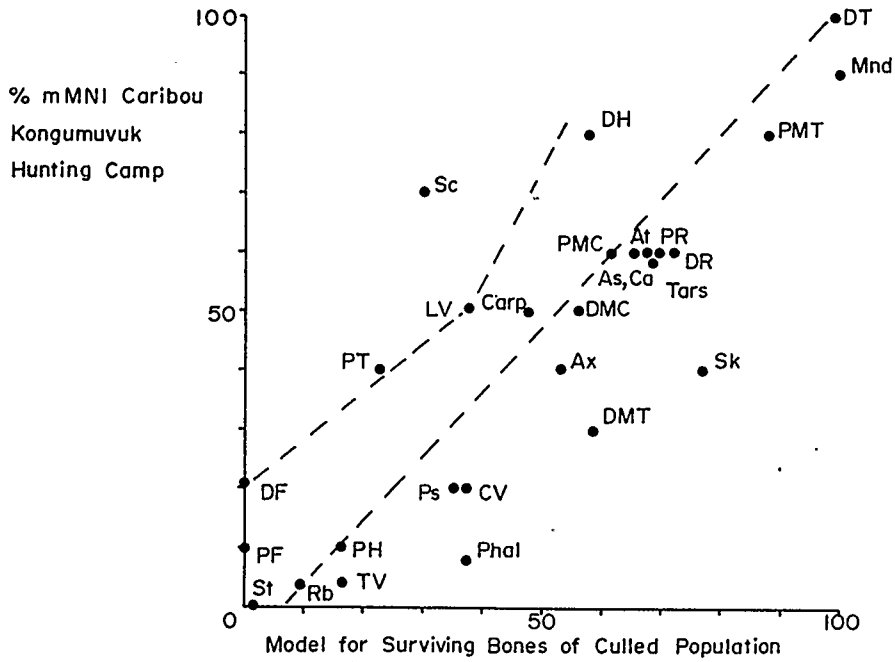

Figure 34. Relationship Between Kongumuvuk Data and Cull Model (Binford 1978:278)

Table 10. Minimum Number of Individuals (Binford's Method), Component 3, Excluding Feature 3

Element	# per Individual	Observed	mMNI	% mMNI
Skull	1	7	7	88
Mandible	2	16	8	100
Atlas	1	3	3	38
Axis	1	4	4	50
Cerv. Vert.	5	8	1.6	20
Thor. Vert.	14	9	0.6	8
Lumbar Vert.	5	9	1.8	23
Pelvis	2	5	2.5	31
Ribs	28	6	0.2	3
Sternum	1	0	0	0
Scapula	2	5	2.5	31
Prox. Humerus	2	2	1	13
Dist. Humerus	2	7	3.5	44
Prox. Radius	2	12	6	75
Dist. Radius	2	8	4	50
Carpals	12	35	2.9	36
Prox. Metacarp.	2	11	5.5	69
Dist. Metacarp.	2	12	6	75
Prox. Femur	2	7	3.5	44
Dist. Femur	2	4	2	25
Prox. Tibia	2	2	1	13
Dist. Tibia	2	5	2.5	31
Tarsals	6	29	4.8	60
Astragalus	2	11	5.5	69
Calcaneum	2	16	8	100
Prox. Metatars.	2	16	8	100
Dist. Metatars.	2	10	5	63
1st Phal.	8	51	6.4	80
2nd Phal.	8	38	4.7	59
3rd Phal.	8	12	1.5	19

single element which does not fit is the distal tibia, a factor which may be due to an inherent weakness in the model (the tibia being the only element with widely differing values for the proximal and distal ends).

While it would be inappropriate to draw any comparisons between the two sites based on the degree of fit to each other, it is not farfetched to interpret the Maple Leaf site in terms of the model, which is after all the whole point of "middle range theory." The model is one of: 1) conservative butchering at the kill site and transport to the hunting stand; 2) a cull at the stand of some choice parts but mostly moderate parts for immediate consumption; 3) a cull at the stand of low utility parts for feeding the dogs; 4) a cull of high to moderate utility portions to be packed away.

This model can be applied to the Maple Leaf case with little difficulty. There is definitely evidence for on site consumption of food, and that secondary butchering was being carried out in the uphill locales. There is skeletal evidence for the presence of domestic dogs, although it is possible that post occupation scavenging of abandoned low utility parts could result in a pattern which mimics feeding. The major difference between the model and the Maple Leaf site is that the modeled situation is one in which game is encountered and killed at a number of

different sites, "conservatively" butchered, then returned to the hunting stand. A "conservative" butchering strategy is based on the conservative modified general utility index (CMGUI), in which the values of lower utility parts are scaled upwards as a function of their weighted means (Binford 1978:199), and is designed for a situation in which the hunter wants to conserve as much of the carcass as possible.

Initially, the material from within the wetland feature had been plotted against the MGUI, resulting in a very weak curve. Based on the model from Kongumuvuk, this was possibly too harsh a strategy for the Maple Leaf kill locus, given its close proximity to the rest of the site. Accordingly, material from within the wetland feature was re-plotted against the CMGUI. Results are shown in Figure 35, and Figure 36 reproduces Binford's plotting of all dispersed summer kill sites against the CMGUI. This plot is of some interest. Generally, the Feature 3 assemblage fits a kill site with a conservative pattern quite well in terms of the axial skeleton and lower forelimbs (although there is some variation in the way in which the atlas and axis have been treated as part of the vertebral or skull unit). However, the upper forelimb is slightly over-represented and the hind limb shows a separate, unique distribution. It is quite strongly over-represented, and

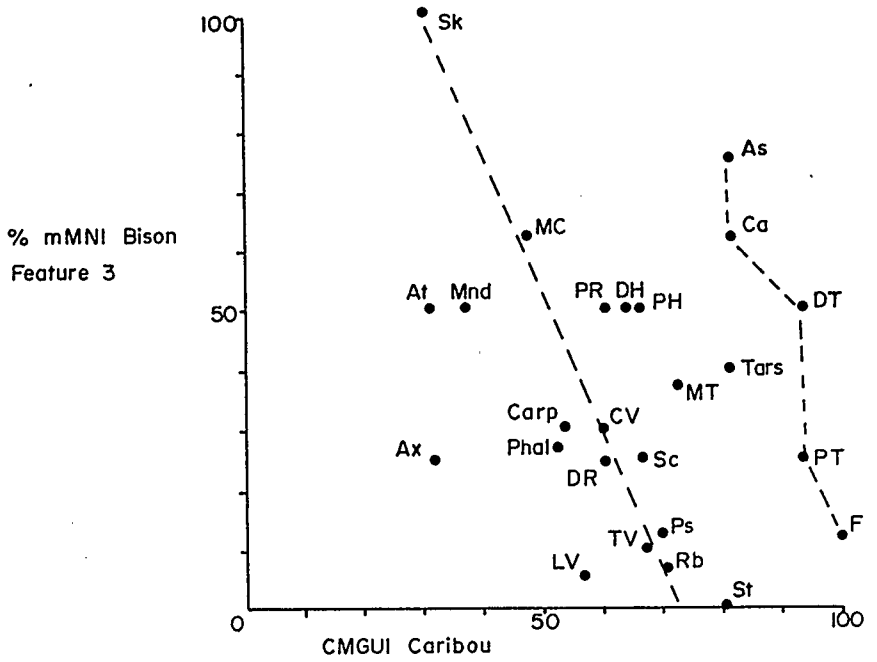

Figure 35. Relationship Between %mMNI Feature 3 and CMGUI

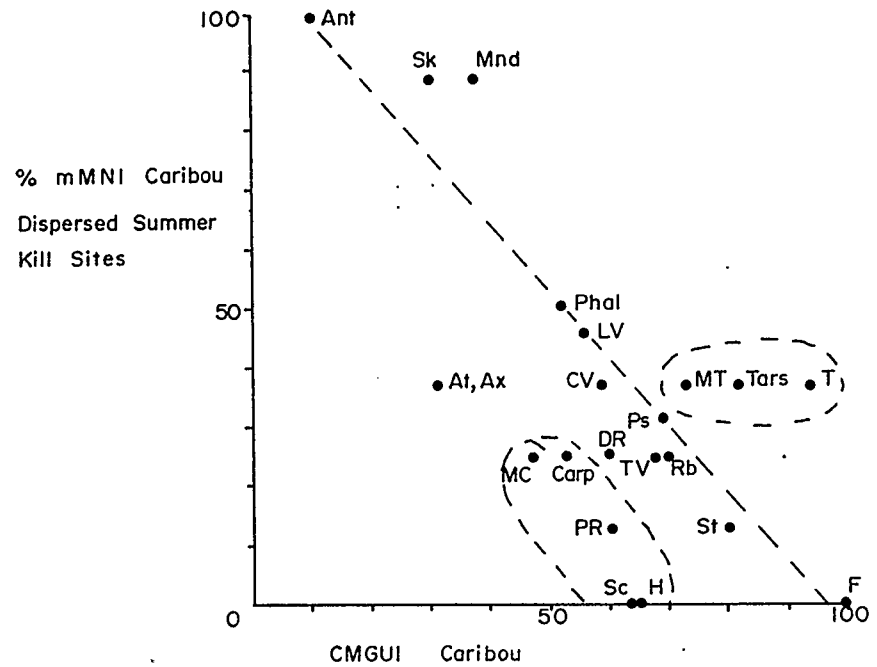

Figure 36. Relationship Between Dispersed Summer Kills and CMGUI (Binford 1978:271)

this over-representation increases drastically further down the limb.

Given the good fit of the rest of the site to the culling model, it is puzzling that Feature 3 does not represent a conservatively butchered kill more closely in terms of the limbs, especially the hind limb. One possibility is that the prehistoric hunters were not making their selections from Feature 3 based solely on a conservative butchering strategy, but that simple proximity has made it appear that way. Given the reconstruction of the trap as a wetland feature producing boggy conditions suitable for miring, it is likely that difficulty of recovery would have influenced the hunters decision - i.e., the "higher up" a meat portion was, the more accessible it was.

Since so much of the interpretation of the site depends upon the trapping mechanism, it is necessary to examine the evidence for miring of bison in general and at the Maple Leaf site in particular.

Bogging Down

In a recent work, Frison has also attempted to dispell some "myths":

> First-hand knowledge and familiarity with the day-to-day behavior of bison allows investigators to evaluate many other proposed methods of procurement. The bogging of bison as a procurement method is based mostly on conjecture

> and a refusal to concede prehistoric man his true hunting ability. Bison clearly enjoy bogs and will wallow in them belly deep to graze and/or fight flies on a hot day. Bogs do little to impede the progress of a healthy animal, although they do trap the weak and sick ones. When someone tries to drive bison into a bog, they usually refuse to cooperate. The same is true of ice. Bison will wander out on an ice-covered stream or pond and may even break through the ice. On the other hand, trying to drive the animals across the ice can be a frustrating experience. . . . The other aspect of killing an animal in a bog is that it is almost impossible to butcher an animal and remove the meat from the bog without ruining it. The knowledgeable hunter first chases an animal, bison or otherwise, out of the bog and then kills it (1982:267).

Frison goes on to discount snowdrifts and bodies of water as methods of bison procurement. In denying the use of these types of natural traps, and stating that the bogging of bison is based mostly on conjecture, Frison downplays both archaeological and ethnographic evidence. Reeves (1978a) in an article summarizing the extensive evidence for bison procurement in the southern Alberta mountain valleys of Waterton and the Crowsnest Pass, documented at least seventeen kills where geohydrological traps were used. From this total, "Nine kills are associated with springheads, wetland deposits, and groundwater seep areas, characterized today by wet 'boggy' conditions" (Reeves 1978a:72). Other kills included ones associated with bodies of water:

> At Crowsnest Lake, Site DjPp-3...contains excavated bison kill components that date ca. 1800 B.C. and 1000 B.C. These are located in

> lake muds, indicating that the bison had been driven off the dry land to be mired in the shallow mucky bottom of the Crowsnest Lake exit (ibid.).

Wilson (1983b:130) suggests that a stampede into a natural quagmire is a possible mechanism for explaining the Hitching Post Ranch assemblage, and states that "Natural stampedes into boggy areas or over precipices could result in bone beds". As well as archaeological evidence, the historic record contains numerous references to bison being mired.

> The very first buffalo mentioned by Hennepin, 1679, the only one seen for '130 leagues' was an old bull mired near the Illinois River. Having killed him, Hennepin says: "We...had much ado to get him out of the mud..." (Roe 1972:129).

> Audubon observed one "unfortunate cow that had fallen into, or rather sunk into a quicksand only seven or eight feet wide; she was quite dead..." (McHugh 1972:238).

> Whenever it was possible, buffalo were driven into places where they floundered and were easily taken. In summer they were guided into marshes; in winter, they were forced into deep snow or over ice ... The hunters did not plan such drives beforehand, but simply exploited the natural advantages of the terrain (Mandelbaum 1979:56, my emphasis).

In denying the use of these types of natural traps, Frison may be accused of an overly narrow viewpoint due to a preoccupation with communal hunting techniques. Of course no large group of hunters would plan out a large communal kill to end in a bog; but a small group of hunters

encountering several animals or a small group of animals in a favourable configuration for use of a natural trap would be foolish not to take advantage of the situation. Frison himself notes that:

> ...most arroyo traps such as Hawken and Agate Basin and sand dune traps such as Casper were probably not capable of totally restraining the animals. Instead, they were designed to restrain the animals long enough for the hunters to take advantage of the animals' confusion (Frison 1982:266).

Jack Willman, Chief Park Warden of Elk Island National Park in central Alberta, has observed the behaviour of the Elk Island bison herd in relation to a wet and boggy natural setting. Like Frison, he notes that the bison enjoy water and boggy areas; however, he also notes that they move through these areas in a very slow, deliberate manner and "pick their paths pretty carefully, and stick to them" (Jack Willman, personal communication 1986). Willman is of the opinion that it would be possible to mire a small herd, or to trap them in small ponds in conjunction with rotten ice in late winter. Two small herds in Elk Island have died natural deaths in this manner in recent years.

Whether the individuals at the Maple Leaf site were actually mired "fast" is an interesting question. The distribution of projectile points around and within the wetland feature suggests that they did not meet a natural death, only later having been scavenged by man. The

absence of significant carnivore damage to Feature 3 bone, its sheer abundance, the high representation of complete unbutchered bones, and the absence of lithics other than points, seems to indicate some degree of unpleasantness or discomfort for butchering in the immediate kill area - perhaps extreme muckiness or standing water. A rather unusual patterning was noted in the distribution of left vs. right forelimb elements, which was determined to have some bearing on this problem, and will be discussed in the following section.

Forelimb Distribution

During the course of analysis it was discovered that forelimb elements from the left side of the body outnumbered those from the right in every instance; for some elements the discrepancy was considerable - twice as many left than right ulnae, and nearly twice as many left than right carpals were recorded. This was initially assumed to be merely an accident of sampling, even though the hindlimbs did not reflect a similar pattern. When carnivore altered bones were examined, twice as many were lefts than rights as well. This was also initially percieved as normal; i.e. since more lefts than rights were present in the sample, more lefts were available to the carnivores. After the patterning in the distribution of

carnivore altered bones was revealed, it was decided as a test to plot the distribution of left vs. right forelimb elements. Carpals were selected as the most numerous forelimb element (49 in total). Figure 37 shows the distribution of right carpals within the excavation block, and Figure 38 the distribution of left carpals. On the basis of visual inspection it seemed immediately apparent that left carpals were correlated with the wetland feature and (to a lesser extent) the hearth, and right carpals were scattered across the rest of the excavation block. No reason for such a distribution was immediately suggested, except perhaps some quirk of sampling. It was decided to test the probability of such a distribution occurring by random chance.

A spatial test was required due to the nature of the data, and point pattern analysis using the quadrat method was selected as a suitable test (unlike the nearest neighbor statistic which is concerned with the relationship between points, this type of analysis considers the distribution of points across a grid). A complete description of the test and results are included in Appendix B. Essentially, the null hypothesis is that there is no statistically significant difference between the distribution of right or left carpals and a random distribution. The results of the test were such that at

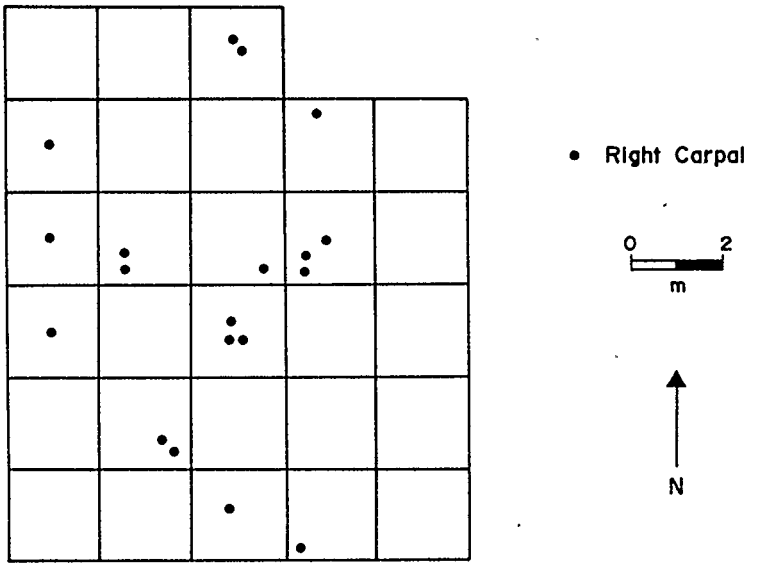

Figure 37. Distribution of Right Carpals

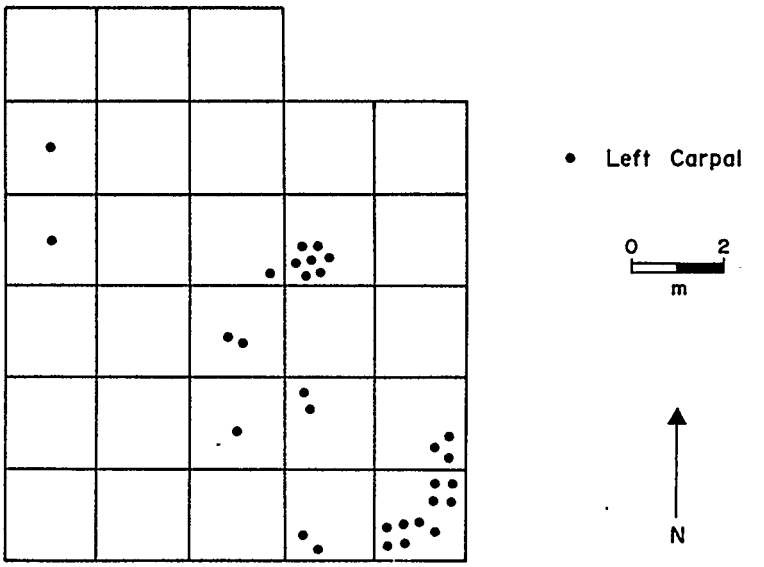

Figure 38. Distribution of Left Carpals

the .05 significance level the null hypothesis was accepted for right carpals and rejected for left carpals. That is, there is a greater than 95% probablility that right carpals are randomly distributed, and less than a 5% chance that left carpals are randomly distributed (even when the significance level is set at .01 these results are the same - less than a 1% chance that the distribution of lefts could have arisen by chance).

Given these results it was decided to plot the rest of the forelimb elements to see if this pattern held. Figure 39 shows the distribution of right forelimb elements and Figure 40 the distribution of left forelimb elements. Phalanges were not included due to a lack of complete confidence in correct siding, and only complete or greater than one half complete bones were included. Visual inspection of these figures confirms the pattern revealed in the carpal plot - left limb elements are more common and show a tight distribution within the wetland feature and around the hearth. Right limb elements show a random distribution and negative correlation with the wetland feature.

A logical explanation for this patterning is that right limbs were more accessible during the butchering process and tended to be removed from the wetland area, further butchered in areas scattered over the uphill part

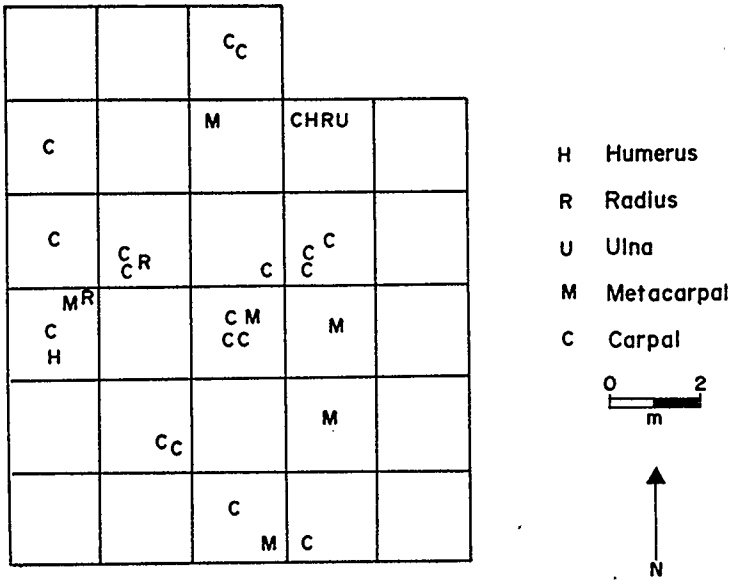

Figure 39. Distribution of Right Forelimb Elements

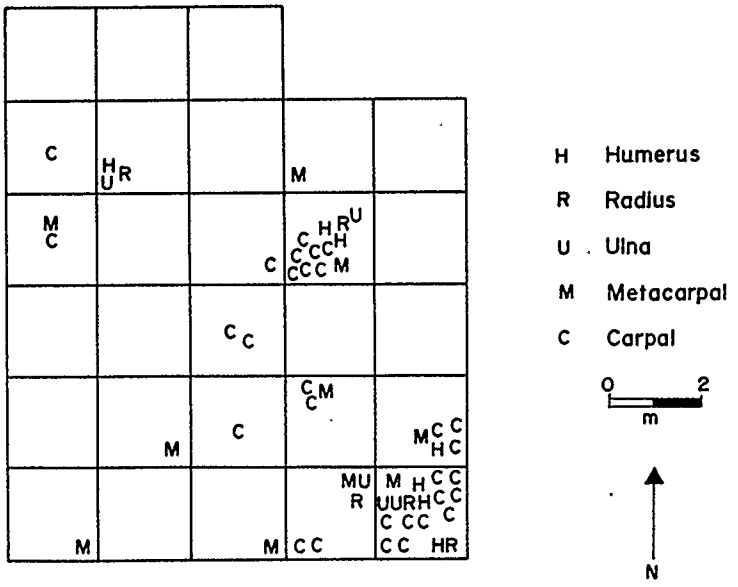

Figure 40. Distribution of Left Forelimb Elements

of the excavations, and removed from the site entirely. Left limbs tended to be left in the feature, or, if removed, were scheduled for immediate consumption. Hindlimbs, because they contain choicer cuts, could have been removed and processed independent of side. It should be emphasized that this reconstruction of events is seen only as a very general trend which resulted in the observed patterning, not as a rigidly adhered to butchering strategy.

No strong explanation is immediately evident for this patterning, although some suggestions may be made. Bison, like all ungulates, are "handed" in that they take a natural left lead; stepping out on their left side first (McHugh 1972:170). This left lead is maintained through all gaits - walk, trot and gallop. At the walk the left rear leads followed by the left front, and a description of the gallop is given below:

> The most rapid gait of a buffalo is the gallop, a progression from left to right, first of the front hooves and then of the rear. The 1 (left front) - 2 (right front) - 3 (left rear) - 4 (right rear) sequence distinguishes this running gait as a transverse gallop, a pattern that also occurs in horses, goats, bears, hogs and camels. A smaller number of animals, including dogs, deer and elk, travel by means of a rotatory gallop, in which the sequence runs smoothly clockwise: 1-2-4-3 (McHugh 1972:170).

It is possible that in a situation where an animal was mired, continued struggling with the "stronger" leg leading

would either free the animal or push it in even deeper. Once mired and killed, it would presumably fall such that the less deeply held side was uppermost.

Another possibility is suggested by ethnographic accounts:

> They never pursue a straight course in travelling. Their eyes are so placed in the head that is is impossible for them to see directly in front; and especially is this true on account of the heavy locks on their forehead. Neither can they look backward, on account of their immense shaggy shoulders, hence they are compelled to keep one side or the other turned in the general direction in which they are going. Not being good travellers sideways, they look ahead with one eye and to the rear with the other, deflecting to the right and then to the left for a distance of two or three hundred yards... (Jones 1899:260, in Roe 1972).

This description is corroborated in a number of accounts (see Roe 1972), including "When the bison runs, it leans very much first to one side for a time, and then to the other, and so on alternately..." (Richardson 1829:282, in Roe 1972). It may be possible that this veering motion on the part of a small herd, alone or in conjunction with the site topography, could result in more animals lying on one and the same side, although this is felt to be a very tenuous possibility.

Although this patterning in the left limb distribution is of some interest, it is not seen to be vital to site interpretation. It may corroborate the actual "bogging

down" of the individual bison, although much more data on the miring mechanics would be necessary to verify this interpretation. One point which should be made is the importance of recording right vs. left, since if this pattern is truly resultant from the physical characteristics of bison and can be verified through wildlife studies or the archaeological record, it might be of use in interpreting kills in which the nature of the trap can only be inferred; e.g., snowdrifts.

Discrimination by Gender

In his study of the spring killed bison at the Garnsey site, Speth found that when both male and female carcasses are present

> ...the hunters evaluate the utility of an anatomical part not only with respect to other parts in carcasses of the same sex, but also with respect to the same part in carcasses of the other sex (1983:100).

In other words, due to the pronounced sexual dimorphism in bison and differing levels of nutritional stress in males and females during different seasons, the standard modified general utility index values may not be sufficient to explain the range of variation in butchering. In late spring, when cows are in poor condition, a bulkier and fatter male forelimb might be selected over a smaller, leaner female hindlimb.

Due to the nature of the Maple Leaf site data, it is not possible to determine whether bulls and cows were being killed simultaneously or in different events. While Speth has no trouble categorizing an assemblage with 50% males and 17% calves as a bull group (Speth 1983:107), most ethnographic accounts and modern behavioral studies concur that a bull group should contain mostly bulls and a cow group mostly cows and calves (Arthur 1975; Frison 1978). Since the sexual composition of all mature individuals at the Maple Leaf site is 50% male and 50% female, it is likely that more than one event has been combined. Given this scenario, overall decision making would be in terms of animals of mostly the same sex (it is possible that the nature of the trap itself had a "randomizing" effect on the ultimate assemblage composition, in that if it was "encounter" hunting, the odds of males or females being in the immediate area might be roughly equal over time).

This is not to say that there were no differences noted in the treatment of males and females in the assemblage, only that it is not possible to relate these differences in a cause-effect manner. Figures 41 and 42 show the distribution of male fore and hindlimb elements. Only the major gender identified limb bones are shown. Forelimbs are present both in the wetland feature and the uphill locales, and the metacarpal shows slightly more

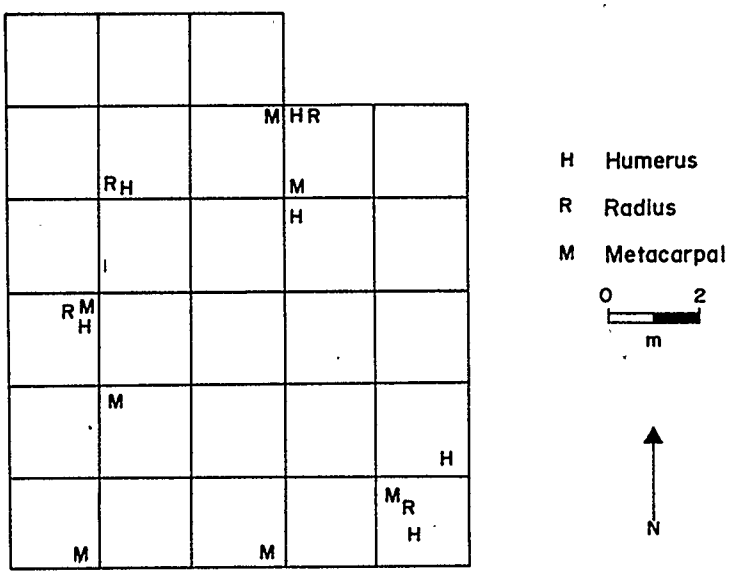

Figure 41. Distribution of Male Forelimb Elements

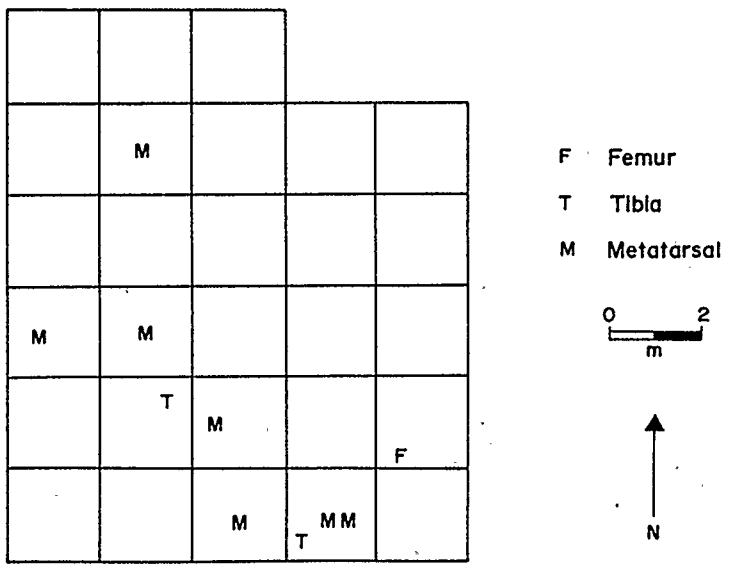

Figure 42. Distribution of Male Hindlimb Elements

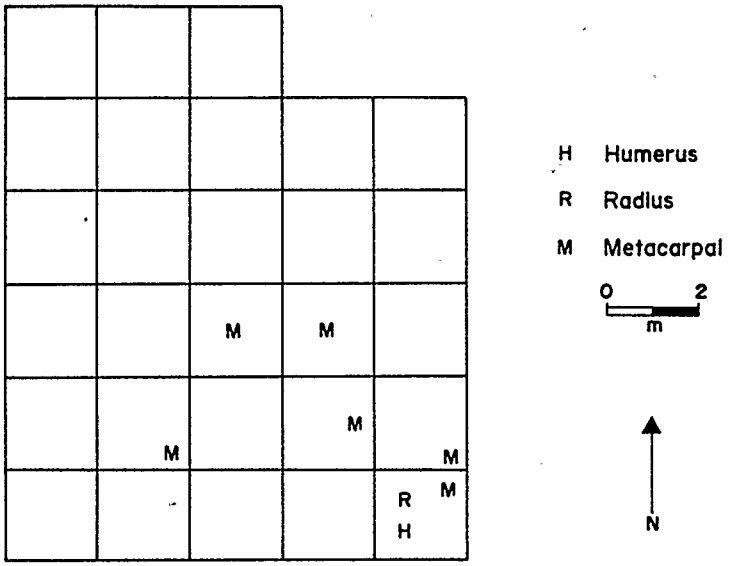

Figure 43. Distribution of Female Forelimb Elements

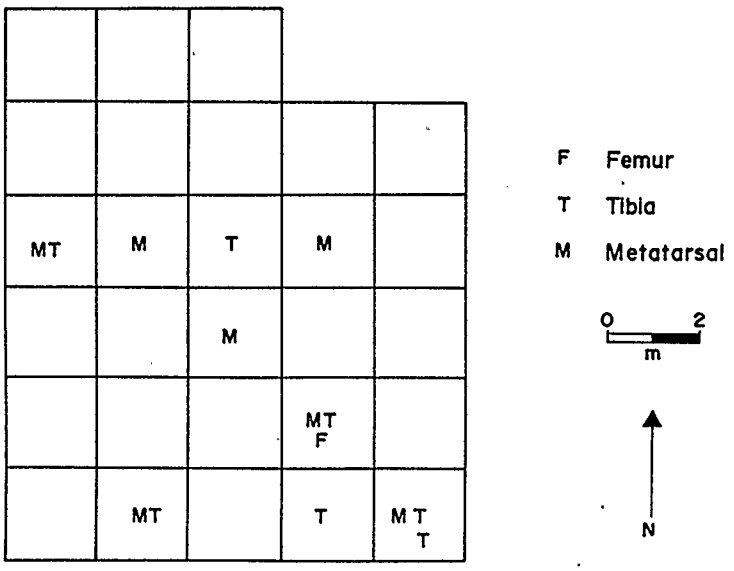

Figure 44. Distribution of Female Hindlimb Elements

scattering. Hindlimbs show fewer elements in absolute terms, less clear clustering, and essentially metatarsals are the most common element in both areas.

In contrast, female forelimbs are totally restricted to complete elements within the wetland feature and a few metacarpals scattered in the immediate area. Hindlimbs show a more scattered distribution and a stronger representation of elements in the uphill areas, although again these consist mostly of metatarsals (Figure 43, 43).

The relatively high ratio of female tibiae left at the site (2 complete, 5 distal) in comparison to male tibiae (1 complete, 1 distal) is of interest. Speth (1983:92) notes that the tibia is one of the elements most susceptible to depletion of marrow fat reserves in female bison.

Of the sexable elements, 66% of the female forelimb elements were unmodified and only 13% of the hindlimb elements were unmodified. For males these ratios were 69% and 36%.

Summary

Evidence has been presented which argues for a very specific interpretation of Component 3 at the Maple Leaf site. The assemblage is seen as having resulted from at least two and possibly several fairly small scale events. Limited evidence points to late winter/early spring

seasonality. At least one cow/calf herd and one bull group were trapped on the site in a small wetland feature. Although ice over standing water may have been involved, a likelier explanation is miring in a very wet, mucky wetland feature. It is uncertain to what extent the animals were driven or manuevered into the area, or if they were already present at the site, but likely "encounter" hunting is represented. The distribution of left vs. right limbs may indicate that some of the animals were stuck fast in the feature, although they need not have been stuck for the feature to "work" as a trap, only slowed down.

Faunal elements, although extensively disarticulated, were not heavily processed. The nature of the stratigraphy, degree of carnivore attrition and the disarticulation of elements makes reconstruction of the actual butchering pattern(s) extremely difficult. The higher representation of complete limb bones in the wetland feature and presence of many fine cutting tools suggests that segmentation was generally achieved by cutting through ligaments rather than smashing through joints (cf. Frison 1978:311-312). The underrepresentation of patellae and presence on some bones of patterns attributed to meat stripping (trochanter snapped off femur, humerus minus lateral tuberosity, lack of pisiform carpal) offers some evidence for this form of butchering. Some limb bones were

definitely utilized for marrow, as is evidenced by spirally fractured bones, but many were not, and carnivore activity has made quantification of such data difficult. Phalanges were not utilized, and there is no evidences of intensive secondary strategies such as bone grease extraction. Small non-identifiable bone fragments are not common and burnt bone is rare and usually due to natural burn horizons in the peat. The presence of a hearth feature indicates the possibility of on-site food consumption.

The distribution of various elements across the excavation block and relative frequency of observed vs. expected bone representation considered in relation to various utility indices offered the best interpretive potential. The use of the trap placed physical limitations on the recovery of carcass portions, although in general a "gourmet" strategy, heavily influenced by considerations of fresh meat seems to have been indicated.

Gender analysis in general revealed differential distribution and processing of males vs. females. It is not possible to determine if these decisions were made relative to a) the presence of both sexes at a single event or events, b) merely the result of different circumstances at different times, or c) the result of consistent differential discrimination against certain elements

(e.g. the tibia) of different sexes at the same time of the year.

Previous interpretation of the assemblage as having resulted from a bison pound (Reeves and Driver 1978) has not been confirmed. Two post-holes identified during the excavation are suggested to either have been placed to augment the chance of success of the natural trap or to have been part of a larger feature not encompassed by the excavation block. If the latter interpretation is correct, much of the evidence for such a structure would have been destroyed by historic impacts and soil borrowing.

Chapter Nine

Conclusions

Cultural remains from one area of the Maple Leaf site were examined for the purpose of thesis research. Although the primary concern was faunal analysis, some baseline interpretations were required due to the lack of previous comprehensive reporting on the completed excavations. A brief summary of salient points is given below.

Summary

The Maple Leaf site is located within the Front Ranges of the southern Alberta Rocky Mountains, in the Crowsnest Pass. The site is situated on a small, distinctive bedrock/terrace landform along the open south-facing slopes of the Crowsnest River valley. Environmental data indicate a grassland environment in the immediate site vicinity for the last ten thousand years, although due to the topography all of the mountain ecoregions are within close (vertical) access. Stratigraphy of the landform (marl, clay and peat) and mollusc analysis indicate that varying degrees of moisture have influenced site microtopography since glacial times. Depth of soil deposition and preservation of faunal material vary across the landform, as does the cultural

record, which indicates use of the site from Early through Late Prehistoric times. For this study, only Components One, Two and Three of the main excavation block were considered.

Component One, dated at ca. 8500 B.P., yielded data pertaining to Early Prehistoric bighorn sheep procurement. Although Driver (1982) has interpreted this component as early evidence of communal hunting and meat sharing, alternate explanations of the faunal assemblage were suggested by examining the observed representation of elements in terms of their modified general utility (Binford 1978). Other faunal remains from this component included very scattered and fragmented bison bones which had been heavily utilized by carnivores. No substantive interpretations of this material were possible. An unusual Early Prehistoric Period projectile point was found in association with more complete bison bones in a backhoe trench adjacent to the excavation area; unfortunately this cultural manifestation was not further investigated during the excavations.

Component Two, dated at ca. 7200 B.P., yielded very limited cultural material, and faunal remains essentially consisted of the four limbs of a young, adult male bison. While the faunal evidence does not indicate a natural death, no diagnostic evidence of carnivore or human

alteration was noted on the bones. The unusual configuration of element representation and lack of data precluded extensive interpretation, although it is the researcher's opinion that the assemblage is cultural. This component was also of interest due to the canid remains, the earliest recorded in the area. Comparison to criteria given by Gilbert (1980), Driver (n.d.) and Walker and Frison (1985) resulted in classification of the specimen as a very large domestic dog, larger than Eskimo dogs but smaller than wolves or wolf/dog hybrids from Wyoming sites. Canids were the only species other than bison identified in every component of the excavation block, and at least two other dogs, one as large as the Component Two individual and one "Eskimo dog" sized individual were recorded in the post-ash levels of the site.

Component Three contained the bulk of cultural material and was the major focus of thesis research. Radiocarbon dates, stratigraphic information and diagnostic lithic artifacts could only provide a broad age estimate of the early Middle Prehistoric, ca. 6000 to 4000 B.P. Although more than one event was almost certainly represented in this component, it was not possible to separate out events, and the assemblage was analysed as a single unit. Some of the implications of the Component Three analysis are considered in the following sections.

Seasonal Hunting and Subsistence Models

In his doctoral dissertation and a recent article Driver (1978, 1985) has presented an excellent synthesis of seasonal subsistence strategies in the Crowsnest Pass. This synthesis is primarily based on site location and faunal assemblages from a relatively large number of sites in a relatively small area. Although he encountered some problems due to "analyst-induced" variation, temporal control and difficulty in determining seasonality, a very strong seasonal correlation between site location and ungulate exploitation was delineated:

> Crowsnest faunal data demonstrate that the seasonal exploitation strategies varied between concentration upon a single resource and the exploitation of a diverse range of fauna. Variation in hunting strategy may be seen as a response to seasonal changes in the abundance and distribution of fauna, resulting in two quite different hunting strategies within a short distance of each other. The winter strategy apparently resembles the subsistence methods of the Plains, with bison as the major resource. The summer strategy is more similar to those recorded from the Interior Plateau and Rocky Mountain Trench of British Columbia in which a wider variety of game was sought (Driver 1985:125).

Due to the necessarily broad-based nature of his study and difficulties in determining exact seasonal affiliations, Driver found it desirable to classify sites in two major seasonal categories - winter (late fall to early spring) and summer (late spring to early fall).

The present study of Component Three fauna from the Maple Leaf site is of some interest in relation to this model, insofar as it reveals some aspects of late winter/early spring bison hunting. According to Driver's model (1978, 1985), bison would have congregated in the lower valley grassland basins and foothills at the eastern end of the Pass during the winter, and in spring gradually moved west up the main valley and tributary valleys in smaller scattered herds. Timing of spring movement would depend on the mildness of the winter, with calving occurring at either locale:

> Assuming that bison moved west either before, during or after the calving season, the Bellevue area may have been important for two reasons. Firstly, the basin around Bellevue was a "natural" trapping area for bison herds. Bison could be gathered in the grassland areas north of the Crowsnest River and driven south to kill sites such as DjPo-9 or DjPo-47. Herds could be predicted to be in the area during late winter or spring, depending upon seasonal weather patterns. Secondly, the area is important because it controls two major routes away from the wintering grounds: the main Crowsnest Pass and Gold Creek, both of which lead into good summer pasture areas (Driver 1978:159).

This discussion seems to have been partially influenced by the interpretation of DjPo-47 (the Maple Leaf site) as a pound which required use of the Bellevue basin as a gathering area. In light of the interpretation of the Maple Leaf site given in this study, a different view of

the site's location, more in line to the second reason stated in the above quotation, is seen as more likely.

It is possible that by late winter to early spring, or at least by early spring, hunting strategies were already shifting to a "summer mode". The type of hunting evidenced at the Maple Leaf site is perhaps more representative of an "encounter" rather than "task-specific" strategy (cf. Driver 1985:125). Many factors would act against "task-specific" hunting as a long term exploitation strategy at this time of year, including unpredictable weather patterns. Another factor which might influence hunting strategies is that not only bison, but other ungulates, including elk, deer and sheep would also be moving between winter and summer ranges at this time of year, increasing the likelihood of being encountered. The Early Prehistoric sheep remains at the Maple Leaf site may well be a result of the sites location in relation to sheep movement between ranges, although firm evidence of seasonality is lacking.

Another consideration mitigating against single species hunting at this time of year as a long term subsistence strategy is the very negative effects of "harassment" on ungulates. In a discussion of ungulate behavior, Geist (1978) makes a number of cogent points about harassment, summarized below:

1) The most critical times of disturbance tend to be during cold weather, late pregnancy when the fetus is sensitive to maternal nutrition, and whenever animals are in a state of negative energy balance.

2) Harrassment can result in avoidance or abandonment of areas and reduction in a populations range, ultimate size, and vulnerability to predation.

3) Highly gregarious ungulates suffer most seriously from disturbances in terms of range reductions and failure to recover spontaneously from low population levels.

Given these factors, it is theoretically possible that intensive single species hunting carried on too late in the season, most particularly large scale or communal hunting, in an environment such as the Crowsnest Pass, could have very negative long term effects on the bison population.

When all of the above factors are considered, it is seen as likely that encounter killing of a wider range of species probably was a more normal spring hunting strategy. Although this suggestion remains to be proven, it raises another interesting question. To what extent were large-scale communal hunting techniques ever used in the Alberta Rocky Mountains? Driver's contention that eastern Crowsnest Pass winter sites reflect a bison focal hunting strategy is undoubtably a correct one; but may not justify carrying the analogy to Plains hunting techniques too far (as indeed he does not).

There is very little evidence to date for large scale communal hunts in the mountains of Alberta. Reeves

summarized the data for the Waterton and Crowsnest Valleys as follows:

> The general bison-driving pattern characteristic of the area for the last 6,000 years...is one of simplicity. Native peoples utilized a variety of landforms and trapping mechanisms to gather, drive and trap the small herds of bison when they were available seasonally into any locale that was at hand and met the entrapment prerequisites. Some locales were obviously preferred, as is reflected in the long use histories for these areas; however the large, single or multi-component kills that are conceptualized as characteristic of the foothills/Plains "classic" bison driving complex are not present (Reeves 1978a:77).

Intensive surveys along the main valley of the Bow River in Banff National Park in recent years have failed to reveal the presence of any large kill sites, although many campsites and lithic workshops have been documented (Fedje personal communication 1986). Similarly, intensive inventories in the major valley and tributary valleys of Jasper National Park have also failed to identify any large kill sites. Instead, a pattern of site location correlating with good ungulate range, mineral licks and hydrological features has been documented (Pickard and Landals 1985).

Conclusions

Most of the published literature dealing with faunal studies on the Plains and in adjacent regions has been concerned with the analysis of large communal kill sites.

A large body of extremely valuable data and interpretations of bison behaviour, age and gender determination, butchering patterns, sophistication of adaptive strategies, ritual, seasonal subsistence and settlement patterns, and numerous other factors has been collected. However, some researchers (e.g. Driver 1983; Reeves 1978; Greiser 1985) have expressed doubts as to whether communal strategies have been overemphasized in archaeological studies of the Plains. Certainly, numerous other methods of killing bison abound in ethnographic and historic accounts (see Roe 1972; Arthur 1975 and Verbicky-Todd 1984 for discussions). Given the special purpose of communal hunts, their presumed seasonal restriction, and the known ethnographic complexity of butchering decisions in response to variables such as season and need (Binford 1978), it is likely that communal hunting has been somewhat overemphasized. In a discussion of this problem, Greiser states

> Recovery of data representing all phases of the seasonal rounds of the various early prehistoric hunting-gathering cultures who inhabited the Central High Plains should be the goal of archaeologists interested in understanding the subsistence and settlement strategies of these people (1985:123).

It could be argued that sites providing records of encounter hunting on the Plains are exceedingly rare; this may or may not be true (see Wilson 1983 for a discussion of archaeological visibility), however such sites are not rare

in the mountains, where they can provide many opportunities for understanding this aspect of prehistoric hunting strategies. Of particular interest in the present study was the use of models developed from ethnoarchaeology (Binford 1978, 1981) to illuminate certain aspects of past human and carnivore behavior. This type of analysis is seen as particularly important for small-scale studies, where sample size may mitigate against more traditional types of studies; and for studies of regional subsistence and settlement patterns among hunter/gatherers.

Recommendations

As a final note, several practical and theoretical recommendations arising from observations made during the course of thesis research will be made.

After the final season of excavation, the Highway 3 development was rerouted such that it did not directly impact the Maple Leaf site. Unfortunately, in anticipation of site destruction none of the excavation areas were backfilled, with distressing consequences. The author revisited the site in 1979 and 1980, during which period a large pond filled the main excavation block. Visits in 1983, 1984 and 1985 revealed extensive slumping of the walls of the main block, and the drying up of the pond rendered the excavations extremely handy for local

residents in search of garden peat, which is being borrowed each spring from the walls of the units and from old and new borrow pits. All or most of such borrowing activities could be stopped quite simply by either digging a trench across or piling gravel on the single dirt road which gives trucks access to the site. This action is strongly recommended since intact areas of the site are still present and will most certainly disappear if borrowing is not stopped. Although levels below the ash are essentially untouched by borrowing, changing moisture regimes, erosion and a number of related factors are likely effecting the quality of the earlier components.

The Early Prehistoric Ptolemy subphase component is one of the few Early Prehistoric components in a stratified context within the Crowsnest Pass. Excavations in the main area, while yielding important data on the sheep remains, did not clarify the nature of the relationship of the early projectile point and more intact bison bones from the backhoe trench. It would be desireable at some future date for further excavations to be carried out in order to determine if materials from the trench were part of some larger activity area.

In a more theoretical vein, it was determined that the modified general utility indices developed for caribou by Binford (1978) were of significant value in determining the

meaning of certain observations. Although the indices were thus adequate for the analysis, the researcher would have felt more comfortable using data directly derived from bison of different sex and ages. This recommendation echoes that of Speth (1983:162).

A final recommendation is a plea for small site archaeology. In areas such as the Crowsnest Pass, which have been the subject of numerous archaeological studies and strong, problem oriented regional synthesis (Driver 1978, 1985), the study of small, less than spectacular sites can be of value in contributing unique information to the record, as I hope this study has shown.

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APPENDIX A

BISON ELEMENT MEASUREMENTS

Appendix A: Measurements of Proximal Metacarpal (after Speth 1983)

Catalog Number	Component	Sex	Side	A	B
77677	3	M	L	7.08	4.58
78499	3	M	L	7.59	4.51
78216	3	M	L	7.48	4.62
77063	3	M	R	7.81	4.68
77333	3	M	R	7.94	4.66
77655	3	M	R	7.74	4.84
77629	3	M	R	7.28	4.30
77046	3	F	L	6.60	4.00
78498	3	F	L	6.49	3.71
78296	3	F	L	6.43	3.71
77605	3	F	L	5.88	3.59
77311	3	F	R	6.36	4.01
781142	2	M	L	8.00	4.61
77867	2	M	R	8.12	-

Appendix A: Measurements of Proximal Radius (after Speth 1983)

Catalog Number	Component	Sex	Side	A	B	C	D	E
781027	3	M	L	10.50	5.49	2.74	-	3.94
78254	3	M	L	10.00	5.04	2.84	-	-
78224	3	M	R	10.10	5.09	3.08	3.74	3.92
781126	3	M	L	10.50	5.55	2.73	-	-
77378	3	M	R	10.40	5.31	-	-	-
781033	3	F	L	8.70	4.29	2.51	3.80	3.40
77586	3	F	L	9.00	4.76	-	-	-
77283	2	M	R	10.50	5.54	3.07	3.91	4.10

Appendix A: Measurement of Distal Humerus (after Speth 1983)

Catalog Number	Component	Sex	Side	I	J	K	L	M	N	O
78354	3	M	L	9.02	5.89	9.40	5.85	8.70	4.31	5.10
78796	3	M	L	9.42	5.83	9.53	5.97	8.43	-	-
781028	3	F	L	7.88	5.11	7.68	4.78	7.02	3.48	4.18
77282	2	M	R	9.61	-	-	-	9.24	4.54	5.16

Appendix A: Measurements of Distal Metatarsals (after Speth 1983)

Catalog Number	Component	Sex	Side	D	E	F	I	J
77201	3	M	L	6.75	3.24	3.09	3.84	3.63
77507	3	M	L	6.58	3.38	3.12	3.99	3.71
77113	3	M	R	6.38	2.99	2.90	3.65	3.51
77025	3	F	L	5.74	2.75	2.72	3.46	3.35
77450	3	F	L	5.71	2.86	2.62	3.60	3.44
78657	3	F	L	5.65	2.75	2.57	3.58	3.32
75077	3	F	R	5.62	-	2.60	3.28	3.27
77493	2	M	L	6.96	3.41	3.33	4.18	3.98
77281	2	F	R	6.01	2.93	2.77	3.83	3.60

Appendix A: Measurements of Proximal Metatarsal (after Speth 1983)

Catalog Number	Component	Sex	Side	A	B
77201	3	M	L	5.78	5.73
780121	3	M	L	5.79	5.79
77387	3	M	L	6.31	6.12
77572	3	M	R	5.61	5.72
77420	3	M	R	5.63	5.67
78120	3	F	L	4.91	4.92
78657	3	F	L	4.99	5.33
77227	3	F	R	4.62	4.60
78364	3	F	R	4.85	4.69
77493	2	M	L	6.44	5.93
781227	2	M	R	6.26	5.90
77281	2	F	R	4.97	4.91

Appendix A: Measurements of Distal Tibia (after Speth 1983)

Catalog Number	Component	Sex	Side	H	I	J
77139	3	M	L	7.63	5.70	5.40
77613	3	M	R	7.44	5.70	5.29
781206	3	F	L	6.47	4.80	4.84
78118	3	F	L	6.40	5.20	4.68
77112	3	F	L	6.03	4.40	4.50
781044	3	F	R	6.69	4.70	4.74
77226	3	F	R	6.07	4.60	4.21
77727	3	F	R	6.38	4.85	4.64
77038	3	F	R	6.42	5.00	4.66
77498	2	M	L	7.75	5.70	5.40
781223	2	M	R	7.98	5.90	5.39

Appendix A: Measurements of Distal Femur (after Speth 1983)

Catalog Number	Component	Sex	Side	H	I	J	K	L	M	N	O
78801	3	M	L	5.31	12.00	7.74	15.40	5.82	5.16	5.77	10.60
77024	3	F	R	4.74	11.10	6.85	14.40	5.40	4.96	5.68	9.67

Appendix A: Measurements of Distal Metacarpal (after Speth 1983)

Catalog Number	Component	Sex	Side	D	E	F	I	J
77677	3	M	L	7.43	3.90	3.74	3.79	3.78
78499	3	M	L	7.42	3.69	3.48	3.94	3.80
78216	3	M	L	7.38	3.70	3.61	4.00	3.90
78708	3	M	L	7.70	3.88	3.50	-	-
77063	3	M	R	7.61	3.73	3.84	4.12	3.99
77333	3	M	R	7.40	3.79	3.77	3.86	3.94
77655	3	M	R	7.42	3.89	3.56	3.98	3.84
77046	3	F	L	6.24	3.20	2.94	3.58	3.49
78498	3	F	L	6.01	3.08	2.77	3.55	3.26
78296	3	F	L	6.21	3.22	2.92	3.57	3.39
781142	2	M	L	7.91	4.20	3.78	4.24	4.14
77867	2	M	R	7.85	3.96	3.76	4.12	4.15

APPENDIX B

STATISTICAL TESTS

Appendix B: Statistical Tests

Two statistical tests used in the text will be briefly explained below.

The t-Test

In Chapter Two a standard two-sample t-test (Moroney 1951:231) was used to determine whether the size range of two samples of bison (the Maple Leaf sample and a comparative sample of modern plains bison) was significantly different; that is whether the mean of the populations from which the two samples were drawn is the same. The test was set up as follows:

Step One: The null hypothesis is that there is no statistically significant difference between the two sample means ($\overline{X}_1 = \overline{X}_2$). The research hypothesis is that there is a statistically significant difference ($\overline{X}_1 \neq \overline{X}_2$).

Step Two: A two sample t-test was selected to test the above hypothesis.

Step Three: The significance level (α) was set at 0.05. The example used below will be for Measurement A of male proximal metacarpals, which showed the most variation between samples.

$\overline{X}_1 = 7.73$ $\quad$ $\overline{X}_2 = 7.57$

$N_1 = 11$ $\quad$ $N_2 = 12$

$S_1 = .34$ $\quad$ $S_2 = 30$

Step Four: The sampling distribution is a t-distribution

$$t = \frac{\overline{X}_1 - \overline{X}_2}{S_p\sqrt{\frac{1}{N_1} + \frac{1}{N_2}}}$$

where Sp = the pooled estimate of the population standard deviation based on the two sample standard deviations, or

$$S_p = \sqrt{\frac{(N_1 S_1)^2 + (N_2 S_2)^2}{N_1 + N_2 - 2}}$$

Using the above values in these equations

t=.347

Step Five: Degrees of freedom are calculated at 21 as follows

$$df = N_1 + N_2 - 2$$

Step Six: The critical value for t in a Two-tailed test is 1.721. Since the calculated value for t was less than t-crit, it was not possible to reject the null hypothesis. Thus, there is no statistically significant difference between the size ranges of the populations from which the two samples were drawn.

Point Pattern Analysis

In Chapter 8 a point pattern analysis was used to test whether there was a statistically significant difference between the distribution of right and left carpals and a random distribution by using the quadrat method and a chi-square test for significance (Mathers 1976:152). The procedure for point pattern analysis using the quadrat method is to grid the sample area with quadrats (in this example the 2 m square excavation units formed the grid), produce an observed table of frequencies given a random distribution, and compare observed vs. expected using a one sample goodness-of-fit test (chi-square). The test was set up as follows:

Step One: The null hypothesis is that there is no statistically significant difference between the distribution of right or left carpals and a random distribution. The research hypothesis is that there is a difference, that they are clustered.

Step Two: A point pattern analysis (quadrat method) and chi-square test was used to test the above hypothesis.

Step Three: The significance level (α) was set at 0.05 and N=28 grid squares.

Step Four: The sampling distribution is a random (Poisson) distribution. Left carpals will be shown as an example below.

Number of Lefts Per Square	Observed Number of Squares	Expected Number of Squares in a Random Distribution
0	18	9.32
1	4	10.25
2	3	5.63
3	1	2.03
4 or more	2	.69
	=28	

The expected number of squares in a random distribution is calculated using the formula:

$$P_{(N)} = \frac{e^{-\lambda} \lambda^{N}}{N!}$$

where e is constant (2.71821) and = density (number of points divided by number of squares). The chi-square test is calculated using the formula:

$$\chi^2 = \Sigma \frac{(fo - fe)^2}{fe}$$

and the result in the above example is $X^2 = 16.1$.

Step Five: Degrees of freedom are calculated as the number of classes minus two, in this case

df = 5 - 2
df = 3

Step Six: The critical value for X^2 at 3 degrees of freedom for the 0.05 significance level is 7.82. Since the value calculated for left carpals is higher than this critical value, for left carpals the null hypothesis is rejected; that is, there is a statistically significant difference between the distribution of left carpals and a random distribution. When the same procedure was used to evaluate right carpals, H_0 could not be rejected.