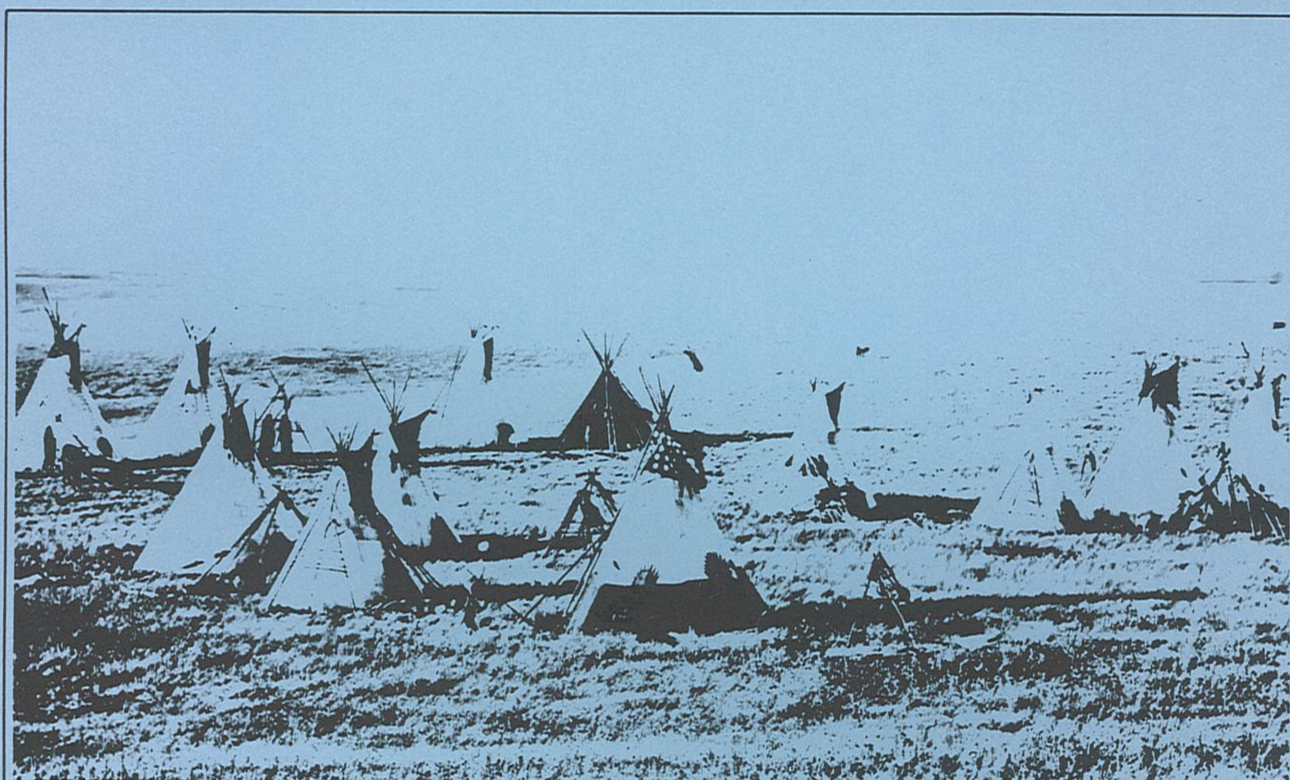
HISTORICAL RESOURCE INVESTIGATIONS WITHIN THE FORTY MILE COULEE RESERVOIR

John H. Brumley and Barry J. Dau



ARCHAEOLOGICAL SURVEY OF ALBERTA
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No. 13
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Alberta
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CULTURE AND MULTICULTURALISM

HISTORICAL RESOURCE INVESTIGATIONS WITHIN THE FORTY MILE COULEE RESERVOIR

by

John H. Brumley

and

Barry J. Dau

Ethos Consultants Ltd.
Group Box 20, Veinerville
Medicine Hat, Alberta
T1A 7E5
Canada

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HISTORICAL RESOURCE INVESTIGATIONS

WITHIN THE FORTY MILE COULEE RESERVOIR

- FINAL REPORT -

Prepared for

ALBERTA ENVIRONMENT

By

John H. Brumley
Barry J. Dau

Ethos Consultants Ltd.
Medicine Hat, AB.

March 1987

Investigations conducted in compliance with the provisions of Alberta Culture, Archaeological Survey of Alberta Research Permits 81-159c; 82-61; 83-91; 85-78c and 86-20c.

EXECUTIVE SUMMARY

Between 1981 and 1986, Ethos Consultants Ltd. of Medicine Hat undertook a major historic resources assessment/mitigation project for Alberta Environment, within an approximately 10 km long portion of Forty Mile Coulee which was selected for development as an irrigation storage reservoir. Initial surveys recorded 108 historic resource sites containing 471 identified features. During the assessment phase of the project 3,001 auger holes encompassing 90.03 square metres were drilled within and adjacent to 354 stone circles. The mitigation phase of the program involved examining 100 features at 43 sites with 856.85 square metres excavated. Subsurface evaluations also included an extensive backhoe testing program and a controlled surface stripping program which encompassed 29,176 square metres at six stone circle sites. In total 21,103 pieces of cultural material were collected.

Analysis of recovered data indicates that the majority of sites examined date to the last 2,000 years and in particular, to the last 400 to 500 years. Evidence is presented which suggests the majority of these sites reflect occupation by groups associated to one or more of the historic tribes comprising the Blackfoot Confederacy.

The majority of sites within the Forty Mile project area are characterized by stone circles or tipi rings reflecting the location of aboriginal lodges. Such features, commonly contain only limited quantities of associated cultural materials and have long proved difficult to adequately examine employing conventional archaeological techniques. A major aspect of the Forty Mile Coulee program was the development, employment and evaluation of a number of specialized excavation, data collection, and analysis techniques tailored to deal with the specific problems and requirements of stone circle research.

The open grasslands characterizing Forty Mile Coulee and its surrounding prairie surface, far from major river valley systems, appears to have been largely inhabited in the spring of the year. It is during that time that the small seasonal lakes in the coulee bottom or on upland prairie surfaces could have best sustained small dispersed herds of bison. Groups of aboriginal bison hunting peoples primarily occupied the area at the same time. They camped largely within or along the edges of the coulee in order to take advantage of terrain diversity which might enhance their chances of hunting success. Bison and their human predators apparently moved often across the prairie landscape at that time of the year. Evidence recovered in excavation indicated aboriginal occupations usually were no more than two or three days in length. The historic resources program conducted in conjunction with development of the Forty Mile Coulee Reservoir has provided a rich and detailed glimpse into a way of life now long gone.

ACKNOWLEDGEMENTS

Alberta Environment is the developer of the Forty Mile Coulee Reservoir, and our client. Bryan Kemper and Ron Middleton were our basic contacts with Alberta Environment and were a tremendous source of assistance and encouragement throughout the several years of this program. Although their primary commitment was clearly to the development objectives of their agency, it was also clear that they wanted those dollars available for cultural resource work to be spent effectively. We hope they are satisfied with the result. In the field, Don Petty of Klohn Leonhoff Ltd. helped in easing communications between archaeologists and reservoir construction personnel.

The Archaeological Survey of Alberta was the Provincial Government agency with the responsibility for ensuring cultural resource work within the Forty Mile Coulee Reservoir project complied with the requirements of Provincial Legislation. Because of the long term and large scale nature of the project, the Archaeological Survey of Alberta was involved in all major aspects of project planning and implementation. David Burley, Martin Magne, and in particular Rod Vickers, are present and former Archaeological Survey staff members who primarily worked with us in that regard. Rod Vickers and Martin Magne significantly edited an initial version of this report, helping to "tighten it up".

In conjunction with the 1982 field program, Michael Wilson served as a subconsultant, carrying out an extensive geoarchaeological study. That work (Wilson 1983) has provided significant data on the nature and rate of various geological processes operating in the project area. The authors have drawn freely on that report.

During the course of field studies at Forty Mile Coulee between 1981 and 1986, 45 individuals were involved in various aspects of field excavation and data analysis. These individuals are identified specifically elsewhere (Dau and Brumley 1987). Donna Thane and Anna Brumley are gratefully acknowledged for the excellent jobs they did in carrying out the voluminous data input, word processing, and graphics tasks associated with the production of this report. The junior author prepared the photographs used in this report.

Alberta Environment is to be commended for its efforts at Forty Mile

Coulee. From our viewpoint, not only has its effort lived up to the letter of Alberta's Historic Resources Act, but to its spirit.

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PREFACE

The majority of archaeological investigation conducted under the auspices of the Historical Resources Act involves rather small areas or narrow, linear development zones. Occasionally, as a matter of chance, such projects encounter especially important sites and result in significant advances in our understanding of Alberta's past. More often, these projects provide prosaic data which become most useful when regional syntheses are undertaken or when the data are integrated into a regional database, such as Brumley has produced for southeastern Alberta. Thus, Alberta archaeology has tended to advance through the slow accumulation of knowledge gained from many small development projects.

The opportunity to undertake strongly research-oriented archaeological investigations is rare; in southern Alberta, Alberta Environment's impoundment projects have provided the best context for such studies. This research structure, as well as reflecting Environment's desire to make genuine contributions to understanding the past, is also the most efficient approach to undertaking archaeology within large area developments. Of course, one should not forget that even the simple inventory data from these investigations are most useful. The survey data from impoundment projects have so far given us some understanding of sample portions of the Milk River, the Oldman River, Crawling Valley spillway between the Red Deer and Bow rivers, and Forty Mile Coulee between the South Saskatchewan and Milk rivers.

The Forty Mile Coulee project presents a major innovative study of stone circle or tipi ring sites, a type of site which is common in the northern Plains of the United States and Canada. Such sites are important in that they represent a major part of the seasonal settlement pattern of prehistoric peoples. The general low density of cultural material within such sites has inhibited archaeological understanding; however, the large sample of consistent observations reported here does much to overcome that problem. While no single research project will ever answer all questions, there is no doubt that this project represents a major step forward in stone circle research.

It is particularly important that the research results from such projects be disseminated to the scholarly community. Only if this is done, will future investigators be able to build upon the work and advance our understanding of Alberta's past. It is with great pleasure that Alberta Environment and Alberta Culture and Multiculturalism have published this volume. We have undertaken this cooperative effort in order that the study may be rapidly transmitted to the archaeological community. It is hoped that this joint venture will not only reflect our commitment to scholarly research within the context of development necessities, but will form a model for other projects.

1.0 INTRODUCTION

The Forty Mile Coulee project involves the construction of a water storage reservoir which is located within a section of Forty Mile Coulee in south central Alberta (Figure 1). The reservoir will be created by the construction of two earth filled dams which are approximately 9.4 km apart and are located along the coulee channel. The reservoir will be filled during periods of excess water supply from the main canal of the St. Mary's River Irrigation District which crosses Forty Mile Coulee near the westernmost dam. During periods of increased water demand, water will be pumped back out of the reservoir into the downstream leg of the canal.

Construction of the reservoir has resulted in considerable disturbance and modification of the land within the project area, and consequently, the total destruction of any historical resources present. The area encompassed by the reservoir basin, damsites and impervious borrow sources which are located on the prairie surface adjacent to the damsites, totals approximately 14.3 square km.

Ethos Consultants Ltd. was contracted by Alberta Environment in 1981 to inventory and assess the heritage resources present within the project area, and to prepare a planning document for use in mitigating the impact of proposed developments on historical resources (Brumley et al. 1982). This inventory indicated that the area was relatively rich in aboriginal archaeological resources. The predominant features found were stone circles or, as they are commonly referred to, tipi rings (Table 1; Figure 2). A major aspect of that study involved the development of a detailed methodological approach and research design to mitigate these resources. Subsequently, Ethos Consultants Ltd., under the direction of the authors, conducted the formulated research program intermittently within the project area during 1982, 1983, 1985, and 1986 (Brumley 1983a; Brumley et al 1983; Dau and Brumley 1984; Dau 1986a; Dau and Brumley 1987).

At present (February 1987), field studies are considered complete within the project area, with actual construction of the two dams and other ancillary features being well over half completed. Previously referenced reports regarding historical resources within the Forty Mile project area

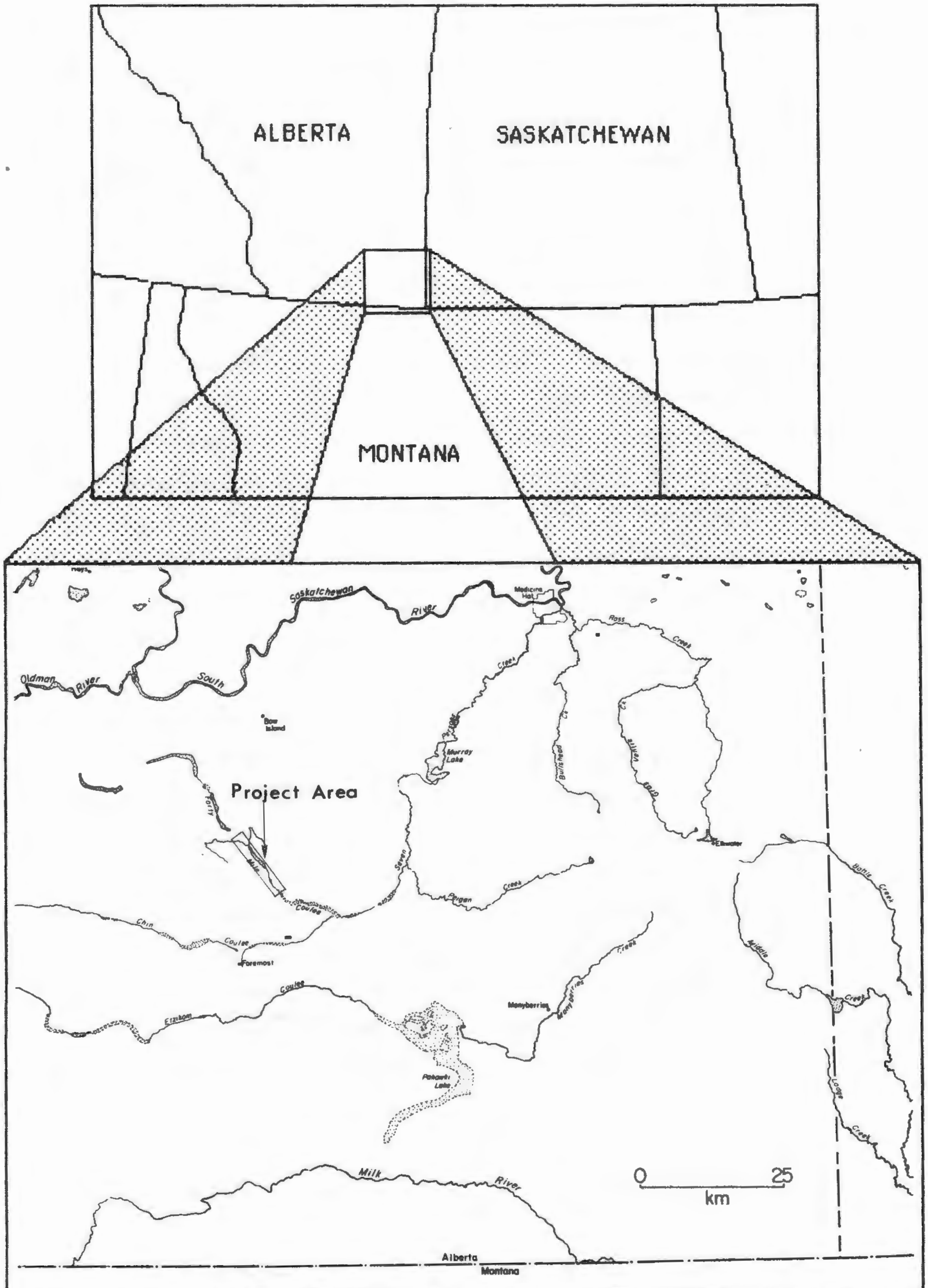


Figure 1: Local and Regional Setting of Forty Mile Coulee Project Area.

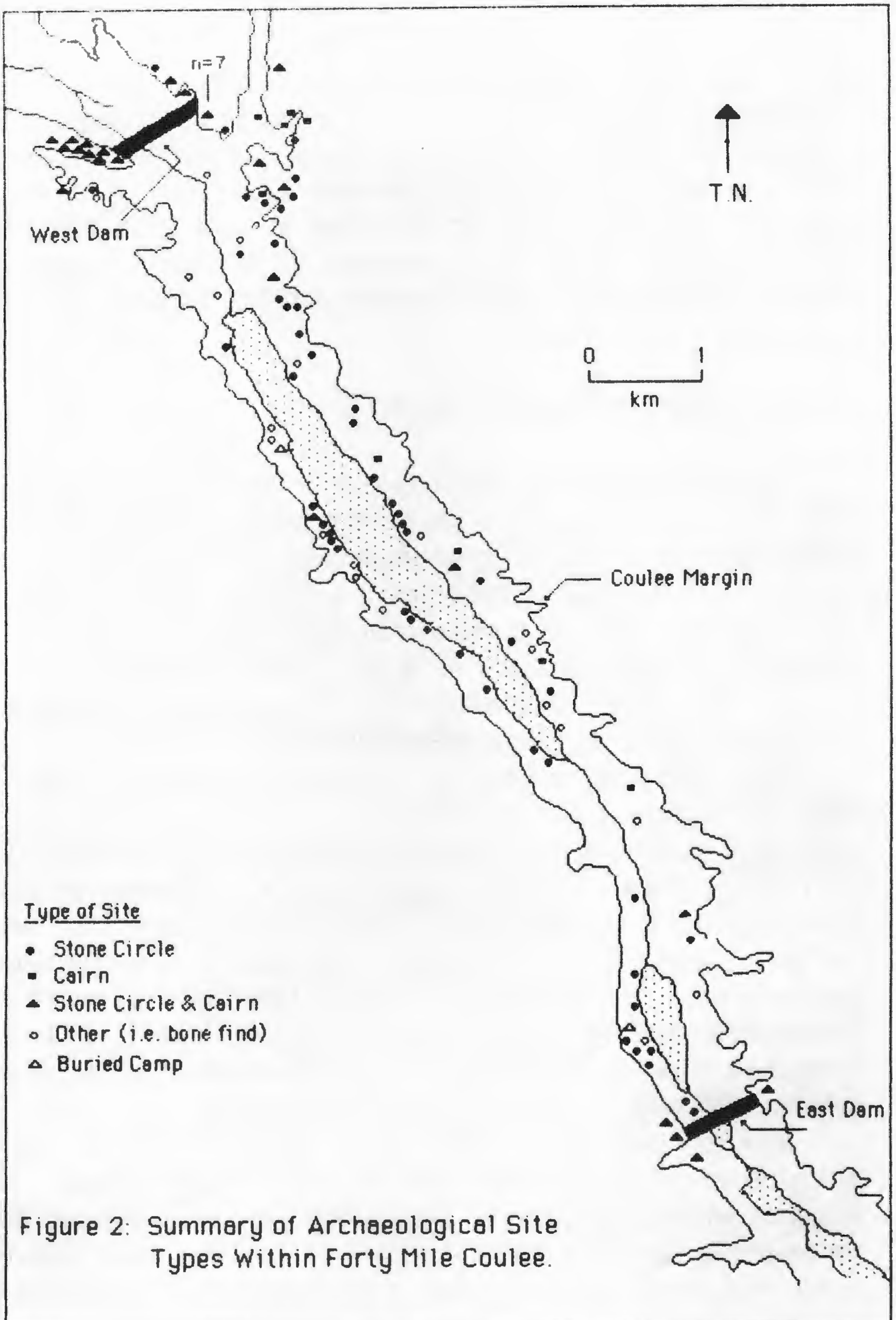


Figure 2: Summary of Archaeological Site Types Within Forty Mile Coulee.

can be considered as planning, data summary, or interim in nature and orientation. The volume of data generated in the course of this project was prodigious. For instance, the final data volume (Dau and Brumley 1987) consists of four parts totalling approximately 1200 pages. That report presents a site-by-site, detailed discussion of work undertaken and describes material and information recovered. In this report the authors present a summarization and final statement regarding the work conducted and the results of this research.

2.0 DESCRIPTION OF DEVELOPMENT PROJECT

The primary purpose of the Forty Mile Coulee Reservoir is to ease water shortages experienced by the St. Mary's River Irrigation District (SMRID) during periods of high irrigation demand in the eastern portion of its district. Once completed and filled, it will allow the total irrigated area within the SMRID to increase from approximately 160,000 ha to maximums of 180,000-200,000 ha (Klohn Leonoff Ltd. 1981:2). The reservoir will consist of two rock-faced earthen dams enclosing an approximately 10 km long section of Forty Mile Coulee (Figures 2-4).

Major inflow and pumping facilities will be located near what is known as the West Dam Site (Figure 2). The West Dam is situated immediately south of the point where the SMRID main canal crosses Forty Mile Coulee by means of a siphon. Its position will allow the reservoir to be filled by gravity flow of water diverted from the SMRID canal. The West Dam will be approximately 700 metres in length and rise 28 metres above the coulee floor. The structure known as the East Dam (Figures 2,4) is located approximately 10 km downstream from the West Dam. It is similar in structure to the West Dam and will have a maximum length of 600 metres and a maximum height of 20 metres above the coulee floor.

Once completed, the reservoir will be filled from the SMRID canal during periods of excess water flow and low irrigation demand. As irrigation demands increase during a year, water would be pumped back into the downstream portion of the canal system. The maximum water capacity of the reservoir has been estimated at 86,000,000 cubic metres (Klohn Leonoff Ltd. 1981:7).

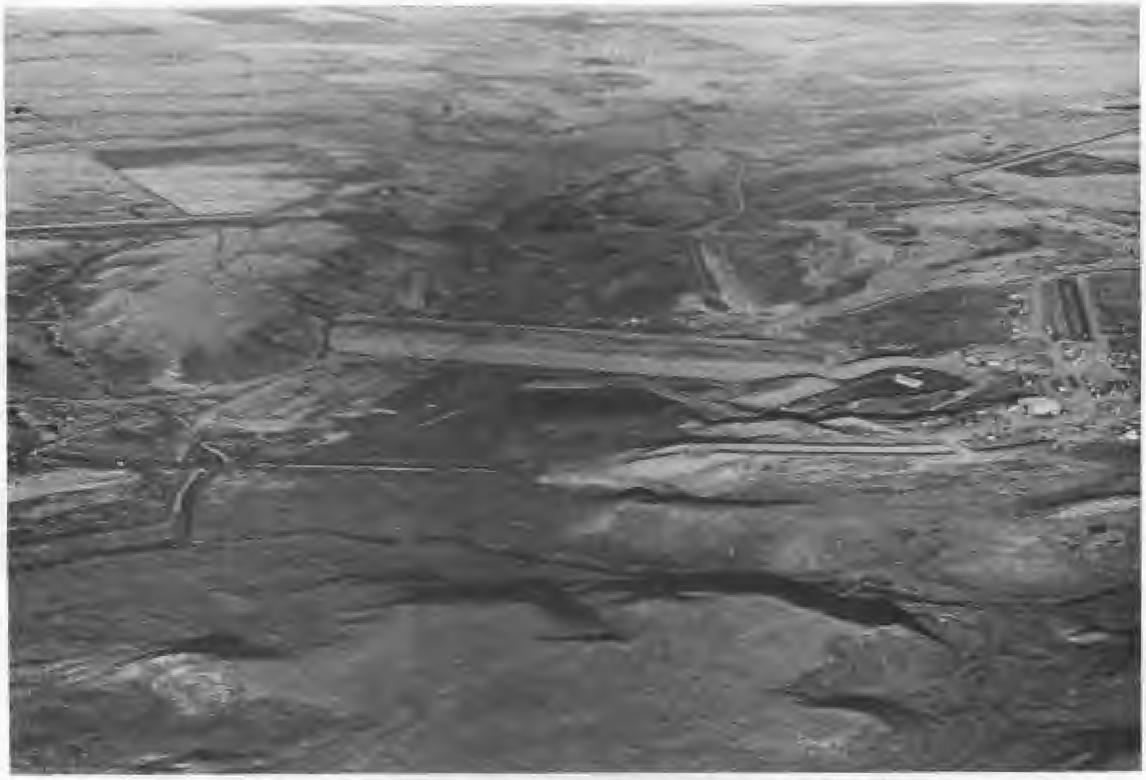


Figure 3: Aerial View Looking SE Towards the West Dam Site While Under Construction.

Figure 4: Aerial View Looking NW Towards the East Dam Site While Under Construction.

In addition to damsite construction, several other types of surface disturbances will affect the historical resources present in the project area. Reservoir filling will impact the entire floor of the coulee between the dams. If maximum water capacity is achieved, the coulee walls will be flooded to a height of 814 metres ASL (Klohn Leonoff Ltd. 1981:12). Additional disturbance along the coulee edge will occur as a result of: 1) SMRID siphon relocation near the west damsite, 2) construction camp development, and 3) borrow pit utilization. The vast majority of these developments are restricted to areas adjacent to the dam sites. Including the flooded area, the total land surface to be impacted by reservoir development along Forty Mile Coulee is in excess of 1000 ha.

3.0 GENERAL ENVIRONMENT OF PROJECT AREA

Numerous studies have been completed which detail the pre and post-glacial environment of Forty Mile Coulee and its surrounding area (Klohn Leonoff Ltd. 1981; McCourt Management Ltd. 1981; Mollard 1981; Stalker 1977; Westgate 1968; Wilson 1983). The following section draws heavily from these sources for primary data. The focus of the section will concentrate on those aspects of the environment considered significant in interpreting aboriginal occupation of the area.

3.1 Holocene Geology

Forty Mile Coulee is a valley feature of the Late Wisconsin period in southeastern Alberta. It flows across a relatively flat upland terrain created by Late Wisconsin ice sheets. Initial coulee formation apparently began approximately 18,000 BP, after the retreat of a localized ice sheet known as the Etzikom Advance (Wilson 1983:34). The last localized ice sheet in the area, known as the Oldman Advance, did not reach as far south as Forty Mile but did create a number of short-term glacial lakes which drained through the coulee and greatly increased its size. This period represents the most significant episode of Forty Mile Coulee formation with downcutting reaching depths of 90-110 metres, well into the bedrock of the area. Near the West Dam site, downcutting exposed a portion of a preglacial feature known as the Foremost Valley.

During the Holocene, all major water sources to the coulee disappeared and flow was restricted to minimal amounts of water from adjacent prairie surfaces, available only on a seasonal basis. The cessation of immediate post glacial water flow was followed by initial rapid sedimentation which then apparently slowed and stabilized. Wilson (1983:46) estimates a deposition rate of 0.1 cm per radiocarbon year for the last 3000 years. Up to 40 metres of sediments have been deposited on the coulee floor. These sediments are derived from alluvial, colluvial, aeolian and lacustrine sources, as well as coulee wall in-falls and slumpage.

3.2 Topography

The topographic character of Forty Mile Coulee is, in most respects, typical of the proglacial drainage features found in southeastern Alberta. It is a well defined, relatively deeply incised feature that meanders in a NW-SE direction across essentially flat open plains terrain (Figures 3-10). Within the project area the coulee varies rim to rim in width of from 625 metres to 1300 metres. Coulee floor widths range from 250 metres to 525 metres. Maximum elevations remain relatively constant from highs of 838.2 metres ASL on the coulee edges to lows of 800.1 metres ASL on the coulee floor.

Flat to gently undulating prairie terrain runs right to the edge of the coulee. The north wall of the coulee has been shaped by a variety of secondary drainage channels, some incised almost to the coulee floor (Figure 2). Slopes in the 40° range are most prevalent along the north wall although gradients of up to 70° are not uncommon. Outcrops of bedrock from the Foremost formation can be found in the most exposed areas of the north wall.

The south wall of the coulee is more sheltered from prevailing winds and is characterized by steeper slopes (Figure 8). Gradients in the 45°-75° range are most common. Because it is sheltered, the south wall retains moisture for a longer period of time each year. This retention has resulted in extensive slumping along its length. Within the project area 18 slump block features were identified during preliminary surveys (Wilson 1983).

Figure 5: Aerial View of Forty Mile Coulee.

Figure 6: Aerial View of Forty Mile Coulee.

Figure 7: Topographic Character of the Prairie Edge of Forty Mile Coulee.

Figure 8: General View Along the South Wall of Forty Mile Coulee.

Figure 9: General View of Coulee Floor Near the East Dam Site.

Figure 10: General View of Coulee Floor in the Center of the Project Area.

Twelve of these are situated along the south wall of the coulee.

The topographic character of the walls of Forty Mile Coulee, although rugged, would not have been a major obstacle preventing aboriginal groups from entering or crossing the coulee. In fact, the terrain may have provided advantageous camping locales during specific times of the year. This is especially true of the south wall and coulee bottom, where the sheltered terrain would have offered a larger and more diverse range of floral resource and shelter from winds.

The floor of the coulee is essentially flat (Figures 9-10), created by rapid sedimentation and the lack of constant water flow. Within the project area, the majority of the coulee floor is covered by two shallow lakes (Figure 2). Data on these lakes indicate they are of recent origin and the result of intentional dumping and unintentional seepage of water from the SMRID canal. Originally, the coulee bottom within the project area contained two shallow lakes in the same general location but much smaller than the existing water bodies. How ephemeral or permanent these original lakes were is difficult to assess. Aside from the lakes, aboriginal occupants of the area would have found essentially open prairie grassland conditions on the floor of the coulee, ideal for large ungulate grazing on a seasonal basis.

Permanent water may have been scarce in Forty Mile Coulee prior to the creation of the recent lakes. In the spring, run-off into the coulee would have created numerous seasonal ponds undoubtedly frequented by large ungulates. Spring/seeps which flow continuously are rare within the project area and are normally found along the south wall of the coulee. However, those are characterized by a wet boggy surface with very little surface water. As such, they could not have provided much water for large numbers of animals. They could however, have provided enough water for aboriginal groups which passed through the coulee. Small holes or pits dug into the springs will quickly fill with water that can then be dipped out.

3.3 Surficial Deposits

A variety of surficial deposits are present within and adjacent to Forty Mile Coulee. The majority are of glacial and post glacial origin and are similar to those found within and adjacent to the other major drainage features within the area (Chin and Etzikom Coulees; Figure 1). The following section derives most of its data from Westgate (1968).

On the coulee edges within the project area the most prevalent surficial deposits are ground moraines derived from the Late Wisconsin ice sheet known locally as the Etzikom Advance. These moraines are composed of unsorted tills mixed with sand, silt, clay and patches of lacustrine or outwash silts and clays. Sections of Washboard moraine, composed of aligned ridges of till, are present near the East Dam site. Tills from these deposits have eroded downslope and can be found on the slump blocks, terraces and bases of the coulee walls. At the West Dam site, the coulee edges are characterized by Lacustrine sediments composed of sand, silt, and clay. In many areas erosion has removed enough of these deposits to expose underlying tills.

Meltwater channel sediments composed of gravel, sand and silt are present throughout the coulee floor. These are generally very deeply buried beneath colluvial deposits, derived largely from the coulee walls. Terrace-like slump block surfaces along the coulee walls are also covered in deep layers of colluvial and wind blown sediments. Deep testing undertaken in 1986 at several of these slump block surfaces along the south wall of the coulee indicated that these deposits can reach thicknesses in excess of 300 cm.

3.4 Flora and Fauna

Forty Mile Coulee lies within what has been termed by Moss (1955) as the mixed prairie phytogeographic region of southern Alberta. The area is more commonly known as short grass prairie. Table 2 outlines the types of flora that can be found within and immediately adjacent to the proposed reservoir. Five distinct micro-environments are recognized in the project area, each containing a restricted set of plant species. As is the case throughout the short grass prairie area, however, there is a certain amount of intermingling of more hardy plant types.

Prior to the recent past, many of the shoreline plant species may have been absent from Forty Mile Coulee. The lack or more limited extent of permanent water would have restricted their spread within the coulee. A few species such as Salt and Alkali grass would have been present adjacent to the permanent springs, lakes, and ponds and along the seasonal run-off channels on the coulee floor.

The aboriginal occupants of Forty Mile Coulee may have taken advantage of many of the plant species present in the area. Woody vegetation such as buckbrush, although limited in extent, may have been of importance, particularly in the spring and fall as a source of fuel for heating and cooking. In addition, summer occupants could have taken advantage of such berry producing plants as Chokecherry, Currant, Gooseberry and Saskatoon. At present, berry plants are not extremely common within the project area. Their habitats are restricted primarily to the slopes of the south coulee wall.

The short grass prairie of southeastern Alberta supports a surprising variety of animals. Within and adjacent to Forty Mile Coulee more than 200 species have been reported or are known to reside (McCourt Management Ltd. 1981; Table 3). Many of these are seasonal residents, occupying the area only during the spring, summer and/or fall. A total of 39 species of mammals can be found within and adjacent to Forty Mile Coulee. They consist of shrews (2), bats (8), lagomorphs (2), rodents (15), carnivores (9) and ungulates (3) (McCourt Management Ltd. 1981). All but two of these were probably resident prior to the homestead era. Cattle arrived with Euro-Canadian settlers and now form the most numerous ungulate found in the coulee.

For aboriginal occupants of the area, the now regionally extinct bison was clearly the most important faunal resource. Ethnographic sources are rich in references to the importance placed on bison by aboriginal groups . Historic resource excavations conducted within the coulee substantiate those references with the recovered faunal sample consisting almost exclusively of bison bone.

During the period when bison occupied Forty Mile Coulee, common carnivores would have included coyote, red fox and bobcat, Plains wolf and possibly the Plains grizzly. Evidence of carnivore gnawing is common on the faunal remains from archaeological sites within the coulee. Well defined marks are suggestive of carnivores no larger than wolf and in addition to wild carnivores may have been produced by domesticated dogs belonging to the aboriginal groups.

Birds are by far the most common group of animals in the Forty Mile Coulee area. A total of 150 species have been reported or identified (McCourt Management Ltd. 1981). They consist of water and shore birds (32), waterfowl (24), raptors (16), upland game birds (4), and passerines (74). The vast majority (98 species) are seasonal visitors, arriving in early summer primarily to nest and raise young. Thirty-seven species are migratory, utilizing the recent shallow lakes in the coulee as staging areas during their north-south movements. The remaining 16 species are hardy birds which reside in the coulee year round.

The presence of permanent water is the primary attraction for a large number of the birds found in the area. Prior to the enlargement of the shallow lakes on the floor of Forty Mile Coulee these species could not have been as common. Early breeding species such as ducks may have been present as they have the ability to take advantage of the kinds of seasonal water sources which may have been in the coulee before the present lakes were created.

Only 11 species of reptiles and amphibians are known for the Forty Mile Coulee area. Studies conducted by McCourt Management Ltd. (1981) resulted in the recording of only three species, all snakes. While the Prairie Rattlesnake and the Western Plains Garter snake are present in reasonable numbers, by far the most common type is the Bull Snake.

Fish are not common within Forty Mile Coulee. The shallow nature of the lakes and the lack of constant waterflow restricts the number of species that can survive. Of the four species expected to be found in the area, McCourt Management Ltd. (1981) identified only two, Northern Pike and White Sucker. Fish are recent occupants, arriving via irrigation canal waters after the present lakes on the coulee floor had been established.

4.0 SUMMARY OF HISTORIC RESOURCE PROGRAMS IN PROJECT AREA 1981-1986

The historic resource assessment/mitigation project within the proposed Forty Mile Coulee Reservoir was initiated late in 1981 (Table 4;

Figure 11). All work completed during that year was conducted within the parameters of a "Terms of Reference" document prepared by Alberta Environment and Alberta Culture. In-field investigations resulted in slight adjustments to the terms of reference and were presented in Brumley et al. (1982:3) as follows:

1. Conduct a surface survey of uncultivated portions of the proposed granular borrow pit areas.
2. Conduct a surface survey and subsurface testing program in the East and West Damsite development zones. Subsurface testing will include collection of soil samples to determine whether pollen is preserved.
3. Conduct evaluation excavations at a representative sample of historic resource sites located in the East and West damsite areas intended to provide baseline data for development of planning and mitigation recommendations.
4. "...to develop a major long-range planning document which will evaluate historic resources vis a vis impacts from the Forty Mile Coulee Project. This document shall evaluate site disturbance data, the scientific and aesthetic value of historic resource sites, the potential for deeply buried sites, techniques appropriate for site data recovery, information dissemination potential and methods, long-range impact potential, and development of suitable research objectives for subsequent studies."

All portions of the project were completed. However, adverse weather conditions lengthened fieldwork through the fall and winter of 1981-1982. Surface surveys resulted in the recording of 102 historic resource sites which contained approximately 650 surface and subsurface features. A portion of the subsurface testing program involved the excavation of 21 backhoe tests within the area to be impacted by the construction of the East and West damsites. The purpose of this testing was to: a) search for buried historic resource sites within the proposed development area, b) determine the nature and extent of sediments present within the coulee area from a historic resource perspective, and c) to collect soil samples suitable for determining whether pollen was preserved

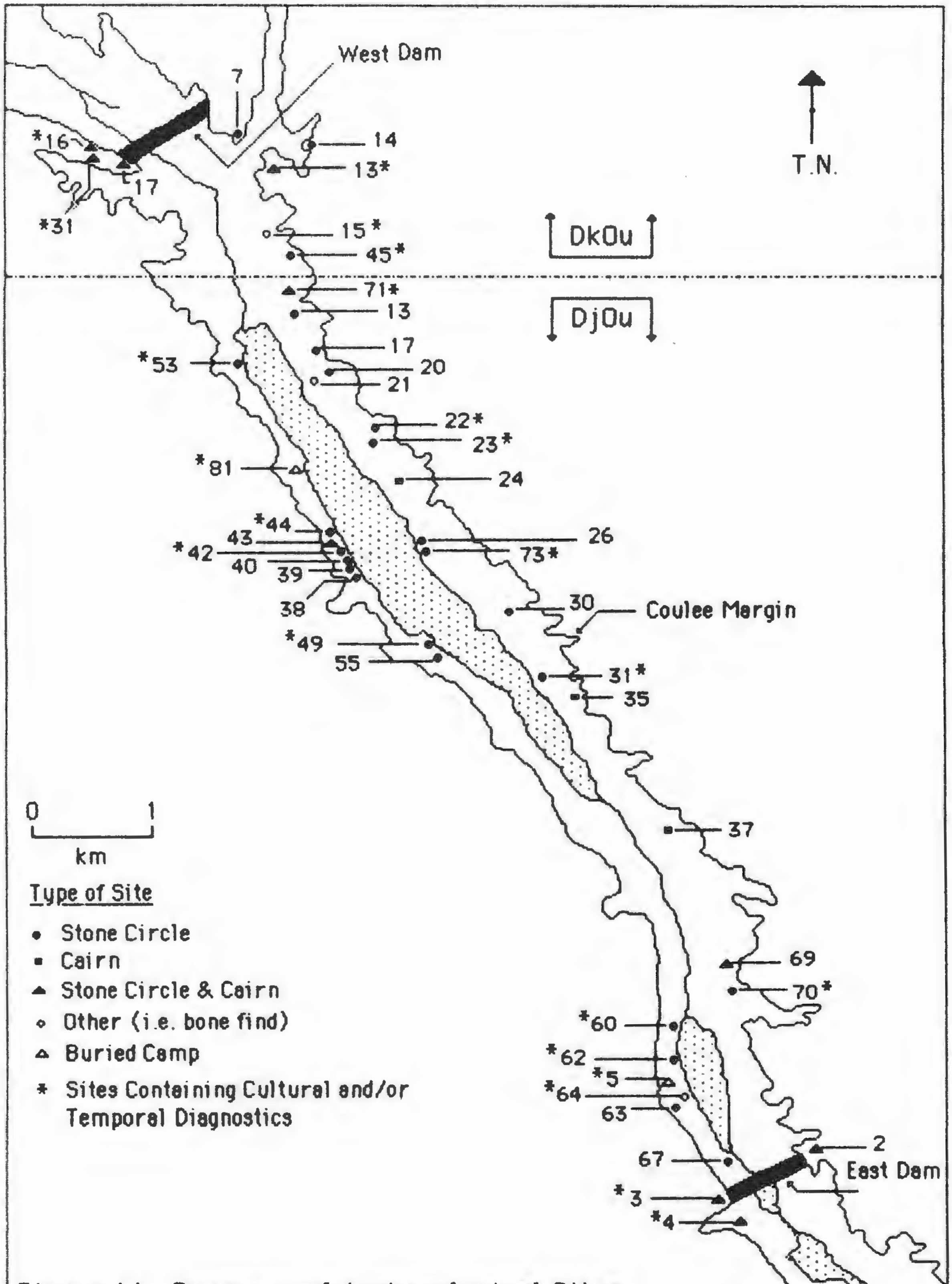


Figure 11: Summary of Archaeological Sites Tested by Excavation Within Forty Mile Coulee.

within the sediments (Brumley et al. 1982:24).

Test excavations were conducted at seven archaeological sites in 1981. All were located within the development zones for the East and West damsites. The sites/features selected for testing were considered to be either representative of those noted within the development area or exhibited indications that they might contain high cultural material densities. A total of 59 square metres were excavated, resulting in the recovery of 764 pieces of cultural material. Only one diagnostic item was found; a projectile point from site DjOu-3. It was identified as a Plains/Prairie side-notched point dating to the Late Prehistoric Period.

Field investigations conducted in 1982 marked the beginning of research directed specifically toward implementation of the research design generated as a result of 1981 work. All field and laboratory work that year was directed towards two objectives. The first was to complete the initial survey and assessment of all development zones within the reservoir. This included: 1) the reservoir basin, 2) the construction campsite and its proposed facilities, 3) proposed construction roads, and 4) impervious borrow sources for the East Dam site (Brumley 1983a:4). In addition, further assessment of sites recorded within the West dam site development zone was to be completed.

The second objective of the 1982 project was to begin testing the hypotheses generated as a result of the 1981 project. A total of 10 were generated (see Section 5), all relating to the nature and function of known archaeological sites within the Forty Mile Coulee Reservoir and to the lifestyles of the aboriginal occupants. The data required for hypothesis testing were collected: 1) during test excavations, 2) through the gathering of specific structural information on stone circles, and 3) through a detailed analysis of the physiographic characteristics of Forty Mile Coulee within the proposed reservoir.

Surface surveys within the reservoir basin encompassed a total of 567 ha and resulted in the recording of 67 historic resource sites. This brought the total of known sites within the reservoir and its margins to 120. Preliminary assessment of the recorded sites formed the largest component of the 1982 project. This assessment involved aerial mapping of sites, detailed recording of surface stone features and the implementation of a standardized auger testing program at all known stone circles. A total of 1612 auger holes, encompassing 48.36 square meters, were drilled within and adjacent to 245 stone circles. Including surface collections, 1063 pieces of cultural material were recovered. During test excavation, 111 square metres were dug at 15 stone circles in 8 sites with a total of 3122 pieces of cultural material recovered.

Diagnostic and/or dateable materials were collected from nine sites. These consisted of: a) identifiable projectile points, b) ceramics, and c) bone samples of sufficient size to be submitted for radiocarbon analysis. Virtually all of these were identified as belonging to the Plains/Prairie and Old Women's Complexes of the Late Prehistoric Period.

The 1983 investigation project was undertaken in conjunction with relocation of the S.M.R.I.D. irrigation siphon across Forty Mile Coulee. The original siphon crossed the coulee immediately east of the proposed West Dam and within the area of the proposed reservoir. In 1983 the siphon was replaced and was relocated to the west just outside the reservoir basin.

The surface survey conducted during 1981 (Brumley et al. 1982) had identified a number of sites within the proposed area for the new siphon. None of these sites had been included in the research design proposed by Brumley (1983a:110) for the reservoir. However, three sites (DkOu-16, 17 and 31) included in the research design were adjacent to the impact zone and the decision was made to complete required mitigation on these sites in conjunction with siphon development.

Although the main focus of the 1983 project was directed towards mitigation of sites DjOu-16, 17 and 31, auger testing was carried out at seven other sites and aerial mapping was completed for the entire West Dam site zone. The project also allowed for the testing of two data recovery procedures hypothesized by Brumley (1983a) as being of possible value in evaluating stone circle sites, controlled surface stripping and test trenching. The auger testing program at sites DjOu-4, 5, 6, 7, 48, 49 and 50 resulted in the drilling of 457 auger holes, encompassing 13.71 square metres. A total of 124 pieces of cultural material were recovered. In test excavation, 96.4 square metres were dug at sites DkOu-16, 17 and 31 with 560 pieces of cultural material found. Controlled surface stripping was completed at sites DkOu-16 and 31. A total of 6,208 square metres were stripped with 146 pieces of cultural material recovered. Only one diagnostic cultural item was found in 1983. It was a small side notched projectile point recovered from site DkOu-16. The specimen was identified as dating to the Late Prehistoric Period.

The 1985 mitigation project focussed on mitigation in the East and West Dam site development zones. Primary effort was placed on mitigation at sites DjOu-2 and 3, located at the East Damsite. Both sites were part of the historic resources mitigation research design proposed by Brumley (1983a:110). In addition, a preliminary assessment consisting of preparation for aerial photography and/or auger testing was planned for sites DjOu-9, DkOu-1, 2, 3, 8, 9, 17, 28, 29, 30, 32 and 33. Finally test excavations were conducted at site DkOu-7 in response to its use as a primary borrow source. Auger testing, which consisted of 39 auger holes, encompassing 1.17 square metres, were dug at site DkOu-17 with only one cultural item recovered. Ninety-three square metres of excavation were completed with 380 pieces of cultural material recovered. No diagnostic items were found.

The historic resource investigations conducted during 1986 were the culmination of the five year assessment/mitigation program within the project area and constituted the largest single year of archaeological work undertaken.

The objectives of the 1986 investigations fell into four basic parts:

1. completion of all mitigation at sites within the reservoir basin and at the West Damsite as per the research design outlined by Brumley (1983a:110);
2. completion of all limited feature mapping/auger testing required at the reservoir;
3. completion of mitigation at site DjOu-2 begun in 1985; and
4. the continuation of testing of controlled surface stripping.

Limited feature mapping and auger testing was completed at 116 features in 22 sites. This consisted of 85 stone circles, 30 cairns and one buried camp. A total of 797 auger tests, encompassing 23.91 square meters, were dug with 20 cultural items recovered.

The original mitigation plan called for the excavation of 500 square metres at 41 stone circles, 12 cairns and 3 buried campsites. All the originally formulated mitigation was completed except at one buried campsite, DjOu-52. This site was destroyed by erosion before mitigation could be completed. In total, during 1986, 506.54 square metres were excavated within and adjacent to the selected features, with 13,054 cultural items recovered.

Further testing by controlled surface stripping within and adjacent to 31 stone circles was planned for several sites in the reservoir basin. Access problems and high water levels reduced the actual number of stone circles examined to 28 at four sites (DjOu-60, 62, 69 and 70). A total of 22,968 square metres were stripped and 1,653 cultural items were collected.

During the 1986 mitigation/assessment project, 14,727 individual cultural items were collected. Eleven projectile points were recovered from five sites (DjOu-5, 22, 49, 62 and 73). The majority (n=8) were referrable to types associated with the Prairie/Plains complex of the Late Prehistoric Period. The remainder consisted of single specimens referrable to the Avonlea, Besant and Pelican Lake complexes. Limited samples of very fragmentary ceramics were also collected from sites DjOu-62 and 73. Both samples appear to be referrable to Saskatchewan Basin ceramics characterizing the Avonlea and Old Women's complexes.

5.0 CULTURAL AND TEMPORAL FRAMEWORK

5.1 Introduction

The evaluation and interpretation of historic resource materials recovered from the Forty Mile Coulee project was carried out from the perspective of the writers' perception of regional history and prehistory. The reader is referred to Reeves (1969; 1973; 1983) and Frison (1978) for thorough discussions of the current models of culture history most commonly employed in the Northern Plains. Vickers (1986) provides a detailed review and discussion of current knowledge of Alberta Plains prehistory. Wormington and Forbis' (1965) Introduction to Alberta

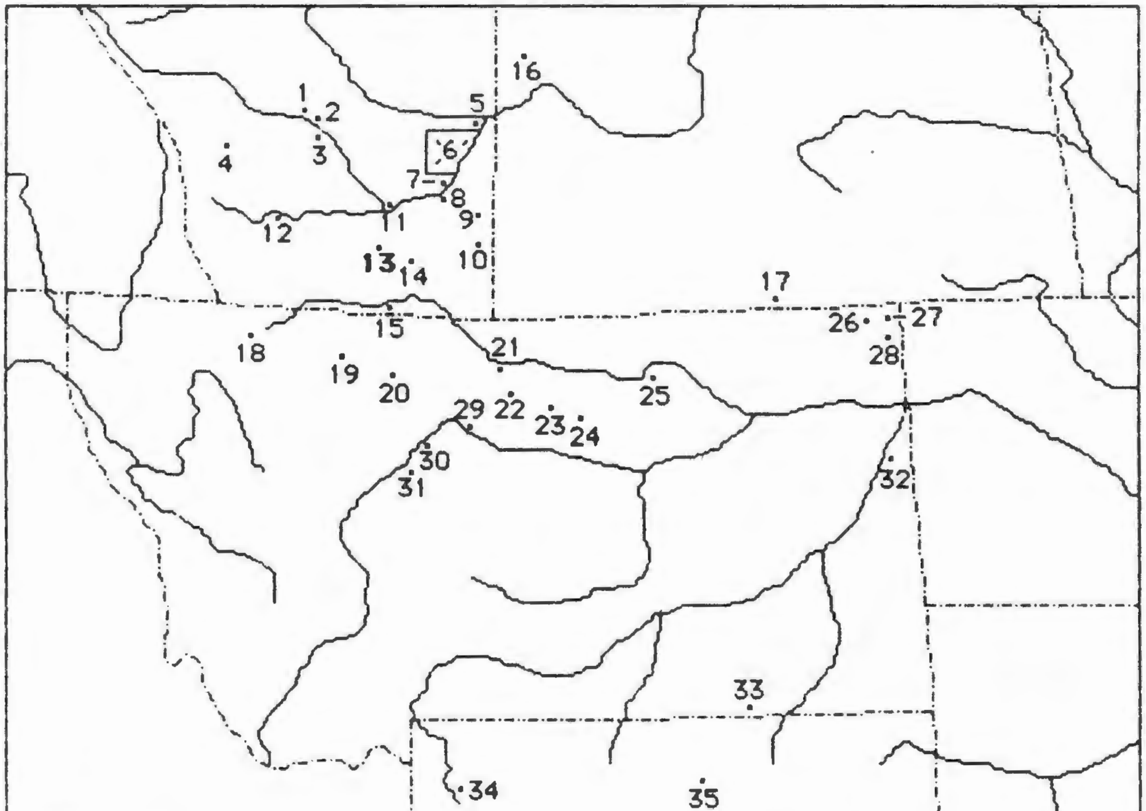
Archaeology is still an important reference as well. Figure 12 summarizes the location of various sites discussed in the following pages. Figure 13 summarizes the major cultural episodes proposed by Frison (1978) and Reeves (1969; 1973; 1983) and relate them to previously reported cultural materials from southeastern Alberta. Figure 14 and Table 5 relate those concepts to materials from the Forty Mile sites.

The writers have become increasingly uncomfortable with major aspects of current models proposed for the prehistory of the Northern Plains, encompassing here the Plains of Alberta, Saskatchewan, Montana and parts of Wyoming and the Dakotas. Herein, the writers propose a new model for interpreting much of the archaeological materials for this area. In writing this section on cultural history, the writers end up in a no-win situation. In presenting new concepts and ideas, we are forced to present much more in the way of external comparisons, supporting evidence and discussion in reference to introduced ideas, than we would have liked in a report whose focus is not simply cultural history. On the other hand, some readers may feel many aspects of the presented model are insufficiently demonstrated and should have been better documented or discussed.

Stylistic and temporal differences in projectile points used by aboriginal groups in the Northern Plains have long been employed as diagnostic indicators of various cultural complexes in the region. Figure 15 presents a stylized sequence of major projectile point forms for the study area. In the following model, it may appear that projectile point typology was almost the only criteria employed in model formulation. This is not the case. This apparent emphasis reflects the aforementioned limitations in time and space which prohibits more detailed exposition of supporting data. In addition to projectile point typology, the following aspects of material culture were examined and found significant in model formulation.

1. broad scale lithic utilization patterns;
2. various aspects of settlement and subsistence;
3. burial systems; and
4. regional distribution patterns.

The following discussion will probably become at times confusing, even to those familiar with the prehistory of the region. Thus, Figure 16, which summarizes the various complexes and cultural relationships



ALBERTA

1. Gleichen (EfPg-2)
2. Cluny (EePg-1)
3. Majorville (EdPc-1)
4. Old Women's (EcPl-1)
5. EeOm-15
6. Suffield Reserve Containing:
   - Cactus Flower (EbOp-16)
   - EbOp-42, EbOp-44
   - Ellis (EcOp-4)
   - Ramillies (EcOr-35)
   - EcOs-41
   - British Block (EdOp-1)
7. Lindoe
8. City Of Medicine Hat Containing:
   - Southridge (EaOq-17)
   - Ross Glen (DlOp-2)
   - Saamis (EaOp-6)
9. Larson (DlOn-3)/Irvine (DlOn-2)
10. Stampede (DlOn-26)
11. Laidlaw (DlOu-7)
12. Ross (DlPd-3)
13. Fletcher (DjOw-1)
14. Forty Mile Coulee Project
15. Gilchrist (DgOu-29

SASKATCHEWAN

16. Elma Thompson (EiOj-1)
17. Buffalo Gap (DgNh-1)

MONTANA

18. Boarding School (24GL302)
19. Ethridge
20. Galata (24TL26)
21. Wahkpa Chu'gn (24HL101)
22. Beaver Creek (24HL411)
23. Timber Ridge (24BL101)
24. Three Buttes (24BL104)
25. Simanton
26. Overby (24SH615)
27. Shippe Canyon (24SH514)
28. Dune Buggy (24RV-1)
29. Lost Terrace (24CH68)
30. Morrow-Bateman (24CH234)
31. Highwood
32. Hagen (24DW2)
33. Benson's Butte (24BH1726)

WYOMING

34. Mummy Cave (48PA201)
35. Piney Creek (48JO311)

Figure 12: Location of Various Sites Discussed.

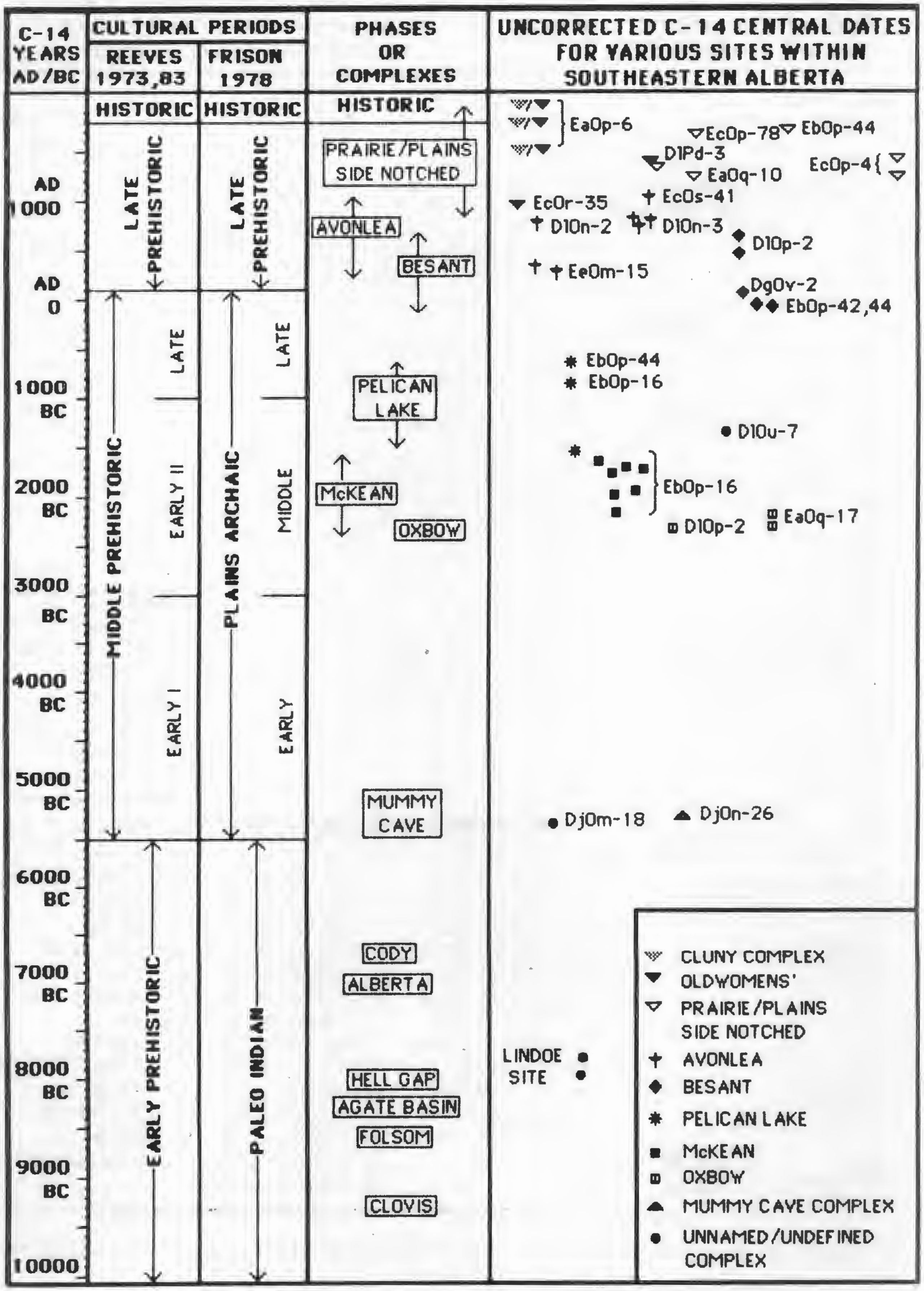
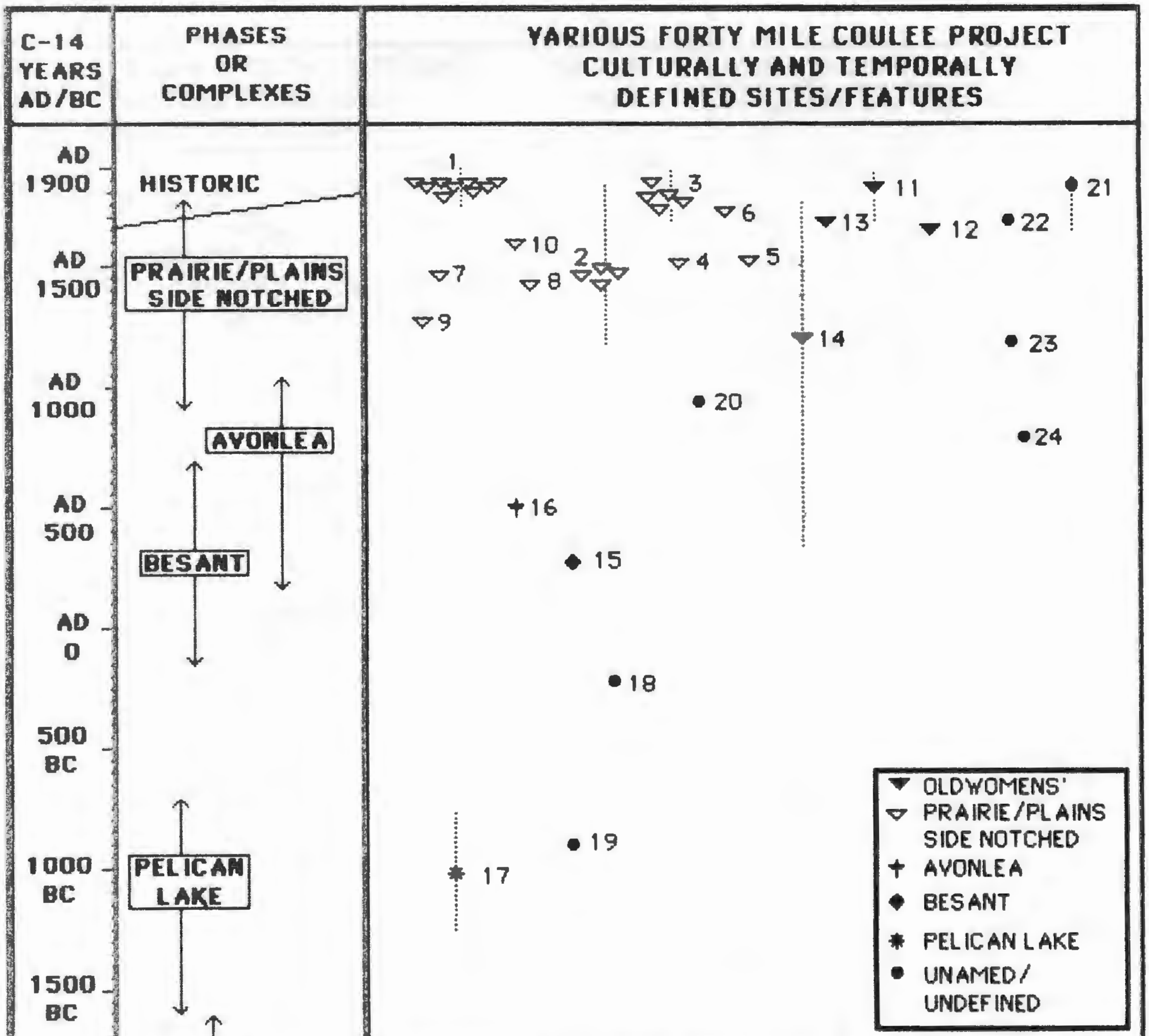


Figure 13: General Northern Plains/S.E. Alberta Cultural Sequence.



REFERENCE TO INDIVIDUAL SITE/FEATURE LOCATIONS

1 DjOu-22, SC-1
DjOu-23, SC-1
DjOu-31, SC-3
DjOu-31, SC-5
DjOu-60, SC-17
DjOu-70, SC-1
DjOu-73, SC-6
DkOu-31, SC-1
DkOu-48, SC-3
2 DjOu-3, SC-1
DjOu-49, SC-3
DjOu-62, SC-5
DkOu-16, SC-8
3 DjOu-42, SC-1
DjOu-53, SC-2
DjOu-60, SC-12
DjOu-60, SC-14
DjOu-64, SC-1
4 DjOu-60, SC-2
5 DjOu-60, SC-9
6 DjOu-62, SC-11
7 DjOu-62, SC-12
8 DjOu-61, SC-2
9 DkOu-13, C-2
10 DkOu-45, SC-1
11 DjOu-44, SC-3
12 DjOu-44, SC-6
13 DjOu-62, SC-9
14 DjOu-73, SC-13
15 DjOu-5, Buried Camp
16 DjOu-81
17 DjOu-58
18 DjOu-4, TT-1
19 DjOu-4, TT-4
20 DjOu-62, SC-7
21 DkOu-15
22 BH test @ 12UVL677037
23 Ditch @ 12UVK744942
24 Ditch @ 12UVK744942

Figure 14: Proposed Cultural and Temporal Model for Forty Mile Coulee.

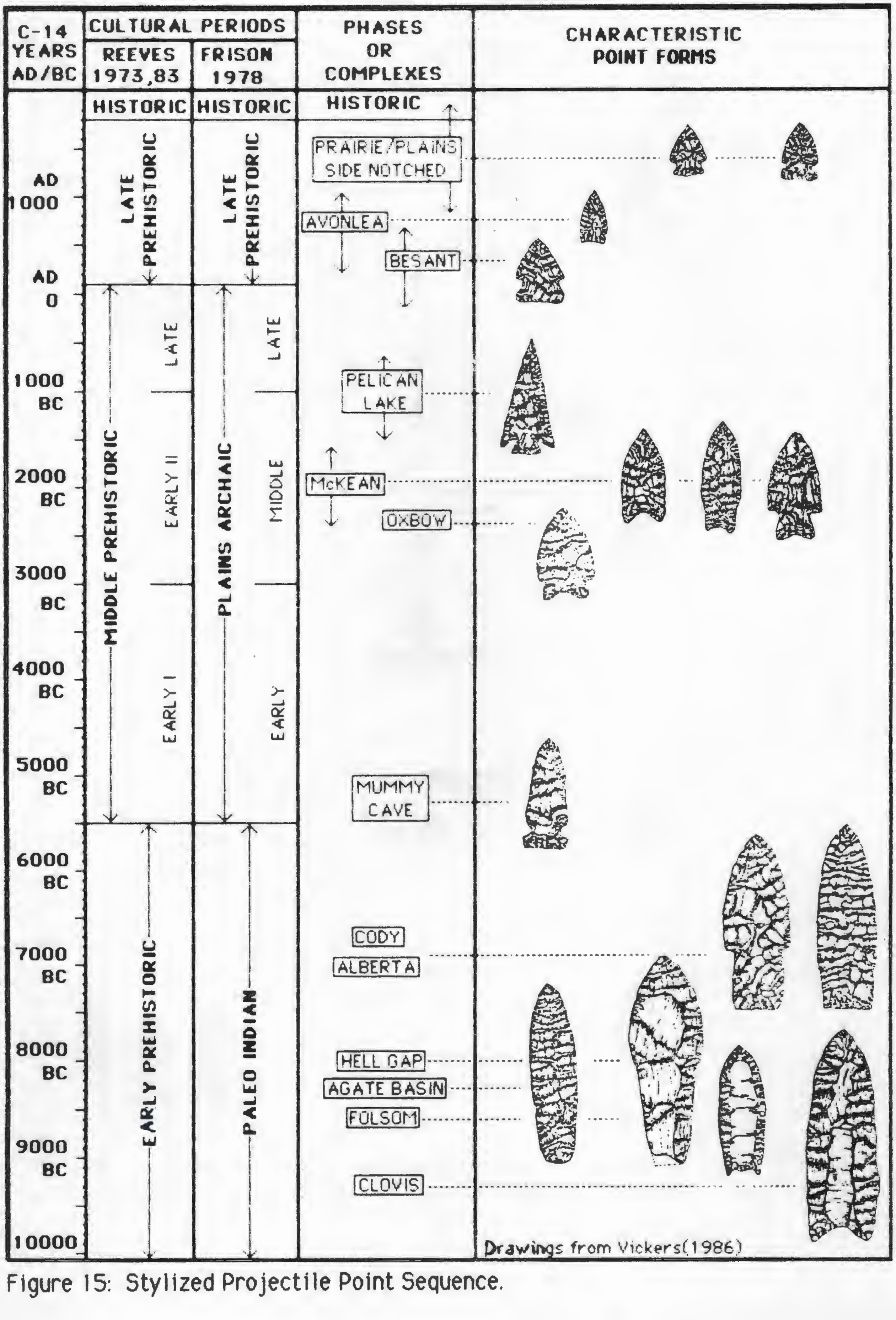


Figure 15: Stylized Projectile Point Sequence.

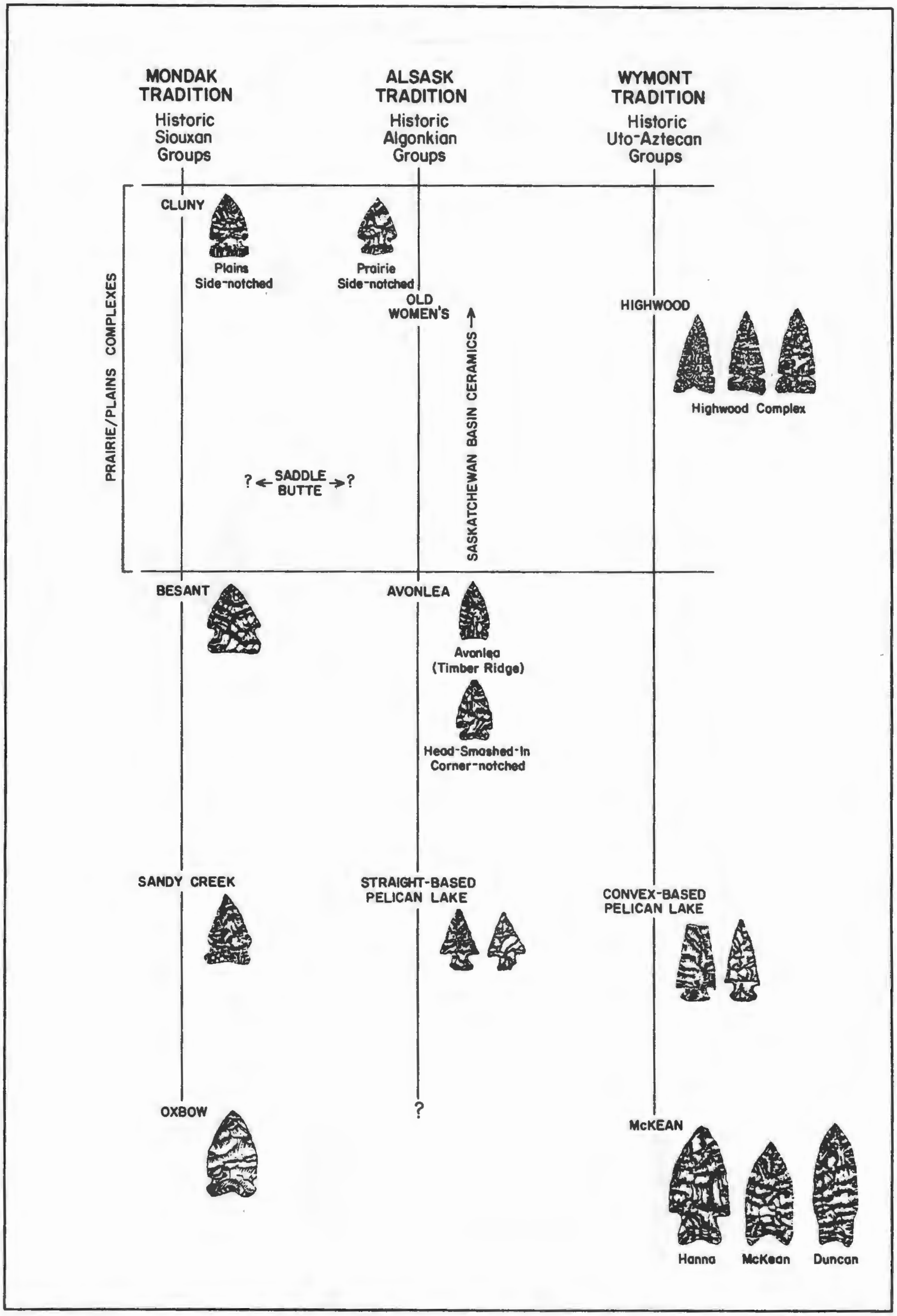


Figure 16: Conceptual Model of Proposed Cultural Relationships.

proposed here, is presented for reference at the beginning rather than the end of the discussion. An attempt has been made to minimize the introduction of new terms and to adopt and utilize existing terminology as much as possible. In referring to the three very broad based cultural traditions proposed here, the names Mondak, Alsask and Wymont are proposed.

The term complex, as used here, refers to "a recurrent configuration of elements or entities within a larger system" (Clarke 1978:489). A phase is an "archaeological unit possessing traits sufficiently characteristic to distinguish it from all other traits similarly conceived, whether of the same or other complexes" (Willey and Phillips 1958:72). Each cultural phase or complex, as they have been defined by various researchers, is identifiable largely on the basis of one or more distinctive projectile point and/or ceramic styles or types`. As the term is used here, complexes need not be mutually exclusive. For instance, the presence of Avonlea type projectile points is used as a primary basis for referring a site/occupation to the Avonlea complex, while Prairie/Plains projectile point varieties as defined by Forbis (1962) and Kehoe (1966) are used in identifying the Prairie/Plains complex. The Saskatchewan Basin ceramic complex as defined by Byrne (1973) is found associated with both Avonlea and Prairie/Plains complex projectile points at many sites in southern Alberta. The association of Prairie/Plains point forms with Saskatchewan Basin Complex ceramics is used as the basis for defining what is referred to here as the Old Women's Complex. Although Reeves (1969, 1983), and subsequently Brumley (1983a,b), have proposed a number of phase and subphase terms encompassing southeastern Alberta and the Forty Mile project area, the following statements reflect a re-assessment and re-evaluation of the data. The term complex is used here in preference to phase or subphase on the premise that the data base is still largely too inadequate to define phases in the manner intended by Willey and Phillips (1958).

5.2 Early Prehistoric or Paleo Indian Period

The Early Prehistoric or Paleo Indian Period dates from ca. 11,500 to

7,500 years B.P. (Figure 13). This period contains a number of archaeological units characterized by projectiles or projectile point systems presumably designed for hafting on a heavy spear. Commonly recognized Paleo Indian or Early Prehistoric complexes in the northern Plains include Clovis, Folsom, Agate Basin, Hell Gap, Alberta, and Cody. Point types of this period are commonly variations on lanceolate preforms. Early Prehistoric or Paleo Indian peoples were apparently big game hunters with the earliest defined group - Clovis - hunting several now extinct animal species, including mammoth. Later groups relied largely on early forms of bison as their primary food source.

Within southeastern Alberta, evidence of Early Prehistoric Period peoples is limited to a few widely scattered surface finds. Gryba (1985) has documented a total of 60 fluted points typologically referrable to Clovis and Folsom from locations throughout central and southern Alberta. The only fluted specimen from the general Forty Mile project area consists of the midsection of a Folsom found in a deflation area atop a prominent hill, 35 km northeast of the Forty Mile project area. There are currently no radiocarbon dates for fluted point materials in Alberta. However, reference to fluted point sites elsewhere suggest a general time span of 11,000 to 11,500 years B.P. for Clovis and 10,000 to 11,000 years B.P. for Folsom (Gryba 1985:33).

Bryan (1980) reports on a stemmed, Hell Gap like projectile point in apparent association with a bison bone bed at the Lindoe site, approximately 95 km northeast of the project area along the South Saskatchewan River valley. Two radiocarbon dates from the site yielded an average central age of 9805 radiocarbon years B.P. (Brumley and Rushworth 1983:152).

Clearly, the largest and most significant Paleo Indian site presently known for southern Alberta is the Fletcher site (DjOw-1). This site is located approximately 40 km west northwest of the Forty Mile project area on the open prairie surface near Chin Coulee, a glacial outwash channel similar in form and origin to Forty Mile Coulee. The Fletcher site consists of two extensive closely spaced bison bone units exposed in the sides of an excavated water dugout. The local water table is high and it has been suggested the area may have been an open, free flowing, spring at the time of occupation. Limited excavations have been carried out at the site and reported by Forbis (1968) and Quigg (1976). Cultural materials recovered from excavation and from the dugout spoil pile consist primarily of projectile points referrable to Alberta and Scottsbluff types. A series of radiocarbon dates run on Fletcher site bone were deemed useless due to groundwater contamination. The site represents an extensive kill location, presumably communal in nature. Its exposed open setting and general location suggested to Forbis (1968) that the site was utilized during warm periods of the year.

Examination of several private collections from southeastern Alberta by the authors, indicates the presence of other Early Prehistoric projectile point forms including Agate Basin and Hell Gap like forms. Regional evidence gathered to date regarding Early Prehistoric period cultural material is interpreted as indicating regional occupation from at least Clovis times onward. The general paucity of Early Prehistoric period cultural materials in contrast to the subsequent Middle and Late Prehistoric periods may reflect a lower population base during the Early Prehistoric. However, this limited Early Prehistoric record probably reflects aspects of archaeological site visibility only recently perceived by researchers. The largest and richest sites known in the region are predominantly situated along the bottom or wall surfaces of major river, stream and coulee valleys. Early Prehistoric period materials within these areas would normally be deeply buried and difficult to find.

No Early Prehistoric Period materials have been recovered within the Forty Mile Coulee project area. As previously noted, Wilson (1983) calculates a deposition rate of 0.1 cm per year within the bottom of Forty Mile Coulee for the last 3,000 years. He further suggests that the deposition rate would have been more rapid during the early Holocene. Based even on the 0.1 cm per year average deposition rate, deposits dating to the Early Prehistoric Period would be situated at from 7.5 to 12 m below surface. In contrast, deposition on the prairie margin bordering Forty Mile Coulee is minimal. There, research indicates the presence of from ca. 0 to 40 cm of deposits laid down atop glacially derived deposits. The absence of recovered Early Prehistoric material in these prairie margin areas is suggested to be attributable to: the more limited amount of archaeological work conducted in those locales; the paucity of diagnostic cultural material generally in all locales; and a probable overall lower population density within the region during Paleo Indian times. The nature, nearby presence, and similar setting of the Fletcher site indicates the potential for Early Prehistoric materials within the areas of the Forty Mile project.

5.3 Middle Prehistoric or Plains Archaic Period

The Middle Prehistoric or Plains Archaic period generally dates from ca. 7500 B.P. to ca. 1900 - 1400 B.P. This period is characterized by a variety of projectile point forms presumably designed for use with the spear thrower or atlatl. Major complexes of interest here include Mummy Cave, Oxbow, McKean, Pelican Lake and Besant. Certain Middle Prehistoric period groups further south in southern Montana and Wyoming are known to have developed a diversified subsistence economy based on hunting a broader spectrum of animal species, as well as gathering and processing wild plant foods. However, available evidence from Alberta suggests Middle Prehistoric peoples still focussed almost exclusively on bison hunting as a subsistence base. Pottery first appears in some Besant phase sites, within and outside Alberta, during the latter part of this period.

Several major Middle Prehistoric period sites are known and have been investigated within southeastern Alberta. The Stampede site (DjOn-26) located approximately 80 km east of the project area in a low lying, heavily wooded and sheltered locale along the northern margin of the Cypress Hills, provides the earliest Middle Prehistoric period evidence. Limited excavation at the site reported by Gryba (1975; 1976) indicates the presence of a series of no less than 14 buried camp layers, spanning 3.85 m of deposits, and dating to the Middle and Late Prehistoric periods. Layer 12A at the site yielded a radiocarbon date of 7245 $\pm$ 2550 years B.P. in association with Bitterroot side notched points diagnostic of what Reeves (1969) refers to as the Mummy Cave complex. Other later Middle Prehistoric period components at the site include Oxbow, Pelican Lake and Besant.

Projectile points characteristic of the Oxbow complex are common in collections throughout southeastern Alberta. However, significant excavated Oxbow components in the area are limited to cultural layers 7 and 8 at the Stampede site (Gryba 1975; 1976) and materials from the Southridge site

(EaOq-17; Brumley 1981a). The Southridge site is situated in the City of Medicine Hat on an open featureless prairie surface, in the vicinity of the Seven Persons Creek and South Saskatchewan River valleys. The approximately 8,000 pieces of cultural material recovered from an excavated area of 142 m^2 have been interpreted as representing a camp locale occupied by two household units for a period of several days. Two radiocarbon dates from the Oxbow occupation provide an average age of 4210 years B.P. The site location and recovered faunal remains were used as the basis for inferring occupation during a warm period of year and the employment of individual or small group hunting techniques. Another site containing a limited Oxbow occupation is Ross Glen (DlOp-2), also located within the City of Medicine Hat. At DlOp-2, Quigg (1982) identified a single stone circle referrable to Oxbow on the basis of an Oxbow point and a radiocarbon date of 4260 $\pm$ 140 B.P. Although the portable wood framed, skin covered tipi was probably an integral part of aboriginal man's adaptation to the open Plains, this Oxbow complex stone circle at Ross Glen provides the first architectural evidence we have for the tipi in the region.

Another major Middle Prehistoric period site in the region is Cactus Flower (EbOp-16), located approximately 85 km north of the project area along the banks of the South Saskatchewan River (Brumley 1975). Ten cultural occupations, designated from most recent (I) to earliest (X), were defined at the site within 6 m of deposits. Occupations I and II are referred to the Pelican Lake complex while Occupations II - VIII are all referrable to the McKean complex. Occupation X yielded no diagnostic cultural materials but is probably McKean as well. A series of radiocarbon dates from Cactus Flower suggest McKean complex occupations from approximately 3500 to 4200 radiocarbon years B.P. Faunal remains suggest that individual or small group hunting of bison in the near site vicinity was the primary subsistence activity. Hunting of antelope in areas away from the site appears to have been a secondary subsistence activity. Seasonally sensitive faunal elements indicate an early spring through fall use of the site.

Architectural evidence for the presence of the tipi or a tipi-like structure was also noted within McKean complex occupations at Cactus Flower. In Occupation VI, a well defined arc of stone clearly representing a stone circle with a hearth in the center was exposed with a part of the stone circle extending outside the limits of excavation. In Occupation VIII, a clearly defined circular concentration of cultural debris appears to reflect the outer margins of a lodge. The main McKean occupation at Cactus Flower (VIII) overlaps and brackets the Oxbow occupations at the Southridge and Ross Glen sites. The diagnostic Oxbow and McKean complex projectile points characterizing these sites are mutually exclusive, providing strong evidence of two distinct cultural groups being represented and in the region at essentially the same time.

Two large, prominent, medicine wheels from the region, Majorville (EdPc-1; Calder 1977) and British Block (EdOp-1; Wormington and Forbis 1965; Finnigan 1982), appear to have been initially constructed and used during Oxbow and McKean complex times. A large tipi ring site laid out in a camp circle arrangement associated with the British Block Medicine Wheel appears to date to McKean times. These two sites provide the best evidence for suggesting that by Oxbow times, aboriginal groups in the area were operating at a level of social order and complexity closely equivalent to historic aboriginal Plains groups (Brumley 1985a).

The Laidlaw site, DlOu-7 consists of a unique antelope pit trap situated along the wall of the South Saskatchewan River valley 30 km due north of the Forty Mile project area (Brumley 1984; 1986). Although no diagnostic materials were recovered in test excavation conducted at the site, a radiocarbon date on bone from the trap yielded a radiocarbon date of 3280 $\pm$ 110 years B.P. This date suggests a Middle Prehistoric age for the structure. It is possibly associated with terminal McKean or Oxbow complex groups, or with initial Pelican Lake complex groups in the area (Figure 13). In the immediate vicinity of the pit trap structure at Laidlaw is a collapsed low walled feature and an extremely large stone circle. The pit trap and associated structures, assumed associated with the pit trap, exhibit close similarities to ethnographic features, again providing early evidence regarding levels of social complexity and organization comparable to the Historic Period.

The Late Middle Prehistoric Period in southeastern Alberta is characterized by two cultural complexes, generally referred to as Pelican Lake and Besant. The authors interpret the available evidence from the region to indicate that what is generally referred to as Pelican Lake developed, at least in part, out of the McKean complex; while Besant developed out of the Oxbow complex (Figure 16). Another cultural complex known as Sandy Creek has been identified and defined from Saskatchewan which appears to reflect a temporally and typologically intermediate complex related to both Oxbow and Besant (Dyck 1983). Excavated components referrable to Sandy Creek have not yet been identified in southeastern Alberta.

Projectile points referrable to the Pelican Lake and Besant complexes are common in local collections. However, excavated and dated occupations are, as yet, rare. Gryba (1975; 1976) identified both a Pelican Lake and a Besant component at the Stampede site in the Cypress Hills. Previous note has been made of the Pelican Lake occupations at Cactus Flower (Brumley 1975). Relatively extensive collections referrable to Pelican Lake and Besant have been recovered in a number of localities within and adjacent to the Cypress Hills, but in mixed or poorly defined stratigraphic contexts (Brumley et al. 1981; Brumley and Dau 1985). Although Pelican Lake points generally are of a size which indicates their use as atlatl darts, a number of specimens are known from Alberta and Saskatchewan contexts where overall size and configuration strongly suggests their use on arrows used with a bow. Dyck (1983:107) is probably right when he suggests, "...one wonders if the bow and arrow wasn't already part of their weaponry - only not so important as in later times."

The Pelican Lake points recovered from the Cactus Flower site fit into this small size range, suggesting use with the bow. Reeves (personal communication in Vickers 1986:74) suggests these small Pelican Lake points have a large neck thickness which precludes their use on the small diameter shaft of an arrow. The neck thickness of the small Pelican Lake points from Cactus Flower (Brumley 1975) and of specimens from sites in the Cypress Hills (Brumley et al. 1981) personally examined by the writers, are as thin as arrowpoints from Late Prehistoric complexes. Dyck (1983:105) notes two basic varieties of Pelican Lake complex projectile points in Saskatchewan. One is characterized by "straight sides, a straight base and corner notches which usually leave sharp tangs on the shoulders." The second variety have wider convex bases with narrower notches. Dyck indicates that in Saskatchewan, the first variety appears earliest, with the second variety occurring about midway through the temporal span of the Pelican Lake complex. From that point on, "the convex-based variety coexists with the straight-based variety from the middle to the end of the Pelican Lake sequences." (Dyck 1983:105).

Dyck's typological splitting of Pelican Lake points into two varieties is consistent with the authors' observation of materials in collections from southern Alberta and northern Montana. However, some distributional and lithic utilization patterns observed by the authors' regarding these two varieties in southeastern Alberta warrant mention and discussion. Dyck's earlier variety of Pelican Lake, which will be referred to here as straight-based Pelican Lake, characterizes Occupation II at Cactus Flower. Dyck's later variety which will be referred to as convex-based Pelican Lake, characterizes the Pelican Lake occupation at EbOp-44.

Straight-based Pelican Lake appears to occur most commonly in collections throughout southeast and southcentral Alberta. The variety is present but rare in northern Montana and essentially absent in central Montana. Convex-based Pelican Lake dominates in northern and central Montana, and in the foothills and mountains of southwestern Alberta. A high percentage of convex-based Pelican Lake points from southern Alberta are made on lithics derived from quarry sources in central, southern and western Montana; in particular porcellanite, Avon chert and Madison Formation cherts. In contrast, straight based Pelican Lake points from southern Alberta appear to be more often made on locally derived lithics. When a non-local lithic is present with straight-based Pelican Lake, it is usually Knife River flint. Early dates for arrowpoint sized Pelican Lake points seem to be associated largely with the straight-based variety. Reeves (1983) defines a Head-Smashed-In corner notched arrowpoint type associated with early Avonlea components and which he interprets as reflecting initial introduction of the bow and arrow. He also uses this point style as evidence of continuity to his earlier Pelican Lake phase. We would differ and perceive Head-Smashed-In corner notched as probably being related to earlier arrowpoint sized specimens associated with what is refered to here specifically as straight-based Pelican Lake. Convex-base Pelican Lake with its stylistic, distributional, and lithic material utilization pattern differences is seen as culturally distinct.

It may be that the observed temporal differences in the straight-based and convex-based Pelican Lake points indicate that the two varieties simply reflect stylistic differences over time within closely related cultural groups. However, differences noted in the presence of apparent arrowpoints associated with straight-based Pelican Lake, along with the major differences observed in lithic utilization and distributional patterns between the two varieties, suggests we may be dealing with significant cultural differences in what is generally termed Pelican Lake. We, in part, follow Reeves (1969) in suggesting that convex-based Pelican Lake materials are derived from earlier McKean complex peoples. However, we suggest that straight-based Pelican Lake materials be considered as a separate entity with, as yet, unknown origins. The terms straight-based and convex-based Pelican Lake are used here more as convenient labels rather than as literal typological descriptions. Further research needs to be directed at examining these two concepts of Pelican Lake before typological ranges can be adequately defined.

An important record of Besant occupation in southeastern Alberta comes from two contiguous sites, EbOp-42 and 44, with are located on the valley wall of the South Saskatchewan River, 90 km northeast of Forty Mile. Although materials from EbOp-42 and 44 have not yet been fully analyzed and reported, it appears the sites reflect an extensive processing area, with an associated bison kill which has to date not been located, but must have been situated in the immediate vicinity. At EbOp-44 the extensive Besant component is overlain by a limited Late Prehistoric Prairie/Plains component, and is underlain by a series of occupations containing much more limited amounts of cultural material. Only one in this series of occupations has yielded culturally diagnostic material, a convex-based Pelican Lake projectile point. The Besant occupation at EbOp-44 (along with the underlying convex-based Pelican Lake and several undefined occupations) contains the remains of bison calves characterized by periosteal layering which indicates a late winter/early spring occupation.

Another major Besant complex site already mentioned in regards to the Oxbow complex is Ross Glen (DlOp-2; Quigg 1982). Ross Glen consists of 18 stone circles which are located on the prairie surface bordering the valley of Bullshead Creek in the City of Medicine Hat. Fifteen stone circles at the site are referrable to Besant and contain large quantities of occupational debris. Quigg uses this debris to infer that the site was probably utilized as a processing area for bison meat obtained at an unidentified, but apparently nearby, bison kill. The stone circles at Ross Glen are the largest sample of such structures in the region which are definitely referrable to the Besant complex. These Besant rings are considerably larger than the majority of stone circles in southeastern Alberta, with mean inside diameters between 7.6 and 8.0 m. It has been noted (Brumley 1983:178) that this larger size may provide a valuable aid in identifying Besant complex stone circles. Independant confirmation of the large size of Besant Complex stone circles was made by Finnigan and Johnson (1984) at the Elma Thompson Site in Saskatchewan. As well, it suggests a significant difference in the size and social structure of groups during Besant times.

Neuman (1975), working on a series of burial mounds along the Missouri River in North and South Dakota, defined a mortuary complex which he refers to as Sonota. Reeves (1983) views Sonota as a regional subphase of Besant. Syms (1977) however, extends the term Sonota, as defined by Neuman, to encompass a number of non mortuary occupations characterized by Besant points in areas well outside the Dakotas. However, other sites situated well outside the Dakotas, also characterized by Besant points and also non-mortuary in nature, he refers to as Besant. The only consistent linkage that can be perceived in Syms' use of the terms Sonota and Besant is a high-use frequency of Knife River Flint in his Sonota components, versus assemblages characterized by low frequency of Knife River Flint. The authors' use of the term Besant complex here refers to all assemblages characterized by Besant style atlatl points, regardless of lithic utilization patterns. The term Sonota, is reserved for use in reference to the mortuary complex as defined by Neuman (1975). The writers acknowledge the obviously significant differences observable in lithic utilization patterns between different Besant site samples, and in particular, in utilization of Knife River Flint. These differences are interpreted as probably reflecting a number of cultural groups analogous to historic Plains band and/or tribal units contained within a broader cultural complex - Besant. As such, the different lithic utilization patterns observed probably reflect differential access - either directly or through trade within these various groups to the Knife River quarries. Ceramics occur with regularity in Besant occupations in the Dakotas and increasingly less frequently in Besant occupations to the north and west. A small quantity of nondescript sherds at the Ross Glen site (Quigg 1982) is the only ceramic association with Besant in the area of southeastern Alberta.

The earliest diagnostic cultural material recovered during the course of the Forty Mile coulee project dates to the Middle Prehistoric Period and is apparently referrable to the straight-based Pelican Lake and Besant complexes. DjOu-58 consists of the isolated find of a projectile point from a plowed field in the coulee bottom which is typologically referrable to straight-based Pelican Lake. Site DjOu-5 consists of a well defined buried camp occupation located on a slump block surface along the south coulee wall at a depth of 140-170 cm BS. Other very limited amounts of definite or possible cultural material were present stratigraphically above and below this occupation. Two diagnostic projectile points were found associated within the occupation. One is apparently referrable to the straight-based Pelican Lake complex, while the other is a Besant point. The straight-based Pelican Lake point is heavily patinated on both surfaces, except along the body edges where the patinated surface has been removed by limited reworking. It would thus appear that the occupation at DjOu-5 is referrable to the Besant complex, with the recovered Pelican Lake point representing an older specimen recovered and reworked by the site's Besant peoples. The radiocarbon date from the site is consistent with this interpretation (Figure 14).

5.4 Late Prehistoric Period

The Late Prehistoric Period, beginning at about A.D. 200 to A.D. 500 is characterized by projectile point types clearly intended for use with the bow and arrow. Although apparent arrowpoints have been noted in relation to the straight-based Pelican Lake and Besant complexes of the Middle Prehistoric, it is during the Late Prehistoric that the bow and arrow became the dominant weapon with apparent atlatl points totally absent or occurring very rarely in assemblages. The transition between the Late Prehistoric and the end of the Middle Prehistoric is apparently not a straight line point in time as modeled in Figure 13, but a several hundred year interface with complexes characterized by atlatl points persisting for some time along with complexes characterized by arrowpoints. In particular, the atlatl dominated Besant complex is in large part coeval with the bow and arrow dominant Avonlea complex (Figure 13). During the terminal end of both Besant and what is here referred to as convex-based Pelican Lake arrowpoints appear which Reeves (1983) terms respectively, Samantha and Head-Smashed-In corner notched. By about A.D. 600 - 800, all cultural complexes in the northern Plains are clearly dominated by projectile points apparently used with the bow and arrow. One might wonder why an innovation such as the bow and arrow, which figures so prominently in the Late Prehistoric, was around for 1500 years at least in straight-based Pelican Lake groups before it "takes off" and replaces the atlatl. One possibility is that the bow used by straight-based Pelican Lake groups was technologically inferior, and as such its role may have been as a novelty, a toy or a weapon generally limited to use in hunting light game. Following this scenario, during late straight-based Pelican Lake times, whatever technological or social limitations were present are overcome and the bow and arrow becomes an effective, all purpose weapon for hunting and defense.

During the Late Prehistoric bison hunting remains the primary subsistence activity. Communal bison kills, which involved driving animals over cliffs, into corrals, or into natural traps, are present throughout the entire prehistoric record. However, they appear to reach a peak in number and magnitude during the Late Prehistoric. Pottery, which first appears in some Besant complex sites late in the Middle Prehistoric, is abundant in many complexes during the Late Prehistoric. However, at several extensively examined Late Prehistoric habitation sites, ceramics are also absent. This suggests there were also a number of cultural groups during the Late Prehistoric who did not adopt the technology of ceramic manufacture and use, although they were undoubtedly aware of it through contacts with ceramic using neighboring groups.

Archaeologists generally segregate Late Prehistoric cultural assemblages into phases or complexes, again on the basis of diagnostic projectile point forms as well as recognized ceramic complexes. The archaeological record of Late Prehistoric peoples in the Northern Plains is both rich and complex. Unfortunately, with a few notable exceptions, archaeologists have not as yet effectively organized or segregated this body of data. Herein the authors propose a number of cultural complexes which are in large part derived from earlier models, but are as well often modified in significant respects. The focus here is on the Forty Mile Coulee area and the southeastern Alberta cultural sequence, with relevant supplementary data drawn from areas of Alberta, Saskatchewan, Montana and the Dakotas.

Initial typological work on Late Prehistoric Period cultural history and projectile point typology in the region was initiated by Forbis (1960; 1962), with his work throughout southern Alberta and particularly at the Old Women's Buffalo Jump. Kehoe (1966) borrows and builds on Forbis' scheme in proposing a small side-notched point system consisting of three defined point types, each with a number of varieties. The three types proposed by Kehoe are Avonlea, Prairie-Side Notched, and Plains-Side Notched. Although Kehoe and Forbis demonstrate the potential cultural and temporal significance of the various point varieties within these types, few other researchers have employed their system. Thus, in order to utilize the level of description that is available in the archaeological literature, only two projectile point complexes will be referred to here for the Late Prehistoric. These are Avonlea and a combined Prairie/Plains Side-Notched. It should be further noted that Forbis and Kehoe's systems were developed in reference to projectile point samples from sites in the Plains of southern Alberta, Saskatchewan and northern Montana. Subsequent research in areas of southern Montana and Wyoming has indicated the presence of additional Late Prehistoric arrowpoint forms not encompassed by the Small Side-Notched point system as it was originally defined. However, these materials are largely outside the area of concern for this discussion and will only be generally referred to here. The term Prairie/Plains complex is also used here in reference to aboriginal cultural materials post dating the known temporal range of Avonlea, but in which no diagnostic points are present. Several examples are present at Forty Mile in the form of stone circles containing historic materials or radiometrically dated but not containing projectile points.

Avonlea points, which characterize the Avonlea complex, are generally very well made, slender arrowpoints having notches which are relatively broad in comparison to their depth, and with straight to moderately concave bases. One of the most distinctive aspects of Avonlea points is their very thin cross-section and fine, well controlled and well patterned flaking. Evidence of Avonlea first appears in the northern Plains at about A.D. 200 and persists until about A.D. 800 to A.D. 1000. Distributionally, Avonlea complex sites are found throughout the Parkland, Plains, Foothills and Mountain front of Alberta (Vickers 1986:92). Dyck (1983:123) indicates Avonlea sites are found throughout southern Saskatchewan. In Montana, Avonlea is concentrated in the northern part of the state, with data from northeastern Montana suggesting a sharply defined, almost boundary-like eastern limit to the distribution of significant amounts of Avonlea complex material. In the vicinity of Malta, Montana along the lower reaches of the Milk River drainage, several major Avonlea kill and camp complexes have been identified (see Ruebelman 1983; Hoy 1973). However, in a survey of archaeological materials from over 60 sites in an extensive area of northeastern Montana beginning, approximately 100 km east of Malta, Joyes and Jerde (1970) note that only one Avonlea point was found at one of the 60 examined site collections. These collections contained materials beginning typologically with Folsom and ending with iron points. In comparison, other Late Prehistoric (Prairie/Plains Side-Notched) arrowpoint forms were present at 21 of the 60 sites, and Middle Prehistoric Pelican Lake and Besant materials were recovered from 33 and 11 of the 60 sites respectively.

Another significant site from the Malta area is the Simanton site which is located in the valley of the Milk River. The site consists of two primary burials along with an isolated human skull which shows evidence of weathering. The two primary burials both appear to be of males, approximately 35 and 45 years of age. The crania of one of the individuals exhibits a massive trauma, possibly caused by a heavy blow which may have been the cause of death. Both crania exhibit green bone cut marks on the upper parietal area of one side which can be reasonably argued as evidence for scalping. Associated grave goods were limited, but included three projectile points. Two of these points were broken Prairie/Plains specimens, and one was a complete Avonlea specimen (G. Ruebelman personal communication 1987).

Further west, Avonlea materials are common along the entire Milk River drainage (see Davis 1966; Stallcop and English 1969; Reeves 1983). Avonlea complex material is prominently present as far south as the Missouri, with Davis and Aaberg (Davis 1976; Davis and Aaberg 1978) reporting on a major Avonlea camp and antelope processing area at Lost Terrace (24CH68) on the banks of the Missouri. Shumate (1950) reports on several kill sites along the Sun River north of the Missouri in the general vicinity of Great Falls which contain Avonlea points. South of the Missouri, the presence and distribution of Avonlea materials is much more limited and sporadic. Based on work in extreme southern Montana and northern Wyoming, Fredlund (1984) defined what she terms the Benson's Butte-Beehive complex containing Avonlea, Avonlea-like and a number of other arrowpoint forms. Dates from the Benson's Butte-Beehive complex sites range from A.D. 400 - 1000. Aside from projectile point types, Fredlund notes a number of differences which set the Benson's Butte-Beehive complex sites apart from Avonlea sites further north. One of these consist of relatively hidden or fortifiable site locations. Fredlund (1984) concludes by stating, "If Avonlea is assumed to have traits cultural and material...then the Benson's Butte-Beehive complex is not Avonlea but only participating in the projectile point technology." In his formulation of the Avonlea phase, Reeves (1983) suggests an Avonlea association for a number of sites in northern Wyoming. The writers do not generally consider those Wyoming sites to be Avonlea but instead to suggest a possible Benson's Butte-Beehive complex association. One further note needs mentioning concerning Avonlea site density and distribution. In independent reviews of Alberta and Saskatchewan Plains archaeology, Vickers (1986) and Dyck (1983) both note that the number of known Avonlea complex sites is lower than for sites relating to many other complexes. However, the writers are sure most Plains archaeologists familiar with Avonlea complex sites would agree that even though Vickers and Dyck may be right, those Avonlea that are known are commonly large and extensive presumably reflecting communal kill and camping events by cultural groups as large or larger than those of other Middle and Late Prehistoric cultural groups. Avonlea lithic assemblages with which the authors are familiar, strongly indicate primary utilization of locally available lithics. Evidence of use of such lithics as Madison Formation cherts, Knife River flint, obsidian or porcellanite is generally rare in Avonlea assemblages. As with earlier straight-based Pelican Lake, when non-local lithics are present they are most commonly Knife River Flint.

Within southeastern Alberta, significant information regarding Avonlea is available from five sites (Figures 13 and 14), one of which was examined in the course of the Forty Mile project. The Ramillies site (EcOr-35) is the best known Avonlea site in the area (Brumley 1976). Ramillies consists of a communal bison kill-camp complex, situated along the edge and within a large coulee originally formed as a glacial outwash channel. The site is located on the open prairie 18 km from the South Saskatchewan River valley and 85 km north of the Forty Mile project area. The kill consists of a depression estimated to originally have been 7-8.5 m long by 3.5-4.5 m wide, situated on the immediate lip or edge of the prairie overlooking the coulee to the north. On the prairie surface are two stone alignments or drive lines leading to the depression. Excavation indicated that the depression started out as a small, natural glacial ice recessional feature which was modified and expanded on by aboriginal peoples. The most significant modification appears to be the construction of an earth and stone wall to enclose the north side of the depression. This constructed wall was approximately 2 m high. Only limited amounts of bone and cultural material were found within the depression during excavation. However, on the slope of the coulee wall immediately below the depression, an extensive midden of bison bone is present and was found to contain numerous projectile points. This bone midden is interpreted as reflecting repeated use and cleaning of the pit trap. Further downslope on the floor of the coulee, excavation identified an associated camp and processing area. Stratigraphy within the various areas of the site is poorly developed. However, it is clear that the earliest use is by Avonlea complex peoples, followed by early groups characteristic of the yet to be defined and discussed Old Women's complex.

EcOs-41 is also located in open prairie along a major glacial outwash coulee on the Suffield Military Reserve approximately 20 km east of Ramillies and 80 km north of the Forty Mile project area (Brumley et al.

1981). The limited excavations conducted at EcOs-41 indicate it consists of an extensive processing area that contains large quantities of bison bone, and presumably is associated with an as yet unlocated communal kill. One of the two radiocarbon dates from the site (Brumley and Rushworth 1983) is considered too late and is rejected. The second date is tentatively accepted but is also late in comparison to other Avonlea dates for the area (Figure 13) and must be viewed critically.

The Larson site (DlOn-3) and Irvine Kill (DlOn-2) are an integrated campsite/bison kill complex located in the rough, heavily wooded valley of Ross Creek, 82 km northeast of the Forty Mile area. Recent, and as yet, unpublished work at the Larson site by Milne (personal communication) indicates it contains a rich series of closely spaced Avonlea camp occupations. Recovered foetal bison remains indicate a mid to late winter occupation.

EcOm-15 consists of an extensive tipi ring campsite located 160 km northeast of the Forty Mile project area near the junction of the Red Deer and South Saskatchewan Rivers (Reeves 1977). Although extensive amounts of Avonlea materials were recovered in mitigation excavation at the site, these materials have not been thoroughly analyzed or reported upon. Two radiocarbon dates for the Avonlea complex occupations at the site are available (Figure 13).

Within the Forty Mile Coulee project area, a well defined buried Avonlea occupation was identified at DjOu-81. The site is located on the south side of the coulee bottom with cultural materials exposed in a cutbank covering an area at least 150 m long (N-S) at a depth of from 15 to 25 cm below surface. Foetal to newborn bison bone from the site suggest an early to mid spring site occupation. Although bison bone was abundant, it was not present in sufficient quantities to suggest the presence of a nearby communal kill. A radiocarbon date for the site (Figure 14, Table 5) places DjOu-81 near the mid range of Avonlea in the region.

Ceramics are frequently found associated with Avonlea complex assemblages in Alberta and Saskatchewan. For Alberta, these ceramics fall into Byrne's Early Variant of the Saskatchewan Basin complex, which will be discussed later. Further south in Montana, ceramics have been reported for a few Avonlea sites (see Fraley and Johnson 1981). However, on the whole, ceramics are rare to totally absent. Presumably the model of differential ceramic utilization mentioned earlier in reference to the Late Prehistoric Period as a whole, applies to regional variants of the Avonlea complex. This differential ceramic utilization pattern within Avonlea provides valuable insights into the nature of the cultural assemblages grouped together here under the umbrella of "Avonlea Complex", as generally defined on the presence of the Avonlea projectile point type. Within southeastern Alberta Avonlea associated ceramics were recovered at Ramillies, EcOs-41 and at the Larson site.

Probably the most generally accepted theory for the origin of Avonlea is that proposed by Reeves (1970), which suggests the bow and arrow diffused onto the Plains to Pelican Lake peoples during the latter part of that phase. The bow was then presumably rapidly adopted and we then see a typological/phase transition takes place to Avonlea. With the reader keeping in mind the concept of straight-based Pelican Lake and convex-based Pelican Lake as previously discussed, we would like to point out some problems with this model and to suggest an alternate.

One problem we perceive in Reeves' Avonlea t Pelican Lake phase model, regards lithic utilization. Avon chert, Madison formation cherts, Fort Union formation porcellanite, and obsidian are utilized extensively in convex-based Pelican Lake complex sites within southern Alberta, southern Saskatchewan and northern Montana. However, during Avonlea there is essentially a total absence of similar lithics being utilized in the same areas. If we are looking at simply a technological change between Pelican Lake and Avonlea as suggested by Reeves, we would expect continuity in lithic utilization patterns. A second problem is that some sites in northern Wyoming within Reeves' Pelican Lake subphase areas such as Mummy Cave (Wedel et al. 1968) appear to show a typological transition from Pelican Lake atlatl point styles to stemmed and corner notched arrowpoints typologically dissimilar to either Avonlea or Head-Smashed-In Corner Notched. Reeves' model does not reconcile these major regional typological differences in his Pelican Lake to Avonlea bow and arrow transition.

The model proposed here is that the differences noted between convex-based and straight-based Pelican Lake reflect significant cultural differences. The arrowpoints noted with straight-based Pelican Lake suggest the presence of the bow and arrow as a secondary weapon system as early as 1500 B.C. Straight-based Pelican Lake, based on present data, is seen as having a core area of distribution in southcentral Saskatchewan, southeastern Alberta and adjacent areas of northern Montana. Phase transition is marked typologically by the development of the Avonlea point type along with the full cultural and technological integration of the bow and arrow into the subsistence economy. This transition apparently takes place about 0-200 A.D. Avonlea apparently then quickly expands from this core area further south and west, displacing convex-based Pelican Lake groups generally as far south as the Missouri and interacting at a secondary level even further south. Avonlea peoples were, in large part, contemporaneous with peoples of the Besant complex. The absence of Avonlea materials recorded from extreme northeastern Montana is interpreted as indicating that area was probably occupied by contemporary, non-Avonlea groups at the time. Probably these were Besant complex peoples and/or their descendents. Intriguingly, the Simanton Burial near Malta with its isolated skull and two primary burials, is complemented by the Overly Burial site (24SH615; Joyes et al. 1984) in extreme northeastern Montana which contained the remains of five individuals in a pit beneath a small cairn. The human skeletal material at Overly suggests four of the burials represent secondary interments. The one primary interment is apparently that of an older male whose skeleton is essentially complete except that the skull, mandible and bones of the arms are missing. As well, one of the secondary burials included a right femur with an arrow point fragment embedded in the head. Although temporally or culturally diagnostic material was not found associated with the Overly Burials, the available evidence tends to support and complement the evidence for intergroup warfare previously discussed for the Simanton site.

The evidence from the Simanton burial site near Malta and the defensive positioning of Fredlund's (1984) Benson's Butte Beehive complex sites suggest Avonlea expansion was not altogether peaceful. These examples also provide the first tangible evidence supporting the existence of inter-group warfare in the region, as was so characteristic of the Historic Period within the area. The Benson's Butte Beehive complex is interpreted as reflecting contemporaneous and neighboring non-Avonlea complex peoples. They, along with other sites such as Mummy Cave, may reflect the separate early adoption of the bow and arrow by groups related to earlier convex-based Pelican Lake peoples.

The presumed subsistence and defensive/offensive advantage provided by the bow and arrow may alone be sufficient to explain the successful territorial expansion by Avonlea peoples. However, the observation by Vickers (1986) and Dyck (1983) regarding the lower frequency of Avonlea sites than in preceding or succeeding time intervals can be used to support the notion of different social structuring by Avonlea peoples which may be reflected in their subsistence and settlement cycle. The vast majority of communal bison kill sites for all cultural episodes in the region are located along or in the near vicinity of major river and stream systems. The settlement model for the southeastern Alberta area (to be presented and discussed in a later section) proposes that open level to strongly rolling prairie areas well removed from major river valleys were utilized primarily during the spring and early summer by both man and bison, largely because of the availability of surface water at that time of year. Because of the generally widespread availability of water, bison populations were more widely dispersed than at any other time of year. Human populations were probably most dispersed at this time as well.

This settlement model is in general supported by the available archaeological evidence. However, two major exceptions are the previously discussed EcOs-41 and Ramillies, two large sites associated with Avonlea communal bison kills in open strongly rolling prairie areas well away from major river or stream systems. These sites suggest that Avonlea peoples did not disperse to the extent or as frequently as other cultural groups. As a result, Avonlea populations may have been as large as earlier and later cultural groups, but with different settlement systems, resulting in fewer overall numbers of sites but with those that are present being on average larger. This model appears to apply to Avonlea sites in other areas as well. For example, two well known Avonlea kill sites in northern Montana, Three Buttes and Timber Ridge (Davis 1966; Stallcop and English 1969) are located in areas well away from major river and stream valleys where water was probably only present on a seasonal basis. If the proposed expansion of Avonlea into the areas of northern Montana and southwestern Alberta occurred as postulated, the ability to maintain larger population aggregates would enhance Avonlea's defensive/offensive advantage.

This settlement model suggests, and at the same time supports, a further hypothesis concerning Avonlea. The significant subsistence, defensive and offensive advantages which an efficiently functioning bow and arrow system would have provided initial Avonlea peoples over their unrelated atlatl using neighbors would not have been overlooked. It seems reasonable to suggest that Avonlea peoples would have attempted to retain proprietary knowledge of the manufacturing and use technology associated with the bow and arrow from those neighboring groups as long as possible. The most effective means of doing this would seem to be through social regulation of bow and arrow technology and use. Based on an examination of the social structure of many historic Northern Plains Indian groups, one means of doing this would be through incorporating its use and power into native religion. The horse-medicine cult which developed during the Protohistoric/Historic Period among most native groups in the Northern Plains provides a possible analogue comparable to what is postulated here for the bow and arrow,

> The horse-medicine cult certainly appears to have been a native invention. Possibly it began to develop shortly after the acquisition of horses in response to the need for the services of veterinarians to care for these precious possessions. Their actions clothed in secrecy, blessed with supernatural sanctions, and embellished with elaborate ritual, their powers feared by their fellow tribesmen, these primitive horse doctors may have extended their activities to include the control of the actions of horses in the hunt, in war, and in horse races.... (Ewers 1955:284)

As well, such postulated regulation of the bow and arrow would likely involve its integration into the spiritual and shamanistic practices developed by all Northern Plains groups in relation to bison hunting, and in particular to communal bison hunting.

Most researchers working with Avonlea complex materials are particularly impressed with the extremely high quality workmanship displayed on the projectile points. This high level of workmanship is particularly evident in earlier Avonlea components and has been referred to as "classic" Avonlea, in contrast to later Avonlea assemblages characterized by poorer overall levels of workmanship, sometimes along with other Prairie/Plains point forms. These latter assemblages are sometimes referred to as "degenerate" Avonlea. The social and religious model proposed above for control of bow and arrow technology during early Avonlea times seems a likely environment in which to find the exhibited levels of projectile point workmanship which clearly seem to exceed functional needs and requirements. The higher levels of social control postulated here may have had additional positive spinoffs and be reflected in the aforementioned apparent differences in Avonlea settlement.

If such efforts by Avonlea peoples to restrict knowledge of bow and arrow technology from their Besant and convex-based Pelican Lake neighbors did occur as postulated, then it obviously only served to delay the diffusion of this system. Obviously, once anyone has seen a bow and arrow being used, the general concept is self evident. However, what is not self evident is the materials, manufacturing and use technology which go along with it. It is postulated that by secreting this technology as much as possible, Avonlea peoples significantly delayed its acquisition by unrelated neighboring groups and were thus able to expand territorially. By mid to late Avonlea times, these neighboring groups had acquired or had begun to acquire and utilize the bow and arrow technology. As bow and arrow technology became more widespread among these neighboring groups, the social and religious prohibitions and regulations regarding its use within Avonlea were seen as no longer justified or functional and thus began to break down. This break down, or disintegration, may be reflected in the overall lower quality of workmanship and variation in styles seen within later or "degenerate" Avonlea assemblages.

The second major projectile point complex recognized here for the Late Prehistoric is termed Prairie/Plains side-notched following Kehoe's (1966) small side-notched point system. Kehoe (1966) collectively recognized 14 varieties for his Prairie and Plains types. It should be emphasized that the Prairie/Plains projectile point complex, as used here, encompasses a broad range of stylistic and metric projectile point variation. Subsequent research is anticipated to meaningfully sort out this variability and to indicate it has regional, cultural and temporal significance. However, as noted, the presently rather poor description of these cultural materials generally available in the literature for the region make this crude Prairie/Plains complex category the only realistic way of dealing with that material at this time.

Traditionally, Prairie/Plains complex sites are seen as developing out of Avonlea. This transition is supported by data from several sites where Avonlea and Prairie/Plains point styles are found together, presumably representing an intermediate transitional stage. However, there is data from other sites where only Prairie/Plains varieties are present with radiocarbon dates contemporary with the midrange of Avonlea in adjacent or the same areas. One of the best sets of data demonstrating this is presented by Dyck (1983:110-111) where he presents a series of radiocarbon dates for Saskatchewan which indicate the contemporaneity of Avonlea materials first with Besant and then with his Prairie side-notched. What is proposed here is that there is not a single transitional sequence from Avonlea to Prairie/Plains side-notched projectile point varieties, but three transitional sequences to Prairie/Plains projectile point varieties. In an area apparently centered about southern Alberta, southern Saskatchewan and northern Montana there is a transition from the Avonlea complex to Prairie/Plains varieties. In an area centered about southcentral Saskatchewan, to northeastern Montana and the western Dakotas there is a transition from Besant to Prairie/Plains varieties. Finally, in an area centered about central and southern Montana there is a transition from convex-based Pelican Lake to Prairie/Plains varieties. It should be emphasized that the term "centered about" refers to the core areas where these events take place. There are few mutually exclusive or tightly defined historic or archaeological cultural distributional patterns in the Northern Plains and the situation here is no exception. It should be further noted that the Prairie/Plains components developing from the earlier convex-based Pelican Lake complex includes, at least in the early stages, are characterized by several corner notched and stemmed arrowpoint varieties not identified or encompassed in Kehoe's (1966) typology.

Again, the broad category of Prairie/Plains complex as used here does not infer cultural homogeneity. What it reflects is our present inability to adequately segregate these materials into culturally meaningfully units. There are, however, some cultural units which we can begin to sort out and subsume as separate complexes under the broader definition of Prairie/Plains complex. Discussion is restricted here to those complexes having relevance to southeastern Alberta in general and the Forty Mile Coulee area in particular.

As noted, ceramics are commonly associated with Avonlea materials in Alberta and Saskatchewan and less frequently in Avonlea sites in Montana. The most thorough study of these Avonlea associated ceramic materials is by Byrne (1973) who on the basis of surface and excavated collections from throughout Alberta, defines the Saskatchewan Basin ceramic complex. The early variant of this complex appears to date to about A.D. 500 (Byrne 1973:345) and is characterized by simple coconut shaped vessels, with plain fabric/net impressed surface finishes, unthickened flat or ridged lips, and decorative punctates on the rim surface. Byrne (1973:383-385) suggests a derivation of this early variant of Saskatchewan Basin complex ceramics from Avonlea ceramics occurring at sites in southcentral Saskatchewan. He goes on to suggest even more distant relationships for the Saskatchewan Basin complex to Laural pottery from Manitoba.

Byrne's late variant of the Saskatchewan Basin complex is similar to the early variant but includes a number of additional features of vessel and rim form, surface finish, and decorative techniques. The changes from Byrne's early to late variant had apparently taken place by AD 1150. The Late variant then persists until the Protohistoric/Early Historic Period. The late variant is associated with projectile point forms of the Prairie/Plains complex. As during Avonlea, late variant ceramics of the Saskatchewan Basin Complex demonstrate relationships to ceramic materials in Saskatchewan and Montana also associated with Prairie/Plains complex point forms.

The term Old Women's phase was coined by Reeves (1969) in reference to post Avonlea cultural materials within southern Alberta. However, at that time he did not present any defining criteria for the phase. Subsequent researchers have used the term Old Women's phase to refer to a broad range of diverse cultural materials characterized by Prairie/Plains point styles throughout southern Alberta, northern and central Montana. Reeves (1980 from Reeves 1983:19-21) later does provide some defining criteria for the

Old Women's phase, including the presence of ceramics. He suggests Old Women's developed as a result of the merging of his Avonlea and Besant phases, and represents the prehistoric ancestors of historic Blackfoot and Gros Ventre groups. Reeves does not directly specify the ceramic association with Old Women's; however it is probable that he in fact means Byrne's Saskatchewan Basin complex. The authors have restricted the definition of the Old Women's complex, as used here, to sites/components characterized by Prairie/Plains side-notched projectile point forms in association with Byrne's (1973) Saskatchewan Basin complex ceramics. We would disagree with Reeves' suggestion that Old Women's developed out of both preceding Avonlea and Besant. Instead, we see Old Women's developing directly out of Avonlea, primarily in southern Alberta. The Besant complex is seen as developing into other generally unrelated Prairie/Plains complexes in areas totally or generally outside Alberta. Elsewhere, other regionally distinct Avonlea complex groups develop into, as yet undefined, complexes characterized by Prairie/Plains point varieties. We would agree with Reeves and Byrne that the evidence increasingly supports the conclusion that the Old Women's complex as defined here, most likely reflects prehistoric Blackfoot groups within Alberta and adjacent areas. However, Reeves (1980 from Reeves 1983:19-21) statements regarding the relationship between his Old Women's and historic Gros Ventre may as yet be premature.

Three major sites located within southeastern Alberta are referred to the Old Women's complex as defined here. The Saamis site (EaOp-6) is an extensive campsite located within the valley bottom of Seven Persons Creek, just upstream from where it enters the South Saskatchewan River valley (Milne-Brumley 1978). The Saamis site, along with the previously discussed Southridge and Ross Glen sites, is situated within the City of Medicine Hat, approximately 65 km northeast of the Forty Mile project area. The site consists of extensive quantities of campsite debris found on various lower terrace surfaces along a several hundred metre section of the stream valley. Dense quantities of butchered bison remains strongly suggests the site's inhabitants were utilizing an as yet unlocated communal bison kill somewhere in the vicinity. Foetal bison calf remains suggest a mid to late winter period of occupation. Diagnostic cultural materials consist of Prairie/Plains point forms, Saskatchewan Basin complex ceramics, a few pieces of European derived trade goods, and a small quantity of ceramics related to the, yet to be discussed, Cluny complex. This material along with a series of three radiocarbon dates indicate a series of occupations dominated by Old Women's complex peoples dating from the Late Prehistoric/Protohistoric Period (Figure 13). Stratigraphic development at the site is limited and it is not clear whether the Old Women's and Cluny complex materials are associated or represent separate, closely spaced events. Although local lithic materials dominate the chipped stone tool assemblage at Saamis, obsidian, Madison Formation cherts, and Avon cherts were relatively common. In particular, there was a very high preference for non-local, Montana derived cherts in endscraper manufacture (Milne-Brumley 1978:135).

The Ross site (DlPd-3) is another significant Old Women's complex site located in a wooded section in the bottom of the Oldman River valley, 70 km northwest of the Forty Mile project area. The site was originally investigated in 1957 and reported on by Forbis (1960). More recently, Vickers (1987) reports on test excavations conducted at the site in 1980. Vickers (1987) identified nine cultural occupations at Ross with diagnostic projectile points (Prairie/Plains varieties) and Saskatchewan Basin complex ceramics recovered from two occupations (I and III) only. Occupations I and III clearly reflect an Old Women's complex association. The remaining seven occupations are interpreted by Vickers (1987) as probably referrable to the Old Women's as well. Recovered cultural material and two accepted radiocarbon dates indicate the entire series of occupations reflect a period of site use during the latter stages of the Late Prehistoric (Figure 13). Seasonality data was recovered from four occupations and indicate site use during late spring (Occupation IV), mid winter (Occupation III), late summer or early fall (Occupation IIIa) and fall (Occupation IIa). Cultural materials indicate a broad range of campsite/processing activities. Extensive quantities of bison faunal remains indicates subsistence is based largely on communal bison hunting - presumably at known kills in the immediate area. Again, although local lithics dominate, non-local lithics in the form of Madison Formation cherts, porcellanite, Avon chert and obsidian are relatively abundant (Vickers

1987).

At the Ramillies site, already described in reference to the Avonlea complex, the latest use of the kill structure and associated camp area is by Old Women's complex peoples. A single radiocarbon date for this Old Women's component indicates an age of ca A.D. 900 (Brumley 1976; Figure 13).

A final site from southeastern Alberta which is referrable only to the Prairie/Plains complex, but which is significant to several issues raised here, is the Ellis site (EcOp-4; Brumley 1985a, 1985b). The site is located on an isolated point of flat prairie overlooking the valley of the South Saskatchewan River, 95 km northeast of the Forty Mile project area. The site is dominated by a centrally situated medicine wheel which consists of a tipi ring sized stone circle, from which radiate 10 or 11 stone lines or spokes. Adjacent to the medicine wheel are an additional 13 tipi ring sized stone circles and two small stone cairns. Excavations were conducted at the site in 1974 and 1985; this resulted in the complete excavation of the medicine wheel and testing of three other stone circles. Cultural materials recovered within, and apparently associated with the medicine wheel, consisted solely of the partial remains of a human skeleton and a partially decomposed painted and pointed wooden post or stake. Several pieces of butchered bison bone were found around and at the base of stones comprising the ring portion of the medicine wheel. They appeared to be contemporaneous with, or to immediately predate, the structure. Radiocarbon dates run on fragments of the wooden stake and bone fragments yielded dates respectively of 450 $\pm$ 16 (Beta 8948) and 730 $\pm$ 70 (Beta 19793) radiocarbon years B.P. These dates clearly indicate a Late Prehistoric, Prairie/Plains complex association for the medicine wheel. Excavation within the spacially associated tipi rings yielded a few Prairie/Plains projectile points along with moderate amounts of debitage. No ceramics were recovered.

An analysis of the data indicates the Ellis site medicine wheel is a burial lodge and memorial, analogous to those used by the Historic Blackfoot to honor prominent warriors. An examination of the ethnographic literature indicates construction of this type of medicine wheel structure is documented only for the Blackfoot. For the Blackfoot, it is only recorded to be constructed in memorial to men who have distinguished themselves as warriors. The known distribution of similar medicine wheels is restricted to the Plains of central and southern Alberta and northern Montana, which corresponds closely to the known historic distribution of the Blackfoot. From the perspective of the model proposed here, the Ellis site data is important in two ways. First, it provides another strong line of evidence for the prehistoric presence of groups ancestral to the Blackfoot within southeastern Alberta. Secondly, it provides strong evidence for prehistoric intergroup warfare. Not only is intergroup warfare indicated, the construction of memorials to prominent warriors indicates warfare was one means of obtaining higher status and prestige.

Byrne (1973) defines a second ceramic complex for the Plains of southern Alberta which he terms Cluny, after the Cluny earthlodge village (EePg-1) where the materials were first recognized (Wormington and Forbis 1965; Forbis 1977). On the basis of Cluny complex ceramics and associated cultural materials Byrne (1973) defines what he calls the One Gun Phase. Here the terms Cluny complex and One Gun Phase, as defined by Byrne, are used synonimously. Cluny complex ceramics are one of a number of ceramic complexes identified in the northern Plains that demonstrate from general to close relationship to Late Prehistoric ceramic traditions apparently derived from the Middle Missouri region of the Dakotas. These various Late Prehistoric Middle Missouri related ceramic complexes, within the study area defined here, appear to date no earlier than A.D. 1400 and persist into the protohistoric period. Examples would include the Hagen (Mulloy 1942) and Dune Buggy (Johnson 1977) site materials from eastern Montana, and the Piney Creek site (Frison 1967) samples in northern Wyoming. By grouping these various sites together in discussing their extended, general ceramic similarities, we are not trying to suggest any close specific relationship, common source of causality, or common ethnicity. In Alberta, Forbis (1977) suggests the Cluny earthlodge village site was occupied briefly, possibly for less than a year, sometime between A.D. 1730 and 1750. Cluny complex ceramics have also been documented at a number of kill and campsites throughout southern Alberta, in apparent association with Old Women's complex material as that term has been defined here. Byrne and Forbis both agree that the Cluny complex, or One Gun phase, reflects a cultural group with apparent cultural origins in the Middle Missouri area of the Dakotas who moved into the area of Alberta during the Protohistoric, only to then die out, move back to where they came, or be absorbed into local Old Women's populations. Byrne (1973:555) evaluates the archaeological, historic and ethnohistoric evidence as indicating a probable Hidatsa affiliation for Cluny complex peoples.

Evidence of Cluny complex materials within southeastern Alberta is largely restricted to the previously noted Saamis site (EaOp-6). As noted, it is not clear whether this Cluny material is culturally associated or simply mixed with the Old Women's complex materials. As a result, the earlier dates shown for Cluny at Saamis in Figure 13 may be too early and quite possibly reflects Old Women's material only.

South of the study area in the Fresno area of the Milk River valley of north central Montana, Keyser (1979, 1980) reports on a series of Late Prehistoric Prairie/Plains complex materials associated with ceramics. Most of these materials, although clearly distinct from the Cluny complex, also show general to close relationships to Middle Missouri ceramics. A small portion of the Fresno ceramic sample appears to show closer relationships to Saskatchewan Basin Complex materials than to the Middle Missouri. In his analysis Keyser lumps together the ceramic samples recovered from a number of sites located over a several kilometer long section of the Milk River valley and considers it as a single unit in attempting to suggest relationships to the Saskatchewan Basin complex. It is suggested here that Keyser has not recognized that his various individual site samples relate to two separate ceramic traditions. Byrne (1973) has previously discussed the presence of ceramics at the Galata, and Ethridge sites (Wedel 1951) and other sites in north central Montana which show general relationships to, but which he considers distinct from, the Saskatchewan Basin complex. Brumley (nd a) has examined and analyzed several other unreported samples of ceramics from the area of northern Montana which show closest relationships to the Saskatchewan Basin complex and which fit into this characterization by Bryne. As well, other small ceramic samples from the region of northern Montana (Brumley nd a) show clear cut relationships to the Middle Missouri region in contexts which do not indicate Saskatchewan Basin complex relationship or influences.

The situation regarding ceramics during the Late Prehistoric Period in central northern Montana, compared to southern Alberta is similar in that both exhibit the presence of two separate and distinct ceramic traditions. The one ceramic tradition shows a definite, but as yet undefined, relationship to the Saskatchewan Basin ceramic complex in Alberta. The second ceramic tradition consists of a series of small samples, showing from general to specific relationships to Middle Missouri ceramics. The Middle Missouri related ceramics presently known from north central Montana demonstrate only general and not close relationships to Cluny complex materials from Alberta.

Another complex characterized by Prairie/Plains points in north central Montana which is of potential relevance to the culture history of the Forty Mile Coulee area, is represented at the Wahkpa Chu'gn site along the Milk River at Havre, Montana (Davis and Stallcop 1966; Brumley 1971, 1973, 1975b, 1976b). There, studies have revealed an extensive series of Besant, Avonlea and Prairie/Plains complex communal kill and associated campsite deposits. The most recent occupation at the site is a sparse Prairie/Plains occupation containing a small amount of ceramics with a close relationship to the Saskatchewan Basin complex. Underlying this occupation, in various areas of the site, is an extensive series of camp and kill deposits characterized by Prairie/Plains point varieties. In spite of extensive excavations within the site, no ceramics have been found associated within these underlying Prairie/Plains occupations which appear to date between AD 900 and AD 1300. Similarities in Prairie/Plains projectile point varieties, lithic utilization patterns and bison butchering methods between these various aceramic Prairie/Plains occupations at Wahkpa Chu'gn strongly indicate we are dealing with a series of events reflecting a single cultural group over a period of approximately 400 years. The term Saddle Butte complex is coined here in reference to this material. Significantly from the perspective of the Forty Mile project, the style, quality of workmanship and utilized lithic types exhibited by Saddle Butte complex projectile points are very similar to those found in Old Women's complex site throughout Southeastern Alberta. Saddle Butte complex peoples seemed to rely largely on lithic materials apparently derived from locally obtainable tills and river gravels. However, small numbers of projectile points made of Knife River flint or Knife River flint-like brown chalcedony are present. Madison Formation cherts, obsidian, and porcellanite are present but rare.

Clues as to the origin and fate of Saddle Butte complex peoples remains obscure. However, the low incidence of southerly derived lithics, point styles and workmanship suggest it is not derived from earlier convex-based Pelican Lake peoples. Its origins are more likely from earlier aceramic Avonlea or Besant complexes. It is presently impossible to determine whether any of the undifferentiated Prairie/Plains complex materials from the Forty Mile project area (Figure 14) are referrable to the Saddle Butte complex. The lack of ceramics in many of the Prairie/Plains samples from Forty Mile may simply be a reflection of the small sample of diagnostics recovered from most sites. Similarities in workmanship, style and materials would make it presently impossible to confidently sort projectile points as being clearly referrable to the Old Women's or Saddle Butte complexes. However, the much earlier date for Saddle Butte materials at Wahkpa Chu'gn in contrast to the later Prairie/Plains dates at Forty Mile (Figure 14) provide some argument against a significant Saddle Butte complex presence in the study area.

The last Prairie/Plains complex of concern here is termed the Highwood complex, in reference to the Highwood bison kill located in central Montana (Shumate 1950). The complex is best known on the basis of work conducted at the Morrow-Bateman bison kill (24CH234; Brumley nd b) near Fort Benton, Montana, and on the basis of limited excavated and surface materials from elsewhere in central and northern Montana (Stallcop 1973), southern Saskatchewan (Kehoe 1966) and southern Alberta (Brumley et al. 1981). Highwood complex projectile point assemblages are characterized by high frequencies of obsidian, porcellanite and Madison Formation cherts. The overall level of workmanship is obviously superior to that exhibited in other temporally coeval Prairie/Plains point complexes . Distinctive Prairie/Plains point varieties, rare to essentially absent in other complexes mentioned, but common in the Highwood complex, include Buffalo Gap single spurred and Emigrant Basal notched varieties (Kehoe 1966). Bison kill levels at the Morrow-Bateman site were characterized by an abundance of unifacial choppers made on quartzite cobbles and an absence of evidence for use of bison mandibles as choppers, as are present in the Saddle Butte complex. Present evidence suggests the Highwood complex is aceramic. However, it shows close relationships to cultural materials located further south in the upper and middle Yellowstone area of southern Montana, which are characterized by Intermountain complex ceramics (Mulloy 1952).

Chronometric control of Highwood complex materials is limited. At the Morrow-Bateman site, the ten Highwood complex use episodes span a time interval of approximately 1300 to 1500 AD (Davis 1982). In northern Montana the only dated Highwood complex materials of which we are aware is from upper levels at the Boarding School bison kill dating to after AD 1600 (Kehoe 1967:44). Present evidence suggests the Highwood complex is focused in the area of central Montana between the Missouri and Yellowstone Rivers. Distinctive projectile point varieties characterizing the Highwood complex have been used in other areas of the Northern Plains and Great Basin as referrable to and indicative of Late Prehistoric/Protohistoric Shoshonean groups (i.e. Reed 1985). The writers tend to concur with these associations but would prefer to use the broader appellation of Uto-Aztecan rather than Shoshoni in discussing these materials on a broad basis.

North of the Missouri river, evidence of Highwood complex materials is rare but sporadically present in a number of locales. Previous mention has been made of materials at the Boarding School sites. Stallcop (1973) reports on the Beaver Creek Park site (24HL411), a small bison kill near the north margin of the Bear Paw Mountains which appears referrable to the Highwood complex. Kehoe's type site for the Buffalo Gap Single Spurred projectile point variety is the Buffalo Gap bison kill in southcentral Saskatchewan (Kehoe 1966). In southern Alberta, firm evidence of Highwood complex materials is illusive and consists largely of a few scattered projectile points made on Madison Formation cherts, porcellanite or obsidian which exhibit higher levels of uniformity and craftsmanship than other Prairie/Plains complex specimens. For example, ceramic materials and projectile points from the Gleichen kill and campsite clearly indicate use of the site by Old Women's and Cluny complex peoples. However, on the basis of raw materials, style and workmanship, several projectile points seem best referrable to the Highwood complex. A large well made Washita point, made on Madison Formation chert was recovered in excavation along Elkwater Lake in the Cypress Hills; it is an example of an isolated item from southern Alberta best referrable to the Highwood complex (Brumley et al. 1981).

Another body of data probably related to the Highwood complex and late prehistoric Shoshoni or Uto-Aztecan occupation in southern Alberta is a number of rock art sites in the Writing-on-Stone locality along the Milk River in extreme south central Alberta. In a recent study of this rock art, Keyser (1977) suggests the materials can be largely related to the Late Prehistoric/Historic Shoshoni and Blackfeet, with the Shoshoni presence most clearly indicated by the shield bearing warrior motif. Over the years, several studies have been carried out attempting to demonstrate a relationship between the distribution of this shield bearing warrior motif at rock art sites and the known historic distribution of the Shoshoni (ie Keyser 1975). Although relatively successful, the main weakness of these studies has been the larger distribution in some parts of the Plains of the shield bearing warrior motif than is documented for the historic Shoshoni. It is suggested here that the shield bearing warrior motif may not be restricted to Shoshoni groups but referrable to members of a broader based, linguistically linked cultural tradition of Uto-Aztecan speakers which encompasses Prehistoric/Historic Shoshonean groups.

Getting back to the rock art of the Writing-on-stone area, there would seem to be reasonable evidence to support Keyser's proposed Shoshoni or Uto-Aztecan relationship for much of the rock art, and a Blackfoot association for most of the remainder. Unfortunately, there is no good archaeological data from Writing-On-Stone to substantiate a link to the Highwood and Old Women's complexes. Brink (1979) reports on limited test excavation within Writing-on-stone Provincial Park. These, however, provide little definitive evidence regarding relationships between the rock art and defined cultural complexes.

Available archaeological, historical and ethnographic data is interpreted here as indicating the Highwood complex is most likely referrable to late prehistoric/protohistoric Uto-Aztecan speaking (ie Shoshoni) groups in the area. Two basic models have been proposed by researchers regarding Shoshonean origins in the Northern Plains. The first sees them as the historic representation of a cultural tradition centered in the mountain areas of parts of southern Montana, Wyoming, Idaho and Utah with roots extending back for at least 5,000 years and possibly as early as 8,000 years (i.e. Husted 1969; Swanson 1972). The second model proposes that the historic Shoshoni in the region reflects a migration that began about AD 1000 in the southern Sierra Nevada foothills and reaching the northern Plains by approximately AD 1400-1600 (see Wright 1978).

Use of the Morrow-Bateman Bison kill, with an initial date of ca AD 1300, appears to reflect the presence of a well established, ongoing subsistence/settlement pattern by a resident population with well established and extensive lithic procurement patterns to sources throughout southeast, central, and southern Montana, as well as to the Yellowstone Park area of Wyoming. This lithic procurement and utilization pattern is closely similar to that exhibited in most convex-based Pelican Lake assemblages in the region. Although studies as yet have not clearly defined intermediate complexes, we would suggest a convex based Pelican Lake complex derivation for the Highwood complex. Much of the evidence used to infer a relatively late date for Shoshoni occupation of the Northern Plains is based on the spread of apparent Shoshonean related ceramics, usually identified on the Northern Plains as Intermountain ware (Mulloy 1952; Wright 1969). Intermountain ware is suggested here as diffusing out of the Great Basin area in the northern Plains and being differentially incorporated into the cultural inventory of various resident Uto-Aztecan speaking groups. As noted, Highwood complex peoples are apparently aceramic although closely related to and contemporaneous with Intermountain complex ceramic using groups further south.

Although data is extremely limited, the evidence from the Boarding School site, rock art data from Writing-On-Stone, and historic and ethnohistoric accounts suggest that beginning about A.D. 1600-1650, and extending into the Protohistoric Period, Highwood complex people (assumed here to reflect historic Uto-Aztecan Shoshoni groups) were periodically present in the area of northern Montana, southern Alberta and southern Saskatchewan. The deposits at Boarding School, Lower Beaver Creek, and Buffalo Gap kill sites, along with the extensive amounts of probably associated rock art in the Writing-On-Stone locality, suggests limited to periodic residence of Highwood complex groups to at least just north of the 49th parallel.

The more subtle evidence of Highwood complex presence north of that area may indicate largely indirect contact. Other possible signs of Highwood complex interaction with Old Women's and undifferentiated Prairie/Plains complex components in south and central Alberta is evidenced at several sites during this time interval. At the Old Women's site, Forbis (1960) notes two specimens with basal notches in levels suggested to date after 1600 AD. Although the degree of workmanship and other aspects of style and form indicate the specimens are not directly referrable to the Highwood complex, the trait of basal notching may be borrowed from it. A second possible reflection of Highwood complex influence in Alberta during this time interval regards lithic utilization patterns. Much higher frequencies of obsidian, Madison Formation cherts, and Avon cherts appear to be present in later versus earlier Old Women's complex occupations. These later Old Women's occupations are generally contemporaneous with the proposed expansion of Highwood complex peoples north of the Missouri River. It would appear that such trade took place in the form of flake blanks or bifacial preforms since in terms of quality of workmanship and stylistic variation, projectile points and other tools made on these non-local material in Old Women's occupations are comparable to associated specimens made on locally derived materials. The Gilchrist site in the Writing-On-Stone locality along the Milk River valley, 60 km south of the Forty Mile project area, is a lithic cache with a mean obsidian hydration date of 1405 A.D. The Gilchrist site supports and is suggested to reflect this proposed Highwood/Old Women's trading model (Brumley 1982). The site is a lithic cache consisting of two chert bifacial preforms and 33 large chert and obsidian flake blanks or fragments. The chert appears referrable to the Avon quarry along the mountains of west central Montana, while the obsidian is most probably from the Yellowstone Park area of southern Montana and northwestern Wyoming. Outside the Milk River drainage in southern Alberta, evidence for the presence of Highwood complex materials is rare and may be analogous to the distributional pattern noted by Fredlund (1984) in regards to Avonlea materials within the Benson's Butte Beehive complex.

In terms of Highwood complex materials within southeastern Alberta and the Forty Mile Coulee area, much of the presently available evidence has already been discussed. In addition, an isolated surface find of a small triangular pendant was made near the margins of the Cypress Hills, approximately 65 km southeast of the Forty Mile project area. The pendant is generally triangular in outline, lenticular in cross-section and made of a soft red material - probably catlinite. Two opposing notches near the apex of the longest sides appear to be intended to attach the object to a cord. All surfaces and edges are generally smooth and polished. On one surface is a finely incised shield bearing warrior figure. The opposite surface has been partially damaged by exfoliation of a fragment. However, along the undamaged margins of that surface can be seen the legs of what was possibly a finely incised turtle or bird figure. The shield bearing figure suggests a Highwood complex association. Further evidence consists of a recent surface find near the town of Irvine, north of the Cypress Hills by a local collector, Aldon Plant. The find consists of a large basal fragment of what is best described as a spear or lance sized Washita point exhibiting Highwood complex workmanship and made on a dark brown chert of probable non-local origin. A similar non-arrowpoint sized Washita specimen was recovered at Morrow-Bateman and a third specimen recovered along the Kevin Rim in northern Montana, is on display at the Toole County Museum in Shelby.

The foregoing information strongly suggests Highwood complex peoples at least passed through the Forty Mile Coulee project area. However, direct evidence of such movement was not documented in work carried out. A single specimen typologically defined as being Buffalo Gap Single Spurred from DjOu-62 is made on locally obtainable chert and is characterized by workmanship most characteristic of the Old Women's complex. This point variety is characteristic of the Highwood complex and may be viewed as evidence of contemporary Highwood complex influences. At Forty Mile, the sample of high value or well made tools and debitage generally reflecting manufacture of such tools was small. However, the sample which was present and presumably contemporaneous with the Highwood complex shows a good representation of obsidian and Madison Formation cherts, in general corroborating the model of significant trade between Old Women's and Highwood complex groups.

As Figure 14 indicates, a majority of the Forty Mile samples can only be generally identified as being referrable to the Prairie/Plains complex. However, based on overall assemblage similarities, contemporary Old Women's components, and the lack of evidence for at least the substantial presence of other cultural complexes, these materials most probably reflect occupations by Old Women's complex peoples as well.

5.5 Historic Period

The historic and ethnographic evidence concerning tribal locations within the Northern Plains is in large part complex, confusing and contradictory. In spite of these problems it provides an important basis for attempts at linking prehistoric cultural assemblages to historic groups. It seems to the writers that there are two main sources of confusion or misunderstanding made in interpreting the historic and ethnohistoric record. First is our own cultural concepts of group territory or boundary in contrast to what appears to have been applicable aboriginally,

> As I have already observed, ...the Slave Indians are through necessity obliged to follow the movements of the Buffaloe, it will herefore be readily conceived that these tribes can have no fixed hunting grounds. There are, however, certain portions of the country considered by each tribe as their land and which they resort to, when circumstances admit. (Herron 1823:3d)

Carefully consider that passage. In reading accounts by early explorers or traders in the Northern Plains it is common, if not the norm, to find reference to the presence of from one to several lodges of a tribal group in the camp of another tribal group. Almost as frequent, are the references to entire groups travelling or found outside their normal territory. The situation is further complicated by the major tribal movements documented historically. These patterns of major movement during the Protohistoric/Historic are usually interpreted as being the result of European expansion along with the introduction of the horse and gun. Although such territorial fluctuation was quite possibly magnified historically, the prehistoric cultural framework presented here assumes this general pattern extends into the prehistoric. Several episodes of major and minor territorial expansion, collapse and overlap are postulated along with significant interarea contact.

A second area of confusion regards ethnohistoric accounts of cultural origin, elicited by traders, explorers and ethnographers. These native accounts often did not have any temporal or spacial scale attached to them by the aboriginal narrator to indicate when and how far such movements took place. The European recorder often then blithfully goes on to "interpret" what he feel is a reasonable time/space scale for the events. It is suggested that quite often the aboriginal accounts may be quite accurate but that the major problem is the temporal and spacial scales attached to them by the European recorder.

For the Plains of southern Alberta Brink (1986) has recently completed a review and evaluation of the evidence for tribal locations at the beginning of the Historic Period to which the reader is referred. Here we will limit ourselves to a brief overview of six historic tribal groups who are interpreted as being of primary relevance to southeastern Alberta and the Forty Mile project area. The information presented below was compiled from an extensive ethnographic study completed by the junior author in conjunction with the 1983 Forty Mile Coulee project (Dau and Brumley 1984:89-130).

One problem encountered by researchers when attempting to ascertain the Protohistoric and Historic distribution of the Algonkian-speaking Blackfoot people is the fact that most historic documents discuss them collectively along with the Blood and the Piegan as a single interrelated group. Collectively, these groups are often referred to as the Blackfoot Confederacy. The earliest historic territory of the Blackfoot proper appears to have been on the northern edges of the Northern Plains. Swanton (1953:20) places the Blackfoot proper on the North Saskatchewan River in Alberta around 1650. In his detailed study of Blackfoot distribution, Ewers (1974:26-27) discusses Swanton's ideas and finds no error in them. The earliest known historic data on the Blackfoot comes from the journals of David Thompson. On the several occasions that he mentions them, Thompson always places the Blackfoot proper as the most northern of the three tribes (Tyrrell 1916). During the 1780s Thompson spent some time with the

Piegan and noted: "...their old men always point out the North as the place where they come from, and their progress has always been to the southwest....this has been their progress for the distance of four hundred miles from the Eagle hills to the Mountains near the Missouri..." (Tyrrell 1916:348). By the time Thompson visited them, however, the members of the Blackfoot Confederacy (Blackfoot proper, Blood, Piegan) had moved south onto the Northern Plains proper. He described their territory in the 1780s in this manner;

> "...by right of conquest have their west boundary to the foot of the Rocky Mountains, southward to the north branches of the Missouri, eastward for about three hundred miles from the Mountains and northward to the upper part of the Saskatchewan. (Tyrrell 1916:345)

Based upon later historical data, Ewers (1974) suggests that the Blackfoot proper maintained their northernmost position within the Confederacy and during the Eighteenth Century occupied the land around the Red Deer and Bow River valleys. Apparently, they did not completely abandon their more northerly territory as they continued to trade at Hudson's Bay trading posts along the North Saskatchewan River during the 1790s (Johnson 1967:79)

During the early part of the Nineteenth Century, several explorers met the various Blackfoot tribes. Unfortunately, they rarely distinguished between the Blackfoot proper, the Blood, or the Piegan. Perhaps the best reference to the Blackfoot proper comes from Alexander Henry, who in 1809 described their distribution as:

> The tract of land which they call their own at present begins on a line due S from Fort Vermillion to the South Branch of the Saskatchewan and up that stream to the foot of the Rocky Mountains; then goes N. along the mountains until it strikes the N. Branch of the Saskatchewan and down that stream to Vermillion river. (Coues 1897 Vol. II:524)

The area described by Henry appears to have remained the home of the Blackfoot proper for most of the first half of the Nineteenth Century. An American trader on the Missouri River noted of the Blackfoot proper:

> From all I could learn, the Blackfeet originally inhabited that region of country watered by the Saskatchewan and its

> tributaries, never extending their hunting or war parties farther south than the head waters of the Milk River... (D.D. Mitchell in Ewers 1974:37)

After approximately 1850, they appear to have made another southward move. In 1858, Henry Hind described their territory as occupying the land between the Marias River in northern Montana and the South Saskatchewan River (Hind 1971 Vol. II:158). The northern border of the Blackfoot proper appears to have been the Red Deer River in the 1870s as Donald Graham's Metis companions were afraid to travel south of this river into Blackfoot territory in 1872 (Dempsey 1956:14). In 1877, however, their range was drastically reduced through Treaty No. 7, to a small reservation along the Bow River in Alberta.

The data presented above appears to indicate that the Blackfoot proper were not occupants of southern Alberta until the late Eighteenth and early Nineteenth Centuries. After 1800 they ranged freely over the area at all seasons of the year, camping along the major and secondary river systems as well as on the open Plains.

The Blood Indians were one of the three Algonkian-speaking native groups commonly lumped together by the early explorers under the name Blackfoot. Always a relatively small group throughout the Historic Period, they maintained close ties and shared common hunting territory with the Piegan and, on occasion, with the Blackfoot proper. They also shared the common lifestyle of the highly mobile, seasonally oriented, bison hunter, prone to long distance journeys for trade or warfare. As a result, ascertaining a distinct core territory for the Blood is a difficult task.

It appears, however, that they always occupied the central position in the geographic distribution of the three Blackfoot Confederacy groups. Swanton (1953:26) suggests that the Blood were found at the headwaters of the Red Deer and Battle Rivers prior to 1700. In 1801, Alexander MacKenzie (Ewers 1974:60) places them on the Red Deer River perhaps, as far east as the central portion of what is now Alberta. While travelling to the Blackfoot in 1855, in order to inform them of an American treaty, James Doty described the territory of the Blood in the following manner:

> These indians occupy the extreme northern portion of the Blackfeet country, bordering on the south branch of the Saskatchewan and extending south to the headwaters of

> Marias and Milk Rivers and east to the 106th degree of Longitude, they confine themselves closely to these limits and are seldom found beyond them, at least on the south. (Doty in Ewers 1974:114)

The area described by Doty includes a large portion of the range of the Blackfoot proper at the time, but there were no apparent quarrels between the two groups. The Blood were very friendly with the Piegan as well, often hunting and trading with them well into Montana. In fact, at least one American explorer, J.M. Stanley, stated that the Blood were permanently located south of the 49th parallel in the mid 1850s (Hind 1971 Vol. II:158). Such a statement is difficult to disprove, but all the available evidence suggests their core territory was north of the Canada/U.S. border. The data presented above suggests that during the Nineteenth Century, the portion of southern Alberta under study here was within the year-round occupation zone of the Blood Indians.

Data on the distribution of the Algonkian-speaking Piegan in the historic record are again far from detailed. Sometime during the mid-Nineteenth Century the Piegan split into two groups called North and South, or Upper and Lower Piegan. Separated by a political boundary (the Canada/U.S. border), they lost intimate contact with each other, and both Ewers (1979) and Wissler (1910) commented that this resulted in somewhat different Origin traditions.

The earliest known record of the Piegan comes from the journals of David Thompson. In the late 1780s he obtained this description of Piegan distribution and movement:

> ...their [the Piegan] old men always point out the North East as the place they came from, and their progress has always been to the southwest. Since the Traders came to the Saskatchewan River, this has been their course and progress for the distance of four hundred miles from the Eagle Hills to the Mountains near the Missouri but this rapid advance may be mostly attributed to their being armed with guns and iron weapons. (Tyrrell 1916:348)

Based primarily upon this account, Swanton (1953:26) placed the Piegan, prior to 1700 between the Red Deer and Battle Rivers in present day Alberta. Thompson may have been the first European to note the persistent Piegan tradition that they were the southernmost tribe of the Blackfoot

Confederacy, and they were always the first to open new territory. According to Thompson (Tyrrell 1916:330-338), sometime around 1730 the Piegan defeated a group of Indians called the Snake and were able to move south of the Red Deer River. Then, in the early 1780s the Snake were decimated by smallpox and the Piegan were subsequently able to move south into the Bow River country.

From this point onward, the Piegan became one of the most prominent tribes in southern Alberta and northern Montana. Alexander Mackenzie included in his journals this description of the location of the Piegan, made by an unnamed official of the Northwest Company in 1789 or 90: "At the Southern headwaters of the North Branch [Saskatchewan River] dwells a tribe called Sarcees....Opposite to those Eastward, on the headwaters of the South Branch, are the Picaneaux [Piegan]..." (Mackenzie in Ewers 1974:34). This association with the foothills of the Rocky Mountains remained with the Piegan throughout their history. In the winter of 1792-93 Peter Fidler traveled with the Piegan from Buckingham House on the North Saskatchewan to their wintering grounds on the Bow or perhaps Highwood River and within a few miles of the foothills (Fidler n.d.:30-75).

By 1800, The Piegan had again extended their range southward. In approximately 1810, Alexander Henry described Piegan territory as follows:

> The country which the Peigans call their own, and which they have been known to inhabit since their first intercourse with traders on the Saskatchewan is...along the foot of the Rocky mountains, on Bow River and even as far S. as the Missouri. (Coues 1897 Vol. II:723)

Apparently the Piegan operated primarily south of the Bow River at the beginning of the Nineteenth Century and perhaps south of the Milk River. Certainly when Lewis and Clark ascended the Marias River in 1803, the only natives they met were Piegan (Ewers 1974:61). By the 1830s, the split into Northern and Southern Piegan was beginning, with the southern group occupying the territory between the Marias and Milk Rivers and the Northern group along the Bow River (Ewers 1979:72-73). Like all Plains bison hunters, however, the Piegan did not restrict themselves to this small area. Many American traders noted them raiding Kutenai and Flathead groups in the Rocky Mountains, and Lowie (1922:260) recorded one native informant who encountered a Piegan raiding party in southern Montana.

An interesting account of how the Southern Piegan lived within their Nineteenth Century range has been provided by Uhlenbeck. In 1911, he interviewed a number of aged natives and acquired an account of their seasonal round of activities prior to the Reservation period. According to Uhlenbeck (1912:1-7), the Southern Piegan wintered along the Marias River. In spring they began to move northeast towards the Cypress Hills. They summered along the Milk River and the open Plains, including such known locales in southern Alberta as Pakowki Lake, Manyberries, Seven Persons Creek and Writing-On-Stone. In fall they cut lodge poles in the area of Cypress Hills and made their way back to the Marias River.

The territory described by Uhlenbeck's informants remained within Piegan range throughout the Nineteenth Century. They were still there when Alexander Culbertson travelled to the Bow River in 1870 (Dempsey 1971:13-15). By the late 1870s, however, they were restricted to two reservations, one in northern Montana and the other in southwestern Alberta. In summation, then, the Piegan have apparently exhibited a southward territorial movement throughout the Historic Period coming to an end in the mid-Nineteenth Century.

The Gros Ventre were an Algonkian-speaking, plains bison hunting group apparently related to the Arapaho and, for an extensive period of time, strong allies of the Blackfoot people. Referred to in the historic record as the Atsina, Fall, Rapid or Big Belly Indians, the Gros Ventre were a much travelled people. Their territory has often been considered as vast because the name Gros Ventre was also used to refer to and was sometimes confused with the Hidatsa.

It has been suggested the Plains Gros Ventre made a major southward territorial shift at the beginning of, or just prior to, the Historic Period. Both Wissler (1910:9) and Ewers (1974:61) suggest this was due to pressure from the well armed Cree and Assiniboine. According to Ewers (1974:58), they may have met their first European in the form of Anthony Henday during his travels on the Northern Plains in 1754-55. As Henday defined these people only as Archithinue, it is unclear which Plains group he actually met. The next explorer to meet the Gros Ventre was Matthew Cocking (Flannery 1953:4) who commented upon them in what may have been their original homeland: the open plains in the forks of the North and South Saskatchewan Rivers. Ewers (1974:60-61) suggests that the Gros Ventre began their southward migration sometime around 1800.

The Gros Ventre were a very mobile people, however, and did not stay long in the area noted by Henry. As early as 1805, Larocque (Burpee 1910) found a bison hunting group suspected to be Gros Ventre in the Big Horn Mountains of Wyoming. John Harriott, a member of the Bow River Expedition found a large party of Gros Ventre in 1822 near the Cypress Hills in southeastern Alberta. The location of the Gros Ventre was described by Hayden as follows:

> At present [1862] and for many years past, they range along the Milk River, on the east side of the Missouri, extending as far as the Cypress Mountains. From this line to the Marias River stretches a beautiful level country well covered with grass and adapted to pasturage of buffalo. Here the indians under consideration may be found at all seasons - in the winter along the banks of the Milk River where wood may be obtained and in summer on the plains where fuel is not so necessary. (Hayden in Flannery 1953:21)

Once confined to this area, they remained and presently inhabit the Fort Belknap Reservation in northcentral Montana. Of importance to the area of southern Alberta under study here, is the fact that the Gros Ventre were prone to broad and long distance wandering. While it seems historically this area was marginal or peripheral to their territory, they were quite likely regular, but transitory visitors.

The Assiniboine were one of the most widespread native groups on the Northern Plains. They were a Siouxan-speaking, highly mobile tribe with various groups spread out from the eastern Woodlands to the Rocky Mountains. Related to the Dakota Siouxan tribes, ethnographers suggest the Assiniboine originated in the eastern Woodlands and began their westward migrations in the mid-Seventeenth Century (Kennedy 1961, Lowie 1909a, Ray 1974).

The first known reference to the Assiniboine comes from LaVerendrye who commented upon their lifestyles during his travels in the Lake Winnipeg area during the 1730s (Burpee 1927:45). Approximately forty years later, Matthew Cocking found them in the woods of central Saskatchewan just north of the North Saskatchewan River (Burpee 1908:104) By the 1780s they had split into a number of separate tribes, as evidenced by the fact that David Thompson met with a group of strictly Woodland Assiniboine at the North Saskatchewan trading post (Tyrrell 1916:307). Thompson may have been the first European to try to define the territory of the Assiniboine, stating: "...their hunting grounds are on the left bank of the Saskatchewan and eastward and southward to the upper part of the Red River...." (Tyrrell 1916:326-327). Assiniboine who were considered strictly Woodland-oriented were noted trading at Edmonton House in 1795 (Johnson 1967:15). The Assiniboine noted on the Battle River in 1795 by Duncan M'Gilivray (Morton 1929:26) apparently were strongly Plains-oriented as they were spotted returning from an unsuccessful horse-stealing raid in the south.

By the early Nineteenth Century, the Assiniboine were hunting over a vast terrain. In 1809, Alexander Henry attempted to describe their territory in the following manner:

> Their lands may be said to commence at the Hair Hills, near Red River, thence running W. along the Assiniboine, from that to the junction of the North and South branches of the Saskatchewan, and up the former branch to Fort Vermillion; then due S to Battle river, then S.E. to the Missourie, down that river nearly to the Mandan villages, and finally N.E. to the Hair hills again. (Coues 1897 Vol. II:516)

Other explorers such as Lewis and Clark in 1804 (Thwaites 1959 Vol. I:221), Larocque in 1805 (Burpee 1910:52), Maximilian in 1833 (Thwaites 1966: Vol. XXII:367), Catlin in 1837 (1973 Vol. I:53), Culbertson in 1850 (1952:133) and Denig in 1854 (1930:346) all reported finding Assiniboine within the area described by Henry. Both McDonald in 1867 (Cowie 1913:205) and Featherstonhaugh in 1870 (1876:44) commented, however, that the western edge of Assiniboine territory was the Milk River.

Of importance to southern Alberta is the fact that almost all of the above mentioned explorers commented upon the mobility of the Assiniboine and their penchant for long trips to other native groups to raid for horses and/or trade. This suggests that they may have been infrequent visitors to southern Alberta but it is unlikely they maintained permanent camps at any time during the Historic Period.

The Uto-Aztecan speaking Shoshoni were one of the more intriguing native groups to occupy the Northern Plains. The historic record presents numerous references that indicate the Shoshoni (or Snake as they were usually called) ranged across the Northern Plains in the period immediately prior to the arrival of the Europeans. Several authors (Lowie 1909b, Swanton 1953, Trenholm and Carley 1964) suggest that these Plains bison hunters were the group now known as the Northern Shoshoni.

The earliest known European reference to the Shoshoni (Snake) for the Plains comes from the journals of Matthew Cocking. While on the South Saskatchewan River in central Saskatchewan during August 1773, Cocking noted: "24. Monday. We did not proceed: This day Hunters saw several Horses up the branch of the other side: They are all in general afraid, supposing the horses to belong to the Snake Indians, with whom they are always at variance." (Burpee 1908:103). In addition to this, Cocking makes reference to the Snake on three other occasions (Burpee 1908:100,110,112), each time as enemies of the group he travelled with. Many authors have utilized these references to indicate the Shoshoni were spread all over the Northern Plains. Burpee (1908:103), who edited Cocking's journal, suggests the explorer did not actually refer to true Shoshoni. Ewers (1974:38), on the other hand, suggests that what Cocking saw may have been far ranging hunting parties of the Shoshoni.

David Thompson provided more data on the Shoshoni. His account of the story of Saukamappe (Tyrrell 1916:328-322) relates events supposedly occurring around 1730 which suggest the Shoshoni could be found as far north as the Bow River in southern Alberta during the early Eighteenth Century. Thompson also provides an account of the smallpox epidemic of 1781 (Tyrrell 1916:336-339) which decimated the Shoshoni and apparently caused them to retreat southward. This left virtually all of the Plains area of what is now Alberta open to the members of the Blackfoot tribes.

How far south the Shoshoni moved is unclear. Thompson (Tyrrell 1916:341-342) noted a war party of Piegan in 1787 who travelled south from the Bow River six days before finding a Shoshoni camp. Based upon this, Ewers (1974:30) suggested the Shoshoni had moved to the Missouri by the late 1780s. Another traveller who made some note of the location of the Shoshoni at the end of the Eighteenth Century was Peter Fidler. While staying with the Piegan on what was apparently the Highwood River in southwestern Alberta during 1792, Fidler met a peace envoy of the Snake (Shoshoni) who were attempting to cement a treaty with the Piegan. Of the lands of the Snake he said:

> The 4 Snake Indians got many presents and returned back to their own Country....They say that they shall sleep 10 nights before they arrive there which I understand is from 250 to 300 miles a true S by E course. (Fidler n.d.:26-27)

If Fidler's calculations are reasonably accurate the Shoshoni lands were located roughly south of the Marias River in northwestern Montana.

The fortunes of the Shoshoni appear to have declined rapidly after this. When encountered by Lewis and Clark in 1805, they were a mountain-oriented people venturing out onto the Plains only in late fall when their numbers were large enough to ward off enemy attacks and to conduct successful bison hunts (Biddle 1904 Vol. II:116) Lewis and Clark also noted that, due to their fear of the peoples then occupying their former range, the Shoshoni would not travel far to hunt bison unless it was absolutely necessary (Biddle 1904 Vol. II:116). The traditional hatred for the Shoshoni by the Plains native groups remained strong throughout the early Nineteenth Century. For example, in 1811 Alexander Henry noted war parties of Blackfoot, Blood and Piegan travelling south from the Saskatchewan River to the headwaters of the Missouri to war against the Shoshoni (Coues 1897 Vol. I:706).

The tradition of a one-time Plains distribution remained firmly implanted among the Shoshoni. Most of the mid-Nineteenth Century American traders and explorers commented on it. Unfortunately, few reported on the exact territory claimed by these people. Wissler's (1910:11-12) Piegan informants told him that the Snake (Shoshoni) formerly occupied all the streams flowing into the Missouri. This means they could have been found as far north as the Milk River. Ewers (1974:42-43) notes a researcher who found Blackfoot informants claiming the Shoshoni territory extended to the Old Man River in southwestern Alberta. Ewers (1974:43-44) also refers to the report of James Teit whose informants indicated the northern boundary of Shoshoni territory was the present-day Canada/U.S. border in the area of the Sweetgrass Hills.

Based upon the data presented above, it appears that just prior to the arrival of the Europeans the Shoshoni ranged over a territory stretching from the Rocky Mountains east perhaps as far as the mouth of the Milk River, north perhaps as far as the Oldman and Bow Rivers, and south into southern Idaho and western Wyoming. By 1800 they were restricted to the mountains of Idaho, Montana and Wyoming, travelling only occasionally onto the Plains north and south of the Missouri. Finally, by the mid-Nineteenth Century, they were restricted to a purely montaine existence.

5.6 Summary and Evaluation

In the preceding sections the writers have attempted to summarize salient features of the region's archaeological record and to interpret that record within a proposed cultural model. This model proposes that cultural relationships between various archaeological complexes are perceivable, beginning at least as early as the Middle Prehistoric Period and culminating in the Historic in the form of a number of linguistically related tribal groups. Three broad based cultural traditions are postulated with the primary linkages between groups and complexes apparently reflecting common linguistic relationships. At any point in time each of these traditions is conceived as consisting of a series of spacially and culturally distinct subunits, presumably closely analogous in form and structure to historic aboriginal bands and tribal entities.

In formulating this model a broad spectrum of archaeological, historic and ethnographic data was examined only a small fraction of which could be touched upon here. The uninitiated reader should be warned that most archaeologists will probably find our associating the three archaeological traditions identified here with historic linguistically related tribal groupings inappropriate. So be it. We did not start out with these groupings and attempt to fit the available archaeological record into them. In fact, just the opposite occurred. We started with the archaeological record and found weak but undeniable cultural similarities which repeatedly suggested the broad geographic, temporal and cultural relationships proposed. It seemed most appropriate to flatly state the obvious and apparent ethnic and linguistic implications that this archaeological record was seen as indicating rather than hinting at it coyly or flatly ignoring it.

This model does not attempt nor intend to deal with the cultural history of historic Salishan groups known to be present historically on the Plains along parts of the east slope of the Rockies. Peripheral to but related to statements made here are the Avonlea or Avonlea-like assemblages documented particularly by Roll (Roll 1982; Roll and Smith 1982) along the Kootenai River west of the Continental Divide. Reeves (1983) has suggested a prehistoric Kootenai ethnic relationship for this material and to subsequent Prairie/Plains assemblages he refers to as the Tobacco Plains phase. Although we have not examined Reeves' model in detail, generally we feel it has merit and see no conflict with proposals suggested here.

The known cultural and temporal record for the Forty Mile Coulee project area documented herein begins with isolated finds of projectile points from sites DjOu-58 and DjOu-5 which are probably referrable to straight-based Pelican Lake. Both specimens are in contexts which lack integrity and provide little real information concerning the presence and use of the Forty Mile area by members of this complex.

The first good evidence of cultural utilization of the Forty Mile project area occurs during Besant complex times at DjOu-5. DjOu-5 is a deeply buried campsite situated on a slump block surface high on the south wall of Forty Mile Coulee. The site is characterized by a rich but spacially restricted cultural activity area, suggestive of a short term occupation by one or at most two lodge sized social groups. Nearly full term foetal bison remains suggest an early to mid spring period of occupation.

The next occupational episode at Forty Mile is represented by DjOu-81 where moderate to extensive campsite deposits are exposed along the face of a cutbank in the coulee bottom for a distance of ca 150 m at a depth of 10-25 cm below surface. Diagnostic projectile points and a radiocarbon date clearly indicate the site is referrable to the Avonlea complex. Again, newborn or foetal bison remains indicate a mid to late spring occupation. The site area is quite large and suggests occupation by a single large social group composed of numerous individual lodge or household units.

The remaining 29 relatively or chronometrically dated aboriginal cultural assemblages from the Forty Mile project area are referrable to the Prairie/Plains complex (n=25) or the Old Women's complex (n=4) (Table 5; Figure 14). All of the radiometric determinations as well as the association of historic metal and glass items indicates a Late Prehistoric to Historic (ca. AD 1300-AD 1880) age for these materials. Ceramics related to the Saskatchewan Basin complex were only recovered from four locations, allowing a precise Old Women's complex association. However, the other identified Prairie/Plains complex materials are evaluated as probably relating to the same cultural groups reflected by the Old Women's complex materials. The lack of ceramics is seen as a problem of limited sized samples or as reflecting the possible replacement of aboriginal ceramics with European trade goods during the Historic Period. Based on several lines of evidence presented earlier, these Old Women's and Prairie/Plains complex materials from the Forty Mile project area are seen as most probably referrable to one or more groups of the historic Blackfoot confederacy which includes the Blackfoot proper, Piegan and Blood tribal groups.

An examination of Figure 14 could lead one to reasonably conclude that aboriginal utilization of the Forty Mile Coulee area was sporadic and limited until the Late Prehistoric. We suspect this impression is totally erroneous and is the result of depositional processes, the overall low density of diagnostics in cultural assemblages, and differential rates of faunal preservation. Previous discussion has been presented regarding the high rate of deposition within the coulee bottom. As a result, sites found in that area by the techniques of surface survey and backhoe testing would expectedly be relatively recent. Earlier cultural material would be so deeply buried as to be unattainable by backhoe testing, or not exposed by the limited cutbank exposures. The surface find of a Pelican Lake point in a plowed field at DjOu-58 appear to contradict this conclusion. However, it may reflect later cultural use and discard of the specimen as reflected at DjOu-5. Alternately, DjOu-58 is located in the central area of the coulee bottom away from coulee walls where infill sediments are derived. Wilson's (1983) data for calculating a coulee bottom depositional rate of 0.1 cm per year is derived from areas along the base of the coulee wall. Although probably still high, the deposition rate in the central portion of the coulee, such as at DjOu-58, may be lower.

Another factor affecting the cultural record at Forty Mile and related to these depositional processes is faunal preservation. Evidence to be presented indicates there is significant variation in the degree of faunal preservation within various locales which can be directly related to differential depositional rates. Faunal material is best preserved in areas of rapid depositional build-up, such as in the coulee bottom. Little or no bone is preserved in exposed locales receiving limited deposition such as the prairie margins. A variety of locales with varying depositional characteristics are present on the coulee wall. Since bone material is the primary item available for radiocarbon dating, this differential preservation greatly inhibits our ability to date features in a broad range of locales. What we have thus generally been able to date are features which because of rapid depositional build-up contain adequate quantities of preserved bone and which because of this same rapid deposition we would already expect to be of recent age.

These factors indicate that the temporally limited cultural record documented from the Forty Mile project area is not an accurate reflection of the aboriginal use of the area through time. The program of backhoe testing on coulee wall slump block surfaces was an attempt to overcome these problems. This attempt proved partially successful in locating DjOu-5, the buried Besant complex campsite and the earliest well controlled cultural materials from the project area.

6.0 REGIONAL SETTLEMENT MODEL AND RESEARCH DESIGN

6.1 Introduction

An understanding of the aboriginal cultural ecology of the Forty Mile project area must be viewed within a larger geographic context. For our purposes here, this shall be southeastern Alberta, arbitrarily delimited here on the south by the International Boundary, on the east by the Alberta/Saskatchewan border, on the north by a line that roughly parallels the north side of the Red Deer River, and on the west by a line approximately midway between the Alberta/Saskatchewan and Alberta/British Columbia borders.

The following settlement and subsistence model for southeastern Alberta was originally presented in Brumley et al. (1982) and was subsequently published in modified form in Brumley (1983b). The model was originally developed to serve as the basis for formulating hypotheses to be tested in research within the Forty Mile Coulee project. The following is a summarized version of these earlier papers (Brumley et al. 1982; Brumley 1983b) which is intended to orient the reader to known and postulated aspects of aboriginal settlement and subsistence in southeastern Alberta. This settlement model provided the basis for developing the research design employed at Forty Mile as well. The Forty Mile research design is considered here to consist of two parts: 1) a series of hypotheses developed from the settlement model; and 2) a set of field and analysis procedures tailored to retrieve data in such a way as to allow the generated hypotheses to be tested and evaluated. The first part of the research design - hypotheses - is dealt with in Section 6.10. Field and analysis procedures are dealt with subsequently in Section 7 and Appendix 1. The basic settlement model and hypotheses as originally formulated in 1982 (Brumley 1983a) and presented here are examined in Sections 8 and 9 in relation to field data collected from 1983 to 1986.

6.2 Basic Aspects of Aboriginal Subsistence and Settlement

Aboriginal groups within southeastern Alberta were dependant upon hunting and gathering for subsistence and as a source of many raw materials for manufacture. Although a very diverse range of floral and faunal resources were exploited by historic and prehistoric groups in the area, bison was the focus of subsistence activities. Bison procurement is considered here the primary activity around which other aspects of aboriginal life were largely structured. The distribution and density of bison and many other faunal resources varied seasonally throughout southeastern Alberta in accordance to a large number of factors. The factors considered of primary importance here in bison distribution are:

1. local availability of surface water;
2. local availability of forage for grazing; and
3. the need of bison and other ungulate species for shelter during severe winter weather.

Almost all of the floral resources available to aboriginal man throughout southeastern Alberta have restricted geographic distributions with berries and many other plant foods having restricted seasonal availability as well.

Big game hunting, mainly of bison, was of primary subsistence importance throughout the aboriginal cultural sequence. A large and diverse variety of big game hunting techniques are documented for the area. However, all these techniques can be grouped into two general categories: individual or small group hunting, and communal hunting. There may, in fact, be no clear cut division between these two categories but instead various techniques may represent points on a continuum, with each requiring more or less in the way of group or communal effort. Although documentation archaeologically is still very scanty for southeastern Alberta, it seems that both categories of hunting techniques were employed at various times by all or most cultural groups. The major factors suggested here to influence utilization of either major category of hunting technique are seasonal and locational variability in the concentration of bison populations; suitable geographic situations for implementation of various hunting techniques; and varying cultural requirements for meat and other animal products. Generally in situations when bison populations are dispersed, communal hunting techniques would be relatively inefficient as they would yield fewer animals to be distributed among a greater number of people. Situations of dispersed animal populations would tend to promote dispersed human populations which relied on individual or small group hunting techniques. Conversely, highly concentrated animal populations would result in situations where communal hunting techniques would be more feasible.

Suitable geographic situations in which to employ various hunting techniques are considered a major factor in understanding the differential aboriginal utilization of various areas of southeastern Alberta. All archaeologically and ethnographically documented bison hunting techniques required, or were strongly aided by, certain topographic situations. Bison jump and trap sites utilized natural topographic features to kill, cripple or contain the animals. Bison pound structures were often constructed in locations which incorporated natural geographic features which would allow for their concealment from the animals being hunted. Communal hunting techniques often relied on natural features to allow hunters to approach animals and maneuver them to the kill location.

Individual or small group hunting techniques most commonly involve hunters lying in wait to ambush animals or the stalking of animals. Both techniques rely heavily on topographic features for concealment. Research within southeastern Alberta suggests the density of archaeological materials is lowest in areas of level to gently rolling prairie, increasing steadily in areas of greater topographic relief until it again decreases in areas of extreme topographic relief, such as in severe badland areas. In areas of extreme topographic relief travel by both man and bison would be inhibited (Brumley and Dau 1985b).

Lithic resources utilized in the manufacture of such items as stone circles, cairns, stone alignments, stone tools and for use in stone boiling is another significant aboriginal resource. These lithic materials have varied distributional characteristics throughout southeastern Alberta. Available lithic materials can be divided into two groups, coarse-granular and medium to fine-grained.

Coarse-granular stone, available in the area, consists primarily of granite, feldspar, argillite, massive quartz, and quartzite which are derived from the Canadian Shield or the Rocky Mountains. These materials are found primarily in glacial tills or river and stream gravels throughout the area. Soft sandstone which has eroded from local bedrock exposures is another variety of coarse granular stone occurring intermittently throughout the study area. Coarse stone occurs in all size categories and was utilized in construction of stone circles, cairns, alignments, and as a raw material for stone boiling. Massive quartz, quartzite, and argillite were also utilized extensively in chipped stone tool production, primarily for the manufacture of minimally modified implements. Such implements include unmodified debitage and marginally retouched stone tools. Such tools were apparently produced on an "as needed" basis and were often discarded after the task for which they were made was completed. These implements are termed low value tools (Brumley 1981a; see also Section 8.5.1)

Locally available medium to fine-grained lithics include a variety of chert, petrified wood and a poor grade of porcellanite. Medium to fine-grained local lithics were utilized almost exclusively for chipped stone tool production. In contrast to coarse granular lithics, these materials represent the majority of extensively modified or well finished tools in all assemblages (high value tools). Medium to fine-grained lithics in pebble or small cobble sized pieces occur widely and thinly scattered throughout glacial tills and gravel deposits in the region. Small black chert pebbles are a variety of local material utilized from moderately to extensively in most cultural assemblages. These black chert pebbles are known to occur in local tills and gravels and may also be derived from local bedrock outcrops, however, no such bedrock localities are currently known. A poor quality porcellanite is present at several known bedrock exposures throughout the study area. However, this material is quite soft and of inferior quality for chipped stone tool production. Local porcellanite is rarely represented in observed assemblages. Medium to fine-grained lithics of definite or probable non-local origin are represented in varying amounts throughout the aboriginal cultural sequence and provide important information on group movements and inter-group relationships.

Prior to the introduction of the horse in the Late Prehistoric and Historic Periods, aboriginal groups in southeastern Alberta were pedestrian and employed domestic dogs to transport goods. Even after the introduction of the horse, most groups relied in part on dogs as a means of transport. Ewers (1955) estimates that a dog could transport a 23 to 34 kg load and a horse a 91 to 136 kg load. Estimates of the distance travelled by aboriginal groups in dog days vary from 8 to 10 km. This figure may have increased somewhat with the acquisition of the horse, but probably not appreciably since dogs were still being utilized in most instances along with the horse. Water transportation by aboriginal groups in the area was very rudimentary and utilized primarily for major river crossings.

The subsistence system developed by aboriginal groups residing within southeastern Alberta necessitated frequent seasonal moves throughout the region in order to exploit various floral and faunal resources. This requirement for mobility, coupled with their means of transport, has important implications in terms of interpreting the archaeological record. Primarily, there would have been selective measures taken in the amount of cultural material transported from place to place. One result may have been the emphasis in most cultural assemblages for the use of what are termed here, low value tools (see Section 8.5.1). Low value implements are generally made on locally available argillite, quartzite and massive quartz.

Such implements are usually produced on an as needed basis and discarded afterwards, thus reducing the transport load.

Means of transport even after the introduction of the horse provided restraints on the size and form of the conical shaped skin lodge utilized by historic and prehistoric aboriginal inhabitants. With only rare exception, lodges did not exceed 8 m in diameter, with the average being approximately 4.5 m in inside diameter. Also, transport and mobility requirements necessitated a light-weight, portable structure such as the skin lodge. Transport limitations and mobility requirements would also influence the amount of surplus items which would be accumulated. Such items would include hides and stored meat. It is postulated that quantities of such items would generally only be accumulated to meet short term requirements and in periods of decreased mobility. Thus, during periods when food resources were plentiful and easily obtainable, only short term reserves of preserved food might be maintained. During or immediately before anticipated longer periods of seasonal food shortages, any available food resources would be more intensively utilized and a larger surplus of stored food would be prepared when possible.

The pole-framed, skin-covered lodge or tipi utilized by historic Plains Indian groups was apparently used prehistorically in a similar form within southeastern Alberta for at least the last 4000 to 5000 years . This is evidenced by the excavated stone circles of that age used to hold down the edges of lodge covers. Although firm evidence is lacking for the use of the lodge earlier, it is hypothesized that such a structure was present and in fact was probably a necessary prerequisite to the successful occupation of much of the Plains by aboriginal groups. The primary characteristics of the skin lodge, considered of importance here, was its light weight, ease of assembly and transport. One drawback of the structure in cold weather might be its high heat loss through the hide cover. Use of interior liners, banking snow up around the exterior, and situating the structure in sheltered areas would tend to reduce heat loss during winter.

Ethnographically and historically, processing of food either for immediate consumption or for storage and subsequent use, involved roasting, boiling or drying. As well, many food products were simply consumed in an unprocessed state. Plant and animal foods processed for immediate consumption were largely roasted or boiled. Food intended for storage and subsequent use was processed by drying either in the open air or over fires. Bone grease and marrow was rendered from faunal elements by placing them in boiling water where the dissolved grease and marrow could then be skimmed from the surface. Ethnographically, strips of meat were commonly dipped in boiling water preparatory to being dried.

Boiling was thus a major activity employed in the processing of foods. Stone boiling was the primary means utilized aboriginally to heat water and involved heating natural stone in a hearth area and transferring the hot stones to a water filled container. The stones transferred heat to the water and as they cooled were removed and returned to the hearth for reheating, while being replaced by other heated stones. Stones repeatedly heated and then placed in water shatter as a result of rapid thermal stress. This shattered rock is one of the major units of cultural material encountered in many sites throughout the cultural sequence, at least as far back in time as the Mummy Cave complex. Even within cultural complexes containing ceramics, stone boiling as evidenced by heat fractured or firecracked rock, continues in apparently unreduced emphasis.

Certain aspects of stone boiling are considered of major significance in relation to the southeastern Alberta settlement model to be presented. Firstly, stone boiling is considered here to be relatively inefficient and to require a considerable amount of fuel energy in order to heat and maintain water at or near the boiling point. It is thus suggested that use of stone boiling in the processing of meat either for immediate consumption or for subsequent drying; and the processing of bone for grease and marrow extraction was speeded up and facilitated by the initial reduction of both into small pieces. In terms of meat processing, this results in archaeological assemblages containing large numbers of low value tools. These tools are interpreted as being used to fillet meat into small thin pieces which would cook rapidly; or if to be subsequently dried, would do so more quickly and thoroughly. Stone boiling also requires natural, usually cobble sized coarse stone and fuel for heating. Sites within southeastern Alberta where evidence of extensive stone boiling activities is reflected are predominantly in locales where coarse stone and wood for fuel are readily available.

The energy requirements of aboriginal groups within southeastern Alberta which are considered of significance here are for:

1. domestic heating and lighting;
2. food processing; and
3. manufacturing.

Energy sources or fuels available and utilized are:

1. solar energy;
2. wind;
3. wood;
4. buffalo chips;
5. grass; and
6. grease.

Energy needs varied significantly on a seasonal basis, primarily in response to varying climatic conditions and differing emphasis on energy dependent cultural activities. Available energy sources also varied considerably on both a seasonal and geographic basis. Wood was the most efficient and apparently the preferred fuel, however, it has a limited distribution throughout the region. Buffalo chips were a wide-spread fuel source but, they do not provide a radiant heat and burn poorly or will not burn at all even when slightly moist. Also, during periods of snow cover buffalo chips would be difficult to find. Animal grease is recorded ethnographically, and is suggested archaeologically, to have been used infrequently as a fuel either alone or to augment and enhance other fuels such as wood or bison chips. Dry grass is also recorded ethnographically as occasionally used as fuel. Solar energy was an important energy source, particularly during the spring, summer and early fall for domestic heating and drying of food. When available, solar energy significantly reduced the demand for other fuel sources. The low humidity which characterizes the area would also make wind at low to moderate velocities an effective meat drying mechanism.

6.3 Aboriginal Utilization Zones

An evaluation of the previously discussed cultural and environmental factors in relation to the physical environment of southeastern Alberta allows for division of the region into what are referred to here as utilization zones. Five zones are recognized here. Each zone exhibits considerable environmental diversity and it is probable that future research will indicate each can be divided into smaller significant subunits for study. However, considering the state of research within the region at present, such subdivision would be premature. The five utilization zones are:

1. the Cypress Hills and its immediate prairie margins;
2. major river, stream and coulee systems along with their immediate prairie margins;
3. open level to gently rolling prairie;
4. open moderately to strongly rolling prairie; and
5. sand hill areas.

With the exception of the Cypress Hills, none of the defined utilization zones represent contiguous land units, but instead a series of from small to large land parcels break the region up into a mosaic of areas each having a specific set of characteristics.

The climate of southeastern Alberta is harsh since it is the hottest and driest area of Alberta; it has a maximum temperature of 42° Celsius recorded for the month of July and a minimum of -46° Celsius recorded for the months of January and February (Webb et al. 1967:99). The average mean annual temperature for the area is 5.6° Celsius (Kendrew and Currie 1955:169). The frost-free growing period varies from 100 to 140 days. Average annual precipitation in various parts of the study area ranges from 280 to 356 mm per year.

On a year-round basis, prevailing winds are from the southwest. In the winter, these winds often bring warm Pacific air masses over the Rockies, resulting in chinook conditions. Chinooks, which may last from a few hours to several weeks, often raise winter temperatures above freezing, which results in the snow cover melting. Gale-force winds are concentrated in the months of March, April and May.

6.4 The Cypress Hills Zone

The Cypress Hills are located in the southeast portion of the study area and consist of a flat topped plateau rising some 300 metres above the surrounding prairie. They cover an area of approximately 1000 square miles, the western third of which is situated within the study area. The top of the plateau comprising the Cypress Hills is essentially flat and slopes moderately downward to the south where it blends into the surrounding prairie. The north and west margins of the Hills are marked by a steep escarpment, rising abruptly above the prairie surface. Numerous major and minor coulee systems dissect the Hills, which largely radiate outward from its margins. Moderately to strongly rolling hummocky ground moraine characterizes the prairie surface bordering the north and west margins of the Hills. Topography and vegetation cover within the Hills appears most suitable for the employment of individual or small group hunting techniques. The strongly to moderately rolling prairie margin bordering the Hills is ideally suited for a total range of hunting techniques.

The surface of the Cypress Hills is mantled in places by a thin layer of loess overlaying extensive beds of tertiary gravels. Occasional outcrops of sandstone and shale bedrock are found in deep coulees and along the escarpment forming the north and west margins of the Hills. The surface of the Cypress Hills has never been glaciated. However, extensive end and ground moraine deposits are found along the margins and flanks of the Hills. Lithics available for aboriginal use consist largely of quartzite and argillite which is found extensively in the tertiary gravels. Medium to fine-grained lithics are apparently quite rare within the Hills.

Surface water within the Cypress Hills portion of the study area consists of Elkwater Lake, a year-round water body 4 km long, several year-round and flowing springs, and several intermittent or year-round streams. Because of its high elevation, the Cypress Hills receives snow cover earlier and retains it later than the surrounding prairie. This snow cover would also provide a widespread source of water from at least mid fall to late winter for man and animals.

The Cypress Hills, because of its higher elevation, reflects different climatic conditions than the surrounding prairie. Precipitation is greater, mean temperatures are lower and the growing season is shorter. Because of these cooler, moister conditions, floral resources are much more diverse and dense than elsewhere in the region. Extensive grassland communities dominated by rough fescue and blue grama grass are found on much of the plateau surface as well as on lower prairie elevations surrounding the Hills.

Major stands of lodgepole pine, white spruce, aspen poplar and balsam poplar are found throughout the Hills, along with a broad range of shrubs and plants including black currant, wild rose, wolf willow, buffalo berry and low bush cranberry.

The large variety and quantity of woody plants found throughout the Hills would be available through the year for use as fuel and as a raw material for implement manufacture. A large quantity and variety of plant food would also be available on a seasonal basis, primarily from late spring to late summer.

With the general exception of antelope, the full range of economically important faunal resources found in the region would have been present in the Cypress Hills. The Cypress Hills exhibit the most diverse range and density of faunal resources within the region. For bison, the Cypress Hills are considered to have been of greatest importance beginning in late summer as seasonal surface water resources available on the open prairie dried up, thus concentrating animals around permanent water sources such as Elkwater Lake. Later as severe winter weather sets in, the Hills provided a shelter base in which bison congregated for protection from wind and to feed. During mild periods of the winter, bison would venture out onto the open prairie margins, retreating once again into the Hills with the onset of storms. Most likely bison probably left the Hills in late winter or early spring as snow cover left the surrounding prairie but stayed on for several more weeks in the higher elevation of the Hills.

Archaeological research within the Cypress Hills has indicated a relatively large number of aboriginal sites are present within all areas, almost all of which appear to reflect campsite activities. Stone circle and cairn sites are rare. Communal kill sites are not recorded within the Hills but at least one has been reported within the prairie margin surrounding the Hills. Of known campsites, the largest and most intensely utilized are situated along the north margin of the Hills near or adjacent to Elkwater Lake. Several of the sites are very extensive in size and contain very high densities of cultural material. Relative and chronometric dating of materials indicates cultural utilization spanning at least 8000 years. Direct evidence of site seasonality is present at only one site; it reflects a late winter to early spring occupation. However, site locational characteristics and the nature of cultural assemblages strongly suggests year-round utilization of the Hills by aboriginal groups for brief to extended time periods. Faunal remains are poorly represented at the sites investigated, in spite of cultural assemblages which reflect heavy emphasis on food processing.

It is suggested that the Cypress Hills were utilized by aboriginal groups repeatedly on a year-round basis, with particular emphasis during the fall, winter and early spring of the year. The nature and amounts of cultural material present suggest occupations were often of long duration. The low density of faunal remains from most sites, as well as the absence of known communal kills within the Hills, suggest that hunting and butchering of animals occurred away from site areas and the meat was transported back to camp for final processing and consumption. Probably, for the sites around Elkwater Lake, much of this hunting took place in the prairie margin surrounding the Hills and employed a total range of hunting techniques.

6.5 Major River, Stream and Coulee Systems Zone

The three major river systems present within the study region provide a sharp physical and environmental contrast to the prairie regions bordering them. This prairie surface is further, and similarly, broken up by relatively small to major stream, coulee and glacial outwash channel systems. This zone also includes the immediate prairie margins bordering these systems.

The land forms placed within this zone demonstrate a broad range of variation. Width, depth and linear extent of each river or coulee system varies markedly. Valley walls range from broad, gently sloping surfaces to vertical faces. Generally, however, there is a sharp angular break between river, stream and coulee valley systems and the land surface into which they are incised. Topographically the area ideally suited for a broad range of aboriginal hunting techniques and is the most likely zone in the region for communal kill techniques.

Surficial deposits in this zone consist largely of exposed bedrock, alluvial and colluvial sediments within valleys and a variety of largely glacially derived sediments along valley margins. The amount of sedimentation within valley systems varies markedly over short distances in response to such factors as the nature of surficial deposits on the adjacent prairie surfaces, and height of specific locales above flood plain. The direction in which various valley wall sections face is a major factor in determining the rate of erosion from those surfaces. North and northeast facing slopes are shaded much more than other surfaces, thus reducing evaporation of available moisture. These slopes also tend to accumulate more moisture in the spring due to a greater snow drift accumulation resulting from the southwest prevailing winds. Such slopes support greater vegetation cover which results in less erosion and downslope deposition.

Bedrock exposures in prairie regions consisting largely of soft sandstones and shales occur predominantly within these valley systems. Bedrock exposures are generally limited in extent with the most extensive sections being along portions of the Red Deer River valley in the northeast section of the study area, and along the Milk River in the south portion of the study area.

Surface water within this zone consists of four types: permanent rivers or streams, seasonal streams, seasonal and permanent lakes, and springs. The Milk, South Saskatchewan and Red Deer Rivers are the only normally year-round flowing water systems within the region. Several secondary streams are present but these are normally active only in the spring to early summer. Many of the large glacial outwash coulee systems contain small sized lake basins which fill during spring runoff. The majority of these are dry by mid to late summer, but several are of a permanent nature.

Seeps or non-flowing springs are common along most major valley systems and may have been locally important to aboriginal groups when other water sources were unavailable. However this type of spring is considered of minimal value to game animals such as bison. Flowing open springs are quite rare in the region and those known are all in proximity to other major water sources.

Again, floral resources show a varied geographic and seasonal distribution throughout this zone. Prairie grassland characterizes most of the valley surfaces and all of the prairie margins. Heavy tree cover (consisting of poplar) is found in low bottom areas of the three major river systems and occasionally along low bottom areas of major secondary streams. Heavy to light brush cover consisting of wolf willow, chokecherry, saskatoon berry, wild rose and buffalo berry are also found in such areas, as well as in some deep sheltered coulee bottoms and along some north or northeast facing valley walls. The size, amount and variety of woody vegetation present in any given valley locale varies greatly. Many coulee systems and portions of the major river and stream systems contain no woody vegetation at all or only small isolated patches on north and northeast facing slopes. A few secondary streams and the major river systems on the other hand, will contain locally extensive areas of dense brush and trees.

Floral communities within these valley systems are, in general, more diverse and abundant than the surrounding prairie region. They provided wood for fuel and manufacturing year-round. As well, a number of plant foods are seasonally available beginning in mid spring to early fall.

The full range of economically important fauna found within southeastern Alberta has been documented ethnographically or archaeologically as present within this valley zone. Historic, ethnographic and archaeological evidence indicates bison were present year-round in at least sections of the valley areas and were concentrated in valley areas at certain times of the year. Beginning in early to mid summer, with the depletion of seasonal water sources on the open plains, bison would tend to gather or frequently travel back and forth to longer term seasonal and year-round water sources such as those found in many valley systems. With the onset of winter weather, various sheltered and brush-covered valley locales could provide shelter from winter storms for small to moderate numbers of bison. From late winter to early summer, with a return to more favorable weather conditions and more readily available surface water, bison are postulated to again have been widely dispersed throughout the region and not as concentrated within valley systems.

The valley system zone contains the largest number and greatest diversity of archaeological features present anywhere within southeastern Alberta. Site types include buried camps, bison kill and bison processing sites, stone circle, cairn and alignment sites, and medicine wheel sites.

Valley bottom areas contain the smallest number of sites within this zone, consisting largely of buried campsites, bison kills, bison kill/processing areas, and a few stone circle sites. Although excavated sites are few in number, several of those present reflect extensive and repeated cultural utilization. All of these large sites are in immediate or near proximity to permanent water and wood resources and all are located in major river or stream valleys. Only small to moderate sized buried camp, bison kill and processing areas have been encountered to date in coulee bottom systems away from major river or stream systems.

Along the base and slope of valley walls, site density increases and includes the site types found in bottom areas as well as a substantial number of stone circle sites. The greatest density and diversity of sites is found on the prairie surface along valley margins and in descending order of frequency consists of stone circles, cairns, alignments, buried camp sites, and medicine wheels. In general terms, habitation sites situated on the prairie margin contain lower densities of cultural material and appear to reflect briefer occupation than similar sites situated on valley walls or bottoms. Seasonality data is available from several sites situated in the valley slope and bottom areas of major rivers which suggest occupations occurred during all periods of the year with an apparent emphasis during the spring and fall. It is suggested that sites along the valley rims were largely occupied from mid spring to early fall, depending on associated water and wood resources. The largest stone circle sites found in southeastern Alberta are situated along valley rims, which in part possibly reflect larger social group gatherings at these locations, and in part reflects repeated occupations of site locales. Medicine wheel sites recorded within southeastern Alberta are all within this zone. The degree of aboriginal utilization of any given section of a valley system appears to be in response to an interplay of a number of factors, most significant of which are water supply, woody plant material and local topography.

It is postulated that well watered and wooded valley locales were occupied during all seasons of the year by aboriginal groups and were particularly important during the late fall to early spring of the year when other fuel resources such as buffalo chips were unusable or not available. Minimal utilization of these areas is postulated from mid spring to early fall as fuel requirements for domestic heating were minimal, alternate energy sources such as buffalo chips were available, and relatively abundant; as well wide-spread surface water allowed bison to disburse widely and thinly across the open Plains.

Sections of valley systems containing little or limited wood or water resources generally reflect more limited utilization. However, such locales normally show higher site densities than adjacent prairie, even with water and wood absent, probably because of the hunting advantage produced by favorable topography. Valley sections with limited wood and water resources were probably occupied on a more limited seasonal basis; beginning only in early to mid spring and, depending on water resources, extending as late as mid fall.

6.6 Open Level to Gently Rolling Prairie Zone

The level to gently rolling prairie which forms this utilization zone is primarily situated on glacial ground moraine or glaciolacustrine sediments found throughout the region. Depending on the specific surface deposit on which an area is situated, lithic resources will range from totally absent to moderately abundant. The flat to gently rolling landscape characterizing this zone is considered poorly suited topographically for employment of all aboriginal hunting techniques. Surface water sources are relatively rare with those present usually consisting of short term seasonal lakes that retain water from late winter to mid or late spring. The zone is characterized by previously described prairie grassland communities with woody vegetation consisting almost exclusively of limited amounts of greasewood and sage. In terms of fauna, the area is well suited for grazing by bison and antelope. For bison, the limited availability of surface water would make the area most suitable for utilization from late winter to mid or late spring.

Archaeological sites and features have a very low density within this zone and consist of small stone circle sites, isolated cairns and small buried or surface campsites. This low density presumably reflects the limited and seasonal availability of water, and presumably bison, along with the poor hunting opportunities offered by the topography. Also, the lack of lithic resources would reduce the chances of highly visible surface stone feature sites from being as abundant, even if the area was occupied.

6.7 Open Moderately to Strongly Rolling Prairie Zone

The surficial deposits within this zone are characterized mainly by hummocky glacial till deposits which contain moderate to extensive amounts of coarse lithic materials and limited, widely dispersed medium to fine grained lithics. Topography here is well suited for many types of individual and small group hunting techniques. Also, the topography is suitable for maneuvering animals into the communal kill situations located in adjacent major valley system zones.

Surface water sources are common, consisting of numerous small seasonal lakes and a few larger and more permanent lakes. Springs are very rare. In terms of flora and fauna, this zone is very similar to the open level to gently rolling prairie zone. As with that zone, utilization by bison probably begins primarily in late winter but, depending on local water resources, may extend to mid or late fall.

Archaeological sites and features occur in high density within this zone. Site types consist primarily of stone circles, cairns and alignments, and occasionally small buried campsites. Excavated stone circle sites are small and usually contain limited quantities of cultural materials, suggesting brief occupation by small groups. Because of the presumed pattern of utilization of the zone by bison and the lack of wood for fuel, this zone was more than likely inhabited aboriginally from mid or late spring to early fall.

6.8 Sand Hills Utilization Zone

Two relatively large areas characterized by stabilized and unstabilized sand dunes are located within the study area. The first is situated along and adjacent to Pakowki Lake in the southern portion of the study area. The second, known as the Middle Sand Hills, is situated in the northeast portion of the Suffield Military Reserve and extends east-northeastward from the reserve across the South Saskatchewan River.

In several places, sand deposits mantle or border hummocky moraine deposits with hills of such deposits often being located along the margins of sand hills or occasionally projecting above surrounding dunes.

Lithic resources are totally absent or very rare within the aeolian deposits themselves, but are obtainable in varying amounts along sand hill margins. Topography in many sand hill areas is extremely rugged, with literally hundreds of steep to sheer faced dunes occupying even a single square mile. The terrain is well suited for utilization of a broad range of individual and communal hunting techniques.

Surface water is relatively abundant within both major sand hill zone areas. Both are bordered by major year-round water sources. Several small flowing springs are present in the Middle Sand Hills and several small seasonal lakes are present in both areas.

Vegetation consists of large to small thickets of chokecherry, sage brush and wolf willow, set within a grassland community. Fauna is typical of the region with greater numbers of cover-preferring species. Because of the extensive brush cover and relatively abundant surface water, the area is hypothesized to have been able to support a bison population on a year-round basis and may have been an important wintering area.

No excavations have been carried out at sites within this zone. However, limited survey has recorded the presence of several buried campsites, three of which suggest extensive and extended campsite activities. Surface materials from one site near Pakowki Lake indicates long-term, multiple occupation of the location from the Early Prehistoric Period onward.

It is suggested that these sand hill areas were utilized repeatedly on a year-round basis. At present it is difficult to infer if there was emphasis in utilization during particular seasons of the year. Until further survey and excavation is conducted, few other inferences can be made on the pattern of cultural utilization.

6.9 The Forty Mile Coulee Project Within The Southeastern Alberta Settlement Model

The foregoing statements have presented a general model formulated in the early stages of the Forty Mile project which attempts to explain the nature, density and distribution of aboriginal cultural materials within southeastern Alberta as a response to a limited number of cultural and environmental factors. Development locations for the proposed Forty Mile Coulee project are all situated within the major river, stream and coulee system zone. Contiguous prairie adjacent to this zone in the project area falls largely within the open level to gently rolling prairie zone. Based on the preceding discussion, it is hypothesized that the Forty Mile Coulee project area was primarily utilized by aboriginal groups from mid spring to early fall. Limited amounts of woody vegetation is suggested to totally or severely restrict winter use of the area by bison, and particularly by man.

The density of archaeological sites consisting primarily of stone circles and secondarily of cairns, is very high within the project area. This probably reflects the focus of human activities away from the nearby, and presumably less favorable, level to gently rolling prairie. Considering the location of the project area and the nature of cultural remains present, the developed research objectives will focus on answering questions concerning aboriginal cultural utilization of this type of geographical situation, and on questions concerning the nature and use of stone circles.

Stone circle sites have a number of characteristics which can be viewed from a research perspective as both positive and negative. From a positive viewpoint, since they mark the former location of aboriginal lodges, they provide an excellent reference point from which to relate associated cultural materials, and thus look for patterned relationships and associations. Since the size of the ring is directly relatable to the floor space and overall size of the lodge, they provide an excellent basis of estimating the size or status of the social group which inhabited the structure. The number and distribution of contemporaneous stone circles present at a site can be used to estimate the size and organization of social groups during different times of the year, or during different cultural occupations. The overall shape of the stone circle and the relative density of stones in various portions of it can be used to infer doorway locations and weather conditions at the time the structure was utilized. This information can then be extrapolated to infer site seasonality and to interpret cultural material distributions.

The negative aspects of stone circle sites may not be so much inherent in the sites themselves, but in the level of our understanding of these sites and present techniques used to examine them. Stone circle sites are usually found in areas of light to moderate deposition. Thus, at sites containing multiple rings it is often difficult, at present, to determine whether various stone circles are contemporaneous or if they represent multiple occupations. The density of cultural material within the majority of stone circle sites is normally low. Thus, recognition of distributional patterns of cultural material within, outside and in various directions around the stone circles, will require fairly high levels of well patterned, sampling in all areas. Also, the bulk of cultural material encountered at most stone circle sites consists of heat fractured or firecracked rock, coarse debitage and cores, and minimally modified stone tools. Archaeological techniques for interpretation of cultural affiliation, site activities, and site seasonality, have largely focused on other classes of cultural material such as projectile points, ceramics, other well finished tools, and faunal remains. Such items are commonly present in low frequency at stone circle sites. The field and analysis procedures developed and employed at Forty Mile were formulated with the intent of overcoming many of the shortcomings in our present ability to fully utilize the potential data provided by stone circles.

6.10 Testable Hypotheses

The multi-year nature of the Forty Mile Coulee archaeological project allowed for the development of a research design oriented towards collecting specific data utilizing specific procedures. Data recovery techniques were tailored to answer a number of questions concerning the aboriginal occupation of Forty Mile Coulee. These questions were posed as a series of testable hypotheses, each dealing with certain aspects of the data base (Brumley 1983a). These hypotheses are summarized below, and discussed more fully in the appropriate sections of the report.

In terms of cultural history, three hypotheses were generated:

1. Early cultural groups were present within the Forty Mile coulee area. Testing this hypothesis requires the discovery

of diagnostic/dateable remains dating to the period 11,500 - 7,500 years B.P. However, due to extensive deposition within the coulee basin and the low frequency of preserved bone and diagnostic cultural materials within prairie surface environments, any evidence of such early occupation will probably be encountered only within isolated slump block features situated on coulee wall margins. Due to these preservation and sampling problems, it will not be possible to formally reject this hypothesis should results be negative.

2. The Late Prehistoric-Protohistoric occupation of the Forty Mile Coulee area was largely by groups referrable, or ancestral to the historic Piegan. This hypothesis could only be tested through the discovery of artifact types which can be specifically attributed to the Peigan, a task which is currently impossible. However, we will examine the historic literature to determine if the hypothesis formulation is reasonable.
3. During the Protohistoric-Historic Period, European trade items, because of their scarcity, were integrated into aboriginal material culture as "high value" tools. If this hypothesis is correct, we anticipate that the distribution of historic material will parallel that of prehistoric "high value" tools. Further, due to longer use-life and greater curation, the hypothesis implies that lower over-all artifact densities should be reflected in such sites.

For the concept of the reconstruction of cultural activities, a total of seven hypotheses were generated:

1. The Forty Mile Coulee area was primarily utilized by aboriginal groups in spring or early summer. If this hypothesis is correct, we anticipate that foetal or newborn bison faunal remains will be present in the assemblages.
2. Aboriginal campsites within the Forty Mile Coulee area reflect an average period of occupation of two to five

days. If correct, we anticipate that a low minimum number of individuals, appropriate for only short-term subsistence needs, will be reflected in the bison faunal sample.

3. Aboriginal cultural groups within the Forty Mile Coulee area subsisted primarily by hunting bison. Bison were obtained by employing individual or small group hunting techniques. If correct, we anticipate that bison will dominate the identified fauna, but that small bison MNI will be characteristic of site faunal assemblages, and that no communal kill sites (bison jumps) will be present.
4. Cultural activities conducted by aboriginal groups occupying the Forty Mile area consisted primarily of processing bison meat obtained in hunting for immediate consumption. Processing of bison meat for later storage and use was minimal. If correct, we anticipate that features (hearths, bone boiling pits) related to processing of dry meat stores will be absent or minimally represented.
5. Tool manufacture was largely restricted to low value items intended for immediate use in meat processing. If correct, we anticipate that low value tools will form the vast majority of the core/debitage assemblage, and that exotic high value lithics will be rare in the site assemblages.
6. The size of aboriginal social groups occupying sites in the Forty Mile area was small, consisting of no more than several extended families. If correct, we anticipate that site size, as reflected by numbers of stone circles, should be small; probably fewer than ten stone circles (minimum recorded Historic Period band size) will be present at most sites.
7. The difference in frequency of faunal remains between sites located in the coulee basin and on the prairie surface reflects differential preservation factors rather than

difference in cultural activities. If correct, we anticipate that the artifact assemblages, exclusive of faunal remains, will show close parallels in type frequencies and densities between the depositional microenvirionments.

Four hypotheses were generated which deal with the basic structure and configuration of stone circles:

1. The directional sectors containing the least number of stones predominantly reflects lodge doorway location. If correct, we anticipate that these low stone number sectors will be predominantly on the eastern (NE, E, SE) side of the stone circles, based on assumptions derived from the ethnographic literature.
2. The directional sectors containing the greatest number of stones within a stone circle reflects strongest and/or prevailing wind direction at the time the lodge reflected by the stone circle was occupied. If correct, we anticipate that sectors containing greatest rock numbers will more frequently occur in the upwind direction, as determined from modern weather data.
3. Where directional differences exist in the diameters of a stone circle, the longest directional diameter will reflect the orientation of the aboriginal lodge with the doorway location situated at one end. If correct, we anticipate that long axis orientation will be consistent with the direction of prevailing winds, and with the stone number sector data discussed in the previous two hypotheses.
4. The interior area of a stone circle is a direct reflection of the size of the social group inhabiting the lodge it reflects. If correct, we anticipate that a cross-cultural survey of the historic literature will demonstrate consistent group sizes inhabiting lodges, given the generally similar lodge size among various Historic Plains tribes. Further, we anticipate that these data will parallel other general measures developed for estimating group size, developed externally to the Plains region.

Two basic hypotheses were generated concerning the distribution of cultural materials:

1. Specific processing and manufacturing activities were spatially structured and segregated in reference to the lodge in general and the lodge doorway in particular. If correct, we anticipate that consistent patterns of material distributions and associations will be reflected in the various analytical units defined for this study.
2. Traditional aboriginal male and female tasks are reflected by differing categories of cultural material and differing spatial patterning of those materials. If correct, the patterns anticipated in the previous hypothesis will occur and, further, will reflect activities and tool categories consistent with ethnographic descriptions of the sexual division of labour.

Finally, in terms of stone cairns, only two hypotheses were generated. Due to a poor comparative data base for cairns, we are unable to postulate the direction and magnitude of the differences anticipated:

1. Cairns associated with stone circles are structurally different than cairns not associated with stone circles.
2. Cultural material associated with cairns in habitation sites is significantly different in nature and density to cultural material associated with cairns in non-habitation sites.

Examination and evaluation of data bearing on the three hypotheses concerning cultural history has already been presented in Section 5. Section 8 summarizes and evaluates data pertaining to the remaining hypotheses.

7.0 DESCRIPTION OF FIELD PROCEDURES

The historic resource assessment/mitigation program at Forty Mile Coulee employed a broad spectrum of in-field data recording procedures. All were tailored to retrieve data in a format suitable to examine the generated hypotheses. It was necessary to develop new data collection methods which could be utilized in conjunction with standard procedures. As it is as important not only to understand the data themselves but to understand the context in which they were recovered, a description of procedure methodology is required. In order not to impede the flow of this report, the descriptions presented in this section will be kept to a minimum and are intended to serve as an introduction to subsequent sections of text. Appendix 1 contains a more detailed "nuts and bolts" discussion of field methodology.

The first step of the historic resources program at Forty Mile Coulee involved a ground survey of all development areas. All survey was completed by foot traverse in linear or "zig-zag" transects, 5 - 10 metres wide. As the survey progressed, it became evident that a substantial number of historic resource sites, each requiring a site plan map, were present in the project area. In-field sketch maps were considered too time consuming to produce and not of sufficient accuracy for data analysis. A more cost effective and accurate system of in-field site/feature marking, combined with aerial photomapping was therefore devised and implemented.

The aerial mapping system involves marking all sites and features in a systematic manner with white ceiling tiles which denote site number, feature centre and feature type. A secondary method of feature marking, employed at several sites, involved whitewashing all visible stones in the feature. Once site/feature marking was complete each site was photographed with a hand held camera from a fixed wing aircraft at an altitude of 250-400 m. The resulting photomaps can be used both in the field and in report preparation.

Surface stone features, especially stone circles, were the most common indicators of cultural activity at Forty Mile Coulee sites. Due to this, a major portion of the project research design was oriented towards the collection and interpretation of data on the basic structure and configuration of stone circles. With a data base of more than 300 stone circles at Forty Mile coulee, drawing plan maps of each individual feature was considered too excessive in terms of overall resources available and the other research objectives of the project. Instead, a procedure known as limited feature mapping was devised.

Limited feature mapping allows a researcher to record information on the size, shape and depth of burial of a feature as well as the placement of the stones which comprise that feature without resorting to the often laborious task of preparing a complete feature drawing. Although originally designed to deal only with stone circles, initial testing of the system showed that it was of sufficient flexibility to be utilized in the study of other surface stone features such as cairns. One of the most important aspects of limited feature mapping is that all data are collected in a standardized fashion. This allows comparisons to be made between features in a site and between groups of sites containing similar features.

Data recovery in a standardized pattern was a key part of the historic resource assessment/mitigation project at Forty Mile Coulee. The examination of all surface stone features was undertaken within the parameters of the Analytical Unit System designed by the senior author. This system (see Appendix 1) creates a total of 40 analytical units based upon clearly defined directional sectors and distance segments, all related to the defined centerpoint of a feature. Because the units are oriented in this manner and not directly related to the size and shape of a feature, comparison of data from a wide variety of different sized features can be undertaken. At Forty Mile Coulee all cultural material recovered from surface collection, auger testing and excavation at stone circles has been field collected and analyzed in terms of analytical unit location.

Limited feature mapping was supplemented at those features targeted for test excavation. There, detailed drawings or full feature mapping of the selected stone circles were prepared. Two distinct methods of full feature mapping were used at Forty Mile Coulee.

The first method involves a device called the Mapping Board (Dau 1981:39-46) which owes its origin to the "tipi quik" mapping system discussed by Smith (1974). Extensive use by the authors of the Mapping Board has shown that the device can produce an acceptable feature drawing with a minimum expenditure of time. The second method employed in the project area involved a device known as the Photoboom (see Appendix 1) and involves the initial whitewashing of all visible stones in a feature. The Photoboom generates an overhead photograph which provides accurate data on the size, shape and location of the stones comprising a feature. There is sufficient flexibility in the system to allow it to be utilized in the mapping of large sites/features or in the production of accurate plan maps of living floors/features at excavated sites.

An integral part of the initial site/feature assessment program at Forty Mile Coulee was the auger testing of all identified stone circles. Auger testing was undertaken in conjunction with limited feature mapping and was designed to provide data which could be utilized in the process of selecting features for test excavation. All auger testing was conducted whenever possible within the parameters of the analytical unit system, with a maximum of ten 0.03 m^2 holes drilled within and adjacent to each stone circle. In order to properly sample all 40 analytical units, four test hole patterns were created and intended for use on a rotational basis at multiple feature sites. A total of 3001 auger holes encompassing 90.03 square metres were drilled within the project area with 2760 related to specific stone circle analytical units.

Based upon auger test results and differences in physiographic locale, a sample of 20% of all recorded features within the project area were selected for test excavation. An important aspect of the project research design was to collect data which might indicate the presence, location and type of activity areas both inside and outside of a stone circle. All test excavations conducted at stone circles were oriented towards recovery of data which would fulfill these basic research objectives. Prior to 1983, 1m x 1m test pits were utilized in stone circle excavation. From 1983 to 1986 30 cm wide test trenches were employed. Laid out within the analytical unit system, test trenches allowed for a larger feature cross-section to be examined than was possible with standard units, given the average 10 square metre per stone circle allocated by the research design. At all examined buried camps and cairns, 1m x 1m test pits were employed. Excavation was carried out in arbitrary 5 or 10 cm levels by hand or through the use of a mechanical device known as S.P.E.E.D. (Self Propelled Earth Excavating Device). A total of 856.85 square metres were excavated within and adjacent to 100 features at 43 sites.

Early on in the excavation portion of the project it was realized that small features and activity areas outside of stone circles would be difficult to locate given the large area (up to 1000 m^2 per feature) involved in the analytical unit pattern. Some type of cost-effective procedure for sampling these large subsurface areas was required. Prior to the Forty Mile project, the authors were involved in projects where large areas of land were stripped by heavy equipment during the course of subdivision development (Brumley 1981a; Dau and Brumley 1980). In both projects, conventional archaeological surface survey and subsurface testing were conducted prior to stripping, with little or no cultural material being detected. The same areas were then re-examined immediately or shortly after topsoil stripping and in both instances, multiple and significant localized cultural features and/or activity areas were identified which warranted mitigative testing or excavation. The previously mentioned Southridge site, which contains the best regional record for the Oxbow complex, was discovered in the course of one of those projects (Brumley 1981a). Although in those projects no controls were exercised over the depth or linear extent of stripping in terms of archaeological potential, those stripping examinations showed that features and artifacts could be identified in-situ and relevant data could be recorded. This examination procedure was employed at Forty Mile Coulee in a form referred to as controlled surface stripping. During stripping in the project area, strict controls were placed on the depth and linear extent of soil removal in order to cover a maximum of area and to create the least amount of damage to potential features and/or artifacts. All features at all the sites involved in controlled stripping had been previously excavated in order to establish the necessary stratigraphic controls required to properly relate the cultural items recovered. A total of 29,176 square metres were stripped within and adjacent to 40 features at 6 sites.

Prior to, and during assessment/mitigation at Forty Mile Coulee, a deep testing program was undertaken. The first phase of the program, directed by Wilson (1983), focussed on data recovery to aid in the reconstruction of paleoenvironmental conditions within the project area. In addition, the program attempted to locate or determine the potential for locating deeply buried archaeological sites. The basic procedures employed and the results of this phase of the deep testing program are detailed in Wilson (1983). In summary, Wilson's studies indicated that by 15,000 B.P. areas suitable for human habitation were present in the project area. However, the rapid rate of post-glacial sedimentation would have quickly buried any cultural materials present. Sites with an antiquity of 10,000 years could be covered by at least 10 metres of deposits. Wilson suggested that this deposition rate would make it infeasible to search for early sites on the coulee floor, but that a search of slump block features on the coulee wall might turn up early sites.

Subsequent phases of the deep testing program, conducted in 1982, 1983 and 1986, concentrated on testing Wilson's suggestions. A total of 41 backhoe pits were excavated in the project area (Figure 12). Nine were dug in the central portion of the coulee floor near the proposed dam sites, 23 were excavated in areas adjacent to the coulee walls and nine were dug on recognized slump block or coulee wall swale features. Rugged terrain along the north wall of the coulee and in the central portion of the reservoir basin restricted equipment access and prevented complete testing of some favorable slump block surfaces. Cultural material recovery was low. Even though depths of up to 400 cm were reached, only one relatively rich buried site was encountered, site DjOu-5, which has been previously discussed in relation to cultural history.

8.0 EVALUATION OF RECOVERED DATA

8.1 Introduction

The assessment/mitigation procedures undertaken within the Forty Mile project area between 1981 and 1986 resulted in the recovery of a substantial amount of data. Information on the structure of stone circles was collected from 336 features at 70 sites. Test excavations were completed at 76 stone circles, 21 cairns, 2 buried camps and one bone find in 43 sites, with a total of 21,103 pieces of cultural material recovered. All of these data are presented in detail in Dau and Brumley (1987). The primary purpose of Section 8.0 is to summarize and discuss the data in a manner which will aid in testing the hypotheses generated for the research design (Section 6.10).

As stone circles dominate the sample of recorded features from Forty Mile Coulee, emphasis is placed on an interpretation and discussion of these features. In order to properly evaluate the stone circle data from Forty Mile Coulee in terms of a broader regional perspective, structural information from an additional 350 stone circles at 93 sites scattered throughout southern Alberta was collected and integrated with the Forty

Mile Coulee material into a single stone circle indices file. This file is presented in full in Dau and Brumley (1987:723-898). Locational, descriptive and reference data on the sites included in the file are presented in Figure 17 and Table 6. Procedures employed in recording and summarizing stone circle data are presented in Appendix 1.

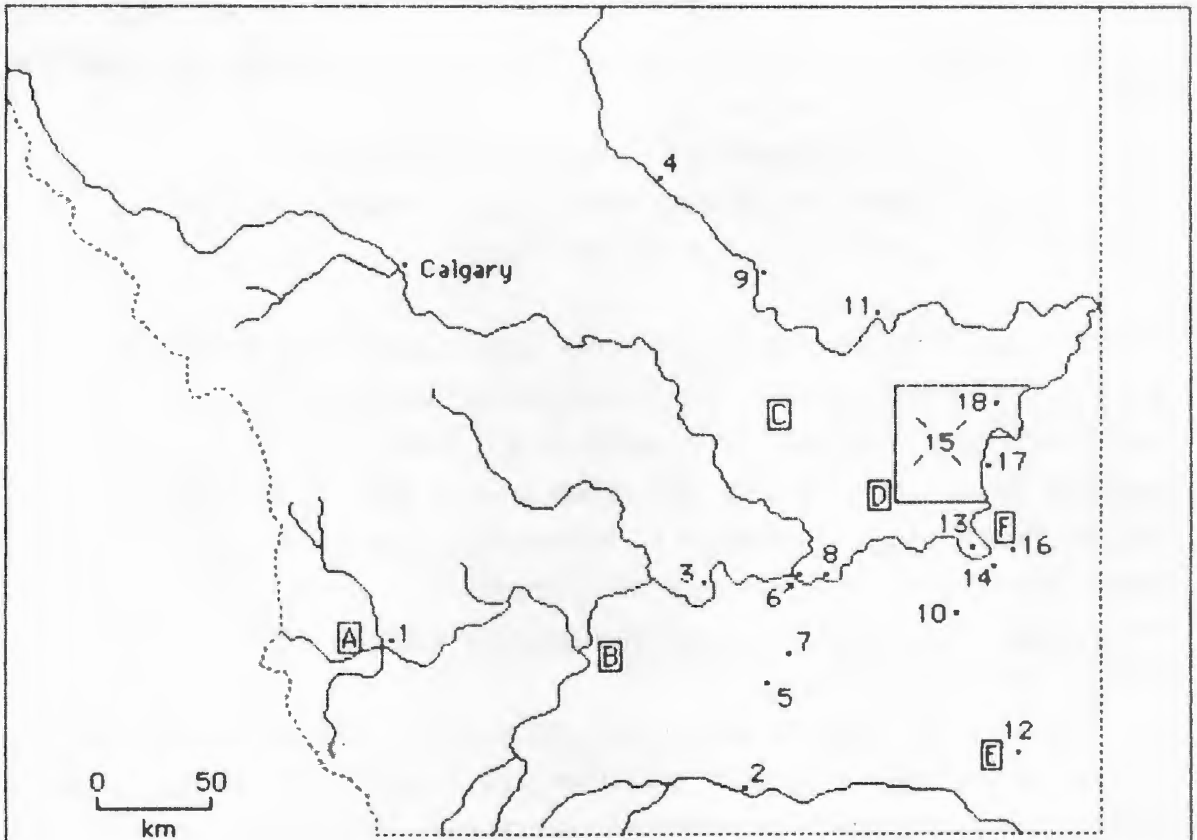
As can be seen in Figure 17, all sites have been grouped according to the nearest weather station in southern Alberta that contains multi-year data, thus allowing for discussion of stone circle structure to focus, when required, on localized climatic information. For example, all sites from the Suffield Military Reserve fall into the category of Group D, as they are most closely spatially associated with the Suffield weather station. In addition, data from the Forty Mile sites, and the features which comprise the camp circle at site EdOp-1, are presented in two ways. They are shown as integrated with their respective weather stations and are presented separately. Separating the Forty Mile sites from other Group E data was done in order to discuss Forty Mile as a unit. Separating the EdOp-1 camp features from Group D was done because those stone circles, which are laid out in the form of a camp circle, are assumed to reflect a single-use event and represent one of the best cases for a set of directly associated features in a site within southeastern Alberta.

8.2 Site Characterization

The data from the 163 stone circle sites included in the stone circle file is considered by the authors to be representative of the range of variation seen in such sites throughout southern Alberta. As a result, it is used as a basis to characterize and examine the nature and setting of stone circle sites on a regional basis. Specific comparisons can be made within this regional sample to the Forty Mile Coulee features to examine significant variation in relation to different geographic or physiographic settings.

At Forty Mile Coulee all but two of the more than 300 recorded stone circles meet the list of criteria stated by Finnigan (1982) as serving to identify a stone circle as a tipi ring:

1. the shape does not deviate significantly from a circle;



PROJECT NUMBER/ ASSOCIATED WEATHER STATION	PROJECT NAME	PROJECT NUMBER/ ASSOCIATED WEATHER STATION	PROJECT NAME
1 A	OLDMAN DAM	10 F	CORRIDA/MURRAY LAKE
2 E	VERDIGRIS COULEE	11 C	SUN OIL/JENNER
3 B	TRANSCANADA 1 :22 WEST	12 E	MED.LODGE/MANYBERRIES
4 C	DOROTHY	13 F	TRANSCANADA BRIDGE
5 E	SR 879 ETZIKOM	14 F	ROSS GLEN
6 D	MURPHYS GRAND FORKS	15 D	SUFFIELD
7 E	FORTY MILE	16 F	TRANSCANADA 1 :22 EAST
8 D	LAIDLAW	17 D	ELLIS
9 C	DEADFISH	18 D	EdOp-1 CAMP CIRCLE

WEATHER STATIONS

A - COWLEY
B - LETHBRIDGE
C - BROOKS
D - SUFFIELD
E - MANYBERRIES
F - MEDICINE HAT

Figure 17: Stone Circle File Individual Project Locations.

2. there are no interior stone features that would render the interior of the tipi ring uninhabitable unless they are clearly a post-use modification;
3. the inside diameter falls between 2.5 and 9 m;
4. the slope of the ground is less than or equal to five degrees;
5. the ground surface is dry and stable.

The only two stone circles at Forty Mile Coulee which may not be tipi rings are found at site DkOu-13. Both have inside diameters in excess of 10 metres and may represent ceremonial or group-use structures. It is also possible these two features are referrable to the Besant complex. As previously discussed (Section 5.3), known Besant complex rings are much larger than rings referrable to other complexes in the region. Neither of these lodge rings at DkOu-13 will be impacted by proposed development and neither was test excavated.

Table 7 summarizes the size of stone circle sites within the sample as a whole, and for the Forty Mile Coulee area in particular. As can be seen, when dealing with the total sample, the majority of stone circle sites are quite small - over 55% consist of from one to three features. When one considers that many of the larger stone circle sites probably reflect multiple occupations of the same locale, it becomes even more apparent that the size of social groups occupying a site at any given time was usually quite small. Data which will be presented in Section 8.3.2 will show that an "average" sized lodge among prehistoric native groups in the region probably contained approximately nine individuals. Aboriginal groups throughout southeastern Alberta were big game hunters, relying on bison as their primary subsistence base. Bison were hunted using a large variety of methods requiring the efforts of from single individuals to large groups (communal kill techniques). The most common communal kill techniques documented for the area consist of bison pound or jump sites. Dyck (1977:56) suggests that operation of a bison pound could be carried out by a camp of 30 people or more. If Dyck's assumptions are correct and if it is assumed that a similar sized camp (four or more lodges) would be required to operate other communal kill operations, it becomes apparent from Table 7 that the majority of stone circle sites in southern Alberta must reflect groups employing individual or small group hunting techniques.

The Forty Mile Coulee stone circle site data exhibit trends similar to those observed for the total sample. Table 7 shows that 62.8% of the sites in the project area contain less than three features per site. Only 32.7% of the sites contain four or more stone circles. If four lodges per camp is considered the minimum required to successfully operate a communal hunt, it is clear that individual or small group hunting techniques were the preferred patterns within and adjacent to the coulee.

One other aspect of stone circle site size requires brief examination here. It deals with the size of aboriginal bands. The term "band" is most commonly used to define a residential group of families which are generally related by marriage or "blood" ties. Vickers (1987:93) has noted that among some Northern Plains native groups band membership could be based upon individual choice rather than kinship. Several bands commonly compose what is referred to as a tribe.

Ethnographic references to the size of native bands during the Historic Period are rare. For the purpose of this discussion the estimate presented by Ewers (1958:9) will be used as it is most applicable to the region under study here. Ewers has estimated that, during pre-horse days, Blackfoot bands were comprised of 20 to 30 families, totalling 100-200 people. If the calculation of 8 or 9 persons per lodge (to be discussed in Section 8.3.2) is used, an archaeological site assumed to represent a band camp should contain a minimum of 12-13 stone circles.

Table 7 shows that only 17.6% of all the sites in the regional stone circle file are sufficiently large enough to be considered as band sized camps. In Forty Mile Coulee only 14.3% of the sites are of sufficient size. The percentages observed in Table 7 may in fact be too high if the sites reflect, as noted above, multiple occupations. If Ewers' estimate is correct, the data in the table indicate that band sized groups may have occupied the region under discussion here. However, their presence was probably minimal. Much more common were small groups, perhaps representing extended families.

Table 8 defines the number codes used in reference to various physiographic settings that are referenced in several subsequent tables. Tables 9 to 11 summarize the average number of stone circles present per site in relation to a number of environmental variables. For any of these data sets, it is assumed that significant differences in average site size values reflect positive or negative selection of those environmental factors by aboriginal groups. High average site size values are interpreted as indicating factors resulting in more frequent selection and repeated occupation of a given locale by both small and large social groups.

Table 9 summarizes average stone circle site size in relation to various physiographic, topographic and surficial deposit settings. In terms of physiographic setting, it can be seen that site size is significantly higher along coulee, stream and river valley edges, and significantly smaller in locales situated on coulee or stream valley walls. For topography, there is a general but not impressive tendency for increasing site size with increasing relief, up to extremes of topographic relief where site size again falls off. In contrast, studies on the Suffield Reserve (Brumley and Dau 1985b) have indicated topographic relief is the most reliable indicator of individual feature density, with a correlation coefficient of + 0.96. That study (ibid) deals with the number of features per unit area in different topographic relief settings and not average site size. Together the two data sets indicate increases in topographic relief results in increased cultural utilization by aboriginal groups. Such increased utilization is apparently only generally correlated to increasing average site size. Both sets of data are generally consistent with suggestions (Section 6) that areas of greater physiographic and topographic relief were preferred by aboriginal groups (both in small groups and band-sized aggregates) as they provide better opportunities to successfully employ the full spectrum of hunting techniques documented for aboriginal groups in the region. Also, such localities generally have a greater likelihood of containing a variety of other resources attractive to man and animals. These include water, woody vegetation and lithic resources. The small average size of sites in coulee valley wall locations is considered to reflect in part, the frequent topographic space limitations imposed on potential site size, as well as the high rate of deposition to be expected in such locales, especially at Forty Mile Coulee. This latter factor would commonly result in all but the most recent stone circles being quickly buried.

Adequate sized samples relating average stone circles site size to surficial deposits are only available for three deposit types: hummocky moraine, meltwater channel sediments and glaciolacustrine silt and clay. The observed differences in average site size between these deposits is interpreted as reflecting related differences in topographic relief.

Tables 10 and 11 summarize average stone circle site size in relation to wood and water resources. In relation to wood for samples of 10 sites or more, there is a marked increase in average site size in areas accessible to large stands of brush and timber. This association is consistent with the previously presented regional settlement model. Wood for fuel is assumed to have been of major importance during cold periods of the year when lodges needed domestic heating and at sites where considerable stone boiling activity took place. At other times of the year, woody fuel may not have been a critical fuel resource, but preferred to buffalo chips when available.

Table 11 indicates a positive correlation between average stone circle site size, water presence and long-term water availability. Year-round streams and major rivers are areas of best water quality, greatest reliability and also where the greatest average site size is found. Such locales would be most amenable for use by both small social groups and by band-sized units. Conversely, average site size in areas where water is absent is lowest. The only apparently inconsistent value is of average stone circle site size in locations adjacent to year-round lakes. The value of 4.3 stone circles per site is much lower than expected in relation to other values in the table. Table 11 indicates that most of the sites coded as having water provided by year-round lakes are from the Forty Mile Coulee area, where the largest lake presently within the proposed reservoir was considered for coding purposes to be a permanent year-round water body. However, as has already been noted (see Section 3.2), it is possible that the lakes in the coulee bottom were not year round, but generally more seasonal and ephemeral in nature, possibly drying up by mid or late summer. Such a possibility seems more consistent with the values presented in Table 11.

The discussion presented here on the relationship between stone circle frequency in relation to topographic relief, physiographic setting and surficial deposit types supports related aspects of the settlement model presented in Section 6. Examination of trends exhibited by the three sets of data indicate all are major factors influencing the density and distribution of stone circles and stone circle sites. The best explanation for these relationships appears to be the varying opportunities for hunting success offered by different physiographic and topographic settings. As well, different surficial deposit types offer varying conditions which may mitigate for or against use of stones as one of a variety of mechanisms used to secure lodge covers (Quigg and Brumley 1982).

The examination of the significance of wood and water in structuring stone circle site size again suggests that the presence of both is a positive factor in site selection. This again supports the settlement model presented in Section 6. Water resources appear to be a major factor affecting stone circle site selection, with locales favored by increasingly long-term and larger water sources showing increasing evidence of aboriginal utilization. One apparent exception to this is a lower than expected frequency of stone circles around year-round lakes. The possible reasons for this exception have been discussed.

The various environmental parameters discussed above can be utilized to suggest site seasonality if they are combined with other known aspects of aboriginal adaptation to the Northern Plains environment and climatic data from the region. One assumption made here is that the present climatic conditions are generally similar to those found during the period reflected by our sample of stone circles and stone circle sites.

According to Kendrew and Currie (1955), temperature data show that southeastern Alberta has only two definable seasons, summer and winter. In winter (November-March) mean monthly temperatures rarely exceed 0^{0} C with mean daily maximums usually never above -6^{0} C. Individual daily extremes below -40^{0} C are not uncommon. During the summer months (May-September), mean monthly temperatures average 10^{0} C. Mean daily maximums during this period can exceed 21^{0} C and mean daily minimums are rarely below 4^{0} C. The two transition months (April and October) exhibit widely varying conditions.

Precipitation data (Kendrew and Currie 1955) show that southeastern Alberta is quite dry. Yearly moisture accumulation rarely exceeds 400 mm. In general, only 60-80 days per year have some type of rain or snow fall. In fact, it is not uncommon for an entire month to pass without any type of precipitation. The wettest period of year is between May and October, with up to 70% of the yearly moisture accumulation occurring at this time. The driest period is between December and February. Snow accumulation is minimal in the winter and it is uncommon for more than 800 mm to fall during the entire season.

Wind patterns exhibit localized variation that may be of importance to understanding stone circle structure. As a result, wind data will be dealt with in more detail later in this section. Because of the noticeable similarities in temperature and precipitation throughout southeastern Alberta, the authors have chosen to utilize detailed data from only one locale (Medicine Hat) as a basis for the following discussions.

Figure 18 summarizes mean temperatures on a monthly basis. If the features in the stone circle file (Dau and Brumley 1987:723-898) were occupied during periods when mean temperatures were below 0° C some type of interior heat source would probably be required. In the archaeological record, physical evidence of interior heating is usually evidenced by interior central hearths. Hearths have also been interpreted as features for food

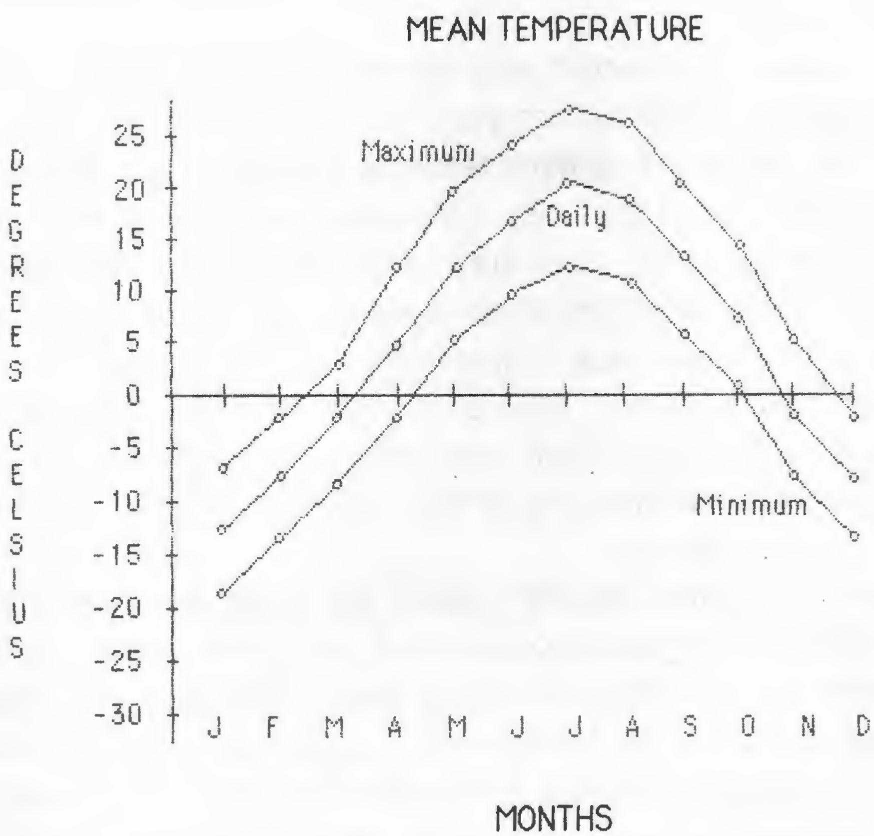


Figure 18: Monthly Mean Temperature Values For Medicine Hat, Alberta.

processing and manufacturing. For these activities, however, the hearth could be situated outside the lodge.

Table 12 details the nature and number of possible features found associated with the stone circles in the southern Alberta stone circle file. The majority of these were identified during the processes of limited stone circle mapping. Often simple clusters of stones near the center of a stone circle were interpreted as central hearths. It was rare that detailed examinations were undertaken to confirm the initial identification. Thus, the values presented in Table 12 can only be used as general rather than absolute indicators of the presence of associated features. However, the data does provide a general basis for examining the relative presence of features in various settings. If it is assumed that all surface indicators do, in fact, represent central hearths Table 12 shows that such features are uncommon. Only 52 (7.6%) of the 686 stone circles in the stone circle file contained evidence of a central hearth. Thirty-three of these were situated within Forty Mile Coulee.

The low frequency of apparent interior hearths represented in the sample suggests a general trend for occupation of these stone circle sites during periods of the year with high daily temperatures and longer daylight. The mean temperature curve (Figure 18) indicates the period of the year best fitting this situation is from about April to the end of September, when mean daily minimum temperatures are above freezing. During the months of June, July and August, high mean temperatures would probably have mitigated against interior fires. Increased solar radiation and mean temperatures, again particularly during June, July and August, would also allow greater use of solar and air drying of meat, thus reducing the need for either interior or exterior hearths.

Where evidence of central interior hearths are found, they tend to be associated with greater than average densities of cultural material. Thus, the presence of central interior hearths may be interpreted variously. They may reflect occupation outside the monthly range suggested here. They may reflect episodes of occupation during the period from mid April to mid September when minimum temperatures were unseasonally low. Finally, central hearths may reflect longer term occupation. Quite probably all three explanations are correct in various contexts. Of major importance, however, is the fact that the low frequency of central hearths, and the yearly mean daily temperature pattern for the region, suggests most stone circles reflect mid April to mid September occupations.

An example from Forty Mile Coulee, which reflects the assumption of greater amounts of cultural material associated with stone circles containing hearths, is site DjOu-62. As will be noted later in this section, two of the four features recorded during excavation were found associated with Stone Circles 12 and 13, both were hearths. These stone circles contained a higher than average amount of faunal material, suggesting a duration of occupation longer than the average for sites in the project area.

The assumption that the presence of central hearths in stone circles is a reflection of longer periods of occupation can be tested by examining the frequency of hearths present in stone circles situated in different physiographic locales. The settlement model (Section 6.0) has suggested that sites situated in open prairie locales were not occupied for lengthy periods of time due to the reduced presence of useable resources. Table 12 shows that of the 456 stone circles situated in open prairie areas (physiographic zones 2.1, 2.2 and 2.3) only 1.6% contain evidence of central hearths. In coulee areas, the settlement model suggests short to moderate length of occupation due to an increase in the amount and variety of useable resources. Table 12 shows that 8.1% of the 119 stone circles situated on coulee areas (physiographic zones 1.1, 3.1, 3.2, 3.3, 6.1, and 6.2) contain evidence of central hearths. Finally, the settlement model indicates that sites situated in river or stream valley zones might be occupied for the longest period of time due to the presence of a wide variety of useable resources. Of the 11 stone circles situated in river or stream valley zones (physiographic zones 1.2, 1.3, 4.2, 5.2 and 5.3) Table 12 shows that 11.7% contain central hearths. As well, such locales are the most likely locales represented in the sample where aboriginal groups may have been residing at periods of the year where interior hearths would have been necessary for heating. Admittedly, the size of the sample used for analysis here is small, but it shows a clear pattern. The percentage frequency of central hearths increases in those areas suggested by the settlement model as amenable to an increase in the length of occupation or where interior heating would be required.

Figures 19 and 20 summarize yearly precipitation patterns. As can be

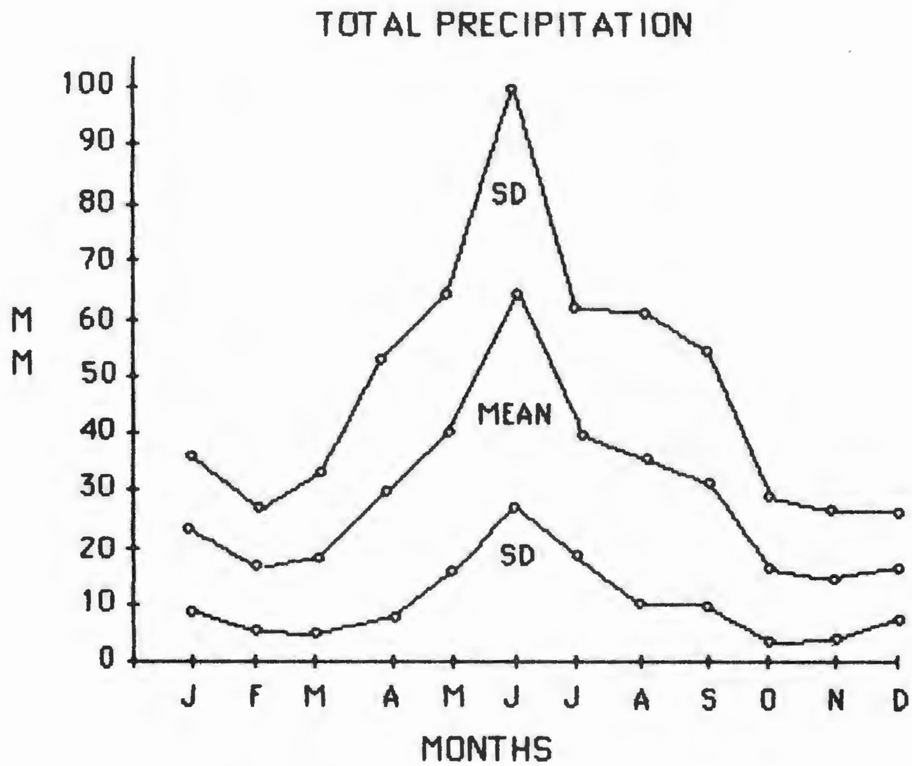


Figure 19: Monthly Mean Precipitation Values, Medicine Hat, Alberta.

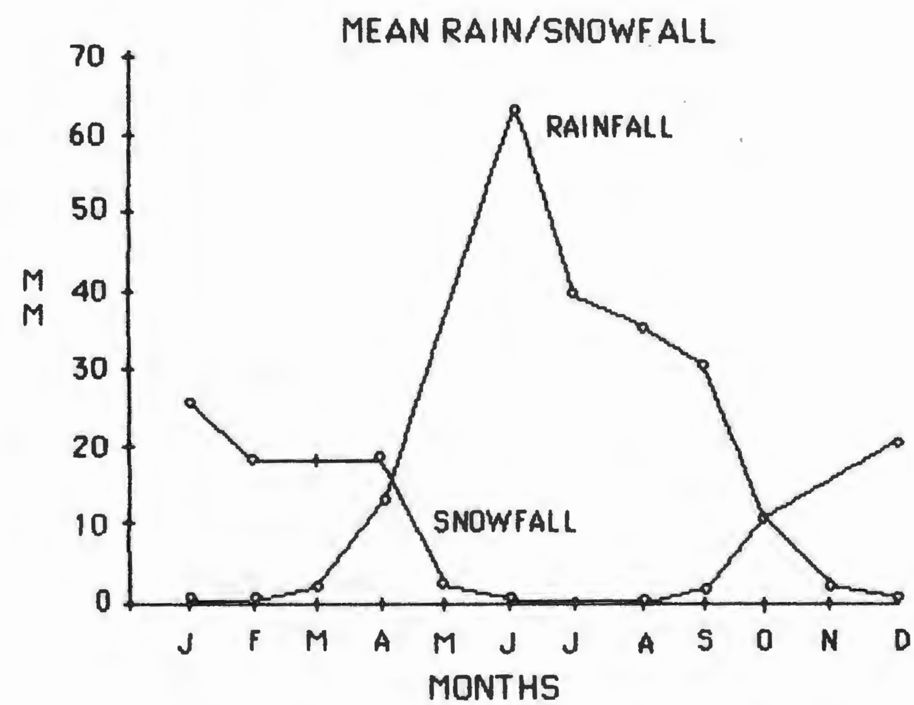


Figure 20: Monthly Mean Rain and Snowfall Values, Medicine Hat, Alberta.

seen, the period of greatest moisture abundance is during the months of April, May and June. Beginning with the melting of winter snow and continuing throughout this period, it is anticipated that seasonal lakes and streams will most frequently contain water for use by both aboriginal groups and herds of bison. After this period, such water sources will only infrequently contain water. Water resource availability was noted as apparently being a significant factor in mean stone circle site size, with the majority of sites and features in the sample (Table 11) being situated in association to such seasonal water sources. The largest sites are situated near year-round water sources in the form of streams and rivers. Presumably these locations could have been utilized throughout the seasonal span of mid April to mid September suggested for occupation of most stone circle sites, but may have been used more frequently and to the general exclusion of other areas from mid to late summer onward.

8.3 Stone Circle Configuration

8.3.1 Introduction

Most, if not all archaeologists familiar with stone circles have at one time or another observed a stone circle with a well defined gap in a section of its wall and/or with a concentration of stones along another portion of the wall. Traditionally, based on "common sense" and limited ethnographic evidence, archaeologists have interpreted the gap in such "classic" features as the doorway location and the area of stone build-up or concentrations as reflecting prevailing wind direction at the time of occupation. However, as most researchers are also aware, the majority of stone circles do not display these features in a "classic" way easily interpreted in the manner mentioned. Sometimes more than one gap may be present in the ring wall or no gap at all. Stone walls may show no clear cut concentration of stones or concentrations in more than one area. As well, even when these occasional "classic" features are present, it is unclear whether the above traditional inferences are in fact valid, to what extent, and how they can be employed in interpretation.

The following subsections examine various aspects of stone circle structure and form in an attempt to test various assumptions and suggestions held by the writers and other researchers. In the original research design (see Section 6.10) four hypotheses concerning stone circle structure and form were formulated which bear reiteration here:

1. The directional sectors containing the least number of stones predominantly reflects lodge doorway location.
2. The directional sectors containing the greatest number of stones within a stone circle reflects strongest and/or prevailing wind direction at the time the lodge reflected by the stone circle was occupied.
3. Where directional differences exist in the diameters of a stone circle, the longest directional diameter will reflect the orientation of the aboriginal lodge with the doorway location situated at one end.
4. The interior area of a stone circle is a direct reflection of the size of a social group inhabiting the lodge it represents.

It can be seen that the above hypotheses are based on the assumption that:

1. The size and shape of a stone circle is normally an accurate reflection of the size and shape of the lodge with which it was associated.
2. Differences in density of stones within the directional segments comprising a stone circle normally reflect responses to conditions at the time the aboriginal lodge was occupied.

Utilizing the stone circle data file, the following subsections examine the various hypotheses generated in the research design and the basic assumptions on which they are based. For this examination, data on wind flow frequency and velocity by direction are utilized in examining a number of stone circle data sets. Wind flow data from six weather stations throughout southern Alberta are presented in Table 13. Weather station and spacially associated stone circle project locations are indicated in Figure 17. Stone circle examination involves lumping and segregating stone circle information into a number of differentially configured data sets depending on specific points being examined. Data is presented in a series of tables which are visually examined looking for clear data tending. Certain data sets are compared by means of correlation coefficient tests using a commercially available microcomputer program (The Cobb Group 1986). The returned correlation coefficient value,

> ...is a measure of the degree of reciprocal change in a group of values that is, what percentage of the variation in the dependent variables....is 'explained' by the variation in the independent variables....the correlation coefficient can range from 1 - perfect correlation, to 0 - no correlation....a coefficient value of .89....indicates that 89 percent of the [dependent variable] can be explained by the corresponding variation in the [independent variable]. (The Cobb Group 1986:57-58)

In comparison of weather to stone circle data, the weather data is always considered the independent variable. It is assumed here, based on an extensive examination and evaluation of both the archaeological and ethnographic literature, that the stones comprising a tipi ring were positioned on the ground along the exterior margin of the lodge cover. It is further assumed that the interior diameters (see Appendix 1) provide the best basis for approximating the area and floorplan shape of the respective aboriginal lodges reflected. Although we are well aware of the many occupational and post-occupational factors which could have altered the structural nature of a tipi ring (see Quigg and Brumley 1984; Finnigan 1982), identifying the occurrence of such factors is usually impossible. The use of grouped and meaned feature values is felt to minimize the effects of such factors in data evaluation.

8.3.2 Stone Circle Size

Of the 686 stone circles included in the stone circle file (Dau and Brumley 1987:723-898), 651 were sufficiently well defined to allow for the calculation of mean inside diameters. Overall sample means are presented in Table 14. For the total sample, mean inside diameters vary from 2.31 to 8.57 metres with an overall mean of 4.60 metres. At Forty Mile Coulee the range is from 2.40 to 7.50 metres with an overall mean of 4.45 metres.

Inside diameter data are used to calculate interior floor areas of stone circles which can then provide the basis of estimating number of occupants. The first step in this process involves an examination of the historic record to determine if sufficient data on aboriginal populations are available for study. While references to population size are not abundant in the record, enough are available to provide a suggestion of the average number of occupants in a lodge. Table 15 presents 35 population estimates collected during the Eighteenth and Nineteenth Centuries from ten aboriginal groups occupying the Northern Plains. As can be seen, the average number of occupants per lodge for each tribal group varies slightly. The lowest is 7.5 persons per lodge for the Assiniboine and the highest is 10 persons per lodge for the Crow. The average for all tribal groups is 7.9 persons per lodge. As discussions dealing with tenths of a person are not realistic, this figure is rounded off to 8 persons per lodge.

While the historic record contains occasional population estimates, rarely does it contain estimates of the size of an average lodge. Apparently, it was common practice for European observers to discuss in detail only the largest and most impressive lodges in a camp, those belonging to high status individuals. Data collected from Forty Mile Coulee provides some information on the size of an "average" sized historic lodge. Table 16 presents inside diameter data on 27 dated stone circles from the project area. Nine of these contained historic trade goods in good associated contexts. Inside diameters of these stone circles vary from 2.80 to 5.45 metres, with a mean of 4.33 metres. Although this sample is small and may not be completely reflective of historic lodge size, it is currently the only data base available for the region and it is assumed here to be representative.

The procedures employed by various researchers (Dau 1983; Deaver 1985; Finnigan 1982) to estimate the number of occupants in a lodge have been based upon generating a formula which calculates the number of persons per square metre of floor area. This has been done in order to provide estimates for lodges of differing size. Finnigan (1982) has suggested that the formula employed by Cook and Heizer (1968) be used in stone circle studies. Cook and Heizer (ibid) calculated a figure of 0.54 persons per square metre of living floor area. At Forty Mile Coulee lodges of known historic age (Table 16) have an average mean inside floor area of 14.72 square metres. Multiplying this by 0.54 results in an estimate of 8 persons per lodge. This is in agreement with the average number of occupants per lodge noted for the historic record, suggesting that Cook and Heizer's figure is acceptable for stone circles of known historic age.

Whether the figure of 0.54 persons per square metre of floor area can be used to infer the number of occupants in a lodge of prehistoric age is a question which, at present, cannot be answered with any degree of accuracy. The data from Forty Mile Coulee does however, provide one line of evidence which suggests the value may be applicable to aboriginal prehistoric structures as well. Kehoe (1960) has suggested that with the introduction of the horse at the beginning of the Historic Period, lodge size increased substantially due to the increased transport efficiency of horses. Table 16 presents data on 13 stone circles from Forty Mile Coulee of known Late Prehistoric age. Mean inside diameters for these features range from 2.82 to 5.23 metres with an overall average mean of 4.05 metres. The table also presents inside diameter data on five stone circles with radiocarbon dates which suggest they date to an interface period between the Prehistoric and Historic Periods. These features have mean inside diameters ranging from 3.50 to 5.70 metres, with an overall mean of 4.11 metres. As noted above, known historic stone circles in the project area have an overall mean inside diameter of 4.33 metres. The data in Table 16 show that there is a limited increase in lodge size from the Late Prehistoric to the Historic Period. This increase is very small however, representing a maximum change of 6.9% in overall mean inside diameter. The noted increase is apparently of minimal significance and quite possibly representing the small size of the sample. It would seem that there is a continuity in lodge size from the Late Prehistoric to the Historic Period. The similarity of average ring diameters between the Historic and Late Prehistoric stone circles suggests that an estimate of eight persons per lodge in the Late Prehistoric Period is not unreasonable.

In order to further test whether the average number of occupants per lodge was similar in the Late Prehistoric and Historic Periods, Table 17 was generated. It presents the density per square metre of various classes of cultural material recovered from the same set of dated stone circles used to generate Table 16. The basic assumption underlying this test was that all else being equal, similar numbers of people per lodge would leave similar amounts of cultural material behind and that a continuity in material density from the Late Prehistoric to the Historic Period would be observable. A close examination of Table 17 shows that the expected trend is not clearly indicated. Density patterns of certain classes of material decrease from the Late Prehistoric to the Historic Period, others increase. On an individual feature basis, the range of variation in overall densities is so great that the calculated means may not reflect reality. It is assumed that factors of artifact preservation, minimal changes in length of occupation and the small size of the sample of features examined have obscured observable trends. It is obvious that an examination of density patterns on this level cannot provide convincing evidence to either prove or disprove the assumption that there were similar numbers of people per lodge in the Prehistoric and Historic Periods. Although the data in Table 17 are of limited value in examining possible changes in population structure, they are of interest in studying changes in cultural activities between the Prehistoric and Historic Periods. A number of differences are present in the table which warrant further discussion. Such discussion will be presented in later, more relevant portions of the text.

As was noted above, the value of 0.54 persons per square metre of floor is considered applicable in estimating the average number of persons in lodges of historic and prehistoric age. For the total sample of features in the stone circle file, it has been noted that the overall mean inside diameter is 4.60 metres. This gives a mean inside floor area of 16.61 square metres. Multiplying this by 0.54 results in an estimate of nine persons per lodge for the region in general. At Forty Mile Coulee the overall mean inside diameter of stone circles is 4.45 metres. This results in a mean inside diameter of 15.54 square metres and an estimate of eight persons per lodge.

Using a variety of ethnographic and archaeological sources, Brumley (1983a:83) has expanded Finnigan's (1982) original data on lodge size and population to include estimates on the number of dogs needed to transport lodges of various sizes and the amount of bison meat required to support various sized households on a daily basis. These estimates are summarized in Table 18. While the table covers most of the data applicable to this study, certain factors of potential significance are not addressed. For instance, no provision is made for the number of dogs needed to transport items other than the lodge. Also, no provision is made for the use of dried meat brought to the site and used as a dietary resource. In spite of these and other limitations, the parameters in Table 18 provide a general basis for estimating population size and the amount of meat needed for daily group maintenance.

As shown in Table 7, an average sized site from the region in general contains approximately seven stone circles. Based upon an estimate of nine persons per lodge, an average site contained 63 individuals. At Forty Mile Coulee, an average site contains five stone circles. Based upon an estimate of eight persons per lodge, an average site in the project area reflects the activities of 40 people.

Using faunal remains (see Section 8.5.3) recovered in excavation, estimates of the amount of meat available for utilization can be made which suggest possible duration of occupation in the project area. In terms of bison, the majority of stone circles contained materials that represent a minimum of one and occasionally two animals. Utilizing the data in Table 18 it is possible to suggest that the majority of stone circles in the project area reflect occupations no greater than three days in length.

Another interesting aspect of the data presented in Table 18 relates to the transport efficiency of lodges of varying size. As noted earlier, Kehoe (1960) has hypothesized an increase in lodge size at the beginning of the Historic Period due to the presence of horses. Prior to the horse, Kehoe (ibid) suggests that lodge size was relatively small due to constraints imposed by dogs as a means of transport. Finnigan (1982), however, has demonstrated that this size constraint could have been overcome prehistorically by mechanisms such as segmenting the lodge cover into manageable sized pieces for dog transport. The largest sized stone circles for which temporal and cultural control is currently available within southeastern Alberta relate to the Besant Complex (Figures 13-15) which clearly indicates that dog transport prehistorically was not a limiting factor in lodge size. Use of larger lodges actually has a transport advantage. If the total lodge weight is divided by the average number of inhabitants for lodges of increasing size, the amount of lodge weight per individual decreases significantly. This reduces substantially the number of dogs per individual required for transport. For example, lodge weight per individual inhabitant for a two metre diameter structure is 41.4 kg; for an 8.5 metre diameter it is 14.7 kg.

As a final comment, it must be noted that the data presented here have suggested the average lodge size did not increase with the introduction of the horse. It is possible that dog transport remained the primary method of lodge movement for the average aboriginal group in the Historic Period. Using horses to transport lodges may have been restricted to high status and/or horse wealthy individuals, thus allowing them to have the large lodges noted in the historic record.

8.3.3 Pattern of Stone Placement

As noted, ethnographic evidence and field observation indicates directional patterns of stone placement along the wall of a stone circle can be interpreted to indicate doorway location and wind direction at the time of feature occupation. However, few empirical tests of these assumptions have been made. The following section examines and tests various assumptions concerning placement and density of stones within stone circles utilizing various data sets from the stone circle file. Several of these tests utilize regional weather data summarized in Table 13. The writers fully appreciate the potential weaknesses of utilizing such recent historic weather data in attempting to examine relationships to features of considerable antiquity. However, it is argued such weather values are still the best and probably only data base available to examine such questions. The reader should also appreciate that the weather data presented in Table 13 represent meaned values characterizing wind velocity and frequency for entire monthly periods.

Figures 21 and 22 graphically illustrate annual wind frequency and velocity (Figure 17) values by direction for the Manyberries weather station, the station closest to Forty Mile Coulee and other Group E sites. Wind frequency values in Figure 21 indicate the percentage frequency of time during a month that the prevailing wind is from a given direction. Wind velocity data in Figure 22 measures the mean force of wind from a given direction during various months. Actual values in Figures 21 and 22 have been scaled down by a factor of 10 for graphic purposes. As can be seen the frequency and velocity of wind from a given direction can vary considerably. For instance, east winds are quite frequent in occurrence but low in velocity. Northwest winds in contrast occur frequently and are of high velocity. A question which should be asked is if winds do influence lodge

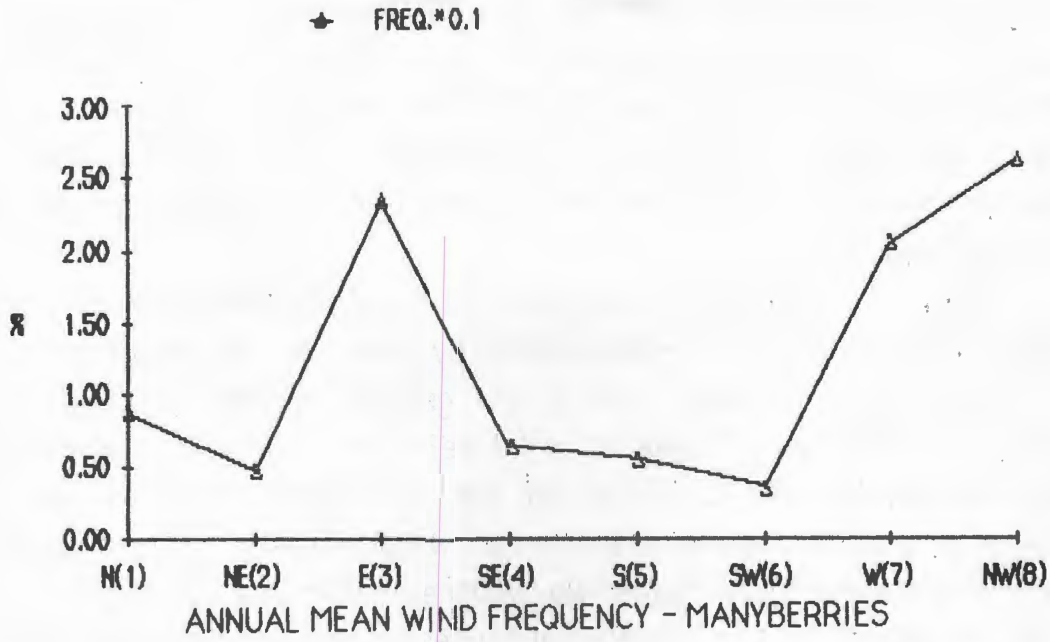


Figure 21: Percentage Frequency (x 0.1) of Wind by Direction For Manyberries Weather Station.

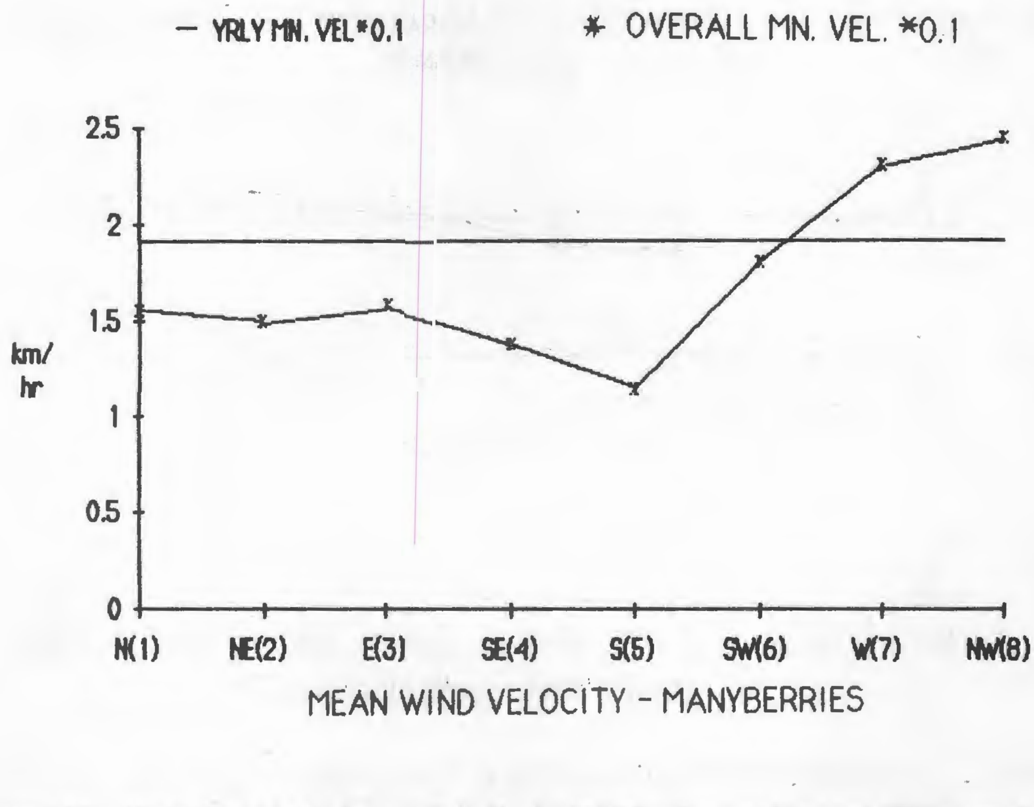


Figure 22: Mean Wind Velocity (km/hr x 0.1) by Direction For Manyberries Weather Station.

orientation and stone placement, which is most important - wind frequency or velocity. Examination of values in Table 19 for Group E features in general and Forty Mile features in particular, indicates a general positive relationship between increasing wind velocity and the mean number of stones per metre of circumference. No relationship is indicated for wind frequency data.

Figure 23 graphically illustrates this relationship between mean number of stones and mean wind velocity by direction. As can be seen, the directional sectors characterized by the greatest number of stones also reflect the direction of greatest wind velocity. As well, the opposing directional sectors (NE, E, SE) contain the least number of stones and are characterized by below the yearly mean wind velocity. This pattern is consistent with and supports the two hypotheses (Section 8.3.1) which state sectors containing the least number of stones reflects doorway location and the greatest number of stones reflect the direction of strongest wind

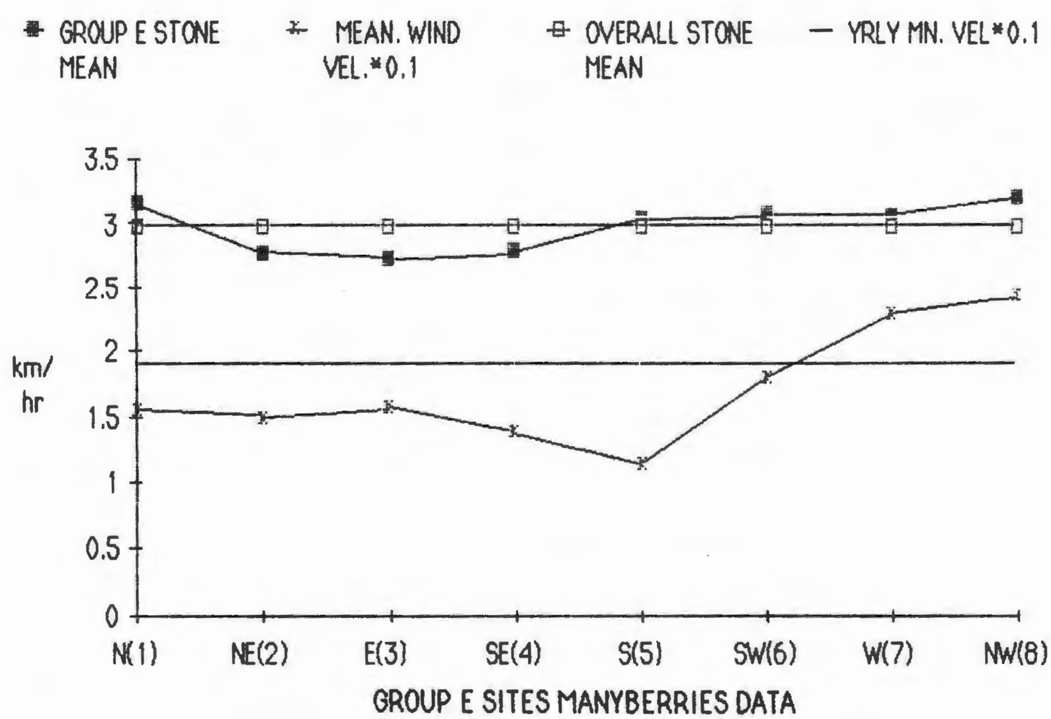


Figure 23: Mean Wind Velocity (km/hr x 0.1) and Mean Number of Stones Per Metre of Circumference, Group E Stone Circles, Manyberries Weather Station.

direction. Also, note that the sectors containing the greatest and least mean number of stones are diametrically oppposed to one another.

The above data suggests there can be a multiplicity of doorway orientation dependant on the direction of highest velocity winds at the time of feature occupation. For Group E sites which include Forty Mile, greatest wind velocity is from the SW, W and NW with apparent opposing doorway orientation to the NE, E and SE (Figure 23).

If as appears to be the case, stone placement does reflect doorway orientation and winds at the time of occupation, the question arises of how accurately or sensitively do stone placement patterns reflect past wind patterns? Can such placement patterns be used to infer seasonality of stone circle construction and use? Can stone placement patterns be used to infer association and/or contemporaneity of stone circles within a site? To examine these questions, specific sets of data were extracted from the stone circle file and compared by means of correlation coefficient values (Tables 21-25). Correlations were calculated between mean number of stones per metre of circumference for each directional sector (Table 19) in relation to corresponding sector mean wind data from appropriate weather station data (Table 13).

Table 21 compares grouped stone circle data from various locales within the stone circle file (Figure 17). In general terms, the table does not imply a high degree of correlation between given months of the year and any stone circle data set. However, comparing the correlation values based on wind flow frequency in contrast to those values based on wind flow velocity, we see that as a whole the latter demonstrate an overall higher level of correlation. This is consistent with earlier discussion of wind velocity being most important in stone circle construction. The highest degree of correlation is demonstrated by Group E and 40 Mile sites with March showing the highest correlation followed closely by high correlation values for November, January and October. The proposed settlement model and faunal evidence to be presented (Section 8.5.3) is consistent with the high correlation in March. However, at least some of the other grouped stone circle samples are believed to represent a broader seasonal spectrum of occupation making a straight forward interpretation of data from these samples difficult.

A second test of the utility of stone patterning as a seasonal indicator is presented in Table 22. Table 22 examines stone values for specific features at Forty Mile containing seasonally sensitive foetal or newborn bison calf remains (see Section 8.5.3). Based on a peak period of calving during May, these suggest a range of occupation of from March to June. Again, wind velocity reflects the highest degree of correlation. Highest correlation values are reflected for DjOu-62, SC-11 and for the sample averaged as a whole. In both instances, however, the high correlation values are not specific to a given month or even to a seasonally limited portion of year.

A final test (Table 23) was run between weather data for the various months. As can be seen, there is generally a high degree of correlation throughout. This suggests the patterns of wind flow frequency and velocity are relatively uniform throughout the year with little monthly or seasonally distinctive patterning. This explains why in Tables 21 and 22 that when we do see a higher level of correlation it is not that seasonally or monthly specific in nature.

A final question to be examined concerns whether similarities and differences in stone circle patterning can be used to suggest association or lack of association between spacially associated stone circles. For this test, two samples were extracted from the stone circle file and correlation coefficient values calculated between the various stone circles comprising each sample. The first sample employed is from site EdOp-1, the British Block medicine wheel and stone circle camp (Figure 24). EdOp-1 has been examined and reported on elsewhere by Wormington and Forbis (1965) and Finnigan (1982). From the perspective of this test, a number of stone circles at EdOp-1 are laid out in the shape of a camp circle analogous to ethnographic examples,

> The circle....was the formation employed when the whole tribe was together. When bands were separated from the main group they might or might not camp in this way, depending somewhat on the length of time they expected to remain in one spot, and on the nature of the terrain. (Flannery 1953:28)

It is assumed here that individual stone circles comprising the camp circle are contemporaneous representing a single occupational event. Other stone circles outside the camp circle may or may not be contemporaneous with the

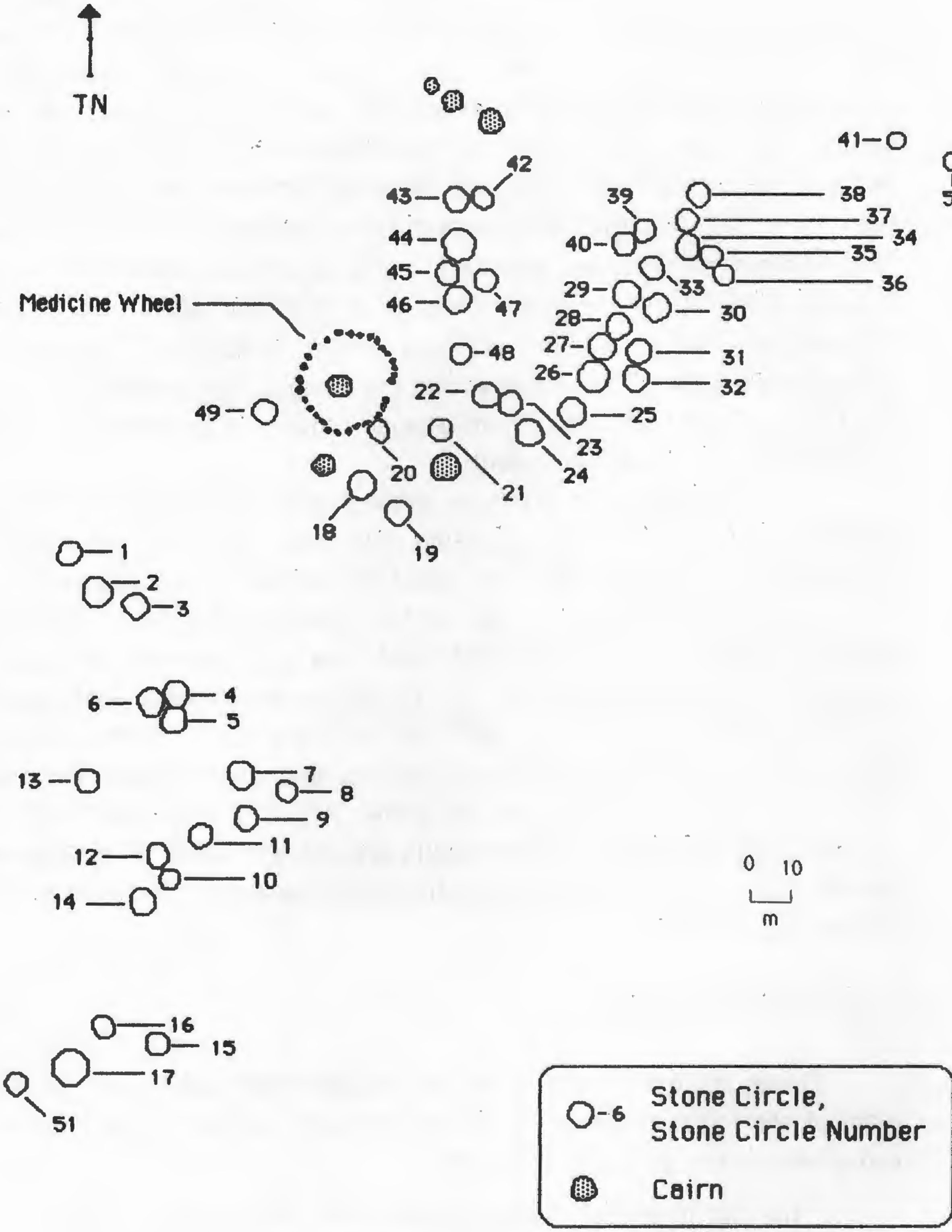


Figure 24: Plan Map of EdOp-1. (Adapted from Finnigan 1982)

camp circle or with one another. Table 24 summarizes the result of correlation coefficient run between various features of the camp circle and two small clusters of stone circles away from the camp circle. Correlations were run between all possible stone circle pairs. For each pair, corresponding stone counts per directional sector were compared for (correlating) increases or decreases. An examination of Table 24 indicates there is little correlation between features of the camp circle or the other two clusters of features examined. Only a limited number of paired features demonstrate correlation values of 0.50 and above. In general, although the site map of EdOp-1 provides the best evidence of an associated, contemporary sets of tipi rings within the camp circle, patterns of stone placement as examined here do not provide convincing evidence supporting such association or contemporaneity.

A second test of the utility of stone patterning as a test of feature association was carried out utilizing data from DjOu-62 at Forty Mile Coulee (Table 25, Figure 25). The spacial distribution of features at the site suggests the presence of four or five discrete groupings or clusters. Faunal evidence (see Section 8.5.3) from the site provides seasonality evidence from Stone Circles 10, 11, 12 and 14 which along with spacial clustering can be used as a basis for inferring their contemporaneity. Because of a lack of feature definition, reliable stone counts and other observations could not be made for Stone Circles 3 and 4 and they are excluded from examination. Data results presented in Table 25 again do not provide good or concurring evidence for contemporaneity of various groups of features at DjOu-62.

8.3.4 Stone Circle Shape

Ethnographic and historic sources indicate that rarely were the floor plans of aboriginal lodges truly circular in nature. Often they were oval to egg-shaped with a definable long axis.

> The tipi is steeper behind than in front. This enables it to brace the better against storms, which come from the west in this region....the floor is not circular but ovoid, flattened behind and longer from front to back than from side to side. (Campbell 1915:691)

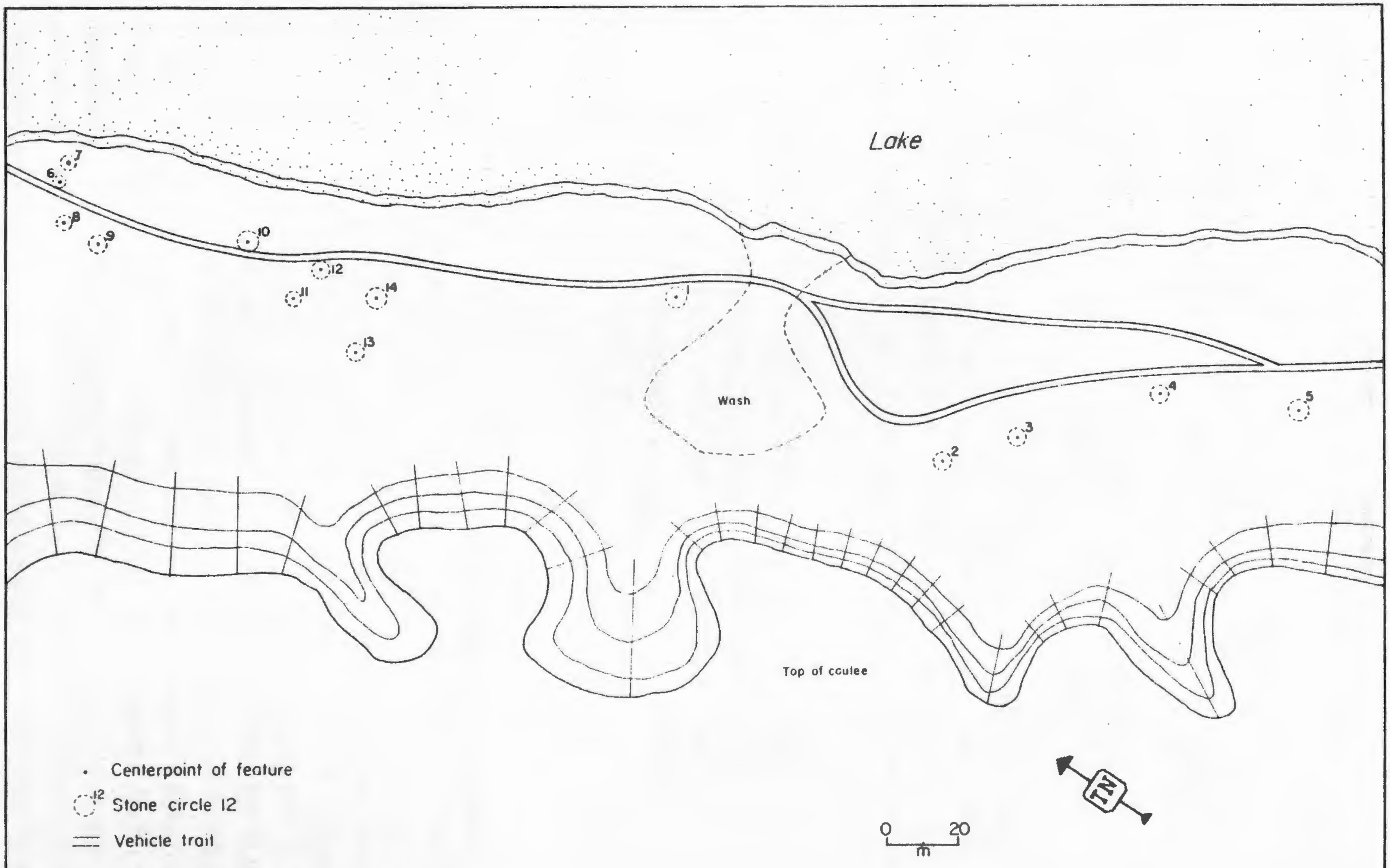


Figure 25: Plan Map of DjOu-62.

Ethnographic accounts suggest doorways were faced east, southeast, or downwind.

> ...the lodges....faced toward the east southeast, from utilitarian consideration, since the prevailing winds were from the northwest in winter and west in summer. (Cooper 1957:55)

Given that wind flow in southern Alberta is often lengthy and of considerable velocity, it should be expected that data on the inside diameters of stone circles from the region would indicate this ethnographically documented oval shape. An examination of Table 14 shows that while there are differences in the mean inside diameters of the recorded stone circles, when taken as a whole these differences are small. Variations between the longest and shortest axes of less than 2% suggest that:

1. stone circles are more circular in character than the ethnographic record suggests one would expect; or
2. during dismantling of the lodge, stones were shifted in a manner which obscured the true shape of the structure; or
3. there were a multiplicity of long axes orientations and that the combination of orientations within a given sample obscures trending.

Based on the other lines of structural evidence which have been presented it would appear that there is a multiplicity of doorway orientations probably associated with long axis orientation which is obscuring general trends. For Group E including Forty Mile sites, doorway orientation appear concentrated to the Northeast, East and Southeast. If this is the case, trending in three of the four associated long axes orientations would presumably be obscured. Only one long axis (N-S) orientation should not be affected by such multiple doorway location. An examination of Group E and Forty Mile data in Table 14 indicates the lowest mean inside diameter value is along the N-S axis. This is consistent with what one would expect if the ethnographic model is correct. Evidence does not suggest North or South were preferred as common doorway orientation at Forty Mile. This N-S inside diameter values should be generally shorter than the axis through the doorway and have the least tendency of being obscured by multiple doorway orientation.

Although this data suggests stone circles do reflect the oval shaped floor plan documented ethnographically for aboriginal lodges, field observation and examination of individual feature data indicates long axis orientation is not always well defined with differences between various axes values often being no more than a few cm.

8.3.5 Discussion

The section on stone circle configuration has shown that an understanding of the structure of these features can be used as an aid in interpreting aboriginal group size, as well as the orientation of aboriginal lodges. The section has also shown that correlations can be reasonably made between ethnographic data concerning lodges and archaeological stone circle remains. The authors note, however, that the observations made here reflect general patterns rather than feature specific attributes. In many instances, individual stone circles will not exhibit the "classic" features or attributes previously mentioned. In conclusion, the derived data have shown that ethnographic information on the number of occupants per lodge can be used to infer estimates of aboriginal group size that are consistent with archaeological models.

Patterns of stone placement have been shown to be indicative of lodge orientation. The directional sectors containing the least number of stones appear to commonly reflect lodge doorways. In the Forty Mile area these doorways were most commonly oriented to the northeast, east and southeast. Finally, the directional sector containing the greatest number of stones usually reflects prevailing winds at the time of occupation and is commonly situated opposite the doorway.

8.4 Stone Cairns

One aspect of the Forty Mile Coulee project concerned itself with a study of small stone cairns. Cairns are the second most common archaeological feature in the project area with a total of 81 cairns recorded at 27 sites. Cairn mitigation involved excavation of 21 features at 10 sites, with a total of 47 square metres excavated within and adjacent to the features. Cultural material recovery was extremely low. The primary purpose of the study was to gather data which would allow for the testing of the hypotheses generated in the research design (Section 6.0).

Information on the function of small stone cairns is limited in both the historical and archaeological record. At present, these features have not captured the imagination of researchers in the same way that stone circles have. The earliest known reference to the possible function of small cairns on the Northern Plains comes from Matthew Cocking, who while travelling just south of the Plains/Parkland border in 1772 saw:

> ...several stone heaps on the tops of the high hills; which the Natives say were gathered by those Archithinue Natives who used to lie behind those heaps; reconnoitering the Country round.... (Burpee 1908:108)

Twenty-eight years later, Peter Fidler presented a different explanation for the cairns he noted on the banks of the South Saskatchewan River:

> ...several old Traps up the bank made of Stones, for killing foxes made by the Indians many years ago.... (Johnson 1967:257)

Ethnographically, the use of cairns as small animal traps was confirmed by Wissler (1910:38-41). Such features may also have served in the ceremonial and religious life of the Northern Plains natives, as burials, or as reported by Bodmer (Thomas and Ronnefledt 1976) as shrines to invoke the approach of bison herds.

Archaeological research into the function of small cairns is almost non-existent. Malouf (1962:1-5) suggested that many cairns were ceremonial in origin and built through accretion as various native groups passed by the site locale. Both Adams (1976:94-95) and Keyser (1979) note that small cairns are commonly found in stone circle sites, a pattern also visible in the project area. While Keyser never explained the reason for this, Adams (1976:95) suggested that the features he recorded were either caches or locational markers. The idea of cairns as locational markers was also examined by Frison (1981:145), although he felt that many served ceremonial purposes as well.

Perhaps the best archaeological evidence for the function of small cairns comes from a feature excavated at site EeOr-63 located on the northern boundary of the Suffield Military Reserve (Brumley and Saylor 1979a). Here, stone placement and a small piece of bone, suggestive of a piece of bait left in a deadfall trap, was recovered from the base of a scattered cairn. The bone was submitted for radiocarbon analysis and returned a date of 1240 ± 120 years BP (RL-1129) (Brumley and Saylor 1979a).

Specific function can be suggested for only two of the 21 cairns excavated at Forty Mile Coulee. At site DkOu-13, Cairn 2 contained numerous pieces of bison bone near its center (Dau and Brumley 1987). A radiocarbon date of 670 ± 60 B.P. (Table 5) was obtained on this bone. The position and nature of this bone indicates it may have been bait in a small animal trap, similar to the one found at site EeOr-63 (Brumley and Saylor 1979a). In addition, the general structure of the cairn is not inconsistent with the supposed structure of aboriginal small animal traps. On the surface, Cairn 5 at site DkOu-16 (Dau and Brumley 1987) differed little from the other cairns at the site. Excavations proved, however, that the cairn was a prominent cluster or concentration of stones along and forming part of the wall of a buried stone circle. It may be that many cairn structures within stone circle sites reflect such a situation.

In terms of the research design (Section 6.0), the first hypothesis dealing with cairns suggests that the structure of cairns in habitation (i.e. stone circle) sites differs from cairns in non-habitation sites. Seventeen of the examined cairns were situated in sites containing evidence of aboriginal occupation. These features had maximum lengths varying from 98 to 286 cm and were composed of 12 to 100+ stones. Maximum stone weights ranged from less than 0.5 kg to more than 20 kg. In general, all were well sodded in with approximately half their stones visible on the surface. The four cairns situated in non-habitation sites varied widely in size and shape. The smallest contained only six stones and the largest more than 150. Although weights were not recorded for these features, the size and nature of the cobbles used in their construction was identical to cairns in habitation sites. The above data suggest that distinct structural differences between cairns in habitation sites and those not associated with habitation sites do not exist. There is however, a very general trend for non-associated cairns to be somewhat larger and contain more stones.

The second hypothesis suggests that cultural material associated with cairns in habitation sites is significantly different in nature and density to cultural material associated with cairns in non-habitation sites. As was noted, the amount of cultural material recovered from cairn excavation was low. The 17 cairns in habitation sites contained mixtures of bone, FCR, cores, debitage and MRST. The four cairns in non-habitation sites contained tiny amounts of bone and one piece of debitage. Despite the lack of extensive comparative data, this suggests cairns in habitation sites do generally serve different functions from those in non-habitation sites.

What function such features actually served is difficult to ascertain. As was noted, the archaeological, historic and ethnographic record suggests small cairns served as ceremonial markers, deadfall animal traps, burial covers and caches. It is possible, however, that all of these ideas refer to cairns in non-habitation sites. It is suggested here that small cairns in stone circle sites may indicate the presence of: 1) buried stone circles, as is the case with Cairn 5 in site DkOu-16; or 2) specific activity areas where stone cairns might be employed in bracing structures such as drying racks. Data on cairns collected from Forty Mile Coulee are less than conclusive. They do show, however, that an understanding of the function of small cairns in habitation sites is of importance and can aid in interpreting aboriginal activities within a camp.

8.5 Cultural Materials

8.5.1 Introduction

Table 26 lists by site the types and amounts of cultural material recovered from the assessment/mitigation program at Forty Mile Coulee. It is evident that, with minor exceptions, the amount of material collected from any single site is low. Given this situation and the fact that the primary purpose of this document is to discuss the Forty Mile Coulee data as a whole, the following section will focus on the description and characterization of individual classes of material rather than individual sites.

At Forty Mile Coulee, the physiographic zone in which given sites are situated appear to have an effect on the type and amount of cultural material recovered. Tables 27 and 28 summarize the cultural material sample by the six different zones recorded in the project area. Interpretations of these tables is included in the examination of each cultural material category.

Four major data recovery procedures were employed during the course of the project: 1) controlled and uncontrolled surface collection, 2) controlled stripping, 3) auger testing; and 4) test excavation. Each procedure was carried out in response to differing conditions and to meet specific needs, with each having inherent sampling biases.

In controlled surface collecting, all surface material found associated with stone circles was collected and recorded in relation to the circle's analytical unit. In uncontrolled surface collection, cultural materials were simply collected and recorded in relation to the site as a whole. There would appear to be a bias in both surface collecting methods towards recovery of larger cultural material items such as cobble cores and firecracked rock. These larger items are apparently more susceptible to upward movement due to frost action. Also because of their larger size, they have a greater likelihood of detection. Bone on the other hand, would have a tendency to be under represented as a result of weathering subsequent to surface exposure. A similar bias towards larger items appears to exist for controlled surface stripping. Controlled stripping was primarily intended to search for ancillary features and activity areas rather than for individual artifacts. In-field assessment of stripping shows a definite tendency for larger cultural material items to be recovered. Smaller items were either removed by the grader or were not observed during the subsequent examination of the stripped areas. In addition, both the surface collection and controlled stripping techniques preclude a determination of density per square metre of cultural material found.

Stone circle augering involves the excavation of a maximum of ten 20 cm diameter holes in a series of standardized patterns within and adjacent to a stone circle (see Appendix 1). Auger testing has proven to be an acceptable method of estimating the kinds and amounts of cultural material found at stone circles in general and within specific analytical units. The procedure as employed does, however, appear to have one important sampling bias. The patterns utilized in auger testing do not include sampling of the areas immediately within and adjacent to the wall of a stone circle. Subsequent text excavation indicates significant and unanticipated differences in these areas in contrast to immediately adjacent areas of the ring's interior and exterior. As a result of this sampling bias, direct "one to one" correlations between the density and distribution of materials recovered from auger testing and test excavation are not possible. Excavation units were generally laid out so they did sample the wall areas of stone circles.

Many of the stone circles selected for excavation were ones exhibiting higher than normal results in augering. The primary purpose of stone circle excavation at Forty Mile Coulee was to: 1) recover a sample of culturally and temporally diagnostic materials; and 2) recover a sufficiently large sample of cultural materials to adequately interpret the nature and range of aboriginal activities taking place. The process of selecting, for excavation, as many stone circles with a higher than normal amount of cultural material recovered from auger testing as possible was based upon the assumption that auger testing results were a reflection of overall cultural material density. Table 29 provides details on those features both auger tested and excavated. Table 30 summarizes that data. It is evident from Table 30 that there is a direct correlation between auger test productivity and cultural material density. Features which contained no material in auger testing (0.0 items per auger hole) exhibited low densities of material when excavated. If, however, even small amounts of material were found in auger testing there was a dramatic rise in the density of material from excavation. Table 30 shows density increases of five to eightfold depending upon mean number of items per auger hole. This is clear evidence of the value of auger testing as a preliminary assessment procedure.

Given the sampling biases discussed above, determining which data recovery technique provides the best basis for examining the various hypotheses concerning distribution of materials within and outside stone circles is important. The test excavation sample is considered best for the purposes of examining spatial relationships of various categories of cultural material within and surrounding stone circles. The excavation sample consists of more than 700 square metres excavated within and adjacent to 76 stone circles. As well, the excavation sample includes a larger sample of cultural material than the auger testing sample, including most diagnostics. The auger testing procedure examined a much larger, more random or non-selective sample of stone circle features (n=336). Auger hole data thus provide a more "averaged" or normative picture of cultural material density and distribution at Forty Mile Coulee stone circle sites. In the following discussion, observations concerning distribution and density of cultural material are based largely on the excavation sample and secondly on the auger testing and controlled stripping sample.

Several of the hypotheses generated in the research design (Section 6.0) deal with the nature and distribution of cultural materials within and adjacent to stone circles. These hypotheses are based upon the assumption that activities at an aboriginal camp were patterned and that these patterns can be determined from the distribution of recovered cultural material. Data from the ethnographic record are scanty, but they do suggest a patterned lifestyle for aboriginal groups. For example,

> There is order enough preserved in every Indian lodge to suit their mode of life....All have their places for sitting and sleeping, at the head of which, if men, are placed their arms and accoutrements; if women, their sewing, garnishing, etc. These places are arranged by the eldest wife or by the grandmother as soon as the lodge is erected by spreading skins on the ground, and are uniformly the same in the same family. They can be and are changed whenever the necessities of the men require it, though the individual's local privileges are not thereby disturbed.
> Places are reserved for strangers or visitors, and baggage, water, cooking utensils, and provisions have each their space allotted. This is not perceived immediately by casual observers, but would be realized by a short residence....the [arrangement]....though, of course, differs when the family circle is great or small, but the same correct appointments of places are visible in all, be the inhabitants few or many. (Denig 1930:507-508)

While Denig's statement refers primarily to the interior of a lodge, the authors suspect that patterning of activities existed outside of the lodge as well and that the primary focal point of activity area orientation was the lodge doorway. The authors further assume that the majority of activities were male or female specific and that various task areas can be generally inferred from the nature and locations of cultural materials recovered. Inside the lodge, where space is limited, such activity areas may be overlapping, mixed and more difficult to define. Outside the lodge, however, space was not as restricted and specific task activity areas may be more discrete and easily discernible.

An integral part of identifying and analyzing the nature and function of activity areas is understanding the nature of the tools found in them. It is suggested that a concept, termed here as "value", can aid in a clearer understanding of cultural material assemblages as a whole. Value represents "...that quality (or qualities) of a thing according to which it is thought of as being more or less desirable, useful, estimable, etc." (Guralnik 1980:1568). The "value" of any item or material is culturally and situationally relative and is primarily dependent on the following criteria:

1. The amount of effort expended to obtain, maintain, and/or produce the item or material.
2. The relative individual or cultural significance attached to the item or material on which it is produced, and the task or role for which it is intended or used.

Value should not be confused with importance. Importance is considered here to be a relative term referring to the need for a particular class of tools or commodity in maintaining the fundamental structure of a society.

It might seem that the concept of value is so highly variable and dependent on such a range of factors, as to be unassignable in an archaeological context. This is not so. Observation suggests that the form and/or relative abundance of many kinds of cultural material is best understood in terms of value and that criteria can be established to relatively determine this value in most instances. Values can be divided into two basic categories, "high" and "low". It is suggested that the basic characteristics required to identify "high" value tools are as follows:

1. Often made on less abundant and/or better quality raw material.
2. Their production normally reflects moderate to extensive amounts of modification (and presumably effort) in order to produce their final form.
3. Commonly, high value tools reflect efforts to resharpen or rejuvenate them after dulling or limited breakage.
4. High value tools are often prepared in advance for subsequent use and are used repeatedly until lost, broken or exhausted. Thus, evidence for the presence of a high value tool category at a site may be limited or totally absent even though that category was

present and used extensively. In addition, the full sequence of tool production as well as the use and discard of high value tools is commonly only partially reflected at any given site.

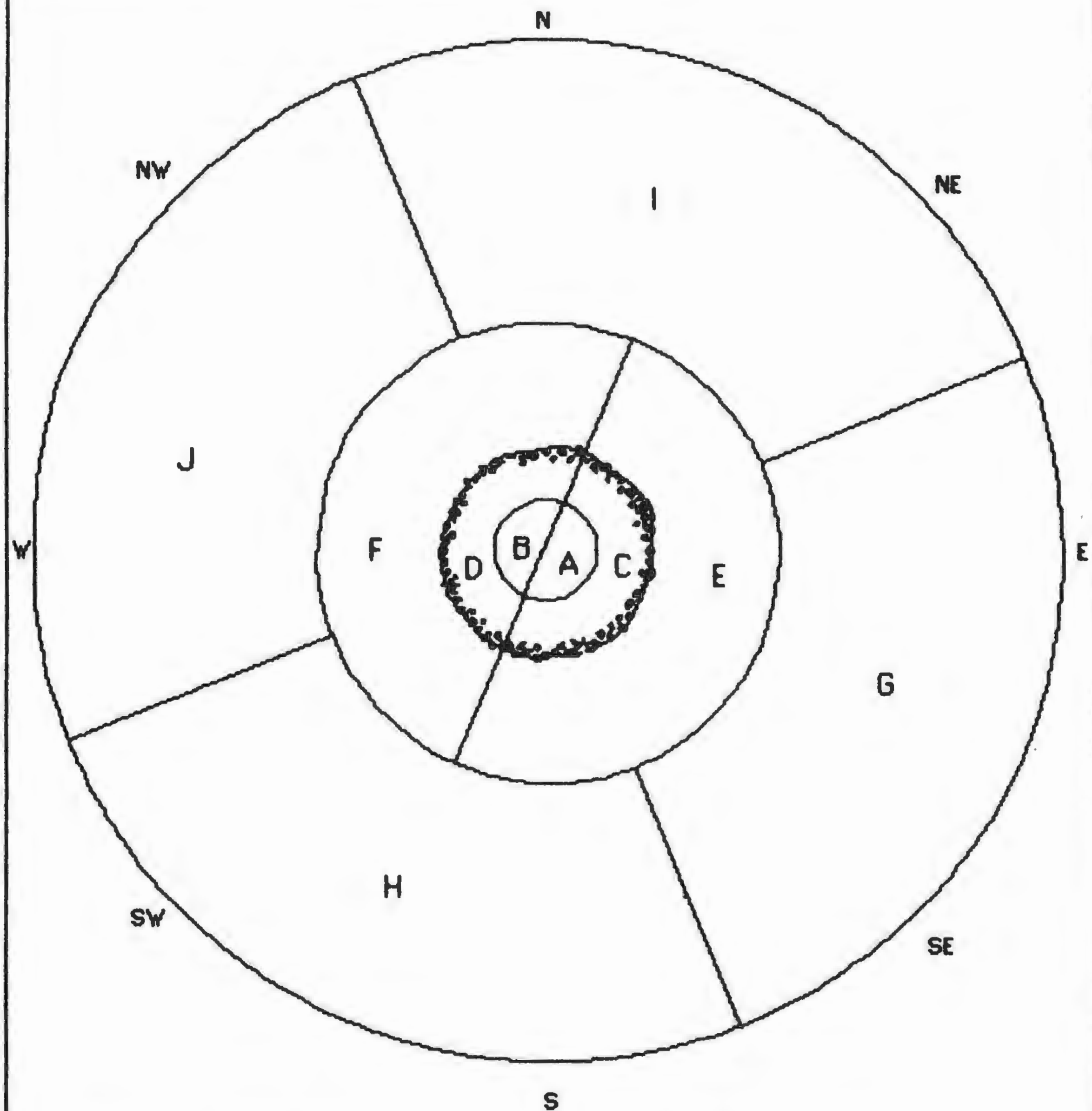
Examples of high value tools would include projectile points and endscrapers.

"Low" value tools can usually be identified based upon the following characteristics:

1. Generally made on situationally available and usually relatively abundant raw materials.
2. Generally reflect minimal or only moderate degrees of modification (and presumably minimal effort) in order to produce their final form.
3. Generally little or no effort is made to rejuvenate these tools after dulling or limited breakage.
4. Low value tools are often produced on an "as needed" basis to conduct a specific task on a specific occasion and are commonly abandoned when that task is completed. As a result, the full range of tool production, use and discard is often reflected at a single site.

Examples of low value tools common in many assemblages would be utilized debitage, marginally retouched stone tools or sidescrapers, and cobble choppers. In using these characteristics to assess tool value, all criteria for either high or low value tools need not pertain in every instance. However, in applying these concepts to specific tool categories, the senior author has found that the majority of one set or another will apply in almost every instance and allow for easy assignment of specific tools or tool categories. In most but not all types of sites low value tools will comprise the bulk of the assemblage.

In the following sections the discussions and interpretations of the relationships between various classes of cultural material are by necessity, somewhat complex. In order to simplify data presentation without eliminating observable trends, the standard 40 analytical units within and adjacent to a stone circle have been combined into 10 locational units. These units (Figure 26) are based on the presumed doorway locations for the features at Forty Mile Coulee, which as have already been noted, are in the southeast, east and northeast sectors. The defined locational units are:



A Front 1/2 Lodge Center
B Back 1/2 Lodge Center
C Front 1/2 Interior Margin
D Back 1/2 Interior Margin
E Front Near Lodge
F Back Near Lodge
G Front Side Away From Lodge
H South Side Away From Lodge
I North Side Away From Lodge
J Back Side Away From Lodge

Figure 26: Major Locational Categories For Lodge.

- Front 1/2 Lodge Center (Analytical Units 2.1, 3.1, 4.1, and 5.1)
- Back 1/2 Lodge Center (Analytical Units 6.1, 7.1, 8.1 and 1.1)
- Front 1/2 Interior Margin (Analytical Units 2.2, 3.2, 4.2 and 5.2)
- Back 1/2 Interior Margin (Analytical Units 6.2, 7.2, 8.2 and 1.2)
- Front Near Lodge (Analytical Units 2.3, 3.3, 4.3 and 5.3)
- Back Near Lodge (Analytical Units 6.3, 7.3, 8.3, and 1.3)
- Front Side Away From Lodge (Analytical Units 3.4, 3.5, 4.4 and 4.5)
- Back Side Away From Lodge (Analytical Units 7.4, 7.5, 8.4 and 8.5)
- North Side Away From Lodge (Analytical Units 1.4, 1.5, 2.4 and 2.5)
- South Side Away From Lodge (Analytical Units 5.4, 5.5, 6.4 and 6.5)

A close examination of Figure 26 will show that the locational area designated Front Side Away From Lodge does not encompass the northeast sector even though this sector contains one of the presumed doorway locations for stone circle sites at Forty Mile Coulee. Due to the nature of the analytical unit system and the desire to break it into reasonably sized sub units for examination by correlation coefficients, it was necessary to place the northeast sector (at distances of 5-15 metres from the lodge) in the zone defined as North Side Away From Lodge. The authors feel that this discrepancy is of minor importance and, as will be shown, has little effect on the observed distributional patterns of cultural materials.

8.5.2 Firecracked Rock

The category of firecracked rock (FCR) is considered here to represent stones which exhibit features reflecting prolonged and/or repeated heating followed by rapid cooling (McParland 1977). Firecracked rock is a common form of occupational debris at many Northern Plains sites and is usually interpreted as reflecting stone boiling as recorded historically for many Indian groups. Catlin (1973:154) describes stone boiling as employed by the Assiniboine:

> ...when they kill meat, a hole is dug in the ground about the size of a common pot, and a piece of raw hide of the animal, as taken from the back, is put over the hole, and then pressed down with the hands close around the sides and filled with water. The meat to be boiled is then put

> in this hole or pot of water, and in a fire, which is built near by, several large stones are heated to a red heat, which are successively dipped and held in the water until the meat is boiled....

In addition to excavated earth pits, stone boiling was also employed historically with birch bark containers (Harper 1971:53) and with buffalo skin basins, formed by driving a series of stakes into the ground in a circular pattern. The hide was placed inside this ring and its edges draped over the stakes to form the walls of the basin (Wissler 1912:70).

As well as cooking meat, stone boiling was also used to render grease from bone:

> ...bones were also crushed, and all the marrow fat extracted from them. This was done by boiling the bones in sufficient water to cover them, and as the marrow or grease rose to the surface it was carefully skimmed off....This fat was eaten with 'pounded meat', and was also used in the making of pemican. (Paget 1909:78)

Generally, stones were used repeatedly until they had broken into pieces too small for the purposes required and were then discarded. The task of stone boiling is considered to have been a part of the activities generally conducted by female members of an aboriginal group.

In his studies of firecracked rock McParland (1977:32) noted three types of fracture patterns appearing on heated stones. Stones exhibiting cortex spalls and bedding plane fractures were apparently only heated. Stones exhibiting blocky fractures which cause the cobble to shatter were apparently heated and then cooled rapidly by immersion in water. All the firecracked rock from the project area exhibit fracture patterns indicative of immersion in water.

At Forty Mile Coulee a total of 1921 pieces of FCR were collected (Table 26). FCR comprise 9.1% of the total sample of materials recovered from the project area (Table 27). In terms of physiographic zone, there appears to be a distinct pattern in the distribution of FCR. This distributional pattern is obscured somewhat in Table 27 due to factors of differential bone preservation to be discussed. If, however, the large sample of bone and ceramics are removed from the totals, trending can be observed (Table 28) in the percentages. There is a tendency for sites situated on the edge of the coulee (physiographic zone 1.1) to contain a higher percentage of FCR than in any other area. This trend suggests that the aboriginal occupants were consciously selecting certain areas for stone boiling activities. Studies conducted on the efficiency of various fuel sources utilized by aboriginal groups (Brink et al. 1986) have shown that bison dung fires can provide sufficient energy to heat the stones used in stone boiling. Of importance in using bison dung as a fuel source is locating the fire in an area where a consistent breeze is present in order to ensure fuel combustion. At Forty Mile Coulee the areas exhibiting the most steady wind flows are on the prairie edge of the coulee (physiographic zone 1.1), and adjacent to the base of coulee walls (physiographic zone 6.1). An examination of Table 28 shows that these areas contain the highest frequencies of FCR, suggesting that if bison dung was the primary fuel source for heating stones, attempts were made to utilize portions of the coulee where the process would operate most effectively.

Figure 27 and Table 31 detail the density of FCR recovered during excavation. FCR density is low (0.00-1.00 items per m^2) to moderate (>1.00-3.50 items per m^2) in both the front and back halves of the lodge center with no clearly defined trends. In the front half interior margins of the lodge FCR is concentrated immediately adjacent to the presumed doorway locations. The back half interior margin of the lodge shows the largest concentration of material in its southern half.

In the area designated Front Near Lodge, FCR is present in moderate amounts, with the greatest concentrations in the presumed exterior doorway area. The area defined as Back Near Lodge primarily contains low densities of FCR except in the sector (A.U. 8.3) which exhibits a moderate density of material. In front of but away from the lodge, densities are also low. The area defined Back Side Away From Lodge exhibits low density except in one sector (A.U. 7.5), where distinct moderate density is present. The north and south sides away from the lodge show primarily low densities of FCR. There is however, one exception. One of the outermost sectors (A.U. 1.5) exhibits a high density (>3.50-15.00 items per m^2) of FCR.

A general examination of Figure 27 shows that FCR is not scattered randomly in the areas within and adjacent to the lodge. This is also true of the sample of FCR recovered from auger testing (Figure 28) although the pattern is slightly different from that of test excavation. Within the lodge

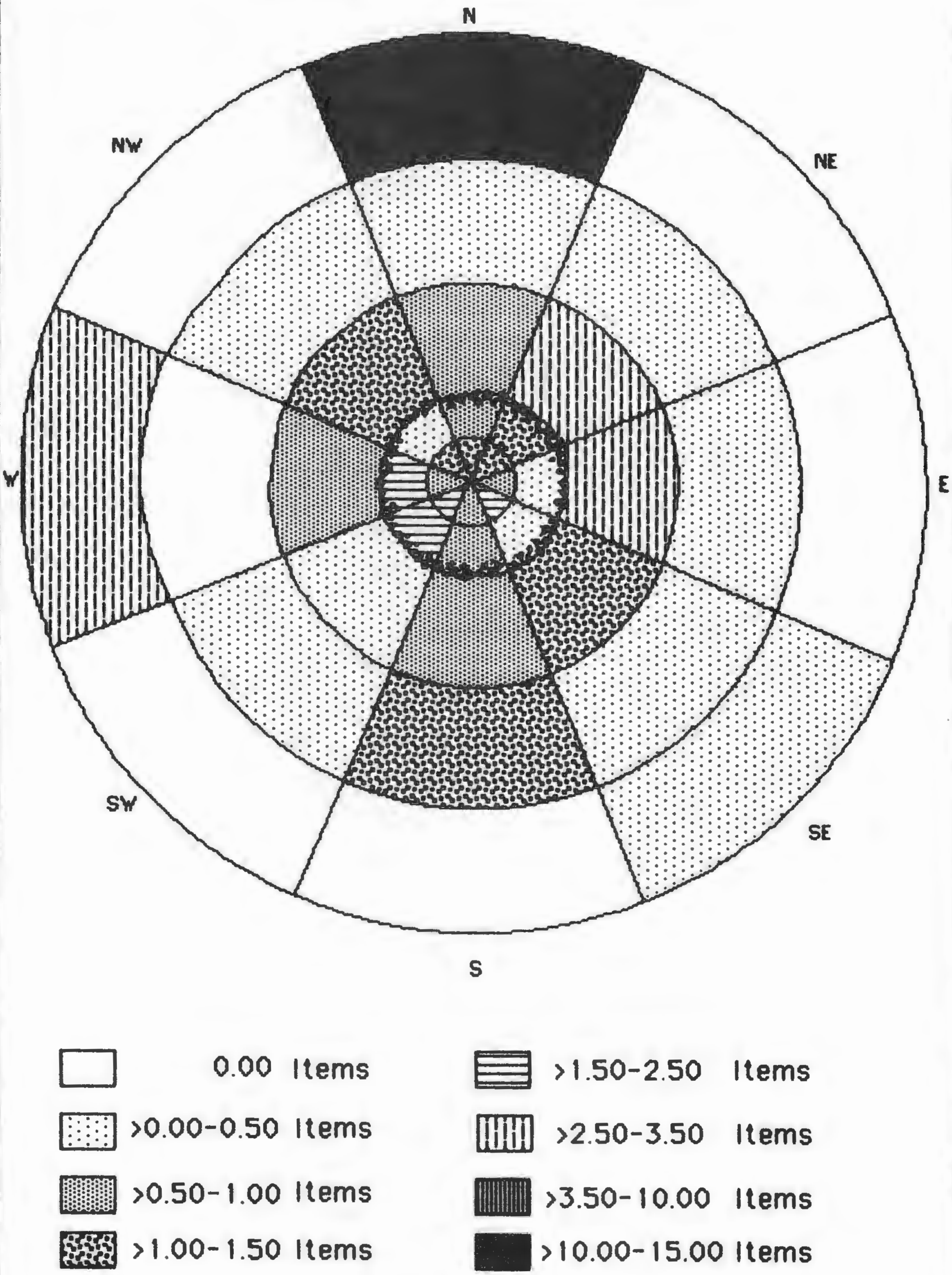


Figure 27: Density (m^2) of Firecracked Rock Recovered From Test Excavation, Forty Mile Coulee.

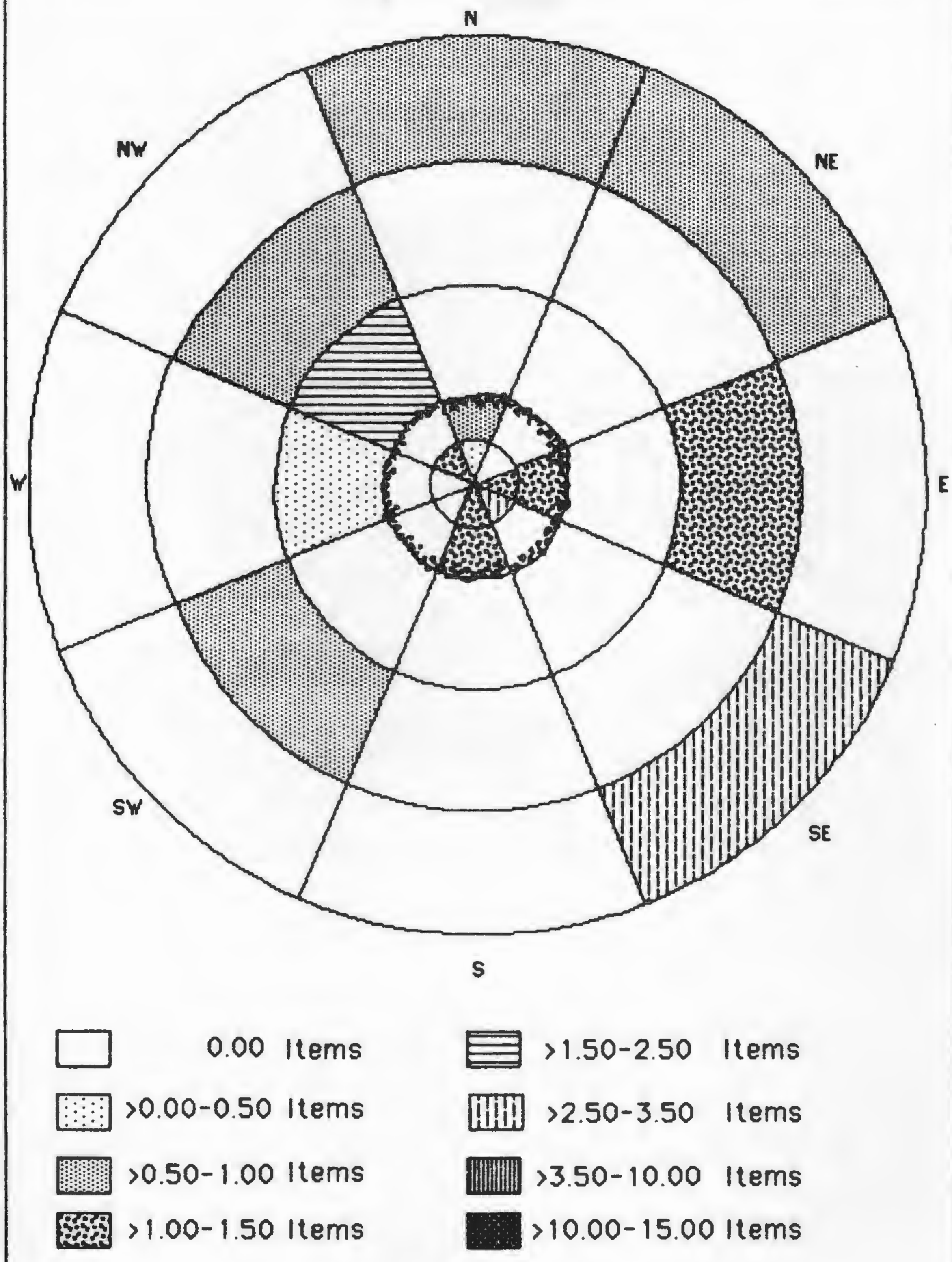


Figure 28: Density (m^2) of Firecracked Rock Recovered From Auger Testing, Forty Mile Coulee.

there is a slight trend for low densities in the doorway areas. Outside of the lodge, the observed patterns suggest specific locales were used for activities requiring FCR. The most prominent of these were outside of the doorway, behind the lodge and 10-15 metres directly north of the lodge.

One interesting aspect of the FCR sample which requires discussion here is apparent in Table 17. The table shows that there is little change in the density of FCR between stone circles of Late Prehistoric age and those of Historic age. With the introduction of metal containers for boiling water in the Historic Period, it was expected that the use of FCR would totally disappear or decline sharply. Apparently this was not the case in the project area. An explanation for the continued significant percentage of FCR may be found in a discussion of the type of fuel used. As noted above, it is possible that bison dung was the primary fuel source at Forty Mile Coulee. The examination of the efficiency of various fuel types undertaken at the Head-Smashed-In site (Brink et al. 1986) has shown that the heat generated by a bison dung fire is not radiant. Rather than expending energy to the atmosphere as wood fires do, dung fires retain energy. Water in a metal container suspended over a dung fire would probably not heat sufficiently or boil. As a result, it would be necessary to continue the practice of heating stones to boil water even though the nature of the vessel containing the water might change. The closely similar densities of FCR in the Late Prehistoric and Historic Periods is probably indicative of a continuation of the use of bison dung as a fuel source.

8.5.3 Faunal Remains

Unmodified and butchered faunal remains constitute the largest class of cultural material from the Forty Mile Coulee project. A total of 16,370 pieces comprising 77.5% of the total assemblage were recovered (Tables 26, 27). Analysis of this material was carried out with the following objectives:

1. identification and determination of the various species and minimum number of individuals represented;
2. obtaining data relevant to identifying site seasonality; and
3. examining the distribution of bone material within and surrounding stone circles.

Table 27 summarizes all surface and excavated cultural material recovered from Forty Mile Coulee as a whole and in relation to various physiographic zones. An examination of Table 27 indicates that a primary difference in the assemblages from various physiographic zones is in the amount of bone represented. In physiographic zone 1.1, bone comprises only 8.8% of the assemblage; in zone 6.2 it constitutes 97.3%. This major spread might be reasonably explained in two ways: a) there is a significant difference in the range and/or intensity of various cultural activities reflected by faunal remains within the various physiographic zones; b) there are differential patterns of bone preservation in the various physiographic zones. Table 27 suggests a strong argument can be made for differential bone preservation in relation to various physiographic settings. The open prairie surface sites (1.1) bordering the coulee contain the least percentage of faunal remains and are situated in the most stable depositional environment. The three coulee wall physiographic zones (3.1, 3.2, 3.3) reflect a combination of depositional cut and fill situations and are intermediate in bone representation. Coulee bottom zones (6.1, 6.2) are characterized by the highest depositional rates and highest frequency of faunal representation.

A second means of exploring the major differences in faunal representation observed between various physiographic zones is to examine other components of the assemblage on the assumption that the activities reflected by bone will be reflected by other categories of cultural material as well. Table 28 summarizes the cultural assemblage from Forty Mile Coulee minus bone and ceramics. Ceramics have been excluded along with bone because extreme fragmentation of the ceramic sample probably results in over emphasizing the significance of ceramics in the assemblage of material. As well, ceramics may not be part of the normal cultural assemblage of many components within the project area. An examination of Table 28 suggests that with bone and ceramics excluded there are apparently major variations in the composition of assemblages located in various physiographic zones. However, these changes do not appear to be of a nature or magnitude to sufficiently explain the variation exhibited in bone.

It would thus seem that differential bone preservation is a major factor affecting the overall composition of cultural assemblages recovered from stone circle sites. Previous stone circle studies at sites located on prairie surfaces in the region have generally noted a low density of cultural material (Brumley et al. 1983b). Such low densities have been used by some authors as an argument against stone circles having functioned as tipi rings or lodge weights, reasoning that more cultural material reflecting habitation should be present. Recognizing that as much as 80 to 96 percent of cultural material originally present (in the form of bone) may not have been preserved, dramatically changes our perspective and the interpretive premises regarding the nature and intensity of cultural activities occurring at such sites.

Preservation of individual bone items in the Forty Mile sample varied considerably within and between sites. Much of the recovered bone exhibited somewhat eroded textural surfaces and weathering cracks. In other instances, bone was excellently preserved with no etched or eroded surfaces. Field observation indicates inter-site differences in faunal preservation are primarily a reflection of the aforementioned differential depositional settings. Intra-site differences in bone preservation appear to reflect microenvironmental differences in pre-burial exposure to sunlight. Bone found in shaded areas, under or along stones, or beneath other faunal elements are often better preserved. The under surface of bone pieces is likewise often better preserved than the upper surface. It is suggested that sunlight in general, and the ultraviolet portion in particular, is a major factor in bone deterioration (see Oster 1968; Emerson 1968). More rapid burial, and partial or total shading are factors in preventing or delaying this deterioration. Bone deterioration as a result of acidic soils does not appear to be a factor within the project area.

The 16,370 pieces of faunal material from the Forty Mile Coulee project came largely from stone circle sites and were segregated whenever possible into groups of material associated with individual stone circle features. Each resulting sample was then analyzed and considered separately. Where materials were recovered in association with features examined by both excavation and by controlled stripping, the collections recovered by each technique were first considered separately and then collectively as a single sample. Tables 34 and 35 summarize basic aspects of the faunal samples from Forty Mile sites. Not included here are sites containing only limited amounts of non-identifiable bone fragments or scraps.

The vast majority of faunal material from all sites within the Forty Mile Coulee project consists of unidentifiable bone scrap. However, based on relative bone thickness and structure, all but a few pieces of this material is clearly referrable to large ungulates, almost certainly bison. Bison remains constitute the bulk of the identifiable sample, consisting of a minimum of 691 elements which represents a minimum of 103 individual animals. Individual site/feature samples are small with all but the features at one site containing no more than one or two bison. The exception is DjOu-62, where a minimum of nine animals are represented at Stone Circle 12; and three animals each are represented at Stone Circles 11 and 14.

Although mule deer are presently abundant within the coulee area, antelope is the only other ungulate species represented in the Forty Mile faunal sample. A total of 16 antelope elements were identified which represent a minimum of 10 individuals in 10 separate site/feature samples.

Non-ungulate faunal material is even more restricted in nature and extent. Remains of canids are most abundant and consist of a minimum of 13 elements, representing a minimum of 9 individuals from 9 individual site/feature samples. Aside from two isolated mandibular teeth, all of the canid material is post cranial. Based on relative size, canid materials have been grouped into two categories. The small to medium category would include coyotes, foxes and equivalent sized domestic dogs. Large canids probably represent large dogs or wolves. Although a few of the canid elements were broken, none showed evidence clearly suggestive of butchering or modification into tools. Further evidence of carnivores, most likely canids, consists of well defined gnaw marks found on a minimum of 60 ungulate elements in 29 individual site/feature samples. Numerous other elements displayed evidence suggestive of gnawing but, due to bone weathering this could not be firmly ascertained.

Bird remains consist exclusively of a single terminal phalanx from a large raptor, probably a hawk or eagle. The item quite possibly served for personal adornment. However, it was not modified in any way for attachment. The final recovered item consists of a small fossilized dinosaur vertebrae from Stone Circle 4, at site DjOu-60. The specimen may have been naturally derived by colluvial action from till or bedrock deposits upslope. Alternately, it may represent a "charm" collected elsewhere and subsequently lost or discarded by the site's aboriginal inhabitants. Use of other locally derived fossils in such a manner is documented for the region ethnographically (Kehoe 1965) and archaeologically (Calder 1977; Brumley 1975a).

In the Plains, evidence of site seasonality is most commonly based upon determining the precise age of young bison at the time of death. This ageing involves examination of mandibular dentition following developed techniques (Frison and Reher 1970; Reher and Frison 1980). Unfortunately, the Forty Mile Coulee sample was not suitable for this technique. Few mandibles were represented in the sample. Those that were present were either badly fragmented or from older individuals not seasonally sensitive.

Another seasonally sensitive indicator consists of newborn or foetal bison remains. Wilson (1974) notes that,

> Fetal bones are in general easily recognized due to the spongy nature and porous appearance of the periosteal and replacement bone tissue. (Wilson 1974:145)

This spongy foetal bone is characterized by clearly visible layering in the periosteal tissue making even small fragments of foetal bone easy to identify. Wilson (personal communication) has done subsequent work concerning foetal and newborn bison calf remains involving the relative size and development of various individual elements which allows for relative estimates of foetal development at the time of death. Several small samples of foetal and young bison remains from sites throughout southern Alberta have been submitted to Wilson for examination and provide a primary basis for much of what we know concerning site seasonality in the region. With this regional sample and Wilson's studies as a basis, the foetal and immature calf remains from the Forty Mile Coulee sites (Tables 34, 35) were examined and evaluated regarding their relative age and the apparent seasonality reflected.

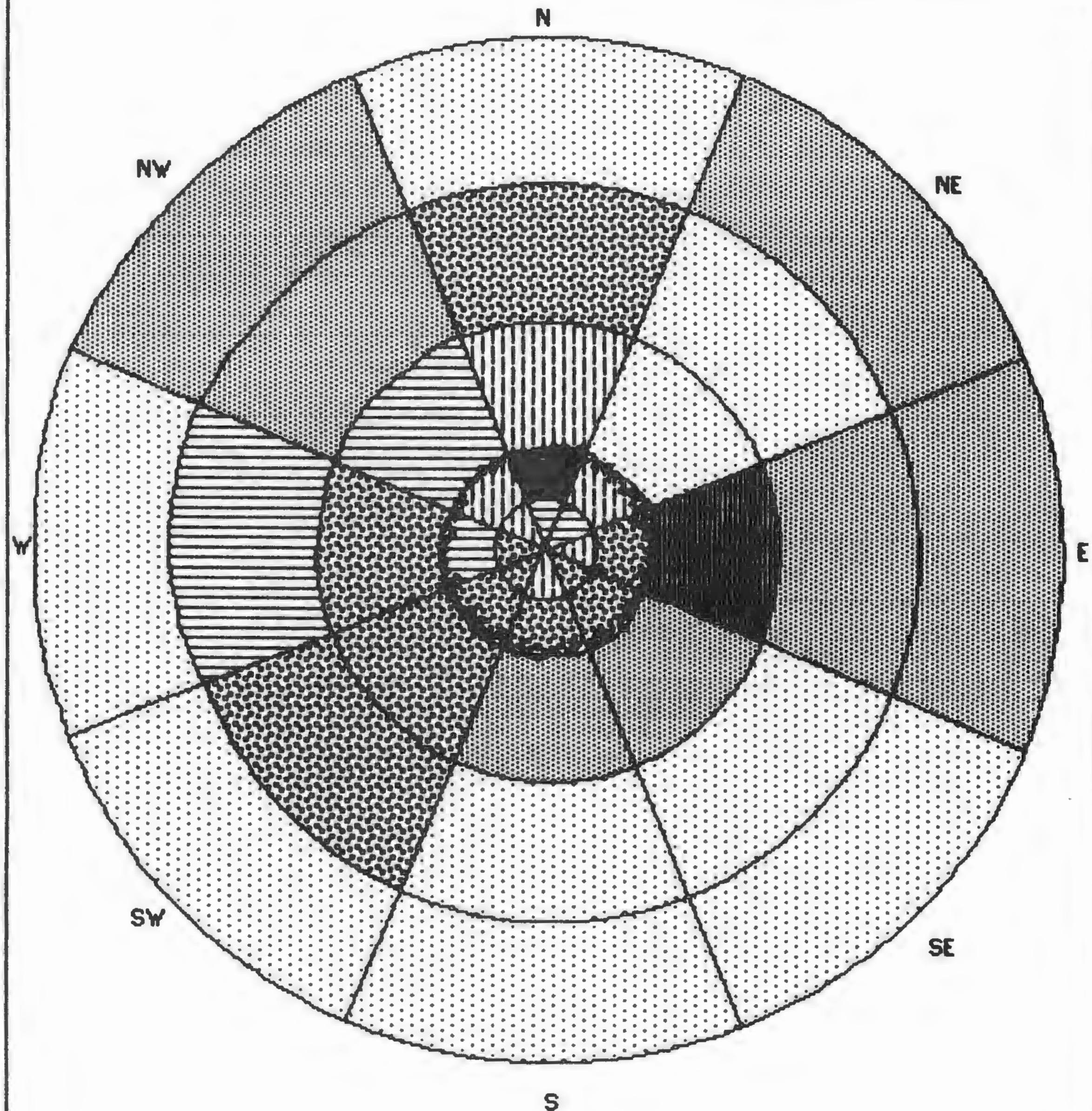
Of the 11 foetal to immature bison calves represented, eight appear to be from foetal individuals one to two months short of full term. One site (DjOu-49, Stone Circle 2) simply contained a small long bone fragment with a well defined periosteal layer. Bone denseness suggest a near full term or newborn calf. The single individual from DjOu-60, Stone Circle 14 is estimated to reflect a calf two to four weeks of age, while a calf from

DjOu-62, Stone Circle 11 appears to represent a one to two month old individual.

Based on a peak period of bison calving beginning in late April and continuing through May (Arthur 1975:52) the foetal and immature bison material from these Forty Mile sites suggests occupation throughout spring and extending possibly into early summer. Foetal and immature bison material is present in each of the identified Besant and Avonlea complex components as well as in several Prairie/Plains and Old Women's components suggesting a long term, ongoing pattern of spring seasonal utilization. The lack of a sample of ageable mandibles makes it impossible to rule out the possibility of significant occupation at other periods of the year. Based on the proposed settlement model, it is suggested such occupation, if present, would be minimal.

Determining exactly what type of cultural activity is reflected by the faunal sample from Forty Mile Coulee is a difficult task. Inside of stone circles, recovered bone is felt to reflect the process of cooking and immediate consumption of meat. Outside of stone circles, several activities may have occurred. The fragmentary nature of the majority of the faunal sample is often assumed to be a reflection of bone grease preparation. However, it may also reflect meat processing for either immediate use or storage. The historic record contains numerous references to the fact that aboriginal groups boiled meat for immediate consumption (Catlin 1973; Denig 1930; Ewers 1958). Studies have shown that stone boiling procedures are not the most efficient way to heat water. In order to improve cooking efficiency, meat was cut into small pieces before being boiled. Also, meat was often cut into small strips and dipped in boiling water before being dried (Coues 1897; Robinson 1879; Turney-High 1941; Wissler 1912). Both of these procedures may have resulted in at least some fragmented bone. Based upon the nature of the faunal sample and the data presented here it is unclear which of the above activities were largely responsible for the faunal sample.

The density patterns of faunal material recovered from test excavation and auger testing in association with stone circles in presented in Figures 29 and 30. Patterns observed for both recovery methods are generally similar. Figure 29 shows that the interiors of stone circles in the project area are rich in faunal material. Both the front and back half of



	0.00 Items		>15.00-20.00 Items
	0.01-5.00 Items		>20.00-30.00 Items
	>5.00-10.00 Items		>30.00-40.00 Items
	>10.00-15.00 Items		>40.00-50.00 Items

Figure 29: Density (m^2) of Bone Recovered From Test Excavation, Forty Mile Coulee.

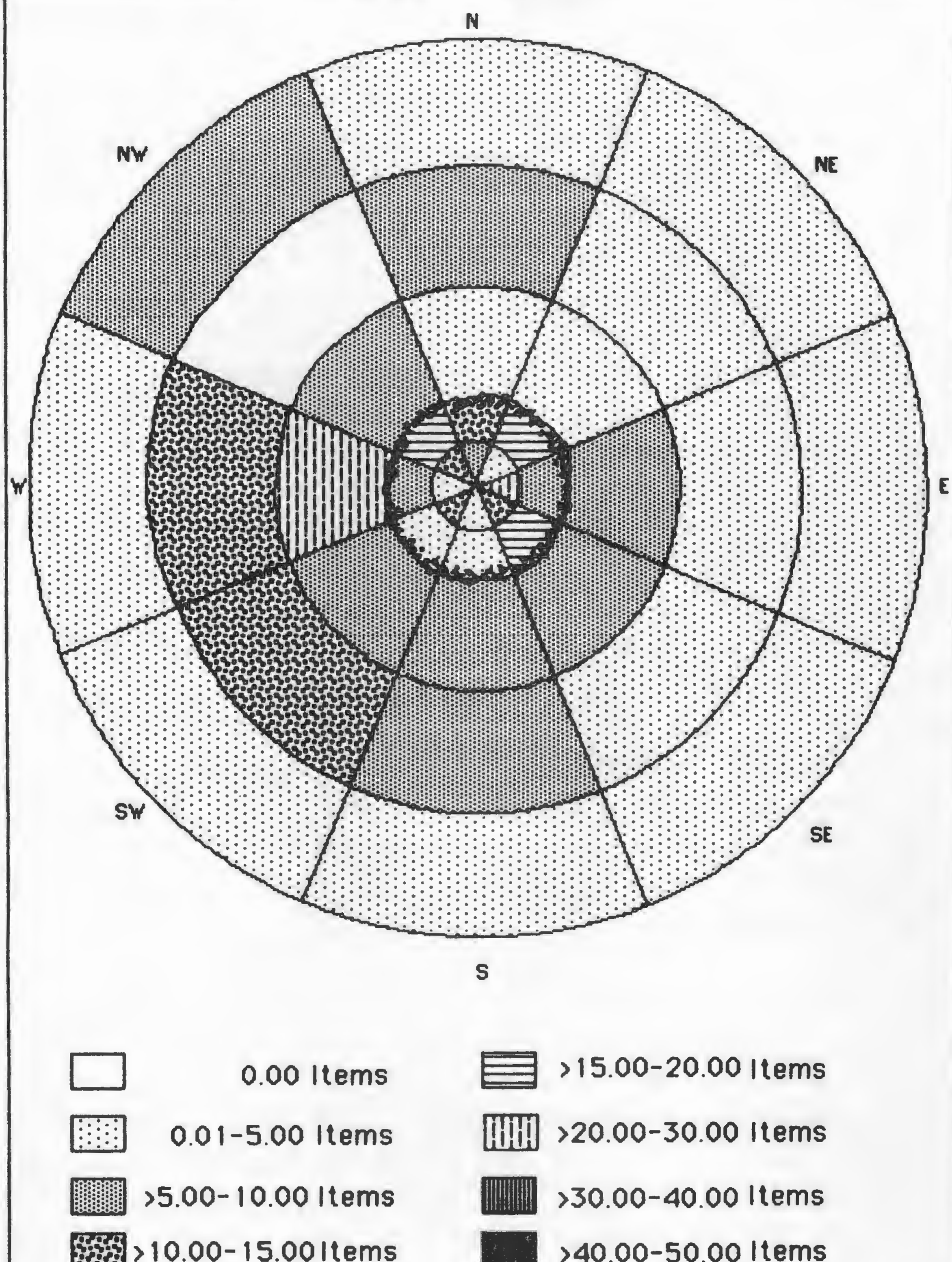


Figure 30: Density (m^2) of Bone Recovered From Auger Testing, Forty Mile Coulee.

the lodge center exhibit moderate (>10.00-20.00 items per m^2) to high (>20.00-50.00 items per m^2) densities. This is to be expected as the lodge center is commonly assumed to be the primary interior food consumption and processing locale. Both the front half and back half interior margins of the lodge also exhibit moderate to high densities of bone. The highest interior density is found in one portion of the back half interior margin (AU 1.2). The reason for such a high density in this area is unclear.

The area designated Front Near Lodge exhibits both low (0.00-10.00 items per m^2) and high densities of faunal material. The locational area defined as Back Near Lodge shows moderate to high densities of bone throughout with a tendency for more material in the northern part of the area. The front side away from the lodge contains the lowest density of all the ten locational areas associated with a stone circle. The Back Side Away From the Lodge exhibits low to moderate densities of material. Both the North Side and South Side Away From the Lodge show moderate densities of bone as well.

A general examination of faunal material density outside of the lodge indicates that activities associated with bone (butchering, cooking, bone grease extraction) were patterned. With the exception of one area outside the doorway, which may represent a preferred cooking locale or a dump area from interior lodge cleaning, bone is scarce in front of the lodge. Behind the lodge, however, faunal material is relatively abundant. This suggests that the primary meat processing locale was situated behind the lodge out of sight of the doorway.

Table 17 presents an interesting aspect of the faunal sample. It shows that stone circles of known Late Prehistoric age contain bone densities almost three times as high as stone circles of known historic age. This is a substantial difference. A possible explanation for this can be found in the change in hunting techniques brought about by the introduction of the horse. Prior to the Historic Period, aboriginal groups were pedestrian hunters presumably preferring, if at all possible, to catch animals close to their camps. If the locales where animals were killed in Forty Mile Coulee were close to the known Late Prehistoric camps, more of the carcasses, including bone, may have been brought to the camp for secondary butchering. This would result in greater amounts of bone. After the introduction of the horse, hunting techniques changed. Ewers (1958:76-84) has noted that the preferred hunting tehnique was the chase. A single horse mounted hunter would select an animal and pursue it. This procedure often ended in the killing of an animal some distance from the camp. It may also have resulted in less of the carcass consisting of bone being returned to the camp for secondary butchering. Although by no means conclusive, the difference in bone densities noted in Table 17 may be the result of this change in hunting practices.

8.5.4 Cores

Cores are considered here to be pieces of stone material utilized for the production of flakes. Specimens from Forty Mile Coulee exhibit no clear evidence of subsequent utilization as chopping and/or cutting tools. At Forty Mile Coulee, the sample of cores has been divided into two major categories, each with two subcategories.

The category of coarse cores contains specimens composed of quartzite, sandstone and argillite (Figure 31). The category of medium/fine cores contains specimens composed of chert, chalcedony, siltstone and mudstone (Figure 32). All of these lithic materials are of local origin and can be found in the glacial tills along coulee edges. The defined subcategories are based upon the overall size of the specimen. Cobble sized cores have maximum lengths varying from 64 to 256 mm (Wentworth 1922). Pebble sized cores have maximum lengths less than 64 mm (ibid).

Cores reflect the first step in stone tool production. Flakes taken from them can be used as simple knives without modification; slightly modified to create "low" value tools such as MRST, or heavily modified to create "high" value tools. Although the evidence is scanty, cores of differing lithic material may be associated with and reflect male or female specific activities. Coarse cores, utilized to produce "low" value tools may have been used exclusively in food processing activities, which are interpreted as reflecting female activities. Medium to fine cores were utilized to produce "high" value tools such as projectile points for use by males, as well as high value tools such as bifacial knives and endscrapers for use by females.

At Forty Mile Coulee a total of 176 cores were collected (Table 26). This represents only 0.9% of the total sample of cultural materials (Table

Figure 31: A Sample of Coarse Grained Cores From Forty Mile Coulee. See Table 36 for Provenience. Artifacts Actual Size.

Figure 32: A Sample of Medium to Fine Grained Cores From Forty Mile Coulee. See Table 36 for Provenience. Artifacts Actual Size.

27). The majority (n=153) are composed of coarse grained lithics, primarily quartzite. In general, the coarse cores exhibit single platforms from which 1-7 flakes have been removed. Crushing and pitting on the recognized platforms suggests hard hammer percussion was the preferred flake removal method. Most coarse cores are cobble sized, with maximum lengths rarely exceeding 230 mm.

Chert and mud or siltstone dominate the sample of 23 medium to fine cores. Their shapes and sizes vary widely and all exhibit multiple platforms. Several can be considered as "exhausted" specimens. Recognizable platforms show less crushing and pitting than on coarse cores, which suggests soft hammer or punch methods of flake removal were utilized. The majority are pebble sized and exhibit much heavier utilization than coarse cores.

Because of the small number of cores recovered from the project area, the percentage frequency variations by physiographic zone noted in Table 28 are difficult to interpret. With one minor exception, all zones exhibit roughly similar percentages of cores in the cultural material samples. The exception is on terrace or terrace-like surfaces forming portions of the coulee wall (physiographic zone 3.2). Here, the percentage frequency of cores is relatively low. It is possible that the occupants of sites in this area were not bringing cores directly to the camp. They may have selected stones at an easily accessible source locale and completed the first stage of reduction on the spot, returning to the camp with collections of flakes and blanks.

The small number of cores recovered from excavation makes extensive discussion of distributional patterns difficult. However, a few minor trends are evident. Figure 33 shows that, inside the lodge, coarse cores are more commonly found in the front half (both front center and front interior margins) than medium to fine cores. The reverse is true for the back of the lodge. In terms of actual densities, most sectors inside the lodge contain moderate amounts of cores (one item per A.U.) with two containing large (two or more items per A.U.) amounts.

Outside of the lodge, the number and type of cores is virtually identical, both in front and behind the lodge. If the single core recovered from auger testing (Figure 34) is added to the sample, a very slight trend for more coarse cores to be found in front of the lodge than behind is

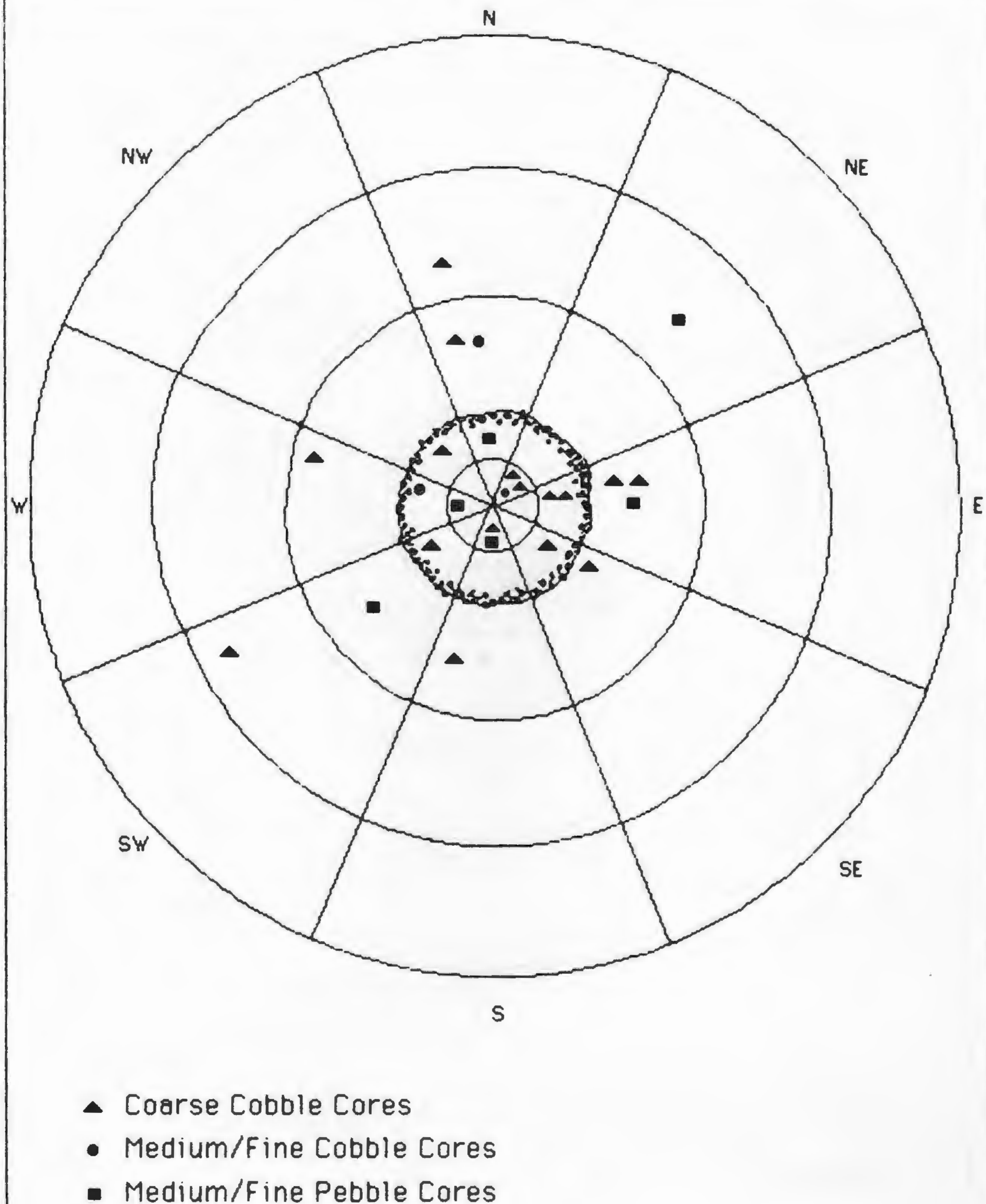
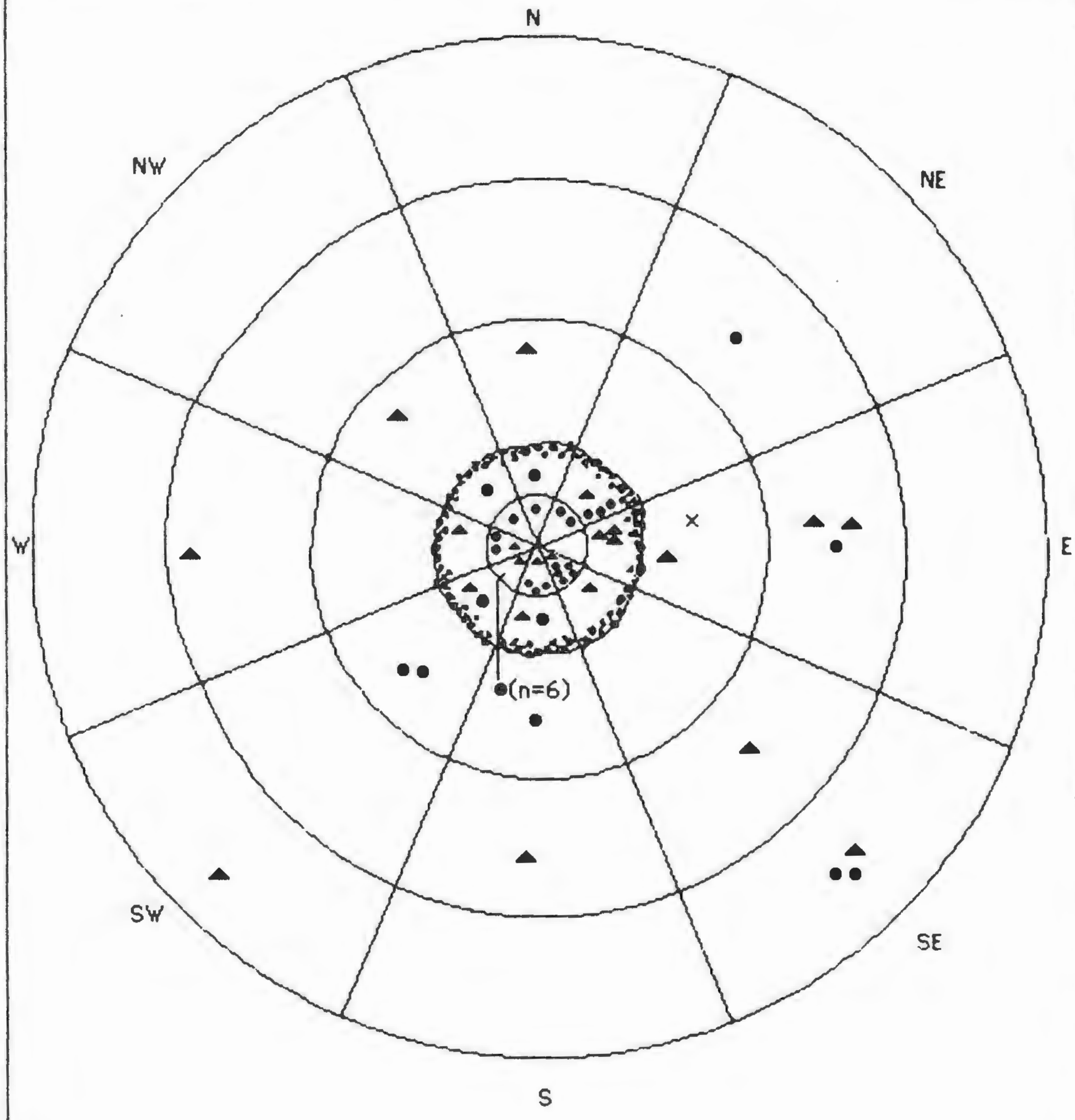


Figure 33: Distribution of Cores Recovered From Test Excavation Forty Mile Coulee.



× Coarse Grained Pebble Core
▲ Coarse Grained Debitage
● Medium/Fine Debitage

Figure 34: Distribution of Cores and Debitage Recovered From Auger Testing, Forty Mile Coulee.

created. General distribution patterns suggest that areas within 5 m of the lodge were the primary focal points for activities utilizing cores (flake and tool production).

8.5.5 Debitage

Debitage is defined here as lithic material removed either intentionally or inadvertently during the course of stone tool production and/or use. Materials defined as debitage exhibit no discernible evidence of subsequent intentional modification. The term debitage includes both flakes and shatter. At Forty Mile Coulee debitage is divided into categories of coarse and medium/fine. These two lithic categories are assumed to reflect male or female specific tasks, with coarse materials possibly reflecting female activities and medium to fine material reflecting both male and female activities. Observation indicates that for coarse materials, debitage and MRST (marginally retouched stone tools) are the desired end products. Very rarely are extensively modified, higher value tools made on these coarse materials. In contrast, medium to fine materials are often used in production of well finished, high value tools. As such, medium to fine debitage may reflect a desired end product or merely a waste by-product of high value tool production. Coarse debitage and MRST on the other hand, are interpreted as being the end product of production and functioned as simple knives used largely for meat processing and were discarded after use or dulling. As such, the presence and location of coarse debitage and MRST in camp situations is taken to suggest the presence and location of female activities and activity areas. Medium to fine debitage in contrast, can presumably reflect both male and female activity areas.

Coarse debitage is composed of quartzite, sandstone and argillite. All are of local origin and can be easily collected from till outcrops in the project area. The category of medium to fine debitage is composed of chert, chalcedony, mudstone, siltstone, petrified wood and obsidian. While certain of these raw materials are available in southeastern Alberta, they are more scarce than quartzite and argillite. Most scarce are lithics of non-local origin, which comprise less than an estimated 5% of the sample. Deaver (1985) has suggested that males would expropriate the best quality and rarest lithics for themselves, to be utilized in the production of tools related to the hunt. However, elsewhere in southeastern Alberta high percentages of Avon chert endscrapers are present in the Besant complex component at EbOp-42 and 44 on the Suffield Reserve; and in the Old Women's/Cluny complex materials at the Saamis site (Milne-Brumley 1978) near Medicine Hat. Even when medium to fine grained lithics were being used for items such as projectile points, useable debitage by-products may have been employed by women as simple knives or further modified into MRST, also for use as simple knives.

At Forty Mile Coulee, identified non-local materials consist of a variety of Madison Formation cherts from sources presumably in central and southern Montana and obsidian apparently from the Yellowstone Park area of Wyoming. On a more general basis, the presence of non-local lithics in a site is often used to infer trade routes and areas of aboriginal contact. It is interesting to note that all non-local lithic material at Forty Mile Coulee came from areas to the south, suggesting trade and contact in that direction. Non-local lithics from areas to the west (Banff chert, Ethrington chert, etc.) were not identified in the sample.

A total of 1705 pieces of debitage were collected from the project area (Tables 26, 27). If bone is excluded from the sample, debitage forms the second largest category of cultural material recovered in excavation, comprising 41.9% of the total (Table 28). In terms of physiographic zone, slight trends in the amount of debitage present can be observed. Along the edge of the coulee (physiographic zone 1.1) the percentage frequency is twice as high for coarse debitage than medium to fine debitage. At the base of the coulee walls (physiographic zone 6.1) a greater percentage of medium to fine debitage was recovered than coarse debitage. Exactly what this pattern represents is unclear.

Figures 35 and 36 detail the density of coarse and medium to fine debitage recovered from test excavation. Figure 34 indicates the same materials recovered in augering. The front half of the lodge center contains low (0.00-0.50 items per m^2), moderate >0.50-1.00 items per m^2) and high (>1.00-3.00 items per m^2) amounts of coarse debitage. Moderate to high amounts of medium to fine debitage are also found in the front half of the lodge center. In the front half interior margin of the lodge, densities of coarse debitage vary from low to high.

In the area designated Front Near Lodge, coarse debitage density

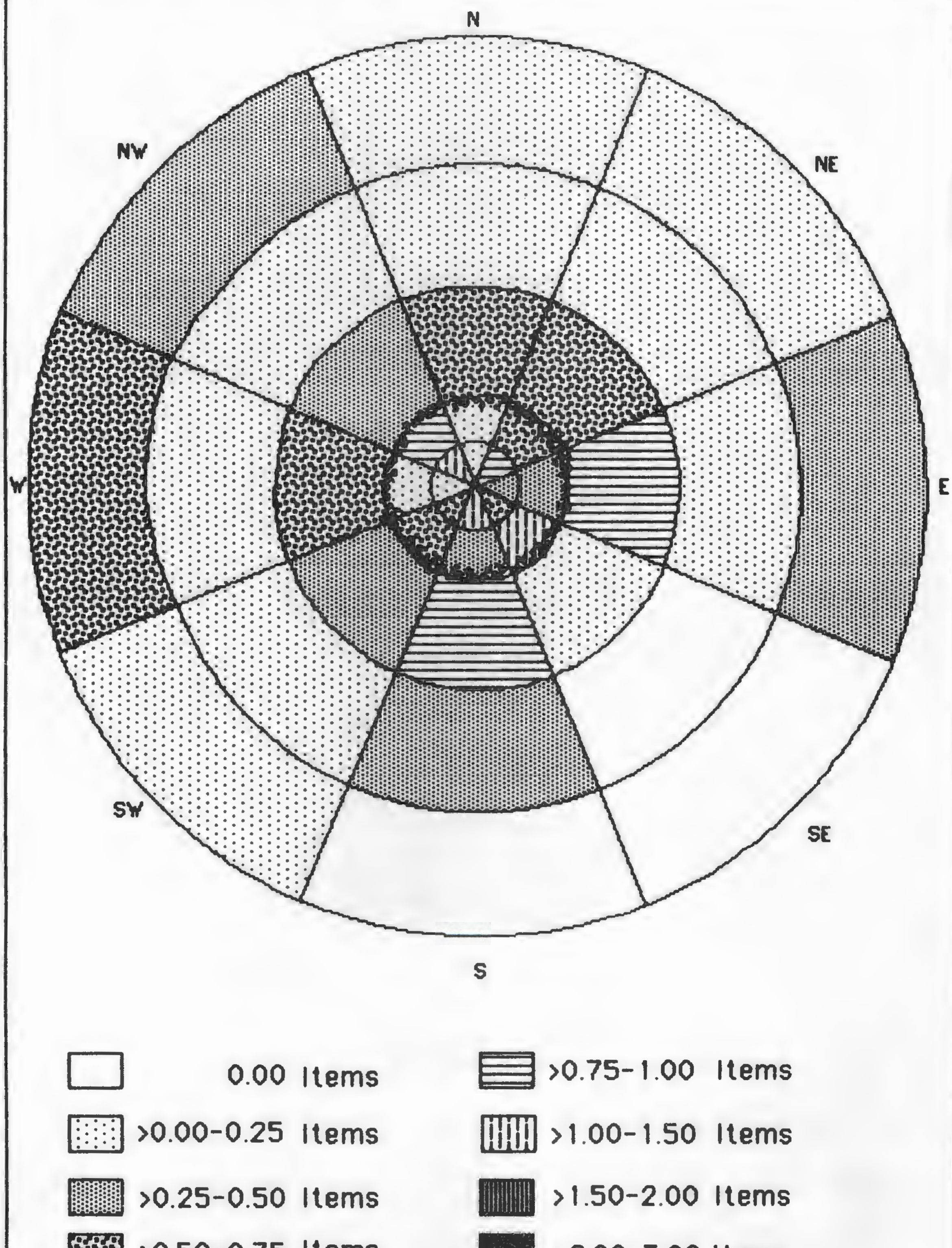


Figure 35: Density(m^2) of Coarse Debitage Recovered From Test Excavation, Forty Mile Coulee.

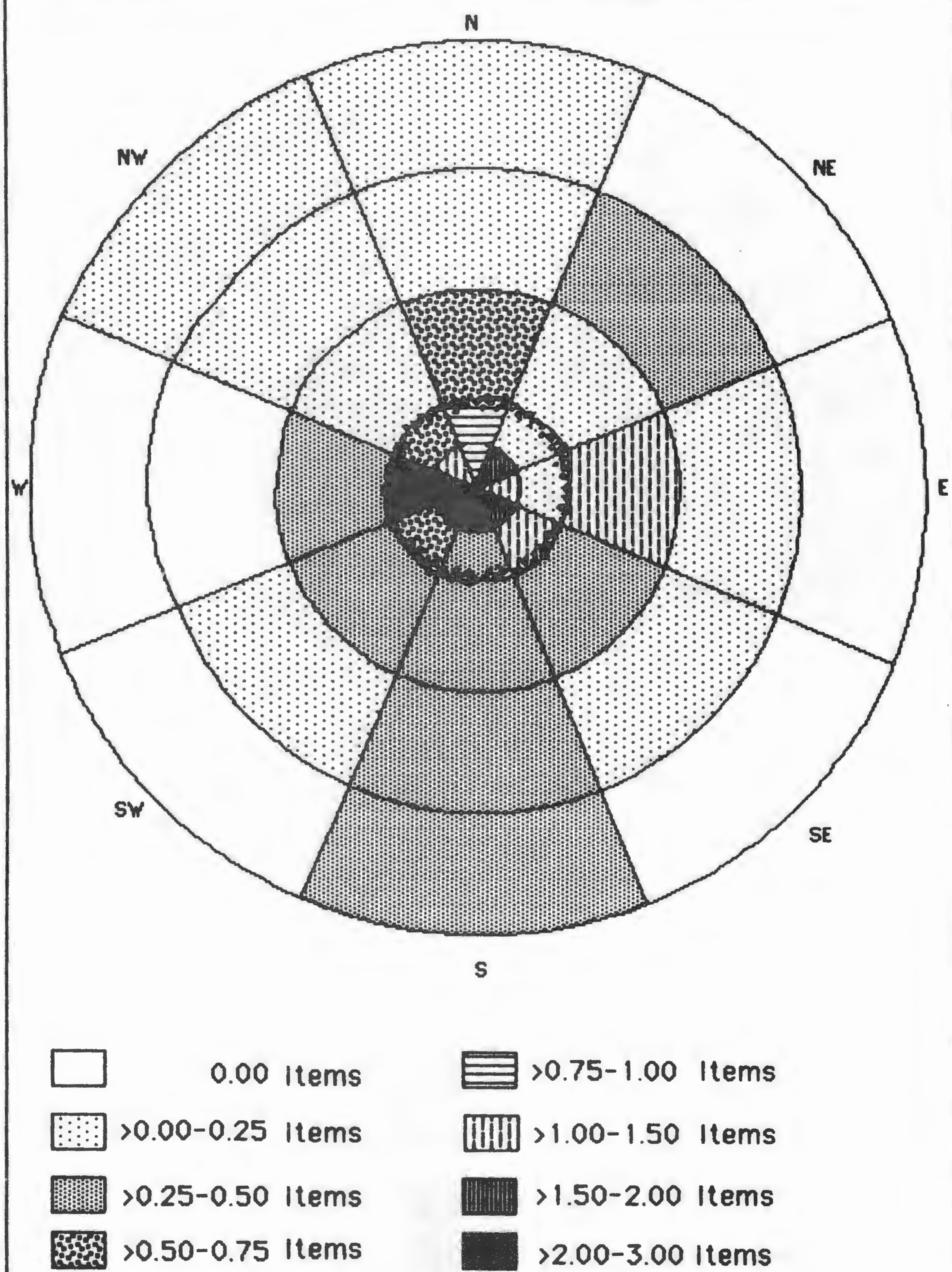


Figure 36: Density (m^2) of Medium/Fine Debitage Recovered From Test Excavation, Forty Mile Coulee.

varies from low to moderate. Medium to fine debitage density exhibits a similar pattern. Behind the lodge (Back Near Lodge) coarse debitage density varies from low to moderate, with no clearly defined pattern. Medium to fine debitage in the same area shows a pattern of moderate density immediately north of the lodge (AU 1.3) and low density in the remaining analytical units. In the four locational areas away from the lodge, coarse debitage densities are low throughout, except immediately west of the lodge at distances of 10-15 metres (AU 7.5) where moderate densities are present. Medium to fine debitage densities are low in all areas away from the lodge but there is a very slight trend for more material to be situated south of the lodge.

8.5.6 Marginally Retouched Stone Tools

Marginally Retouched Stone Tools (MRST) are defined as chipped stone artifacts characterized by intentionally produced marginal unifacial and bifacial flaking along one or more edges. Flaking patterns are usually limited in extent and have not significantly altered the preform shape of the blank upon which the tool is produced. Limited retouch, often associated with platform preparation and edge trimming, can be seen on many flakes and cores; such retouch is not considered here as reflecting MRST. Artifacts identified as MRST form the most abundant type of tool in the project area, and are considered of "low" value. They were usually produced quickly, apparently for immediate use and then discarded. Depending upon the angle of the working edge, MRST are seen as having served as simple knives in butchering processes or as scrapers in hide processing.

At Forty Mile Coulee a total of 207 MRST were collected. They represent 5% of the total sample of cultural materials if bone is excluded (Table 28). The MRST were divided into two types based upon lithic material. Coarse MRST (Figure 37) are produced on flakes and shatter of locally available quartzite and argillite. The majority of the 152 specimens identified exhibit a single working edge which varies in shape and length depending upon the size of the blank used. Flaking is always unifacial in character and varies from poorly to very well patterned. Edge angles range from 40° - 80° suggesting that coarse MRST served as chopping, cutting or scraping tools. They were probably utilized in all aspects of the butchering

Figure 37: A Sample of Coarse Grained Marginally Retouched Stone Tools From Forty Mile Coulee. See Table 36 for Provenience. Artifacts Actual Size.

of meat, an activity assumed to be largely undertaken by the female members of an aboriginal group.

The 55 medium to fine MRST collected from the project area exhibit a major range of size and shape (Figure 38). They were produced primarily on local chert and siltstone although an occasional non-local lithic material was utilized. Working edges vary widely in length and shape, but all were created by well patterned unifacial or alternate unifacial flaking. Edge angles vary from 30^0 - 50^0 suggesting these MRST served primarily as small knives.

In terms of physiographic zone (Tables 27 and 28) the small sample of MRST exhibit one apparently significant trend. There would appear to be a direct correspondence between the absolute and relative frequency of FCR to both categories of MRST. This suggests a functional relationship between these material categories. In contrast, the two categories of coarse and medium to fine debitage previously discussed, do not follow a similar pattern in relation to FCR. This provides evidence against earlier arguments that many pieces of debitage served as unmodified knives, functionally similar to MRST.

The distribution of the 85 MRST recovered from test excavation is presented in Figure 39 (see also Table 31). Inside the lodge, the front half (front center and front interior margin) contains the majority of MRST. Coarse and medium to fine items are present in relatively equal amounts. Artifact density is high (2 or more items per analytical unit) throughout the area. In the back half of the lodge (back center and back interior margin) medium to fine MRST dominate the sample. Densities vary from low (0 items per analytical unit) through moderate (1 item per analytical unit) to high (2 or more items per analytical unit).

Outside, but within five metres of the lodge, MRST are distributed roughly equally between the areas designated Front Near Lodge and Back Near Lodge. Coarse MRST are by far the most common type. A clear pattern is present in the four locational areas away from the lodge. MRST are concentrated in the area designated Back Side Away From Lodge at distances of 10-15 metres. Medium to fine MRST dominate the sample in this area. The same pattern can be observed in the sample of MRST recovered from auger testing (Figure 40; Table 32)

Figures 39 and 40 show that the activities associated with MRST

Figure 38: A Sample of Medium to Fine Grained Marginally Retouched Stone Tools From Forty Mile Coulee. See Table 36 for Provenience. Artifacts Actual Size.

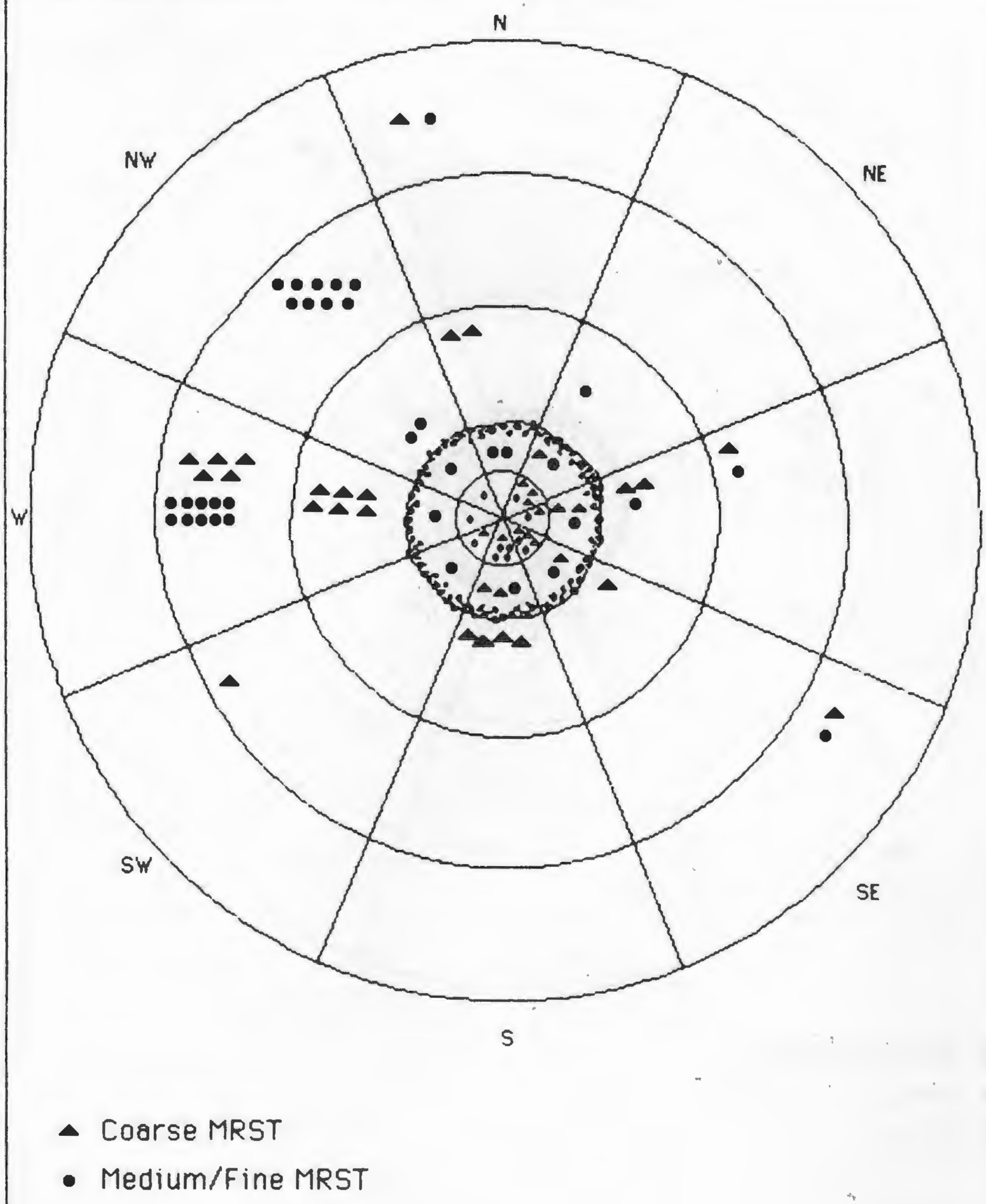


Figure 39: Distribution of Marginally Retouched Stone Tools From Test Excavation, Forty Mile Coulee.

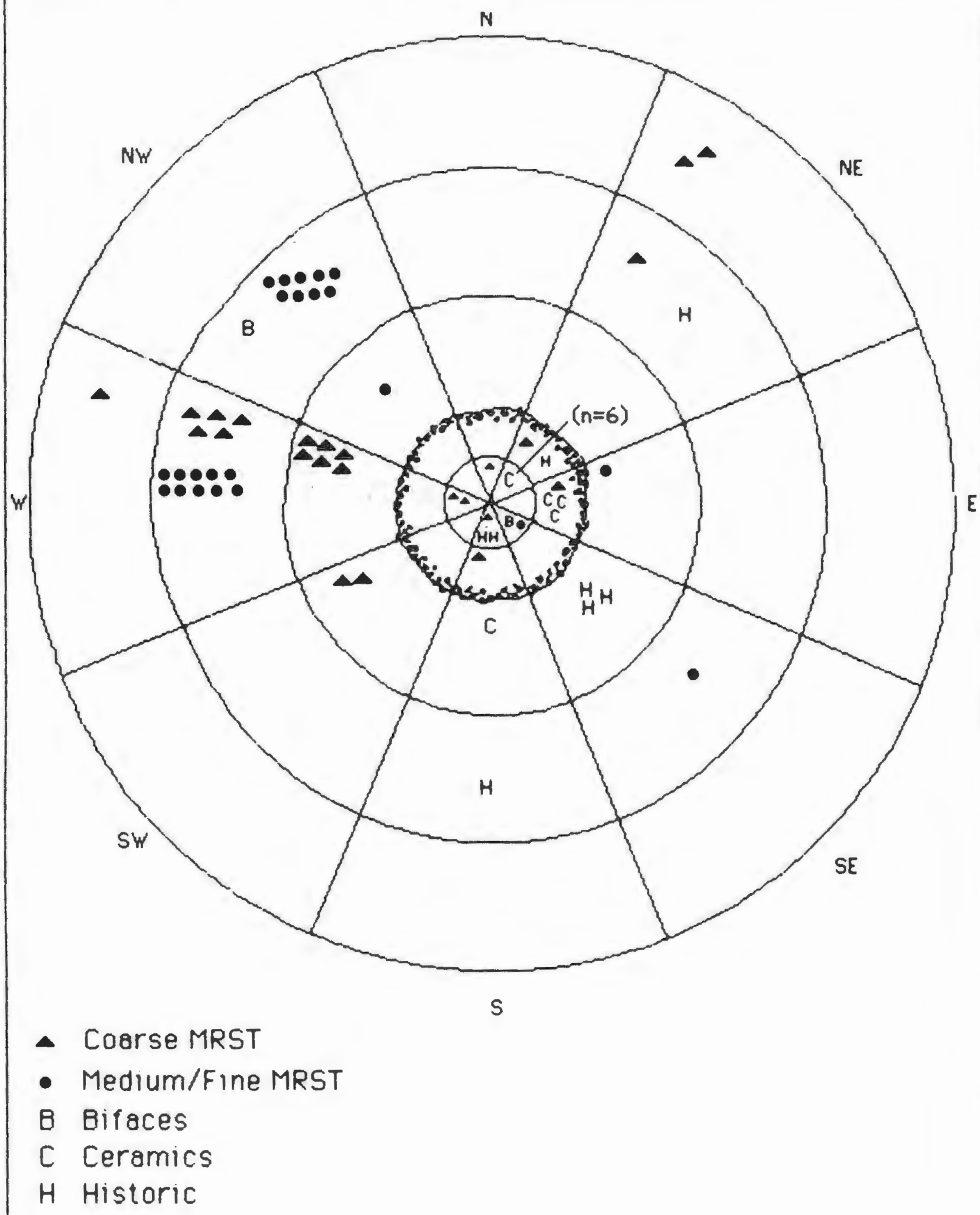


Figure 40: Distribution of Tools, Ceramics and Historic Items Recovered from Auger Testing, Forty Mile Coulee.

were patterned within a camp. Inside the lodge these activities took place most commonly at the front of the lodge. Outside of the lodge there appears to be a relatively equal distribution of coarse and medium to fine MRSI. They are, however, concentrated behind the lodge in an area which may have served as the main meat processing locale.

8.5.7 Projectile Points

Following MacNeish (1958:85) a projectile point is considered here to be a pointed man-made object (artifact) of stone, bone, shell, wood, or metal that can be hafted to a shaft (of an arrow, dart or lance) to facilitate penetration. At Forty Mile Coulee all identified projectile points were made of chipped stone and are assumed to have served in hunting activities. In total, 19 points (Figure 41) were collected from nine sites in the project area. Excluding bone, this represents only 0.4% of the total amount of cultural material recovered (Table 27). Projectile points are considered high value tools and their location within and adjacent to stone circles is considered indicative of male activities, reflecting point manufacture and replacement.

The sample exhibits a wide range of sizes, shapes and flaking qualities which will not be discussed in detail here. For metric and non-metric descriptions of individual specimens, the reader is referred to Dau and Brumley (1987:683-694). All the points were produced on medium to fine grained lithics, primarily local cherts. Non-local lithic materials utilized include Madison Formation cherts, obsidian and Knife River flint. As with the non-local debitage sample, non-local lithics used in point manufacture suggest trade and contact to the south rather than the east or west.

The majority of points found at Forty Mile coulee exhibit enough diagnostic characteristics to allow them to be related to specific cultural complexes. The oldest points in the sample are referrable to the Pelican Lake complex which dates from ca. 1600 B.C. to ca. 700 B.C. (Figure 14). Two Pelican Lake specimens were found in the project area; one from site DjOu-5, a buried camp (Figure 41,*4) and another from a plowed field on the floor of the coulee (Figure 41,*10). The point from site DjOu-5 is not considered to reflect a Pelican Lake occupation for the site. It exhibits

Figure 41: Projectile Points (1-19) and Endscrapers (20-21) From Forty Mile Coulee. See Table 36 for Provenience. Artifacts Actual Size.

evidence of having been reworked some time after original abandonment and it is assumed to have been utilized by later occupants of the site. These later occupants belonged to the Besant complex which extended from ca. 150 B.C. to ca. 700 AD (Figure 14).

The next oldest point (Figure 41,#18) has been identified as belonging to the Avonlea phase which dates from ca. 150 AD to ca. 1050 AD (Figure 14). This specimen was recovered from site DjOu-81, a buried camp. The remaining 15 specimens all exhibit characteristics which suggest they can be referred to as Prairie/Plains Side Notched varieties.

As can be seen in Figure 41, a number of the specimens are in fact, unnotched. They do however, fit well into the general range of shapes and sizes for these Prairie/Plains point varieties. This suggests that the unnotched specimens represent point blanks which were abandoned during production. Breaks are present on the majority of the sample of points. It is assumed these breaks occurred during attempts to manufacture, resharpen or haft the specimens and were the cause of their abandonment or discard.

The distribution of the 15 points recovered from stone circle excavation is presented in Figure 42 and Table 31. Because of the small size of the sample it is difficult to discuss distribution patterns in terms of the ten defined locational areas. In general, however, it is apparent that activities associated with projectile points were focussed on the interior of the lodge and in areas outside but within five metres of the lodge. Such areas are assumed to reflect locales of arrow refitting and point manufacture.

8.5.8 Endscrapers

Artifacts defined as endscrapers are unifacially flaked stone tools produced by concentrating secondary retouch on the distal end of a flake or split pebble blank. Retouch results in a steep faced transverse working edge. Most artifacts in this category have a triangular or "thumbnail" shape and were used by being held in the hand or were hafted to a bone or wood handle. Semenov (1964:88) has noted that the general configuration of endscrapers makes them ideal for working the fleshy side of skins. MacNeish (1958:105) added scraping wood and gouging marrow from split bones to the

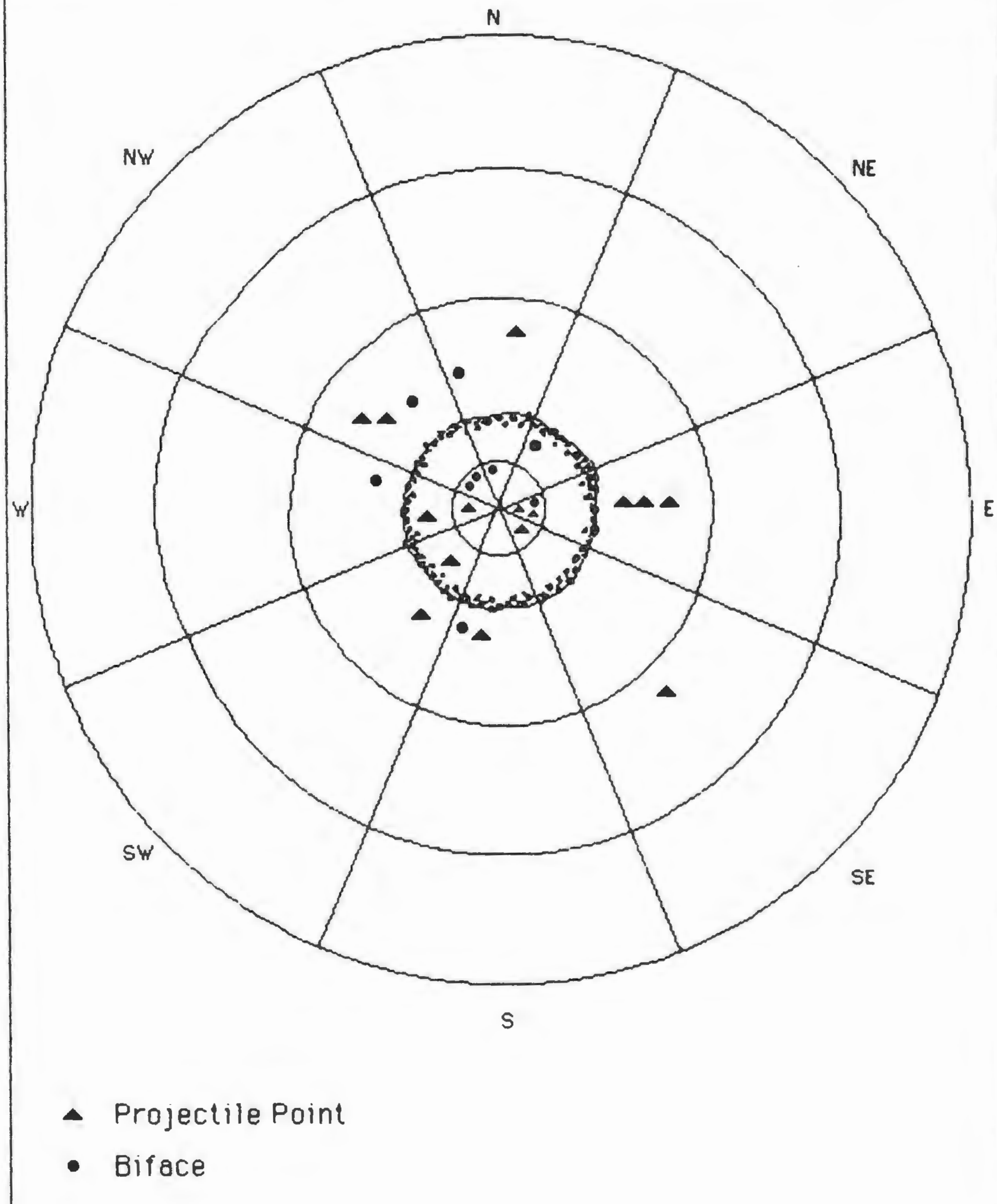


Figure 42: Distribution of Projectile Points and Bifaces From Test Excavation, Forty Mile Coulee.

list of tasks suitable for endscrapers. It was, however, as a hide working implement that endscrapers were apparently most commonly employed.

Virtually all ethnographic accounts of hide working note that it was a task undertaken by women only (Denig 1930:540-542); Grinnell 1962:213-220; Lowie 1909:175-177; Robinson 1879:345; Wilson 1934:417). These accounts also note that the process of preparing a hide was time consuming and, to a certain extent, seasonal in nature. The amount of time required to properly prepare a bison hide appears to have varied from lows of two days (Turney-High 1941:79-81; Uhlenbeck 1912:9) to highs of five days (Wilson 1934:417). The average was about three days, approximately the same amount of time required for an average sized lodge group to consume the useable meat of a single bison. Both Robinson (1879:345) and Flannery (1957:54) stated that hides taken from animals in the winter were considered the best as they were thicker and hairier than at any other time of the year.

At Forty Mile Coulee only two endscrapers were recovered. Both were found during test excavation and both came from contexts not directly related to stone circles. At site DjOu-3, a large endscraper (Figure 41,*20) was found in a buried occupation beneath a stone circle. The second endscraper (Figure 41,*21) was found at site DjOu-81, a buried Avonlea camp. Detailed metric and non-metric descriptions of these tools are presented in Dau and Brumley (1987:694:695).

The lack of endscrapers in the excavated stone circles is consistent with the ethnographic data presented here. That data has shown that evidence of hide working (i.e.: endscrapers) might only be expected at camps occupied for more than three days or during the fall/winter when hides are in prime condition. Archaeological sites in the region containing numbers of endscrapers such as the Ross site (Vickers 1987), the Saamis site (Milne-Brumley 1978) and those in the Cypress Hills (Brumley et al. 1981) all appear to have been occupied for lengthy periods of time or during the winter and are consistent with this model.

At Forty Mile Coulee, the stone circle sites do not fit within the assumed parameters for sites expected to contain endscrapers. As has already been discussed, faunal data indicate that these sites were occupied in the spring, a time when bison hides were of poor quality. In addition, the data suggest that few of the sites were utilized for periods in excess of three days. The endscrapers that were recovered from the project area must therefore represent occupations different from the normal pattern observed within the coulee. Little can be said of the specimen from site DjOu-3 as it was recovered from an undated level. However, the specimen from site DjOu-81 helps to substantiate the supposition that Avonlea peoples employed different settlement strategies to exploit the resources of the area than did either earlier or later groups.

8.5.9 Bifaces

Bifaces are defined here as chipped stone tools characterized by moderate to complete modification of a preform as a result of bifacial flaking. This bifacial flaking on any given surface can vary from marginal to overall. Most projectile points, as well as some endscrapers and drills, are specialized forms of bifaces. The general characteristics of specimens from the project area suggest they were utilized as knives for cutting meat and hides. It is commonly assumed that larger bifaces were used during coarse butchering and that small bifaces were utilized for finer meat segmentation. Because of their general manufacture from better quality lithics and the increased expenditure of time required to create them, they are considered to be "high" value tools. Bifaces are assumed here to largely reflect the activities of female members of an aboriginal group.

At Forty Mile Coulee a total of 16 complete and partial bifaces were collected from 12 sites (Table 26). They represent the second largest class of "high" value stone tools and comprise 0.1% of the total sample including bone (Table 27); 0.3% if bone is excluded (Table 28). Individual metric and non-metric observations are presented in Dau and Brumley (1987:695-705) and will not be discussed here.

As can be seen in Figures 43 and 44 the sample of bifaces exhibit a wide variety of shapes and sizes which strongly suggests they were produced for specific rather than general purposes. Lithic material types vary widely as well. Four (Figure 43,*1,2,9; Figure 44,*5) were produced on pieces of local coarse grained quartzite or argillite. The majority of the remainder were produced on pieces of local medium to fine grained lithics, primarily chert and petrified wood. Three specimens were produced on lithics of non-local origin. Two (Figure 44,*3,7) were made on pieces of a

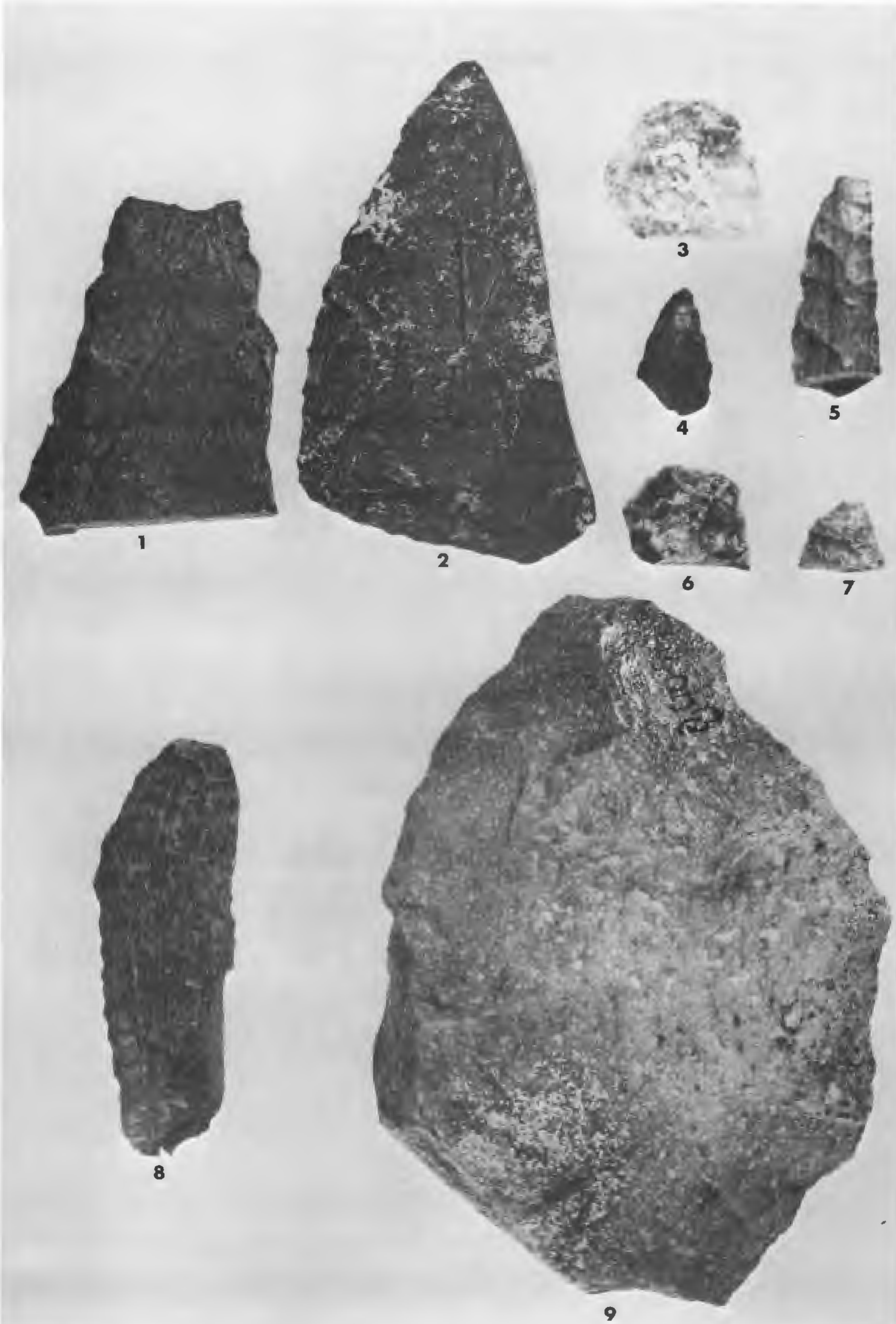


Figure 43: Bifaces From Forty Mile Coulee. See Table 36 for Provenience. Artifacts Actual Size.

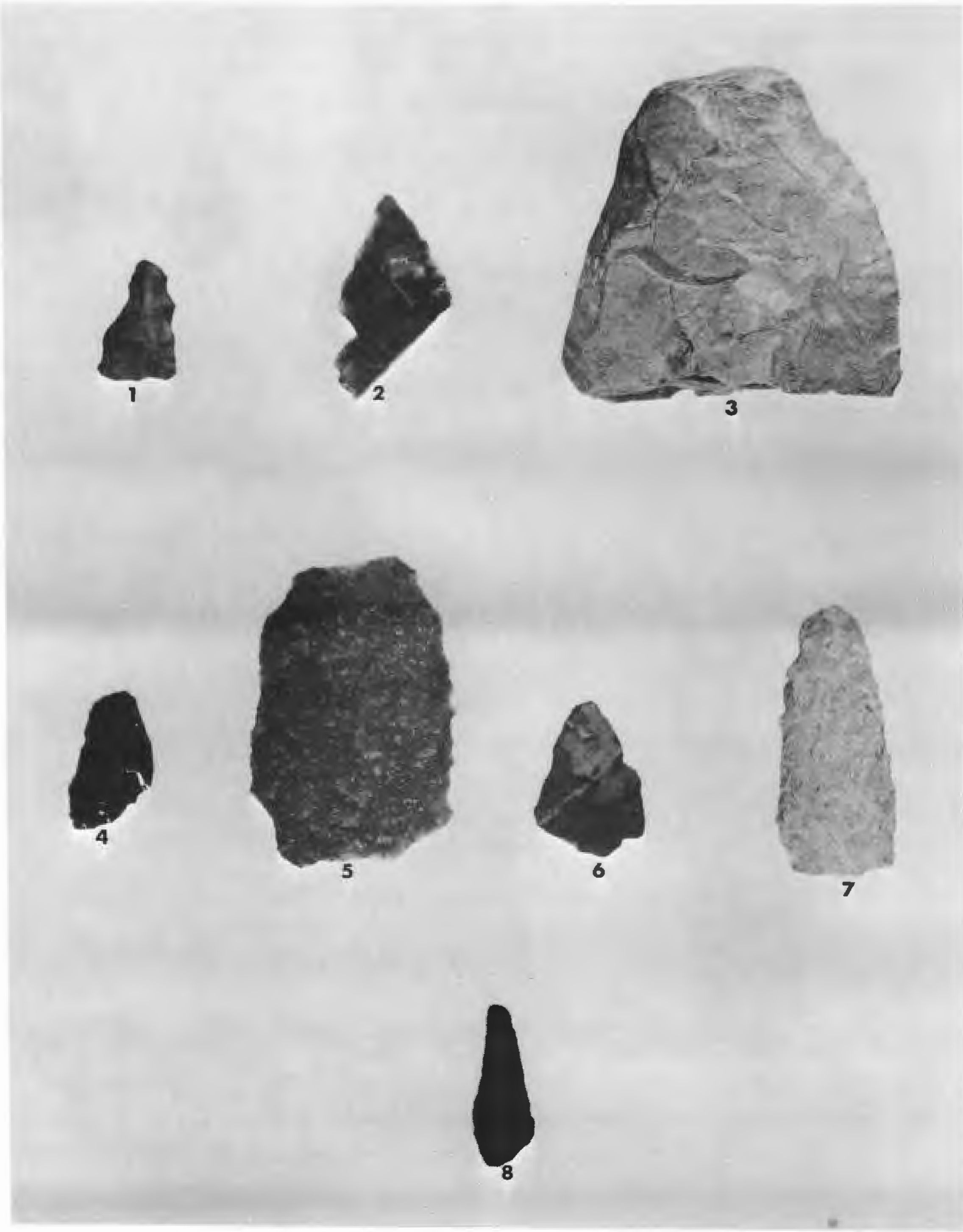


Figure 44: Bifaces (1-7) and Drills (8) From Forty Mile Coulee. See Table 36 for Provenience. Artifacts Actual Size.

high quality tan chert, the nearest known sources of which are situated in central Montana. The third (Figure 44,*4) was produced on a piece of obsidian presumably from the Yellowstone Park area of Wyoming. The largest of the specimens, produced on non-local lithics exhibits characteristics which suggest it was a preform blank used with only minor modification (Figure 44, *4).

The quality of flaking varies widely between specimens, regardless of lithic type. All, however, exhibit working edge angles that range from 25^0 to 50^0. This suggests that most bifaces in the sample were used as cutting tools.

In terms of physiographic zone, Table 28 shows that minor variations in percentage frequencies of bifaces are present. The lowest frequency is on the prairie edge of the coulee (physiographic zone 1.1). The highest frequency is on the crests of ridges or knolls, forming portions of the coulee wall (physiographic zone 3.1). The authors are, at present, unsure of the reason for this observed variation.

Figure 42 presents the distribution of the ten bifaces recovered from test excavation in direct association with stone circles. Because of the small sample size detailed analyses of distributional patterns are inappropriate. In general, however, the figure shows that bifaces were concentrated in the center of the lodge and in the area outside of the lodge designated Back Near Lodge. Although it appears that bifaces and projectile points are found together, a closer examination of Figure 42 shows that of the 24 analytical units inside and within five metres of the lodge only four (16%) contain both points and bifaces. This indicates that the areas related to the production and use of bifaces were contiguous to, but not necessarily associated with projectile points.

8.5.10 Other Lithic Formed Tools

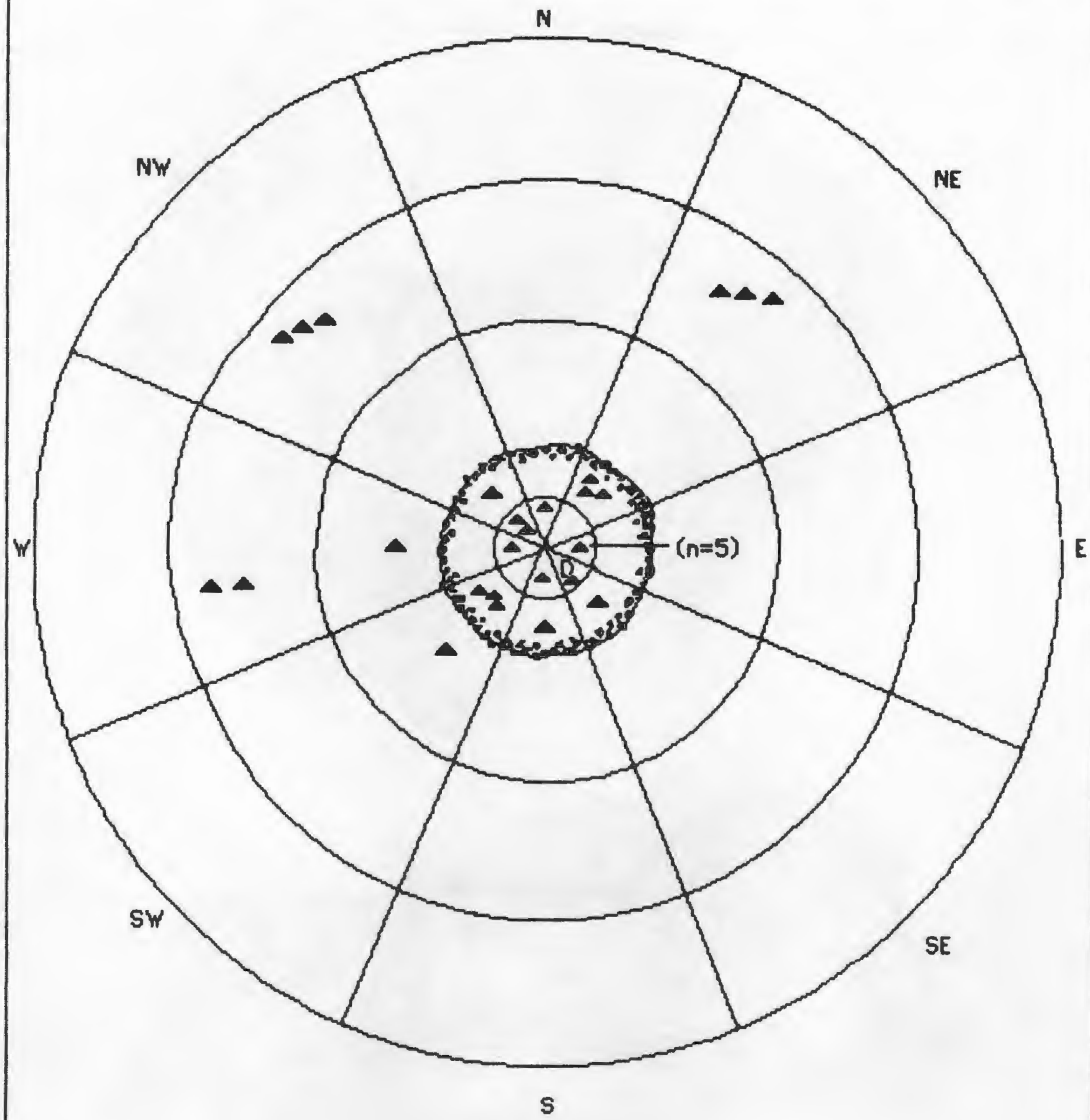
At Forty Mile coulee, four stone tools representing three infrequent classes of cultural material were collected. The following section has been designed to provide only general descriptions and discussions. The reader is referred to Dau and Brumley (1987:705-709) for metric and non-metric observations of the individual items.

A single artifact identified as a drill was recovered from Stone

Circle 3 in site DjOu-44 (Figure 44,*8). Drills are defined here as chipped stone tools that exhibit flaking patterns suggestive of an item used to puncture hides or produce holes in bone or wood. The drill from site DjOu-44 is small and was produced on a piece of medium to fine grained local green chert. It exhibits alternate unifacial flaking patterns, indicative of a tool used with a twisting motion and has a tip heavily polished by use-wear. The general configuration of the item suggests it was used to puncture soft materials such as hides rather than bone or wood. Located inside, near the center of a stone circle (Figure 45) the drill may have served as a tool in the working of hides.

Two artifacts designated unifaces were found in the project area. Unifaces are chipped stone tools produced as a result of intentionally patterned flake removal across most or all of one face of a flake or blank. Depending upon the size of the tool and the angle of the working edge, they were probably utilized as chopping, scraping or cutting implements. Based upon the quality of workmanship involved in production, unifaces can be classed as either "high" or "low" value tools. The unifaces from Forty Mile Coulee are considered to have been of "low" value. The specimen from site DjOu-67 (Figure 46,*1) was produced on a primary decortication flake from a large core of local quartzite. The uniface from site DkOu-48 (Figure 46,*2) was produced on one half of a small split cobble (also of local quartzite). The size and working edge angles of both tools suggest they served as simple choppers possibly used for butchering.

The last category of tools to be discussed here is that of grooved mauls. A single broken specimen was found in the project area (Figure 47). It was collected from a plowed field at site DjOu-66, adjacent to a cluster of stone circles. Grooved mauls are distinctive tools which were apparently hafted by leather or sinew to a wooden handle. They are assumed to have served as a multi-purpose implement for driving stakes, pounding meat or berries, breaking bones for marrow extraction, or crushing seeds. The specimen from DjOu-66 is broken across its proximal end. The distal end is complete, however, and exhibits extensive crushing and pitting.



▲ Historic Item
D Drill

Figure 45: Distribution of Other Cultural Materials Recovered From Test Excavation, Forty Mile Coulee.

1

2

Figure 46: Unifaces From Forty Mile Coulee. See Table 36 for Provenience. Artifacts Actual Size.

Figure 47: Grooved Maul From Forty Mile Coulee. See Table 36 for Provenience. Artifact Actual Size.

8.5.11 Bone Tools

Bone tools are defined here as implements produced on complete elements or fragments of bone, and which also exhibit extensive modification to the original shape of the bone used. At Forty Mile Coulee only one bone tool was identified (Figure 48). It was found at site DjOu-62, just outside of Stone Circle 13 (AU 7.3). The reader is referred to Dau and Brumley (1987:709-712) for detailed metric data on this tool.

An examination of the tool shows that it was produced on a sliver of ungulate long bone. It is highly polished over its entire surface. Such polish may have occurred during the shaping of the implement, but is more likely due to use-wear. The extreme proximal tip is broken off, the remainder is well rounded and exhibits extreme polish and wear. The configuration of the tool suggests it served as an awl. It is possible this implement was brought to the area as part of a "high" value tool kit and abandoned after it was broken beyond repair.

Figure 48: Bone Tool From Forty Mile Coulee. See Table 36 for Provenience.

8.5.12 Ceramics

Ceramics, usually in the form of small sherds, are a class of cultural material infrequently found in stone circle sites within the project area. Most researchers suggest the throwing, decoration, firing and use of such vessels was an activity exclusive to female members of an aboriginal group. At Forty Mile Coulee a total of 643 ceramic sherds were recovered from five stone circles at three sites (Table 26). They represent a surprisingly high 3.0% of all cultural materials recovered from the project area. Table (27) shows that all were found in sites adjacent to the base of the coulee wall (physiographic zone 6.1), an area also noted for extremely high bone density. Detailed descriptions of the sample will not be presented here. The following section will examine the sample in general terms only. The reader is referred to Dau and Brumley (1987:718-724) for a more extensive discussion.

A total of 236 body and rim sherds were collected from site DjOu-44. The majority (n=182) were found in Stone Circle 3, with the remainder (n=54) found in Stone Circle 6. All the sherds from the site are similar, with a grey-black surface color and a compact black paste containing angular quartz particles as temper. The majority are small in size and heavily weathered. Identified body sherds exhibit partially smoothed cord marked patterns on their exterior surfaces. Rim sherds (Figure 49,*1,2) are rounded and slightly thickened with most of the overhang on the exterior surface. Cord marked decoration patterns are also present on the rims, and one specimen (Figure 49,*1) exhibits a series of oblique, linear, V-shaped grooves along its edge. The nature of the sample suggests that no more than two vessels are represented.

At site DjOu-62, eight very badly weathered sherds were collected; one from Stone Circle 9 and seven from Stone Circle 12. Little can be said of these specimens due to their fragmentary nature, but in surface treatment they generally resemble the sherds from DjOu-44. It is unlikely that the sample represents more than two vessels.

A total of 399 body and rim sherds were recovered from site DjOu-73; all were found in Stone Circle 13. Like the specimens from site DjOu-44 and 62, the sherds at site DjOu-73 are small and heavily weathered.

Figure 49: A Sample of Ceramics From Forty Mile Coulee. See Table 36 for Provenience. Artifacts Actual Size.

identifiable exterior surfaces on the 389 body sherds are mottled grey in color. Paste is compact and hard, dark grey to black in color, with temper composed of small angular quartz particles. Surface treatment consists of a heavily smoothed over cord marked pattern.

The ten rim sherds in the sample are distinctive (Figure 49,*3,4). They exhibit a broad, slightly rounded lip that extends over both the exterior and interior surfaces. Like the body sherds, surface decoration is minimal. It consists of a smoothed over cord marked pattern similar to the body sherd pattern. The basic similarity of all the sherds from DjOu-73 suggest they represent a single vessel.

The ceramic sample from the project area shows a number of minor variations. In general, however, they are remarkably similar in terms of sherd thickness, paste, temper, surface color and decoration. All fit within the range of ceramic types identified by Byrne (1973) as comprising the Saskatchewan Basin complex. This complex dates from 150-250 AD to 1700 AD (Byrne 1973:331-341; see Section 5.4).

Despite the fact that the ceramics at Forty Mile Coulee were recovered from widely separated sites, Figure 50 shows a remarkable consistency in the spacial patterning of the sample. By far the greatest density is in the front half of the lodge center (AU 3.1). Low densities are present in the sectors containing the presumed doorway both inside and immediately outside of the lodge. This suggests that the primary focal point for the use of ceramic vessels was the center of the lodge with broken vessels discarded in doorway areas both inside and outside of the lodge.

8.5.13 Metal and Glass Materials

The category of metal and glass materials consists of all items recovered in test excavation and auger testing that are of Euro-American or Euro-Canadian origin. Such items were introduced to the aboriginal inhabitants of the area through trade. Ethnographic sources note the use of trade items by both men and women.

A total of 11 metal fragments and 27 pieces of glass were collected from 10 sites in the project area (Table 26). Combined, they represent 0.2% of the total sample of cultural materials recovered (Table 27); 1.1% if bone and ceramics are excluded (Table 19). Metric and non-metric observations

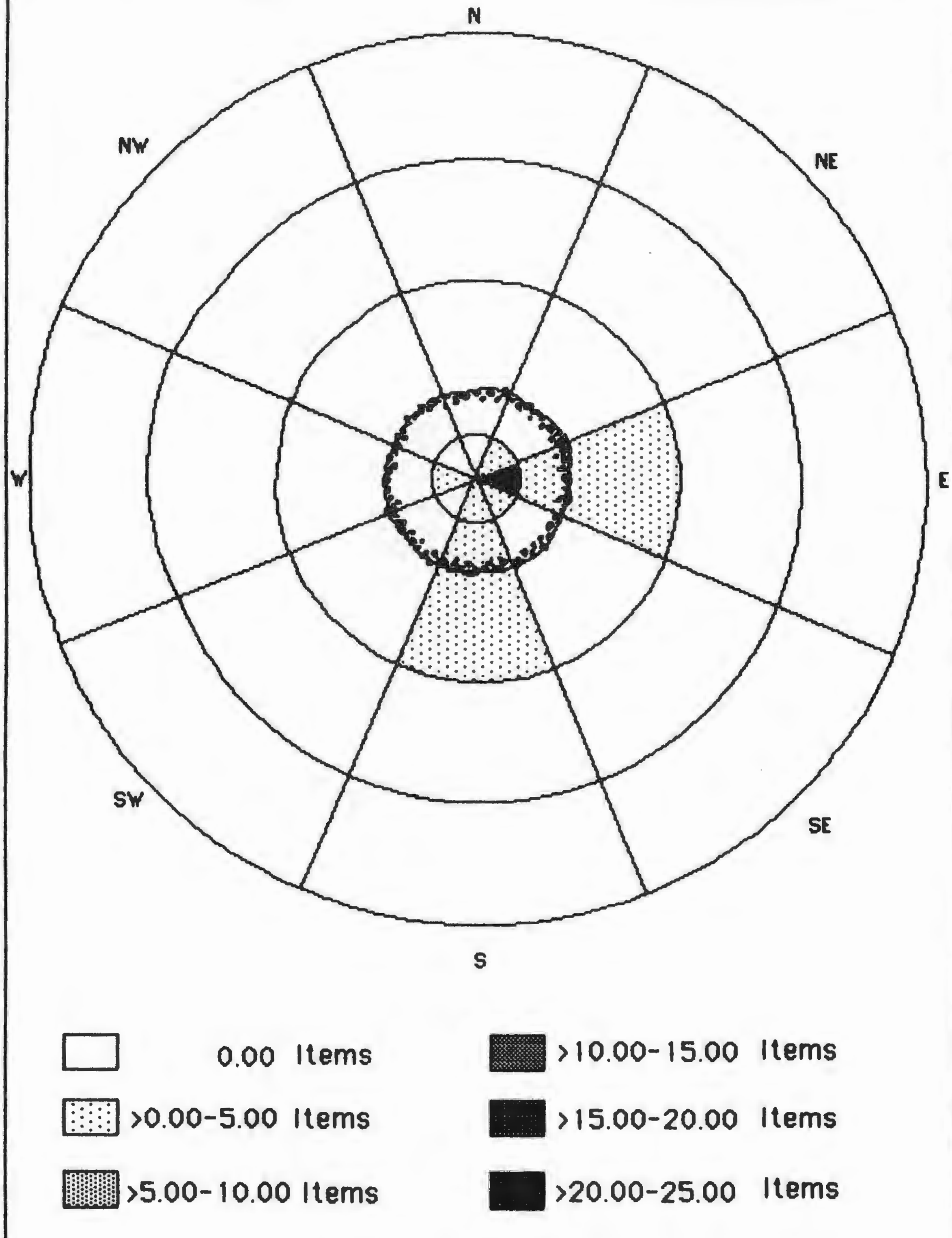


Figure 50: Density (m^2) of Ceramics Recovered From Test Excavation, Forty Mile Coulee.

on all the specimens are presented in Dau and Brumley (1987:712-718). All of the identified metal fragments are heavily corroded. Recognizable items consist of a small can (Figure 51,*1), a knife blade (Figure 51, *10) and the handle from a pail or bucket (Figure 51, *11). Amongst the remainder, one fragment from site DjOu-73 (Figure 51, *8) may represent a portion of a metal projectile point.

The glass fragments (Figure 52) exhibit a wide variety of shapes and sizes. All represent pieces of bottles rather than pieces of plates or bowls. Evidence of re-use of the fragments as tools is largely absent. The largest glass piece (Figure 52, *5) does, however, exhibit one edge which appears to have been reworked to form a scraper. Unfortunately, glass is known to inadvertently fracture and flake very easily, and as a result the retouch observed on this specimen may not reflect intentional reworking of the fragment.

That portion of the research design (Section 6.0) which deals with historic goods (metal and glass) suggests that these materials, due to scarcity, would be considered of "high" value. Figure 45 shows that the majority of historic materials were found inside the lodge. Outside of the lodge, the pattern is somewhat more diffuse. If, however, the data from auger testing (Figure 40) are included, there is a tendency for historic goods to be found in the same areas where a variety of other classes of cultural material, especially "high" value tools, are concentrated. While by no means conclusive, the distribution patterns of historic goods seem to indicate they were considered "high" value items by aboriginal groups.

The data in Table 17 exhibit a pattern that requires examination here. The table shows that stone circles containing historic trade goods have a much smaller density of artifacts made of stone than stone circles of known Late Prehistoric age. It is suggested here that this difference may be the result of a reduced emphasis on stone tools during the Historic Period. With the introduction of more effective metal tools such as knives, guns and, possibly, projectile points the need to produce tools from lithic material may have declined. As metal tools were more durable they were probably utilized for longer periods of time and would not be discarded as often as stone tools in short term camps like those found in Forty Mile Coulee.

Figure 51: Metal Fragments From Forty Mile Coulee. See Table 36 for Provenience. Artifacts Actual Size.

Figure 52: Glass Fragments From Forty Mile Coulee. See Table 36 for Provenience. Artifacts Actual Size.

8.5.14 Features

The term feature is referred to here as a specific locale within a site where one or more cultural activities were concentrated. Features are usually identified as a concentration of cultural material, a presumed inadvertently created soil stain or an intentionally excavated pit. Stone circles are one form of feature considered separately here. All the features described here are considered as ancillary to stone circles and are generally of small size. As a group, features are difficult to discuss due to the fact that most researchers describe and interpret them in different ways. In this section the authors have divided features into five general groups: 1) hearths, 2) pit features, 3) middens/refuse piles, 4) work stations, and 5) other features.

Hearths reflect areas where fires were employed. They might be used for a variety of purposes including heating and lighting lodge interiors, heating stones for stone boiling and cooking. Excavated pits commonly represent stone boiling pits, where water was boiled for cooking and bone grease extraction. Middens/refuse piles generally represent areas where cultural debris was dumped on the surface. Work stations are identified here as locales where clusters of lithic debris and/or cores are found. Finally, the category of other includes a mixed sample of infrequently represented features such as irregular soil stains and post molds.

Preliminary surface observations, undertaken during limited stone circle mapping, indicated that features were present at stone circle sites in the project area although in limited quantities (see Table 12). As features are usually considered primary indicators of activity areas, and as the research design involves an examination of activity areas both inside and outside of stone circles, identifying and recording such features during test excavation at Forty Mile was considered important. It was assumed that feature identification inside of stone circles would be relatively simple given the small areas involved. Outside however, where areas up to 1000 m^2 per stone circle are involved, the chances of encountering features was considered slim due to the limited area of excavation allocated for each stone circle. In order to deal with this problem, controlled surface stripping (see Section 7.0 and Appendix 1) was employed.

The results were less than expected. Even though almost 30,000 square metres were stripped within and adjacent to 40 stone circles at six sites, only two features were recorded. Both were found in one site, DkOu 16. The first was a refuse pile composed of bone fragments and FCR in Analytical Unit 1.5 of Stone Circle 6. The second was a cluster of FCR in Analytical Unit 1.3 of Stone Circle 7.

The results of the search for features in test excavation were only slightly better, with four features identified. They consist of a small boiling pit in Analytical Unit 5.2 of Stone Circle 6 at site DjOu-44; a shallow surface hearth in Analytical Unit 8.3 of Stone Circle 11 at site DjOu-62; a central hearth in Stone Circle 12 at site DjOu-62; and a cluster of unmodified cobbles in Analytical Unit 5.1 of Stone Circle 1 at site DkOu-16.

The lack of features in the project area surprised the authors. Given the amount of FCR recovered from the sites it was assumed that the hearths necessary for heating these stones would be present in reasonable numbers. As they were not located, the authors further examined feature location and type by examining feature type and location from published data on 22 sites in southern Alberta. The results of that study are presented (integrated with the Forty Mile Coulee data) in Table 37. As can be seen from the table, features are not uncommon within and adjacent to at least some stone circles. The five defined feature types can be found scattered throughout the 40 analytical units associated with stone circles. Some 59.2% of all recorded features were found inside of stone circles (distance units .1 and .2). Hearths dominate the sample but pit features, middens/refuse piles and other features are present. Noticeably lacking are features defined as work stations.

All feature types are present outside of stone circles (distance units .3, .4 and .5). Middens/refuse piles comprise the majority of the sample, although the number of hearths is almost as large. Of interest outside stone circles, is the fact that most recorded features can be found within five metres of the wall of the stone circle (distance unit .3). In terms of this discussion, it is important to note that only 6.7% of all recorded features are found outside the defined limits of the analytical unit system.

Obviously, suggestions concerning the general lack of features at Forty Mile coulee are required. Two possible reasons are proposed here which are based upon the Forty Mile data presented in this report and from the published sources which provided the data for Table 37. The first involves length of occupation and seasonality. Generally stone circle sites containing features are interpreted by the authors as having been occupied for longer periods of time than sites containing no features. Also, sites with stone circles exhibiting central hearths are often assumed to have been occupied during cold seasons or during inclement weather. As has been shown in earlier sections of this report, the Forty Mile Coulee sites are assumed to have been occupied for short periods of time which suggests that features should not be found in great numbers. Unfortunately, the suspected season of occupation for the sites (March-May) is famous, in southeastern Alberta, for its changeable and often harsh weather. As a result, interior hearths for lodge heating should be expected in a reasonable sample of stone circles. In addition, the presence of FCR at the sites indicates that fires were used, if only briefly.

The second postulated reason for the lack of features provides some explanation for the discrepancies noted above. It suggests that the lack of observed features, especially hearths, is a result of the type of fuel used. As was noted in Section 8.5.2, this fuel at Forty Mile may have been predominantly bison dung. Studies conducted at the Head-Smashed-In buffalo jump (Brink et al. 1986) have shown that bison dung fires can provide sufficient energy to heat stones for stone boiling. In addition, the ethnographic record is full of references to the use of bison dung fires at all times of the year for both cooking and heating (Cowie 1913; Denig 1961; Johnson 1967; Hind 1971; etc.) Such fires would not require prepared hearths nor would they leave extensive evidence (excavated pits, charcoal, or ash stains) of their presence, as would fires utilizing wood. Occasionally, given proper preservation conditions, the location of a bison dung fire might be discovered in the form of an area of fire-reddened earth. The feature outside of Stone Circle 11 at site DjOu-62 was composed of fire-reddened earth and may represent the remains of a dung fire.

The authors feel that the reasons stated above explain the general lack of defined features at Forty Mile Coulee. The short-term nature of the occupation would preclude the creation of features associated with activities requiring extensive time. In addition, fires for lodge heating and stone boiling utilized a fuel source which left minimal evidence in the archaeological record.

8.6 Cultural Activities and Activity Areas

The preceding section (8.5) has provided descriptions of the nature, density and distribution of individual cultural material categories. Insofar as possible, each material category has been interpreted as to the nature of the activities it reflects. This section attempts to integrate or articulate that data on individual cultural material categories to suggest general patterns of activity within and around the lodge. Ethnographic evidence suggests highly specific and different economic and social roles for men and women within aboriginal Plains societies. Based on this ethnographic data, an attempt is made here to suggest not only what activities various kinds of cultural material reflect, but whether they can be used to identify male or female specific tasks. In so doing, a number of tables and figures have been prepared which require brief introduction and comment.

Figures 53 and 54 summarize the density of all categories of cultural material, excluding bone, as indicated by the test excavation and augering programs respectively. Bone has been excluded from the figures because of the apparent differential preservation factors affecting its presence and/or abundance (see Section 8.5.3). Separate values for bone material alone is presented in Figures 29 and 30. Table 38 lists the results of a series of correlation coefficient tests run between paired sets of all the various categories of cultural materials. Each pair of cultural materials are grouped in variously configured spacial clusters or sets. The correlation coefficient test is the same as employed earlier in Section 8.3 and is discussed in more detail there. For this examination, correlation values of 0.70 and above are considered significant. As noted in Section 8.3, the correlation values listed may reflect either positive or negative values due to the statistical program employed. Manual calculation of the significant correlation values was carried out separately to determine if the values are positive or negative. A close examination of Table 38 suggests that significant correlation values may indicate two situations:

1. "High traffic" areas where a variety of mutually exclusive, essentially unrelated cultural activities took place. Interior lodge

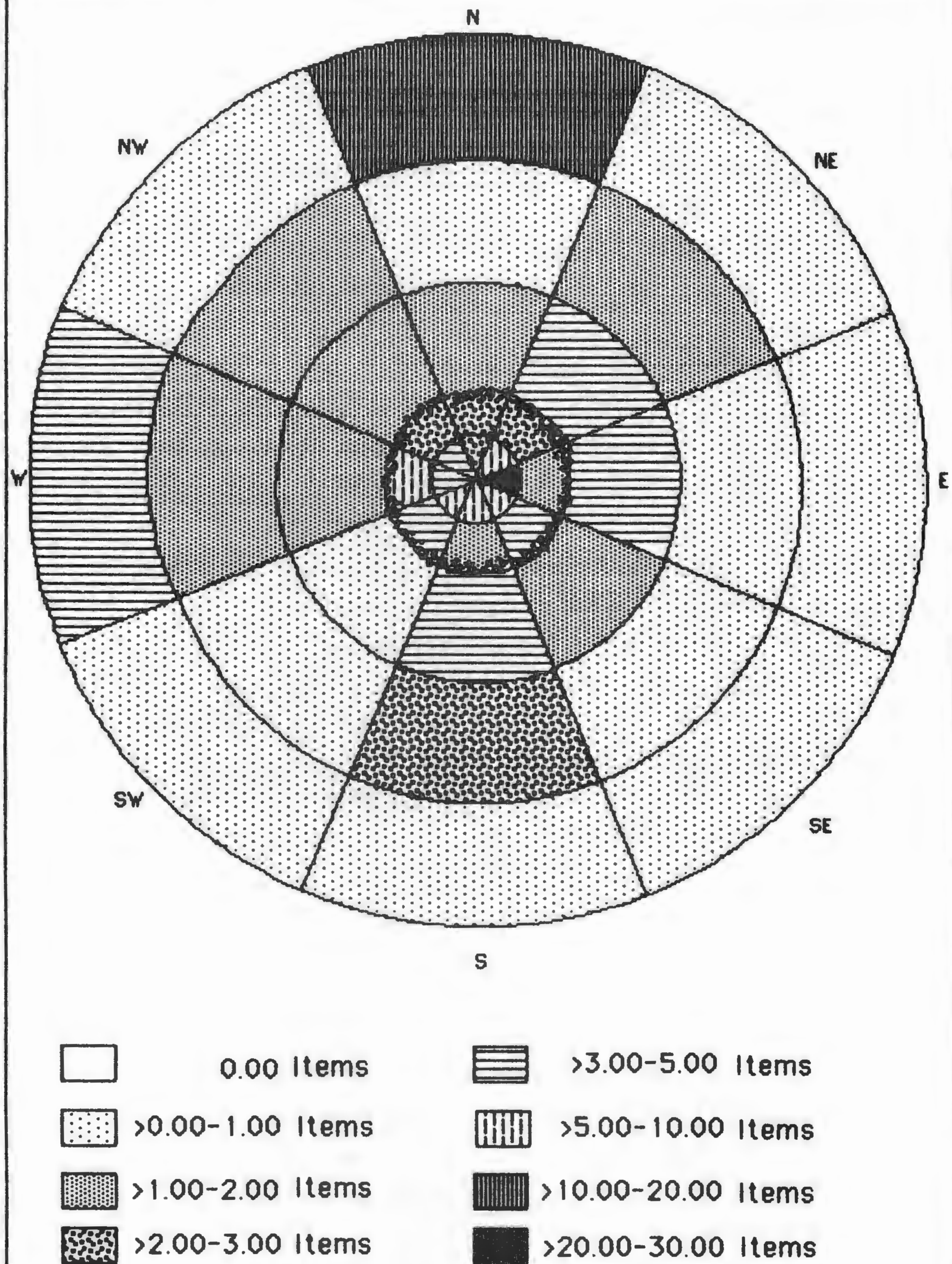


Figure 53: Density (m^2) of all Cultural Material Recovered From Test Excavation, Excluding Bone, Forty Mile Coulee.

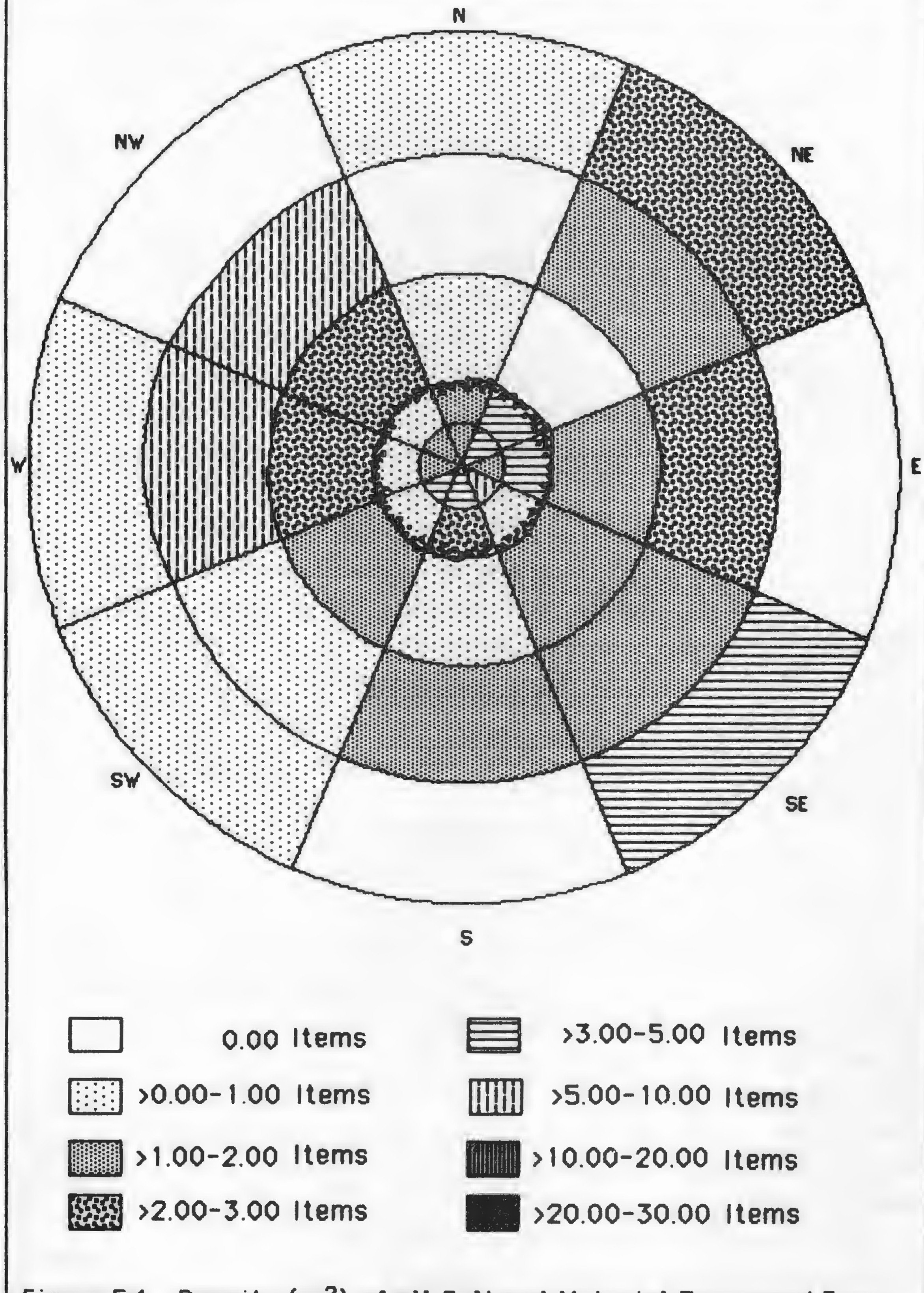


Figure 54: Density (m^2) of all Cultural Material Recovered From Auger Testing, Excluding Bone, Forty Mile Coulee.

areas and locations in front near the lodge were the areas most susceptible to this situation. Many of the high correlation values there appear to be the result of coincident spacial association.

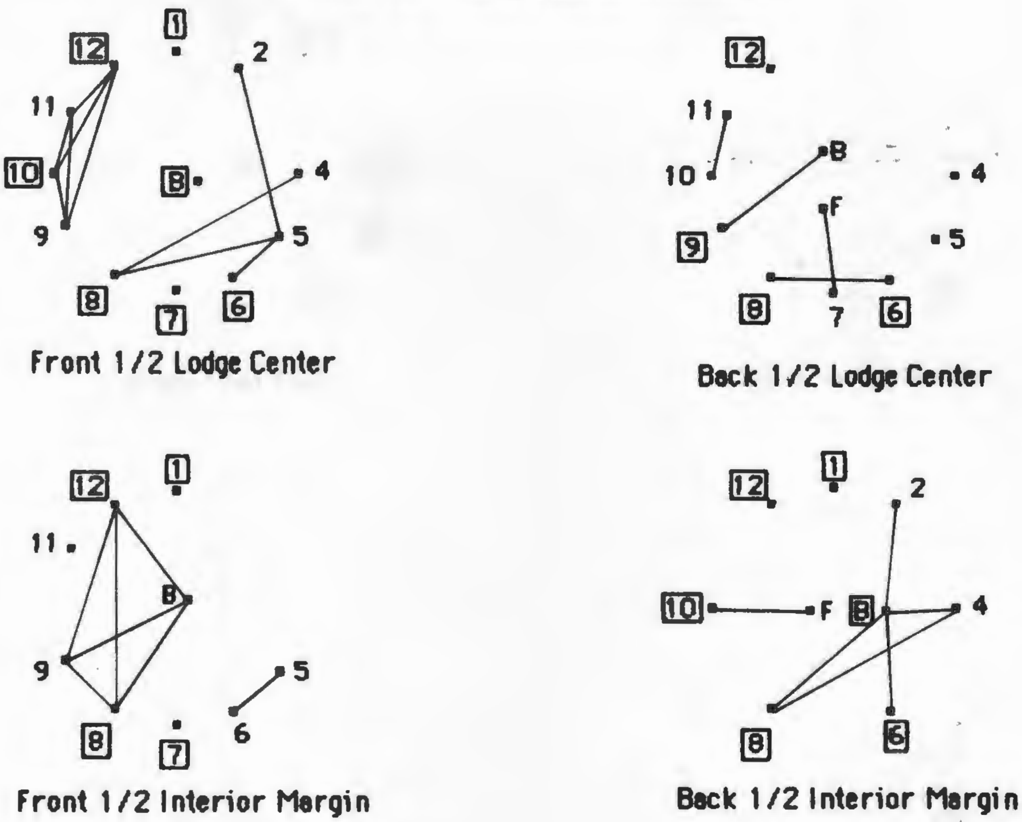
2. Functionally associated or disassociated categories of cultural material. An example would be a positive correlation between two kinds of cultural material used in, and reflecting the same cultural activity. Alternately, two non-functionally related cultural material categories would be expected to demonstrate no correlation or a negative correlation.

For our purposes here, it is the second type of situation in which we are most interested. As high correlation values can reflect both of the situations noted above, it is often difficult to ascertain which may be operating. By configuring the analytical units into a number of different sets, it is possible to better evaluate which of the situations may be applicable. Figure 55 graphically illustrates the moderate and high frequency occurrence of various cultural material categories in relation to defined lodge areas (Figure 26). Moderate frequency of occurrence is indicated by isolated number symbols. A boxed-in number symbol indicates a high frequency of occurrence. Items absent or occurring in low frequency are not represented. In Figure 55, lines linking various cultural material categories indicate positive relationships suggested by high correlation coefficient values.

Table 39 summarizes the estimated number of pieces of cultural material associated with an "average" stone circle within the Forty Mile project area. Auger testing results are used in the table as they are felt to be more representative of possible cultural material density than excavation results due to the sampling biases discussed in Section 8.5.1. Again, because of differential bone preservation, values are presented with and without bone. Table 40 summarizes proposed functions, male and female associations, areas of concentration and apparent relationships between various categories of cultural material. Arguments for many of the conclusions presented in Table 40 have been previously presented in respective parts of section 8.5.

Examination of the above tables and figures indicates that a complex set of spacial and associational relationships exist between the various categories of cultural material. Since these relationships are already

Interior Lodge Relationships *



CULTURAL CATEGORIES

F - Firecracked Rock
B - Bone
1 - Coarse Cobble Cores
2 - Med/Fine Cobble Cores
3 - Coarse Pebble Cores
4 - Med/Fine Pebble Cores
5 - Coarse Debitage
6 - Med/Fine Debitage
7 - Coarse MRST
8 - Med/Fine MRST
9 - Bifaces
10 - Projectile Points
11 - Ceramics
12 - Other

* Moderate and High Frequencies Shown only

□ High Frequency Categories Boxed in

— Apparent Positive Correlation

Figure 55: Schematic Diagram Showing Postulated Interior and Exterior Lodge Cultural Material Relationships. (continued next page)

Exterior Lodge Relationships*

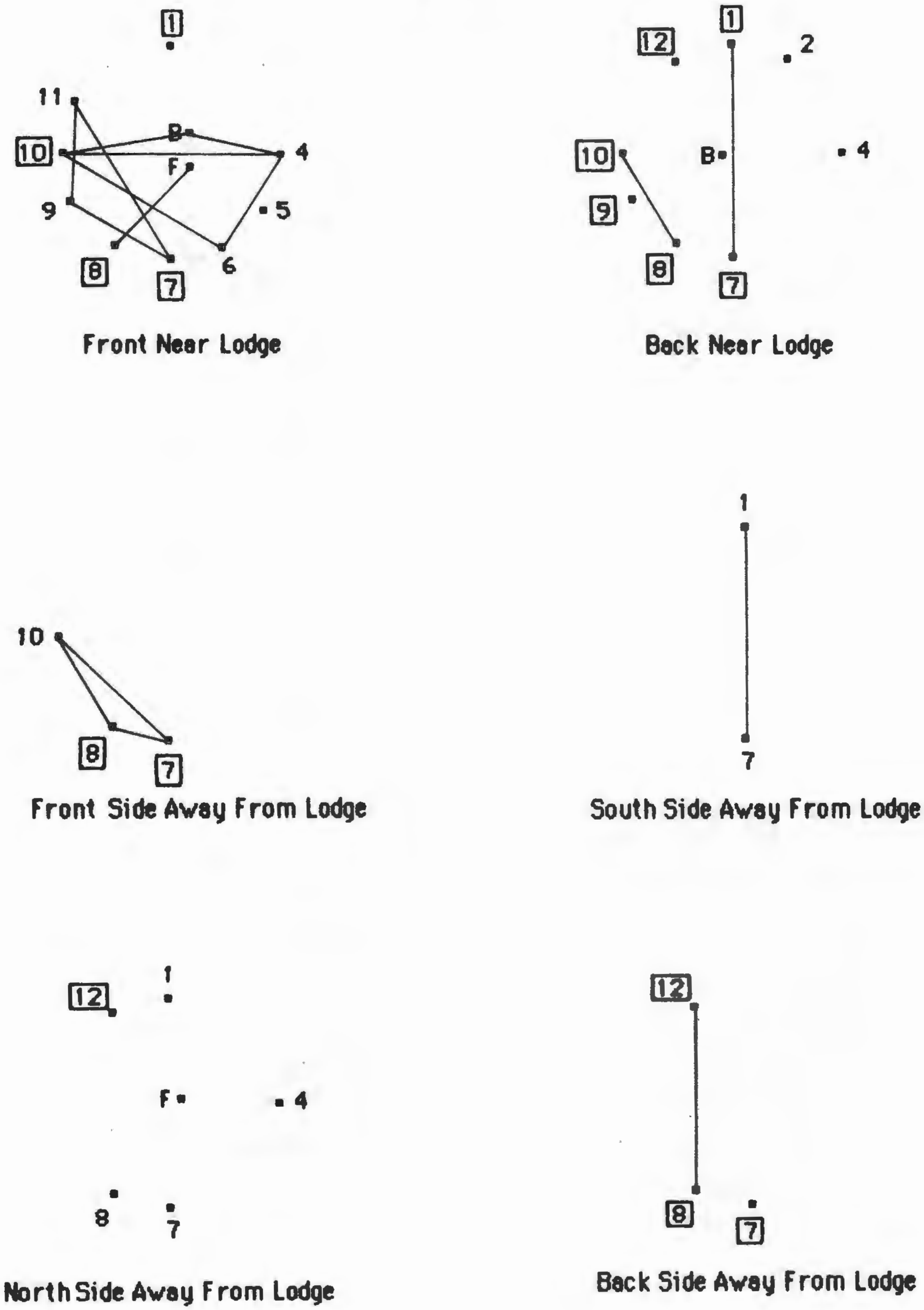


Figure 55: Continued (Note: see preceding page for legend)

thoroughly presented in figure and table form, they will not be reiterated in detail here. Instead, the following discussion will focus on select aspects of the data and on general statements concerning the spacial structuring of cultural material within and surrounding stone circles.

As anticipated, the lodge walls (as reflected by the stone circle) and doorway area appear to form primary boundaries around which activities and activity areas are structured. The greatest density and diversity of cultural materials is within and immediately adjacent to the stone circle (Table 39). However, this density is in part is illusionary. If one takes into account the relative size of each distance unit associated with an "average" sized stone circle at Forty Mile, over 69% of all associated cultural material including bone is found from 5 to 15 meters away from the exterior margins of the stone circle. If bone is excluded from the sample the frequency increases to 84%. Again, although the interior of a stone circle contains the highest "density" of cultural material, the total "number" of items represented by that density amounts to no more than 4% of the total associated cultural assemblage. Thus, conventional excavation strategies which focus extensively or exclusively on excavation of stone circle interiors are "high grading" associated cultural materials. Such an approach is in part justifiable as a means of increasing the probability of acquiring high value, culturally and/or temporally diagnostic materials. However, it is hoped that the distributional data presented here have demonstrated the potential of, and need for, systematic examination of areas well away from the immediate margins of the stone circles.

Evidence of intentional cleaning and disposal of cultural material was absent from Forty Mile sites. Considering that the average duration of occupation is estimated at 1 to 3 days, this is not unexpected. Presumably insufficient cultural material would accumulate within such a time interval to warrant such activities. One possible exception might be the lodge interior. Moderate to high densities of bone and FCR (Figures 27, 29) in areas in front of the presumed preferred doorway areas could reflect some refuse disposal from the lodge interior out the doorway. One important comment is required here. Throughout this report it is assumed that all of the cultural items collected have been found in situ. Post depositional movement is assumed to have been minimal. In Section 8.5.3 it was noted that some of the faunal material exhibits evidence of carnivore gnawing.

Carnivores may have gnawed bones in place or they may have moved them away from where they were originally deposited. Usually they selected only large (often complete) elements. Most of the sample of bone from the project area is small and fragmented, showing no evidence of carnivore activity. It is felt that the possible movement of a small number of larger pieces of bone is of only minimal significance in terms of the overall density patterning of bone material.

The areas totally surrounding the exterior lodge margins (distance unit 0.3) are also characterized by a high density and diversity of cultural material. In particular the area behind the lodge demonstrates evidence of extensive utilization. Presumably, the immediate lodge margin was a preferred activity area due to its proximity to the lodge interior. The lodge might also have provided desired shade or shelter from sun or wind conditions, with the observed patterns indicating movements of individuals to appropriate sheltered area.

In areas further away from the lodge (distance units .4 and .5), the range of cultural materials is more restricted, and characterized by higher proportions of lower value items. These materials are most abundant in the locational areas designated north, south and back side away from the lodge (Figure 26). Cultural materials present appear to largely reflect meat processing. Faunal remains although abundant and extensively fragmented may or may not reflect processing for bone grease or marrow extraction. It is possible that bone presence and fragmentation is incidental to meat processing activities.

Of particular note is the total lack of a positive correlation between firecracked rock (FCR) and faunal remains (Table 38). The only significant correlation between these materials is strongly negative in the front half of the lodge center area. The lack of position association between FCR and faunal remains is seen as an argument against significant bone grease processing. The moderate to high frequencies of FCR and faunal remains in areas outside and away from the lodge can best be interpreted as reflecting different kinds or different non-contiguous episodes of meat processing.

The scope of meat processing activities as reflected by various kinds and quantities of cultural material appears to be taking place on a relatively large volume and space consuming scale in areas outside of the lodge. It would appear that such areas reflect secondary processing of bulk quantities of meat and/or bone materials. In contrast, quantities of similar material, particularly FCR and faunal remains, within lodges are more suggestive of smaller scale food processing, possibly for, or reflecting immediate consumption. Ceramic containers are suggested here to have been employed almost exclusively in final food preparation. As can be seen in Figure 50, ceramics are restricted to areas within the lodge and immediately outside of lodge doorways.

Bison processing tools and processing by-products clearly dominate the cultural assemblage for sites at Forty Mile Coulee. Ethnographic evidence suggests that these activities were largely conducted by women (see also Table 40). The primary role of males inhabiting the Forty Mile project sites is seen as hunters of the animals being processed in the camps. Evidence of apparent male activities at the sites is limited to projectile points and possibly various cultural materials categories which reflect chipped stone tool production. Materials relating to chipped stone tool production need not necessarily represent male specific activities. In particular, the production of coarse debitage and MRST for use as simple low value tools (probably used as knives) could well have been undertaken by women. Projectile points, medium to fine cobble and pebble cores and medium to fine debitage are considered the best indicators of locations utilized by males for various tool manufacturing and refitting activities. Distribution of these materials indicates male activities were focused in areas within and immediately adjacent to the lodge (distance units .1 to .3; Figures 36,42).

In conclusion, the authors wish to note that the discussion of activities and activity areas presented above has been, by necessity, couched in general terms only. Because groups of materials can reflect a variety of activities, the data presently available for study from Forty Mile Coulee does not allow us to irrevocably state that a certain activity took place in a specific area. The observed patterns can as yet only be used to interpret general trends of activity emphasis. Perhaps one of the most important aspects of this analysis is that it has shown that activities were patterned both inside and outside of a stone circle and with appropriate methodologies can be detected archaeologically. With the data base now available for comparative examination, future research at other sites in other areas may be able to focus on providing clearer interpretations of what observed patterns reflect.

9.0 SUMMARY AND CONCLUSIONS

Historical resource work within the Forty Mile Coulee area was carried out to mitigate the effects of construction of an approximately 10 km long irrigation reservoir. This reservoir project, undertaken by Alberta Environment, is intended to upgrade and expand the system capabilities of the St. Mary's River Irrigation District. Historical resource investigations conducted between 1981 and 1986 resulted in the discovery and recording of 108 historic resource sites, containing 471 identified features. Cultural resource materials within the Forty Mile project area are almost exclusively archaeological in nature and reflect aboriginal cultural activities. An extensive program of site/feature recording, mapping and excavation was carried out to mitigate development impact. In all, over 900 square metres of area were excavated and more than 20,000 pieces of cultural material recovered. The authors feel the historic resource mitigation program undertaken and summarized here, appropriately and sufficiently satisfies Alberta Environment's legal obligation under the Alberta Historic Resources Act. No further mitigation in conjunction with reservoir development, as presently defined, is considered necessary or warranted.

The historic resource investigation carried out in conjunction with the Forty Mile Coulee Reservoir development represents one of the single largest archaeological projects undertaken in the province of Alberta. In the following final pages of this report, the authors would like to touch upon what are felt to be the primary accomplishments, results and lessons resulting from that work.

The large scale, multi-year nature of the Forty Mile historic resources program had a major effect on the final results. During the initial inventory and assessment stage of the historic resource program, Alberta Environment required a planning document be prepared, evaluating the nature and significance of the resource, and the development of a research design for further work. The settlement model and testable hypotheses discussed in Section 6.0 were the primary result of that requirement, and formed the basis for subsequent research efforts. Similarly conceived and structured research designs are a relatively common feature of many major archaeological research programs carried out in the last decade throughout North America. However, an additional component of the Forty Mile Coulee research design was the development of a highly structured and detailed set of field recording, collection and analysis procedures, tailored to allow the data gathered to be flexibility manipulated and configured in a variety of ways depending on the specific question or questions being asked. In particular, these recording and data collection techniques focus on stone circle sites and stone circles because of their abundance in the project area. These techniques have been detailed in Appendix 1. The authors would strongly argue that without these techniques, our ability to critically examine and test the initially formulated settlement model and hypotheses would have been severely hampered. It is further argued that a major problem of many archaeological research designs is a failure to address and develop appropriate methodologies on this "nuts and bolts" level.

Although the authors are pleased with the stone circle methodologies developed for the Forty Mile Project and described here, we certainly do not delude ourselves and think that further new and innovative methodologies for stone circle study will not be introduced. However, we would urge that researchers who wish to employ some of the methodological concepts and techniques presented here, refrain from unnecessary "tinkering". Archaeologists in general (the authors included) have an unfortunate tendency to borrow methodological concepts from other researchers and to reformat or modify them in minor ways. Such changes are usually unsubstantive in nature. This tendency possibly reflects a need to demonstrate our individual "creativeness" or "inventiveness". The result, unfortunately, is the creation of a number of small individual sets of data, possibly each of interest, but mutually incomparable and thus of much less overall value.

Hopefully the utility of the standardized methodologies developed as a result of the Forty Mile Coulee Project for examining various aspects of stone circle structure and studying the distribution of spacially associated cultural materials, has been adequately demonstrated. It should be obvious that geographically diverse and numerically extensive data bases for dealing with various questions of stone circle research have a tremendous potential to enhance our ability to more meaningfully and productively utilize dwindling research dollars. In future stone circle research efforts, the authors intend to build upon and expand the data files developed in the course of this project. The authors invite and look forward to co-operative data sharing with other stone circle researchers in the Northern Plains.

Early archaeological research in the Plains tended to focus on questions of culture history, attempting to identify and trace prehistoric cultural groups by way of the archaeological record. Changes and differences in the archaeological record were often interpreted as reflecting such mechanisms as differing cultural traditions, technological change, population expansion and/or development. Beginning in the 1960s and continuing to present, studies emphasizing cultural history have fallen into disfavor, to be replaced by what was initially termed new archaeology and more currently the cultural process school. Cultural process studies in the Northern Plains have largely focused on examining aboriginal people's adaptation and responses to the Plains environment. In essence, most studies of cultural process in the Northern Plains can quite aptly be described as studies of cultural ecology with differences in the archaeological record commonly being explained as cultural responses or adaptations to various geographic or temporal environmental changes.

Cultural process studies in the Northern Plains have made major contributions to our knowledge of Plains prehistory. However, as is often the case, the pendulum of change from the culture history to the cultural process school is argued to have swung too far. Examination of such questions as ethnicity, broad cultural traditions and population movements have been generally ignored and have a relatively low level of "respectability" in the current archaeological community. It is argued here that pursuing questions of cultural process without simultaneously examining questions of culture history is in large part fruitless. The reverse holds true as well. Effective and realistic modeling of archaeological materials requires equal consideration and evaluation of both sets of variables. The culture history and regional settlement models presented in Sections 5.0 and 6.0 respectively, represent attempts at implementing this philosophy within the Forty Mile Coulee Project area in particular, and the surrounding region in general.

Stone circles and stone circle sites generally similar to those at Forty Mile Coulee are probably the most common or abundant site/feature type in the region. Stone circle sites, including those from the project area, characteristically contain low densities of cultural material. Over the past two decades many of these "average" stone circles and sites have been excavated to varying extents. The results, in general, have been less than satisfactory due to the overall low amount of cultural material recovered, and in particular to the rarity or total absence of datable materials or cultural and temporal diagnostics. Much more productive have been studies which have focussed on those rare stone circles that contain high densities of cultural material. The obvious question that arises is; do the results of studies at such rich features typify what is found at the "average" low stone circles as well? Should "average" stone circles, containing low densities of cultural materials, be "written off" and efforts focussed on identifying and then extensively examining the rare "rich" rings? These and other questions are of importance to all archaeologists involved in stone circle research. They are of particular interest and concern to historic resource managers given responsibility for these resources.

The author's results would argue that the methodologies developed in the course of the Forty Mile Coulee project suggest a middle ground be followed in further stone circle research. The limited stone circle mapping techniques and the auger testing program, structured in relation to the analytical unit system, provide an economically viable basis for extracting basic data sets from all or a major portion of the stone circle sample within a given project area. As indicated in this report, stone circle structural information can be utilized to estimate the size of the social group inhabiting individual lodges and for determining lodge orientation. The data recovered from unusually large stone circles can also provide clues to the presence of non-domestic lodges, or of lodges possibly relating to the Besant complex. The auger test program probably provides the most reasonable system of examining large samples of stone circles and identifying features containing higher than average densities of cultural materials. As well, when linked to the analytical unit system, augering allows us to combine data from a large sample of individual stone circles in a number of configurations depending on the specific question or questions being posed.

When "rich" stone circles are encountered, they should still be the focus of heavy excavation emphasis. Such features can always provide valuable data, particularly in examining questions concerning spacial patterning of activities. However, with comparative data from auger testing and the excavation of "average" stone circles in the same general area it should now be possible to better evaluate and assess information from such "rich" stone circles, both on an individual feature and on a broader regional basis.

Density and distribution patterns identified at Forty Mile Coulee may not apply in other regional settings. However, this study does indicate that distribution patterns are present, and can be detected in the archaeological record. Detection of such patterns in various settings can be employed to structure test excavation samples which may enhance the chance of recovering temporal or cultural diagnostics, bone or charcoal samples suitable for radiometric dating, or faunal remains applicable for seasonality and subsistence studies.

In summary, it is argued that many of the methodologies and findings resulting from the Forty Mile Coulee project can be employed in other project settings to extract meaningful and significant sets of data from both "average" and "rich" stone circles alike.

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TABLES

Table 1: Summary of Forty Mile Coulee Project Historic Resource Sites/Features.

SITE TYPE	PHYSIOGRAPHIC SETTING PRAIRIE MARGIN [1.1]	COULEE WALLS & FLOOR [3.1,3.2,3.3,6.1,6.2]	TOTAL
Stone Circle*	14(2)	47(26)	61(28)
Cairn	4	5(3)	9(3)
Stone Circle/Cairn	13(6)	5(3)	18(9)
Buried Camp		6(2)	6(2)
Other:			
Lithic Scatter		6	6
Bone Find		6(1)	6(1)
Isolated Find		1	1
Historic	1		1
TOTAL:	32(8)	76(35)	108(43)

FEATURE TYPE	PRAIRIE MARGIN	COULEE WALLS & FLOOR	TOTAL
Stone Circle	215(22)	139(54)	354(76)
Cairn	68(13)	13(8)	81(21)
Buried Camp		7(2)	7(2)
Stone "Arc"**	3	11	14
Lithic Scatter		6	6
Bone Find		7(1)	7(1)
Isolated Find		1	1
House Foundation	1		
TOTAL:	287(35)	184(65)	471(100)

* Includes two sites with buried camp deposits

[ ] Physiographic Setting Codes Included

( ) Sites/Features tested by excavation

** Due to their poorly defined nature, stone arcs which are often assumed to be stone circles are not considered as such in subsequent discussions

Table 2: Major Floral Resources Within Forty Mile Coulee*.

COULEE EDGES	
Spear grass	*Stipa comata*
June grass	*Koeleria cristata*
Sandberg bluegrass	*Poa secunda*
Blue grama grass	*Bouteloua gracilis*
Western wheatgrass	*Agropyron smithii*
Sedges	*Carex spp.*
Pasture sagewort	*Artemesia frigidia*
Winterfat	*Eurotica lanata*
Little club moss	*Selaginella densa*
Moss phlox	*Phlox hoodii*
Sagebrush	*Artemesia cana*
Buckbrush	*Symphoricarpos occidentalis*
Pincushion cactus	*Mammilaria viviparia*
Prickly pear cactus	*Opuntia polycantha*
STEEP, SHELTERED NORTH FACING SLOPES AND THE BOTTOMS OF SECONDARY DRAINAGE CHANNELS	
Buckbrush	*Symphoricarpos occidentalis*
Wild rose	*Rosa woodii*
Chokecherry	*Prunus virginiana*
Currant and Gooseberry	*Ribes spp.*
Saskatoon	*Amelanchier alnifolia*
Prairie rose	*Rosa arkansana*
HEAVILY ERODED AND SOUTH FACING SLOPES	
Greasewood	*Sarcobatus vermiculatus*
Indian rice grass	*Oryzopsis hymenoides*
Prickly pear cactus	*Opuntia polycantha*
Pincushion cactus	*Mammilaria viviparia*

Table 2: Continued

LAKE SHORELINE AND HIGH MINERAL CONTENT AREAS

Salt grass	*Distichlis strictata*
Samphire	*Salicornia rubra*
Foxtail barley	*Hordeum jubatum*
Alkali grass	*Puccinellia nuttaliana*
Greasewood	*Sarcobatus vermiculatus*
Slough grass	*Beckmannia syzigachne*
Reed canary grass	*Phalaris arundinaceae*
Brome grass	*Bromus inermis*
Sweet Clover	*Melilotus officianalis*
Cattail	*Typha latifolia*
Spike rush	*Eleocharis palustris*

GENTLE SLOPES ON COULEE WALLS AND COULEE FLOOR

Green needlegrass	*Stipa viridula*
June grass	*Koeleria cristata*
Blue grama grass	*Bouteloua gracilis*
Sandberg bluegrass	*Poa secunda*
Porcupine grass	*Stipa curtiseta*
Prairie clover	*Petalostemon purpureum*
Golden bean	*Thermopsis rhombifolia*
Pincushion cactus	*Mammilaria vivipari**a*

* Derived from McCourt Management Ltd. 1981

Table 3 : An Abbreviated List of Faunal Resources in Forty Mile Coulee (Adapted from McCourt Management Ltd. 1981).

MAMMALS

Plains grizzly	*Ursus horribilis**
Bison	*Bison bison**
Wolf	*Canis lupus**
Mule deer	*Odocoileus hemionus*
White tailed deer	*Odocoileus virginianus*
Pronghorn antelope	*Antilocapra americana*
Cattle	*Bos spp.***
Muskrat	*Ondatra zibethicus***
Coyote	*Canis latrans*
Red fox	*Vulpes vulpes*
American badger	*Taxidea taxus*
Striped skunk	*Mephitis mephitis*
Jackrabbit	*Lepus townsendii*
Deer mouse	*Peromyscus maniculatus*
Porcupine	*Erethizon dorsatum*
Richardson's ground squirrel	*Spermophilus richardsonii*
Bobcat	*Lynx rufus*
Kit fox	*Vulpes velox hebes**

BIRDS

Marsh hawk	*Circus cyaneum*
Swainson's hawk	*Buteo swainsoni*
Hungarian partridge	*Perdix perdix***
Canvasback duck	*Aythya valisneria***
Blue winged teal	*Anas discors***
Mallard duck	*Anas platyrhynchos***
American pigeon	*Anas americana***
Eared grebe	*Podiceps nigricullis***
California gull	*Larus californicus***
Marbled godwit	*Limosa fedos***
White pelican	*Pelecanus erythrorhyncus***
Long-billed curlew	*Numenius americanus*
Horned lark	*Eremophilia alpestris*
Black billed magpie	*Pica pica*

Table 3: Continued

Black capped chickadee	*Perus atricapillus*
Rock wren	*Sulpincies desoletus*
Great blue heron	*Ardea herodius*
Canada goose	*Branta canadensis***
Shorteared owl	*Asio flammeus*
Western meadowlark	*Sturnella neglecta*
REPTILES AND FISH	
Bull snake	*Pituophis melanoleucus*
Prarie rattlesnake	*Croatulus viridis*
Western plains garter snake	*Thamnophis radix*
Northern pike	*Esox lucius***
White sucker	*Catostomus commersoni***

* Now extinct in project area

** Probably not resident prior to recent historic period

Table 4: Summary of Forty Mile Coulee Test Excavation Program.

SITE	FEATURE	PHYSIOGRAPHIC ZONE	TOTAL AREA TESTED (sq m)	YEAR TESTED	REFERENCE(s)
DjOu-2	Stone Circle 1	1.1	10.00	1985-1986	Dau 1986; Dau & Brumley 1987
	Stone Circle 2	1.1	10.00	1985-1986	Dau 1986; Dau & Brumley 1987
	Stone Circle 6	1.1	10.00	1985	Dau 1986
	Stone Circle 9	1.1	10.00	1985	Dau 1986
	Stone Circle 15	1.1	10.00	1985-1986	Dau 1986; Dau & Brumley 1987
	Cairn 5	1.1	3.00	1986	Dau & Brumley 1987
	Cairn 6	1.1	3.00	1986	Dau & Brumley 1987
	Cairn 8	1.1	2.00	1986	Dau & Brumley 1987
	Cairn 9	1.1	1.00	1986	Dau & Brumley 1987
DjOu-3	Stone Circle 1	1.1	45.00	1981, 1985	Brumley et al. 1983; Dau 1986
	Cairn 1	1.1	4.00	1981	Brumley et al. 1983
DjOu-4	Stone Circle 9	6.1	8.00	1981	Brumley et al. 1983
DjOu-5	Buried Camp	3.2	13.00	1986	Dau & Brumley 1987
DjOu-13	Stone Circle 1	6.1	10.21	1986	Dau & Brumley 1987
DjOu-17	Stone Circle 1	3.3	10.65	1986	Dau & Brumley 1987
DjOu-20	Stone Circle 2	6.1	10.56	1986	Dau & Brumley 1987
DjOu-21	Cairn 1	6.2	2.00	1986	Dau & Brumley 1987
DjOu-22	Stone Circle 1	3.3	10.00	1986	Dau & Brumley 1987
DjOu-23	Stone Circle 1	3.3	9.49	1986	Dau & Brumley 1987
DjOu-24	Cairn 1	3.2	2.00	1986	Dau & Brumley 1987
DjOu-26	Stone Circle 1	3.1	9.98	1986	Dau & Brumley 1987
	Stone Circle 2	3.1	9.33	1986	Dau & Brumley 1987
DjOu-30	Stone Circle 1	3.1	10.56	1986	Dau & Brumley 1987
DjOu-31	Stone Circle 3	6.1	11.05	1986	Dau & Brumley 1987
	Stone Circle 5	6.1	11.07	1986	Dau & Brumley 1987
	Stone Circle 6	6.1	9.97	1986	Dau & Brumley 1987
DjOu-35	Cairn 1	3.2	2.00	1986	Dau & Brumley 1987
	Cairn 2	3.2	2.00	1986	Dau & Brumley 1987
DjOu-37	Cairn 1	6.1	2.00	1986	Dau & Brumley 1987

Table 4: Continued

SITE	FEATURE	PHYSIOGRAPHIC ZONE	TOTAL AREA TESTED (sq m)	YEAR TESTED	REFERENCE(s)
DjOu-38	Stone Circle 1	3.1	10.00	1986	Dau & Brumley 1987
	Stone Circle 3	3.1	10.91	1986	Dau & Brumley 1987
DjOu-39	Stone Circle 1	3.1	10.88	1986	Dau & Brumley 1987
					Dau & Brumley 1987
DjOu-40	Stone Circle 3	6.1	10.17	1986	Dau & Brumley 1987
DjOu-42	Stone Circle 1	6.1	10.00	1982	Brumley et al. 1983
DjOu-43	Stone Circle 1	3.1	4.00	1982	Brumley et al. 1983
	Cairn 1	3.1	2.00	1986	Dau & Brumley 1987
DjOu-44	Stone Circle 3	6.1	12.00	1982	Brumley et al. 1983
	Stone Circle 4	6.1	10.09	1986	Dau & Brumley 1987
	Stone Circle 6	6.1	8.00	1982	Brumley et al. 1983
DjOu-49	Stone Circle 2	6.1	10.00	1986	Dau & Brumley 1987
	Stone Circle 3	6.1	10.35	1986	Dau & Brumley 1987
DjOu-53	Stone Circle 2	3.3	10.59	1986	Dau & Brumley 1987
DjOu-55	Stone Circle 1	6.1	10.00	1986	Dau & Brumley 1987
	Stone Circle 2	6.1	10.00	1986	Dau & Brumley 1987
DjOu-60	Stone Circle 2	6.1	11.22	1986	Dau & Brumley 1987
	Stone Circle 5	6.1	10.31	1986	Dau & Brumley 1987
	Stone Circle 7	6.1	10.77	1986	Dau & Brumley 1987
	Stone Circle 8	6.1	10.94	1986	Dau & Brumley 1987
	Stone Circle 9	6.1	8.00	1982	Brumley et al. 1983
	Stone Circle 12	6.1	8.00	1982	Brumley et al. 1983
	Stone Circle 14	6.1	10.44	1986	Dau & Brumley 1987
DjOu-62	Stone Circle 5	6.1	8.00	1982	Brumley et al. 1983
	Stone Circle7	6.1	10.00	1982	Brumley et al. 1983
	Stone Circle 9	6.1	11.00	1982	Brumley et al. 1983
	Stone Circle 11	6.1	11.22	1986	Dau & Brumley 1987
	Stone Circle 12	6.1	39.94	1986	Dau & Brumley 1987
	Stone Circle 13	6.1	8.82	1986	Dau & Brumley 1987
DjOu-63	Stone Circle 1	6.1	10.00	1982	Brumley et al. 1983
DjOu-64	Stone Circle 1	3.1	5.00	1982	Brumley et al. 1983
DjOu-67	Stone Circle 1	6.2	4.00	1982	Brumley et al. 1983
	Stone Circle 2	6.2	8.00	1982	Brumley et al. 1983
	Stone Circle 3	6.2	4.00	1982	Brumley et al. 1983

Table 4: Continued

SITE	FEATURE	PHYSIOGRAPHIC ZONE	TOTAL AREA TESTED (sq m)	YEAR TESTED	REFERENCE(s)
DjOu-67	Stone Circle 4	6.2	4.00	1982	Brumley et al. 1983
DjOu-69	Stone Circle 2	6.1	10.89	1986	Dau & Brumley 1987
	Cairn 1	6.1	2.00	1986	Dau & Brumley 1987
	Cairn 2	6.1	2.00	1986	Dau & Brumley 1987
DjOu-70	Stone Circle 1	3.3	10.65	1986	Dau & Brumley 1987
DjOu-71	Stone Circle 2	3.1	9.99	1986	Dau & Brumley 1987
DjOu-73	Stone Circle 3	6.1	9.98	1986	Dau & Brumley 1987
	Stone Circle 6	6.1	10.31	1986	Dau & Brumley 1987
	Stone Circle 8	6.1	11.47	1986	Dau & Brumley 1987
	Stone Circle 9	6.1	10.51	1986	Dau & Brumley 1987
	Stone Circle 13	6.1	13.28	1986	Dau & Brumley 1987
DjOu-81	Buried Camp	6.1	18.00	1986	Dau & Brumley 1987
DkOu-7	Stone Circle 2	1.1	10.00	1985	Dau 1986
	Stone Circle 5	1.1	10.00	1985	Dau 1986
	Cairn 1	1.1	2.00	1985	Dau 1986
DkOu-13	Stone Circle 1	1.1	8.00	1981	Brumley et al. 1983
	Stone Circle 2	1.1	7.00	1981	Brumley et al. 1983
	Cairn 1	1.1	2.00	1986	Dau & Brumley 1987
	Cairn 2	1.1	2.00	1986	Dau & Brumley 1987
DkOu-14	Stone Circle 1	1.1	6.00	1981	Brumley et al. 1983
DkOu-15	Bone Find	6.2	5.00	1981	Brumley et al. 1983
DkOu-16	Stone Circle 1	1.1	8.00	1981	Brumley et al. 1983
	Stone Circle 6	1.1	11.48	1983	Dau & Brumley 1984
	Stone Circle 7	1.1	8.17	1983	Dau & Brumley 1984
	Stone Circle 8	1.1	8.45	1983	Dau & Brumley 1984
	Stone Circle 10	1.1	1.00	1983	Dau & Brumley 1984
	Cairn 1	1.1	1.00	1983	Dau & Brumley 1984
	Cairn 2	1.1	2.00	1983	Dau & Brumley 1984
	Cairn 4	1.1	1.00	1983	Dau & Brumley 1984
	Cairn 5	1.1	8.00	1983	Dau & Brumley 1984
DkOu-17	Stone Circle 1	1.1	8.00	1981	Brumley et al. 1983
	Cairn 1	1.1	2.00	1983	Dau & Brumley 1984
DkOu-31	Stone Circle 1	1.1	8.46	1983	Dau & Brumley 1984
	Stone Circle 2	1.1	8.16	1983	Dau & Brumley 1984

Table 4: Continued

SITE	FEATURE	PHYSIOGRAPHIC ZONE	TOTAL AREA TESTED (sq m)	YEAR TESTED	REFERENCE(s)
DkOu-31	Stone Circle 4	1.1	8.14	1983	Dau & Brumley 1984
	Stone Circle 5	1.1	8.00	1983	Dau & Brumley 1984
	Stone Circle 6	1.1	8.54	1983	Dau & Brumley 1984
DkOu-45	Stone Circle 1	6.1	10.85	1986	Dau & Brumley 1987

Summary: Excavation completed at 100 features in 43 sites
76 Stone Circles
21 Cairns
2 Buried Camps
1 Bone Find

Table 5: Sites in the Forty Mile Coulee Project Area Containing Culturally and/or Temporally Diagnostic Materials.

LOCATION	MATERIAL	COMMENTS
DjOu-3 SC-1	2 Projectile Points (tip & midsection)	These two fragments appear to represent parts of Plains/Prairie side notched point varieties dating to the Late Prehistoric. Both specimens were located within and are apparently associated with construction and use of the stone circle.
DjOu-4 Test Trench 1 160 cm BS	Bison Bone	A radiocarbon date of 2170 ± 70 BP (Beta 6410) was obtained (Wilson 1983:44) on bone which may not be cultural in origin.
DjOu-4 Test Trench 2 300 cm BS	Bison Bone	A radiocarbon date of 2850 ± 135 (GX8400 G) was obtained (Wilson 1983: 44) on the bone which may not have been culturally modified or derived.
DjOu-5 Buried Camp	2 Projectile Points	The 2 points recovered from the buried camp are referrable to the Besant and Pelican Lake complexes. The Pelican Lake point appears to have been re-used by the Besant occupants of the site. The site is assigned to the Besant complex.
DjOu-5 Buried Camp	Bison Bone	A radiocarbon date of 1680 ± 70 BP (Beta 19794) was obtained from a sample of bone collected from the same occupation that contained the projectile points (150-170 cm BS). The sample produced a C13/C12 value of -19.47.
DjOu-22 SC-1	Projectile Point	This well formed, but broken specimen appears referrable to the Washita projectile pint variety dating to the latter part of the Late Prehistoric.
DjOu-22 SC-1	Glass Fragments	Nine small glass fragments apparently derived from two vessels were found inside and outside the stone circle. Several were found in the same test trench and at the same level as the projectile point. The glass is of historic non aboriginal origin.

Table 5: Continued

DjOu-23 SC-1	Glass & Metal Fragments	A metal can fragment and a single small fragment of glass were collected from areas outside the stone circle. The items are of historic non aboriginal origin.
DjOu-31 SC-3	Glass Fragments	The 8 small pieces of glass collected from this stone circle exhibit characteristics which suggest they were derived from a single vessel. They are of historic non-aboriginal origin.
DjOu-31 SC-3	Bison Bone	A radiocarbon date of 470 $\pm$ 150 BP (Beta 19796) was obtained on a sample of bone associated with the stone circle. The sample is not consistent with the historic material at one sigma, but is acceptable at two sigma. The sample produced a C13/C12 value of -19.69.
DjOu-31 SC-5	Metal & Glass Fragments	Four small pieces of glass and one piece of metal were recovered from inside and outside of the stone circle. All are of historic origin.
DjOu-42 SC-1	Bison Bone	A radiocarbon date of "modern" (Beta 6720) was obtained on this sample from 0-20 cm BS in the first occupation associated with the stone circle having a mean depth of burial of 12.1 cm.
DjOu-42 SC-1	Bison Bone	A radiocarbon date of "modern" (Beta 6719) was obtained on this bone sample from 20-30 cm BS in a second occupation not associated with Stone Circle 1.
DjOu-44 SC-3	Bison Bone	A radiocarbon date of "modern" (Beta 6718) was obtained on bone from inside and associated with Stone Circle 3.
DjOu-44 SC-3	Ceramics	The sample consists of 126 ceramic sherds, primarily from inside the feature. Exterior surfaces were cord/fabric impressed with some smoothing with a thickened lip plus linear, oblique impressions on the rim sherds. This single pot is comparable to Saskatchewan Basin ceramics of the Avonlea/Old Womans complexes.

Table 5 Continued

DjOu-44 SC-3	Projectile Point	This incomplete, triangular unnotched point appears to represent a preform of a Late Prehistoric Plains/Prairie side notched point variety.
DjOu-44 SC-6	Bison Bone	A radiocarbon date of 300 ± 50 BP (Beta 6717) was obtained from this bone. The sample was from tests 13-18, 0-15 cm BS. The bone was recovered outside but in apparent association with the stone circle.
DjOu-44 SC-6	Ceramics	A total of 49 body sherds were recovered from outside but apparently associated with the stone circle. The material appears referable to Saskatchewan Basin Complex ceramics.
DjOu-44 SC-6	Projectile Point	This is a single incomplete, triangular unnotched point which appears to represent a preform of a Late Prehistoric Plains/Prairie side notched point variety.
DjOu-49 SC-3	Projectile Point	Although broken and resharpened this specimen appears to represent an undifferentiated Late Prehistoric Plains/Prairie side notched variety.
DjOu-53 SC-2	Bison Bone	A radiocarbon date of "modern" (Beta 19798) was obtained on a sample of bison bone from the interior of Stone Circle 2 in CMU-1. The sample produced a C13/C12 value of -26.28.
DjOu-58	Projectile Point	The site represents an isolated find of a single complete Pelican Lake (Reeves 1972:68) point recovered from the surface of a plowed field.
DjOu-60 SC-2	Bison Bone	A radiocarbon date of 430 + 90 BP (Beta 19799) was obtained from a sample of bison bone. The material was collected from the interior of the stone circle. The sample produced a C13/C12 value of -25.96.
DjOu-60 SC-9	Bison Bone	A radiocarbon date of 440 ± 50 BP (Beta 6710) was obtained on this sample. The fragments were in association with SC-9, buried an average of 14.8 cm BS. The bone was found inside the ring.

Table 5 Continued

DjOu-60 SC-12	Bison Bone	A radiocarbon date of "Modern" (Beta 6711) was obtained on the sample. The fragments were from inside Stone Circle 12.
DjOu-60 SC-12	Bison Bone	A radiocarbon date of 320 $\pm$ 60 BP (Beta 6712) was obtained from the sample. The bone was from inside SC-12.
DjOu-60 SC-14	Bison Bone	A radiocarbon date of "modern" (Beta 19800) was obtained on a sample of bison bone from CMU-1. The sample produced a C13/C12 value of -25.51.
DjOu-60 SC-17	Metal Fragments	Four small, thin iron or steel metal fragments were recovered. The items are of non aboriginal origin.
DjOu-62 SC-5	Projectile Point	This small broken specimen retains no diagnostic characteristics. Its small size and configuration suggests it is an arrow point referrable to the Late Prehistoric Period.
DjOu-62 SC-5	Metal Fragment	A single thin, rusty iron or steel metal fragment was recovered from between 0-15 cm BS. It suggests an age of occupation of from 1750 - 1800 A.D.
DjOu-62 SC-7	Bison Bone	A radiocarbon date of 1020 $\pm$ 50 BP (Beta 6715) was obtained from this sample. The bone was recovered from inside and outside of SC-7.
DjOu-62 SC-9	Ceramics	A single small body sherd was discovered from Test 1, inside SC-9 at 0-10 cm BS. It is likely the sherd is referrable to the Saskatchewan Basin Complex (Byrne 1973) dating between AD 150 to 1750.
DjOu-62 SC-9	Bison Bone	A radiocarbon date of 250 $\pm$ 80 BP (Beta 6716) was obtained from this sample. The bone was recovered from both inside and outside SC-9.
DjOu-62 SC-11	Bison Bone	A radiocarbon date of 230 $\pm$ 90 BP (Beta 19801) was obtained on a sample of bone from the interior of the stone circle. The sample produced a C-13/C12 value of -22.53.

Table ? Continued

DjOu-62 SC-12	Projectile Points	Five projectile points were collected from areas within and immediately outside the stone circle. Although all are arrowpoint sized specimens and appear referable to Plains/Prairie side notched forms, only two retain characteristics sufficient to refer them to defined varieties. One appears to be a Pekisko point while the other appears to be a poorly made example of Buffalo Gap single spurred.
DjOu-62 SC-12	Bison Bone	A sample of bison bone weighing 447 g was collected from the interior of the stone circle and submitted for radiocarbon dating. The date obtained was 470 $\pm$ 70 BP (Beta 19802). The sample produced a C13/C12 value of -20.77.
DjOu-64 SC-1	Bison Bone	A radiocarbon date of "modern" was obtained (Beta 6713) from the sample. The bone came from inside SC-1.
DjOu-70 SC-1	Metal Fragments	A badly rusted metal knife and a metal pail or bucket handle were found during Controlled Surface Stripping outside the stone circle. The items are of non aboriginal historic origin.
DjOu-71 SC-2	Projectile Point	A single small poor quality and heavily reworked point was found outside the stone circle. Although most diagnostic characteristics have been removed this specimen appears referrable to a Plains/Prairie Side notched form characteristic of the Late Prehistoric.
DjOu-71 SC-2	Bison Bone	A radiocarbon date of 530 + 70 BP (Beta 19804) was obtained on a sample of bone from inside and outside the stone circle. The sample produced a C13/C12 value of -19.55.
DjOu-73 SC-6	Metal Fragments	Two small, rusted pieces of iron or steel were recovered from augering.

Table 5 : Continued

DjOu-73 SC-13	Ceramics	The 400 sherds recovered from the interior of the stone circle all appear to have been derived from a single vessel. Their configuration and decorations suggest they are referrable to Saskatchewan Basin ceramics dating to either the Avonlea or Old Women's complex.
DjOu-81	Projectile Point	This single, well formed point was found at a depth of 10-20 cm BS in the central portion of this buried campsite. It is clearly referrable to the Avonlea complex of the Late Prehistoric Period.
DjOu-81	Bison Bone	A sample of 245 g of bison bone from depths of 10-20 cm in the pits containing and surrounding the recovered projectile point was submitted for radiocarbon analysis. A date of 1450 $\pm$ 90 BP (Beta 19806) was obtained. The sample produced a C13/C12 value of -20.65.
DkOu-13 Cairn 2	Bison Bone	A radiocarbon date of 670 $\pm$ 60 BP (Beta 19807) was obtained on a sample of bison bone from the interior of the cairn. The sample produced a C13/C12 value of -18.38.
DkOu-15	Bone	A radiocarbon date of "modern" (Beta 6412) was obtained (Wilson 1983:44) from bone fragments recovered 15-20 cm BS. This site consists of a partial bison skeleton of possible non cultural origin.
DkOu-16 SC-8	Projectile Point	A well formed side notched point was recovered immediately outside of the stone circle. It has been identified as a Nanton point referable to the Late Prehistoric Period.
DkOu-31 SC-1	Glass Fragments	Three small glass fragments were collected from auger holes outside the stone circle.

Table 5 Continued

DkOu-45 SC-1	Bison Bone	A radiocarbon date of 350 ± 80 BP (Beta 19808 was obtained on a sample of bison bone from both inside and outside the stone circle. The sample produced a C13/C12 value of -20.16.
DkOu-48 SC-3	Glass Fragment	A single glass fragment was recovered from an auger hole outside the feature. The item is of historic age.
Backhoe Test at 12UVL677037	Bone	A radiocarbon date of 220 ± 140 BP (Beta 6413) was obtained (Wilson 1983: 44) from a small sample of bone material recovered between 15 and 30 cm BS. It is not known if this material is of cultural origin.
Drainage Ditch at 12UVK744942	Bone	A radiocarbon date of 750 ± 80 BP (Beta 6411) was obtained (Wilson 1983:44) from this sample of bone from 125 cm BS. It is not known if this sample was cultural or not.
Drainage Ditch at 12UVK744942	Bone	A radiocarbon date of 1190 ± 230 BP (Beta 6409) was obtained (Wilson 1983: 44) from this bone sample recovered 75 cm BS. As one can see this sample and Beta 6411 appear to be in reverse order as to age. This could be the result of slope wash activity moving older sediments on top of younger.

Table 6: Stone Circle File Individual Site Data.

SITE NUMBER	NO. S.C. IN SITE	PHYS. SETTING	PROJECT	REFERENCE	PROJECT REF. NO.	PROJECT GROUP
DjOu-2	22	1.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-3	1	1.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-4	14	6.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-12	1	3.2	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-13	1	6.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-14	2	6.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-17	2	3.3	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-20	2	6.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-22	1	3.3	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-23	1	3.3	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-25	2	6.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-26	3	3.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-30	1	3.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-31	6	6.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-36	1	3.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-38	3	3.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-39	1	3.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-40	3	6.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-42	1	6.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-43	2	3.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-44	6	6.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-49	3	3.3	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-53	4	3.3	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-54	1	3.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-55	2	6.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-56	2	6.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-57	3	6.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-59	1	6.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-60	17	6.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-62	14	6.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-63	1	6.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-64	1	3.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-65	1	3.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-66	1	3.2	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-67	4	6.2	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-69	2	6.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-70	1	3.3	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-71	3	3.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-72	2	6.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-73	13	6.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-74	1	6.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-75	1	3.2	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-78	1	6.1	Forty Mile	Dau & Brumley (1987)	7	E
DjOu-80	4	6.1	Forty Mile	Dau & Brumley (1987)	7	E
DkOu-3	1	1.1	Forty Mile	Dau & Brumley (1987)	7	E

Table 6: Continued

SITE NUMBER	NO. S.C. IN SITE	PHYS. SETTING	PROJECT	REFERENCE	PROJECT REF. NO.	PROJECT GROUP
DkOu-4	21	1.1	Forty Mile	Dau & Brumley (1987)	7	E
DkOu-5	1	1.1	Forty Mile	Dau & Brumley (1987)	7	E
DkOu-6	2	1.1	Forty Mile	Dau & Brumley (1987)	7	E
DkOu-7	21	1.1	Forty Mile	Dau & Brumley (1987)	7	E
DkOu-11	5	1.1	Forty Mile	Dau & Brumley (1987)	7	E
DkOu-12	3	1.1	Forty Mile	Dau & Brumley (1987)	7	E
DkOu-13	42	1.1	Forty Mile	Dau & Brumley (1987)	7	E
DkOu-14	3	1.1	Forty Mile	Dau & Brumley (1987)	7	E
DkOu-16	15	1.1	Forty Mile	Dau & Brumley (1987)	7	E
DkOu-17	5	1.1	Forty Mile	Dau & Brumley (1987)	7	E
DkOu-19	1	1.1	Forty Mile	Dau & Brumley (1987)	7	E
DkOu-20	1	1.1	Forty Mile	Dau & Brumley (1987)	7	E
DkOu-27	6	1.1	Forty Mile	Dau & Brumley (1987)	7	E
DkOu-28	15	1.1	Forty Mile	Dau & Brumley (1987)	7	E
DkOu-29	1	1.1	Forty Mile	Dau & Brumley (1987)	7	E
DkOu-30	1	1.1	Forty Mile	Dau & Brumley (1987)	7	E
DkOu-31	5	1.1	Forty Mile	Dau & Brumley (1987)	7	E
DkOu-32	4	1.1	Forty Mile	Dau & Brumley (1987)	7	E
DkOu-33	3	1.1	Forty Mile	Dau & Brumley (1987)	7	E
DkOu-34	8	1.1	Forty Mile	Dau & Brumley (1987)	7	E
DkOu-35	8	1.1	Forty Mile	Dau & Brumley (1987)	7	E
DkOu-43	3	6.1	Forty Mile	Dau & Brumley (1987)	7	E
DkOu-44	4	6.1	Forty Mile	Dau & Brumley (1987)	7	E
DkOu-45	1	6.1	Forty Mile	Dau & Brumley (1987)	7	E
DkOu-48	3	1.1	Forty Mile	Dau & Brumley (1987)	7	E
DkOu-49	10	1.1	Forty Mile	Dau & Brumley (1987)	7	E
DkOu-50	4	1.1	Forty Mile	Dau & Brumley (1987)	7	E
DhOx-5	10	6.1	Verdigris Coulee	Quigg (1982b)	2	E
DhOx-6	20	6.1	Verdigris Coulee	Quigg (1982b)	2	E
DhOx-7	18	6.1	Verdigris Coulee	Quigg (1982b)	2	E
DlOp-2	18	1.2	Ross Glen	Quigg (1982a)	14	F
DlOw-6	31	1.3	Murphy Grand Forks	Quigg (1983)	6	D
EaOq-10	20	2.3	Trans Canada Bridge	Quigg (1980)	13	F
EbOq-22	1	2.3	Suffield	Dau (1983)	15	D
EbOq-28	7	2.3	Suffield	Dau (1983)	15	D
EbOq-29	2	2.3	Suffield	Dau (1983)	15	D
EbOq-30	9	2.3	Suffield	Dau (1983)	15	D
EbOq-32	1	2.3	Suffield	Dau (1983)	15	D
EbOq-74	2	2.3	Suffield	Dau (1983)	15	D
EbOq-101	1	2.3	Suffield	Dau (1983)	15	D
EbOq-102	1	2.3	Suffield	Dau (1983)	15	D
EbOq-140	3	2.4	Suffield	Dau (1983)	15	D
EbOq-141	1	2.3	Suffield	Dau (1983)	15	D
EbOq-142	1	2.4	Suffield	Dau (1983)	15	D
EbOq-143	1	2.2	Suffield	Dau (1983)	15	D

Table 6: Continued

SITE NUMBER	NO. S.C. IN SITE	PHYS. SETTING	PROJECT	REFERENCE	PROJECT REF. NO.	PROJECT GROUP
EbOs-7	1	2.2	Suffield	Brumley et al. (1981b)	15	D
EbOs-8	1	2.2	Suffield	Brumley et al. (1981b)	15	D
EcOp-4	13	1.3	Suffield	Brumley (1985b)	15	D
EcOp-78	10	2.2	Suffield	Brumley et al. (1981b)	15	D
EcOq-22	11	2.2	Suffield	Brumley et al. (1981b)	15	D
EcOq-193	2	2.1	Suffield	Brumley et al. (1981b)	15	D
EcOq-212	29	2.1	Suffield	Brumley et al. (1981b)	15	D
EcOr-101	33	2.2	Suffield	Brumley et al. (1981b)	15	D
EcOr-127	20	2.2	Suffield	Brumley et al. (1981b)	15	D
EcOs-39	1	1.1	Suffield	Brumley et al. (1981b)	15	D
EcOs-50	3	2.2	Suffield	Brumley et al. (1981b)	15	D
EcOs-56	2	2.2	Suffield	Brumley et al. (1981b)	15	D
EcOs-58	15	2.2	Suffield	Brumley et al. (1981b)	15	D
EdOp-14	2	2.1	Suffield	Brumley et al. (1981b)	15	D
EdOp-93	2	2.2	Suffield	Brumley et al. (1981b)	15	D
EdOq-150	3	2.3	Suffield	Brumley et al. (1981b)	15	D
EdOr-44	6	6.1	Suffield	Brumley et al. (1981b)	15	D
EdOr-45	4	1.1	Suffield	Brumley et al. (1981b)	15	D
EdOr-46	17	6.2	Suffield	Brumley et al. (1981b)	15	D
EdOr-48	1	1.1	Suffield	Brumley et al. (1981b)	15	D
EdOr-51	18	1.1	Suffield	Brumley et al. (1981b)	15	D
EdOr-77	5	2.4	Suffield	Brumley et al. (1981b)	15	D
EeOo-11	19	2.2	Suffield	Brumley et al. (1981b)	15	D
EeOq-31	1	2.4	Suffield	Brumley et al. (1981b)	15	D
EeOr-46	1	1.1	Suffield	Brumley et al. (1981b)	15	D
EeOr-48	1	2.3	Suffield	Brumley et al. (1981b)	15	D
EeOr-53	1	2.2	Suffield	Brumley et al. (1981b)	15	D
EeOr-54	28	2.2	Suffield	Brumley et al. (1981b)	15	D
EeOr-58	15	2.3	Suffield	Brumley et al. (1981b)	15	D
EdOp-1	25	1.1	Suffield	Finnigan (1982)	15	D
EdOp-1	26	1.1	EdOp-1 Camp Circle	Finnigan (1982)	18	D
EeOr-63	5	2.2	Suffield	Brumley & Saylor (1979a)	15	D
EgOx-56	50	1.3	Deadfish	Quigg (1982c)	9	C
DjPl-15	39	1.3	Oldman Dam	Stuart & Brumley (1987)	1	A
DjPl-28	8	5.2	Oldman Dam	Dau (1986b)	1	A
DjPl-61	2	1.3	Oldman Dam	Stuart & Brumley (1987)	1	A
DjPl-78	9	1.3	Oldman Dam	Stuart & Brumley (1987)	1	A
DjPl-113	1	1.3	Oldman Dam	Stuart & Brumley (1987)	1	A
DjPl-114	3	1.3	Oldman Dam	Stuart & Brumley (1987)	1	A
DjPl-115	76	1.3	Oldman Dam	Stuart & Brumley (1987)	1	A
DjPl-121	3	5.2	Oldman Dam	Dau (1986b)	1	A
DjPl-132	2	5.3	Oldman Dam	Dau (1986b)	1	A
DjPl-135	2	1.3	Oldman Dam	Stuart & Brumley (1987)	1	A
DkOr-2	3	6.1	Corrida/Murray Lake	Brumley & Dau (1985c)	10	F
DkOr-3	1	2.2	Corrida/Murray Lake	Brumley & Dau (1985c)	10	F

Table 6: Continued

SITE NUMBER	NO. S.C. IN SITE	PHYS. SETTING	PROJECT	REFERENCE	PROJECT REF. NO.	PROJECT GROUP
DkOs-1	6	1.1	Corrida/Murray Lake	Brumley & Dau (1985c)	10	F
DiOu-7	2	6.1	SR879 Etzikom	Quigg (1984)	5	E
DlOu-8	5	3.2	SR879 Etzikom	Quigg (1984)	5	E
DiOu-9	8	3.1	SR879 Etzikom	Quigg (1984)	5	E
DiOu-10	5	3.1	SR879 Etzikom	Quigg (1984)	5	E
DiOu-11	1	3.1	SR879 Etzikom	Quigg (1984)	5	E
DlOo-10	7	1.1	Trans Canada 1:22 East	Dau (1984)	16	F
DlOo-11	4	1.1	Trans Canada 1:22 East	Dau (1984)	16	F
DlOo-12	10	1.1	Trans Canada 1:22 East	Dau (1984)	16	F
DlOo-14	5	1.1	Trans Canada 1:22 East	Dau (1984)	16	F
DlOo-15	1	3.1	Trans Canada 1:22 East	Dau (1984)	16	F
DlPb-4	4	1.3	Trans Canada 1:22 West	Dau (1984)	3	B
DiOo-1	8	2.3	Medicine Lodge Manyberrie	Brumley & Dau (1985a)	12	E
DiOo-2	1	2.3	Medicine Lodge Manyberrie	Brumley & Dau (1985a)	12	E
DiOo-3	2	2.3	Medicine Lodge Manyberrie	Brumley & Dau (1985a)	12	E
DiOo-4	9	2.1	Medicine Lodge Manyberrie	Brumley & Dau (1985a)	12	E
DiOo-5	9	2.3	Medicine Lodge Manyberrie	Brumley & Dau (1985a)	12	E
DiOo-6	1	2.1	Medicine Lodge Manyberrie	Brumley & Dau (1985a)	12	E
DiOo-7	7	2.4	Medicine Lodge Manyberrie	Brumley & Dau (1985a)	12	E
DiOp-3	3	1.1	Medicine Lodge Manyberrie	Brumley & Dau (1985a)	12	E
DiOp-4	2	2.3	Medicine Lodge Manyberrie	Brumley & Dau (1985a)	12	E
DiOp-5	4	2.3	Medicine Lodge Manyberrie	Brumley & Dau (1985a)	12	E
DiOp-6	3	2.3	Medicine Lodge Manyberrie	Brumley & Dau (1985a)	12	E
DjOo-39	2	6.1	Medicine Lodge Manyberrie	Brumley & Dau (1985a)	12	E
DjOo-40	1	3.1	Medicine Lodge Manyberrie	Brumley & Dau (1985a)	12	E
DjOo-45	11	6.1	Medicine Lodge Manyberrie	Brumley & Dau (1985a)	12	E
DjOo-46	1	2.3	Medicine Lodge Manyberrie	Brumley & Dau (1985a)	12	E
DjOo-47	1	2.3	Medicine Lodge Manyberrie	Brumley & Dau (1985a)	12	E
DlOu-9	2	4.2	Laidlaw	Brumley (1984)	8	D
EfOt-11	4	1.2	Sun Oil/Jenner	Brumley & Saylor (1979b)	11	C
EhPb-1	2	1.3	Dorothy	Brumley & Kooyman (1978)	4	C

Table 7: Summary of Mean Stone Circle Site Sizes.

TOTAL SAMPLE			FORTY MILE COULEE SITES ONLY		
NO. OF STONE CIRCLES PRESENT	NO. OF SITES	% OF TOTAL	NO. OF STONE CIRCLES PRESENT	NO. OF SITES	% OF TOTAL
1	46	28.2	1	23	32.8
2	25	15.3	2	10	14.3
3	19	11.7	3	11	15.7
4	11	6.7	4	6	8.6
5	9	5.5	5	4	5.7
6	5	3.2	6	3	4.3
7	3	1.8	7		
8	5	3.2	8	2	2.9
9	4	2.4	9		
10	5	3.2	10	1	1.4
11	2	1.2	11		
12			12		
13	2	1.2	13	1	1.4
14	2	1.2	14	2	2.9
15	4	2.4	15	2	2.9
16			16		
17	2	1.2	17	1	1.4
18	3	1.8	18		
19	1	0.6	19		
20	3	1.8	20		
21-25	3	1.8	21-25	3	4.3
26-30	2	1.2	26-30		
31-35	2	1.2	31-35		
36+	5	3.2	36+	1	1.4
Total Sites:	163	100	Total Sites:	70	100
Total Stone Circles:	1157		Total Stone Circles:	354	
Average No. of SC Per Site:	7.1		Average No. of SC Per Site	5.0	

Table 8 : Number Codes For Defined Physiographic Settings.

CODE	PHYSIOGRAPHIC SETTING
1.0	prairie surfaces along coulee, stream, river valley, or other escarpment edges
1.1	coulee valley edge
1.2	major stream valley edge
1.3	major river valley edge
1.4	edge of other type of escarpment
2.0	open prairie surfaces away from major escarpment features
2.1	located in low swale area between nearby rises or hills
2.2	located on essentially horizontal prairie surface
2.3	located atop crest of hill or ridge
2.4	located on slope of hill or ridge
3.0	slope areas of coulee valley walls
3.1	located on crest of ridges or knolls forming portion of coulee wall
3.2	located on terrace or terrace-like (i.e. slump blocks) surfaces forming portion of coulee wall
3.3	located within the bottom of draws dissecting into coulee wall
4.0	slope areas of stream valley walls
4.1	located on crest of ridges forming portion of stream valley wall
4.2	located on terrace or terrace-like (i.e. slump blocks) surfaces forming portion of stream valley wall
4.3	located within the bottom of draws dissecting into stream valley wall
5.0	slope areas of river valley walls
5.1	located on the crest of ridges forming portions of river valley wall
5.2	located on terrace or terrace-like (i.e. slump blocks) surfaces forming portion of river valley wall
5.3	located within bottom of draws dissecting into river valley wall
6.0	coulee bottom areas
6.1	located adjacent to the base of coulee walls (within one-quarter of total coulee bottom width adjacent to coulee wall)
6.2	located within the central portion of the coulee bottom
7.0	stream bottom areas
7.1	located adjacent to the base of stream valley wall (within one-quarter of total stream valley bottom adjacent to stream valley wall)
7.2	located within central portion of stream valley bottom
8.0	river bottom areas
8.1	located adjacent to base of river valley wall (within one-quarter of the total valley bottom width adjacent to valley wall)
8.2	located within central portion of river valley bottom

Table 9: Summary of Mean Stone Circle Site Size in Relation to Various Environmental Characteristics.

PHYSIOGRAPHIC SETTING	ALL SITES		FORTY MILE COULEE SITES ONLY	
	# OF SITES	AV. NO. SC/SITE	# OF SITES	AV. NO. SC/SITE
Prairie margin along coulee, stream, river valley escarpment	54	11.1	27	7.9
Located on coulee, stream or river valley walls	28	2.4	18	1.8
Located in coulee bottoms	34	5.8	25	4.4
Open prairie surfaces	47	6.1	0	0.0
All locations	163	7.1	70	5.0
TOPOGRAPHIC RELIEF (No. of 25 ft Contour Lines)				
0 to 1 contour lines	0	0.0	0	0.0
2 contour lines	1	1.0	0	0.0
3 contour lines	6	6.8	0	0.0
4 contour lines	15	6.4	5	5.2
5 contour lines	36	6.2	22	7.4
6 contour lines	26	9.1	12	2.9
7 contour lines	31	5.5	21	4.9
8 contour lines	40	9.4	10	3.5
> 8 contour lines	8	2.1	0	0.0
All Locations	163	7.1	70	5.0
SURFICIAL DEPOSIT				
Indeterminate	3	3.7	0	0.0
Ground Moraine	5	19.2	3	9.3
Hummocky & Ridged end Moraine	1	18.0	0	0.0
Hummocky Moraine	71	6.4	0	0.0
Kame, Kame Moraine	1	19.0	0	0.0
Meltwater Channel Sediment	48	3.9	43	4.0
Outwash Sand and Gravel	1	20.0	0	0.0
Lacustrine Silt and Clay	2	22.0	0	0.0
Glaciolacustrine Silt and Clay	25	7.7	24	7.7
Alluvium	6	20.5	0	0.0
All Locations	163	7.1	70	5.0

Table 10: Summary of Stone Circle Site Size in Relation to Wood Resources.

	PRIMARY (0-1km Distance)				SECONDARY (>1-2 km Distance)			
	ALL SITES		FORTY MILE COULEE ONLY		ALL SITES		FORTY MILE COULEE ONLY	
	# OF SITES	AV. # SC/SITE	# OF SITES	AV. # SC/SITE	# OF SITES	AV. # SC/SITE	# OF SITES	AV. # SC/SITE
Indeterminate	1	31.0	0	0.0	2	41.0	0	0.0
No woody vegetation	66	7.7	0	0.0	46	8.0	0	0.0
Light brush-area no greater than 50m in diameter	19	5.4	11	6.0	5	3.6	0	0.0
Light brush-area greater than 50 m in diameter	36	5.7	35	5.7	33	7.1	28	7.0
Light to moderate brush - area no greater than 50 m in diameter	1	50.0	0	0.0	10	4.0	2	1.5
Light to moderate brush - area greater than 50 m in diameter	30	3.8	24	3.7	55	3.7	40	3.9
Light brush to heavy timber area greater than 50 m in diameter	10	14.5	0	0.0	12	17.9	0	0.0
All Locations	163	7.1	70	5.0	163	7.1	70	5.0

Table 11: Summary of Stone Circle Site Size in Relation to Water Resources.

	ALL SITES		FORTY MILE COULEE SITES ONLY	
PRIMARY (0-1 km Distance)	NO. OF SITES	AV. NO. SC/SITE	NO. OF SITES	AV. NO. SC/SITE
Absent	13	4.1	0	0.0
Small Seasonal Ponds or Lakes	28	7.6	0	0.0
Larger Seasonal Lakes	8	8.9	3	5.7
Year-round Lakes	31	4.3	25	3.6
Seasonal Streams	29	6.7	14	8.9
Year-round Streams	6	4.8	0	0.0
Major Rivers	18	15.1	0	0.0
Springs	30	6.4	28	4.4
All Locations	163	7.1	70	5.0
SECONDARY (>1-2 km Distance)				
Absent	4	1.3	0	0.0
Small Seasonal Ponds or Lakes	44	6.1	6	2.7
Larger Seasonal Lakes	9	8.8	0	0.0
Year-round Lakes	48	7.3	41	6.0
Seasonal Streams	35	7.6	19	3.9
Year-round Streams	12	4.9	3	5.7
Major Rivers	10	12.6	0	0.0
Springs	1	1.0	1	1.0
All Locations	163	7.1	70	5.0

Table 12: Summary of Stone Circle Associated Features.

SAMPLE LOCATION:	INTERIOR HEARTHS	EXTERIOR HEARTHS	INTERIOR PITS	EXTERIOR PITS	OTHER INTERIOR FEATURES	OTHER EXTERIOR FEATURES	TOTAL NUMBER OF FEATURES	TOTAL NUMBER OF STONE CIRCLES
GROUP A SITES	8						8	54
GROUP B SITES							0	3
GROUP C SITES							0	13
GROUP D SITES*	4		2	1	1		8	172
GROUP E SITES**	35	3			5	6	49	397
GROUP F SITES	5		2	3	9	3	22	47
40 MILE ONLY	33	3			4	3	43	336
EdOp-1 CAMP	2		1	1	1		5	26
BY PHYS. ZONE:								
-1.1	19	3	1	1	3	4	31	292
-1.2	5		2	3	9	3	22	16
-1.3	8						8	86
-2.1								12
-2.2	1		1				2	51
-2.3	1					2	3	48
-2.4								8
-3.1	4				1		5	29
-3.2					1		1	8
-3.3								8
-4.2								2
-5.2								5
-5.3								2
-6.1	12				1		13	111
-6.2	2						2	8
TOTAL SAMPLE:	52	3	4	4	15	9	87	686

* Includes EdOp-1 Camp Sample
** Includes Forty Mile Sample

Table 13: Wind Flow Patterns From Select Weather Stations in Southern Alberta.

Percentage Frequency — COWLEY, ALTA. A*

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	CALM
JANUARY	29.0	0.4	1.2	0.1	1.9	0.3	9.1	1.1	6.2	1.2	14.1	6.0	19.6	0.7	3.0	1.0	5.1
FEBRUARY	23.2	1.1	1.2	0.2	3.8	0.8	11.5	1.5	7.2	1.0	12.0	4.7	19.0	0.7	3.2	1.7	7.2
MARCH	18.9	0.6	1.0	0.1	3.3	0.6	9.7	1.2	8.7	2.0	11.9	6.4	23.7	0.7	2.8	1.4	7.0
APRIL	21.8	0.8	2.2	0.9	6.2	1.5	6.0	1.1	4.5	1.8	13.3	8.7	18.7	1.2	3.7	2.3	5.3
MAY	24.7	1.0	3.2	0.8	6.2	2.1	6.5	1.0	3.2	1.4	8.2	10.3	15.9	1.2	4.9	3.6	5.8
JUNE	21.0	0.9	2.0	0.5	6.2	1.8	6.9	0.8	2.9	1.5	11.3	10.3	20.5	1.3	4.4	3.6	4.1
JULY	21.7	0.9	2.2	0.3	4.3	1.6	8.6	1.0	4.3	1.2	10.4	7.9	15.8	1.5	6.1	6.8	5.4
AUGUST	27.2	0.2	1.9	0.2	5.2	1.4	6.2	0.9	4.1	1.3	13.0	6.8	16.3	0.7	6.1	3.3	5.2
SEPTEMBER	28.1	0.3	1.7	0.2	3.4	0.6	6.1	0.8	5.0	1.4	16.0	5.6	17.6	0.9	4.5	2.7	5.1
OCTOBER	19.6	0.2	1.7	0.2	4.6	0.9	4.9	0.6	7.0	1.4	24.2	4.9	18.4	0.3	4.1	2.0	5.0
NOVEMBER	25.4	0.3	1.0	0.1	2.6	0.3	5.0	0.5	5.6	1.2	20.6	7.8	18.3	0.8	4.7	1.6	4.2
DECEMBER	18.1	0.2	0.8	0.1	2.5	0.6	6.2	0.9	5.5	1.8	22.4	12.2	19.4	0.6	3.7	0.8	4.2
YEAR	23.2	0.6	1.7	0.3	4.2	1.0	7.2	0.9	5.4	1.4	14.8	7.6	18.6	0.9	4.3	2.6	5.3

Mean Wind Speed in Kilometres per Hour

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
JANUARY	12.8	12.6	10.1	8.8	9.6	15.6	13.6	13.6	13.3	25.5	29.0	33.9	31.6	17.7	10.4	12.6
FEBRUARY	14.3	13.8	11.7	10.7	11.4	13.8	12.3	12.8	13.6	26.0	30.1	33.0	32.3	19.6	10.5	14.8
MARCH	14.3	14.1	10.0	10.6	12.2	13.1	12.2	11.4	11.8	21.2	26.7	28.6	30.8	18.3	10.1	14.4
APRIL	15.4	12.4	12.8	20.0	12.5	15.8	12.0	11.9	11.7	20.4	26.7	28.8	27.9	13.5	11.7	15.9
MAY	15.8	16.8	11.8	18.3	15.0	16.5	12.5	13.0	10.8	17.8	22.4	29.8	24.9	17.0	12.4	14.3
JUNE	13.8	14.6	12.1	11.8	14.8	15.6	14.1	11.4	11.0	19.3	24.6	28.1	24.3	20.4	12.0	14.7
JULY	14.0	11.4	9.8	14.4	12.7	14.8	12.9	11.3	10.6	17.4	21.2	25.9	22.6	17.4	11.4	14.4
AUGUST	13.0	11.8	9.3	12.2	11.8	13.9	12.1	12.5	13.7	20.6	23.7	26.9	21.1	17.0	12.6	16.3
SEPTEMBER	14.2	11.6	10.3	16.6	14.2	17.0	12.9	13.4	10.5	20.4	27.1	29.0	22.6	19.4	11.6	14.6
OCTOBER	15.0	11.1	8.2	15.3	10.1	16.4	12.9	13.6	12.4	24.2	29.8	32.2	28.6	17.0	13.1	17.4
NOVEMBER	14.1	14.6	9.0	17.4	10.7	18.1	11.8	20.1	13.2	25.3	33.4	37.2	31.0	20.1	11.7	17.4
DECEMBER	13.7	11.6	9.5	13.0	13.7	16.9	15.8	16.3	14.5	26.0	34.6	38.9	32.3	22.0	12.6	15.5
YEAR	14.2	13.0	10.4	14.1	12.4	15.6	12.9	13.4	12.3	22.0	27.4	31.0	27.5	18.3	11.7	15.2

Table 13: Continued

Percentage Frequency LETHBRIDGE ALTA. B*

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	CALM
JANUARY	5.6	4.0	4.3	2.8	3.3	2.0	2.3	1.7	3.8	4.5	10.7	17.9	19.3	4.4	4.2	3.3	5.9
FEBRUARY	6.2	3.5	4.4	2.8	3.9	2.0	3.2	1.7	3.8	4.5	10.3	17.0	18.5	4.5	4.1	3.3	6.3
MARCH	6.3	3.4	3.7	2.7	3.5	2.1	3.2	2.2	5.1	6.1	12.3	15.8	16.9	4.8	4.3	3.7	3.9
APRIL	7.2	3.8	4.1	2.7	3.6	2.7	4.1	2.9	5.2	5.2	10.7	14.4	17.0	4.6	4.7	4.3	2.8
MAY	6.2	3.5	3.9	3.0	4.3	2.8	4.9	3.6	5.4	4.5	9.7	13.1	16.7	5.4	5.9	4.3	2.8
JUNE	4.7	3.2	3.6	2.4	3.5	2.4	4.0	3.0	5.1	4.7	10.5	15.3	19.9	6.0	5.4	3.5	2.8
JULY	4.6	3.0	3.5	3.2	4.6	2.8	4.8	3.4	5.3	5.3	11.1	14.1	16.6	5.3	5.0	3.0	4.4
AUGUST	5.3	3.2	3.8	3.3	4.2	2.9	4.0	2.8	4.8	5.0	10.5	14.1	17.0	5.8	5.4	3.5	4.4
SEPTEMBER	6.0	2.6	2.9	2.4	3.2	2.3	3.7	2.9	5.8	5.9	12.2	14.3	17.1	5.0	5.6	4.3	3.8
OCTOBER	4.4	2.2	2.0	1.4	1.7	1.6	2.7	2.1	5.6	6.6	13.8	19.2	21.8	4.0	3.9	3.3	3.7
NOVEMBER	4.9	2.9	2.5	2.0	2.3	1.5	2.2	1.9	5.3	6.1	13.0	18.4	21.5	4.3	4.2	3.1	3.9
DECEMBER	5.2	2.9	3.3	2.0	2.3	1.4	1.8	1.7	4.0	5.1	12.2	19.5	21.0	4.5	4.6	3.6	4.9
YEAR	5.5	3.2	3.5	2.6	3.4	2.2	3.4	2.5	4.9	5.3	11.4	16.1	18.6	4.9	4.8	3.6	4.1

Mean Wind Speed in Kilometres per Hour

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
JANUARY	16.8	14.1	12.2	11.6	10.6	11.9	10.4	11.2	13.8	18.4	23.0	33.4	32.3	14.5	14.5	18.5
FEBRUARY	17.6	13.8	12.8	11.9	11.2	12.6	12.1	11.9	14.0	17.8	22.7	33.8	33.0	15.2	14.8	18.6
MARCH	19.5	16.8	13.2	12.5	11.9	13.6	13.7	13.5	15.1	19.5	22.8	30.5	30.3	16.8	16.0	20.4
APRIL	20.4	18.7	16.5	15.0	13.6	14.7	15.9	15.1	16.5	19.0	21.3	29.7	30.3	17.9	17.1	21.0
MAY	19.0	18.6	17.2	16.3	14.9	15.7	16.1	17.5	16.0	16.8	20.1	28.0	28.5	18.1	17.8	19.9
JUNE	17.1	17.6	15.9	14.2	13.4	14.9	15.0	15.9	15.3	16.5	19.4	27.2	27.3	18.5	17.3	17.7
JULY	15.5	14.9	13.0	13.0	11.4	12.5	13.2	14.0	14.3	15.6	17.8	22.5	23.7	16.8	16.2	17.3
AUGUST	15.4	14.0	12.5	13.0	10.9	12.0	13.1	13.5	13.0	14.1	17.7	23.4	23.4	17.0	15.9	16.0
SEPTEMBER	19.6	16.4	13.7	11.2	10.8	11.4	12.7	12.9	14.1	16.5	18.5	24.9	26.1	16.6	17.2	19.6
OCTOBER	17.4	15.3	13.6	11.5	10.2	11.4	13.4	13.1	15.4	18.2	22.4	31.1	31.6	16.3	16.5	20.3
NOVEMBER	17.4	14.8	14.0	11.6	9.8	10.8	11.2	12.0	15.1	18.6	23.1	31.3	32.9	16.0	15.8	18.1
DECEMBER	17.3	12.5	12.2	11.4	10.3	11.9	11.9	10.8	13.4	17.7	23.5	34.2	34.7	15.9	15.1	20.5
YEAR	17.8	15.6	13.9	12.8	11.6	12.8	13.2	13.5	14.7	17.4	21.0	29.2	29.5	16.6	16.2	19.0

Table 13: Continued

Percentage Frequency

BROOKS, ALTA. C*

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	CALM
JANUARY	15.4		6.6		4.0		8.0		14.5		16.5		14.2		19.7		1.1
FEBRUARY	14.9		6.5		5.3		8.6		17.0		16.7		12.9		17.2		0.9.
MARCH	13.8		7.5		5.6		9.8		15.5		17.7		10.1		19.5		0.5
APRIL	12.5		11.0		6.5		11.5		13.7		16.4		8.9		19.4		0.1
MAY	8.9		9.9		6.4		14.2		16.0		15.1		9.3		20.0		0.2
JUNE	7.6		11.3		5.4		11.7		12.7		15.6		11.7		23.9		0.1
JULY	8.1		12.0		5.7		12.6		13.4		15.9		11.5		20.4		0.4
AUGUST	8.7		12.2		5.1		12.1		16.0		14.2		9.9		21.7		0.1
SEPTEMBER	8.6		10.7		3.9		10.3		18.5		14.8		10.8		22.2		0.2
OCTOBER	8.3		5.6		2.6		7.5		20.0		23.0		12.8		20.0		0.2
NOVEMBER	9.6		5.0		3.5		8.7		20.4		20.2		12.7		19.4		0.5
DECEMBER	14.1		5.6		2.8		7.0		17.3		19.7		13.0		19.4		1.1
YEAR	10.9		8.7		4.7		10.2		16.2		17.2		11.5		20.2		0.4

Mean Wind Speed in Kilometres per Hour

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
JANUARY	12.5		11.5		10.4		13.3		11.6		17.4		11.9		14.3	
FEBRUARY	11.9		11.2		10.5		12.3		11.9		16.3		11.3		13.1	
MARCH	12.6		12.9		12.4		13.4		12.7		15.8		10.6		14.5	
APRIL	15.7		16.2		14.2		14.3		13.7		18.4		14.2		18.0	
MAY	14.3		14.8		13.6		16.0		13.7		16.8		12.7		15.9	
JUNE	11.1		14.7		11.3		13.2		13.3		16.7		12.1		14.7	
JULY	9.2		12.3		10.4		12.5		11.5		14.9		11.3		13.4	
AUGUST	9.1		12.3		9.6		12.3		11.1		14.9		10.9		13.1	
SEPTEMBER	10.0		13.3		9.4		12.1		11.2		15.0		10.4		14.2	
OCTOBER	11.3		13.5		9.5		12.7		13.0		17.5		11.6		15.5	
NOVEMBER	11.7		10.7		10.7		12.1		13.1		18.2		11.5		14.0	
DECEMBER	13.9		11.1		9.1		12.4		12.4		17.6		11.8		14.2	
YEAR	11.9		12.9		10.9		13.1		12.4		16.6		11.7		14.6	

Table 13: Continued

Percentage Frequency — SUFFIELD, ALTA. D*

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	CALM
JANUARY	13.4		6.2		13.7		7.1		9.0		17.5		18.4		14.4		0.3
FEBRUARY	11.3		6.0		16.9		7.1		10.8		18.5		16.7		12.6		0.1
MARCH	13.4		6.2		15.5		7.0		11.3		17.1		16.2		13.2		0.1
APRIL	14.8		9.2		14.2		8.6		11.2		15.9		14.1		12.0		0.0
MAY	11.8		8.0		14.9		11.2		10.2		15.0		15.1		13.7		0.1
JUNE	10.7		9.1		12.6		8.9		10.0		15.6		18.1		14.9		0.1
JULY	8.6		7.9		14.1		11.1		10.0		17.3		18.5		12.5		0.0
AUGUST	11.5		8.2		14.6		10.2		10.8		15.2		15.2		14.2		0.1
SEPTEMBER	12.8		6.4		12.5		8.7		11.5		17.8		15.7		14.5		0.1
OCTOBER	10.7		4.6		7.8		7.7		13.1		23.8		19.7		12.5		0.1
NOVEMBER	11.2		4.4		10.6		8.0		12.5		21.6		18.7		13.0		0.0
DECEMBER	11.4		5.2		12.3		5.4		12.2		19.9		18.3		15.2		0.1
YEAR	11.8		6.8		13.3		8.4		11.0		17.9		17.1		13.6		0.1

Mean Wind Speed in Kilometres per Hour

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
JANUARY	18.5		12.5		14.8		13.2		18.7		20.9		18.0		17.0	
FEBRUARY	18.6		13.5		14.5		12.3		20.2		21.0		18.2		18.1	
MARCH	19.0		15.9		15.1		13.3		19.1		21.2		19.3		19.5	
APRIL	20.7		18.7		16.9		15.5		19.5		21.6		21.6		21.8	
MAY	21.4		16.8		17.5		16.7		17.9		21.0		21.6		21.9	
JUNE	18.9		16.8		15.6		14.6		17.0		20.0		21.2		21.3	
JULY	16.5		15.6		15.6		14.6		15.3		19.1		20.5		19.2	
AUGUST	17.7		15.3		14.9		14.1		15.8		19.3		18.9		20.3	
SEPTEMBER	19.0		14.9		15.1		13.9		17.0		18.9		18.9		20.7	
OCTOBER	18.4		14.1		14.3		14.5		19.3		21.5		20.7		19.9	
NOVEMBER	16.6		12.0		13.7		13.5		18.9		21.7		19.4		17.9	
DECEMBER	18.7		13.3		14.0		13.0		19.0		21.8		19.6		18.2	
YEAR	18.7		15.0		15.2		14.1		18.1		20.7		19.8		19.7	

Table 13: Continued

Percentage Frequency — MANYBERRIES, ALTA. E*

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	CALM
JANUARY	5.8		2.8		25.5		3.3		2.1		2.7		19.4		36.4		2.0
FEBRUARY	6.0		5.3		29.6		4.2		2.5		2.1		18.6		29.8		1.9
MARCH	8.7		3.6		28.3		4.7		3.9		3.4		20.3		25.2		1.9
APRIL	11.1		5.0		23.2		7.0		7.2		3.7		20.2		22.1		0.5
MAY	11.9		5.9		21.3		10.1		7.8		3.7		18.7		19.8		0.8
JUNE	9.1		5.9		16.3		7.6		6.8		5.1		26.0		22.2		1.0
JULY	12.0		6.0		19.6		7.3		7.8		3.2		22.6		20.9		0.6
AUGUST	12.0		5.8		18.6		7.1		8.4		4.1		20.3		22.9		0.8
SEPTEMBER	9.7		4.9		19.2		8.3		7.0		3.6		20.6		25.9		0.8
OCTOBER	8.7		4.0		21.7		7.8		6.4		3.4		20.6		26.7		0.7
NOVEMBER	5.9		3.5		27.3		6.2		3.9		4.0		20.5		27.5		1.2
DECEMBER	4.6		3.4		30.0		4.1		2.0		3.1		17.3		34.0		1.5
YEAR	8.8		4.7		23.4		6.5		5.5		3.5		20.4		26.1		1.1

Mean Wind Speed in Kilometres per Hour

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
JANUARY	15.4		12.5		15.2		11.2		9.0		21.9		25.3		26.9	
FEBRUARY	12.2		15.2		15.3		13.2		8.7		18.0		24.3		25.7	
MARCH	18.0		12.9		16.4		12.0		10.8		20.6		23.0		25.7	
APRIL	18.6		18.8		17.9		16.7		14.4		19.9		24.7		27.0	
MAY	19.9		17.8		18.6		17.7		14.3		17.6		23.2		24.0	
JUNE	17.5		17.4		16.0		16.1		12.6		19.4		23.8		23.2	
JULY	16.0		16.7		14.9		14.4		12.1		13.0		21.2		21.4	
AUGUST	14.2		15.8		15.7		14.6		12.3		16.1		20.1		21.6	
SEPTEMBER	15.5		14.7		14.9		13.3		11.3		15.5		20.9		22.4	
OCTOBER	14.6		14.7		14.1		12.9		11.8		17.3		21.6		23.7	
NOVEMBER	12.5		10.9		14.1		11.4		10.4		18.4		22.8		23.8	
DECEMBER	11.8		11.4		15.3		10.3		9.1		18.6		24.4		26.6	
YEAR	15.5		14.9		15.7		13.7		11.4		18.0		22.9		24.3	

Table 13: Continued

Percentage Frequency

MEDICINE HAT, ALTA. F*

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	CALM
JANUARY	8.0	4.3	3.5	2.0	4.7	1.0	0.6	0.5	1.9	4.1	23.9	9.8	8.5	5.3	6.7	4.9	10.3
FEBRUARY	7.5	3.6	3.8	2.5	5.1	1.1	0.7	0.4	2.0	4.4	23.8	10.2	7.7	4.6	7.0	5.2	10.4
MARCH	7.0	4.3	3.7	2.3	5.8	2.0	1.1	1.2	3.8	5.8	22.5	8.0	8.0	4.6	7.0	4.8	8.1
APRIL	6.9	4.4	4.4	3.4	7.6	2.7	2.1	2.6	5.1	5.6	17.4	8.0	8.2	5.0	6.6	4.9	5.1
MAY	6.5	3.9	4.7	3.3	8.2	4.0	3.1	3.0	5.5	5.6	14.5	7.2	9.4	5.4	6.3	4.5	4.9
JUNE	5.1	3.2	4.9	3.3	7.0	3.1	2.5	2.4	4.8	4.8	16.2	8.6	11.4	6.4	6.4	3.9	6.0
JULY	4.7	3.3	4.7	3.0	7.4	3.4	2.7	1.9	4.2	4.5	17.5	9.2	11.3	5.8	5.5	3.6	7.3
AUGUST	5.2	4.0	5.0	3.3	7.4	3.1	2.3	2.2	3.8	4.7	17.1	9.1	9.6	6.0	6.3	4.0	6.9
SEPTEMBER	5.6	3.7	4.1	2.4	5.9	2.1	1.7	1.5	4.4	6.3	20.7	8.9	8.6	5.5	7.3	4.8	6.5
OCTOBER	4.7	2.8	2.6	1.6	3.6	1.6	1.1	1.1	4.1	7.4	28.3	10.7	9.8	5.2	5.8	3.6	6.0
NOVEMBER	5.2	3.0	2.9	1.5	4.2	1.2	0.9	0.8	3.0	6.4	28.6	10.0	9.0	5.1	6.1	4.3	7.8
DECEMBER	6.4	3.5	3.0	1.9	3.6	0.9	0.6	0.3	2.1	4.9	28.8	9.9	9.0	5.2	6.6	4.6	8.7
YEAR	6.1	3.7	3.9	2.5	5.9	2.2	1.6	1.5	3.7	5.4	21.6	9.1	9.2	5.4	6.5	4.4	7.3

Mean Wind Speed in Kilometres per Hour

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
JANUARY	14.3	12.4	10.5	12.9	12.1	8.7	5.9	10.5	13.8	19.5	19.8	17.8	20.9	18.5	16.7	18.0
FEBRUARY	13.3	12.1	11.2	13.5	13.5	10.8	6.3	10.1	15.9	20.0	19.2	17.4	19.5	18.6	17.7	19.3
MARCH	16.3	14.9	12.2	14.2	13.7	13.5	8.2	15.0	20.3	20.2	18.4	19.5	20.4	18.6	17.9	19.2
APRIL	18.6	17.2	14.7	17.8	16.5	14.9	13.7	19.5	20.2	20.1	17.9	21.5	23.1	21.1	20.2	21.6
MAY	18.0	16.4	14.4	16.2	15.2	16.3	15.7	19.7	18.6	18.9	17.0	19.7	22.4	20.5	19.2	20.3
JUNE	16.4	15.7	14.9	15.8	13.7	14.6	13.2	18.4	17.0	17.3	16.1	19.0	20.7	19.6	18.3	18.2
JULY	14.4	13.9	12.4	13.4	14.1	14.5	12.4	15.9	13.5	14.8	14.4	17.2	18.6	18.7	17.4	16.9
AUGUST	15.2	14.3	11.7	12.8	12.9	13.4	13.0	17.4	14.4	14.9	14.7	17.2	18.5	18.3	17.7	17.9
SEPTEMBER	16.9	15.2	11.4	13.3	13.3	12.9	10.2	16.8	16.7	17.6	16.3	17.7	19.7	19.2	18.6	21.1
OCTOBER	16.3	14.7	11.7	12.0	12.0	11.6	10.0	15.4	18.5	20.1	18.9	19.6	22.1	19.8	19.5	20.0
NOVEMBER	15.8	12.9	11.7	11.9	11.4	10.3	7.2	12.3	16.7	20.6	19.7	19.1	21.2	19.0	18.5	19.8
DECEMBER	14.9	13.3	10.5	12.7	11.1	8.0	7.2	10.8	16.2	20.0	20.5	19.7	21.9	18.4	18.4	19.9
YEAR	15.9	14.4	12.3	13.9	13.3	12.5	10.3	15.2	16.8	18.7	17.7	18.8	20.8	19.2	18.3	19.4

*See Figure 17
Data derived from Environment Canada 1982

Table 14: Summary of Mean Inside Diameter Values

SAMPLE LOCATION:	N-S MEAN	NE-SW MEAN	E-W MEAN	NW-SE MEAN	ALL DIR. MEAN	ALL DIR. N=
GROUP A SITES	4.69	4.69	4.64	4.70	4.68	52
GROUP B SITES	4.59	4.89	4.90	5.05	4.86	3
GROUP C SITES	4.38	4.45	4.30	4.27	4.35	13
GROUP D SITES*	4.79	4.78	4.79	4.72	4.77	172
GROUP E SITES *	4.36	4.46	4.44	4.44	4.45	367
GROUP F SITES	5.21	5.17	5.16	5.20	5.2i	44
40 MILE ONLY	4.37	4.47	4.45	4.45	4.45	321
EDOP-1 CAMP	4.57	4.67	4.54	4.64	4.61	26
BY PHYS. ZONE						
-1.1	4.56	4.66	4.63	4.65	4.63	282
-1.2	5.71	5.82	5.90	5.83	5.82	16
-1.3	4.63	4.59	4.58	4.55	4.59	86
-2.1	3.99	3.91	3.60	4.10	3.96	8
-2.2	4.68	4.68	4.71	4.65	4.68	51
-2.3	4.70	4.78	4.64	4.59	4.74	42
-2.4	4.70	4.52	4.58	4.51	4.57	7
-3.1	4.23	4.28	4.33	4.32	4.28	27
-3.2	4.54	4.70	4.62	4.56	4.61	8
-3.3	4.03	4.16	3.82	3.81	4.00	7
-4.2	8.87	9.87	9.76	9.60	9.53	2
-5.2	4.79	4.98	5.28	5.07	5.04	3
-5.3	4.59	4.53	4.05	4.44	4.41	2
-6.1	4.34	4.38	4.41	4.33	4.38	102
-6.2	4.06	3.88	4.15	4.10	4.04	8
TOTAL SAMPLE	4.56	4.62	4.60	4.59	4.60	651
ST. DEVIATION						
-40 MILE ONLY	0.96	0.95	0.98	1.02	0.91	
-EdOp-1 CAMP	0.98	1.04	1.03	0.98	0.97	
-TOTAL SAMPLE	1.24	1.25	1.25	1.32	1.20	

*Group E Includes 40 Mile Project Features , Group D Includes EdOp-1 Camp Features

Table 15: Historic Estimates of Aboriginal Population.

TRIBAL GROUP	YEAR DATA COLLECTED	ESTIMATED NO. OF LODGES	ESTIMATED POPULATION	ESTIMATED NO. OF PEOPLE PER LODGE	REFERENCE
ASSINIBOINE	1780s	400	3,200	8	Tyrell 1916
	1823	3,000	28,000	9.3	Lowie 1909a
	1833	3,000	28,000	9.3	Thwaites 1966
	1850	1,500	4,000	2.7	Culbertson 1952
	1854	750-820	4,500-4,920	6	Denig 1930
	1860	500-550	4,000-4,900	8-9	Kennedy 1961
				Group Average: 7.5	
GROS VENTRE	1823	600	4,200	7	Herron 1823
	1854	360	2,880	8	Ewers 1974
	1858	360	2,520	7	Hind 1971
	1860	265	2,100	8	Ewers 1974
	1864	233	1,864	8	Ewers 1974
				Group Average: 7.6	
BLACKFOOT	1809	200	1,600	8	Ewers 1958
	1823	600	4,200	7	Herron 1823
	1854	290	2,610	9	Ewers 1974
	1855	500	5,000	10	Hind 1971
	1858	250	1,750	7	Hind 1971
	1870	216	1,700	8	Ewers 1958
				Group Average: 8.2	
BLOOD	1809	100	800	8	Ewers 1958
	1823	400	2,800	7	Herron 1823
	1854	270	2,430	9	Ewers 1974
	1855	400	4,000	10	Hind 1971
	1858	350	2,450	7	Hind 1971
				Group Average: 8.2	
CHEYENNE	1850	300	3,000	10	Culbertson 1952
				Group Average: N/A	
CREE	1855	1,000-1,100	4,000-5,000	4-4.5	Denig 1961
				Group Average: N/A	
CROW	1804	350	3,500	10	Swanton 1953
	1805	300	2,400	8	Burpee 1910
	1850	400	4,800	12	Culbertson 1952
				Group Average: 10	

Table 15: Continued

TRIBAL GROUP	YEAR DATA COLLECTED	ESTIMATED NO. OF LODGES	ESTIMATED POPULATION	ESTIMATED NO. OF PEOPLE PER LODGE	REFERENCE
PIEGAN	1823	600	4,200	7	Herron 1823
	1855	290	2,610	9	Ewers 1974
	1868	460	3,700	8	Wissler 1939
				Group Average: 8	
SARCEE	1780s	90	650	7	Tyrell 1916
	1800	35	280	8	Jenness 1972
	1801	90	650	7	Coues 1897
				Group Average: 7.7	
SIOUX (Dakota)	1833	1,130	8,510	7.5	Thwaites 1959
	1850	3,000	30,000	10	Culbertson 1952
				Group Average: 8.8	
				Total Average (All Tribes): 7.9	

Table 16: Mean Inside Diameters From Dated Stone Circles, Forty Mile Coulee*.

FEATURES WITH HISTORIC TRADE GOODS

SITE	STONE CIRCLE NUMBER	MEAN INSIDE DIAMETER (m)
DjOu-22	1	4.06
DjOu-23	1	2.80
DjOu-31	3	4.92
DjOu-31	5	5.45
DjOu-62	5	4.79
DjOu-70	1	4.21
DjOu-73	6	4.18
DkOu-31	1	3.46
DkOu-48	3	5.11
AVERAGE MEAN INSIDE DIAMETER:		4.33

FEATURES WITH "MODERN" OR "HISTORIC" C-14 DATES

SITE	STONE CIRCLE NUMBER	MEAN INSIDE DIAMETER (m)
DjOu-42	1	3.91
DjOu-44	3	5.70
DjOu-60	12	3.62
DjOu-60	14	3.50
DjOu-64	1	3.82
AVERAGE MEAN INSIDE DIAMETER:		4.11

FEATURES WITH LATE PREHISTORIC DIAGNOSTICS/C-14 DATES

SITE	STONE CIRCLE NUMBER	MEAN INSIDE DIAMETER (m)
DjOu-3	1	4.01
DjOu-44	6	4.24
DjOu-49	3	3.95
DjOu-60	2	5.23
DjOu-60	9	4.93
DjOu-62	7	2.82
DjOu-62	9	3.88
DjOu-62	11	4.20
DjOu-62	12	4.18
DjOu-71	2	2.80
DjOu-73	13	4.17
DkOu-16	8	3.71
DkOu-45	1	4.50
AVERAGE MEAN INSIDE DIAMETER:		4.05

* See Table 5 for data on cultural diagnostics and C-14 dates

NOTE: Overall mean inside diameter of 4.45 m for all stone circles at Forty Mile Coulee

Table 17: Cultural Material Density (m^2) From Dated Stone Circles, Forty Mile Coulee.

SITE/FEATURE	FCR	BONE	CORES, DEBITAGE, STONE TOOLS	CERAMICS	HISTORIC ITEMS	TOTAL DENSITY	TOTAL DENSITY W/O BONE & CERAMICS
FEATURES WITH HISTORIC TRADE GOODS							
DjOu-22:SC-1	0.00	16.11	0.10	0.00	0.87	18.05	0.97
DjOu-23:SC-1	0.00	12.19	0.61	0.00	0.10	13.01	0.82
DjOu-31:SC-3	3.45	11.93	2.83	0.00	0.71	18.90	6.98
DjOu-31:SC-5	0.26	4.14	0.09	0.00	0.44	4.94	0.79
DjOu-62:SC-5	0.00	1.57	0.36	0.00	0.12	2.05	0.48
DjOu-70:SC-1	0.00	0.17	0.01	0.00	0.01	0.18	0.01
DjOu-73:SC-6	0.67	2.00	0.19	0.00	0.19	3.05	1.05
DjOu-31:SC-1	0.00	0.00	0.23	0.00	0.35	0.58	0.23
DkOu-48:SC-3	0.00	0.00	0.00	0.00	4.17	4.17	4.17
MEAN:	0.49	5.35	0.49	0.00	0.77	7.21	1.72
FEATURES WITH "MODERN" OR "HISTORIC" C-14 DATES							
DjOu-42:SC-1	1.95	23.17	1.27	0.00	0.00	26.38	3.21
DjOu-44:SC-3	0.24	19.64	6.28	15.32	0.00	41.48	6.52
DjOu-60:SC-12	0.00	69.04	1.09	0.00	0.00	70.13	1.09
DjOu-60:SC-14	0.47	23.06	0.37	0.00	0.00	23.90	0.84
DjOu-64:SC-1	0.00	34.15	0.00	0.00	0.00	34.15	0.00
MEAN:	0.53	33.81	1.80	3.06	0.00	39.21	2.33
FEATURES WITH LATE PREHISTORIC DIAGNOSTICS/C-14 DATES							
DjOu-3:SC-1	3.04	0.20	1.73	0.00	0.00	4.98	1.93
DjOu-44:SC-6	0.48	19.59	1.57	5.68	0.00	27.32	2.06
DjOu-49:SC-3	0.85	11.58	1.60	0.00	0.00	14.03	2.45
DjOu-60:SC-2	0.00	8.94	0.61	0.00	0.00	9.55	0.61
DjOu-60:SC-9	0.36	17.80	0.97	0.00	0.00	26.21	1.33
DjOu-62:SC-7	0.00	20.41	0.39	0.00	0.00	20.80	0.39
DjOu-62:SC-9	0.09	12.60	0.35	0.00	0.00	13.13	0.44
DjOu-62:SC-11	0.17	49.48	0.61	0.00	0.00	50.17	0.70
DjOu-62:SC-12	1.89	108.57	6.65	0.17	0.00	117.28	8.54
DjOu-71:SC-2	0.09	6.32	0.78	0.00	0.00	7.19	0.87
DjOu-73:SC-13	1.25	2.07	0.89	29.52	0.00	33.73	2.14
DkOu-16:SC-8	0.00	0.00	0.92	0.00	0.00	0.92	0.92
DkOu-45:SC-1	0.54	13.90	0.63	0.00	0.00	15.06	1.17
MEAN*:	0.67	20.88	1.36	2.72	0.00	26.18	1.81
MEAN**:	0.57	15.31	0.92	2.93	0.00	20.77	1.25

* Includes DjOu-62:SC-12 data, ** Excludes DjOu-62:SC-12 data

NOTE: Values expressed in items per square metre

Table 18: Reconstructed Parameters of Aboriginal Lodges From Stone Circle Diameters.

	MEAN INSIDE LODGE DIAMETER													
	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5
Total Lodge Weight With Liner (a)	90.67	117	135.28	163.58	183.84	214.11	236.37	268.6	292.81	327.18	353.27	389.46	417.64	455.83
Total Lodge Weight Without Liner (a)	82.85	105.61	120.32	145.05	161.77	188.47	207.16	235.8	256.5	287.18	309.82	342.47	367.08	401.7
Average No. of Inhabitants (a)	2	3	4	5	7	9	11	13	15	18	21	24	27	31
Dogs Needed to Transport Lodge With Liner (b)	3	3	4	5	5	6	7	8	9	10	10	11	12	13
Dogs Needed to Transport Lodge Without Liner (b)	2	3	4	4	5	6	6	7	8	8	9	10	11	12
Average Daily Meat Consumption Men + Dogs With Liner (c)	19.8	24.3	32.4	40.5	49.5	62.1	74.7	87.3	99.9	117	130.5	147.6	164.7	186.3
Average Daily Meat Consumption Men + Dogs Without Liner (c)	16.2	24.3	32.4	36.9	49.5	62.1	71.1	83.7	96.3	109.8	126.9	144	161.1	182.7
No. of Bison Needed for Daily Needs With Liner (d)	0.11	0.13	0.18	0.22	0.27	0.34	0.41	0.48	0.55	0.65	0.72	0.82	0.91	1.03
No. of Bison Needed for Daily Needs Without Liner (d)	0.09	0.13	0.18	0.20	0.27	0.34	0.39	0.46	0.53	0.61	0.70	0.80	0.89	1.01

(a) Lodge weight values and average number of inhabitants based on Finnigan (1981)

(b) Average transport capacity of each dog estimated at 34 kg following Ewers (1955:306)

(c) Average daily fresh meat consumption for men & dog valued respectively at 4.5 kg & 3.6 kg following Dyck (1977:57)

(d) Average amount of useable meat per bison valued at 181 kg following Dyck (1977:57)

Table 19: Mean Number of Stones Per Metre of Circumference.

SAMPLE	BY DIRECTIONAL SECTOR								BY ENTIRE	SC. SAMPLE
LOCATION:	N(1)	NE(2)	E(3)	SE(4)	S(5)	SW(6)	W(7)	NW(8)	FEATURE	(N=)
GROUP A SITES	3.27	3.13	2.99	3.17	3.33	2.92	3.46	2.94	3.15	54
GROUP B SITES	4.02	2.62	3.15	1.57	3.32	2.45	3.49	3.49	3.01	3
GROUP C SITES	6.35	6.89	5.40	5.13	4.91	6.17	5.67	5.85	5.80	13
GROUP D SITES*	4.70	4.77	4.82	4.57	4.86	4.60	4.75	4.83	4.74	172
GROUP E SITES *	3.16	2.78	2.73	2.79	3.04	3.08	3.07	3.21	2.98	397
GROUP F SITES	3.74	3.43	2.85	3.85	3.86	3.77	3.73	4.62	3.73	47
40 MILE ONLY	2.85	2.54	2.55	2.67	2.82	2.89	2.89	2.96	2.77	336
EDOP-1 CAMP	5.34	5.81	5.06	6.00	7.02	6.02	6.10	5.87	5.92	26
BY PHYS. ZONE:										
-1.1	3.47	3.14	3.12	3.34	3.62	3.67	3.60	3.63	3.45	291
-1.2	3.31	3.15	2.49	4.43	3.50	3.69	3.86	4.41	3.61	16
-1.3	4.22	4.50	4.31	4.15	3.95	3.57	3.77	4.07	4.07	86
-2.1	4.08	2.95	3.27	3.08	4.35	3.17	2.63	3.43	3.37	12
-2.2	4.59	4.60	4.77	4.73	4.98	4.69	4.99	5.22	4.81	51
-2.3	4.94	4.72	4.04	3.68	4.12	4.11	4.56	4.48	4.33	48
-2.4	3.21	3.07	2.16	1.95	2.86	2.44	3.28	3.00	2.75	8
-3.1	5.17	4.25	3.74	3.92	4.72	5.05	4.50	5.52	4.61	29
-3.2	3.32	4.36	4.98	4.84	4.84	3.87	4.70	3.39	4.29	8
-3.3	1.59	1.67	2.07	2.14	1.67	1.03	2.46	2.62	1.91	8
-4.2	4.01	3.34	3.48	3.21	3.48	2.41	3.34	3.21	3.31	2
-5.2	2.79	1.86	2.06	2.27	3.92	2.79	3.61	4.13	2.93	5
-5.3	4.05	5.78	3.18	4.34	4.63	4.34	4.05	3.18	4.19	2
-6.1	2.62	2.39	2.35	2.09	2.32	2.46	2.50	2.51	2.38	112
-6.2	4.17	2.68	4.96	2.68	3.46	3.62	2.91	3.93	3.55	8
TOTAL SAMPLE:	3.67	3.45	3.35	3.40	3.63	3.57	3.64	3.76	3.56	686

*Group E includes 40 Mile Project features, Group D includes EdOp-1 Camp features

Table 20: Inside Circumference Values and Sector Stone Counts for Specific Stone Circles Discussed.

SITE NUMBER	DjOu-22	DjOu-44	DjOu-49	DjOu-60	DjOu-62	DjOu-62	DjOu-62	DjOu-62	DjOu-62	DjOu-62	DjOu-62
STONE CIRCLE NO.	1	4	2	14	1	2	5	6	7	8	9
INSIDE CIRCUMFERENCE	12.76	12.1	14.2	11	16.61	14.47	15.05	13.59	8.86	12.85	12.19
N COUNT	1	3	1	2	1	2	6	2	4	1	1
NE COUNT	2	3	2	3	0	2	9	0	4	5	3
E COUNT	3	3	0	4	4	3	4	1	3	5	3
SE COUNT	4	3	3	3	1	3	2	1	1	7	6
S COUNT	2	1	3	2	6	0	1	1	2	5	0
SW COUNT	3	4	2	1	1	3	3	1	5	1	3
W COUNT	6	5	2	3	4	3	2	0	2	1	5
NW COUNT	2	5	3	3	5	3	6	0	1	4	3
SITE NUMBER	DjOu-62	DjOu-62	DjOu-62	DjOu-62	DjOu-62	EdOp-1	EdOp-1	EdOp-1	EdOp-1	EdOp-1	EdOp-1
STONE CIRCLE NO.	10	11	12	13	14	1	2	3	4	5	6
INSIDE CIRCUMFERENCE	17.86	13.2	13.13	12.48	14.94	6.06	6.84	5.93	6.05	4.91	5.08
N COUNT	1	1	17	3	5	6	18	4	7	9	9
NE COUNT	2	0	7	4	6	3	15	8	8	2	9
E COUNT	4	1	6	3	7	4	17	8	7	4	13
SE COUNT	3	2	1	2	6	10	10	11	12	5	9
S COUNT	3	0	6	2	2	7	14	7	8	6	17
SW COUNT	3	3	13	1	0	6	23	8	7	11	9
W COUNT	4	5	9	2	2	7	12	3	9	9	8
NW COUNT	3	5	14	2	1	7	15	8	11	9	7

Table 20: Continued

SITE NUMBER	EdOp-1	EdOp-1	EdOp-1	EdOp-1	EdOp-1	EdOp-1	EdOp-1	EdOp-1	EdOp-1	EdOp-1	EdOp-1
STONE CIRCLE NO.	22	23	24	25	26	27	28	29	30	31	32
INSIDE CIRCUMFERENCE	16.08	13.29	18.41	17.69	19.29	16.96	14.55	16.93	20.26	14.20	14.92
N COUNT	12	5	9	8	10	8	9	8	9	5	8
NE COUNT	10	5	7	9	9	4	7	9	17	11	4
E COUNT	10	7	7	15	13	11	8	6	5	4	0
SE COUNT	6	7	12	10	8	6	8	8	13	3	12
S COUNT	5	8	12	12	6	9	17	12	15	15	20
SW COUNT	4	7	9	11	24	16	8	11	17	16	14
W COUNT	4	5	14	6	19	4	9	10	20	10	20
NW COUNT	10	8	13	10	13	5	9	8	17	10	14

SITE NUMBER	EdOp-1	EdOp-1	EdOp-1	EdOp-1	EdOp-1	EdOp-1	EdOp-1	DjOu-22	DjOu-44	DjOu-49	DjOu-60
STONE CIRCLE NO.	33	42	43	44	45	46	47	1	4	2	14
INSIDE CIRCUMFERENCE	15.71	10.62	12.88	19.45	13.01	13.45	12.75	12.76	12.10	14.20	11.00
N COUNT	8	5	11	19	15	26	10	1	3	1	2
NE COUNT	7	9	12	29	26	14	13	2	3	2	3
E COUNT	13	9	11	19	13	13	10	3	3	0	4
SE COUNT	6	10	14	37	21	11	16	4	3	3	3
S COUNT	9	10	13	19	10	12	19	2	1	3	2
SW COUNT	4	5	8	19	10	8	12	3	4	2	1
W COUNT	7	8	10	24	15	11	13	6	5	2	3
NW COUNT	7	11	11	20	19	8	15	2	5	3	3

Table 20: Continued

SITE NUMBER	DjOu-62	DjOu-62	DjOu-62	DjOu-62	DjOu-62	DjOu-62	DjOu-62
STONE CIRCLE NO.	1	2	3	4	5	6	7
INSIDE CIRCUMFERENCE	16.61	14.47	-	-	15.05	13.59	8.86
N COUNT	1	2	-	-	6	2	4
NE COUNT	0	2	-	-	9	0	4
E COUNT	4	3	-	-	4	1	3
SE COUNT	1	3	-	-	2	1	1
S COUNT	6	0	-	-	1	1	2
SW COUNT	1	3	-	-	3	1	5
W COUNT	4	3	-	-	2	0	2
NW COUNT	5	3	-	-	6	0	1

SITE NUMBER	DjOu-62	DjOu-62	DjOu-62	DjOu-62	DjOu-62	DjOu-62	DjOu-62
STONE CIRCLE NO.	8	9	10	11	12	13	14
INSIDE CIRCUMFERENCE	12.85	12.19	17.86	13.2	13.13	12.48	14.94
N COUNT	1	1	1	1	17	3	5
NE COUNT	5	3	2	0	7	4	6
E COUNT	5	3	4	1	6	3	7
SE COUNT	7	6	3	2	1	2	6
S COUNT	5	0	3	0	6	2	2
SW COUNT	1	3	3	3	13	1	0
W COUNT	1	5	4	5	9	2	2
NW COUNT	4	3	3	5	14	2	1

Table 21: Correlation Coefficient Values for Weather Data in Relation to Meaned Feature Data

SAMPLE LOCATION	IN RELATION TO MEAN WIND FLOW FREQUENCY*											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
GROUP A SITES	0.2323	0.3114	0.4514	0.1811	0.1916	0.2195	0.1851	0.1119	0.1231	0.0290	0.0719	0.0556
GROUP B SITES	0.0587	0.0541	0.0415	0.0602	0.0515	0.0359	0.0115	0.0386	0.0452	0.0261	0.0434	0.0540
GROUP C SITES	0.0031	0.0079	0.0001	0.0192	0.0538	0.0016	0.0011	0.0014	0.0124	0.0200	0.0563	0.0002
GROUP D SITES	0.0009	0.0011	0.0070	0.0006	0.0098	0.0022	0.0349	0.0008	0.0064	0.0628	0.0358	0.0028
GROUP E SITES	0.0468	0.0009	0.0037	0.0157	0.0038	0.0843	0.0432	0.0845	0.0628	0.0381	0.0043	0.0068
GROUP F SITES	0.0075	0.0066	0.0053	0.0009	0.0118	0.0005	0.0071	0.0033	0.0076	0.0106	0.0073	0.0122
40 MILE ONLY	0.0528	0.0013	0.0055	0.0181	0.0064	0.1213	0.0475	0.0849	0.0786	0.0526	0.0110	0.0098
EdOp-1 CAMP	0.0381	0.0306	0.0335	0.1035	0.0858	0.0011	0.0001	0.0380	0.0001	0.1112	0.0496	0.0125

SAMPLE LOCATION	IN RELATION TO MEAN WIND FLOW VELOCITY*											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
GROUP A SITES	0.0719	0.0632	0.0762	0.0369	0.0305	0.0045	0.0328	0.0045	0.0031	0.0193	0.0162	0.0113
GROUP B SITES	0.0904	0.0780	0.0928	0.0942	0.0862	0.0704	0.0954	0.0775	0.2098	0.0661	0.0899	0.0683
GROUP C SITES	0.0395	0.0248	0.0352	0.3784	0.0492	0.0906	0.0089	0.0316	0.1307	0.0755	0.0010	0.0592
GROUP D SITES	0.0013	0.0206	0.0187	0.0346	0.0000	0.0160	0.0000	0.0024	0.0297	0.0000	0.0042	0.0004
GROUP E SITES	0.3508	0.1433	0.4245	0.2690	0.1948	0.2388	0.1232	0.1364	0.2669	0.3347	0.3288	0.2643
GROUP F SITES	0.0681	0.0722	0.0983	0.1439	0.2443	0.2494	0.1712	0.3695	0.2226	0.2597	0.1708	0.1687
40 MILE ONLY	0.4239	0.2072	0.4564	0.2961	0.2006	0.2917	0.1151	0.1820	0.2895	0.3873	0.4411	0.3471
EdOp-1 CAMP	0.0933	0.1685	0.0991	0.0354	0.0050	0.0086	0.0015	0.0024	0.0076	0.1795	0.2098	0.1294

* Wind data derived from appropriate group weather station, summarized in Figure 17 and Table 13. Stone circle data from Table 19

Table 22: Correlation Coefficient Values for Weather Data and Known Seasonally Sensitive Stone Circles at Forty Mile Coulee.

	IN RELATION TO MEAN WIND FLOW FREQUENCY*											
SITE/FEATURE*	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
DjOu-22 SC-1 (A)	0.0212	0.0304	0.0584	0.0714	0.0845	0.2611	0.1228	0.0600	0.0786	0.0773	0.0805	0.0191
DjOu-44 SC-4 (A)	0.3729	0.2748	0.2670	0.2451	0.2059	0.4750	0.2925	0.3050	0.3596	0.3336	0.3130	0.2929
DjOu-49 SC-2 (B)	0.0231	0.1030	0.1585	0.1222	0.1108	0.0071	0.0720	0.0396	0.0123	0.0270	0.0801	0.0622
DjOu-60 SC-14 (C)	0.3356	0.4908	0.4540	0.4485	0.5272	0.2781	0.3994	0.3424	0.3725	0.4021	0.4507	0.4138
DjOu-62 SC-10 (A)	0.2188	0.2711	0.2953	0.2594	0.2355	0.2975	0.2199	0.1828	0.2346	0.2780	0.3575	0.2666
DjOu-62 SC-11 (A)	0.3885	0.2435	0.2532	0.2663	0.2322	0.5673	0.3327	0.3655	0.4365	0.3980	0.3251	0.2832
DjOu-62 SC-12 (A)	0.0542	0.0145	0.0206	0.0225	0.0046	0.0286	0.0304	0.0604	0.0320	0.0222	0.0093	0.0221
DjOu-62 SC-14 (A)	0.0166	0.0022	0.0023	0.0016	0.0200	0.0407	0.0001	0.0075	0.0112	0.0059	0.0002	0.0007
Averaged Values	0.5665	0.5461	0.4987	0.4569	0.4403	0.4685	0.4536	0.4695	0.5119	0.5011	0.5080	0.5299

	IN RELATION TO MEAN WIND FLOW VELOCITY*											
SITE/FEATURE*	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
DjOu-22 SC-1 (A)	0.1185	0.2022	0.0491	0.0849	0.0932	0.1834	0.1014	0.1530	0.0972	0.1008	0.1837	0.1584
DjOu-44 SC-4 (A)	0.8635	0.9043	0.8005	0.8672	0.8051	0.9468	0.6425	0.8563	0.8449	0.8326	0.8000	0.8120
DjOu-49 SC-2 (B)	0.0007	0.0119	0.0032	0.0142	0.0021	0.0072	0.0065	0.0158	0.0037	0.0311	0.0146	0.0052
DjOu-60 SC-14 (C)	0.0012	0.0466	0.0015	0.0267	0.1054	0.0059	0.1798	0.0891	0.0487	0.0060	0.0008	0.0138
DjOu-62 SC-10 (A)	0.0956	0.1658	0.0446	0.0486	0.0229	0.0467	0.0225	0.1365	0.0565	0.0765	0.1936	0.2005
DjOu-62 SC-11 (A)	0.8478	0.8326	0.7698	0.7866	0.6844	0.8236	0.5350	0.7842	0.7808	0.8368	0.9094	0.8592
DjOu-62 SC-12 (A)	0.3310	0.1175	0.4598	0.2478	0.2208	0.2290	0.1054	0.1096	0.2445	0.2522	0.2091	0.1958
DjOu-62 SC-14 (A)	0.3779	0.2119	0.3273	0.2184	0.0501	0.2161	0.0302	0.1595	0.1751	0.3367	0.4171	0.3390
Averaged Values	0.4800	0.6222	0.5093	0.6559	0.7851	0.6032	0.6870	0.6802	0.6815	0.5286	0.4091	0.4930

* Wind data derived from Manyberries Weather Station. Individual Feature data presented in Table 20.

(A) Contains foetal bison remains estimated 1-2 months short of full term

(B) Foetal to newborn calf element present

(c) Contains remains of bison calf estimated 2-4 weeks old

Table 23: Correlation Coefficient Values Between Various Monts of the Year, Manyberries Weather Station.

MEAN WIND FLOW FREQUENCY

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
JAN	1.0000											
FEB	0.9480	1.0000										
MAR	0.8987	0.9702	1.0000									
APR	0.8659	0.9167	0.9723	1.0000								
MAY	0.8012	0.8638	0.9256	0.9751	1.0000							
JUN	0.7325	0.6844	0.7402	0.8163	0.7812	1.0000						
JUL	0.7808	0.7966	0.8710	0.9525	0.9376	0.9190	1.0000					
AUG	0.8725	0.8417	0.8841	0.9526	0.9221	0.8917	0.9720	1.0000				
SEP	0.9301	0.8782	0.8855	0.9291	0.9056	0.8862	0.9249	0.9731	1.0000			
OCT	0.9495	0.9252	0.9319	0.9528	0.9237	0.8543	0.9136	0.9592	0.9909	1.0000		
NOV	0.9424	0.9803	0.9797	0.9428	0.8953	0.7631	0.8425	0.8738	0.9149	0.9585	1.0000	
DEC	0.9729	0.9849	0.9345	0.8696	0.8102	0.6471	0.7365	0.8116	0.8712	0.9176	0.9672	1.0000

MEAN WIND FLOW VELOCITY

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
JAN	1.0000											
FEB	0.8887	1.0000										
MAR	0.9669	0.7989	1.0000									
APR	0.8880	0.9444	0.8577	1.0000								
MAY	0.7278	0.7862	0.7605	0.8837	1.0000							
JUN	0.8963	0.9224	0.8338	0.9384	0.8444	1.0000						
JUL	0.5518	0.7291	0.5407	0.8240	0.8903	0.7532	1.0000					
AUG	0.8285	0.9799	0.7611	0.9608	0.8371	0.8892	0.8156	1.0000				
SEP	0.8690	0.9180	0.8600	0.9857	0.9356	0.9205	0.8643	0.9459	1.0000			
OCT	0.9282	0.9436	0.8808	0.9799	0.8056	0.9223	0.7418	0.9382	0.9564	1.0000		
NOV	0.9637	0.9030	0.9047	0.8708	0.6990	0.8503	0.5632	0.8531	0.8608	0.9334	1.0000	
DEC	0.9540	0.9391	0.8991	0.9041	0.7338	0.8528	0.6172	0.9057	0.8950	0.9477	0.9853	1.0000

- Weather data presented in Table 13

Table 24: Correlation Coefficient Values Between Various Stone Circles at EdOp-1.

STONE CIRCLE	CLUSTER 7- CAMP CIRCLE														
NUMBER *	22	23	24	25	26	27	28	29	30	31	32	33	42	43	44
22	1.0000														
23	0.0490	1.0000													
24	0.2557	0.0679	1.0000												
25	0.0111	0.4459	0.2070	1.0000											
26	0.1816	0.0117	0.0017	0.0216	1.0000										
27	0.0639	0.1278	0.1622	0.3367	0.2255	1.0000									
28	0.1042	0.2174	0.1444	0.0380	0.1588	0.0065	1.0000								
29	0.5142	0.0128	0.1253	0.0612	0.0339	0.0391	0.3721	1.0000							
30	0.3193	0.0060	0.3124	0.3754	0.1130	0.0991	0.0062	0.4558	1.0000						
31	0.2722	0.0498	0.0173	0.0021	0.1332	0.0983	0.1908	0.7460	0.4442	1.0000					
32	0.5366	0.0596	0.7434	0.1815	0.0355	0.0080	0.3347	0.5883	0.4864	0.2950	1.0000				
33	0.1946	0.0109	0.1015	0.3306	0.1565	0.0003	0.0439	0.2603	0.5264	0.1824	0.2353	1.0000			
42	0.0005	0.2561	0.1354	0.0619	0.2866	0.2976	0.0661	0.0268	0.0121	0.0158	0.0070	0.0856	1.0000		
43	0.0270	0.0319	0.0226	0.0118	0.8514	0.2757	0.1069	0.0262	0.0437	0.1784	0.0030	0.0681	0.4395	1.0000	
44	0.0206	0.0393	0.0167	0.0755	0.1073	0.2472	0.1207	0.0247	0.0318	0.1601	0.0040	0.1053	0.1199	0.3552	1.0000
45	0.1760	0.1315	0.0115	0.1249	0.1519	0.5389	0.2735	0.1491	0.0347	0.1245	0.1327	0.0334	0.1541	0.1978	0.5096
46	0.3758	0.3387	0.1322	0.0575	0.1487	0.0121	0.0004	0.0741	0.2706	0.1918	0.1333	0.0748	0.2318	0.0195	0.0193
47	0.2227	0.3232	0.3681	0.0007	0.1995	0.0645	0.4892	0.3083	0.2001	0.1376	0.4232	0.0419	0.4191	0.3411	0.0754
4	0.0202	0.0974	0.4336	0.0565	0.0651	0.3200	0.0083	0.0238	0.1033	0.0855	0.1004	0.0999	0.4363	0.2673	0.4366
5	0.0951	0.0078	0.2005	0.1161	0.4404	0.1278	0.0024	0.1127	0.0960	0.1109	0.3198	0.2341	0.2737	0.4553	0.2381
6	0.0296	0.1739	0.0226	0.3967	0.1866	0.1088	0.6129	0.0868	0.1322	0.0413	0.0027	0.3296	0.0420	0.1236	0.0895
1	0.2187	0.1296	0.5976	0.0534	0.0090	0.0160	0.0575	0.0305	0.0404	0.0296	0.3981	0.1542	0.0465	0.1219	0.1621
2	0.0139	0.0008	0.3165	0.0826	0.3144	0.6403	0.0274	0.0126	0.0294	0.1583	0.0635	0.0137	0.5018	0.5884	0.4429
3	0.0008	0.3384	0.0378	0.3164	0.0672	0.0276	0.0224	0.0420	0.0225	0.0168	0.0784	0.0100	0.2155	0.1793	0.2518

* Individual feature data presented in Table 20 and Figure 24.

Table 24: Continued

STONE CIRCLE NUMBER *	CLUSTER 7 CAMP CIRCLE 45	46	47	CLUSTER 4 4	5	6	CLUSTER 5 1	2	3
22									
23									
24									
25									
26									
27									
28									
29									
30									
31									
32									
33									
42									
43									
44									
45	1.0000								
46	0.0021	1.0000							
47	0.0004	0.2039	1.0000						
4	0.2489	0.1770	0.2964	1.0000					
5	0.3084	0.0043	0.0164	0.0033	1.0000				
6	0.2693	0.0015	0.1530	0.1427	0.1236	1.0000			
1	0.0100	0.0488	0.3006	0.5283	0.1254	0.0117	1.0000		
2	0.2265	0.0108	0.2915	0.5208	0.1912	0.0003	0.2427	1.0000	
3	0.0979	0.2232	0.1156	0.2036	0.1899	0.0071	0.0425	0.0114	1.0000

* Individual feature data presented in Table 20 and Figure 24

Table 25: Correlation Coefficient Values for Various Stone Circles at DjOu-62.

STONE CIRCLE NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	1.0000													
2	0.0986	1.0000												
3	*****	*****	*****											
4	*****	*****	*****	*****										
5	0.2160	0.0172	*****	*****	1.0000									
6	0.0503	0.0567	*****	*****	0.0425	1.0000								
7	0.3312	0.0005	*****	*****	0.1332	0.1152	1.0000							
8	0.0079	0.0277	*****	*****	0.0002	0.0231	0.2769	1.0000						
9	0.3137	0.1042	*****	*****	0.3381	0.2104	0.1695	0.0265	0.2014					
10	0.3137	0.1042	*****	*****	0.3381	0.2104	0.1695	0.0265	0.2014	1.0000				
11	0.0664	0.4074	*****	*****	0.0346	0.2233	0.1342	0.1697	0.2611	0.1890	1.0000			
12	0.0021	0.0087	*****	*****	0.1400	0.0413	0.1827	0.6326	0.1936	0.2170	0.1034	1.0000		
13	0.0866	0.0274	*****	*****	0.5333	0.0030	0.0336	0.0765	0.0262	0.1706	0.3206	0.0102	1.0000	
14	0.1401	0.0032	*****	*****	0.1057	0.0605	0.0001	0.2770	0.0278	0.0332	0.3554	0.2187	0.5879	1.0000

*Individual feature data presented in Table 20 and Figure 25

Table 26: Cultural Material Summary, Forty Mile Coulee.

PROVENIENCE	F.C.R.	BONE	COARSE CORES	MED/FINE CORES	COARSE DEB.	MED/FINE DEB.	COARSE MRST	MED/FINE MRST	OTHER	TOTAL
	TOTAL CULTURAL MATERIAL FROM ALL CONTEXTS*									
DjOu-2	253		24	3	49	20	28	6		383
DjOu-3	173	15	3	2	110	39	17	5	E-1,PP-2,BF-1	368
DjOu-4		200	4	1	2	6	1	1		215
DjOu-5	94	834	1		179	150	4	2	PP-2,BF-1	1267
DjOu-11		1								1
DjOu-12										0
DjOu-13		83			1					84
DjOu-14										0
DjOu-17		5						1		6
DjOu-20		1	2		2	1		1		7
DjOu-21										0
DjOu-22		176							GF-9,PP-1	186
DjOu-23		119			6				GF-1,MF-1	127
DjOu-24										0
DjOu-25			1							1
DjOu-26	4	35	1		8	91	1			140
DjOu-28										0
DjOu-30	3									3
DjOu-31	42	256	1		12	22			BF-1,GF-12,MF-1	347
DjOu-35	1				1	1				3
DjOu-36					3					3
DjOu-37		1								1
DjOu-38	2	48			40	15		1	BF-1	107
DjOu-39	7	19			9	5	1	2		43
DjOu-40	3	78			17	8				106
DjOu-42	21	282			11	11		2		327
DjOu-43	4	20	7	1	2	4	3			41

Table 26: Continued.

PROVENIENCE	F.C.R.	BONE	COARSE CORES	MED/FINE CORES	COARSE DEB.	MED/FINE DEB.	COARSE MRST	MED/FINE MRST	OTHER	TOTAL
			TOTAL CULTURAL MATERIAL FROM ALL CONTEXTS*							
DjOU-44	145	680	2	3	37	70		5	BF-3,PP-2,	1184
DjOu-47		2					1			3
DjOu-49	57	765	2		41	36		1	BF-1,PP-2	905
DjOu-53	1	450				2				453
DjOu-54									BF-1	1
DjOu-55		28			6	3				37
DjOu-56										0
DjOu-57										0
DjOu-58									PP-1	1
DjOu-59										0
DjOu-60	9	2002	1		13	17		1	BF-3,MF-4	2050
DjOu-62	90	7362	8	3	57	237	9	5	PP-6,MF-1, P-8,BF-1	7787
DjOu-63	18	4	1		2	2				27
DjOu-64		191		1		1	1	1		195
DjOu-65	2				4		2			8
DjOu-66			2						GM-1	3
DjOu-67	1	350	1	1		6		1	BF-1,U-1	362
DjOu-69	2	28			1					31
DjOu-70	1	222	2		1	6			MF-2	234
DjOu-71	1	65			6	1			BF-1,PP-1	75
DjOu-72		3	1					1		5
DjOu-73	87	803			22	19	3		P-399,MF-2, HST-1	1337
DjOu-74										0
DjOu-75		2		2			1			5
DjOu-78										0
DjOu-80										0

Table 26: Continued

PROVENIENCE	F.C.R.	BONE	COARSE CORES	MED/FINE CORES	COARSE DEB.	MED/FINE DEB.	COARSE MRST	MED/FINE MRST	OTHER	TOTAL
	TOTAL CULTURAL MATERIAL FROM ALL CONTEXTS*									
DjOu-81	134	514			75	77	2	4	E-1,PP-1,BF-1, GF-1	810
DkOu-3										0
DkOu-4	7	32	5		2		3			49
DkOu-5			1			1				2
DkOu-6										0
DkOu-7	19		6		6	12	6	1		50
DkOu-11										0
DkOu-12		3								3
DkOu-13	48	85		1	6	4	4	2		150
DkOu-14	18	3	1	1	8	5		1		37
DkOu-15		355								355
DkOu-16	595		39	2	16	13	31	7	PP-1	704
DkOu-17	9		2	1	14	16	1		GF-1	44
DkOu-20			1							1
DkOu-27					1					1
DkOu-28	4		8		1		1			14
DkOu-29					1					1
DkOu-30			2							2
DkOu-31	26	37	10		11	3	14	2	GF-3	106
DkOu-32	1		2							3
DkOu-33	1		1				2			4
DkOu-34							1			1
DkOu-35										0
DkOu-43		6			1					7
DkOu-44		1	1							2
DkOu-45	6	155			3	4		1		169
DkOu-47		2				1				3

Table 26: Continued

PROVENIENCE	F.C.R.	BONE	COARSE CORES	MED/FINE CORES	COARSE DEB.	MED/FINE DEB.	COARSE MRST	MED/FINE MRST	OTHER	TOTAL
					TOTAL CULTURAL MATERIAL FROM ALL CONTEXTS*					
DkOu-48	7		1				4		GF-1,U-1	14
DkOu-49	4		8	1	5	3	6	1		28
DkOu-50	1									1
BACKHOE TESTS	20	47				1	5			73
TOTAL	1921	16370	153	23	792	913	152	55	724	21103

* Includes all auger, excavated, surface, controlled stripping, and backhoe materials

E = Endscraper
PP = Projectile Point
BF = Biface
GF = Glass Fragment
MF = Metal Fragment

DR = Drill or Awl
P = Pottery
GM = Grooved Maul
HST = Hammerstone

Table 27: Summary and Percentage Frequency of all Recovered Materials, Forty Mile Coulee Project.

	PHYSIOGRAPHIC ZONE						
CULTURAL MATERIAL CATEGORY	1.1 [22]	3.1 [10]	3.2 [5]	3.3 [5]	6.1 [22]	6.2 [4]	TOTAL [68]
F.C.R.	1166	23	99	2	626	5	1921
(%)	**59.0**	**3.7**	**7.6**	**0.2**	**4.0**	**0.5**	**9.1**
BONE	175	378	847	972	13281	717	16370
(%)	**8.8**	**61.5**	**65.2**	**96.7**	**85.7**	**97.3**	**77.5**
COARSE CORES	115	8	3	2	234	1	153
(%)	**6.1**	**1.3**	**0.2**	**0.2**	**0.2**	**0.2**	**0.7**
MED/FINE CORES	10	2	2	0	8	1	23
(%)	**0.5**	**0.3**	**0.2**	**0.0**	**0.1**	**0.2**	**0.2**
COARSE DEBITAGE	231	72	179	7	303	0	792
(%)	**11.6**	**11.7**	**13.8**	**0.7**	**1.8**	**0.0**	**3.7**
MED/FINE DEBITAGE	116	117	151	8	514	7	913
(%)	**5.9**	**18.9**	**11.7**	**0.8**	**3.3**	**0.8**	**4.3**
COARSE M.R.S.T.	119	8	9	0	15	1	152
(%)	**6.0**	**1.3**	**0.7**	**0.0**	**0.1**	**0.2**	**0.7**
MED/FINE M.R.S.T.	25	4	2	1	22	1	55
(%)	**1.3**	**0.6**	**0.2**	**0.1**	**0.2**	**0.2**	**0.2**
UNIFACES	1	0	0	0	0	1	2
(%)	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.2**	**0.1**
BIFACES	1	3	1	0	10	1	16
(%)	**0.1**	**0.5**	**0.1**	**0.0**	**0.1**	**0.2**	**0.1**
ENDSCRAPERS	1	0	0	0	1	0	2
(%)	**0.1**	**0.0**	**0.0**	**0.0**	**0.1**	**0.0**	**0.1**
PROJECTILE POINTS	3	1	2	1	11	1	19
(%)	**0.2**	**0.2**	**0.2**	**0.1**	**0.1**	**0.2**	**0.1**
CERAMICS	0	0	0	0	643	0	643
(%)	**0.0**	**0.0**	**0.0**	**0.0**	**4.1**	**0.0**	**3.0**
HIST. OR OTHER TOOLS	5	0	1	13	23	0	42
(%)	**0.3**	**0.0**	**0.1**	**1.2**	**0.2**	**0.0**	**0.2**
TOTAL	1968	616	1296	1006	15481	736	21103
(%)	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

* [ ] Number of Sites

Table 28: Summary and Percentage Frequency of all Recovered Materials Excluding Ceramics and Bone, Forty Mile Coulee.

	PHYSIOGRAPHIC ZONE						
CULTURAL MATERIAL CATEGORY	1.1 [22]	3.1 [10]	3.2 [5]	3.3 [5]	6.1 [22]	6.2 [4]	TOTAL [68]
F.C.R.	1166	23	99	2	626	5	1921
(%)	65.0	9.7	22.0	5.9	40.3	26.2	46.9
COARSE CORES	115	8	3	2	24	1	153
(%)	6.4	3.4	0.7	5.9	1.5	5.3	3.7
MED/FINE CORES	10	2	2	0	8	1	23
(%)	0.6	0.8	0.4	0.0	0.5	5.3	0.5
COARSE DEBITAGE	231	72	179	7	303	0	792
(%)	12.8	30.7	39.9	20.6	19.5	0.0	19.5
MED/FINE DEBITAGE	116	117	151	8	514	7	913
(%)	6.4	49.2	33.7	23.6	33.0	36.7	22.4
COARSE M.R.S.T.	119	8	9	0	15	1	152
(%)	6.6	3.4	2.1	0.0	1.0	5.3	3.7
MED/FINE M.R.S.T.	25	4	2	1	22	1	55
(%)	1.4	1.6	0.4	2.9	1.4	5.3	1.3
UNIFACES	1	0	0	0	0	1	2
(%)	0.1	0.0	0.0	0.0	0.0	5.3	0.1
BIFACES	1	3	1	0	10	1	16
(%)	0.1	1.2	0.2	0.0	0.6	5.3	0.3
ENDSCRAPERS	1	0	0	0	1	0	2
(%)	0.1	0.0	0.0	0.0	0.1	0.0	0.1
PROJECTILE POINTS	3	1	2	1	11	1	19
(%)	0.2	0.4	0.4	2.9	0.7	5.3	0.4
HIST. OR OTHER TOOLS	5	0	1	13	23	0	42
(%)	0.3	0.0	0.2	38.2	1.4	0.0	1.1
TOTAL	1793	238	449	34	1557	19	4090
(%)	100.0	100.0	100.0	100.0	100.0	100.0	100.0

* [ ] Number of Sites

Table 29: Comparison of Auger Hole Results to Individual Features Subsequently Test Excavated.

SITE	STONE CIRCLE NUMBER	NUMBER OF AUGER HOLES DRILLED	% OF AUGER HOLES WITH MATERIAL	TOTAL NUMBER OF AUGER HOLE ITEMS	RANGE OF ITEMS PER AUGER HOLE	MEAN NO. OF ITEMS PER AUGER HOLE	TOTAL AREA EXCAVATED (m2)	TOTAL NO. ITEMS FOUND (EXCAVATION)	MEAN NO. EXCAVATED ITEMS PER m2
DjOu-2	1	7	14.3	2	0-2	0.30	10.00	29	2.90
	2	7	0.0	0	0	0.00	10.00	8	0.80
	6	7	0.0	0	0	0.00	10.00	21	2.10
	9	7	14.3	1	0-1	0.10	10.00	14	1.40
	15	6	0.0	0	0	0.00	10.00	71	7.10
DjOu-4	9	8	25.0	2	0-1	0.25	8.00	106	13.25
DjOu-13	1	10	10.0	9	0-9	0.90	10.21	75	7.30
DjOu-17	1	10	0.0	0	0	0.00	10.65	5	0.50
DjOu-20	2	9	0.0	0	0	0.00	10.56	4	0.40
DjOu-22	1	10	30.0	13	0-6	1.30	10.00	173	17.30
DjOu-23	1	9	22.2	7	0-5	0.78	9.49	120	12.64
DjOu-26	1	9	11.1	1	0-1	0.10	9.98	44	4.41
	2	9	11.1	3	0-3	0.33	9.33	77	8.25
DjOu-30	1	10	0.0	0	0	0.00	10.56	3	0.28
DjOu-31	3	9	11.1	4	0-4	0.44	11.05	209	18.91
	5	9	11.1	10	0-10	1.11	11.07	46	4.16
	6	10	0.0	0	0	0.00	9.97	77	7.72
DjOu-38	1	9	0.0	0	0	0.00	10.00	40	4.00
	3	10	0.0	0	0	0.00	10.91	67	6.14
DjOu-39	1	10	10.0	1	0-1	0.1	10.88	43	3.95
DjOu-40	3	10	20.0	2	0-1	0.20	10.17	103	10.13
DjOu-42	1	9	33.3	17	0-10	1.90	10.00	295	29.5
DjOu-43	1	8	0.0	0	0	0.00	4.00	31	7.75
DjOu-44	3	9	33.3	16	0-8	1.80	12.00	503	41.90
	4	8	0.0	0	0	0.00	10.09	60	5.95
	6	9	11.0	4	0-4	0.44	8.00	599	74.9
DjOu-49	2	6	33.3	2	0-1	0.33	10.00	729	72.90
	3	9	11.1	1	0-1	0.10	10.35	167	16.14
DjOu-53	2	12	16.7	8	0-7	0.67	10.59	444	41.93
DjOu-55	1	6	0.0	0	0	0.00	10.00	14	1.40
	2	7	0.0	0	0	0.00	10.00	23	2.30
DjOu-60	2	10	10.0	4	0-4	0.40	11.22	106	9.45
	5	8	50.0	5	0-2	0.63	10.31	70	6.79
	7	10	40.0	7	0-4	0.70	10.77	376	34.91
	8	9	22.2	18	0-17	2.00	10.94	112	10.24
	9	8	12.5	9	0-9	1.10	8.00	207	25.90

Table 29: Continued

SITE	STONE CIRCLE NUMBER	NUMBER OF AUGER HOLES DRILLED	% OF AUGER HOLES WITH MATERIAL	TOTAL NUMBER OF AUGER HOLE ITEMS	RANGE OF ITEMS PER AUGER HOLE	MEAN NO. OF ITEMS PER AUGER HOLE	TOTAL AREA EXCAVATED (m2)	TOTAL NO. ITEMS FOUND (EXCAVATION)	MEAN NO. EXCAVATED ITEMS PER m2
DjOu-60	12	9	44.0	38	0-21	4.20	8.00	542	67.75
	14	9	11.1	1	0-1	0.10	10.44	233	22.32
DjOu-62	5	10	10.0	1	0-1	0.10	6.00	20	3.30
	7	8	62.5	70	0-17	8.75	7.00	164	23.40
	9	9	22.0	16	0-15	1.80	8.00	185	23.10
	11	8	37.5	11	0-6	1.36	11.22	564	50.27
	12	7	71.4	58	0-19	8.29	39.94	4651	116.45
	13	8	50.0	10	0-4	1.25	8.82	621	70.41
DjOu-63	1	8	25.0	2	0-1	0.25	7.00	25	3.60
DjOu-64	1	10	30.0	4	0-2	0.40	5.00	191	38.20
DjOu-67	1	8	0.0	0	0	0.00	4.00	56	14.00
	2	9	44.0	8	0-5	0.90	8.00	166	20.75
	3	9	0.0	0	0	0.00	4.00	69	17.25
	4	9	11.0	1	0-1	0.10	8.00	106	13.25
DjOu-69	2	10	30.0	17	0-12	1.70	10.89	6	0.55
DjOu-70	1	10	10.0	12	0-12	1.20	10.65	129	12.11
DjOu-71	2	10	10.0	20	0-20	2.00	9.99	54	5.41
DjOu-73	3	10	20.0	11	0-10	1.10	9.98	47	4.71
	6	6	16.7	2	0-2	0.33	10.31	30	2.91
	8	8	50.0	34	0-16	4.25	11.47	668	58.24
	9	7	14.3	13	0-13	1.86	10.51	68	6.47
	13	9	11.1	3	0-3	0.33	13.28	454	34.17
DkOu-7	2	9	0.0	0	0	0.00	10.00	18	1.80
	5	8	0.0	0	0	0.00	10.00	3	0.30
DkOu-16	6	8	12.5	1	0-1	0.10	11.48	28	2.44
	7	8	0.0	0	0	0.00	8.17	6	0.73
	8	7	0.0	0	0	0.00	8.45	8	0.95
	10	10	0.0	0	0	0.00	1.00	2	2.00
DkOu-31	6	9	11.1	1	0-1	0.10	8.54	1	0.12
DkOu-45	1	10	30.0	9	0-4	0.90	10.85	159	14.65
TOTAL (n=66)	-	573	16.6	482	0-21	0.84	650.09	14345	22.06

Table 30: Summary of Auger Hole Test Results to Corresponding Features Test Excavated.

NUMBER OF SITES/ FEATURES *	AUGER DATA				EXCAVATION DATA			
	MEAN NO. OF ITEMS PER AUGER HOLE	TOTAL NO. OF AUGER HOLES EXCAVATED	RANGE OF ITEMS PER AUGER HOLE	MEAN DENSITY OF ITEMS PER m2 **	TOTAL EXCAVATED AREA m2	TOTAL NO. OF ITEMS RECOVERED	MEAN NO. OF ITEMS PER m2	RANGE OF MEAN NO. OF ITEMS PER m2
12 (20)	0.0	166	0.0	0.0	172.36	586	3.39	0.28-17.25
16 (21)	0.10-0.50	181	0-4	7.9	199.03	3314	16.65	0.12-74.90
6 (7)	0.51-1.00	68	0-9	25.98	70.22	1410	20.08	6.79-41.93
10 (16)	1.01-5.00	143	0-21	60.37	161.54	4220	26.12	0.55-70.41
1 (2)	5.01-10.00	15	0-19	284.44	46.94	4815	102.57	23.40-116.45

* Features indicated in brackets ( )
** Based upon 0.03 m2 per auger hole

Table 31: Density of Cultural Material Recovered in Stone Circle Excavation Program*.

CULTURAL MATERIAL CATEGORIES

ANALYTICAL UNIT	FCR	BONE	COARSE COBBLE CORES	M/F COBBLE CORES	COARSE PEBBLE CORES	M/F PEBBLE CORES	COARSE DEBITAGE	M/F DEBITAGE	COARSE MRST	M/F MRST	C/COBBLE UNIFACES	PEBBLE UNIFACES	END-SCRAPERS	BIFACES	PROJ. POINTS	CERAMICS	OTHER	TOTAL DENSITY	TOTAL DENSITY W/O BONE	TOTAL EX AREA
1.1	1.13	16.57	0.00	0.00	0.00	0.00	0.19	0.85	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.09	18.93	2.35	10.62
1.2	0.73	44.61	0.00	0.00	0.00	0.06	0.18	0.91	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	46.68	2.07	16.41
1.3	0.67	21.93	0.02	0.02	0.00	0.00	0.51	0.60	0.05	0.00	0.00	0.00	0.00	0.02	0.02	0.00	0.00	23.86	1.93	43.00
1.4	0.22	14.89	0.11	0.00	0.00	0.00	0.22	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.67	0.78	9.00
1.5	12.48	0.36	0.00	0.00	0.00	0.00	0.12	0.12	0.06	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.21	12.85	16.50
SUBTOTAL 1.0	2.73	20.84	0.02	0.01	0.00	0.01	0.32	0.57	0.03	0.04	0.00	0.00	0.00	0.02	0.01	0.00	0.01	24.62	3.78	95.53
2.1	1.04	18.08	0.10	0.05	0.00	0.00	0.79	1.83	0.15	0.10	0.00	0.00	0.00	0.00	0.00	3.46	0.00	25.59	7.51	20.24
2.2	1.21	29.40	0.00	0.00	0.00	0.00	0.57	0.19	0.06	0.06	0.00	0.00	0.00	0.06	0.00	0.00	0.19	31 75	2.35	15 75
2.3	2.76	4.79	0.00	0.00	0.00	0.00	0.67	0.16	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.41	3.62	31.50
2.4	0.29	2.48	0.00	0.00	0.00	0.10	0.10	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	3.52	1.05	10.50
2.5	0.00	5.73	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.87	0.13	7.50
SUBTOTAL 2.0	1.52	12.27	0.02	0.01	0.00	0.01	0.56	0.56	0.05	0.05	0.00	0.00	0.00	0.01	0.00	0.82	0.07	15.96	3.68	85.49
3.1	0.52	27.88	0.00	0.00	0.00	0.00	0.39	1.42	0.06	0.06	0.00	0.00	0.00	0.06	0.13	23.89	0.32	54.73	26.85	15.53
3.2	0.25	13.02	0.08	0.00	0.00	0.00	0.34	0.17	0.08	0.04	0.00	0.00	0.00	0.00	0.00	0.47	0.00	14.46	1.44	23.65
3.3	2.54	32.52	0.04	0 00	0.00	0.02	0.80	1.04	0.04	0.02	0.00	0.00	0.00	0.00	0.06	0.36	0.00	37.44	4.92	50.00
3.4	0.24	7.82	0.00	0.00	0.00	0.00	0.12	0.24	0.06	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.55	0.73	16.50
3.5	0.00	7.73	0.00	0.00	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.00	0.27	7.50
SUBTOTAL 3.0	1.28	22.57	0 04	0.00	0.00	0.01	0.51	0.72	0.05	0.04	0.00	0.00	0.00	0.01	0.04	3.53	0.04	28.85	6.28	113.18
4.1	1.70	11.97	0.00	0.00	0.00	0.00	0.65	1.96	0.13	0.09	0.00	0.00	0.00	0.00	0.04	4.79	0.04	21.37	9.40	22.98
4.2	0.41	12.95	0.05	0.00	0.00	0.00	1.40	1.35	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.05	16.32	3.37	19.30
4.3	1.11	6.95	0.03	0.00	0.00	0.00	0.25	0.44	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.83	1.87	31.50
4.4	0.11	0.76	0 00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.22	9.00
4.5	0 11	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.11	0.00	0.00	0.00	0.00	0.11	0.00	0.00	1.44	0.44	9.00
SUBTOTAL 4.0	0.92	8.28	0.02	0.00	0.00	0.00	0.54	0.94	0.07	0.04	0.00	0.00	0.00	0.00	0.00	1.20	0.02	12.03	3.75	91.78
5.1	0.59	23.83	0.07	0.00	0.00	0.07	1.26	2.23	0.07	0.30	0.00	0.00	0.00	0.00	0.00	0.37	0.07	28.88	5.05	13.47
5.2	0.72	10.94	0.00	0.00	0.00	0.00	0.30	0.42	0.08	0.04	0.00	0.00	0.00	0.00	0.00	0.04	0.04	12.59	1.65	23.67
5.3	0.90	7.80	0.03	0.00	0.00	0.00	0.87	0.47	0.13	0.00	0.00	0.00	0.00	0.03	0.03	1.50	0.00	11.77	3.97	30.00
5.4	1.39	3.50	0 00	0.00	0.00	0.00	0.39	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.56	2.06	18.00
5.5	0.00	2.67	0.00	0.00	0.00	0.00	0.00	0.44	0.00	0.00	0.00	0 00	0.00	0.00	0.00	0.00	0.00	3.11	0.44	4.50
SUBTOTAL 5.0	0.86	9.92	0.02	0.00	0.00	0.01	0.64	0.68	0.08	0.06	0.00	0.00	0.00	0.01	0.01	0.57	0.02	12.87	2.96	89.64
6.1	2.41	12.92	0.00	0.00	0.00	0.00	0.52	2.35	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.31	5.39	19.12
6.2	1.71	14.70	0.05	0.00	0.00	0.00	0.65	0.65	0.00	0.05	0.00	0.00	0.00	0.00	0.05	0.00	0.15	18.02	3.32	19.87
6.3	0.23	11.19	0.00	0.00	0.00	0.03	0.32	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.03	12.10	0.90	31.00
6.4	0.16	10.86	0.05	0.00	0.00	0.00	0.22	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.41	0.54	18.50
6.5	0.00	1.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0 00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.11	0.11	9.00
SUBTOTAL 6.0	0.92	11.24	0.02	0.00	0.00	0.01	0.39	0.69	0.02	0.02	0.00	0.00	0.00	0.00	0.02	0.00	0.04	13.38	2.13	97.49
7.1	0.59	14.25	0.00	0.00	0.00	0.07	0.07	2.29	0.00	0.07	0.00	0.00	0.00	0.00	0.07	0.07	0.07	17.58	3.32	13.54
7.2	1.89	18.51	0.00	0 05	0.00	0.00	0.20	2.97	0.00	0.05	0.00	0.00	0.00	0.00	0.05	0.00	0.00	23.72	5.21	19.56
7.3	0.79	10.54	0 03	0.00	0.00	0.00	0.51	0.45	0.17	0.00	0.00	0.00	0.00	0 03	0.00	0.00	0.03	12.54	2.00	35.50
7.4	0.00	15.92	0.00	0.00	0.00	0.00	0.16	0.00	0.40	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.16	17.44	1.52	12.50
7.5	2.57	4.10	0.00	0.00	0.00	0.00	0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.24	3.14	10.50
SUBTOTAL 7.0	1.09	12.78	0.01	0.01	0.00	0.01	0.34	1.15	0.12	0.13	0.00	0.00	0.00	0.01	0.02	0.01	0.04	15.73	2.95	91.60
8.1	1.19	21.74	0.00	0.00	0.00	0.00	1.40	1.40	0.00	0.05	0.00	0.00	0.00	0.10	0.00	0.00	0.10	25.98	4.24	19.32
8.2	0.46	24.37	0.07	0.00	0.00	0.00	0.86	0.73	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.07	26.62	2.25	15.14
8.3	1.18	18.96	0.00	0.00	0.00	0.00	0.32	0.25	0.00	0.07	0.00	0.00	0.00	0.04	0.07	0.00	0.00	20.89	1.93	28.00
8.4	0.06	6.65	0.00	0.00	0.00	0.00	0.18	0.18	0.00	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.18	7.76	1.12	17.00
8.5	0.00	6.33	0.00	0.00	0.00	0.00	0.33	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.83	0.50	6 00
SUBTOTAL 8.0	0.75	17.21	0.01	0.00	0.00	0.00	0.63	0.57	0.00	0.15	0.00	0.00	0.00	0.04	0.02	0.00	0.07	19.46	2.25	85.46
DISTANCE UNITS																				
0.1	1.22	18.03	0.02	0.01	0.00	0.01	0.70	1.82	0.07	0.09	0.00	0.00	0.00	0.03	0.05	4.13	0.08	26.25	8.22	134.82
0.2	0.91	19.79	0.03	0.01	0.00	0.01	0.55	0.91	0.04	0.07	0.00	0.00	0.00	0.01	0.01	0.08	0.06	22.47	2.68	153.35
0.3	1.33	15.78	0.02	0.00	0.00	0.01	0.55	0.51	0.05	0.01	0.00	0.00	0.00	0.01	0.03	0.22	0.01	18.53	2.76	280.50
0.4	0.35	7.86	0.02	0.00	0.00	0.01	0.19	0.17	0.06	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.07	8.91	1.05	111.00
0.5	3.32	3.09	0.00	0.00	0.00	0.00	0.20	0.07	0.03	0.03	0.00	0.00	0.00	0.00	0.01	0.00	0.00	6.75	3.66	70.50
BY PHYS. SETTING																				
1.1	2.76	0.12	0.05	0.00	0.00	0.02	0.50	0.32	0.09	0.06	0.00	0.00	0.00	0.00	0.01	0.00	0.00	3.94	3.82	233.21
3.1	0.26	5.14	0.02	0.00	0.00	0.01	0.71	1.13	0.01	0.02	0.00	0.00	0.00	0.01	0.01	0.00	0.02	7.35	2.21	90.08
3.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.3	0.51	15.61	0.00	0.00	0.00	0.00	0.79	0.36	0.00	0.04	0.00	0.00	0.00	0.02	0.04	0.00	0.20	17.56	1.96	50.56
6.1	0.71	25.79	0.01	0.01	0.00	0.00	0.40	0.97	0.02	0.05	0.00	0.00	0.00	0.01	0.02	1.74	0.05	29.76	3.97	363.32
6.2	0.05	17.05	0.00	0.05	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	17.50	0.45	20.00
TOTAL ALL	1.26	14.52	0.02	0.00	0.00	0.01	0.48	0.73	0.04	0.04	0.00	0.00	0.00	0.01	0.02	0.83	0.04	18.00	3.49	757.17

* Values expressed in items per square metre

Table 32: Density of Cultural Material Recovered in Stone Circle Auger Testing Program*.

CULTURAL MATERIAL CATEGORIES

ANALYTICAL UNIT	FCR	BONE	COARSE COBBLE CORES	M/F COBBLE CORES	COARSE PEBBLE CORES	M/F PEBBLE CORES	COARSE DEBITAGE	M/F DEBITAGE	COARSE MRST	M/F MRST	C/COBBLE UNIFACES	PEBBLE UNIFACES	END-SCRAPERS	BIFACES	PROJ. POINTS	CERAMICS	OTHER	TOTAL DENSITY	TOTAL DENSITY W/O BONE	TOTAL EX. AREA
1.1	0.38	7.58	0.00	0.00	0.00	0.00	0.00	0.38	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.71	1.14	2.64
1.2	0.82	13.58	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.81	1.23	2.43
1.3	0.00	1.25	0.00	0.00	0.00	0.00	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.67	0.42	2.40
1.4	0.00	7.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.10	0.00	1.83
1.5	0.61	0.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.21	0.61	1.65
SUBTOTAL 1.0	0.37	6.39	0.00	0.00	0.00	0.00	0.09	0.18	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.12	0.73	10.95
2.1	0.00	1.67	0.00	0.00	0.00	0.00	0.00	0.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50	0.00	5.00	3.33	2.40
2.2	0.00	16.67	0.00	0.00	0.00	0.00	0.45	1.35	0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.45	19.82	3.15	2.22
2.3	0.00	1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.30	0.00	2.31
2.4	0.00	0.55	0.00	0.00	0.00	0.00	0.00	0.55	0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.55	2.19	1.64	1.83
2.5	0.68	0.68	0.00	0.00	0.00	0.00	0.00	0.00	1.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.72	2.04	1.47
SUBTOTAL 2.0	0.10	4.50	0.00	0.00	0.00	0.00	0.10	0.59	0.49	0.00	0.00	0.00	0.00	0.00	0.00	0.59	0.20	6.55	2.05	10.23
3.1	1.23	23.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.10	1.23	2.43
3.2	1.15	8.81	0.00	0.00	0.00	0.00	1.15	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	1.15	0.00	12.64	3.83	2.61
3.3	0.00	6.14	0.00	0.00	0.44	0.00	0.44	0.00	0.00	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.46	1.32	2.28
3.4	1.01	2.53	0.00	0.00	0.00	0.00	1.01	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.05	2.53	1.98
3.5	0.00	2.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.61	0.00	1.53
SUBTOTAL 3.0	0.74	9.60	0.00	0.00	0.09	0.00	0.55	0.09	0.09	0.09	0.00	0.00	0.00	0.00	0.00	0.28	0.00	11.54	1.94	10.83
4.1	3.20	12.33	0.00	0.00	0.00	0.00	0.46	2.28	0.00	0.91	0.00	0.00	0.00	0.46	0.00	0.00	0.00	19.63	7.31	2.19
4.2	0.00	15.83	0.00	0.00	0.00	0.00	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.25	0.42	2.40
4.3	0.00	6.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.37	8.22	1.37	2.19
4.4	0.00	1.13	0.00	0.00	0.00	0.00	0.56	0.00	0.00	0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.26	1.13	1.77
4.5	2.78	4.17	0.00	0.00	0.00	0.00	0.69	1.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.03	4.86	1.44
SUBTOTAL 4.0	1.10	8.81	0.00	0.00	0.00	0.00	0.40	0.70	0.00	0.30	0.00	0.00	0.00	0.10	0.00	0.00	0.30	11.81	3.00	9.99
5.1	1.22	4.88	0.00	0.00	0.00	0.00	0.41	1.22	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.81	8.94	4.07	2.46
5.2	1.19	4.76	0.00	0.00	0.00	0.00	0.40	0.40	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.14	2.38	2.52
5.3	0.00	9.01	0.00	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.00	9.91	0.90	2.22
5.4	0.00	8.85	0.00	0.00	0.00	0.00	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52	9.90	1.04	1.92
5.5	0.00	2.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.04	0.00	1.47
SUBTOTAL 5.0	0.57	6.04	0.00	0.00	0.00	0.00	0.28	0.47	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.28	7.93	1.89	10.59
6.1	0.00	10.96	0.00	0.00	0.00	0.00	0.44	2.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.04	3.07	2.28
6.2	0.00	2.60	0.00	0.00	0.00	0.00	0.43	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.46	0.87	2.31
6.3	0.00	5.97	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.96	1.99	2.01
6.4	0.58	11.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.28	0.58	1.71
6.5	0.00	0.71	0.00	0.00	0.00	0.00	0.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.42	0.71	1.41
SUBTOTAL 6.0	0.10	6.58	0.00	0.00	0.00	0.00	0.31	0.93	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.13	1.54	9.72
7.1	0.00	1.16	0.00	0.00	0.00	0.00	0.39	0.78	0.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.10	1.94	2.58
7.2	0.00	7.41	0.00	0.00	0.00	0.00	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.82	0.41	2.43
7.3	0.40	28.51	0.00	0.00	0.00	0.00	0.00	0.00	2.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31.33	2.81	2.49
7.4	0.00	10.49	0.00	0.00	0.00	0.00	0.62	0.00	3.09	6.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.37	9.88	1.62
7.5	0.00	1.85	0.00	0.00	0.00	0.00	0.00	0.00	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.47	0.62	1.62
SUBTOTAL 7.0	0.09	10.43	0.00	0.00	0.00	0.00	0.28	0.19	1.30	0.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.22	2.79	10.74
8.1	1.28	13.25	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.96	1.71	2.34
8.2	0.00	19.91	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.35	0.43	2.31
8.3	1.85	7.87	0.00	0.00	0.00	0.00	0.46	0.00	0.00	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.65	2.78	2.16
8.4	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.36	0.00	0.00	0.00	0.60	0.00	0.00	0.00	6.55	6.55	1.68
8.5	0.00	6.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.80	0.00	1.47
SUBTOTAL 8.0	0.80	10.44	0.00	0.00	0.00	0.00	0.10	0.20	0.00	1.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	12.65	2.21	9.96
DISTANCE UNITS																				
0.1	0.88	9.32	0.00	0.00	0.00	0.00	0.21	1.04	0.21	0.10	0.00	0.00	0.00	0.05	0.00	0.31	0.10	12.22	2.90	19.32
0.2	0.42	11.08	0.00	0.00	0.00	0.00	0.42	0.34	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.05	12.69	1.61	19.23
0.3	0.28	8.58	0.00	0.00	0.06	0.00	0.17	0.17	0.44	0.11	0.00	0.00	0.00	0.00	0.00	0.06	0.17	10.02	1.44	18.06
0.4	0.28	5.23	0.00	0.00	0.00	0.00	0.35	0.14	0.42	1.39	0.00	0.00	0.00	0.07	0.00	0.00	0.14	8.02	2.79	14.34
0.5	0.50	2.40	0.00	0.00	0.00	0.00	0.17	0.17	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.48	1.08	12.06
BY PHYS. SETTING																				
1.1	0.57	1.37	0.00	0.00	0.02	0.00	0.35	0.10	0.25	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.02	2.74	1.37	48.96
3.1	0.19	6.78	0.00	0.00	0.00	0.00	0.00	0.78	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.95	1.16	5.16
3.2	0.00	3.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.33	0.00	0.90
3.3	0.00	12.17	0.00	0.00	0.00	0.00	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.53	0.00	0.00	0.53	13.76	1.59	1.89
6.1	0.44	20.57	0.00	0.00	0.00	0.00	0.16	1.00	0.08	0.12	0.00	0.00	0.00	0.04	0.00	0.40	0.24	23.05	2.47	25.08
6.2	0.00	8.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.57	0.00	1.05
TOTAL ALL	0.48	7.86	0.00	0.00	0.01	0.00	0.26	0.41	0.17	0.08	0.00	0.00	0.00	0.02	0.00	0.12	0.10	9.53	1.66	83.04
																		TOTAL AUGER HOLES		2760.00

* Values expressed in items per square metre

Table 33: Density of Cultural Material Recovered in Stone Circle Controlled Stripping Program*.

CULTURAL MATERIAL CATEGORIES

ANALYTICAL UNIT	FCR	BONE	COARSE COBBLE CORES	M/F COBBLE CORES	COARSE PEBBLE CORES	M/F PEBBLE CORES	COARSE DEBITAGE	M/F DEBITAGE	COARSE MRST	M/F MRST	C/COBBLE UNIFACES	PEBBLE UNIFACES	END-SCRAPERS	BIFACES	PROJ. POINTS	CERAMICS	OTHER	TOTAL DENSITY	TOTAL DENSITY W/O BONE	TOTAL EX. AREA
1.1	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.3	10	128	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.4	10	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.5	0	27	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUBTOTAL 1.0	20	185	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	0	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.3	1	59	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2.4	14	130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.5	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0
SUBTOTAL 2.0	15	218	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0
3.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.2	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.3	0	83	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
3.4	3	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
3.5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUBTOTAL 3.0	3	93	2	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0
4.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.2	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.3	0	149	1	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0
4.4	0	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.5	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUBTOTAL 4.0	0	195	1	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0
5.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.2	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.3	2	201	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.4	50	13	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
5.5	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUBTOTAL 5.0	52	239	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
6.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.2	0	6	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
6.3	0	20	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.4	6	125	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
6.5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUBTOTAL 6.0	6	152	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
7.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.2	0	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.3	0	110	0	0	0	0	2	0	6	0	0	0	0	0	0	0	0	0	0	0
7.4	10	58	0	0	0	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0
7.5	0	69	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
SUBTOTAL 7.0	10	264	0	0	0	0	2	1	11	10	0	0	0	0	0	0	0	0	0	0
8.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.2	0	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.3	0	95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.4	0	85	0	0	0	0	0	0	1	9	0	0	0	0	0	0	0	0	0	0
8.5	1	28	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
SUBTOTAL 8.0	1	237	0	0	0	0	0	1	1	9	0	0	0	0	0	0	0	0	0	0
DISTANCE UNITS																				
0.1	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.2	0	131	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
0.3	13	845	3	0	0	0	5	1	7	0	0	0	0	0	0	0	1	0	0	0
0.4	93	463	2	0	0	0	1	1	7	20	0	0	0	0	0	0	0	0	0	0
0.5	1	132	2	0	0	0	0	2	0	1	0	0	0	0	0	0	1	0	0	0
BY PHYS. SETTING																				
1.1	1103	0	5	0	0	0	3	0	10	0	0	0	0	0	0	0	0	0	0	0
3.1	0	88	2	0	0	0	0	1	0	1	0	0	0	0	0	0	2	0	0	0
3.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.1	10	1539	2	0	0	0	5	3	0	0	0	0	0	0	0	0	0	0	0	0
6.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL ALL	113	1627	9	0	0	0	8	4	10	1	0	0	0	0	0	0	2	0	0	0

* Values expressed are actual numbers

Table 34: Forty Mile Coulee Project Individual Site/Feature Faunal Summary

Site/Feature Provenience	Bison		Canids		Antelope	Other/ Comment	# of Gnawed Elements
	Foetal/ Newborn	Other Bison	Large	Med/ Small			
DjOu-5 Buried Occupation	1(3)	1(33)		1(1)	1(3)	1	1
DjOu-5 Backhoe Test Pits		1(7)					
DjOu-13 SC-1 Excavation		1(2)	1(2)				
DjOu-17 SC-1 Excavation		1(1)					
DjOu-22 SC-1 Excavation	1(1)	1(4)	1(1)			1	
DjOu-23 SC-1 Excavation		1(4)			1(1)		
DjOu-26 SC-1 Excavation		1(1)					
DjOu-26 SC-2 Excavation		1(1)					
DjOu-31 SC-3 Excavation		1(4)					1
DjOu-31 SC-5 Excavation		1(3)					1
DjOu-31 SC-6 Excavation		1(1)					
DjOu-38 SC-1 Excavation		1(2)	1(1)				1
DjOu-38 SC-3 Excavation		1(1)					
DjOu-39 SC-1 Excavation		1(1)	1(1)				
DjOu-40 SC-3 Excavation		1(6)					
DjOu-42 SC-1 Excavation		1(3)					
DjOu-42 SC-1 Buried Occupation Excavation		1(8)					
DjOu-43 SC-1 Excavation		2(4)					
DjOu-44 SC-3 Excavation		1(2)					
DjOu-44 SC-4 Excavation	1(1)					1	
DjOu-44 SC-6 Excavation		1(3)					
DjOu-44 SC-6 Buried Occupation Excavation		1(4)					
DjOu-47 Surface		1(2)					
DjOu-49 SC-2 Excavation	1(1)	2(17)	1(1)		1(2)	2	6
DjOu-49 SC-3 Excavation		1(8)			1(2)		
DjOu-53 SC-2 Excavation	1(1)	2(16)		1(2)		3	2
DjOu-55 SC-1 Excavation		1(1)					1
DjOu-55 SC-2 Excavation		1(1)	1(3)				1
DjOu-60 Backhoe Test 5		1(1)					

Table 34: Continued

Site/Feature Provenience	Bison: Foetal/ Newborn	Bison: Other Bison	Canids: Large	Canids: Med/ Small	Antelope	Other/ Comment	# of Gnawed Elements
DjOu-60 SC-1 to 11 Associated Areas		1(3)					
DjOu-60 SC-1 Excavation		1(1)					
DjOu-60 SC-1 Controlled Stripping		1(7)					1
DjOu-60 SC-1 Combined Sample		1(8)					1
DjOu-60 SC-2 Excavation		1(1)				4	
DjOu-60 SC-2 Controlled Stripping		1(3)					
DjOu-60 SC-2 Combined Sample		1(4)				4	
DjOu-60 SC-3 Controlled Stripping		1(2)					
DjOu-60 SC-4 Controlled Stripping						5	
DjOu-60 SC-5 Excavation		1(1)					
DjOu-60 SC-5 Controlled Stripping		1(2)					1
DjOu-60 SC-5 Combined Sample		1(3)					1
DjOu-60 SC-6 Controlled Stripping					1(1)		
DjOu-60 SC-7 Excavation		1(2)					
DjOu-60 SC-7 Controlled Stripping		1(2)					
DjOu-60 SC-7 Combined Sample		1(4)					
DjOu-60 SC-8 Excavation		1(1)			1(1)		
DjOu-60 SC-8 Controlled Stripping		1(5)					1
DjOu-60 SC-8 Combined Sample		1(6)			1(1)		1
DjOu-60 SC-9 Excavation		1(3)					
DjOu-60 SC-9 Controlled Stripping		1(5)					3
DjOu-60 SC-9 Combined Sample		1(7)					2
DjOu-60 SC-10 Controlled Stripping		1(6)			1(1)		
DjOu-60 SC-12 Excavation		1(14)			1(1)		
DjOu-60 SC-13 Controlled Stripping		1(1)					
DjOu-60 SC-14 Excavation	1(1)	1(9)				6	2
DjOu-60 SC-14 Controlled Stripping		1(5)					
DjOu-60 SC-14 Combined Sample	1(1)	1(13)				6	2
DjOu-60 SC-16		1(2)					

Table 34: Continued

Site/Feature Provenience	Bison		Canids		Antelope	Other / Comment	# of Gnawed Elements
	Foetal / Newborn	Other Bison	Large	Med/ Small			
DjOu-62 SC-1 Controlled Stripping		2(20)				7	1
DjOu-62 SC-2 Controlled Stripping		1(6)					1
DjOu-62 SC-3 Controlled Striping		1(8)					1
DjOu-62 SC-4 Auger Holes		1(1)					
DjOu-62 SC-5 Excavation		1(2)			1(3)		
DjOu-62 SC-5 Controlled Stripping		1(1)					
DjOu-62 SC-5 Combined Sample		1(3)			1(3)		
DjOu-62 SC-7 Excavation		1(10)					
DjOu-62 SC-8 Controlled Stripping		1(1)					
DjOu-62 SC-9 Excavation		1(2)					
DjOu-62 SC-9 Controlled Stripping		1(8)					1
DjOu-62 SC-9 Combined Samples		1(9)					1
DjOu-62 SC-9 Lower Buried Occupation		1(1)					
DjOu-62 SC-10 Controlled Stripping	1(1)	1(20)				1	1
DjOu-62 SC-11 Excavation	1(1)	1(18)				1	2
DjOu-62 SC-11 Controlled Stripping		1(8)					
DjOu-62 SC-11 Combined Sample	1(1)	2(20)				1	2
DjOu-62 SC-12 Excavation	1(6)	6(159)				1	8
DjOu-62 SC-12 Controlled Stripping		6(40)					1
DjOu-62 SC-12 Combined Sample	1(6)	8(192)				1	8
DjOu-62 SC-13 Excavation		2(36)					6
DjOu-62 SC-13 Controlled Stripping		1(5)					
DjOu-62 SC-13 Combined Samples		2(41)					6
DjOu-62 SC-14 Excavation	1(1)	2(7)				1	1
DjOu-62 SC-14 Controlled Stripping	1(1)	2(16)				1	2
DjOu-62 SC-14 Combined Samples	1(2)	2(20)				1	3
DjOu-62 Backhoe Test 2		1(1)					
DjOu-62 SC-2,3 Associated Controlled Stripping Areas		1(4)					
DjOu-62 SC-10 to 14 Associated Controlled Stripping Areas		2(6)					

Table 34: Continued

Site/Feature Provenience	Bison: Foetal/ Newborn	Bison: Other Bison	Canids: Large	Canids: Med/ Small	Antelope	Other/ Comment	# of Gnawed Elements
DjOu-64 SC-1 Excavation		2(13)					
DjOu-67 SC-1 Excavation		1(2)					
DjOu-67 SC-2 Excavation		1(7)					
DjOu-67 SC-3 Excavation		1(1)					
DjOu-67 SC-4 Excavation		1(1)					
DjOu-69 SC-2 Excavation		1(2)	1(1)				1
DjOu-70 SC-1 Excavation		1(8)					1
DjOu-71 SC-2 Excavation		1(2)			1(1)		
DjOu-73 SC-3 Excavation		1(2)					
DjOu-73 SC-6 Excavation		1(2)					
DjOu-73 SC-7 Excavation		1(1)					
DjOu-73 SC-8 Excavation		1(11)					1
DjOu-73 SC-9 Excavation		1(3)					1
DjOu-75 BH Test 1		1(4)					
DjOu-81 Buried Occupation	1(3)	1(20)				1	2
DkOu-13 Cairn 1 Excavation		1(3)					
DkOu-31 SC-2 Excavation		1(1)					8
DkOu-45 SC-1		1(10)					1

- Values outside ( ) indicate MNI represented; values inside ( ) indicate MNE represented

1. Foetal bison remains estimated 1-2 month short of full term
2. Bone fragment with well defined periosteal layering.
3. Newborn bison remains from calf estimated 0-4 weeks old.
4. Terminal phalanx from large raptor ie eagle, hawk.
5. Fossilized dinosaur vertebral centrum 21 mm long.
6. Newborn bison remains from calf estimated 2-4 weeks old.
7. Immature bison humerus present from ca 1-2 month old calf.

Table 35: Summary of Forty Mile Coulee Project Faunal Sample.

	MINIMUM NO. OF ELEMENTS		MINIMUM NO. OF INDIVIDUALS		MEAN NO. OF ELEMENTS PER INDIVIDUAL	
SPECIES	SAMPLE TOTAL	INDIVIDUAL SITE/FEATURE RANGE	SAMPLE TOTAL	INDIVIDUAL SITE/FEATURE RANGE	INDIVIDUAL SITE/FEATURE RANGE	TOTAL SAMPLE RANGE
Bison						
- Foetal/Newborn	21	0-6	11	0-1	0-6	1.90
- other	670	0-192	92	0-8	0-33	7.28
Antelope	16	0-3	10	0-1	0-3	1.60
Canids						
- Med/Small	3	0-2	2	0-1	0-2	1.50
- Large	10	0-3	7	0-1	0-3	1.43

Other: - Single terminal phalanx from a large raptor at SC-2, DjOu-60
- Single small fossilized dinosaur vertebral centrum from SC-4, DjOu-60

Data derived from Table 25. Where features are characterized by both controlled stripping and excavation samples, the combined sample only is used here.

Total Sample = 79 individual sites/features

Table 36: Provenience Data for Illustrated Artifacts

FIGURE	NUMBER	SITE	PROVENIENCE
31	1	DjOu-4	SC-6, A.U. 1.4, Surface
	2	DkOu-7	Cairn 3, Surface
32	1	DkOu-17	Cairn 1, A.U. K.1, 10-20 cm BS
	2	DjOu-75	SC-1, A.U. 8.2, Surface
	3	DjOu-3	SC-1, Test Pit 35, 20-30 cm BS
	4	DjOu-2	Cairn 7, Surface
	5	DjOu-64	Feature 1, Surface
	6	DjOu-39	SC-1, A.U. 7.3, Surface
37	1	DkOu-31	SC-4, A.U. 5.4, 0-5 cm BS
	2	DjOu-2	SC-17, A.U. 5.3, Surface
	3	DjOu-26	SC-1, A.U. 4.1, 0-10 cm BS
	4	DjOu-39	SC-1, Surface
38	1	DjOu-3	Test Pit 10, 20-30 cm BS
	2	DjOu-5	Test Pit 3, 160-170 cm BS
	3	DjOu-38	SC-1, A.U. 2.2, 0-10 cm BS
	4	DjOu-81	Test Pit 11, 20-25 cm BS
	5	DkOu-17	SC-1, A.U. 4.1, 0-10 cm BS
	6	DjOu-44	SC-6, Test Pit 15, 30-35 cm BS
	7	DkOu-7	SC-5, A.U. 7.1, 10-20 cm BS
	8	DjOu-62	SC-12, A.U. 8.1, 10-20 cm BS
	9	DkOu-49	SC-7, A.U. 2.5, Auger Test
41	1	DjOu-3	SC-1, A.U. 7.2, 0-10 cm BS
	2	DjOu-3	SC-1, A.U. 6.2, 10-20 cm BS
	3	DjOu-5	Test Pit 4, 150-160 cm BS
	4	DjOu-5	Test Pit 8, 160-170 cm BS
	5	DjOu-22	SC-1, A.U. 6.3, 0-10 cm BS
	6	DjOu-44	SC-6, A.U. 5.3, 0-5 cm BS
	7	DjOu-44	SC-3, A.U. 4.1, 0-10 cm BS
	8	DjOu-49	SC-3, A.U. 4.1, Auger Test
	9	DjOu-49	SC-3, A.U. 4.5, 0-10 cm BS
	10	DjOu-58	Surface Find
	11	DjOu-62	SC-5, A.U. 8.4, Surface
	12	DjOu-62	SC-12, A.U. 1.3, 20-30 cm BS
	13	DjOu-62	SC-12, A.U. 3.3, 10-20 cm BS
	14	DjOu-62	SC-12, A.U. 3.3, 10-20 cm BS

Table 36: Continued

FIGURE	NUMBER	SITE	PROVENIENCE
41	15	DjOu-62	SC-12, A.U. 3.3, 20-30 cm BS
	16	DjOu-62	SC-12, A.U. 7.1, 10-20 cm BS
	17	DjOu-71	SC-2, A.U. 8.3, 10-20 cm BS
	18	DjOu-81	Test Pit 9, 20-25 cm BS
	19	DkOu-16	SC-8, A.U. 8.3, 0-5 cm BS
	20	DjOu-3	SC-1, Test Pit 3, 20-30 cm BS
	21	DjOu-81	Test Pit 17, 20-25 cm BS
43	1	DjOu-3	SC-1, Test Pit 2, 20-25 cm BS
	2	DjOu-5	Backhoe Test 3; 0-140 cm BS
	3	DjOu-31	SC-3, A.U. 1.1, 10-20 cm BS
	4	DjOu-44	SC-3, A.U. 3.1, 5-15 cm BS
	5	DjOu-38	SC-3, A.U. 8.3, 10-20 cm BS
	6	DjOu-44	SC-3, A.U. 3.1, 5-15 cm BS
	7	DjOu-49	SC-2, A.U. 7.3, 0-10 cm BS
	8	DjOu-49	SC-2, A.U. 6.1, 10-20 cm BS
	9	DjOu-54	SC-1, A.U. 0.0, Surface
44	1	DjOu-60	SC-12, A.U. 8.1, 10-20 cm BS
	2	DjOu-60	SC-12, A.U. 3.1, 10-20 cm BS
	3	DjOu-60	SC-14, A.U. 1.3, 0-10 cm BS
	4	DjOu-62	SC-11, A.U. 8.3, 10-20 cm BS
	5	DjOu-62	SC-12, A.U. 8.2, 10-20 cm BS
	6	DjOu-67	SC-4, A.U. 2.2, 10-15 cm BS
	7	DjOu-71	SC-1, A.U. 1.5, Auger Test
	8	DjOu-44	SC-3, A.U. 4.1, 10-15 cm BS
46	1	DjOu-67	SC-4, A.U. 5.3, Surface
	2	DkOu-48	SC-3, A.U. 6.3, Surface
47	N/A	DjOu-66	Surface
48	N/A	DjOu-62	SC-13, A.U. 7.3, 10-20 cm BS
49	1	DjOu-44	SC-3, A.U. 2.1, 0-15 cm BS
	2	DjOu-44	SC-3, A.U. 3.1, 0-10 cm BS
	3	DjOu-73	SC-13, A.U. 3.1, 0-10 cm BS
	4	DjOu-73	SC-13, A.U. 3.1, 0-10 cm BS

Table 36: Continued

FIGURE	NUMBER	SITE	PROVENIENCE
51	1	DjOu-23	SC-1, A.U. 7 4, 0-10 cm BS
	2	DjOu-31	SC-5, A.U. 8.4, 0-10 cm BS
	3	DjOu-60	SC-17, A.U. 2.2, Auger Test
	4	DjOu-60	SC-17, A.U. 4.3, Auger Test
	5	DjOu-60	SC-17, A.U. 4.3, Auger Test
	6	DjOu-60	SC-17, A.U. 4.3, Auger Test
	7	DjOu-62	SC-5, A.U. 8.4, 0-10 cm
	8	DjOu-73	SC-6, A.U. 5.1, Auger Test
	9	DjOu-73	SC-6, A.U. 5.1, Auger Test
	10	DjOu-70	SC-1, A.U. 2.5, Controlled Stripping
	11	DjOu-70	SC-1, A.U. 4.3, Controlled Stripping
52	1	DjOu-22	Sc-1, A.U. 2.4, Auger Test
	2	DjOu-22	SC-1, A.U. 2.2, 0-10 cm BS
	3	DjOu-22	SC-1, A.U. 2.2, 0-10 cm BS
	4	DjOu-22	SC-1, A.U. 2.2, 10-20 cm BS
	5	DjOu-22	SC-1, A.U. 2.4, 0-10 cm BS
	6	DjOu-22	SC-1, A.U. 2.4, 0-10 cm BS
	7	DjOu-22	SC-1, A.U. 2.4, 0-10 cm BS
	8	DjOu-22	SC-1, A.U. 6.3, 0-10 cm BS
	9	DjOu-22	SC-1, A.U. 8.2, 0-10 cm BS
	10	DjOu-23	SC-1, A.U. 7.4, 0-10 cm BS
	11	DjOu-31	SC-3, A.U. 1.1, 0-10 cm BS
	12	DjOu-31	SC-3, A.U. 3.1, 0-10 cm BS
	13	DjOu-31	SC-3, A.U. 3.1, 0-10 cm BS
	14	DjOu-31	SC-3, A.U. 3.1, 0-10 cm BS
	15	DjOu-31	SC-3, A.U. 3.1, 0-10 cm BS
	16	DjOu-31	SC-3, A.U. 3.1, 0-10 cm BS
	17	DjOu-31	SC-3, A.U. 5.2, 0-10 cm BS
	18	DjOu-31	SC-3, A.U. 8.1, 0-10 cm BS
	19	DjOu-31	SC-5, A.U. 4.2, 10-20 cm BS
	20	DjOu-31	SC-5, A.U. 6.2, 0-10 cm BS
	21	DjOu-31	SC-5, A.U. 6.2, 0-10 cm BS
	22	DjOu-31	SC-5, A.U. 6.2, 0-10 cm BS
	23	DjOu-81	Test Pit 18, 20-25 cm BS
	24	DkOu-31	SC-1, A.U. 1.5, Auger Test
	25	DkOu-31	SC-1, A.U. 1.5, Auger Test
	26	DkOu-31	SC-1, A.U. 1.5, Auger Test
	27	DkOu-48	SC-3, A.U. 5.4, Auger Test

Table 37: Stone Circle Ancillary Feature Distribution*.

ANALYTICAL UNIT	HEARTHS	PIT FEATURES	MIDDENS/ REFUSE PILES	WORK STATIONS	OTHER FEATURES	TOTAL(%)
1.1	6					6 (4.4)
1.2	2	1	2		1	6 (4.4)
1.3	1		2			3 (2.2)
1.4	1				1	2 (1.5)
1.5	2		2	1		5 (3.7)
2.1	3		1			4 (2.9)
2.2			1			1 (0.8)
2.3	1	2	1			4 (2.9)
2.4	1		2		1	4 (2.9)
2.5				1		1 (0.8)
3.1	9	2	1		4	16 (11.8)
3.2			5		1	6 (4.4)
3.3	1	1	1	1	1	5 (3.7)
3.4						0 (0.0)
3.5			3			3 (2.2)
4.1	5				1	6 (4.4)
4.2	2		2		1	5 (3.7)
4.3	3					3 (2.2)
4.4						0 (0.0)
4.5						0 (0.0)

Table 37: Continued

ANALYTICAL UNIT	HEARTHS	PIT FEATURES	MIDDENS/ REFUSE PILES	WORK STATIONS	OTHER FEATURES	TOTAL(%)
5.1	7				2	9 (6.7)
5.2	1	1				2 (1.5)
5.3			1			1 (0.8)
5.4						0 (0.0)
5.5			1			1 (0.8)
6.1	2					2 (1.5)
6.2	1	1			2	4 (2.9)
6.3		1	1			2 (1.5)
6.4						0 (0.0)
6.5						0 (0.0)
7.1	3					3 (2.2)
7.2	2		1			3 (2.2)
7.3	1	1	1			3 (2.2)
7.4			1			1 (0.8)
7.5			1			1 (0.8)
8.1	5					5 (3.7)
8.2	1				1	2 (1.5)
8.3	3			1	1	5 (3.7)
8.4	1					1 (0.8)

Table 37: Continued

ANALYTICAL UNIT	HEARTHS	PIT FEATURES	MIDDENS/ REFUSE PILES	WORK STATIONS	OTHER FEATURES	TOTAL(%)
8.5			1			1 (0.8)
0.0	5	1	3			9 (6.7)
TOTAL (%)	69 (51.1)	11 (8.1)	34 (25.2)	4 (3.0)	17 (12.6)	135
DISTANCE UNITS						
.0	5	1	3			9 (6.7)
.1	40	2	2		7	51 (37.7)
.2	9	3	11		6	29 (21.5)
.3	10	5	7	2	2	26 (19.3)
.4	3		3		2	8 (5.9)
.5	2		8	2		12 (8.9)
TOTAL (%)	69 (51.1)	11 (8.1)	34 (25.2)	4 (3.0)	17 (12.6)	135

Total Number of Sites = 25
( ) Percentage of Total

* Data derived from: Adams 1978; Brumley et al. 1981b, 1983; Brumley & Dau 1985a; Dau & Brumley 1984, 1987; Davis et al. 1982; Deaver 1985; Finnigan 1982; Milne-Brumley et al. 1978; Quigg 1978, 1982a; Ronaghan & Landals 1983; Van Dyke 1982; Wright et al. 1984.

Table 38: Correlation Coefficients for Forty Mile Coulee Stone Circle Sites Cultural Material Categories.

ANALYTICAL UNIT SET	FCR/ BONE	FCR/ C. COB. CORES	FCR/M-F COB. CORES	FCR/M-F PEB. CORES	FCR/COARSE DEBITAGE	FCR/M-F DEBITAGE	FCR/COARSE MRST
AU'S 1.1-8.5(N=40)	0.0123	0.0135	0.0008	0.0092	0.0006	0.0017	0.0002
DISTANCE UNITS 0.1-0.5	0.3147	0.6432	0.1098	0.4905	0.0875	0.0866	0.5324
DISTANCE UNITS 1.1-8.1	0.4409	0.0790	0.0045	0.2794	0.0001	0.0458	0.0237
DISTANCE UNITS 1.2-8.2	0.0001	0.2366	0.4061	0.0160	0.0986	0.2719	0.2365
DISTANCE UNITS 1.3-8.3	0.0450	0.0028	0.0719	0.0113	0.2500	0.0626	0.0784
DISTANCE UNITS 1.4-8.4	0.1321	0.0186	#NUM!	0.0004	0.5607	0.3071	0.0985
DISTANCE UNITS 1.5-8.5	0.2169	#NUM!	#NUM!	#NUM!	0.0001	0.0007	0.1192
DIRECTIONAL UNITS 1.0-8.0	0.2992	0.0376	0.4155	0.1594	0.3081	0.1122	0.0154
DIRECTIONAL UNIT 1.1-1.5	0.4425	0.1316	0.0631	0.0601	0.2097	0.3781	0.5382
DIRECTIONAL UNIT 2.1-2.5	0.0072	0.0001	0.0001	0.1607	0.5222	0.0002	0.0005
DIRECTIONAL UNIT 3.1-3.5	0.6487	0.0490	#NUM!	+0.9692	**+0.8761**	0.3120	0.0023
DIRECTIONAL UNIT 4.1-4.5	0.4164	0.0002	#NUM!	#NUM!	0.0542	0.5353	0.1918
DIRECTIONAL UNIT 5.1-5.5	0.0049	0.0026	#NUM!	0.0197	0.0646	0.0406	0.0154
DIRECTIONAL UNIT 6.1-6.5	0.4104	0.0000	#NUM!	0.1204	**+0.7554**	**+0.8202**	0.0935
DIRECTIONAL UNIT 7.1-7.5	0.2527	0.0416	0.1508	0.0962	0.3268	0.0126	0.5266
DIRECTIONAL UNIT 8.1-8.5	0.5523	0.0124	#NUM!	#NUM!	0.3178	0.3538	#NUM!
FRONT 1/2 LODGE CENTRE	-0.9486	0.0564	0.0069	0.2038	0.0250	0.0585	0.5887
BACK 1/2 LODGE CENTRE	0.1082	#NUM!	#NUM!	0.4123	0.0404	0.0822	**+0.8764**
FRONT 1/2 INT. MARGINS	0.6947	**+0.7569**	#NUM!	#NUM!	0.0350	0.1239	0.0406
BACK 1/2 INT. MARGINS	0.4271	0.0993	0.4253	0.1941	0.1148	0.3687	#NUM!
FRONT NEAR LODGE	0.1681	0.2413	#NUM!	0.2452	0.0675	0.0165	0.5127
REAR NEAR LODGE	0.2138	0.0035	0.0052	0.6971	0.0014	0.0005	0.0117
FRONT AWAY LODGE	0.0046	#NUM!	#NUM!	#NUM!	0.1728	**+0.7680**	0.1972
SOUTH SIDE AWAY LODGE	0.0018	0.0501	#NUM!	#NUM!	**+0.7962**	0.0509	0.0501
NORTH SIDE AWAY LODGIE	0.0018	0.0501	#NUM!	#NUM!	**-0.7962**	0.0509	0.0501
BACK SIDE AWAY LODGE	0.2886	#NUM!	#NUM!	#NUM!	**-0.8251**	0.3216	0.1180

- Correlation values may be either positive or negative **unless otherwise indicated**
-**Bold Values >=0.7<0.9**
-**Boxed Values >0.9**

Table 38: Continued

ANALYTICAL UNIT SET	FCR/M-F MRST	FCR/ BIFACES	FCR/PROJ. POINTS	FCR/ CERAMICS	BONE/CRSE. CBLE. CORES	BONE/M-F CBLE. CORES	BONE/M-F PBLE. CORES
AU'S 1.1-8.5(N=40)	0.0081	0.0005	0.0011	0.0016	0.0529	0.0277	0.0555
DISTANCE UNITS 0.1-0.5	0.4294	0.0373	0.0417	0.0122	**+0.8301**	**+0.8685**	0.3970
DISTANCE UNITS 1.1-8.1	0.1217	0.0315	0.2015	0.1230	0.0536	0.0005	0.0050
DISTANCE UNITS 1.2-8.2	0.0119	0.0346	**0.7803**	0.2092	0.1805	0.0082	0.6927
DISTANCE UNITS 1.3-8.3	0.1656	0.1731	0.0028	0.0010	0.0958	0.1059	0.1006
DISTANCE UNITS 1.4-8.4	0.1543	#NUM!	#NUM!	#NUM!	0.3364	#NUM!	0.1486
DISTANCE UNITS 1.5-8.5	0.1192	#NUM!	0.0272	#NUM!	#NUM!	#NUM!	#NUM!
DIRECTIONAL UNITS 1.0-8.0	0.0961	0.0368	0.0258	0.0041	0.1117	0.0146	0.0071
DIRECTIONAL UNIT 1.1-1.5	0.0078	0.0749	0.0631	#NUM!	0.0240	0.0062	**+0.7530**
DIRECTIONAL UNIT 2.1-2.5	0.1118	0.0059	#NUM!	0.0001	0.0859	0.0859	0.2218
DIRECTIONAL UNIT 3.1-3.5	0.0432	0.0110	0.1271	0.0092	0.0112	#NUM!	0.4999
DIRECTIONAL UNIT 4.1-4.5	0.0044	#NUM!	0.0226	0.6556	0.3517	#NUM!	#NUM!
DIRECTIONAL UNIT 5.1-5.5	0.0208	0.0398	0.0398	0.0295	**+0.7624**	#NUM!	**+0.6469**
DIRECTIONAL UNIT 6.1-6.5	+0.9536	#NUM!	0.0345	#NUM!	0.1944	#NUM!	0.0123
DIRECTIONAL UNIT 7.1-7.5	0.4279	0.0416	0.0015	0.0962	0.0452	0.3410	0.0253
DIRECTIONAL UNIT 8.1-8.5	0.1690	0.6558	0.3332	#NUM!	0.3286	#NUM!	#NUM!
FRONT 1/2 LODGE CENTRE	0.1422	0.3007	0.0661	0.1626	0.0003	0.0514	0.1063
BACK 1/2 LODGE CENTRE	0.0056	0.0635	0.4123	0.4123	#NUM!	#NUM!	0.1320
FRONT 1/2 INT. MARGINS	0.5748	**+0.7887**	#NUM!	0.4024	0.2074	#NUM!	#NUM!
BACK 1/2 INT. MARGINS	0.2895	#NUM!	+0.9673	#NUM!	0.2082	0.1242	+0.9107
FRONT NEAR LODGE	+0.9465	0.4171	0.0198	0.3094	0.3488	#NUM!	+0.9906
REAR NEAR LODGE	0.6161	+0.9358	0.2130	#NUM!	0.0000	0.5442	0.2753
FRONT AWAY LODGE	0.1972	#NUM!	0.0012	#NUM!	#NUM!	#NUM!	#NUM!
SOUTH SIDE AWAY LODGE	#NUM!	#NUM!	#NUM!	#NUM!	+0.9433	#NUM!	#NUM!
NORTH SIDE AWAY LODGE	#NUM!	#NUM!	#NUM!	#NUM!	+0.9433	#NUM!	#NUM!
BACK SIDE AWAY LODGE	0.3040	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!

Table 38: Continued

ANALYTICAL UNIT SET	BONE/CRSE DEBITAGE	BONE/COARSE MRST	BONE/M-F MRST	BONE/ BIFACES	BONE/PROJ. POINTS	BONE/ CERAMICS	BONE/ OTHER	C. C. CORES/ M-F C. CORES
AU'S 1.1-8.5(N=40)	0.1389	0.0034	0.0294	0.1167	0.0418	0.0635	0.0522	0.0484
DISTANCE UNITS 0.1-0.5	**+ 0.8409**	0.1309	0.0169	0.4495	0.2750	0.1858	0.1964	0.5568
DISTANCE UNITS 1.1-8.1	0.1465	0.0050	0.1195	0.1817	0.1102	0.3653	0.5695	0.5904
DISTANCE UNITS 1.2-8.2	0.0889	0.2040	**+0.8280**	0.0868	0.0576	0.1021	0.0000	0.1304
DISTANCE UNITS 1.3-8.3	0.0413	0.0247	0.0533	0.0002	0.4932	0.0088	0.0507	0.0078
DISTANCE UNITS 1.4-8.4	0.0574	0.3844	0.2211	#NUM!	#NUM!	#NUM!	0.0107	#NUM!
DISTANCE UNITS 1.5-8.5	0.2512	0.3558	0.3558	#NUM!	0.1442	#NUM!	#NUM!	#NUM!
DIRECTIONAL UNITS 1.0-8.0	0.0538	0.1183	0.0028	0.2634	0.4240	0.1532	0.0033	0.0666
DIRECTIONAL UNIT 1.1-1.5	0.0307	0.3104	0.4406	0.0083	0.0062	#NUM!	0.0116	0.0018
DIRECTIONAL UNIT 2.1-2.5	0.3028	0.4438	0.5606	**+0.7174**	#NUM!	0.0859	0.0079	+1.0000
DIRECTIONAL UNIT 3.1-3.5	**+0.7396**	0.0238	0.0117	0.2346	0.6729	0.2447	0.2346	#NUM!
DIRECTIONAL UNIT 4.1-4.5	**+0.7970**	0.0884	0.0147	#NUM!	0.1314	0.2549	**+0.8159**	#NUM!
DIRECTIONAL UNIT 5.1-5.5	0.6707	0.2009	+0.9140	0.0162	0.0162	0.0114	**+0.8954**	#NUM!
DIRECTIONAL UNIT 6.1-6.5	0.6879	0.0888	0.3917	#NUM!	0.2770	#NUM!	0.2685	#NUM!
DIRECTIONAL UNIT 7.1-7.5	0.6971	0.0574	0.1530	0.0452	0.2800	0.0253	0.1477	0.0625
DIRECTIONAL UNIT 8.1-8.5	0.5189	#NUM!	0.2360	0.2400	0.0481	#NUM!	0.0209	#NUM!
FRONT 1/2 LODGE CENTRE	0.0010	**-0.7123**	0.0529	0.5119	0.2179	0.3447	0.5740	0.5283
BACK 1/2 LODGE CENTRE	0.6386	0.3512	0.0281	**+0.7436**	0.1320	0.1320	0.5855	#NUM!
FRONT 1/2 INT. MARGINS	0.0022	0.1300	**+0.8337**	+0.9874	#NUM!	0.1049	**+0.8927**	#NUM!
BACK 1/2 INT. MARGINS	0.2044	#NUM!	+0.9601	#NUM!	0.5994	#NUM!	0.3597	0.3216
FRONT NEAR LODGE	0.1421	0.0023	0.0440	0.0709	**+0.7653**	0.0008	#NUM!	#NUM!
REAR NEAR LODGE	0.0167	0.1785	0.1513	0.2093	0.2218	#NUM!	-0.9348	0.2142
FRONT AWAY LODGE	**-0.7728**	0.0616	0.0616	#NUM!	0.3120	#NUM!	#NUM!	#NUM!
SOUTH SIDE AWAY LODGE	0.0749	- 0.9433	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
NORTH SIDE AWAY LODGE	0.0749	- 0.9433	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
BACK SIDE AWAY LODGE	0.4753	+ 0.9530	**+0.7101**	#NUM!	#NUM!	#NUM!	0.3811	#NUM!

Table 38: Continued

ANALYTICAL UNIT SET	C. C. CORES/ M-F PBL CORES	C. C. CORES/ COARSE DEB.	C. C. CORES/ M-F DEB.	C. C. CORES/ CRSE MRST	C. C. CORES/ M-F MRST	C. C. CORES/ BIFACES
AU'S 1.1-8.5(N=40)	0.0001	0.1604	0.0164	0.0145	0.0026	0.0341
DISTANCE UNITS 0.1-0.5	0.3553	0.4605	0.3023	0.1659	0.0312	0.1479
DISTANCE UNITS 1.1-8.1	0.0562	0.1824	0.0579	0.3637	0.4113	0.1840
DISTANCE UNITS 1.2-8.2	0.1304	0.2252	0.0921	0.0076	0.1327	0.1304
DISTANCE UNITS 1.3-8.3	0.0226	0.1959	0.6444	0.3770	0.2820	0.0021
DISTANCE UNITS 1.4-8.4	0.0411	0.0584	0.0005	0.0375	0.1018	#NUM!
DISTANCE UNITS 1.5-8.5	#NUM!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#NUM!
DIRECTIONAL UNITS 1.0-8.0	0.0561	0.0224	0.0790	0.0052	0.5616	0.1773
DIRECTIONAL UNIT 1.1-1.5	0.0973	0.0152	0.2429	0.0983	0.1828	0.1108
DIRECTIONAL UNIT 2.1-2.5	0.0625	0.3559	+0.9814	**+0.8225**	0.6189	0.0625
DIRECTIONAL UNIT 3.1-3.5	0.0504	0.1153	0.0280	0.2763	0.0050	0.1374
DIRECTIONAL UNIT 4.1-4.5	#NUM!	0.5554	0.0569	0.1109	0.0960	#NUM!
DIRECTIONAL UNIT 5.1-5.5	**+0.8066**	0.8942	**+0.8358**	0.2341	**+0.7540**	0.0405
DIRECTIONAL UNIT 6.1-6.5	0.1663	0.0649	0.0892	0.0443	0.0147	#NUM!
DIRECTIONAL UNIT 7.1-7.5	0.0625	0.2641	0.0771	0.0308	0.0897	+1.0000
DIRECTIONAL UNIT 8.1-8.5	#NUM!	0.0706	0.0372	#NUM!	0.0399	0.1195
FRONT 1/2 LODGE CENTRE	0.1643	0.4608	0.2259	0.1107	0.2442	0.3204
BACK 1/2 LODGE CENTRE	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
FRONT 1/2 INT. MARGINS	#NUM!	0.0369	0.0276	0.0048	0.1934	0.2989
BACK 1/2 INT. MARGINS	0.3216	+0.9954	0.4042	#NUM!	0.2528	#NUM!
FRONT NEAR LODGE	0.2622	0.0045	0.6396	0.2929	0.4421	0.0694
REAR NEAR LODGE	0.3274	+0.9772	**+0.7589**	**+0.7332**	0.3274	0.0957
FRONT AWAY LODGE	#NUM!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#NUM!
SOUTH SIDE AWAY LODGE	#NUM!	0.0224	0.2059	+1.0000	#NUM!	#NUM!
NORTH SIDE AWAY LODGE	#NUM!	0.0224	0.2059	-1.0000	#NUM!	#NUM!
BACK SIDE AWAY LODGE	#NUM!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#NUM!

Table 38: Continued

ANALYTICAL UNIT SET	C. C. CORES/ P. POINTS	C. C. CORES/ CERAMICS	C. C. CORES/ OTHER	M-F CBL CORE/ M-F PBL CORE	M-F CBL CORE/ COARSE DEB.	M-F CBL CORE/ M-F DEB.
AU'S 1.1-8.5(N=40)	0.0235	0.0015	0.0215	0.0106	0.0030	0.2323
DISTANCE UNITS 0.1-0.5	0.0212	0.0331	0.3377	0.3929	+ 0.9089	+ 0.8337
DISTANCE UNITS 1.1-8.1	0.1503	0.0206	0.1160	0.0476	0.0124	0.0009
DISTANCE UNITS 1.2-8.2	0.0134	0.3339	0.0045	0.0204	0.1235	+ 0.8189
DISTANCE UNITS 1.3-8.3	0.0082	0.2024	0.0551	0.0444	0.0012	0.0454
DISTANCE UNITS 1.4-8.4	*NUM!	*NUM!	0.1546	*DIV/0!	*DIV/0!	*DIV/0!
DISTANCE UNITS 1.5-8.5	*DIV/0!	*NUM!	*NUM!	*NUM!	*DIV/0!	*DIV/0!
DIRECTIONAL UNITS 1.0-8.0	0.0804	+ 0.7380	0.0362	0.2733	0.2736	0.0072
DIRECTIONAL UNIT 1.1-1.5	0.0018	*NUM!	0.0973	0.0625	+ 0.9435	0.0096
DIRECTIONAL UNIT 2.1-2.5	*NUM!	+ 1.0000	0.1563	0.0625	0.3559	+ 0.9814
DIRECTIONAL UNIT 3.1-3.5	0.0719	0.1246	0.1374	*DIV/0!	*DIV/0!	*DIV/0!
DIRECTIONAL UNIT 4.1-4.5	0.3075	0.1521	0.1880	*NUM!	*DIV/0!	*DIV/0!
DIRECTIONAL UNIT 5.1-5.5	0.0405	0.1855	0.4575	*DIV/0!	*DIV/0!	*DIV/0!
DIRECTIONAL UNIT 6.1-6.5	0.0904	*NUM!	0.2539	*DIV/0!	*DIV/0!	*DIV/0!
DIRECTIONAL UNIT 7.1-7.5	0.1580	0.0625	0.0405	0.0625	0.0622	0.5383
DIRECTIONAL UNIT 8.1-8.5	0.0625	*NUM!	0.0006	*NUM!	*DIV/0!	*DIV/0!
FRONT 1/2 LODGE CENTRE	0.6452	0.4042	0.3737	0.1111	0.0010	0.0034
BACK 1/2 LODGE CENTRE	*DIV/0!	*DIV/0!	*DIV/0!	*DIV/0!	*DIV/0!	*DIV/0!
FRONT 1/2 INT. MARGINS	*NUM!	0.6088	0.4628	*NUM!	*DIV/0!	*DIV/0!
BACK 1/2 INT. MARGINS	0.0194	*NUM!	0.5906	0.1111	0.2889	+ 0.9902
FRONT NEAR LODGE	0.4621	0.1663	*NUM!	*DIV/0!	*DIV/0!	*DIV/0!
REAR NEAR LODGE	0.6662	*NUM!	0.0004	0.1111	0.3497	+ 0.7024
FRONT AWAY LODGE	*DIV/0!	*NUM!	*NUM!	*NUM!	*DIV/0!	*DIV/0!
SOUTH SIDE AWAY LODGE	*NUM!	*NUM!	*NUM!	*NUM!	*DIV/0!	*DIV/0!
NORTH SIDE AWAY LODGE	*NUM!	*NUM!	*NUM!	*NUM!	*DIV/0!	*DIV/0!
BACK SIDE AWAY LODGE	*NUM!	*NUM!	*DIV/0!	*NUM!	*DIV/0!	*DIV/0!

Table 38: Continued

ANALYTICAL UNIT SET	M-F CBL CORE/ CRSE. MRST	M-F CBL CORE/ M-F MRST	M-F CBL CORE/ BIFACES	M-F CBL CORE/ P. POINTS	M-F CBL CORE/ CERAMICS	M-F CBL CORE/ OTHER
AU'S 1.1-8.5(N=40)	0.0061	0.0006	0.0051	0.0052	0.0013	0.0259
DISTANCE UNITS 0.1-0.5	0.0772	0.0400	0.6194	0.3915	0.4179	0.2145
DISTANCE UNITS 1.1-8.1	0.3843	0.0014	0.0810	0.0661	0.0009	0.1240
DISTANCE UNITS 1.2-8.2	0.1325	0.0231	0.0204	0.4376	0.0247	0.1232
DISTANCE UNITS 1.3-8.3	0.0014	0.0587	0.0403	0.0039	0.0317	0.0473
DISTANCE UNITS 1.4-8.4	#DIV/0!	#DIV/0!	#NUM!	#NUM!	#NUM!	#DIV/0!
DISTANCE UNITS 1.5-8.5	#DIV/0!	#DIV/0!	#NUM!	#DIV/0!	#NUM!	#NUM!
DIRECTIONAL UNITS 1.0-8.0	0.0992	0.0150	0.0217	0.1143	0.1049	0.0060
DIRECTIONAL UNIT 1.1-1.5	0.2222	0.1174	0.0000	+1.0000	#NUM!	0.0625
DIRECTIONAL UNIT 2.1-2.5	**+0.8225**	0.6189	0.0625	#NUM!	+1.0000	0.1563
DIRECTIONAL UNIT 3.1-3.5	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
DIRECTIONAL UNIT 4.1-4.5	#DIV/0!	#DIV/0!	#NUM!	#DIV/0!	#DIV/0!	#DIV/0!
DIRECTIONAL UNIT 5.1-5.5	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
DIRECTIONAL UNIT 6.1-6.5	#DIV/0!	#DIV/0!	#NUM!	#DIV/0!	#NUM!	#DIV/0!
DIRECTIONAL UNIT 7.1-7.5	0.1308	0.0470	0.0625	0.1726	0.0625	0.1895
DIRECTIONAL UNIT 8.1-8.5	#NUM!	#DIV/0!	#DIV/0!	#DIV/0!	#NUM!	#DIV/0!
FRONT 1/2 LODGE CENTRE	0.5018	0.0553	0.1111	0.2237	0.0851	0.2569
BACK 1/2 LODGE CENTRE	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
FRONT 1/2 INT. MARGINS	#DIV/0!	#DIV/0!	#DIV/0!	#NUM!	#DIV/0!	#DIV/0!
BACK 1/2 INT. MARGINS	#NUM!	0.1446	#NUM!	0.3439	#NUM!	0.2552
FRONT NEAR LODGE	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#NUM!
REAR NEAR LODGE	0.0038	0.1111	0.0041	0.0361	#NUM!	0.3303
FRONT AWAY LODGE	#DIV/0!	#DIV/0!	#NUM!	#DIV/0!	#NUM!	#NUM!
SOUTH SIDE AWAY LODGE	#DIV/0!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
NORTH SIDE AWAY LODGE	#DIV/0!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
BACK SIDE AWAY LODGE	#DIV/0!	#DIV/0!	#NUM!	#NUM!	#NUM!	#DIV/0!

Table 38: Continued

ANALYTICAL UNIT SET	M-F PBL CORE/ CRSE DEB	M-F PBL CORE/ M-F DEB	M-F PBL CORE/ CRSE MRST	M-F PBL CORE/ M-F MRST	M-F PBL CORE/ BIFACES
AU'S 1.1-8.5(N=40)	0.0002	0.0765	0.0219	0.0081	0.0271
DISTANCE UNITS 0.1-0.5	0.4211	0.6309	**+0.8294**	0.2119	0.6064
DISTANCE UNITS 1.1-8.1	0.0002	0.2971	0.0517	0.4396	0.1890
DISTANCE UNITS 1.2-8.2	0.1389	0.0000	0.1325	+0.9661	0.0204
DISTANCE UNITS 1.3-8.3	0.0045	0.0449	0.1190	0.0323	0.2955
DISTANCE UNITS 1.4-8.4	0.0761	0.1901	0.0354	0.0506	#NUM!
DISTANCE UNITS 1.5-8.5	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#NUM!
DIRECTIONAL UNITS 1.0-8.0	0.1911	0.0043	0.1198	0.1282	0.0679
DIRECTIONAL UNIT 1.1-1.5	0.0518	0.3362	0.1620	**+0.8909**	0.1037
DIRECTIONAL UNIT 2.1-2.5	0.3928	0.0236	0.1316	0.2589	0.0625
DIRECTIONAL UNIT 3.1-3.5	**+0.8446**	0.1776	0.0299	0.1273	0.0625
DIRECTIONAL UNIT 4.1-4.5	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#NUM!
DIRECTIONAL UNIT 5.1-5.5	0.6117	+0.9919	0.0234	+0.9800	0.0625
DIRECTIONAL UNIT 6.1-6.5	0.0117	0.0537	0.1666	0.1666	#NUM!
DIRECTIONAL UNIT 7.1-7.5	0.3353	0.2133	0.1308	0.0324	0.0625
DIRECTIONAL UNIT 8.1-8.5	#DIV/0!	#DIV/0!	#NUM!	#DIV/0!	#DIV/0!
FRONT 1/2 LODGE CENTRE	**+0.7907**	0.5326	0.2364	+0.9824	0.1111
BACK 1/2 LODGE CENTRE	0.2757	0.2699	0.1111	0.3893	0.3318
FRONT 1/2 INT. MARGINS	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
BACK 1/2 INT. MARGINS	0.3370	0.0585	#NUM!	+0.9872	#NUM!
FRONT NEAR LODGE	0.1381	**+0.8559**	0.0172	0.0901	0.1111
REAR NEAR LODGE	0.3291	0.2710	0.2025	0.1111	**-0.8893**
FRONT AWAY LODGE	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#NUM!
SOUTH SIDE AWAY LODGE	#DIV/0!	#DIV/0!	#DIV/0!	#NUM!	#NUM!
NORTH SIDE AWAY LODGE	#DIV/0!	#DIV/0!	#DIV/0!	#NUM!	#NUM!
BACK SIDE AWAY LODGE	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#NUM!

Table 38: Continued

ANALYTICAL UNIT SET	M-F PBL CORE/ P. POINTS	M-F PBL CORE/ CERAMICS	M-F PBL CORE/ OTHER	COARSE DEB/ M-F DEB	COARSE DEB/ CRSE MRST
AU'S 1.1-8.5(N=40)	0.0030	0.0058	0.0890	0.1594	0.0054
DISTANCE UNITS 0.1-0.5	0.1127	0.6074	0.6468	**+0.7769**	0.1350
DISTANCE UNITS 1.1-8.1	0.0060	0.0835	0.0081	0.0076	0.0396
DISTANCE UNITS 1.2-8.2	0.0476	0.0247	0.1232	0.0037	0.0004
DISTANCE UNITS 1.3-8.3	0.1097	0.0114	0.2755	0.2143	0.1625
DISTANCE UNITS 1.4-8.4	*NUM!	*NUM!	0.5492	0.0594	0.0028
DISTANCE UNITS 1.5-8.5	*DIV/0!	*NUM!	*NUM!	0.1111	0.2065
DIRECTIONAL UNITS 1.0-8.0	0.0040	0.0009	0.0160	0.1154	0.0433
DIRECTIONAL UNIT 1.1-1.5	0.0625	*NUM!	0.0625	0.0262	0.0713
DIRECTIONAL UNIT 2.1-2.5	*NUM!	0.0625	0.6250	0.3606	0.4870
DIRECTIONAL UNIT 3.1-3.5	0.0474	0.0585	0.0625	0.3446	0.0065
DIRECTIONAL UNIT 4.1-4.5	*DIV/0!	*DIV/0!	*DIV/0!	0.5612	0.0151
DIRECTIONAL UNIT 5.1-5.5	0.0625	0.0001	**+0.7079**	0.6186	0.3656
DIRECTIONAL UNIT 6.1-6.5	0.1402	*NUM!	0.0014	0.3872	0.0000
DIRECTIONAL UNIT 7.1-7.5	0.6035	+ 1.0000	0.0317	0.3482	0.0216
DIRECTIONAL UNIT 8.1-8.5	*DIV/0!	*NUM!	*DIV/0!	+ 0.9808	*NUM!
FRONT 1/2 LODGE CENTRE	0.2237	0.2348	0.0271	**+0.8310**	0.0013
BACK 1/2 LODGE CENTRE	- 1.0000	- 1.0000	0.0072	0.0353	0.0006
FRONT 1/2 INT. MARGINS	*NUM!	*DIV/0!	*DIV/0!	**+0.8529**	**-0.8318**
BACK 1/2 INT. MARGINS	0.3333	*NUM!	0.2552	0.3661	*NUM!
FRONT NEAR LODGE	**+0.7076**	0.0097	*NUM!	0.0882	0.2359
REAR NEAR LODGE	0.0001	*NUM!	0.4258	**+0.8749**	0.5905
FRONT AWAY LODGE	*DIV/0!	*NUM!	*NUM!	0.0125	0.2078
SOUTH SIDE AWAY LODGE	*NUM!	*NUM!	*NUM!	0.0357	0.0224
NORTH SIDE AWAY LODGE	*NUM!	*NUM!	*NUM!	0.0357	0.0224
BACK SIDE AWAY LODGE	*NUM!	*NUM!	*DIV/0!	0.1215	0.2758

Table 38: Continued

ANALYTICAL UNIT SET	COARSE DEB/ M-F MRST	COARSE DEB/ BIFACES	COARSE DEB/ P. POINTS	COARSE DEB/ CERAMICS	COARSE DEB/ OTHER	M-F DEB/ CRSE MRST
AU'S 1.1-8.5(N=40)	0.0005	0.0755	0.0070	0.0021	0.0037	0.0000
DISTANCE UNITS 0.1-0.5	0.1015	**+0.7800**	0.6390	0.4445	0.0971	0.2396
DISTANCE UNITS 1.1-8.1	0.3011	0.0088	0.2390	0.0468	0.0258	0.0917
DISTANCE UNITS 1.2-8.2	0.0905	0.0001	0.0411	0.0607	0.1032	0.2697
DISTANCE UNITS 1.3-8.3	0.0166	0.0092	0.0134	0.5015	0.1082	0.0548
DISTANCE UNITS 1.4-8.4	0.0020	*NUM!	*NUM!	*NUM!	0.0678	0.4725
DISTANCE UNITS 1.5-8.5	0.2065	*NUM!	0.1634	*NUM!	*NUM!	0.0329
DIRECTIONAL UNITS 1.0-8.0	0.0214	0.0520	0.0137	0.0644	0.1386	0.6461
DIRECTIONAL UNIT 1.1-1.5	0.1510	0.0011	+0.9435	*NUM!	0.0431	0.2795
DIRECTIONAL UNIT 2.1-2.5	**+0.7833**	0.0446	*NUM!	0.3559	0.2126	**+0.8257**
DIRECTIONAL UNIT 3.1-3.5	0.1075	0.0001	0.1937	0.0004	0.0001	0.0553
DIRECTIONAL UNIT 4.1-4.5	0.0141	*NUM!	0.1406	0.0331	**+0.8480**	0.2278
DIRECTIONAL UNIT 5.1-5.5	0.5764	0.1156	0.1156	0.2994	0.3606	0.0425
DIRECTIONAL UNIT 6.1-6.5	**+0.8328**	*NUM!	0.3974	*NUM!	0.5285	0.2359
DIRECTIONAL UNIT 7.1-7.5	0.1995	0.2641	0.4988	0.3353	0.3279	0.3433
DIRECTIONAL UNIT 8.1-8.5	0.2020	0.5895	0.1064	*NUM!	0.0155	*NUM!
FRONT 1/2 LODGE CENTRE	**+0.8874**	0.4939	0.6784	0.6643	0.3445	0.0351
BACK 1/2 LODGE CENTRE	0.0204	0.2815	0.2757	0.2757	0.0545	0.3342
FRONT 1/2 INT. MARGINS	0.1233	0.0107	*NUM!	0.2122	0.0045	0.5188
BACK 1/2 INT. MARGINS	0.2616	*NUM!	0.0266	*NUM!	0.5282	*NUM!
FRONT NEAR LODGE	0.0816	0.2845	0.4755	0.4318	*NUM!	0.0236
REAR NEAR LODGE	0.3373	0.0830	0.6040	*NUM!	0.0057	0.2426
FRONT AWAY LODGE	0.2078	*NUM!	0.2602	*NUM!	*NUM!	0.0007
SOUTH SIDE AWAY LODGE	*NUM!	*NUM!	*NUM!	*NUM!	*NUM!	0.2059
NORTH SIDE AWAY LODGE	*NUM!	*NUM!	*NUM!	*NUM!	*NUM!	0.2059
BACK SIDE AWAY LODGE	0.6989	*NUM!	*NUM!	*NUM!	**-0.7315**	0.3328

Table 38: Continued

ANALYTICAL UNIT SET	M-F DEB/ M-F MRST	M-F DEB/ BIFACES	M-F DEB/ P. POINTS	M-F DEB/ CERAMICS	M-F DEB/ OTHER	CRSE MRST M-F MRST	CRSE MRST BIFACES	CRSE MRST P. POINTS
AU'S 1.1-8.5(N=40)	0.0005	0.0082	0.0748	0.0550	0.0067	0.3727	0.0009	0.0008
DISTANCE UNITS 0.1-0.5	0.0000	**+ 0.8272**	0.3926	**+ 0.8039**	0.3699	0.3493	0.3379	0.0283
DISTANCE UNITS 1.1-8.1	0.2689	**- 0.7885**	0.0005	0.0649	0.2079	0.1170	0.3502	0.0006
DISTANCE UNITS 1.2-8.2	0.0000	0.1056	0.3673	0.1280	0.1749	0.1934	0.0819	0.3091
DISTANCE UNITS 1.3-8.3	0.0672	0.0163	0.1024	0.0468	0.0616	0.2408	0.2826	0.0864
DISTANCE UNITS 1.4-8.4	0.3136	#NUM!	#NUM!	#NUM!	0.0055	0.6024	#NUM!	#NUM!
DISTANCE UNITS 1.5-8.5	0.0329	#NUM!	0.0554	#NUM!	#NUM!	+1.0000	#NUM!	**+ 0.7447**
DIRECTIONAL UNITS 1.0-8.0	0.0699	0.2004	0.0046	0.0005	0.0405	0.0180	0.1773	0.0056
DIRECTIONAL UNIT 1.1-1.5	0.1392	0.2668	0.0096	#NUM!	0.2266	0.0266	0.0873	0.2222
DIRECTIONAL UNIT 2.1-2.5	0.6320	0.0502	#NUM!	+0.9814	0.0826	**+0.8833**	0.0328	#NUM!
DIRECTIONAL UNIT 3.1-3.5	0.1525	0.5804	+ 0.9330	0.5891	0.5804	0.6585	0.0637	0.0300
DIRECTIONAL UNIT 4.1-4.5	0.0766	#NUM!	0.0429	0.6110	**+0.8340**	**+0.8517**	#NUM!	0.5630
DIRECTIONAL UNIT 5.1-5.5	+0.9759	0.0422	0.0422	0.0013	**+0.7147**	0.0376	0.5249	0.5249
DIRECTIONAL UNIT 6.1-6.5	0.6373	#NUM!	0.0218	#NUM!	0.0032	0.0284	#NUM!	0.4114
DIRECTIONAL UNIT 7.1-7.5	0.1465	0.0771	**+ 0.8300**	0.2133	0.0981	**-0.7809**	0.0308	0.3305
DIRECTIONAL UNIT 8.1-8.5	0.1187	0.6649	0.0956	#NUM!	0.0510	#DIV/0!	#DIV/0!	#DIV/0!
FRONT 1/2 LODGE CENTRE	0.6391	**- 0.7578**	**-0.7260**	**- 0.8586**	0.5653	0.1348	0.4163	0.2838
BACK 1/2 LODGE CENTRE	**+0.7190**	**- 0.8609**	0.2699	0.2699	0.5215	0.0276	0.3318	0.1111
FRONT 1/2 INT. MARGINS	0.0010	0.1685	#NUM!	0.2118	0.0400	0.4948	0.0974	#NUM!
BACK 1/2 INT. MARGINS	0.0830	#NUM!	0.2768	#NUM!	0.3407	#DIV/0!	#NUM!	#DIV/0!
FRONT NEAR LODGE	0.0070	0.0120	**+ 0.7959**	0.0140	#NUM!	0.4711	+ 0.9096	0.1696
REAR NEAR LODGE	0.3049	0.0429	0.3814	#NUM!	0.0844	0.2025	0.0968	0.6533
FRONT AWAY LODGE	0.0007	#NUM!	0.2612	#NUM!	#NUM!	+1.0000	#NUM!	**+ 0.7168**
SOUTH SIDE AWAY LODGE	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
NORTH SIDE AWAY LODGE	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
BACK SIDE AWAY LODGE	0.0301	#NUM!	#NUM!	#NUM!	0.0062	0.6095	#NUM!	#NUM!

Table 38: Continued

ANALYTICAL UNIT SET	CRSE MRST CERAMICS	CRSE MRST OTHER	M-F MRST BIFACES	M-F MRST P. POINTS	M-F MRST CERAMICS	M-F MRST/ OTHER	BIFACES/ P. POINTS	BIFACES/ CERAMICS
AU'S 1.1-8.5(N=40)	0.0140	0.0170	0.0120	0.0021	0.0000	0.1217	0.0222	0.0938
DISTANCE UNITS 0.1-0.5	0.3384	0.4599	0.0269	0.4393	0.0076	0.5914	0.6962	**+0.8168**
DISTANCE UNITS 1.1-8.1	0.0554	0.0557	0.2446	0.0254	0.0113	0.0126	0.0002	0.0310
DISTANCE UNITS 1.2-8.2	0.3052	0.0007	0.0021	0.0564	0.0631	0.0635	0.0476	0.0247
DISTANCE UNITS 1.3-8.3	0.2408	0.0628	0.0551	0.3445	0.0512	0.1362	0.0772	0.1302
DISTANCE UNITS 1.4-8.4	#NUM!	0.0478	#NUM!	#NUM!	#NUM!	0.2091	#NUM!	#NUM!
DISTANCE UNITS 1.5-8.5	#NUM!	#NUM!	#NUM!	**+ 0.7447**	#NUM!	#NUM!	#DIV/0!	#NUM!
DIRECTIONAL UNITS 1.0-8.0	0.0094	0.0767	0.4510	0.0202	0.1423	0.2034	0.0215	0.0862
DIRECTIONAL UNIT 1.1-1.5	#NUM!	0.1620	0.1947	0.1174	#NUM!	0.1174	0.0000	#NUM!
DIRECTIONAL UNIT 2.1-2.5	**+ 0.8225**	0.0527	0.1047	#NUM!	0.6189	0.0773	#NUM!	0.0625
DIRECTIONAL UNIT 3.1-3.5	0.0696	0.0637	0.3031	0.1501	0.3044	0.3031	0.7932	+ 0.9996
DIRECTIONAL UNIT 4.1-4.5	0.4497	0.1423	#NUM!	**+ 0.7385**	0.1696	0.1043	#DIV/0!	#DIV/0!
DIRECTIONAL UNIT 5.1-5.5	0.6430	0.0846	0.0859	0.0859	0.0029	**+ 0.8269**	+1.0000	+ 0.9416
DIRECTIONAL UNIT 6.1-6.5	#NUM!	0.2614	#NUM!	0.1005	#NUM!	0.2720	#DIV/0!	#NUM!
DIRECTIONAL UNIT 7.1-7.5	0.1308	0.6761	0.0897	0.0961	0.0324	**+ 0.8358**	0.1580	0.0625
DIRECTIONAL UNIT 8.1-8.5	#NUM!	#DIV/0!	0.0954	0.0345	#NUM!	0.6772	0.0095	#NUM!
FRONT 1/2 LODGE CENTRE	0.2715	0.6075	0.2008	0.3430	0.3500	0.0845	**+0.8858**	+0.9699
BACK 1/2 LODGE CENTRE	0.1111	- 0.9304	0.4067	0.3893	0.3893	0.0820	0.3318	0.3318
FRONT 1/2 INT. MARGINS	0.3841	0.2180	**+ 0.8007**	#NUM!	0.3237	**+ 0.8814**	#NUM!	0.1395
BACK 1/2 INT. MARGINS	#NUM!	#DIV/0!	#NUM!	0.4434	#NUM!	0.2635	#DIV/0!	#NUM!
FRONT NEAR LODGE	+ 0.9477	#NUM!	0.3022	0.0000	0.2542	#NUM!	0.0526	+0.9430
REAR NEAR LODGE	#NUM!	0.1286	0.3636	**+ 0.7913**	#NUM!	0.3303	0.0564	#NUM!
FRONT AWAY LODGE	#NUM!	#NUM!	#NUM!	**+ 0.7168**	#NUM!	#NUM!	#DIV/0!	#NUM!
SOUTH SIDE AWAY LODGE	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
NORTH SIDE AWAY LODGE	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
BACK SIDE AWAY LODGE	#NUM!	0.2700	#NUM!	#NUM!	#NUM!	**+0.8828**	#NUM!	#NUM!

Table 38: Continued

ANALYTICAL UNIT SET	BIFACES/ OTHER	P. POINTS/ CERAMICS	P. POINTS/ OTHER	CERAMICS OTHER
AU'S 1.1-8.5(N=40)	0.1525	0.3213	0.0608	0.2682
DISTANCE UNITS 0.1-0.5	0.1353	0.3683	0.0374	0.2931
DISTANCE UNITS 1.1-8.1	0.2623	0.6764	0.6082	+0.7358
DISTANCE UNITS 1.2-8.2	0.5118	0.0577	0.0109	0.1330
DISTANCE UNITS 1.3-8.3	0.0052	0.0400	0.0529	0.0736
DISTANCE UNITS 1.4-8.4	#DIV/0!	#NUM!	#DIV/0!	#DIV/0!
DISTANCE UNITS 1.5-8.5	#NUM!	#NUM!	#NUM!	#NUM!
DIRECTIONAL UNITS 1.0-8.0	0.1281	0.2552	0.0355	0.0006
DIRECTIONAL UNIT 1.1-1.5	+0.9390	#NUM!	0.0625	#DIV/0!
DIRECTIONAL UNIT 2.1-2.5	0.1563	#DIV/0!	#DIV/0!	0.1563
DIRECTIONAL UNIT 3.1-3.5	+1.0000	+0.7997	+0.7932	+0.9996
DIRECTIONAL UNIT 4.1-4.5	#DIV/0!	0.0210	0.0426	0.2707
DIRECTIONAL UNIT 5.1-5.5	0.1481	+0.9416	0.1481	0.0306
DIRECTIONAL UNIT 6.1-6.5	#DIV/0!	#NUM!	+0.8328	#DIV/0!
DIRECTIONAL UNIT 7.1-7.5	0.0405	0.6035	0.0134	0.0317
DIRECTIONAL UNIT 8.1-8.5	0.0065	#NUM!	0.2688	#DIV/0!
FRONT 1/2 LODGE CENTRE	+0.9556	+0.9405	+0.8595	+0.8848
BACK 1/2 LODGE CENTRE	0.5861	1.0000	0.0072	0.0072
FRONT 1/2 INT. MARGINS	+0.9259	#DIV/0!	#DIV/0!	0.3732
BACK 1/2 INT. MARGINS	#DIV/0!	#NUM!	0.1108	#DIV/0!
FRONT NEAR LODGE	#NUM!	0.2072	#NUM!	#NUM!
REAR NEAR LODGE	0.4171	#NUM!	0.3146	#DIV/0!
FRONT AWAY LODGE	#NUM!	#NUM!	#NUM!	#NUM!
SOUTH SIDE AWAY LODGE	#NUM!	#NUM!	#NUM!	#NUM!
NORTH SIDE AWAY LODGE	#NUM!	#NUM!	#NUM!	#NUM!
BACK SIDE AWAY LODGE	#DIV/0!	#NUM!	#DIV/0!	#DIV/0!

Table 39: Estimated Number of Cultural Material Items Associated With an "Average" Sized Stone Circle, Forty Mile Coulee.

	DISTANCE UNIT					
	.1	.2	.3	.4	.5	TOTAL
TOTAL DISTANCE UNIT AREA (m2)	4.85	14.54	156.52	313.54	470.53	959.98
PERCENTAGE OF TOTAL CIRCLE AREA	0.50	1.51	16.30	32.66	49.03	100
INDIVIDUAL ANALYSIS UNIT AREA (m2)	0.61	1.82	19.57	39.19	58.82	N/A
NO. OF ITEMS PER DISTANCE UNIT (m2) (INCLUDING BONE)	12.22	12.69	10.02	8.02	3.48	N/A
ESTIMATED TOTAL NO. ITEMS PRESENT PER UNIT (INCLUDING BONE)	59	185	1568	2515	1637	5964
NO. ITEMS PER m2 (EXCLUDING BONE)	2.90	1.61	1.44	2.79	1.08	N/A
ESTIMATED TOTAL NO. ITEMS PRESENT PER UNIT (EXCLUDING BONE)	14	23	225	875	508	1645

- Based on a mean inside diameter of 4.45 m and a mean outside diameter of 5.48 m derived from the stone circle file (Dau and Brumley 1987). Working diameter of 4.97 m used in calculating area.

- Based upon auger test program results.

Table 40. Summary of Proposed Functions, Concentration Loci, and Associational Relationship for Various Cultural Material Categories

Material Category:	Firecracked Rock (FCR)
Male or Female Task Related:	Female
Function or Activities Reflected:	Waste by product of stove boiling. Stove boiling presumably employed for meat drying, meat cooking, bone grease extraction
Concentration Loci:	Back 1/2 lodge center, back 1/2 interior lodge margins, front near lodge, north side away from lodge
Interior Lodge Associations:	Coarse MRST, projectile points
Exterior Lodge Associations:	Medium to fine MRST

Material Category:	Faunal Remains
Male or Female Task Related:	Predominately female
Function or Activities Reflected:	Butchering, food processing, food preparation, food consumption
Concentration Loci:	All areas of lodge interior, front near lodge, back near lodge
Interior Lodge Associations:	Medium to fine pebbble cores, medium to fine MRST, bifaces, other (historic items)
Exterior Lodge Associations:	Medium to fine pebble cores, projectile points

Table 40: Continued

Material Category:	Coarse Cobble Cores and Pebble Cores
Male or Female Task Related:	Unclear, possibly either
Function or Activities Reflected:	Tool manufacture primarily of unmodified coarse debitage and/or coarse MRST. No evidence of their use as chopping or cutting tools
Concentration Loci:	Front 1/2 lodge center, front and back 1/2 interior lodge margin, front near lodge, back near lodge, south side away from lodge, north side away from lodge
Interior Lodge Associations:	None
Exterior Lodge Associations:	Coarse MRST

Material Category:	Medium to fine cobble and pebble cores
Male or Female Task Related:	Predominately male
Function or Activities Reflected:	Predominately high value tool production. Conveniently sized waste by product might be used as unmodified flake knives or modified into medium to fine MRST
Concentration Loci:	Front and back 1/2 lodge center, back 1/2 interior margin, front and back near lodge, north side away from ldoge
Interior Lodge Associations:	Faunal remains, coarse debitage, medium to fine MRST
Exterior Lodge Associations:	Faunal remains, medium to fine debitage, projectile points

Table 40: Continued

Material Category:	Coarse debitage
Male or Female Task Related:	Unclear, possibly either
Function or Activities Reflected:	Material category may be the waste byproduct and/or desired end product of coarse cobble core reduction. Suitable pieces may have been used as simple, low value knives in food processing
Concentration Loci:	Front and back halves of lodge center, front 1/2 interior margins, front near lodge
Interior Lodge Associations:	Medium to fine debitage, medium to fine MRST
Exterior Lodge Associations:	None

Material Category:	Medium to fine debitage
Male or Female Task Related:	Predominately male
Function or Activities Reflected:	Primarily high value tool production. Secondarily suitable pieces may have been used as simple knives in food processing
Concentration Loci:	Throughout lodge interior, and in front near lodge
Interior Lodge Associations:	Medium to fine cobble cores, coarse debitage, medium to fine MRST
Exterior Lodge Associations:	Medium to fine pebble cores, projectile points

Table 40: Continued

Material Category:	Coarse MRST
Male or Female Task Related:	Female
Function or Activities Reflected:	Simple knives used for cutting primarily meat. Assumed important in segmenting meat into thin strips for subsequent stone boiling and/or air drying
Concentration Loci:	Front and back of lodge center, front 1/2 lodge margin, all areas outside lodge
Interior Lodge Associations:	Firecracked rock
Exterior Lodge Associations:	Coarse cobble cores, medium to fine MRST, bifaces, projectile points, ceramics

Material Category:	Medium to fine MRST
Male or Female Task Related:	Female
Function or Activities Reflected:	Simple knives used for cutting primarily meat. Assumed important in segmenting meat into thin strips for subsequent stone boiling and/or air drying
Concentration Loci:	Throughout lodge interior, and in all exterior areas except south side away from lodge
Interior Lodge Associations:	Faunal remains, medium to fine pebble cores, coarse debitage, medium to fine debitage, bifaces
Exterior Lodge Associations:	Firecracked rock, coarse MRST, projectile points, other (historic items)

Table 40: Continued

Material Category:	Bifaces
Male or Female Task Related:	Predominately female
Function or Activities Reflected:	The majority of bifaces appear to reflect well made, high value knives used in meat processing. Occasional specimens appear to reflect preforms or blanks reflecting high value tool production presumably carried out by males
Concentration Loci:	Front and back 1/2 lodge center, front 1/2 interior margins, front and back near lodge
Interior Lodge Associations:	Faunal remains, medium to fine MRST, ceramics, other (historic items)
Exterior Lodge Associations:	Coarse MRST, ceramics

Material Category:	Projectile Points
Male or Female Task Related:	Male
Function or Activities Reflected:	Within the context of stone circle campsites, projectile points are interpreted as reflecting point manufacture and replacement
Concentration Loci:	Front and back 1/2 lodge center, back 1/2 interior margins, front near lodge, back near lodge, front away from ldoge
Interior Lodge Associations:	Bifaces, ceramics, other (historic items)
Exterior Lodge Associations:	Faunal remains, medium to fine pebble cores, medium to fine debitage, coarse MRST, medium to fine MRST

Table 40: Continued

Material Category:	Ceramics
Male or Female Task Related:	Female
Function or Activities Reflected:	Food preparation and or processing
Concentration Loci:	Front and back lodge center, front 1/2 interior margins, front near lodge
Interior Lodge Associations:	Bifaces, projectile points, other (historic items)
Exterior Lodge Associations:	Coarse MRST, bifaces

Material Category:	"Other" category consists largely of EuroCanadian-EuroAmerican items as well as a single bone awl and stone drill
Male or Female Task Related:	Both as male and female
Function or Activities Reflected:	Several activities are reflected. Bottle fragments probably contained alcohol or patent medicines. Metal fragments are suggestive of knives, a possible arrow point, a metal box or container, and canned foods. Bone awl and stone drill suggestive of manufacturing
Concentration Loci:	Throughout lodge interior, back near lodge, north and back sides away from lodge
Interior Lodge Associations:	Faunal remains, medium to fine MRST, bifaces, projectile points, ceramics
Exterior Lodge Associations:	None

APPENDIX 1: FIELD PROCEDURES AND SURFACE FEATURE ANALYSIS METHODOLOGY

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1.0 INTRODUCTION

In an archaeological project the size and scope of that undertaken at Forty Mile Coulee, how data are collected determines significantly how that data can be analyzed and what questions can be asked. During the period 1981 to 1986 a wide variety of data recovery procedures were employed in the Forty Mile project area. Many are typical of assessment/mitigation projects in southern Alberta. Others, however, are new and designed to gather types of information required to adequately test hypotheses generated in the Forty Mile research design. Much of this methodology is considered to have utility in other studies within the region. The following sections outline basic procedures and conventions used to locate, record, collect and analyze data from the Forty Mile Coulee project. Formatting, in general, follows that originally presented by (Brumley et al. 1983). The stone circle indices discussed in Section 6.0 are a direct outgrowth of concepts presented in earlier studies (see Brumley and Kooyman 1978).

2.0 FIELD SURVEY PROCEDURES

The examination of development locations surveyed involved essentially parallel, on-foot, linear traverses of an entire location. The spacing of individual traverses varied according to ground cover and depositional locales. In heavily grassed-over areas, traverses were spaced at roughly 5 to 8 metre intervals, increasing to 15 metre intervals in areas of little or no ground cover. When cultural material was observed, standard Archaeological Survey of Alberta site forms were completed and the site plotted on 1:10,000 or 1:5,000 base maps available for the project area. Non-site localities considered to have high potential for subsurface cultural material were also noted on maps in the field for future reference in selecting backhoe testing locales, but were not assigned site numbers.

3.0 AERIAL MAPPING PROCEDURE

Because of the large number of sites involved in the Forty Mile Coulee project and the importance placed on proper feature location, a system of producing accurate site plan maps was required for both in-field and report use. The system employed in the project area involved a combination of ground-based feature marking and low level aerial photographic techniques.

3.1 Site/Feature Marking

Subsequent to location and recording, sites were revisited in order to mark the location and features present for airphoto mapping. Two systems were utilized during the course of the project. In the first system, each feature was identified using a standard 12 inch square white ceiling tile placed in the centre or on the margin of the feature. The same tiles were used to produce a standard set of markers which indicated site number, scale and true north. Table 1 and Figure 1 summarize the ground marking procedures employed.

The second system used the same basic site number, scale and true north identification procedures as were employed in the first system. Individual features were not marked with white tiles. Rather, all visible stones in each feature were white-washed in an attempt to make them stand out from their surroundings and therefore more visible from the air.

3.2 Photographic Procedures

Air photography was carried out utilizing a standard 35 mm camera with a 50 mm f 2.0 lens and Tri-X black and white film. A Cessna 172 aircraft, with the passenger window modified to open completely, was employed flying at an altitude of 300 - 400 metres. The photographer, wearing a hooded jacket as protection from wind buffeting, would simply lean out the window and take essentially vertical exposures of the various sites as they were passed over. Because of the high cost of aircraft rental, careful flight planning was required in order to ensure the maximum number of sites were photographed per flight. An example of a completed airphoto and plan map is presented in Figure 2.

An important aspect of airphoto mapping as employed here was the rapid processing and printing of film to insure resultant film quality and complete coverage. Ethos Consultants has a small black and white darkroom so that "utility grade" 8 x 10 prints can be processed quickly, inexpensively and provided to field personnel for their subsequent use.

Table 1: Site Airphoto Ground Marking Code and Guide.

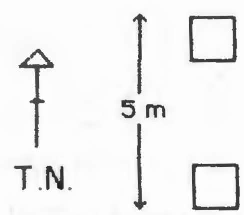
General
- Magnetic declination 19° East of True North in project area
- Directional scales oriented in relation to True North in field using compass

Stone Circle Marking
- Stone Circles marked with solid white tiles placed in defined centre of feature

Cairn Marking
- Cairns marked by diagonally marked squares: placed on south margin of feature

Other Features
- Other features consisting of hearths, lithic scatter, marked with horizontally marked squares: placed in centre or along south margin of feature indicated

Site Scale, Numbering and Directional Markers
- Two solid white squares 5m apart and oriented in relation to True North using compass are to be situated in the NE portion of the site, with all features located S and W of the scale marker. The scale marker should be slightly isolated from the feature markers so that it can be easily distinguished on an air photo.
- Use string and wooden stakes to establish directional line with compass - do not use metal chain



- Between the two end markers of the directional scale, two sets of white blocks will be used to indicate site numbers. The first set will be situated ca. 1.5 m South of the North end of the scale and will represent the first digit of the site number. The second set will be located ca. 1.5 m North of the South end of the scale and represents the second digit of the site number. Figure 1 indicates the number code system.

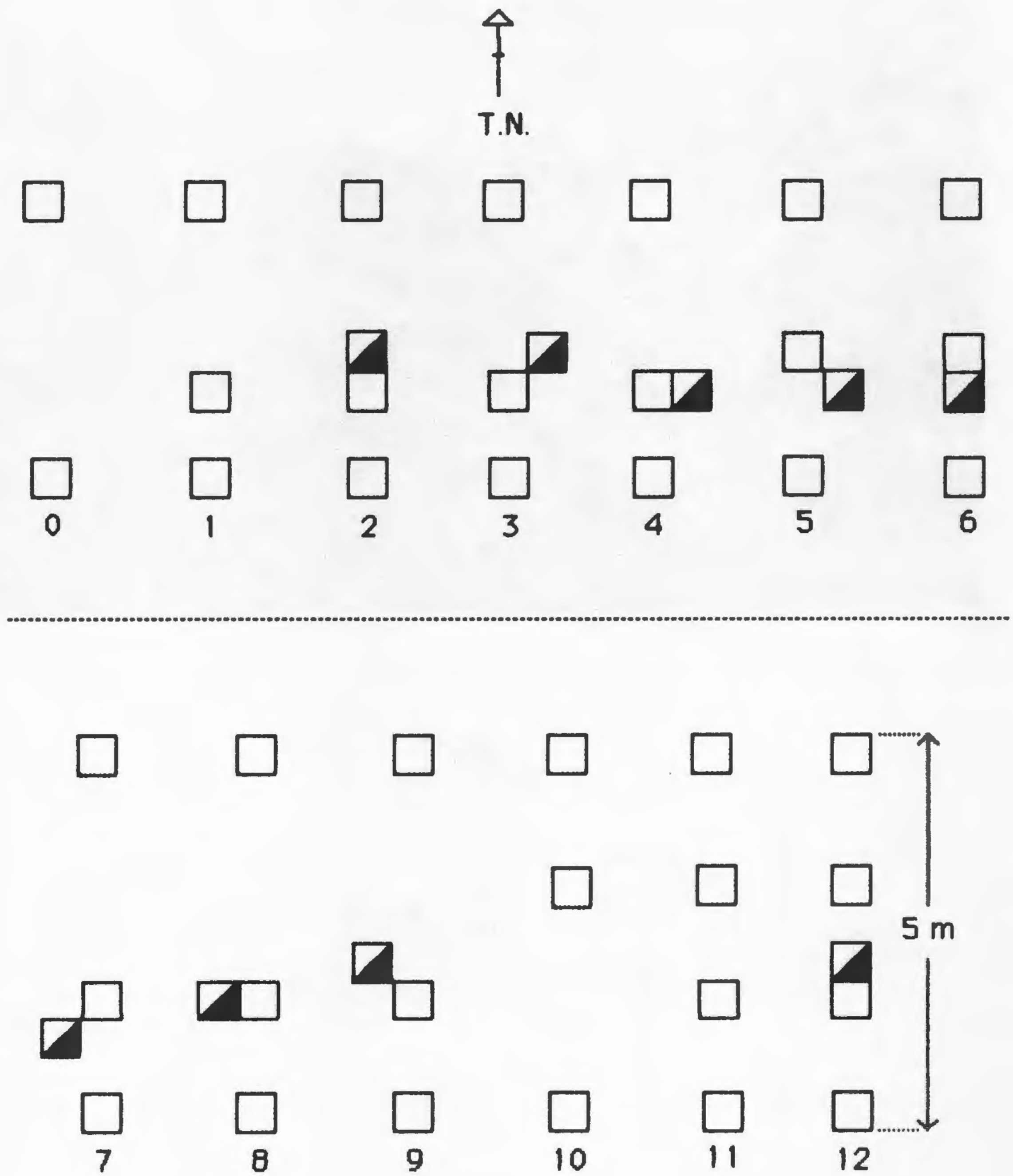


Figure 1: Site Marking Code For Aerial Photography.

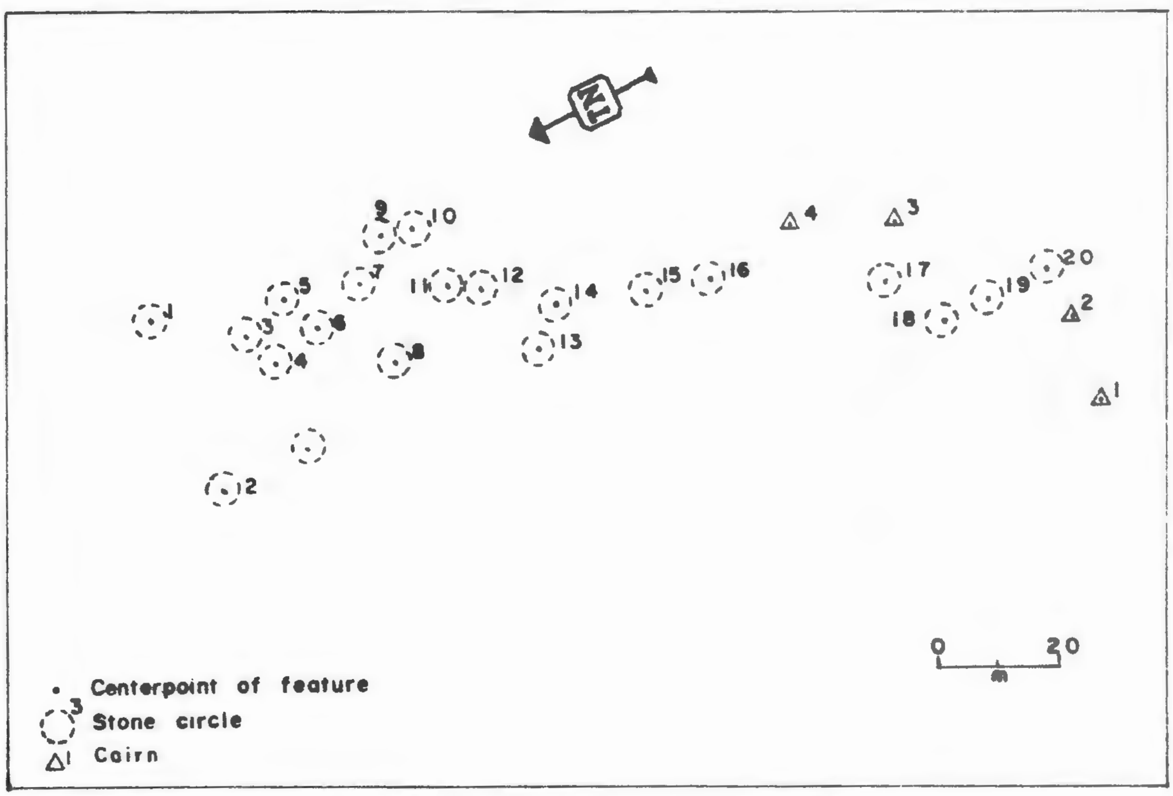


Figure 2: An Example of a Completed Airphoto and Plan Map.

4.0 DATA COLLECTION PROCEDURES - STONE CIRCLES

4.1 Introduction

Stone circles, because of their numerical predominance in sites within the Forty Mile Coulee area, have been a specific focus of investigation during the project. Research here, and in other areas of the Plains, indicates that individual rings within multiple stone circle sites may reflect a number of separate cultural and temporal events occurring intermittently in the same locale. Thus, in contrast to normal archaeological methodology, the focus taken here is first to examine the individual stone circle, and secondly examine its relationship to other stone circles and features comprising the site as a whole.

Following Quigg and Brumley (1984) the term stone circle as used in this report,

> ...refers to circular or roughly circular stone outlines of cultural origin. Partial circular stone outlines are also included. Stone circles include features variously described as tipi rings, medicine wheels, war lodges, and vision quest structures. Extensive archaeological and ethnographic information overwhelmingly indicates the vast majority of stone circles fall into the category of tipi rings, that is stone features constructed to hold down lodge covers. Kehoe [1960:463] suggests tipi rings be defined as ...an approximately regular stone circle, between about seven to about 30 feet in diameter...., averaging 16 feet, the boulders of the circle being of a size and weight suitable for securing a lodge cover. Finnigan [1982] suggests that, ...a stone circle can be identified as a tip ring if it meets each of these criteria:
> (1) the shape does not deviate significantly from a circle;
> (2) there are not interior stone features that would render the interior of the tip ring uninhabitable unless they are clearly a post-use modification;
> (3) the inside diameter falls between 2.5 m and 9 m;
> (4) the slope of the ground is less than or equal to [five degrees];
> (5) the ground surface is dry and stable.

Unless specifically noted otherwise, all stone circles recorded within the Forty Mile Coulee project have been considered as tipi rings.

4.2 Stone Circle Definition

Field observation indicates that stone circles vary greatly in their degree of definition; ranging from features with sharply defined interior and exterior wall margins and circularity, to essentially amorphous clusters of stone identifiable as a stone circle because of a lack of natural mechanisms to account for the stones, and for the vague circularity and clustering of the stones. This spectrum of variability can be divided into four general categories of definition:

Good: Stones comprising the features are easily distinguishable from other stones present. The margins of the features are easily discernible.

Moderate: Stones comprising the features are generally easily distinguishable from other stones present. The margins of the feature are somewhat more difficult to define in all or portions of the feature.

Poor: Stones comprising the feature are sometimes difficult to discern from natural stone present and/or are so deeply buried that one is not sure if what is seen is a relatively accurate reflection of the feature. Ring wall margins are often diffuse and difficult to delimit.

Amorphous: Although identifiable as a stone circle, the feature is essentially amorphously structured, making determination of ring wall margins extremely difficult to totally speculative.

Most of the following sets of stone circle observations can only realistically be carried out on from Good to Moderately defined stone circles; only partial sets of observations are possible on poorly defined to amorphous features. Specifically, it must be possible to define interior wall margins sufficiently to secure an accurate centre point for the ring in order to complete a full set of data observations.

4.3 Analytical Unit Definition

As noted in Section 4.2, the focus of the data collection approach presented here is on the individual stone circle. In order to standardize collection procedures, a system of 40 Analytical Units have been devised that relate to the interior of a stone circle and the area surrounding it. Analytical Units are based upon distance from the defined centre point of the feature and true north. Two subsystems make up the basic Analytical Units. The first divides the distance from the centre point of the feature outward into standard sections called distance units. The second consists of eight defined directional sectors oriented in relation to true north. A summary of the Analytical Unit system is presented in Table 2 and Figure 3.

Figure 4 illustrates a second series of analytical units used in recording cultural material from amorphous or some poorly defined stone circles where the centre point cannot be reasonably defined (see Section 4.4.2). The centre point of the stone circle used for orienting this system is simply a visual estimate. The second major difference between this and the other stone circle analytical unit system is that the distance units outward are not defined in part by the inner ring wall margin. Distance units are simply spread at 5 m intervals. Finally, the coding system for identifying individual analytical units employs a combination of letters and numbers so as not to confuse materials collected under the two systems.

A few general rules of useage, adopted for analytical units, need discussion. Analytical units for various stone circles often overlap. Cultural material found in overlapping analytical units is generally assigned to the analytical unit of the closest stone circle. Exceptions would occur only if other lines of evidence indicated the material was not associated with the nearest stone circle. One instance would be multi-occupational sites where, for example, the upper occupational unit is associated with a surface stone circle. This material would be assigned analytical unit designations relative to its location. No analytical unit designation of BOC (Buried Occupation) would be assigned to cultural material from the lower occupational units. Where one metre square excavation units, occasionally used at Forty Mile, encompass portions of more than one analytical unit, the material is assigned to the A.U. in which the largest portion of the excavation is situated.

4.4 Limited Stone Circle Mapping

At Forty Mile Coulee basic information on the size and structure of every stone circle found was required as part of the research design formulated. In response to this, a system known as Limited Stone Circle Mapping was devised which provides all the basic structural data on a stone

Table 2: Summary of Analytical Units For Stone Circle Investigation.

DIRECTIONAL SECTORS

DIRECTION	N	NE	E	SE	S	SW	W	NW
ANGULAR RANGE (^{0})	337.5 - 22.5	22.5 - 67.5	67.5 - 112.5	112.5 - 157.5	157.5 - 202.5	202.5 - 247.5	247.5 - 292.5	292.5 - 337.5
ANGULAR MID POINT (^{0})	0	45	90	135	180	225	270	315

DISTANCE UNITS

Distance Units are structured to subdivide the area within and outside a stone circle into a number of subareas defined directionally and spatially in relation to the defined centre points. Directional units within the system correspond to directional units defined above and are numbered sequentially from 1 (North) to 8 (Northwest). Distance Units are defined as follows:

.0 exact ring centre

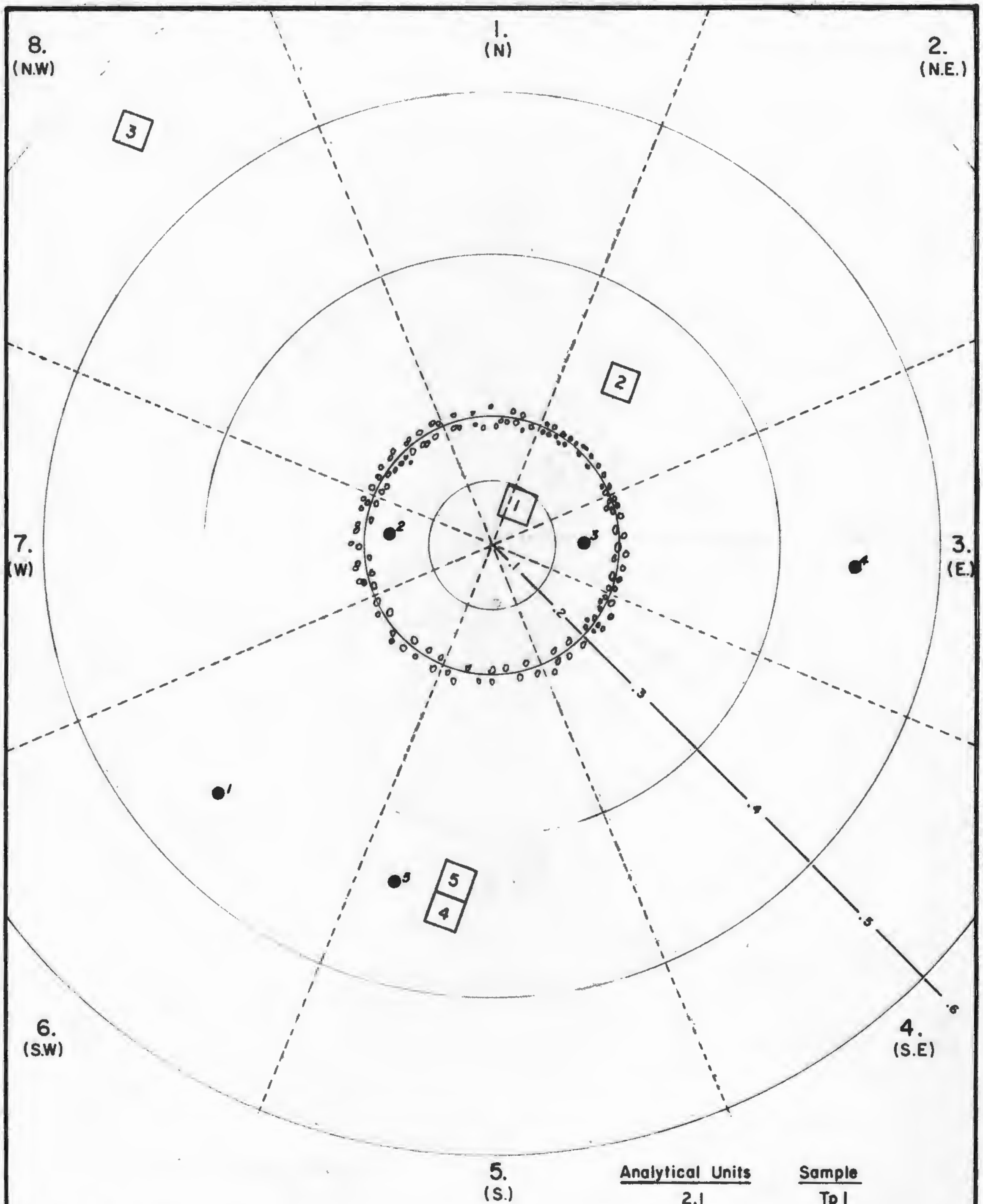
.1 from centre point to midpoint between centre point and central portion of ring wall

.2 from boundary of .1 unit outward to central portion of ring wall

.3 from central portion of ring wall outward for 5 m

.4 from greater than 5 m to 10 m outward from central portion of ring wall

.5 from greater than 10 m to 15 m outward from central portion of ring wall



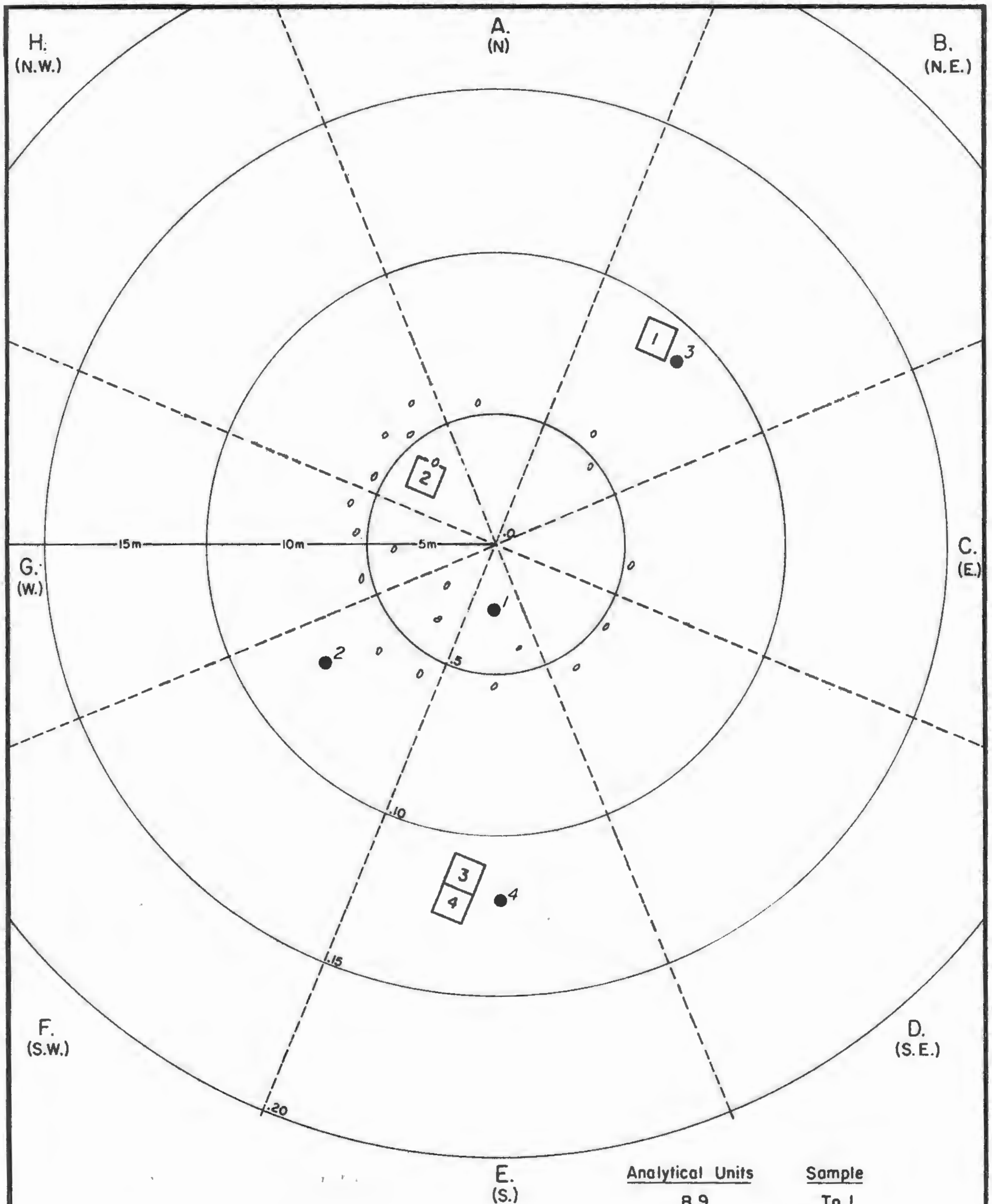
[2] Test Pit (Tp 2)

● 3 Test Hole (Th 3)

Analytical Units	Sample
2.1	Tp 1
2.3	Tp 2
3.2	Th 3
3.4	Th 4
5.4	Th 5; Tp 4,5
6.4	Th 1
7.2	Th 2
8.4	Tp 3

Figure 3: Schematic Diagram of Directional Segments and Stone Circle Analytical Units.

Drawn by J. Andreas.



3 Test Pit (Tp 3)

•2 Test hole (Tp2)

Analytical Units	Sample
B.9	Tp 1
H.4	Tp 2
E.11	Tp 3
E.12	Tp 4
E.3	Th 1
F.7	Th 2
B.9	Th 3
E.12	Th 4

Figure 4: Schematic Diagram of Analytical Units for Amorphous or Poorly Defined Stone Circles.

Drawn by L. Mueller.

circle and is time and cost effective.

4.4.1 Field Recording Materials

In Limited Stone Circle Mapping two items are of importance. They are the Limited Stone Circle Recording Form and the Mapping Board. An example of the basic recording form is presented here as Table 3 and a description of the types of entries required is provided in the following sections. The Mapping Board (Figures 5 and 6) is utilized to collect the majority of the data on the form. Developed from the "tipi quik" system discussed by Smith (1974), the Mapping Board,

> ...consists of two parts. The first is a plywood square approximately 75 cm across, to which has been glued a sheet of paper containing a circle marked in degrees from 0 to 360. The board sits on three short wooden legs attached by brass screws. The exact center of the board has a drilled hole which holds a freely pivoting wooden block used as a clamp to hold the zero end of a tape measure.
>
> The second part of the device is the drawing paper, which consists of an exact [but much smaller] copy of the circle glued to the plywood board. Two lines bisect the small circle at 90 degrees and mark its center. To allow rapid field mapping, four ruler-type scales were devised that allow circles from 2.5 to 10 m radius to be drawn on the small circle without the problem of converting scale from the standard millimeter ruler.
>
> The large board is placed near or inside the feature to be mapped. A compass is used to align the board. Once aligned, the board is held in place by three metal pins pushed through holes drilled in the perimeter of the board, and then into the ground. The pivoting wooden clamp with a tape measure already in it is then attached to the center of the board. The tape is run out t the first point to be mapped [a rock in a stone circle, a point on a cairn, the corner of an excavation unit, etc.] and the distance is read along with the degree mark covered by the tape. This information is then transferred to the drawing paper and the object is mapped in. (Dau 1981:41,43)

For limited stone mapping, the centre point and true north must be determined in the field, with the centre of the mapping board positioned precisely over the centre point, and the 0 degree mark aligned to true north.

4.4.2 Centre Point Definition

Determination of a centre point for stone circles is frequently

Table 3: Limited Stone Circle Observations Form.

LIMITED STONE CIRCLE OBSERVATIONS

SITE: ____________ SC*: ____________ DATE: ____________

RECORDED BY: ____________

DIAMETERS:	N-S	E-W	NE-SW	SE-NW
INSIDE:	______	______	______	______
OUTSIDE:	______	______	______	______

* considered approximate due to factors such as poorly defined, erosion, deeply buried, etc.

STONE COUNTS (rocks from ring wall only):

N ______ SE ______ W ______

NE ______ S ______ NW ______

E ______ SW ______

* counts considered questionable due to factors such as erosion or deposition.

STONE DEPTHS IN cm BS (1 from each sector):

Average sized stone: ______ cm diameter

N ______ SE ______ W ______

NE ______ S ______ NW ______

E ______ SW ______

COMMENTS:

Feature Definition: Good ______ Moderate ______ Poor ______

Feature Burial: Extensive: ______ Moderate ______ Shallow ______

Stone Clustering in Ring Wall: (Y or N) ______ Sector ______

Topographic Setting: Surface on which circle situated:

Level to gently sloping ____; Moderately sloping ____:

steeply sloping ____.

Directional Sectors within AUs where terrain would affect use of

Surface: ______ Type of terrain: ______

OTHER COMMENTS: ______

Table 3: Continued.

ASSOCIATED FEATURES:

FEATURE: ____________ SECTOR(s): ____________
FEATURE: ____________ SECTOR(s): ____________
FEATURE: ____________ SECTOR(s): ____________
FEATURE: ____________ SECTOR(s): ____________
FEATURE: ____________ SECTOR(s): ____________
FEATURE: ____________ SECTOR(s): ____________

ASSOCIATED SURFACE MATERIALS:

Type	Distance	Angle	AU	Comments

AUGER HOLE DATA: PATTERN #: ____________

AU	# Drilled	*O/C	Depth	Material Recovered

* O: Overlapping
C: Clear

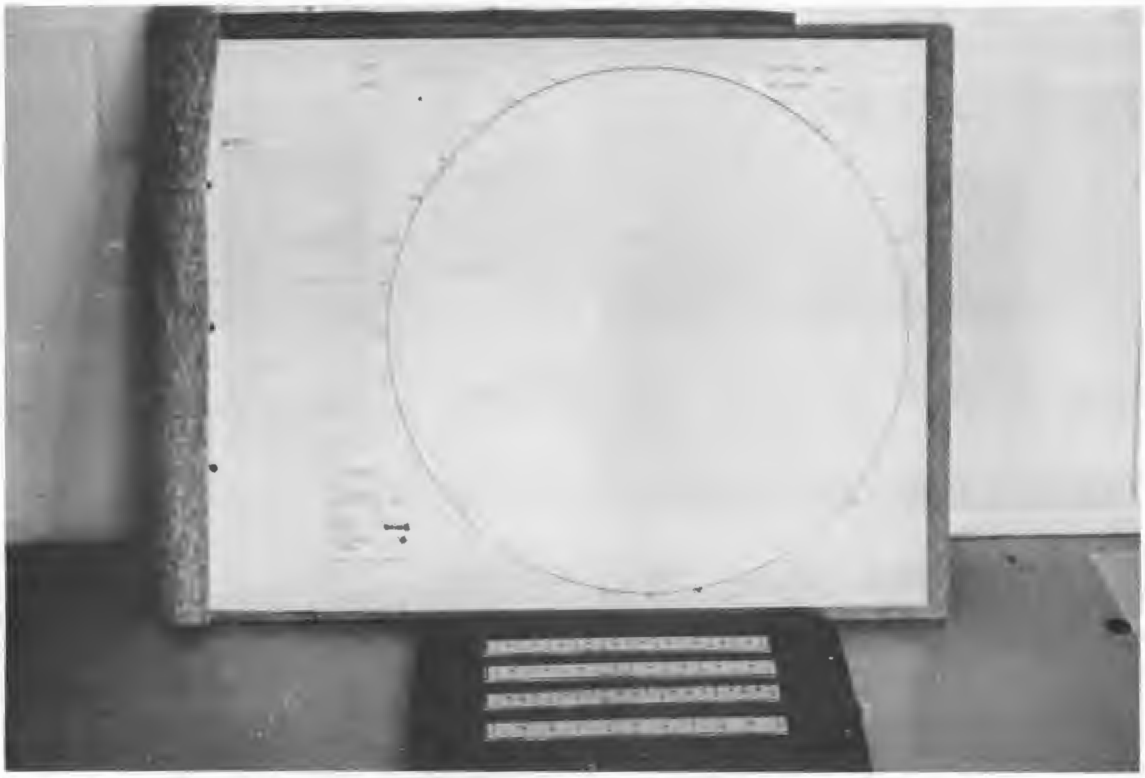


Figure 5: Mapping Board Data Entry Form and Scales.

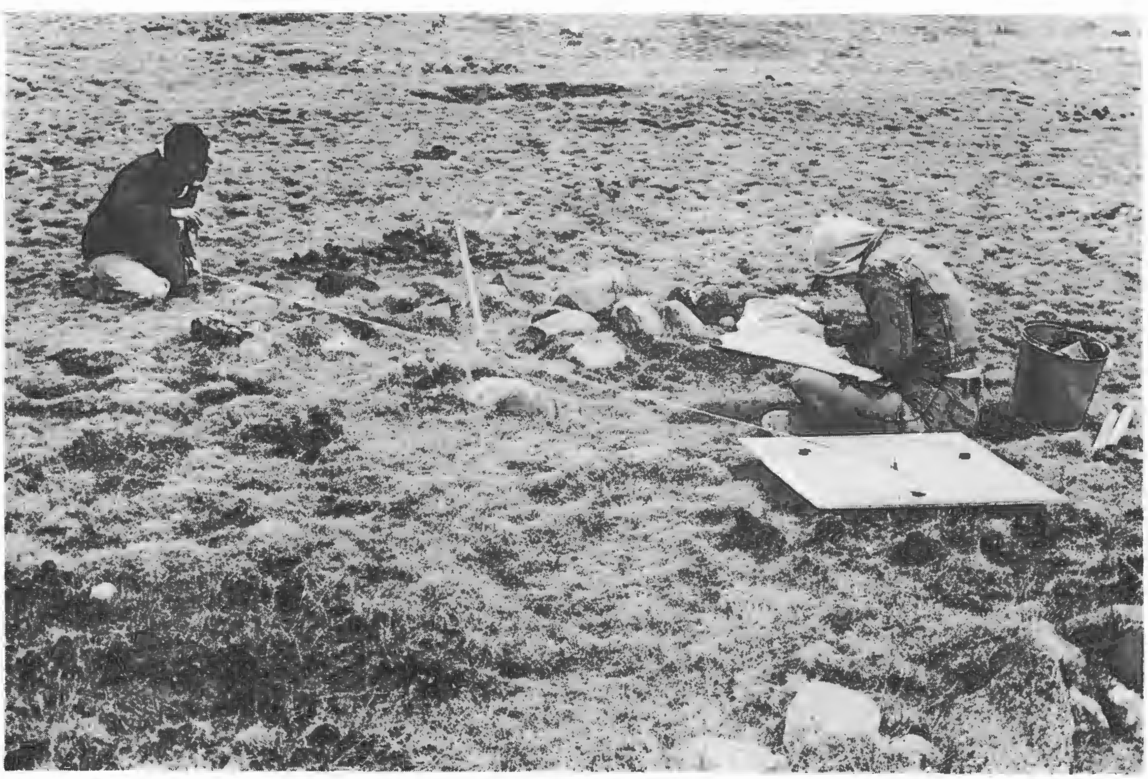


Figure 6: Mapping Board in Operation.

difficult due to the often only generally circular nature of the feature and the imprecise boundary of ring wall margins. However, relatively precise definition of the centre point is essential as it serves as the reference point for all subsequent measurements and observations.

The approach taken here in determining the centre point in the field is as follows:

1. A chain is held at any point on the interior ring wall margin and stretched across the ring to essentially the opposite side, where it is swung back and forth until the greatest inside diameter is found. With the chain held in that position, a pin or stake is placed at the midpoint of the defined axis.
2. This process is repeated at two other locations along the inner ring wall roughly equidistant from one another.
3. The three stakes or pins thus placed in the central portion of the ring define a triangle, the centre point of which is visually defined, marked and used as the centre point (Figure 7).

4.4.3 Orientation of Mapping Board

In limited stone circle recording the centre of the board is positioned over the centre point of the stone circle. A compass is positioned on the board and it is rotated until the 0 degrees point is aligned to true north. Magnetic declination is determined to the nearest 1 degree from 1:50,000 National Topographic Series maps of the area and corrected with the compass. Using one or two tape measures or strings stretched across the surface of the mapping board, each directional segment of the ring is determined and the number of stones present in each counted and recorded (Table 2, Figure 3).

4.4.4 Diameters

The first step in Limited Stone Circle Mapping is the determination of inside and outside diameters. Four measurements are taken along the major cardinal directions (N-S, E-W, NE-SW, SE-NW). All measurements are recorded in centimeters (Table 3).

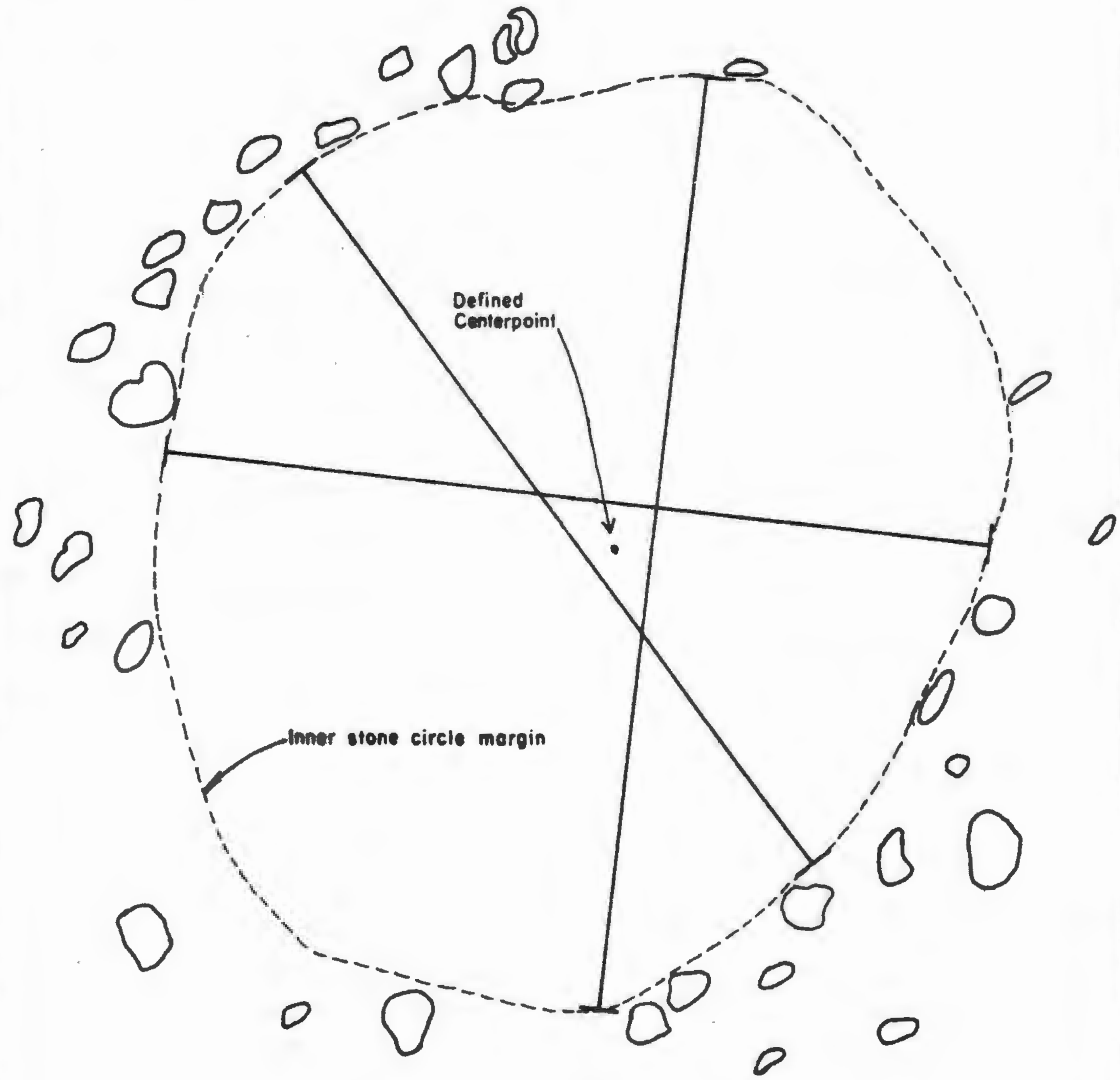


Figure 7: Stone Circle Centre Point Definition.

Drawn by L. Mueller.

4.4.5 Stone Counts, Depths and Clustering

Where a stone is situated on the boundary between two sectors, it is counted in the sector where the largest portion of the stone is located. In Limited Stone Circle Mapping one stone from each of the eight sectors is removed from the feature and its maximum basal depth is measured. The stones selected are those situated closest to the exact centre of each directional sector. Upon completion of stone counts and calculation of depths, data are presented on the observed definition of the feature (good, moderate, poor) and on the depth the feature is buried beneath the surface (extensive, moderate, shallow).

Finally, information on the observed presence of stone clustering and the sector of its location is presented. Calder (1977) and Quigg (1982a) have both reported on stone circles where all or portions of the ring wall consist of spaced clusters of stone. Quigg (1982a) notes at the Ross Glen site that the clusters are equidistantly spaced and suggests in such instances, that all or a portion of the lodge cover was being raised off the ground and stones (reflected by the clusters) placed around individual lodge poles. Such clustering may reflect season of occupation.

4.4.6 Topographic Setting and Limitations

Although no standardized categories were defined, general observations were made on the type and sector location of topographic features which might influence and restrict use of the analytical units area of a stone circle by its inhabitants. Such features would included steep slopes, cutbank edges, lake shores, etc.

4.4.7 Other Observations

On the Limited Stone Circle recording form space is left for relevant comments regarding the feature being mapped. Because of the varied nature of individual stone circles it is expected that aspects of the structure of certain features may not be accommodated in the basic data entries on the form. The "other comments" section is utilized to record all necessary information.

4.4.8 Associated Features and Surface Material

A standard part of the Limited Stone Circle recording procedure involves a careful examination of the surface within and up to 15 metres outside the margins of a stone circle. Any features (hearths, boiling pits, FCR clusters, etc.) and any pieces of cultural material are recorded in terms of their Analytical Unit location. Relevant items are then collected. Locational data on any other surface stone features within the Analytical Units of the feature being mapped are also recorded.

4.5 Auger Testing and Auger Hole Data

An integral part of Limited Stone Circle Mapping involves the drilling of auger tests within and adjacent to a stone circle. Normally ten auger tests are placed within the defined Analytical Units of a given feature. Each auger hole measures 0.03 m^2 in size and is drilled as far below the suspected occupation level of the stone circle as possible. Unless there is evidence to the contrary, all recovered cultural material is considered associated with the stone circle being assessed.

The location of individual auger holes has been standardized into four separate patterns (Table 4, Figure 8) related to specific Analytic Units. As a field crew records various features within one or more sites, they would progressively use one of the four pattens (i.e. 1 to 4 and then repeat) from feature to feature. Each pattern is designed to test an equally broad directional and distance spectrum from the centre point of the ring. Collectively, the four patterns sample the forty Analytical Units defined for stone circles.

The Limited Stone Circle recording form is utilized to record all relevant auger hole data. All entries on the form (Table 3) are more or less self-explanatory with the exception of the column headed "O/C". This refers to whether or not the auger hole is Overlapping or Clear. Any auger hole situated in an exterior Analytical Unit which intersects with an Analytical Unit of another stone circle is recorded as overlapping. All auger holes inside a stone circle or in exterior Analytical Units that do not intersect

Table 4: Standardized Auger Hole Drilling Patterns.

ANALYTICAL UNIT	DRILLING PATTERN #	ANALYTICAL UNIT	DRILLING PATTERN #
1.1	1	5.1	3
1.2	3	5.2	1
1.3	1	5.3	3
1.4	3	5.4	1
1.5	1	5.5	3
2.1	2	6.1	4
2.2	4	6.2	2
2.3	2	6.3	4
2.4	4	6.4	2
2.5	2	6.5	4
3.1	3	7.1	1
3.2	1	7.2	3
3.3	3	7.3	1
3.4	1	7.4	3
3.5	3	7.5	1
4.1	4	8.1	2
4.2	2	8.2	4
4.3	4	8.3	2
4.4	2	8.4	4
4.5	4	8.5	2

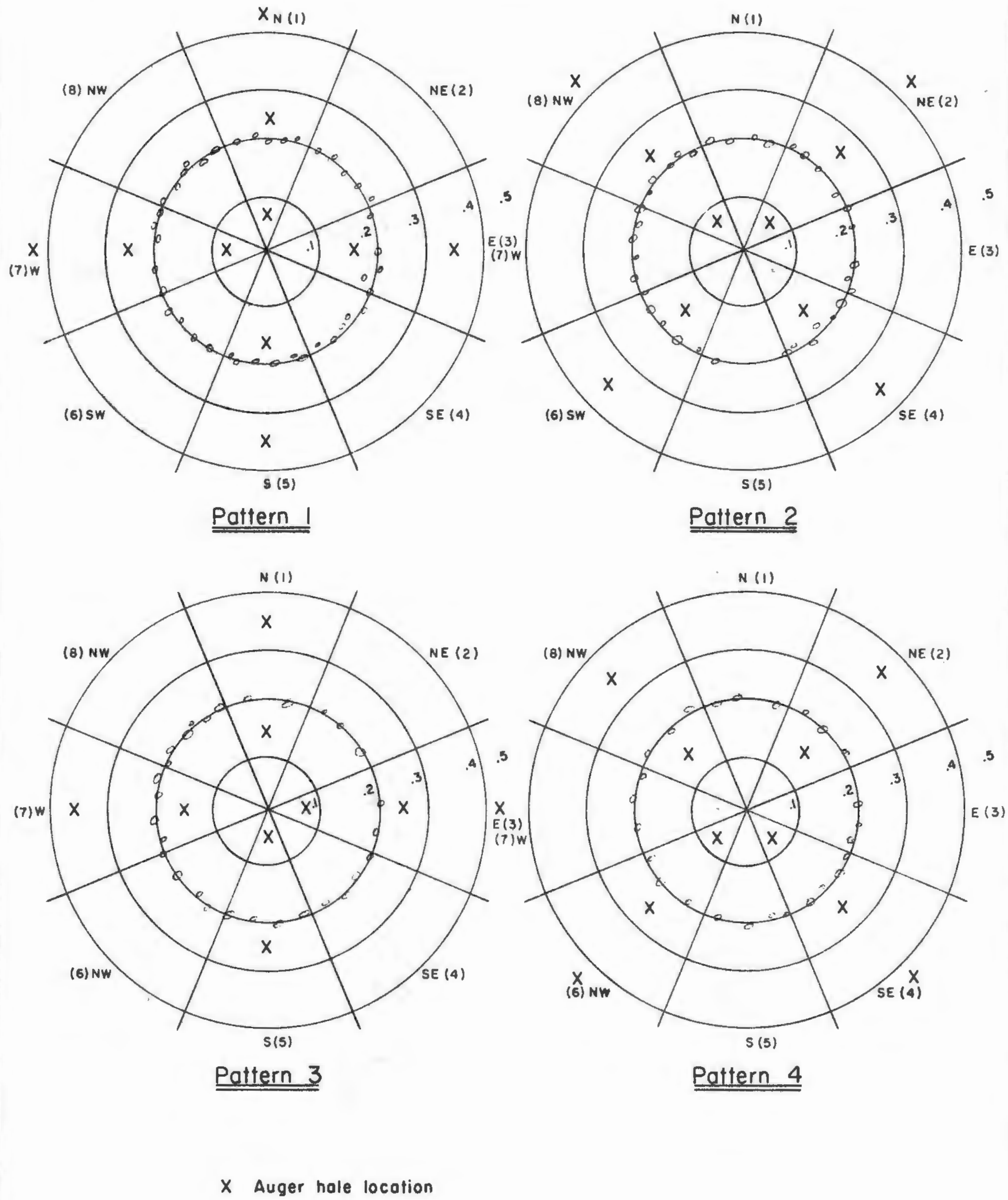


Figure 8: Schematic Diagram of Stone Circle Auger Hole Test Patterns.

Drawn by L. Mueller.

with an Analytical Unit of another stone circle are recorded as clear. For any stone circle a portion of the ten auger holes may be deleted or not drilled if:

a) the auger hole is situated in an overlapping analytical unit closer to another stone circle than the one it is intended to test; or
b) the auger hole was situated in a physiographic situation impossible or very unlikely to have been utilized by the makers of the stone circle (i.e. in a lake, up or down the face of a cutbank).

4.6 Full Feature Mapping

During the course of the Forty Mile Coulee project, full feature mapping was undertaken only at those stone circles intended for excavation. This procedure results in not only a detailed drawing of a stone circle, but an accurate locational map of the test trenches or pits laid out inside the feature. At Forty Mile Coulee, two full feature mapping techniques were utilized, the Mapping Board and the Photoboom.

A description of how the Mapping Board functions has already been presented in Section 4.4.1. It will not be reiterated here. The Mapping Board has proven itself to be an efficient, multi-purpose device which produces acceptably accurate feature drawings (see Figure 9).

New to full feature mapping procedures is a device known as the Photoboom. The Photoboom is;

> ...a mechanical device [Figure 10] used to raise a camera directly above the feature to be mapped. The resulting photograph then constitutes the feature map. The photoboom consists of three lengths of 15 cm diametre tubing, transported on its own trailer. Once on-site, these tubes are joined end to end resulting in a boom approximately 15 metres long. One end of this boom is permanently attached to the trailer and acts as the fulcrum or pivot. The camera is attached to the opposite end of the boom. The boom can then be raised and lowered by means of an electric winch attached to the trailer.
>
> The procedure of photobooming a feature is quite simple. First the photoboom is oriented such that a permanent mark on the photoboom is lined up over the centre point of the feature. The camera is then positioned such that it points down to the ground and back along the boom towards the trailer at a 55° angle from the horizontal. The boom is then raised to a 55° angle from the horizontal. This procedure, without going into the geometry, results in the camera becoming vertically oriented directly over the centre point of the feature at a

Figure 9: An Example of Actual Stone Circle Drawing Produced From Mapping Board Data.

Figure 10: Photoboom in Operation.

Figure 11: Stone Circle Mapped by Photoboom.

maximum altitude of 12 metres. The camera is triggered by means of compressed air. (Stuart and Brumley 1987).

Experience has shown that white-washing of the visible stones in the feature being photographed improves resolution in the photoplate and results in a high quality drawing (see Figures 11 and 12). The Photoboom can provide a more accurate representation of a feature than the majority of commonly utilized mapping techniques.

4.7 Stone Circle Excavation

Between 1981 and 1986, a total of more than 860 square metres were excavated within and adjacent to 100 surface and subsurface features at Forty Mile Coulee. For stone circles, two types of excavation procedures were utilized, test pits and test trenches. At Forty Mile Coulee, the basic test pit unit was 1 m x 1 m square, oriented towards true or magnetic north and usually located inside a stone circle (i.e. Figure 9). All pits were excavated in 5 cm or 10 cm levels measured below surface.

The test trench system was based upon the defined Analytical Units of a stone circle and the auger hole pattern employed during initial assessment of the feature. Each trench was 30 cm in width, and its length was equal to the length of the Analytical Unit, as a result, all exterior trenches were 500 cm in length. Interior trenches, however, varied in length depending upon the size of the stone circle. Figures 13 and 14 show how a test trench pattern was laid out. All interior trench analytical unit segments were excavated, but in the majority of cases, only five of the six exterior analytical unit segment trenches were excavated. This procedure was used to ensure that an average of ten square metres of excavation was not greatly exceeded. The deletion of an exterior segment trench from excavation was based upon in-field observation and the results of auger testing. All trenches were excavated in 5 cm or 10 cm levels, with removed soil passed through a 6.32 mm mesh screen. Recovered cultural materials were bagged according to site, feature, trench and depth (Figure 15).

Although excavation by hand was the most common method of recovering data, subsurface testing was also undertaken with the aid of SPEED (Self Propelled Earth Excavating Device, Figure 16). SPEED is an hydraulically powered mechanical device, mounted in a trailer, which can be

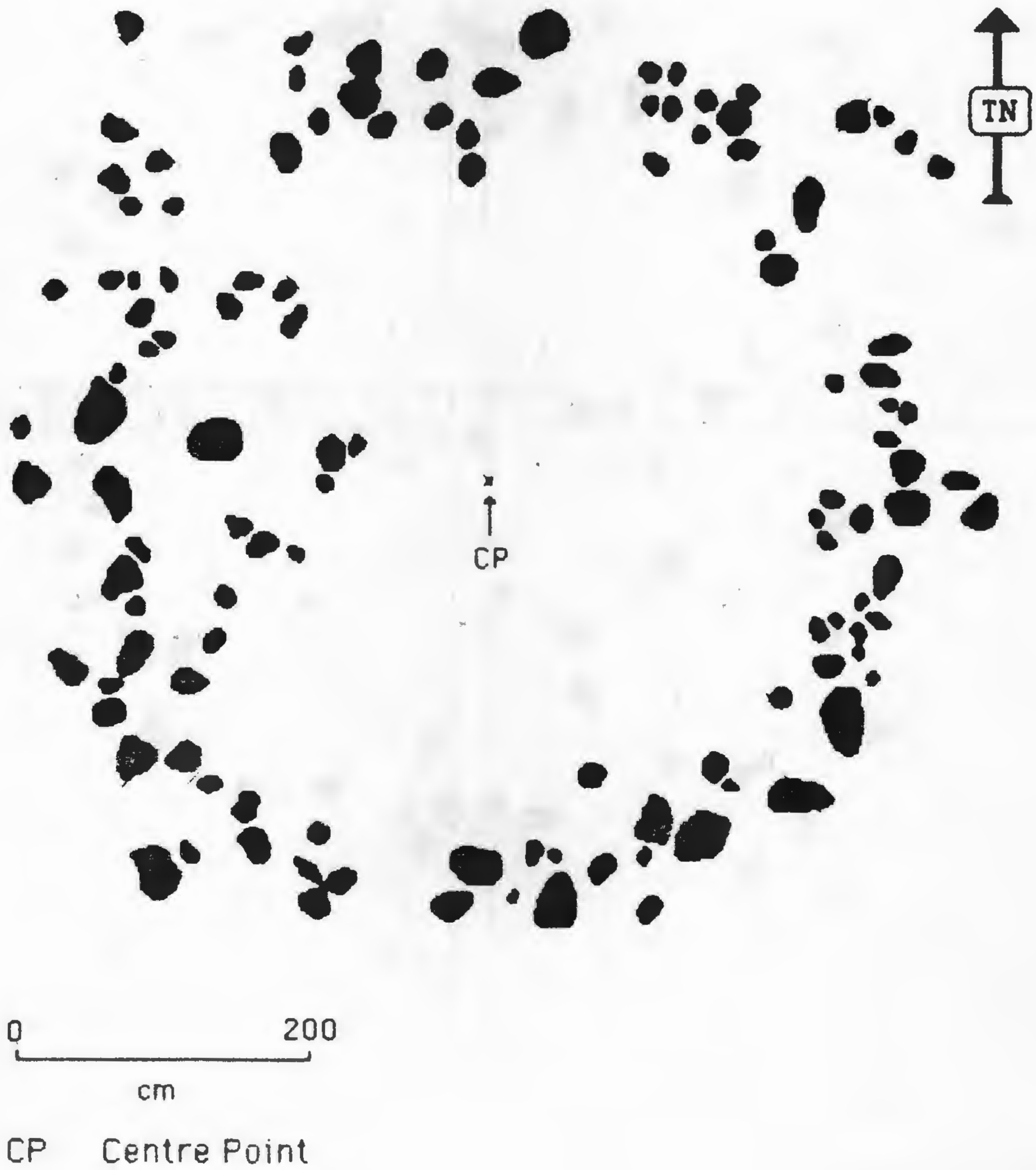
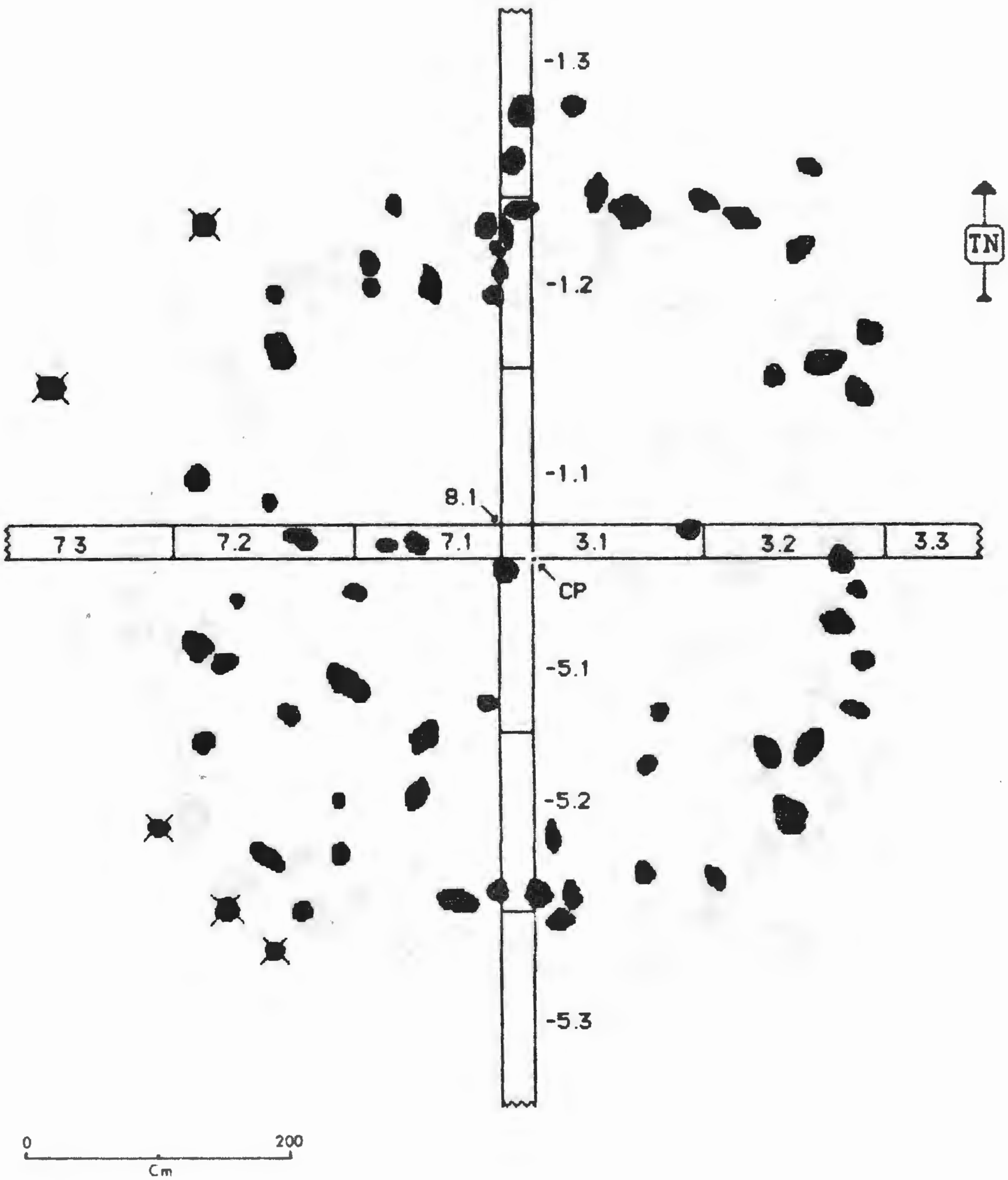


Figure 12: An Example of a Stone Circle Drawing Produced From Photoboom Data and Digitizer.



CP Centre Point

Stone not included in Stone Circle Analysis

1.1 Excavated Test Trench 1.1

Figure 13: An Example of Interior Test Trench Pattern at a Stone Circle.

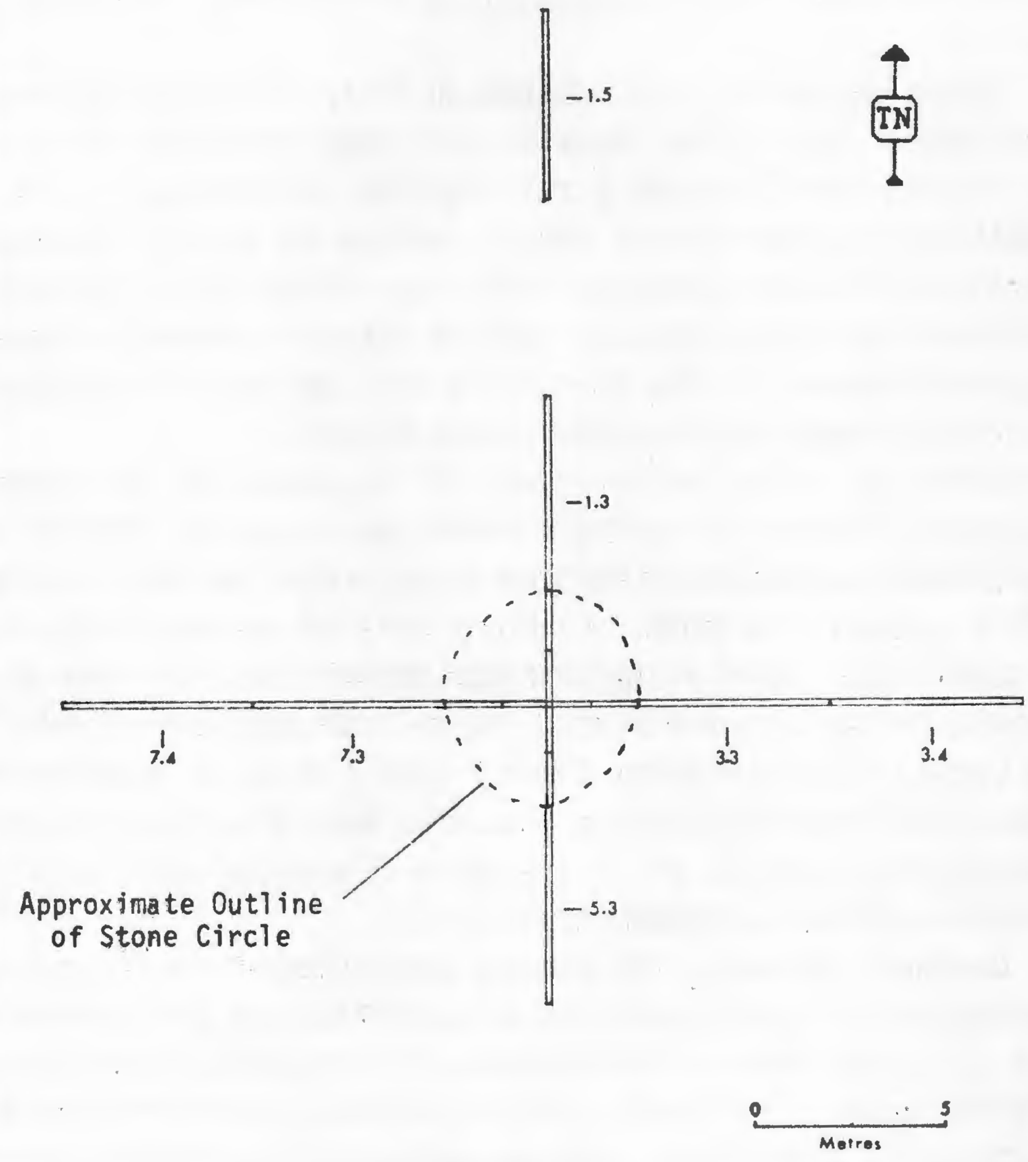


Figure 14: An Example of an Exterior Test Trench Pattern at a Stone Circle.

positioned and leveled over a test pit or trench. Precision controls then operate a rotating bit which can be lowered and moved within the confines of the pit or trench, loosening soil for later removal and screening. Accuracy to within 0.5 cm (both horizontally and vertically) can be achieved (Figure 16).

During the course of excavations at Forty Mile Coulee it became clearly evident that cultural materials were being recovered from depths and locations which suggested they might not be associated with the occupation of the feature being tested. As the prime focus of the project was on the occupation associated with the visible surface features, a method was required to designate cultural materials assumed associated with given features. Sorting the material into defined Cultural Material Units (CMUs) proved to be the solution to the problem.

CMUs are defined on the basis of horizontal and stratigraphic relationships between the cultural material and recognized stone circles. As an example, excavation at two stone circles within the same site might result in recovery of a sample of cultural material apparently associated with both circles. Based on the horizontal and vertical provenience of the materials, the sample would be split into two cultural material units; i.e. Stone Circle 1 - CMU 1, and Stone Circle 2 - CMU 1. Material recovered from depths greater than the suspected occupation level of a feature would be sorted into CMU-2, CMU-3, etc. In the course of analysis, materials within each defined CMU were analyzed separately.

Questions concerning the possible association of the features and associated cultural materials within defined CMU's were dealt with in the course of site discussion and interpretation. For the purpose of analysis and interpretation, surface cultural material is normally considered associated with the nearest stone circle. Likewise, cultural material from auger holes is considered associated with the nearest stone circle (CMU-1). Analytical unit designation for items within a CMU is only possible if that CMU is considered associated with a given feature.

4.8 Controlled Surface Stripping

The emphasis placed on the recovery of data concerning the types and location of aboriginal activities inside and outside of stone circles at Forty

Figure 15: Test Trench Excavation in Progress.

Figure 16: SPEED in Operation.

Mile Coulee required that a cost effective procedure be employed which could sample large subsurface areas. Extreme precision would not be necessary in the procedure, yet it would require sufficient horizontal and vertical control to retain and record the majority of buried artifacts and all buried features. The method devised for Forty Mile Coulee has been termed Controlled Surface Stripping.

In Controlled Surface Stripping, a large grid is established over a site or a portion of a site which contains one or more stone circles. The grid is designed so that any artifact or feature discovered can be easily and accurately plotted. An example of the type of grid system utilized at Forty Mile coulee is presented in Figure 17. Once the grid is established, all surface cultural features are plotted and marked in a manner which will preclude them from being recorded during subsurface examination. If any non-cultural surface material (i.e. stones) are present in the grid, they too are plotted and marked.

Actual soil removal within the defined grid is accomplished with a standard road grader (Figures 18 and 19). This machine, with an experienced operator, can remove the soil in strips no thicker than 2-3 cm. In a single pass the entire grid is stripped to a depth of 2-3 cm and a detailed examination of the exposed area is completed. All observed cultural material is plotted on the grid and collected. The grader then completes another pass and the examination process is repeated. Subsequent passes are completed until a depth is reached which encompasses the suspected occupation level of the observed surface features. If subsurface features (i.e. hearths, boiling pits, FCR or bone concentrations, stone circles, etc.) are encountered during stripping and are of sufficient quality to require detailed excavation, they are plotted and avoided by the grader.

5.0 DATA COLLECTION PROCEDURES - OTHER FEATURES

5.1 Introduction

Although stone circles dominate the sample recorded at Forty Mile Coulee, other feature types do exist. Cairns, buried camps and surface lithic scatters are present in limited quantities throughout the project area. The basic data collection procedures utilized for stone circles have been

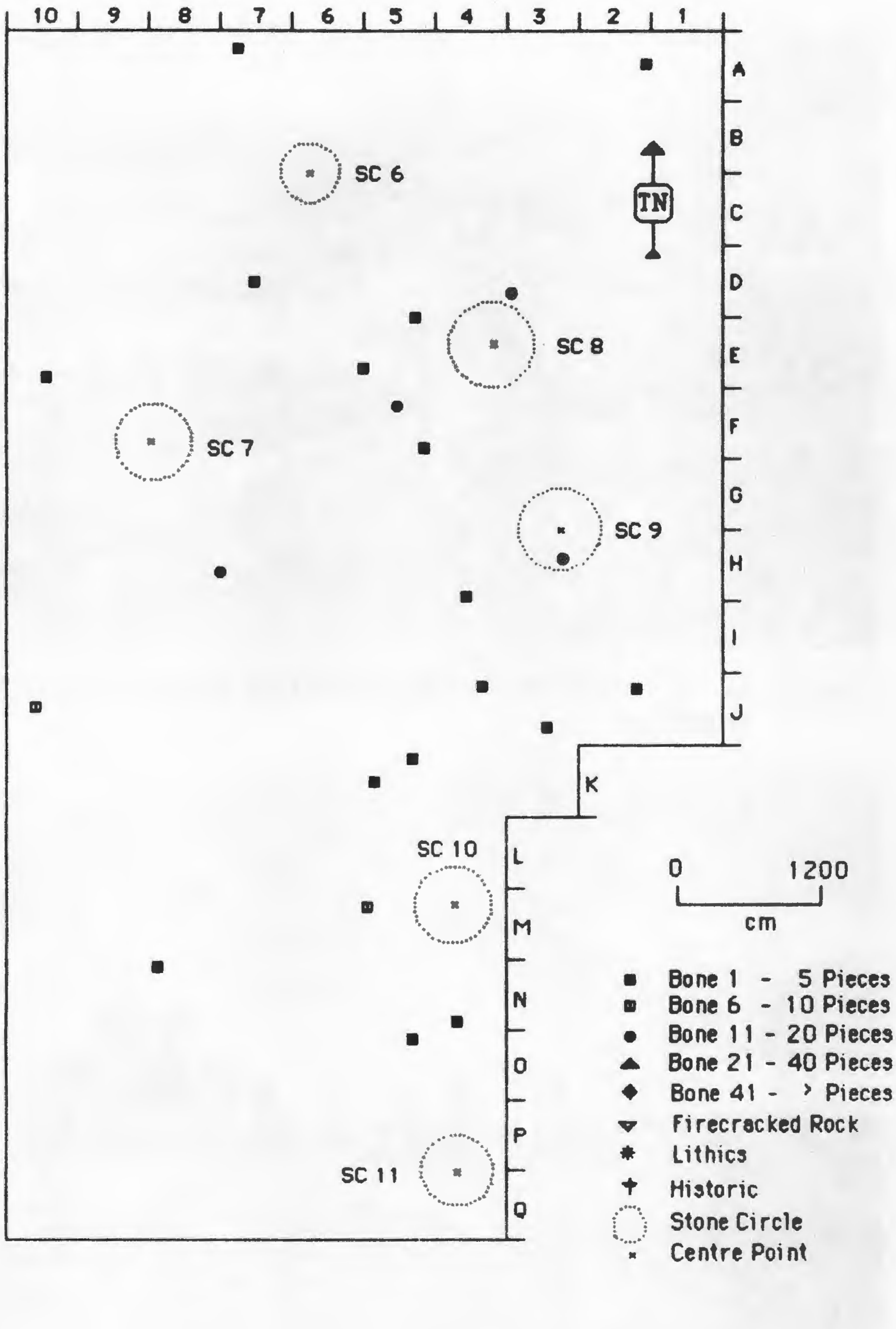


Figure 17: An Example of a Controlled Surface Stripping Grid.

Figure 18: Controlled Surface Stripping in Progress on the Floor of Forty Mile Coulee.

Figure 19: Controlled Surface Stripping in Progress on the Edge of Forty Mile Coulee.

adapted to deal with these features.

5.2 Analytical Units

Although rarely employed, the same set of Analytical Units used in recording poorly defined or amorphous stone circles can be utilized in recording the spatial and directional location of cultural material and test units at localities such as buried campsites, lithic scatters, etc. The centre point of the Analytical Unit is positioned varyingly by the investigator in relation to the nature of the materials present and the intention of the work undertaken. For instance, in a buried camp an investigator may position the centre point of the Analytical Unit in the central part of the locale to be tested by augering or excavation. Within a surface camp, the centre of the Analytical Units would normally be placed in the central portion of the identified site area. The central axis of the Analytical Unit is oriented in relation to true north.

For cairns, a third set of Analytical Units developed in response to the nature of the structure, has been devised and is summarized in Figure 20. Cairn Analytical Units are normally only used in collecting cultural material when the cairn is not associated with a stone circle. Centre point for orientation of Analytical Units is defined by the midpoint of the cairn's long axis.

5.3 Cairn Observations

Cairns are the second most common cultural feature encountered within the Forty Mile Coulee area. In spite of their high frequency of occurrence within southern Alberta and throughout the Plains, little archaeological data is available concerning their nature, age, cultural association and function. Ethnographic data for the region suggest cairns, at least in part, reflect religious shrines, deadfall animal traps, hunting blinds, burial covers and the remains of ancillary structural features in campsites. Because of the general dearth of data and knowledge relating to these features, it was considered unrealistic to develop a thorough research design and field strategy to deal with these structures. Instead, a standardized recording sheet (Table 5) was developed for cairns intended to

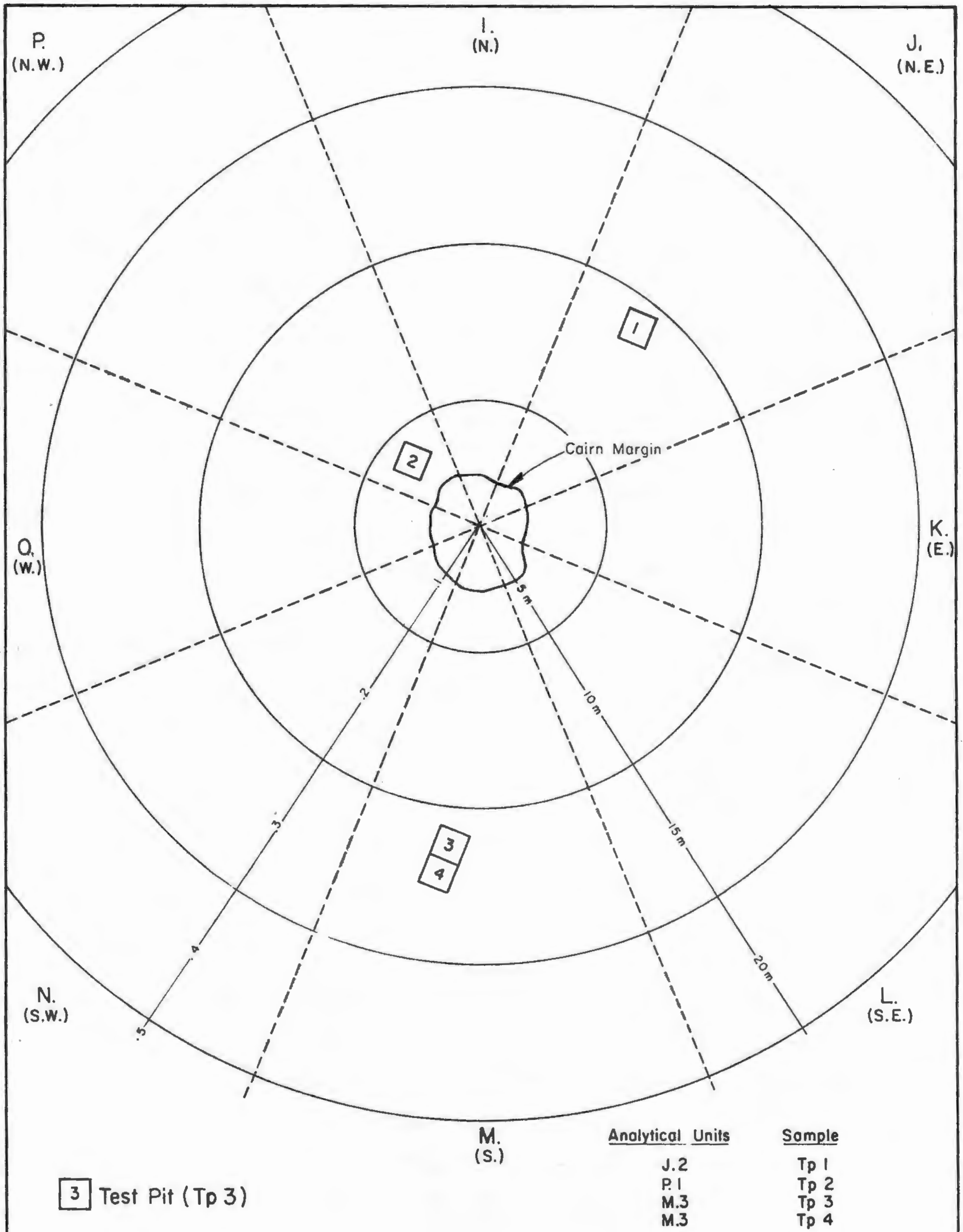


Figure 20: Schematic Diagram of Analytical Units for Cairns.

Drawn by L. Mueller.

Table 5: Limited Cairn Observations Form.

LIMITED CAIRN OBSERVATIONS

Site: ____________________ Cairn: ____________________

Recorders: ____________________ Date: ____________________

Shape: ____________________ # of Stones: ____________________

Long Axis ( ): ____________________ Short Axis ( ): ____________________

Depth of Burial: ____________________ Average Rock Size: ____________________

Height of Cairn: ____________________ # of Tiers: ____________________

Associated Material: ____________________

____

____

____

Associated Features: ____________________

____

____

____

Comments and Observations: ____________________

____

____

____

____

____

gather sufficient empirical data, hopefully adequate to provide the base line information needed to formulate such designs and strategies.

Cairn shape is presented in reference to the plan view outline of the feature and described in reference to basic two dimensional shape categories defined by Brumley (1981c).

The directional orientation of cairn long and short axes is described in relation to true north. Number of stones comprising the cairn refers to stones visible on the surface. For large complex cairn structures, a greater than value for number of stones may be given (e.g. 100+).

Depth of burial is determined by excavating three or more stones from along the margins of the cairn and measuring their basal depth below surface. Each depth value is recorded separately.

Average rock size is an impressionistically derived value of the mean diameter of stones comprising the feature.

Cairn height refers to the height of the highest point of the cairn in relation to the surface of the ground surrounding the cairn. Depending on the irregularity of the surrounding ground surface, cairn height may be taken from two or more points around the periphery with each value recorded separately for subsequent averaging.

Number of tiers refers to the degree of stone stacking. A four tiered cairn would be one where at least the highest point reflects stones stacked four high.

Space is left on the form to include: locational data on any surface cultural material noted within the Analytical Units defined for the feature and in any nearby (and possibly associated) features. Because of the wide variation in cairn structure a "comments or observations" section is included on the form which provides the recorder with the opportunity to include any other relevant information on the feature.

5.4 Excavation Procedures

For all non-stone circle features excavated at Forty Mile Coulee, standard 1 m x 1 m test pits were utilized. Test trenching was not attempted, as the procedure was difficult to implement in the absence of accurately defined feature centre points. In the case of cairns, test pits were set up to: 1) completely cover the cairn or 2) cover enough of the cairn to provide a cross-section of the feature.

Test pit location at buried camps was based upon cultural material concentrations noted in natural exposures or backhoe tests. Attempts were made to ensure that the limited amount of excavation area available (10-20 square metres per site) was used to collect a representative sample of cultural material. All test pits at all non-stone circle features were excavated in 5 or 10 cm levels, measured below surface. Removed soil was passed through a 6.32 mm mesh screen, with all cultural material bagged according to site, feature, test pit and depth.

6.0 DERIVED STONE CIRCLE INDICES

6.1 Introduction

The focus on stone circle studies during the Forty Mile Coulee project has resulted in the recovery of a large amount of data on stone circles. In order to organize and analyze this data, a set of standardized stone circle indices have been devised along with other observations (Table 6). The indices are structured so that they can be applied to sites other than those from Forty Mile Coulee, thus allowing for regional comparisons. This section and the following one (Section 7.0) outline the basic data sets employed in generating the derived stone circle indices.

6.2 Calculation of Diameters

Mean diameters were determined simply by summing the separate directional diameter values and dividing by the number of observations for each set of inside and outside diameters. Mean diameters were only calculated when it was possible to record at least three of the four directional diameters for each data set.

6.3 Maximum Diameters

Greatest inside and outside diameters are selected from the appropriate columns on the indices form. A standard code is utilized to record the data. The codes used are:

Table 6: Stone Circle Indices Data Entry Form.

	DIAMETERS (m) INSIDE	OUTSIDE
N-S [2]		
E-W [3]		
NE-SW [4]		
SE-SW [5]		
MEAN		
CIRC.		

SITE: ____________
SC#: ____________
Number of SC in site: ____________
Physiographic Setting: ____________
Topographic Relief: ____________
Surficial Deposits: ____________
Primary Water Resources: ____________
Secondary Wood Resources: ____________
Associated Cultural Features: ____________

Greatest Inside Diameter: ____________
Greatest Outside Diameter: ____________

	COUNT	RANK	WEIGHT
N			
NE			
E			
SE			
S			
SW			
W			
NW			
TOT.			

Topographic Limitation: ____________
Cultural Association: ____________
Basis for Cultural Association: ____________
Cultural Material Density-Inside: ____________
Cultural Material Density-Outside: ____________
Tested Area (sq.m)-Inside: ____________
Tested Area (sq.m)-Outside: ____________
Feature Definition: ____________
Stone Clustering: ____________
Nearest Neighbor Distance: ____________

Mean number of stones per sector: ____________
Mean number of stones per metre of circumference: ________
Mean depth (cm): ________ n= ________

CODE	MEANING
0	Indeterminate
1	Two or more diameters of equal length
2	North-South
3	East-West
4	Northeast-Southwest
5	Southeast-Northwest

6.4 Stone Counts, Sector Ranking and Stone Weights

The columns in the lower left of the indices form record basic data on the stones comprising the stone circle, organized by Analytical Unit. Individual sector stone counts are taken from the Limited Stone Circle Observations form.

Each sector is then ranked from 1 to 8 in relation to the least (rank of 1) to the greatest (rank of 8) number of stones present. If two or more sectors have equal numbers of stones present, relative ranking of each is established by adding in stone counts from the two adjacent sectors, finding the totals and comparing these for ranking. For example:

SECTOR	STONE COUNT	RANKING
N	6	8
NE	5	7
E	4	4
SE	5	6
S	3	1
SW	4	2
W	4	5
NW	4	3

If this procedure fails to relatively rank sectors of equal value, stone counts for additional sets of adjacent sectors are added on to the sectors, until differing values are obtained and the sectors can be relatively ranked. Rarely, stone counts will be encountered where this system does not work. In such instances, ranking is indeterminate.

If, during full feature mapping, weights were calculated for all the stones in the feature, these weights are entered by sector. Total number of stones and total weight are then calculated.

6.5 Mean Number of Stones Per Sector

Mean number of stones per sector is calculated by summing the total number of stones for all sectors and dividing by eight.

6.6 Mean Number of Stones Per Metre of Circumference

The circumference for stone circles is calculated using the mean inside diameter value. Utilizing the circumference value obtained, the mean number of stones per metre of circumference is calculated as: total number of stones in ring (all sectors) divided by circumference value.

6.7 Mean Stone Depth

Mean stone depth was determined by averaging the total of stone depth observations taken for the feature. The size of the sample of stone depth observations is also recorded.

6.8 Topographic Limitations

The topographic limitations entry simply refers to any variations in the local terrain which might have affected aboriginal use of the land surface within the site. If recorded, this information can be transferred from the Limited Stone Circle Observations form. Entry codes are as follows:

PR	limitations present
AB	limitations absent
IND	limitations indeterminate or not recorded

6.9 Cultural Association and Basis for Cultural Association

For sites where cultural or temporal diagnostics have been obtained, entries are provided to present relevant data. Entry codes are as follows:

CULTURAL ASSOCIATION CODE

CODE	MEANING
0	Indeterminate
1	Historic
2	Post-Avonlea
3	Avonlea
4	Besant
5	Pelican Lake
6	Oxbow
7	Mummy Cave/Bitterroot
8	Other

BASIS FOR CULTURAL ASSOCIATION CODE

CODE	MEANING
0	Not applicable
1	Radiocarbon date
2	Projectile point typology
3	Ceramics
4	Obsidian hydration date
5	Apparently associated and culturally defined features or materials
6	Other

6.10 Cultural Material Density and Areas Tested

Where a feature has been excavated, the total number of square metres excavated within and outside the feature is presented. Excavated cultural material with the exception of bone is totalled by number and expressed as number of items per square metre excavated. This information is presented separately for the areas within and outside the feature. Bone is not included as: 1) many reports do not indicate the number of pieces found; 2) there is a strong possibility that bone is differentially preserved and thus inaccurately reflected in many stone circle assemblages. Densities are expressed as a code. Entry codes are as follows:

DENSITY OF CULTURAL MATERIAL CODE

CODE	MEANING
1	Indeterminate - data not presented
2	Indeterminate - feature not tested
3	0 pieces per m^2
4	>0-5 pieces per m^2
5	>5-10 pieces per m^2
6	>10-15 pieces per m^2
7	>15-20 pieces per m^2
8	>20-25 pieces per m^2
9	>25-30 pieces per m^2
10	>30-35 pieces per m^2
11	>35-40 pieces per m^2
12	>40-45 pieces per m^2
13	>45-50 pieces per m^2
14	>50 pieces per m^2

6.11 Feature Definition

Data on feature definition are taken from the Limited Stone Circle Observations form. If no information on feature definition is recorded on the form, data can be gathered from site forms, site notes and relevant feature drawings. Definitions are expressed as a code. Entry codes are as follows:

STONE CIRCLE DEFINITION CODE

CODE	MEANING
1	Good
2	Moderate
3	Poor
4	Good - but incomplete (i.e. partial circle)
5	Moderate - but incomplete (i.e. partial circle)

6.12 Stone Clustering

Stone clustering data are collected from the Limited Stone Circle Observations forms. If a complete drawing of the stone circle is available, data on clustering can be gathered from it. Entry codes for clustering are as follows:

CODE	MEANING
PR	Present
AB	Absent
IND	Indeterminate (not recorded)

7.0 SITE/FEATURE ENVIRONMENTAL CHARACTERISTICS

7.1 Physiographic Setting

Physiographic setting data are derived from sources such as topographic maps, air photos and field observations. Defined physiographic setting categories for individual sites and features are:

1. Located on open prairie surface from 0 to 0.5 km from the edge of a coulee, stream or river valley; or the edge of any other major escarpment feature.
   - 1.1 coulee valley edge
   - 1.2 major stream valley edge
   - 1.3 major river valley edge
   - 1.4 edge of other type of escarpment
2. Located on open prairie surface greater than 0.5 km from the edge of a coulee, stream, river valley; or the edge of any other major escarpment features.
   - 2.1 located in low swale area between nearby rises or hills
   - 2.2 located on essentially horizontal prairie surface
   - 2.3 located atop crest of hill or ridge
   - 2.4 located on slope of hill or ridge
3. Located on slope of coulee valley wall.
   - 3.1 located on crest of ridges or knolls forming portion of coulee wall

3.2 located on terrace or terrace-like surfaces (i.e. slump blocks) forming portion of coulee wall

3.3 located within the bottom of draws dissecting into coulee wall

4. Located on slope of major stream valley wall.

   4.1 located on the crest of a ridge forming a portion of stream valley wall

   4.2 located on terrace or terrace-like surface (i.e. slump blocks) forming portion of stream valley wall

   4.3 located within the bottom of draws dissecting stream valley wall

5. Located on slope of river valley.

   5.1 located along the crest of a ridge forming a portion of the river valley wall

   5.2 located on terrace or terrace-like surfaces (i.e. slump blocks) forming a portion of river valley wall

   5.3 located within the bottom of draws dissecting the stream valley wall

6. Located in coulee bottom.

   6.1 located adjacent to base of coulee walls (within one-quarter of total coulee bottom width adjacent to coulee wall

   6.2 located within the central portion of the coulee bottom (central half of total coulee bottom width)

7. Located in major stream valley bottom.

   7.1 located adjacent to the base of the stream valley wall (within one-quarter of total coulee bottom width, adjacent to valley wall)

   7.2 located within the central portion of the stream valley (central one-half of the total valley bottom width)

8. Located in major river bottoms.

   8.1 located adjacent to the base of the river valley wall (within one-quarter of the total valley bottom width, adjacent to valley wall)

   8.2 located within central portion of river valley (central half of total valley bottom width)

7.2 Topographic Relief

Site/feature topographic relief is here scaled according to the number of separate 25 foot contour interval lines present within the site area and within a 0.5 km radius of the site. Topographic relief is determined utilizing 1:50,000 scale NTS map sheets, with 25 foot contour intervals. Separate, but equal, elevation contour lines within the area examined are each counted separately. Defined topographic relief categories are:

1. 0 to 1 contour lines
2. 2 contour lines
3. 3 contour lines
4. 4 contour lines
5. 5 contour lines
6. 6 contour lines
7. 7 contour lines
8. 8 contour lines

7.3 Surficial Deposits

Surficial deposit information for sites within southeastern Alberta is determined by reference to maps by Stalker (1963) and Westgate (1968). Surficial deposit categories presented there and utilized here are:

0. Indeterminate
1. Ground Moraine
2. Hummocky and ridged end moraine
3. Hummocky moraine
4. Eskers, crevasse fillings
5. Kame, kame moraine
6. Meltwater channel sediment
7. Outwash sand and gravel
8. Lacustrine silt and clay
9. Sand and silt

10. Mixed
11. Aeolian sand
12. Glaciolacustrine silt and clay
13. Sand
14. Alluvium
15. Stream alluvium
16. Eroded slope

7.4 Primary and Secondary Water Resources

Surface water information is largely derived from 1:50,000 NTS map sheets, augmented where possible by field observation and other sources. Surface water resources are described first in relation to their distance from the site, and second in relation to their nature and extent. Primary surface water resources are considered to be those located within the site area or within a 1.0 km radius of the site margins. Secondary surface water resources are those located from greater than 1.0 to 2.0 km from the site margins. Where more than a single type of surface water source is present within either the primary or secondary resource areas, the water resource considered to be the most long-term or which is of superior water quality, is that which is coded. Codes utilized for both primary and secondary water resources are:

0. Indeterminate
1. Absent: no known surface water sources present
2. Small seasonal pond or ponds containing water primarily for short periods during spring. Normally dry throughout the remainder of the year.
3. More permanent lakes or seasonal ponds containing water for much of the year, normally dry before late summer or early fall, being rejuvenated the following spring.
4. Lakes normally containing water on a year-round basis.
5. Seasonal streams or sections of streams containing water for a short period during the spring and after major rain storms.
6. Streams or sections of streams normally containing small to moderate amounts of water for much or all of the year.

7. Major rivers normally containing large quantities of water on a year-round basis.
8. Surface flowing spring or spring seep, active on a year-round basis.
9. Intermittently active or presently inactive springs or spring seeps.

7.5 Primary and Secondary Woody Vegetation Resources

Woody vegetation resource information may be derived from a number of sources including 1:50,000 NTS maps, air photos and field observations. Primary woody vegetation resources are those located within, and in a 1.0 km radius of the site margins. Secondary woody vegetation resources are those located greater than 1.0 to 2.0 km from the site margins. Where more than one type of woody resources are available, the largest source is the one coded. Woody vegetation reflecting definite or probable recent historic activity is not considered in analysis. Codes utilized for both primary and secondary woody resources are:

0. Indeterminate
1. No woody vegetation is present. Thinly scattered sagebrush or greasewood may be present but is not considered.
2. One or more stands of light brush such as wild rose. Collectively, these stands are estimated to cover an area less than 50 m in diameter.
3. One or more stands of light brush such as wild rose. Collectively, these stands are estimated to cover an area greater than 50 m in diameter.
4. One or more stands of light to moderately heavy brush such as wild rose, willow, chokecherry, bullberries and saskatoon. Collectively, these stands are estimated to cover an area less than 50 m in diameter.
5. One or more stands of light to moderately heavy brush such as wild rose, willow, chokecherry and saskatoon. Collectively, these stands are estimated to cover an area greater than 50 m in diameter.

6. One or more stands of light brush to heavy timber. Collectively, these stands are estimated to cover an area less than 50 m in diameter.
7. One or more stands of light brush to heavy timber. Collectively, these stands are estimated to cover an area greater than 50 m in diameter.

7.6 Associated Cultural Features

On the Stone Circle Indices form space is left for an associated cultural feature code. Data on associated features is gathered from site notes, site plan maps, feature drawings and the Limited Stone Circle Observation form. Entry codes are as follows:

ASSOCIATED CULTURAL FEATURE CODES

CODE	MEANING
0	No associated cultural features observed or reported
1	Interior earth stain present probably representing an unprepared surface hearth
2	Interior, circular, stone-outlined hearth
3	Exterior, circular, stone-outlined hearth
4	Interior rock and/or FCR cluster that may represent a hearth area
5	Exterior rock and/or FCR cluster that may represent a hearth area
6	Interior excavated pit
7	Exterior excavated pit
8	Interior FCR refuse pit
9	Exterior FCR refuse pit
10	Interior post molds
11	Exterior earth stain that probably represents an unprepared surface hearth
12	Interior FCR scatter
13	Exterior FCR scatter

1. Final Report of the 1983 Season at Head-Smashed-In Buffalo Jump, Alberta. By Jack Brink, Milt Wright, Bob Dawe and Doug Glaum. 373 pp. 1985.

2. FjPi-29, A Prehistoric Workshop Site in the Alberta Parklands. By Barry Newton and John W. Pollock. 119 pp. 1985. (Bound with Nos. 3 and 4)

3. Archaeological Excavation at the Strathcona Science Park Site (FjPi-29). By Heinz Pyszczyk. 222 pp. 1985. (Bound with Nos. 2 and 4)

4. The Results of Mitigative Excavations During the Fall of 1979. Strathcona Science Park Archaeological Site (FjPi-29). By John W. Ives. 108 pp. 1985. (Bound with Nos. 2 and 3)

5. A Spatial Analysis of Artifact Distribution on a Boreal Forest Archaeological Site. By John W. Ives. 167 pp. 1985.

6. The Archaeology of the Victoria Post, 1864-1897. By Michael R.A. Forsman. 225 pp. 1985.

7. Hawkwood Site (EgPm-179): A Multi-component Prehistoric Campsite on Nose Hill. By Stan Van Dyke and Sally Stewart. 224 pp. 1985.

8. Blackfoot Ethnography. By Kenneth E. Kidd. 217 pp. 1986.

9. Final Report of the 1984 Season at Head-Smashed-In Buffalo Jump, Alberta. By J. Brink, M. Wright, B. Dawe and D. Glaum. 445 pp. 1986.

10. Ross Glen: A Besant Stone Circle Site in Southeastern Alberta. By J. Michael Quigg. 208 pp. 1986.

11. A Selected Bibliography of Historic Artifacts: c. 1760-1920. By Mary Margaret Smith and Heinz Pyszczyk. 325 pp. 1988.

12. Medicine Wheels on the Northern Plains: A Summary and Appraisal. By John H. Brumley. 126 pp. 1988.

13. Historical Resource Investigations within the Forty Mile Coulee Reservoir. By John H. Brumley and Barry J. Dau. 370 pp. 1988.