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Core reduction and artifact curation| Patterns of prehistoric behavior from northern Wyoming

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CORE REDUCTION AND ARTIFACT CURATION:

PATTERNS OF PREHISTORIC BEHAVIOR FROM NORTHERN WYOMING

by

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ABSTRACT

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From analysis of lithic assemblages from surface sites that have been 100 percent collected archaeologists should be able to get more information about prehistoric behavior. The purpose of this research is to identify prehistoric cultural behavior as it is reflected in the lithic material from these small sites.

Surface collections of lithic material collected from two areas in northern Wyoming were used; 11 sites from the Polecat Bench and 25 from the Acme, Wyoming, area. By analyzing each artifact on the basis of observed attributes, those behaviors associated with material procurement, artifact movement, and site activity were identified. Of major importance was the identification of differences in core reduction stages for the two areas.

It was discovered that different patterns of artifact movement and core reduction activity are represented in the two study areas. Seventy-two percent of the Polecat Bench sites had raw material on-site. Most sites in this area were initial core reduction sites. Raw material was imported to 96 percent of the Acme sites. These sites showed more secondary core reduction and tool manufacturing activities than was present at Polecat Bench.

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I would like to thank Dr. Fredrick C. Munday for making the Polecat Bench material available to me and for his energy and technical experience. Through Fred I gain a new and better perspective about rocks.

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CHAPTER I

INTRODUCTION

The aim of many archaeological investigations on the Northern Plains has been the identification of cultural sequences (Mulloy 1958; Wedel 1961; Reeves 1970). Most of these investigations focused on important stratified sites - e.g. Pictograph Cave - which contained great quantities of the cultural debris so important to archaeological interpretation. For many years, little or no data has been available on smaller, single component, sites. Until the advent of "contract archaeology" and the rapid expansion of archaeological activities, it simply was not pratical for students to examine and evaluate small minimal information site loci. In this thesis I will investigate the cultural remains present at some of these less prestigious sites, but nevertheless, sites which can contribute to our understanding of prehistoric behavior. These were all surface sites where 100 percent of the surface cultural material was collected. Generally, they were small sites with little artifact content. They warranted investigation so that better field interpretation of prehistoric sites could be made.

From an analysis of the lithic debitage recovered from two archaeological surveys in northern Wyoming (Lincoln's 1977 survey near Acme, Wyoming, and Munday's 1977 survey of the Polecat Bench near Powell, Wyoming) I will address several questions in order to identify prehistoric behavior involved in: 1) the selection and procurement of raw material; 2) the transport of raw material; 3) the stage of core reduction; and 4) the inter-site movement of artifacts. Behavioral differ-

ences between aboriginal groups in the two survey areas should be identified.

Each artifact from the 36 sites used for this study (11 from Polecat Bench; 25 from the Acme area) was analyzed and measured for 19 variables. The observations considered raw material type, flake shape, and flake production attributes. These variables were chosen so that differences in artifact assemblages might be easily recognized. The data drawn from these variables suggest area differences in human behavior.

This archaeological research has the potential to help archaeologists deal with some of the problems that they face in small site data analysis because it is one of the first attempts to undertake an intensive analysis of small lithic sites. The data derived should provide information pertinent to identifying prehistoric human behavior, e.g., the often ignored core reduction process and raw material utilization. It should give archaeologists a useful perspective on how to interpret and explain some Northern Plains archaeological material.

Another contribution may lie in my outline of a substantial site classification system. Some investitators have used what may be incorrect data for developing their site typologies (e.g., Fox 1977; Gregg 1977a; and Fredlund 1977). Often they have based their site classification schemes and behavioral interpretations on artifact occurance and implied site function which, unfortunately, do not always represent the actual tool use category. In addition, their criteria for including a particular site within a specific category often has been based on intuition. Such intuitive grouping, with poorly defined

sorting criteria, is a major problem in the discipline and does little to advance the science. For this study a more empirical approach is taken.

By no means does this research exhaust the work available to Northern Plains Archaeologists. It addresses a small problem by looking at the surface debris from a number of sites from northern Wyoming.

CHAPTER II

THEORETICAL DISCUSSION AND HYPOTHESIS

Until recently, archaeologists have been concerned with description and classification as a means of developing cultural history. Consistent with this theoretical framework is the "normative" concept of culture which underscores culture as a shared phenomenon analogous to the norms of a group (Flannery 1967:119). Binford considered that:

> . . . a normative theorist is one who sees as his field of study the ideational basis for varying ways of human life - culture . . . . the archaeologist's task then lies in abstracting from cultural products the normative concepts extant in the minds of men now dead (Binford 1967:203).

By conceptualizing human behavior in this way, a normative theorist views these group norms, or "mental templates", as the models used by man to make his tools; hence, man's technological systems - past and present - are seen as derived from normative views of a group's consciousness by participants of that group.

Normative archaeologists study culture change and history by describing artifacts, artifact assemblages, and sites and then by comparing the data gained from the analysis in terms of the artifact types present and the number of artifacts representing each type. They perceive changes in artifact form as resulting from changes in artifact frequency relative to time and space. Exposing these types of relationships has led archaeologists to propose elaborate schemes of prehistoric cultural classification, e.g., the Pecos Classification (Pecos Conference of 1927) and Mulloy's tripartite outline for the prehistory of the Northern Plains (Mulloy 1958).

In opposition to the normative view of culture is tne "new" archaeology which considers culture in a systemic context. The systemic approach as a part of archaeological theory views culture as an adaptive mechanism which allows man to place an artificial technological system between himself and his physical environment. As adaptive tools, technological systems are manipulated by human beings for their benefit; technology allows for a more efficient and comfortable interaction with the environment. Drawing from White (1959:8) and Aberle (1960:3), Binford stated that:

> . . . culture is an extrasomatic adaptive system that is employed in the integration of a society with its environment and with other socio-cultural systems. Culture, in this sense, is not necessarily shared; it is participated in by man (Binford 1965:205).

The significance of this statement is that it outlines a systemic approach that enables the archaeologist to look at culture as a system and yet does not ignore the idiosyncratic nature of culture (Taylor 1948:100).

One of the foremost goals of archaeology is to explain and predict prehistoric human behavioral variability as it is evidenced by the artifactural remains. Some archaeologists achieve this goal by employing the hypothetical-analog method of research (Smith 1977:598). By using this sophisticated method of inductive research in conjunction with the systemic approach, archaeologists are able to reason testable hypotheses based on observations made on artifact forms, artifact arrangement in time and space, and the prehistoric environmental context. All of those attributes interact together to influence cultural behavior.

Wilmsen (1970:3-4) has identified three basic structural components which express cultural variability: social units, cultural units, and structural poses. Social units are those interpersonal (altruistic) mechanisms which direct individuals to form functional adaptive groups; cultural units are more inclusive and active mechanisms (e.g. technological, social, and idealogical) by which a society (adaptive groups of people) encounters and manipulates its environment. Archaeologists are directly concerned with the technological aspect of cultural units; by understanding them, archaeologists can identify patterns of human behavior. Wilmsen quotes Gearing (1962:15) who has defined a structural pose as "the way a simple human society [is] appropriately organized at a particular moment for a particular purpose." A task of archaeology is to identify the structural poses of prehistoric cultures. For a realization of this task, archaeologists must rely on two assumptions:

> 1) The form and composition of assemblages recovered from geologically undisturbed contexts are directly related to the form and composition of human activities at a given location.
>
> 2) The minimal social processes and organizational principles exhibited by human groups today were operative in the past (Binford and Binford 1966:291).

In summary, in order to identify prehistoric behavior, culture must be viewed as an adaptive mechanism. The archaeologist must realize that he only sees an expression of behavior as exemplified through a prehistoric technological system.

Lithic Analysis

In conjunction with the growth of systems theory in archaeology interest has increased in advancing the analytic methods used to study

material culture. Of particular interest for this research are advances in the study of chipped stone technology. Concern with Lithic studies centers around three research strategies: 1) typological studies, e.g., the work of Bordes (1968) and White (1963); 2) functional studies, e.g., Lewis and Sally Binford (1966), Wilmsen (1970), Ammerman and Feldman (1974), and Shiffer (1976) and 3) experiemental studies, e.g., Bonnichsen (1977). Each of these contributes to our knowledge of prehistoric technological systems.

For this thesis, the most crucial papers are those which involve typological and functional studies. In these studies, researchers have attempted to define the behavioral mechanisms involved in the relationship between lithic technological systems and site selection (settlement patterns). Why prehistoric occupations occur at specific locals may be reflected in the stone artifacts remaining at a site; stone material, types of artifacts, and artifact manufacturing processes (when identified) are useful in helping to identify past behavior. Important papers include Schiffer (1976), Ammerman and Feldman (1974), Schneider (1974; 1972), Wilmsen (1970; 1968), S. Binford (1968), Bordes (1968), Binford and Binford (1966), and Sockett (1966). Perhaps the best summation of the problems discussed in these papers was given by S. Binford:

> If we view lithic assemblages as sets of tools designed to perform specific tasks, then differences between assemblages on some broad cultural level can be interpreted as reflecting: 1) differences in the jobs being performed . . . ; 2) differential site utilization - that is, different site types . . . ; 3) replacement of one functional unit of the assemblage for another - what is commonly termed stylistic variability . . . ; or 4) sampling error (Binford 1968:50).

I would add to this by including differences in site location and differences in how tools were currated and abandoned as factors reflecting assemblage differences (Ammerman and Feldman 1974).

Stone artifacts are reflections of cultural behavior, and as such an analysis of their attribute sets should reveal the structure of the behavior used in their manufacture. I will paraphrase Knudson (1973) in giving definitions of some terms used here. Artifacts are non-human entities modified by human behavior; their formal variation results from the interaction of internal physical properties (e.g., raw material) and the external activities of human beings. Attributes of specific artifacts are expressions of each of the morphological traits an artifact has; these traits are often interrelated and combine to define the artifact. An Attribute set defines the varying expressions of similar classes of attributes taken from several artifacts. Once attribute sets have been identified they can be combined to form attribute systems which are "assemblages" of attribute sets accepted as reflecting specific behaviors (Knudson 1973:7). It is the attribute systems which help archaeologists construct models of prehistoric behavior.

Artifacts can reflect: 1) where they were selected (Watson, LeBlanc, and Redman 1971; Binford 1965); 2) where they were made (Munday 1976; Binford 1965); 3) where and how they were used (Schiffer 1976; Binford and Binford 1966; Binford 1965) and; 4) where they were dicarded (Ammerman and Feldman 1974; Binford 1973; Munday and Lincoln 1979). Attribute systems may reflect each of these behavioral processes. Knudson identified three distinct attribute systems:

1) Production attribute systems - Those interrelated attributes, and their inferred organization, which reflect behavior involved in selection and modification of environmental material to make culturally useful forms.

2). Utilization attribute systems - Those interrelated attributes, and their inferred organization, which reflect behavior involved in using an artifact in adapting to the social and physical environment.

3). Stylization attribute systems - Those interrelated attributes, and their inferred organization, which reflect individual and/or communal choices of technical expression or design and particular skill in execution within the constrains imposed by production and utilization requirements, it is the attribute systemic structure not necessarily assignable to the other systems (Knudson 1973:8).

By employing this classification scheme, archaeologists are able to define many potential objectives (Sheets 1975:369). In this thesis, I consider the problem of explicating the structure of a lithic industry by analyzing a selected part of the technology of the prehistoric culture in the Northern Plains. It is important to note that all of the products of an industry (both tools and wastage) are significant to a technological analysis where the goal is to understand how materials were utilized.

We will assume for most lithic industries a direct relationship between tool manufacture and tool use; i.e., most tools were used for the task for which they were made.

In lithic assemblages one would expect to find a high degree of correspondence between technological and functional types (Sheets 1975:370). However, we cannot assume this direct correspondence because different tools can have varying use-lifes and may exhibit different dropping rates (Ammerman and Feldman 1974; Binford 1973). The causes for this may be reflected in some inherent quality of the raw material (e.g. high quality vs. low quality stone) or in the

availability of local resources (e.g., water or raw material). In observations of debris left at activity locations of the Nunamiut Eskimos, Binford states that:

> The most striking fact to emerge . . . is that with regard to artifacts per se there is little correlation between what is done and the artifacts remaining (Binford 1973:242).

In a similar vein, Ammerman and Feldman noted that:

> From a functional point of view, we may not be paying enough attention to those tools and tool types that are repeatedly used and seldom discarded and too much to those used only a few times and abandoned (Ammerman and Feldman 1974:616).

In summary, we cannot assume that all of the chipped stone within a given assemblage: 1) were manufactured for the same use; 2) were used for only one task; 3) were the only items in that industry that were used for that task. The attributes used in a technological classification should not be used to predict functional categories. Only if the two show a significant degree of correspondence should they be combined, otherwise, taxenomic and technological classifications should be constructed independently in order to maintain the integrity of an assemblage (Sheets 1975:370).

Sheets (1975:371, Fig. 1) presents a model of the potential variables which can influence the structure of a lithic manufacturing industry (see Fig. 1). The significance of this model is that it shows how to propose and test descriptive models of lithic industries so that questions may be structured in such a way that all variables are explored effectively.

By employing the concept of industry, observations made on the technological system can be isolated and made into useful categories. An industry is defined as a manufacturing or productive enterprise

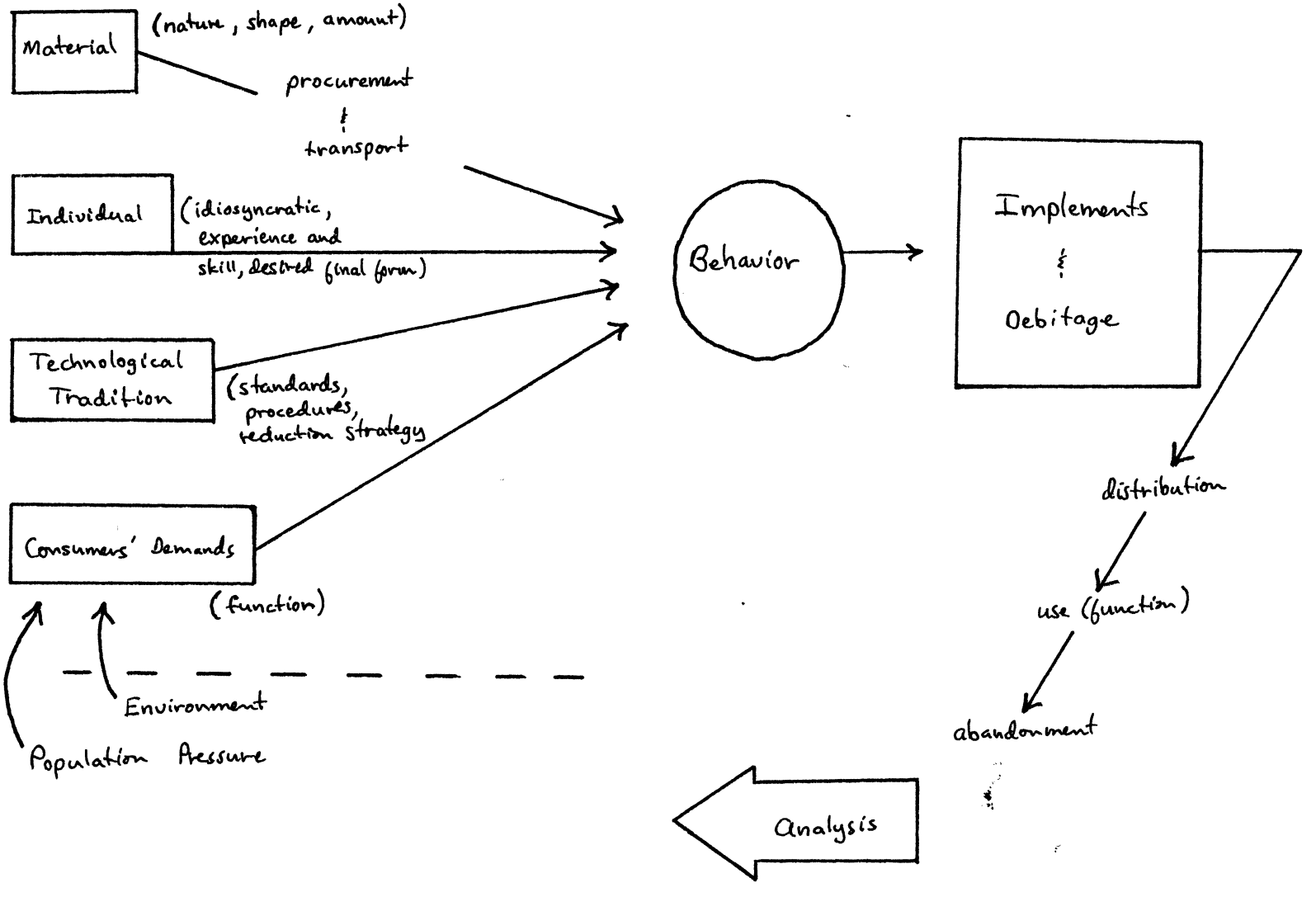

Figure 1. Potential variables affecting the structure of a lithic manufacturing industry. From Sheets, 1975.

focusing on a particular raw material and involving certain common (consistent) means of processing that raw material (Sheets 1975:372).

The basic chipped stone industry for the Acme area concentrated on the use of porcellanite, while that of the Polecat Bench was almost entirely derived from basalt. Both industries reflect, in their assemblages, the fracturing capabilities of the common rock types available for stone tool use.

Artifacts are arbitrarily assigned into classes by the archaeologist; they do not naturally fall into categories because of some inherent quality(ies). In a subjective analysis, artifacts are placed into categories because they look like other artifacts already placed in that group. These types of decisions are usually based on the presence or absence of distinctive attributes of the final product (e.g., the channel flake of a Folsom Projectile Point). In a technological analysis, the determining criteria for placing a specimen in a particular category are the procedures of manufacture in common with other members of that category; the steps involved with the core reduction sequence would be very important for a technological analysis.

Site Typologies

A useful way to identify and discuss prehistoric behavior is to define settlement patterns. Prehistoric peoples on the Northern Plains had a sensitive awareness of their environment; this forced them to locate themselves so that resources (e.g., food, water, and raw materials) could be most efficiently exploited. With the advent of the "new" archaeology, and even earlier, research strategies designed

to identify settlement patterns have been important for the archaeologist. Willey (1953), in an important monograph on Peruvian archaeology, described a four-part classification for sites located in the Viru Valley of Peru. In the Near East site typologies resulting from an identification of settlement patterns have been developed by Hole and Flannery (1967) and Marks and Freidel (1977).

The development of a classification system based on the definition of site types is useful because it allows the archaeologist to isolate individual units from the data. These types of classification systems also function as the building blocks out of which models can be constructed and comparisons made (Chang 1968:2). These are the points from which behavior can be isolated. Chang has defined an archaeological settlement as ". . . the physical locale or cluster of locales where the members of a community lived, ensured their subsistence, and pursued their social functions" (Chang 1968:3). An important note here is that a "settlement" need not be restricted to one archaeological component or site. Spacial units, which may reflect a prehistoric community's functional territory, probably included wide expanses of land within a region and consisted of several environmental zones. The land areas used by the inhabitants of an area most likely consisted of many different locations, each being significant in terms of procuring resources.

Several site typologies have been used by investigators working in two major geological features of the Northern Plains; these are the Powder River Basin and the Big Horn Basin (Fox 1977a, 1977b; Fredlund 1977; Gregg 1977a, 1977b, 1977c; and Beckes 1976). These

typologies employ two means of looking at the data. These are: 1) attempts to identify functional tool categories and then use these to group sites into a general scheme (Gregg 1977a, 1977b, 1977c; Fredlund 1976); and 2) attempts to identify sites on the basis of i) quantity and quality of cultural material, ii) areal extent of the site, and iii) functional tool categories (Fox 1977a, 1977b; Beckes 1976).

There are two inherent problems with these typologies which make it difficult to apply them to definitions of human behavior. These are: 1) they are poorly defined and vague - the classification system cannot be replicated, hence, their application is nebulous; and 2) the use of functional tool categories as prime indicators of behavior may lead to errors in site identification.

To illustrate the fact that some of these typologies are poorly defined I cite Fox (1977b) and Gregg (1977c) on their classification of "lithic scatter areas" and "chipping stations." Fox (1977b:61) states that "Lithic scatter areas are so designated because of the lithic debitage scattered about the surface of the site." He goes on to say that less than ten flakes spread over a "wide" area is the usual criteria for designating a site as a lithic scatter site. Chipping stations, (Fox 1977b:62), on the other hand, are sites where, "often as few as a dozen flakes . . ." constitute the cultural material from these sites but, at other locations an "abundance of lithic debitage . . ." constitute this site type. Chipping stations are further distinguished by the extent of the stone debris - usually concentrated in a small area ($1\text{-}2m^2$). For neither lithic scatter areas nor chipping stations does Fox clearly state a functional reason for the existence of these

types of sites; one is left to infer the human activity that occurred. Chipping stations, "appear to have been the result of a brief, individual stone knapping activity" (Fox 1977b:62). He does not suggest what type of stone knapping and hence, cannot adequately define his site types.

Gregg's criteria for site definiation are equally vague and poorly defined. He bases his typological system on functional tool categories. Even though he very explicitly defines the artifact classes he uses (e.g., preform, scraper, projectile point, etc.) he fails to explain why certain tool types occur at particular site types (e.g. base camps, hunting camps, porcellanite procurement-workshops, or transient camps) in "relatively" greater or lesser quantities (see Gregg 1977c:27, Table 2). These types of non-quanititative intuitive criteria should be avoided because they lead to confusion and do not allow archaeologists to replicate the typology system. In adition, Gregg ignores other, possibly significant factors, e.g., site proximity to raw materials and resources.

Beckes' and Fox's site classification systems are too general because anyone trying to duplicate their work would have a great deal of leeway in assigning sites to specific categories. Using their criteria an archaeologist might confuse hunting camps, village sites, and vantage points (Beckes 1976) or lithic scatter areas, chipping stations, and occupation sites (Fox 1977b). Because their systems are general and poorly defined they are difficult to apply and use in archaeological explanation.

Lastly, because all of these site typological systems attempt to employ variability in the function of tools they all could potentially lead to errors in site classification. First of all, tool function is implied in all areas except for Gregg (1977a, 1977b, 1977c) where an attempt to identify wear patterns was made. As stated earlier, tools can have different use-lifes and abandonment rates; hence, the lithic material recovered from a site may in fact represent tools used at other locales while the tools used at the site may have been carried away. These are possibilities that should not be ignored, but rather should be pursued and tested before statements can be made about human behavior based on tool functional variability.

Questions

I pose several questions that will be addressed in this thesis. I intend to exmine one general site category in order to make some definitive statements about prehistoric human behavior. I examined the lithic collections from small sites where 100 percent of the surface material was recovered (25 sites from the Acme area and 11 sites from Polecat Bench). My intent is to outline some characteristics of the artifacts found at these sites. From an analysis of their lithic collections I hope to present a more accurate site topology system and to partially explain prehistoric behavior in this area.

Characteristically these sites were small (less than 700m^2). Chipped stone material comprises all of the cultural material present, and it was assumed that no subsurface cultural material was present. The amount of stone debris ranged from less than 10 pieces to over 100; usually the amount was less than 50 pieces. Tools ocurred infrequently;

especially rare were diagnostic projectile points.

I will address these questions in my analysis:

1) What were the core reduction strategies employed by the inhabitants of the two areas?

2) How did the core reduction strategies relate to tool procurement and the site typology system?

3) What raw materials were present and will their identification give an indication of differential use, and/or raw material preference, and/or group movements and trade between the two areas studied?

4) Do the data from these sites reflect movement of artifacts across space as seen in the relationship between, for example, cores vs. flakes vs. tools?

5) Is my site category correct?

CHAPTER III

METHODOLOGY

Field Survey

The methodology used for each field survey will be quoted directly from the archaeological reports in which they appeared. First will be the Acme area report (Lincoln 1977) followed by the Polecat Bench report (Munday 1979).

Acme Area

> The crew consisted of two members . . . . Our survey methods were designed to permit a visual inspection of 100 percent of the project area by physically walking over all the lands involved. Each day, specific lands were designated for survey (usally one section). These were oriented either in a north-south or east-west direction in order to precipitate surveying and logistical ease. The crew walked parallel to each other spacing about 100 feet apart. At times the rugged terrain forced an abandonment of the patterned survey, and we adopted a strategy more suited to the natural conformation of the land. Prominent hillocks, points of land, knolls, and all arroyos were inspected with close scrutiny. Depending on the terrain, the crew investigated on the average five to seven hundred acres each working day . . . .
>
> Whenever an archaeological site was discovered, we conducted a thorough ground search in order to determine the nature and extent of the cultural materials present. Our sampling procedure was to collect all cultural material present if the site was small . . . Whenever possible, specific inter- and intra-site relationships were noted (Lincoln 1977:5-6).

Polecat Bench

> Archaeological survey was conducted by three archaeologists. Eighteen passes were made across each section with diversions made to thoroughly examine high points . . . and potential occupation areas. An initial pass was made across each section with field personnel between 10 and 20 meters apart. This was done to determine the true density of and variability in archaeological occurrences. Subsequent passes were made with personnel ca. 50 to 75 meters apart.

> This methodology probably resulted in few, if any, major archaeological occurrences being missed.
>
> Samples were collected from a large number of artifact occurrences, primarily to facilitate interpretation about uncollected sites. Where some areas exhibit extensive artifact occurrences . . . , samples were collected when it was possible to isolate what may have been single occupation assemblages, i.e. small artifact clusters. This often resulted in single artifacts or small clusters of artifacts being collected. Samples were also collected from extensive lithic areas where it was not possible to determine the extent of single occupation units. This was done in order to gain insight into spatial variability in artifact deposits. In every case, all lithic materials . . . were collected. Therefore, where collection took place, they are reported as complete assemblages in this report (Munday 1979:46-47).

Site Selection

One of the primary reasons for doing this research came from my desire to make a useful classification of small surface sites; this should help in identifying some behavioral patterns present among prehistoric occupants of the Northern Plains. These sites represent the most common type of archaeological occurrence on the Northern Plains. The requirements needed for a site to be included in this study were:

1) Consisted only of surface cultural remains, and

2) Had 100 percent of the surface material collected.

A total of 36 sites met these requirements and were used in this study: 11 from Polecat Bench and 25 from the Acme area.

Analysis of Stone Material

In each case, the entire assemblage was laid out so that I could familiarize myself with the collection. After initial superficial observations, the debitage from a collection were categorized into raw material types, and each specimen was measure for 19 variables of which

10 were used in this study (a variable was not considered useful if the sample size for that variable was too low to show statistical relationships, e.g., the variable dorsal scar pattern). The variables do not represent an exhaustive attribute list; however, they were selected because they seemed to be the most useful for this study.

The variables were combined into three categories. The data collected from the variables indicated particular aspects of behavior resulting from human occupation at small surface sites.

1) Behavior associated with raw material selection and raw material movement over space. These variables will help determine why certain stone types were selected for their tool making properties and indicate possible sources of raw material procurement. The variable is:

Raw material types - Identifies differences in raw materials used for tool manufacture. This selection may result from raw material availability or material movement resulting from trade or intergroup contact.

2) Those variables which indicated behavior associated with the core reduction sequence. Individual site or areal differences were identified from each assemblage. The variables are:

a) Core type - This variable indicates how raw material was used and shows the kinds of flakes produced from a core. It is an important indicator of what flake properties (e.g. whether or not they were interior or exterior flakes, flake shape, and ease of flake chipping) were important fortool manufacture.

b) Length (fig. 2) - This variable was used as one measure of flake shape to help determine if there were differences in the mean flake shape between assemblages of artifacts.

c) Width
d) Thickness
e) Platform Length
f) Platform Width

(Fig. 2) These variables identify the same behavioral parameters as the variable length.

3) The behaviors associated with flke production and their subsequent selection for tool manufacture are identified by the following variables:

Flake type - This variable involved examination of broken tools which would have been broken during manufacture of on-site use and then abandoned. It should indicate some general activities at that site.

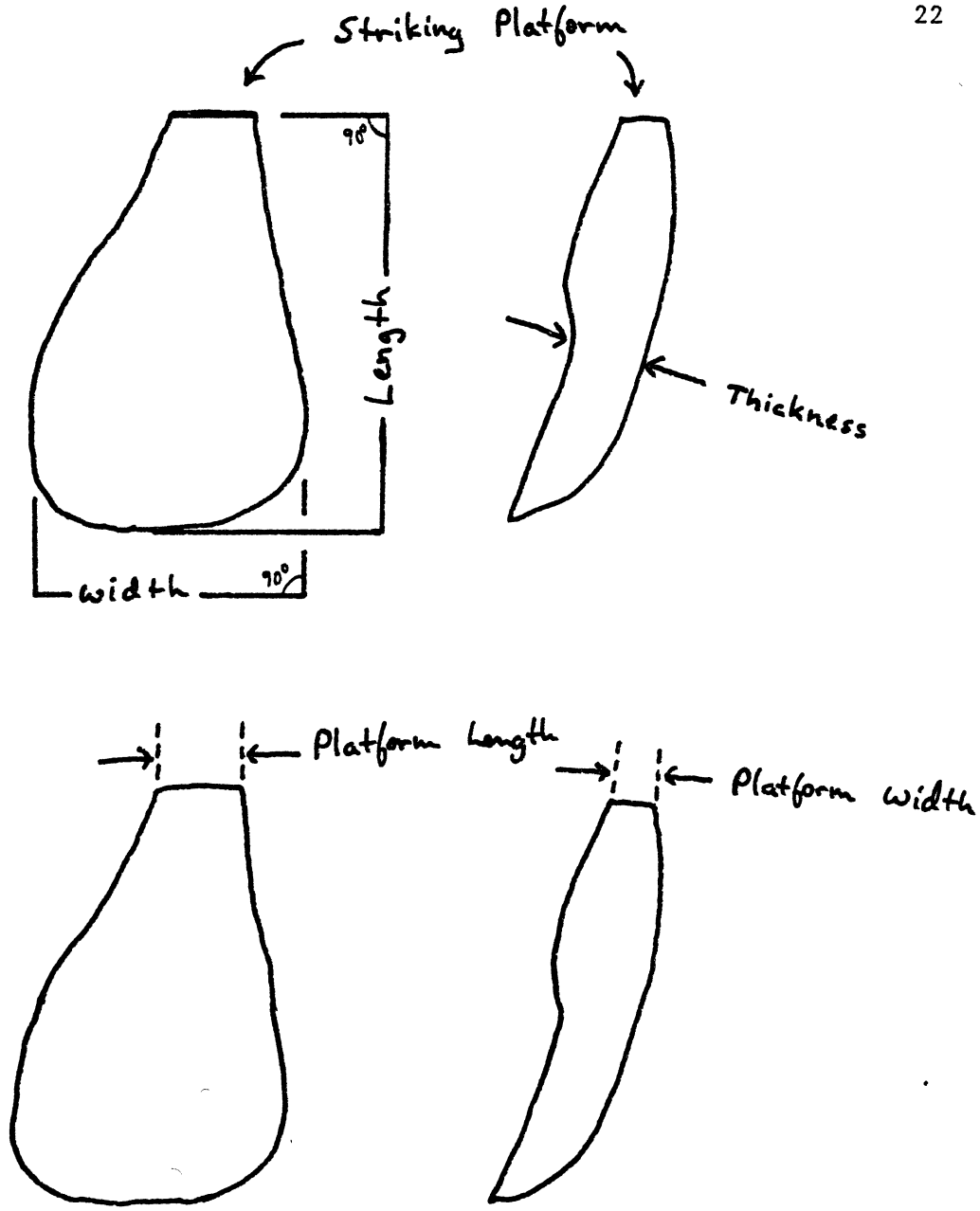

Figure 2. Measured flake variables.

CHAPTER IV

THE DATA

Background Information

The Acme area (fig. 3)

The Acme area borders the Tongue River approximately 11 miles northeast of Sheridan, Wyoming. It consists of riverine, steep-sided bluffs, rolling plain, and forest environments. Recent geologic uplift caused a wide range of elevation for this area. Maximum relief is about 720 ft.; the highest ground lies along the western edge of the project (4220 ft. MSL) and the lowest elevation (approximately 3500 ft.) is at the Tongue River in the northeastern corner near the Montana/Wyoming state line. The most rugged and abrupt terrain extends along the borders of the Tongue River valley where steep cliffs rise as much as 240 ft. above the valley floor. In general, landforms slope gently upward from the river's edge toward the west.

The Tongue River is the major water source and follows a winding course along the eastern borders of the area. The headwaters of this important river originate to the southwest in the Big Horn Mountains. The river carved a wide valley where steep sandstone cliffs border parts of the floodplain. In places, canyons extend back from the river's edge. Youngs Creek, the other important water source for the area, occupies a broad floodplain away from steep cliff faces. It flows from the northwest out of Montana into the Tongue River.

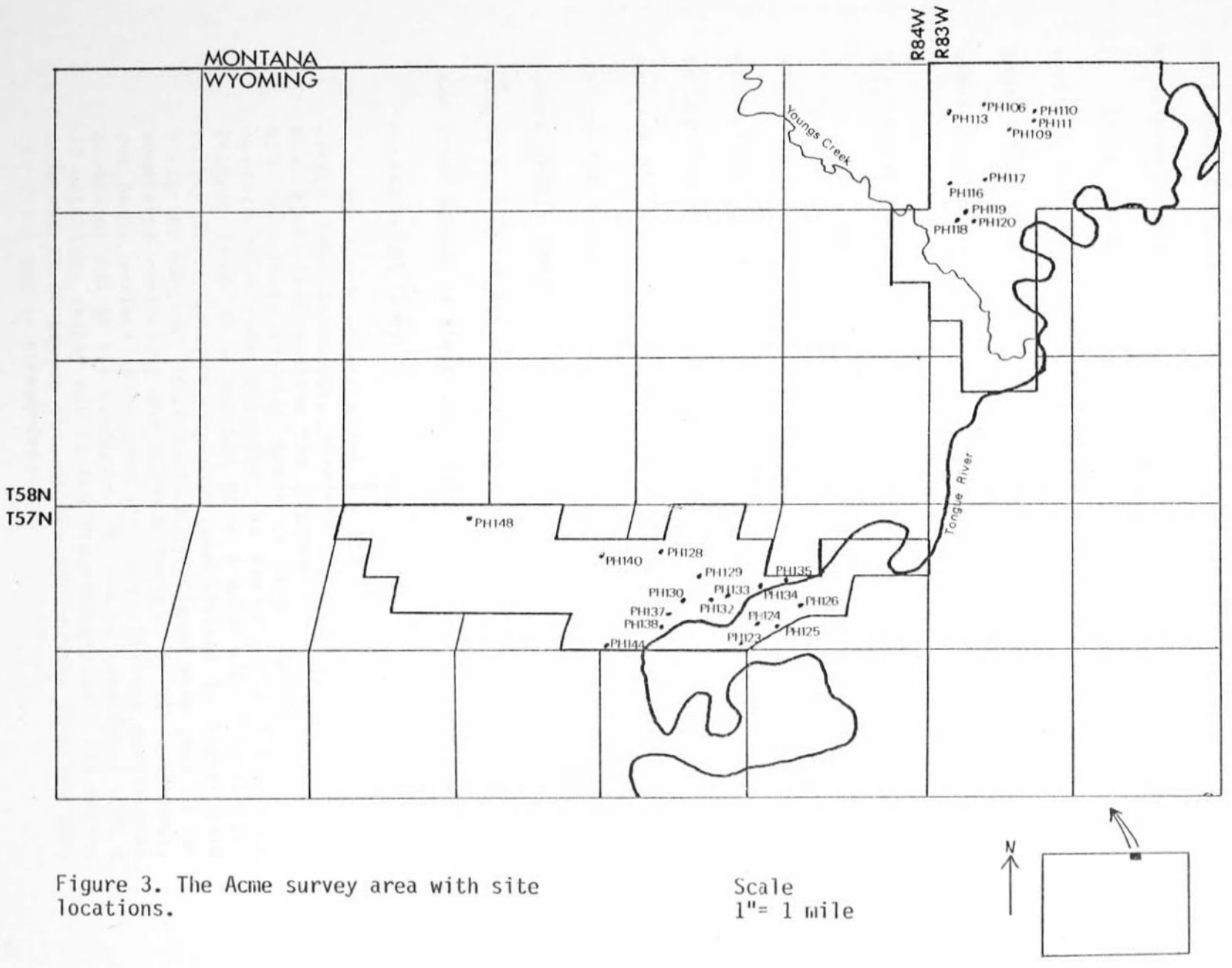

Figure 3. The Acme survey area with site locations.

West of the stream valleys, gently rolling terrain is dissected by many small drainages. For the most part, these are deep-cut arroyos cut by seasonal stream runoff.

Short prairie grasses, sagebrush, and prickly pear dominate the sparsely scattered vegetation. Along the banks of the Tongue River and Youngs Creek are strands of cottonwood and willow. At the higher elevations and away from flowing water are ponderosa pine and juniper.

The Polecat Bench area (Fig. 4)

Polecat Bench is a high level mesa in the Bighorn Basin located approximately 8 miles northwest of Powell, Wyoming. It is about 20 miles long and between 3-5 miles wide. The surface stands between 200 to 500 feet above the basin floor. The highest ground is at the southeastern tip (5210 ft. MSL). The lowest elevation is at the northwestern end of the bench (approximately 4725 feet). In general, the landform slopes gently upward from northeast to southwest. There are no water sources on Polecat Bench, however, Sage Creek, Alkali Creek, and Cottonwood Creek border it along two/thirds of the base.

Munday noted that:

> The bench stands alone and distinct from the mountain ranges (the Beartooth, Absaroka, Owl Creek, and Bighorn Mountains) that enclose the Bighorn Basin. Mackin (1937: 839) considers Polecat Bench to be a remnant of a high surface that once occupied the basin. The surface of Polecat Bench is a portion of a 3 mile wide longitudinal valley whose lateral extension was limited by higher land along its margins. This surface is aligned with gaps in the mountains encircling the Bighorn Basin. To the southwest, the bench surface is aligned with a gap in the Rattlesnake Mountains and to the northeast, it can be associated with a 10 mile long valley cut in the Pryor Mountains. The modern Shoshone River passes through the Rattlesnake Mountain gap; the Pryor gap is stream-free.

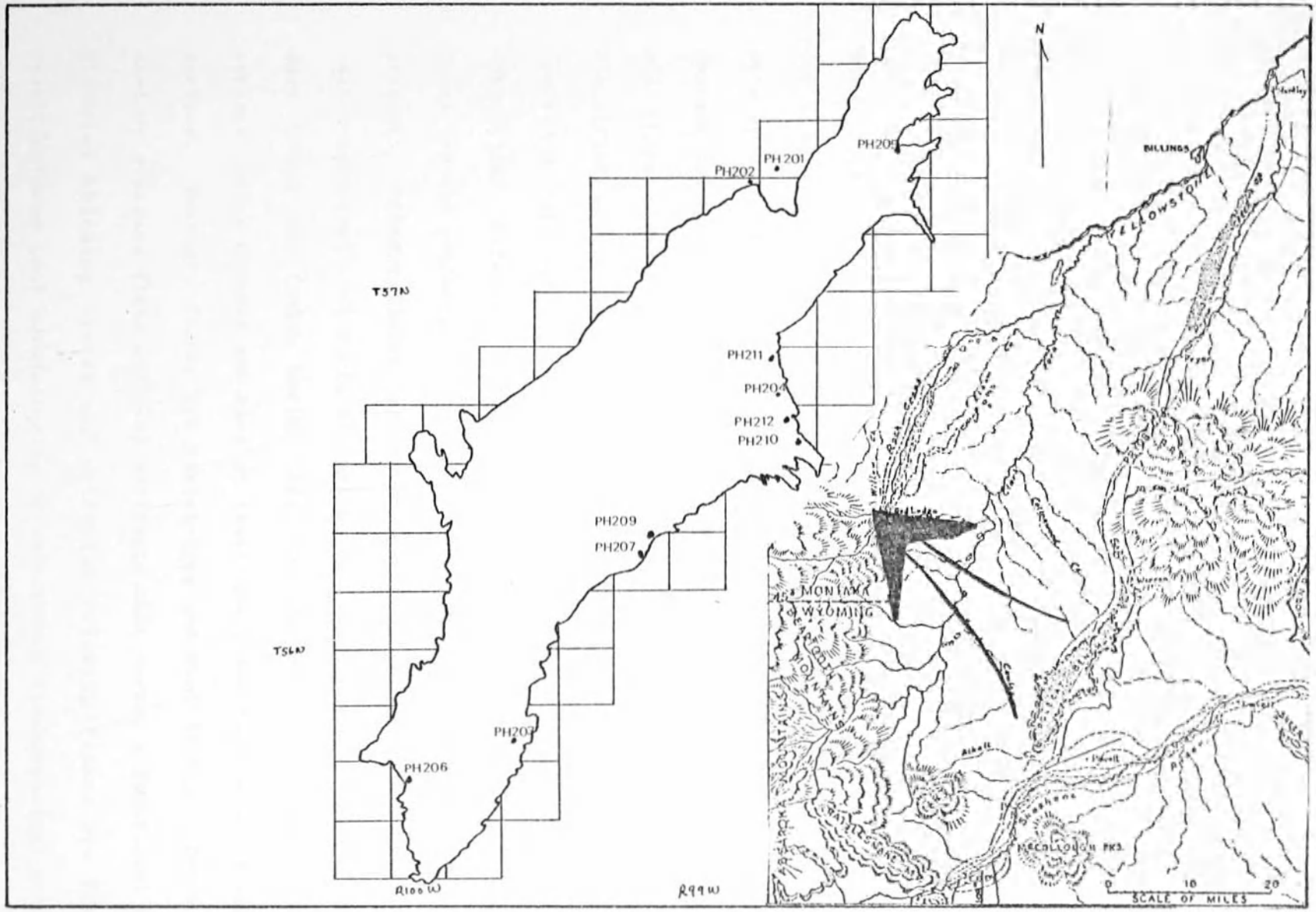

Figure 4. The Polecat Bench survey area with site locations. From Mackin, 1937.

Scale
3/8"= 1 mile

> A major feature of much of the Polecat Bench surface is a coarse gravel. This is found primarily on the northern area, the east and west laterals, and the southern tip of the bench. . . He (Mackin) suggests it was deposited by an early course of the Shoshone River. As such, the surface of Polecat Bench represents a remnant of the basin topography as it existed when the Shoshone flowed along what Mackin (1937) calls either the Polecat Valley or the Polecat-Shoshone Valley (Munday 1978:1-3).

Sources of Data

The following discussion is a summary description and interpretation of the data from each site. For convenience, each site was given an arbitrary number by the author (see Appendix I); those in the PH-100's were from the Acme area while those designated in the PH-200's were from the Polecat Bench. The site sample represents all of the 100 percent collected archaeological occurrences from the two project areas. All flake measurements were taken in millimeters. Artifacts were classified as primary flakes, secondary flakes, tertiary flakes, cores, tools (in all cases, a tool could be classified in one of the other categories), bifacial thinning flakes, or unifacial thinning flakes. Cores are the production units for flakes; prepared cores have no cortex present. Primary flakes are non-core artifacts that are 100 percent cortex (external rock surface) covered on their dorsal surface. Secondary flakes are flakes having less than 100 percent of their dorsal surface cortex covered and have at least one flake scar on their dorsal surface. Tertiary flakes are cortex-free internal flakes. Tools are used or pressure flake modified artifacts that served a functional use. Bifacial thinning flakes and unifacial thinning flakes are flakes resulting from tool manufacturing or maintenance (resharpening) activities (Frison 1968).

Porcellanite, chert, chalcedony, quartizite, obsidian, and basalt are the terms used to designate the raw material types. Porcellanite is a hard, dense, siliceous rock having the texture, dull luster, hardness, fracture and appearance of unglazed porcelain (American Geologic Institute 1973:557). This material is common throughout the Northern Plains, and is associated with lignite deposits. The term chert refers to a wide variety of cryptocrystalline rocks which are medium-grained, opaque, and possess good conchoidal fracturing properties. Chalcedony is a fine-grained semi-transparent to translucent, opaline siliceous rock. Quartzites are coarse-textured siliceous rocks. They have various fracturing capabilities, from excellent to poor and are meta-sedimentary in origin. Obsidian is volcanic glass as opposed to non-volcanic glass which occurs in the area (Frison 1974: 61). Basalt is a fine-grained, igneous rock.

Several symbols are used to indicate various measures. These are:

N = population size

$\overline{X}$ = population mean

S = standard deviation

All measurements are in millimeters.

Sites on Polecat Bench

PH-201

Size: 5m diameter
Location: 50m west of seasonal tributary to Cottonwood Creek. The view in all directions is good.
Nearest Raw Material: Light scatter on site.

Artifact Type	No.
cores	0
primary flakes	4
secondary flakes	8
tertiary flakes	11

Raw Material	No.
basalt	23

Flake Measurements	N	$\bar{X}$	S
length	6	54.3	10.2
width	9	60.3	12.1
thickness	13	12.8	4.6
platform length	7	30.1	5.1
platform width	7	9.7	2.9

Tools - 0

The absence of cores and the high percentage (17.4%) of primary flakes suggest initial core reduction occurred on site but with later core removal. Probably, cores were removed to be used as future tool manufacturing units. Raw material was available at this site. These data suggest this locale was an initial reduction site with emphasis on obtaining tool production units for future use.

PH-202

Size: not recorded

Location: on the flats away from water. The view is good.

Nearest Raw Material: on site

Artifact Type	No.
cores	1
primary flakes	2
secondary flakes	21
tertiary flakes	24

Raw Material	No.
basalt	48

Flake Measurements	N	$\bar{X}$	S
length	13	66.2	13.4
width	13	71.2	20.7
thickness	25	15.7	5.9
platform length	18	26.1	7.6
platform width	24	10.2	5.0

Tools

1 bifacial fragment
1 end scraper

One core was recovered from this site; the flake scars have an irregular pattern and the core still had flake production capabilities. From the debitage it was not possible to reconstruct the core. Even though primary flakes were recovered, the above evidence suggests primary flake removal from the site. The presence of raw material on site suggest material acquisition as a site activity with removal of flakes to be used for future tool manufacture. The site appears to have been an initial core reduction locale. The presence of tools suggest possible tool manufacturing activities.

PH-203

Size: 2m diameter
Location: on the flats away from water. The view is good.
Nearest Raw Material: on site

Artifact Type	No.
cores	1
primary flakes	4
secondary flakes	11
tertiary flakes	3

Raw Material	
basalt	19

Flake Measurements	N	$\bar{X}$	S
length	8	104.1	47.6
width	8	92.2	24.3
thickness	8	27.3	19.4
platform length	-	-	-
platform width	-	-	-

Tools - 0

The debitage contained one core which had two secondary flakes removed from it; both flakes were present in the artifact assemblage. In addition, a nodule of basalt was reconstructed by piecing together 2 primary flakes and 5 secondary flakes. This nodule revealed that 4 secondary flakes, all having cortex covered platforms, were missing from the assemblage; they were probably selectively removed for future tool manufacturing. Tool production activities caused relatively high percentages of tertiary flakes to be present, the low percentage of tertiary flakes at this site suggests no tool manufacturing occurred. The above data plus the on-site availability of raw material indicate the site probably was a location where initial core reduction took place.

PH-204

Size: 5m diameter
Location: on the flats away from water. The view is good.
Nearest Raw Material: on site

Artifact Type	No.
cores	1
primary flakes	3
secondary flakes	9
tertiary flakes	18
heat fractures	3

Raw Material	No.
basalt	28
quartzite	5

Flake Measurements	N	$\bar{X}$	S
length	7	75.1	46.9
width	7	77.6	38.9
thickness	7	16.1	9.1
platform length	4	26.6	4.9
platform width	4	10.7	4.3

Tools

1 unidentified

One-half of a basalt nodule was reconstructed by piecing together 5 flakes from the assemblage. Two of the flakes were secondary flakes and three were heat fracture flakes indicating the use of fire to heat the nodule to facilitate flake production. The reconstructed nodule is missing one primary flake and one secondary flake. This suggests they were removed from the site. One primary flake was quartzite; the core was missing suggesting it was removed from the site. The tool was crude having edge retouch; use scars were not present. These data suggest PH-204 was an initial core reduction site where selected flakes were removed for future use.

PH-205

Size: 2m diameter
Location: along the western edge of a small gully that heads north into a seasonal drainage. If affords a clear view of the flat surface, but the drainage, to the north, cannot be seen.
Nearest Raw Material: on site

Artifact Type	No.
cores	2
primary flakes	0
secondary flakes	20
tertiary flakes	27

Raw Material	No.
basalt	49

Flake Measurements	N	$\bar{X}$	S
length	11	77.1	36.1
width	11	78.6	22.6
thickness	12	17.0	7.5
platform length	5	22.6	14.8
platform width	5	13.8	4.0

Tools - 0

Three cores were partially rebuilt from the debitage recovered. The results indicate that several primary and secondary flakes were removed. Because the view is partially restricted and raw material occurs on-site it is likely the site was not used as a lookout station. The evidence suggests this was an initial core reduction site.

PH-206

Size: not recorded
Location: assocation with a stone circle near the edge of the bench. The view of the lower elevations is good.
Nearest Raw Material: off-site, distance not recorded

Artifact Type	No.
cores	2
primary flakes	1
secondary flakes	11
tertiary flakes	9

Raw Material	No.
basalt	23

Flake Measurements	N	$\bar{X}$	S
length	7	77.9	15.1
width	7	119.5	29.1
thickness	7	23.8	20.7
platform length	1	21.5	-
platform width	1	19.3	-

Tools - 0

PH-206 was not a material procurement site because raw material was absent. The data suggest at leat one nodule of basalt or several cores were brought to this site for flaking. A core was partially reconstructed from the debitage; some secondary flakes, not found in the assemblage, were missing. They were chipped from the core elsewhere or were removed from PH-206 for future use. Site location near the bench edge affords a good view of the basin below. This, coupled with the fact that raw material was imported and that flaking debris is light indicates PH-206 was probably a lookout station. Occupation sites usually have much more chipped stone debris and have a high degree of tool variability (Carmichael 1977:228; Bettinger 1977:14); no tools were found at PH-206.

Because the stone circle was one of a group of rings, and the only one having artifacts associated with it, I believe that the stone structures and lithic debris represent different occupation periods. Basalt nodules were not used to construct the circles.

PH-207

Size: 5m diameter
Location: 50m west of a Cottonwood Creek tributary. The view was restricted
Nearest Raw Material: on site.

Artifact Type	No.
core	1
primary flakes	4
secondary flakes	10
tertiary flakes	2

Raw Material	No.
basalt	16
quartzite	1

Flake Measurements	N	$\bar{X}$	S
length	8	91.6	24.7
width	8	83.8	19.6
thickness	9	22.5	8.3
platform length	8	29.7	11.0
platform width	8	10.7	5.0

Tool - 0

The data suggest cores were brought to this location, then removed after some initial flaking. Twenty-four percent of the debitage was primary flakes - the highest percentage for any Polecat Bench site. In addition, the one quartzite artifact was a primary flake. This alone shows core movement to and from the site. For these reasons this site must be classified as an initial core reduction activitiy site.

PH-209

Size: not recorded
Location: associated with three stone rings along the Polecat Bench cliff face. The view of the basin is excellent.
Nearest Raw Material: on site

Artifact Type	No.
cores	3
primary flakes	0
secondary flakes	7
tertiary flakes	3

Raw Materal	No.
basalt	11
quartzite	2

Flake Measurements	N	$\bar{X}$	S
length	3	88.0	15.9
width	3	82.3	21.5
thickness	6	16.7	2.2
platform length	1	22.0	-
platform width	1	14.0	-

Tools - 0

Because of the pancity of artifacts PH-209 is difficult to interpret. On-site raw material availability suggests material acquisition activities and the absence of primary flakes may indicate removal of these artifacts. However, it is equally likely that prepared cores were brought to this site. Two of the cores, one each of basalt and quartzite, still had flake production capabilities; for this reason, I will suggest that prepared cores were not brought to the site and later abandoned. From the data available it is impossible to determine if the tipi rings and lithic debris were from the same occupation. All evidence indicates this site was a secondary core reduction activity location.

PH-210

Size: 10m x 50m
Location: along the cliff top overlooking a steep sided canyon. The view is excellent in all directions.
Nearest Raw Material: off-site, distance not recorded.

Artifact Type	No.
cores	2
primary flakes	2
secondary flakes	11
tertiary flakes	80

Raw Material	No.
basalt	73
chert	9
quartzite	10
obsidian	3

Flake Measurements	N	$\bar{X}$	S
length	5	42.0	20.0
width	6	23.9	17.7
thickness	25	5.8	3.8
platform length	20	12.2	6.1
platform width	20	4.1	3.6

Tools

3 side scrapers
1 spokeshave
1 projectile point

Other Diagnostic Artifacts

6 bifacial thinning flakes

Artifacts movement was very active at this site. Even though 4 raw materal types were represented, both collected cores were quartzite. One primary flake was quartizite and the other was basalt. All raw materials were imported to this site because they do not occur locally. These data suggest prepared cores (expecially obsidian and chert) were brought to the site and later removed; one would not necessarily expect to find obsidian or chert primary flakes because of the prized value of such material which necessitated continued reuse until use-life was exhausted. No bifacial tools were recovered, however, 6 bifacial thinning flakes - all basalt - were present. This indicates tool removal for latter use.

These data suggest site activities of tool maintenance and manufacture. The view from the cliff top was panoramic; excellent for observing game movement in the basin. PH-210 was probably a hunting camp.

PH-211

Size: 3m diameter
Location: on the flat bench top. The view is good in all directions.
Nearest Raw Material: on site

Artifact Type	No.
cores	5
primary flakes	0
secondary flakes	16
tertiary flakes	10

Raw Material	No.
basalt	31

Flake Measurements	N	$\bar{X}$	S
length	8	84.4	33.2
width	8	78.1	24.6
thickness	9	19.5	4.5
platform length	4	29.1	15.1
platform width	4	15.2	5.3

Tools

1 biface

Three of the five cores were capable of further flake production. This suggests prepared cores were not brought to the site and later abandoned, rather that on-site raw material was flaked. Primary flakes were probably removed from the chipping area. For these reasons I suggest PH-211 was an initial core reduction site. The presence of the bifacial thinning flakes indicates it was manufactured at another chipping locale. On-site use of the tool was not determined and the data suggest no reason for abandonment.

PH-212

Size: 10m x 50m
Location: near the cliff edge overlooking a steep-sided canyon. The view was excellent.
Nearest Raw Material: off-site, 200m in the canyon bottom.

Artifact Type	No.
cores	5
primary flakes	2
secondary flakes	23
tertiary flakes	44

Raw Material	No.
basalt	10
chert	21
quartzite	43

Flake Measurements	N	$\bar{X}$	S
length	12	59.8	30.9
width	12	48.8	22.9
thickness	19	12.3	9.8
platform length	14	18.2	11.6
platform width	15	7.6	5.0

Tools

1 spokeshave
1 hammerstone

This site is very similar to PH-210. They both were the largest sites from Polecat Bench, having the same site dimensions. At both sites raw material is offsite and the location near the cliff edge afforded an excellent view of the basin. The artifact assemblages are similar in most respects; having more than two raw material types, cores, primary flakes, and tools all being present, platform length and width measurements the lowest for Polecat Bench sites, and the only Polecat Bench spokeshaves both having been made of chert.

All cores and primary flakes were quartzite though no pieces fit together to form larger cores. This indicates that basalt and chert cores were removed. Cores of these two stone types were probably brought in prepared as no primary flakes of these raw materials were present. No tool maintenance production flakes were present.

These data suggest PH-12 was used as a hunting camp with possible tool manufacturing activities taking place.

Sites in the Acme Area

PH-106

Size: 10m diameter
Locations: near the cliff edge, 1.4 km from the Tongue River. Excellent view of the valley below.
Nearest Raw Material: off-site, 750m.

Artifact Type	No.
cores	1
primary flakes	0
secondary flakes	3
tertiary flakes	9

Raw Material	No.
porcellanite	11
chert	1
quartizite	1

Flake Measurements	N	$\bar{X}$	S
length	-	-	-
width	2	32.8	8.3
thickness	5	3.8	1.7
platform length	5	11.2	6.8
platform width	5	5.4	4.2

Tools

1 chopper
1 microblade

All raw material was imported to this site. The single core was porcellanite with no cortex present. It had no flake production capabilities. Because no primary flakes were recovered and both the chert and quartzite artifacts were tertiary flakes this suggests that prepared cores were brought to the site locale and later removed. The chopper was procellanite while the microblade was chert; both were broken. The evidence suggests that prehistoric hunters made maximum use of the site's location by occupying the site as a lookout station rather than a hunting camp.

PH-109

Size: 45m x 15m
Location: near the cliff edge, 1.2 km north of the Tongue River. Visibility was exellent, unbroken for 4 km.
Nearest Raw Material: off site, 0.8 km.

Artifact Type	No.
cores	1
primary flakes	1
secondary flakes	5
tertiary flakes	20

Raw Material	No.
porcellanite	26
chert	1

Flake Measurements	N	$\bar{X}$	S
length	-	-	-
width	-	-	-
thickness	16	4.6	2.4
platform length	7	7.7	2.8
platform width	9	3.5	1.9

Tools

2 endscrapers
1 knife
3 unidentified

Other Diagnostic Artifacts

1 bifacial thinning flake

The core recovered from this site was porcellanite and was exhausted as a flake production unit; no core reconstruction was possible. The presence of the primary flake suggests the importing of non-prepared cores. The one chert find was a broken knife, indicating possible on-site use before abandonment. All of the tools were broken. Because of the excellent view and the absence of raw material the data seemed to suggest PH-109 was a hunting/lookout site. Initial core reduction appears to have occurred.

PH-110

Size: 10m diameter
Location: below the ridge top at the head of a steep erosional cut which slopes down to the Tongue River, 1.1 km away. The view was restricted.

Nearest Raw Material: off site, 1.1 km

Artifact Type	No.
cores	2
primary flakes	0
secondary flakes	7
tertiary flakes	36

Raw Material	No.
porcellanite	44

Flake Measurements	N	$\bar{X}$	S
length	3	15.3	1.5
width	3	13.0	2.3
thickness	16	4.5	2.5
platform length	12	6.9	5.2
platform width	13	2.2	1.8

Tools

1 side scraper
1 graver
3 unidentified

Both cores had cortex remaining on their external surfaces (< 25%) and they were exhausted. One core was also a secondary flake. This seems to suggest that unprepared cores were imported. The absence of primary flakes suggests they were removed. All of the tools were broken indicating on-site use. Site activity probably included initial core reduction; the tools suggest hide and/or wood and bone working activities.

PH-111

Size: 15m x 7m
Location: below the ridge top at the hed of a steep erosional cut which slopes down to the Tongue River, 1.1 km away. The view is restricted.
Nearest Raw Material: off site, 1.1 km

Artifact Type	No.
cores	5
primary flakes	0
secondary flakes	8
tertiary flakes	43

Raw Material	No.
porcellanite	53
chert	2
quartzite	1

Flake Measurements	N	$\bar{X}$	S
length	12	29.5	10.9
width	12	32.9	7.2
thickness	22	6.0	3.3
platform length	20	10.4	5.6
platform width	20	3.8	3.3

Tools

4 side scrapers
3 end scrapers
1 graver
1 graver/scraper
9 unidentified

Three types of raw material were brought to this location, however, the cores are of porcellanite (4) and quartzite (1). This suggests two types of artifact movement: 1) that chert core(s) were brought in and removed and 2) that quartzite flakes - if produced on-site - were removed. Four of the cores appear to have initial flake removal away from PH-111, while one porcellanite core with 50 percent cortex remaining was brought as an unprepared nodule. The absence of primary flakes suggests they were removed.

Thirty-two percent of the artifacts were tools, a high percentage of the debitage. PH-111 was similar in many respects to PH-110, located 50 m away. The similar tool assemblages suggest similar site activities occurred; e.g., hide and/or wood and bone preparation. Initial and secondary core reduction appears to have taken place.

PH-113

Size: 10m diameter

Location: near the cliff edge. The view of the Tongue River valley was excellent.
Nearest Raw Material: off site, 0.8 km.

Artifact Type	No.
cores	3
primary flakes	0
secondary flakes	1
tertiary flakes	16

Raw Material	No.
porcellanite	16
chert	1
quartzite	2

Flake Measurement	N	$\bar{X}$	S
length	6	38.4	14.4
width	7	38.3	22.8
thickness	7	9.4	6.9
platform length	4	16.0	2.9
platform width	5	7.5	4.6

Tools

2 side scrapers
1 spokeshave
1 chopper
2 unidentified

All of the cores were porcellanite indicating that chert and quartzite cores were imported and removed. Because the cores lack cortex suggests that prepared cores were brought to the site; in fact, one core was also a tertiary flake. The absence of primary flakes further supports this. None of the tools were broken which suggests they were not intended for future use; whether or not they were used on site cannot be determined. Site activity includes secondary core reduction.

Because of the elevated location the site may have functioned as a hunting/lookout station.

PH-116

Size: 5m diameter
Location: near a cliff edge overlooking Youngs Creek. Visibility unbroken for 2.5 km to the southwest.
Nearest Raw Material: off site, 200m.

Artifact Type	No.
cores	1
primary flakes	1
secondary flakes	0
tertiary flakes	14

Raw Material	No.
porcellanite	15
quartzite	1

Flake Measurements	N	$\bar{X}$	S
length	2	28.0	6.0
width	5	24.7	12.5
thickness	9	6.7	4.3
platform length	6	8.9	4.8
platform width	6	4.6	3.8

Tools

2 bifaces
2 sidescrapers
2 unidentified

Other Diagnostic Artifacts

1 bifacial thinning flake

The presence of one quartzite tertiary flake suggests quartzite cores were imported to the site and later removed. The core was exhausted but had cortex remaining on 75 percent of its surface. This core was probably brought to the site in its raw form. The lack of secondary flakes may suggest removal of these flakes.

All of the tools were broken, indicating possible on-site use or manufacture. The presence of the bifacial thinning flake suggests tool maintenance activities occurred.

Because of the excellent view, I believe this site was used as a hunting/lookout locale. The data indicate raw material was brought to the site for tool manufacture and maintenance.

PH-117

Size: 20m x 10m
Location: in a swale near a cliff edge. This location afforded an excellent view of the Tongue River valley.
Nearest Raw Material: off site, 0.4 km

Artifact Type	No.
cores	2
primary flakes	0
secondary flakes	4
tertiary flakes	37

Raw Material	No.
porcellanite	40
chert	1
quartzite	2

Flake Measurements	N	$\bar{X}$	S
length	8	35.3	14.2
width	12	27.4	11.0
thickness	23	5.1	2.5
platform length	9	7.6	4.2
platform width	9	2.1	1.2

Tools

3 side scrapers
1 projectile point
1 biface
3 unidentified

Although three raw material types were recovered, both cores were porcellanite. The non-porcellanite artifacts consist of one chert tertiary flake, one quartzite tertiary flake, and a side scraper made of quartzite; all were broken. This indicates that prepared cores of chert and quartzite were brought to this location and later removed.

The absence of primary flakes supports this suggestion that only prepared cores were brought to the site. Both cores had their flake production capabilities exhausted and no cortex remained on either one.

All the tools were broken indicating possible on-site use. The projectile point was a Late Plains Period side-notched variety.

These data suggest that tool manufacturing activities occurred at PH-117. There was no evidence to indicate anything but temporary occupation. The absence of bone suggests the site was not a kill site. Because of the elevated location with an excellent view I suggest PH-117 was a hunting/lookout site.

PH-118

Size: 10m x 5m
Location: near a cliff edge overlooking Youngs Creek and the Tongue River valley.
Nearest Raw Material: off site, 0.4 km

Artifact Type	No.
cores	2
primary flakes	2
secondary flakes	10
tertiary flakes	112

Raw Material	No.
porcellanite	78
chert	39
chalcedony	3
quartzite	6

Flake Measurements	N	$\bar{X}$	S
length	20	18.6	7.5
width	37	16.9	9.6
thickness	56	3.3	2.3
platform length	39	6.7	4.0
platform width	41	2.3	1.6

Tools

2 bifaces
2 microblades
1 uniface
1 end scraper
1 spokeshave
1 graver
1 graver/scraper
1 projectile point
1 knife
11 unidentified

Other Diagnostic Artifacts

5 bifacial thinning flakes

Four types of raw material were recovered but the two cores recovered were porcellanite and both primary flakes were chert. The cores were exhausted and had 25 percent and 80 percent cortex remaining respectively. All of the chalcedony and quartzite pieces were tertiary flakes. Since raw material does no occur on-site, these data suggest that unprepared nodules of porcellanite and chert were brought to the site, while only prepared cores of chalcedony and quartzite were imported.

The presence of bifacial thinning flakes suggests tool maintenance activities occurred. The high degree of tool variability suggests PH-118 was more than a base-camp (Bettinger 1977:14; Carmichael 1977: 228). However, no structural or faunal debris were found.

PH-119

Size: 7m diameter
Location: near a cliff edge. The view of the Tongue River valley was excellent.
Nearest Raw Material: off site, 0.4 km

Artifact Type	No.
cores	0
primary flakes	0

secondary flakes	0
tertiary flakes	26

Raw Materal	No.
porcellanite	22
chert	2
quartzite	2

Flake Measurements	N	$\bar{X}$	S
length	2	16.3	7.5
width	6	20.9	8.6
thickness	10	2.8	1.2
platform length	5	7.4	5.0
platform width	6	2.4	1.3

Tools

1 side scraper
1 unidentified

Because only tertiary flakes were recovered this suggests that only prepared cores were brought to the site. These were removed at site abandonment. Because of this and the excellent view I suggest this site was utilized as a hunting/lookout location.

PH-120

Size: 5m diameter
Location: near a cliff edge. The view of the Tongue River valley was excellent.
Nearest Raw Material: off site, 0.4 miles

Artifact Type	No.
cores	0
primary flakes	3
secondary flakes	0
tertiary flakes	63

Raw Material	No.
porcellanite	37
chert	15
chalcedony	1
quartzite	13

Flake Measurements	N	$\bar{X}$	S
length	5	22.9	17.1
width	13	16.3	6.3
thickness	21	3.6	3.6
platform length	12	5.9	4.8
platform width	13	2.5	3.0

Tools

1 unidentified

Other Diagnostic Artifacts

2 bifacial thinning flakes

The absence of cores suggests they were removed from the site. In addition, because two primary flakes were porcellanite and one was chert this indicates that unprepared nodules of these two raw materials were imported. All the chalcedony and quartzite flakes were tertiary suggesting they were removed from prepared cores. The two bifacial thinning flakes suggest tool maintenance activities occurred; one was chert and the other quartzite indicating the raw material of two tools removed from the site locale. The elevated location may indicate the site was used as a hunting/lookout station.

PH-123

Size: 10m x 5m
Location: near a cliff edge overlooking the Tongue River valley. The view was excellent.
Nearest Raw Material: off site, acorss river 0.5 km

Artifact Type	No.
cores	2
primary flakes	2
secondary flakes	2
tertiary flakes	17

Raw Material	No.
porcellanite	16

chert	5
quartzite	2

Flake Measurements	N	$\bar{X}$	S
length	8	31.9	10.5
width	12	29.1	9.1
thickness	12	6.8	2.8
platform length	7	10.9	9.7
platform width	7	3.6	2.4

Tools

1 side scraper
1 graver
1 graver/scraper
4 unidentified

Both cores recovered were chert; one had 30 percent cortex remaining, the other was 65 percent cortex covered. One primary flake was porcellanite and the other was quartzite; no chert primary flakes were recovered. These data suggest several things: 1) unprepared chert nodules were brought in and abandoned; 2) chert primary flakes were generated on-site and removed, and; 3) prepared cores of porcellanite and quartzite were brought in and removed after some initial core reduction activity.

All of the tools were complete except two unidentified ones. The identitied tools are associated with wood and/or bone working activities. Use scars are present on these tools and may indicate on-site activities. Because of the excellent view obtained from the site location, PH-23 may have functioned as a hunting/lookout locale.

PH-124

Size: 15m x 10m
Location: on a 18 percent slope, elevated 12m above the Tongue River. Visibility is restricted by forest.
Nearest Raw Material: off site, across river 1.1 km

Artifact Type	No.
cores	3
primary flakes	0
secondary flakes	1
tertiary flakes	32

Raw Material	No.
porcellanite	34
quartzite	2

Flake Measurements	N	$\bar{X}$	S
length	10	34.2	10.6
width	16	32.7	7.1
thickness	18	10.2	9.3
platform length	12	7.7	5.4
platform width	12	3.7	3.0

Tools

1 uniface
1 side scraper
1 end scraper
1 graver
1 knife
1 unidentified

All of the cores were porcellanite; one still had flake production capabilities. None of them had cortex remaining. This, and the fact that no primary flakes were recovered, suggests that prepared cores of porcellanite were imported and abandoned after secondary core reduction occurred and that prepared quartzite cores were imported and later removed. The high degree of tool variability suggests PH-124 may have been an occupation site.

PH-125

Size: 20m x 17m
Location: near a cliff edge overlooking the Tongue River valley. The view of the valley is excellent.
Nearest Raw Material: off site, across river

Artifact Type	No.
cores	0
primary flakes	1
secondary flakes	11
tertiary flakes	31

Raw Material	No.
porcellanite	26
chert	16
quartzite	1

Flake Measurements	N	$\bar{X}$	S
length	13	33.2	11.7
width	19	29.0	11.2
thickness	25	6.7	4.0
platform length	20	10.1	6.3
platform width	20	3.7	2.1

Tools

3 end scrapers
1 baface
5 unidentified

Other Diagnostic Artifacts

1 bifacial thinning flake
1 unifacial thinning flake

The single primary flake was chert. Because no cores were recovered these data suggest that cores were imported to the site and later removed. The chert core was unprepared while those of porcellanite and quartzite were prepared cores. Bifacial and unifacial thinning flakes indicate tool maintenance activities. The site may have functioned as a hunting/lookout locale.

PH-126

Size: 15m diameter
Location: near a cliff edge. View of the Tongue River valley, both upstream and downstream was excellent.
Nearest Raw Material: off site, across river 1.2 km

Artifact Type	No.
cores	1
primary flakes	0
secondary flakes	2
tertiary flakes	55

Raw Material	No.
porcellanite	46
chert	5
quartzite	7

Flake Measurements	N	$\bar{X}$	S
length	8	35.1	17.6
width	13	27.1	8.8
thickness	26	6.2	4.5
platform length	18	9.5	6.3
platform width	19	4.1	2.4

Tools

2 side scrapers
1 biface
1 uniface
1 spokeshave
1 graver
1 microblade
1 unidentified

Primary flakes were not recovered and the single core was porcellanite; it had been prepared. This suggests that prepared cored of all three raw materials were brought to the site and later removed. The view of the Tongue River valley was excellent indicating possible site use as a hunting/lookout locale. However, the high degree of tool variability suggests the site may have been a base-camp (Bettinger 1977: 14; Carmichael 1977:228).

PH-128

Size: 10m diameter
Location: on the flat open plain
Nearest Raw Material: off site

Artifact Type	No.
cores	1
primary flakes	0
secondry flakes	1
tertiary flakes	12

Raw Material	No.
porcellanite	14

Flake Measurements	N	$\bar{X}$	S
length	-	-	-
width	2	19.5	10.5
thickness	4	4.1	2.1
platform length	4	8.3	4.2
platform width	4	2.8	1.8

Tools

2 side scrapers
1 blade
2 unidentified

The data suggest that prepared cores were imported to this site. This is suggested because: 1) no primary flakes were recovered and 2) the core was exhausted and had no cortex present. All the tools were broken indicating possible on-site use.

PH-129

Size: 7m diameter
Location: at the head of a draw which leads to a Tongue River side canyon. The view of the canyon was restricted, but to the southeast the view of the open plain was good.
Nearest Raw Material: off site, 1.2 km

Artifact Type	No.
cores	2
primary flakes	1
secondary flakes	2
tertiary flakes	49

Raw Material	No.
porcellanite	53

Flake Measurements	N	$\bar{X}$	S
length	3	39.5	23.4
width	5	26.8	14.6
thickness	9	6.5	4.9
platform length	9	14.6	12.4
platform width	9	5.8	3.6

Tools

1 uniface
1 graver
1 knife
4 unidentified

Both cores were exhausted of their flake production capabilities; one was also the primary flake. This indicates that at least one prepared core and one primary flake were imported to the site for tool manufacturing; both were abandoned on-site. All the tools were broken except the knife. This suggests possible on-site use of the tools and abandonment when broken.

PH-132

Size: 15m x 10m
Location: near a cliff edge overlooking the Tongue River valley. The view of the valley was good.
Nearest Raw Material: off site, 0.4 km

Artifact Type	No.
cores	5
primary flakes	3
secondary flakes	12
tertiary flakes	86

Raw Material	No.
porcellanite	96
chert	10

Flake Measurements	N	$\bar{X}$	S
length	21	32.3	10.8
width	28	27.7	9.8
thickness	41	7.2	4.5

platform length	28	12.8	6.2
platform width	32	4.9	3.0

Tools

3 bifaces
2 side scrapers
1 end scrapers
1 graver
1 unidentified

Other Diagnostic Artifacts

1 bifacial thinning flake

The cores recovered were all porcellanite; no cortex was present on any of them and all flake production capabilities were exhausted. The primary flakes were made from chert. These data suggest that unprepared chert nodules were brought to the site and removed after some flake production activities. The presence of the bifacial thinning flake indicates tool maintenance activities. Because of the elevated location, PH-132 may have been used as a hunting/lookout site.

PH-133

Size: 5m diameter
Location: near a cliff edge overlooking the Tongue River valley. The view of the valley was excellent.
Nearest Raw Material: off site, 0.9 km

Artifact Type	No.
cores	1
primary flakes	0
secondary flakes	5
tertiary flakes	12

Raw Material	No.
porcellanite	16
quartzite	2

Flake Measurements	N	$\bar{X}$	S
length	4	29.0	11.7
width	5	24.9	3.5

thickness	6	6.6	2.9
platform length	4	12.6	7.4
platform width	4	4.4	3.5

Tools

3 end scrapers
1 uniface
1 unidentified

The absence of primary flakes and the fact that the porcellanite core was partially prepared suggests that only prepared cores were brought to the site and abandoned when exhausted, otherwise they were removed. The two quartzite secondary flakes were taken from a partially prepared core that was removed when the site was abandoned. Two of the side scrapers and the unidentified flake had over 50 percent cortex remaining on their dorsal surface. They were crudely manufactured suggesting possible hasty on-site manufacture and use. Becasue of the elevated location, PH-133 may have functioned as a hunting/lookout site.

PH-134

Size: 15m x 10m
Location: near a cliff edge overlooking the Tongue River valley. The view of the valley is good.
Nearest Raw Material: off site, 0.9 km

Artifact Type	No.
cores	1
primary flakes	0
secondary flakes	2
tertiary flakes	35

Raw Material	No.
porcellanite	36
quartzite	2

Flake Measurements	N	$\bar{X}$	S
length	9	31.9	10.5

width	13	29.6	10.2
thickness	17	6.1	2.3
platform length	13	10.3	4.7
platform width	12	4.3	2.9

Tools

1 end scraper
1 spokeshave
5 unidentified

The one core recovered was made from porcellanite. It was a single platform core with many parallel flakes scars; it was an exhausted microblade production unit. No microblade tools were recovered indicating that they were removed from the site. The data suggest that prepared cores were imported; tool making cores were exhausted on-site while other cores were removed. The elevated location suggests possible site use as a hunting/lookout station.

PH-135

Size: 20m x 10m
Location: near a cliff edge about 7 meters above the Tongue River valley. The view is limited to 200 meters upstream or downstream.
Nearest Raw Material: off site, 1.2 km

Artifact Type	No.
cores	4
primary flakes	0
secondary flakes	1
tertiary flakes	10

Raw Material	No.
porcellanite	12
quartzite	3

Flake Measurements	N	$\bar{X}$	S
length	3	41.3	12.2
width	4	33.6	6.9
thickness	5	8.0	3.3
platform length	4	12.6	5.7
platform width	4	5.8	4.9

Tools

1 uniface
1 spokeshave

Three porcellanite and one chert cores were recovered. The absence of primary flakes and the fact that two cores have no cortex while the other two have less than 25 percent cortex remaining suggests that prepared cores were imported. One core still having flakes production capabilities was abandoned. The low flake/core ratio (2.75) suggests: 1) little flake production per core unit, or: 2) a large amount of flake removal.

PH-137

Size: 5m diameter
Location: on the flats in a Tongue River side canyon. The view was restricted in all directions.
Nearest Raw Material: on site

Artifact Type	No.
cores	0
primary flakes	0
secondary flakes	2
tertiary flakes	14

Raw Material	No.
porcellanite	16

Flake Measurements	N	$\bar{X}$	S
length	6	48.8	20.1
width	6	44.3	11.6
thickness	8	11.1	4.1
platform length	5	13.8	8.5
platform width	5	5.2	1.3

Tools

1 bifaces
1 side scraper
3 unidentified

Nodules of porcellanite was scattered across the canyon near PH-137; raw material was readily available. The lack of cores and primary flakes suggests removal of these artifacts after some initial core reduction. The high percentage of tools (one biface, the side scraper and the two unidentifieds were not broken) suggests that they may have been manufactured on-site. There was no conclusive evidence as to why they were present. The site probably functioned as a material acquisition locale.

PH-138

Size: 7m diameter
Location: on a small hillock overlooking the Tongue River. The view was restricted by vegetation.
Nearest Raw Material: off site, 100m

Artifact Type	No.
cores	3
primary flakes	0
secondary flakes	4
tertiary flakes	54

Raw Material	No.
porcellanite	61

Flake Measurements	N	$\bar{X}$	S
length	10	29.6	8.4
width	13	26.2	11.6
thickness	23	5.6	2.5
platform length	15	11.0	4.9
platform width	15	4.3	2.3

Tools

2 side scrapers
2 knives
1 biface
1 unidentified

Other Diagnostic Artifacts

1 unifacial thinning flake

Two of the cores recovered still had flake production potential. None of the cores had cortex on their surface. This along with the fact that no primary flakes were recovered suggests that prepared cores were brought to PH-138 and abandoned after the desired artifact was produced or when the core was exhausted as one was. All of the tools except one side scraper were broken, suggesting on-site use or manufacture.

PH-140

Size: 5m diameter
Location: on the flat open plain. Visibility was good in all directions.
Nearest Raw Material: off site, 1.2 km

Artifact Type	No.
cores	1
primary flakes	3
secondary flakes	5
tertiary flakes	8

Raw Material	No.
porcellanite	17

Flake Measurements	N	$\bar{X}$	S
length	7	75.6	26.1
width	8	56.1	12.5
thickness	8	12.5	4.4
platform length	7	21.0	11.7
platform width	8	8.9	4.3

Tools

4 knives
1 side scraper
1 graver
1 graver/scraper

The core had less than ten percent cortex covering suggesting that it was imported partially prepared. The three primary flakes are from different cores suggesting they were brought as potential cores or tools

(one knife was also a primary flake). It seems unlikely that PH-140 was a hunting/lookout locale; less than 75m east was a small hillock which would have served this purpose much better. Knives represent 24 percent of the artifact assemblage which suggests butchering activities. However, this was not substantiated because no faunal remains were present. Three of the knives were unbroken. PH-140 was difficult to classify because the only evidence for site activity comes from associated tools which may or may not have been used on-site.

PH-144

Size: 15m diameter
Location: near a cliff overloooking the Tongue River valley. The view of the valley was excellent.
Nearest Raw Material: off site, 200m

Artifact Type	No.
cores	1
primary flakes	0
secondary flakes	3
tertiary flakes	25

Raw Material	No.
porcellanite	28
chert	1

Flake Measurements	N	$\bar{X}$	S
length	6	55.6	27.4
width	5	43.0	15.6
thickness	10	9.1	3.6
platform length	7	18.1	7.1
platform width	11	6.5	3.2

Tools

2 spokeshave
1 graver
1 knife
1 blade
3 unidentified

The core was porcellanite and all flake production capabilities were exhausted. Because no primary flakes were recovered, these data suggest that prepared cores were imported. All the tools except the spokeshave were broken suggesting on-site use or manufacture. The excellent view of the Tongue River valley suggests the site may have been used as a hunting/lookout site.

PH-148

Size: 5m diameter
Location: on the open plain. Visibility in all directions was good.
Nearest Raw Material: off site, 2.3 km

Artifact Type	No.
cores	1
primary flakes	0
secondary flakes	3
tertiary flakes	18

Raw Material	No.
porcellanite	21
quartzite	1

Flake Measurements	N	$\bar{X}$	S
length	1	63.0	0
width	2	42.5	8.5
thickness	6	9.5	5.0
platform length	9	20.6	12.0
platform width	9	12.1	13.8

Tools

3 knives
1 uniface
1 endscraper
1 spokeshave
1 graver
1 unidentified

The core was a prepared porcellanite core with no flake production capabilities remaining. The single quartzite artifact was a secondary

flake with a cortex-free striking platform. These data suggest that prepared cores were brought to the site. The high tool variability suggest PH-148 may have been a camp (Bettinger 1977:14; Carmichael 1977:228).

CHAPTER V

DATA COMPARISON AND CONCLUSIONS

An important component of the field and laboratory work involved with this thesis is the development of a useful site classification model that can be used in the field. This is important because many Federal agencies are now requiring a non-collection policy for all archaeological surveys. Such a classificatory scheme must be general enough to allow ease of use but still provide useful information about artifact type, density, and patterning. I previously discussed several site typologies recently used on the Northern Plains (Beckes 1976; Fox 1977a, 1977b; Fredlund 1977; Gregg 1977c). The collective shortcomings of these typologies are that they are vague and non-reproducable speculation based on what can be misleading information (see discussion, chapter 2). For these reasons, those typologies are inadequate for identifying on-site activities and associated human behavior.

The model used for this thesis, like the others, is to be applied to data derived from lithic assemblages. It is one, however, that is based on waste debitage rather than one which identifies numbers of tools and their functions. By identifying primary, secondary, and tertiary flakes from the artifact assemblages it becomes possible to identify the stage of core reduction and flaking activity. Hence, a site can be designated as having: (1) initial core reduction; (2) secondary core reduction; and/or (3) tool manufacture and maintenance activities taking place. Table 1 is a summary of site classification based on debitage analysis for those sites having reasonable sample sizes (a reasonable sample size is one having 5 measurable

Table 1 - Core Reduction Activity at
Sites Having Flake Length/Width Ratio Measured

Site	Initial Core Reduction	Secondary Core Reduction	Tool Manufacture and Maintenance
PH-201	x		
202	x		
203	x		
204	x		
205	x		
206	x	x	
211	x		
212		x	x

Initial Core Reduction = 75%
Secondary Core Reduction = 25%
Tool Manufacture & Maintenance = 12.5%

Site	Initial Core Reduction	Secondary Core Reduction	Tool Manufacture and Maintenance
PH-111	x	x	x
113		x	
117		x	x
118	x	x	x
123	x	x	
124		x	
125	x	x	
126		x	
132	x		x
134		x	x
137	x		
138		x	x
140		x	

Initial Core Reduction = 46%
Secondary Core Reduction = 85%
Tool Manufacture & Maintenance = 46%

flakes). Table 2 identifies artifact movement to and from sites. Important to the model is the identification of the on-site presence or absence of raw material. If no raw material is present, it is important to note at what reduction stage the material was brought in; e.g. (1) as nodules; (2) as prepared cores; or (3) as primary flakes.

Tools can be useful in determining site classification if one is looking for numbers of tool categories rather than total numbers of tools (Carmichael 1977). This is assuming that base camps will have more tool types present than other sites because of more varied activities taking place.

A model such as the one presented here is beneficial and useful because it is derived from data obtained from the actual remains of flaking behavior - the waste debitage. These data do not suggest that tools were used where archaeologists find them, it does, however, indicate core reduction stage and local raw material movement and possible on-site behavior associated with these activities.

Raw Material

Table 3 shows the distribution of raw material at each site as a percentage of the total sample of artifacts. These date indiate a strong preference for the use of certain local stone types for tool manufacture. Basalt is very common on Polecat Bench and was readily used by prehistoric groups. It was neither available nor present in the Acme area. Porcellanite, however, does not naturally occur on Polecat Bench as it does along the buttes of the Tongue River. This material was not found at sites on the bench. Chert and Quartizite were available in both areas; in Tongue River gravel deposits

Table 2 - Artifact Movement

Site	Nodules in	Nodules out	Cores in	Cores out	Primary Flakes in	Primary Flakes out	Secondary Flakes in	Secondary Flakes out
PH-201				x				
202						x		
203								x
204						x		x
205						x		x
206	x							x
207				x				
209				x				
210			x	x				
211						x		
212	x		x	x				
	18%		18%	45%		36%		36%

Site	Nodules in	Nodules out	Cores in	Cores out	Primary Flakes in	Primary Flakes out	Secondary Flakes in	Secondary Flakes out
PH-106			x	x				
109	x		x	x				
110	x					x		
111	x		x	x		x		
113			x	x				
116	x		x					
117			x	x				
118	x		x					
119			x					
120	x		x	x				
123	x		x	x		x		
124			x	x				
125	x		x	x				
126			x	x				
128			x					
129			x		x			
132	x		x	x				
133			x					
134			x	x				
135			x					
137				x		x		
138			x					
140			x		x			
144			x					
148			x					
	36%		92%	52%	8%	16%		

Table 3 - Percentage
Frequencies of Raw Material

Site	N	Porcellanite	Chert	Chalcedony	Quartzite	Obsidian	Basalt
PH-201	23	-	-	-	-	-	100
202	49	-	-	-	-	-	100
203	19	-	-	-	-	-	100
204	30	-	-	-	17	-	83
205	51	-	-	-	-	-	100
206	23	-	-	-	-	-	100
207	17	-	-	-	6	-	94
209	19	-	-	-	11	-	89
210	95	-	9	-	11	3	77
211	31	-	-	-	-	-	100
212	74	-	28	-	58	-	14
PH-106	13	84	8	-	8	-	-
109	27	96	4	-	-	-	-
110	59	100	-	-	-	-	-
111	56	95	3	-	2	-	-
113	19	84	5	-	11	-	-
116	16	94	-	-	6	-	-
117	43	93	2	-	5	-	-
118	126	62	31	2	5	-	-
119	26	84	8	-	8	-	-
120	66	56	23	1	20	-	-
123	23	70	22	-	9	-	-
124	36	94	-	-	6	-	-
125	43	60	37	-	3	-	-
126	58	79	9	-	12	-	-
128	14	100	-	-	-	-	-
129	53	100	-	-	-	-	-
132	106	91	9	-	-	-	-
133	18	89	-	-	11	-	-
134	38	95	5	-	-	-	-
135	15	80	20	-	-	-	-
137	16	100	-	-	-	-	-
138	61	100	-	-	-	-	-
140	17	100	-	-	-	-	-
144	29	97	3	-	-	-	-
148	22	95	-	-	5	-	-

and in gravel beds on Polecat Bench. Obsidian, collected from site PH-210, was imported; probably from deposits in Yellowstone National Park. These data suggest that raw material procurement involved exploitation of local sources. It is unlikely that raw material movement took place between these groups.

To determine if raw material flaking characteristics were different for the two study areas the mean length/width ratio was taken for each artifact in the assemblages. This measure standardizes the mean artifact size. The ratios are shown in Table 4 for those sites having an adequate sample size.

If flaking behavior is different for the two areas, then this should be indicated by comparing the length/width ratios of the two assemblage pupulations. A Mann-Whitney test was used to determine if the length/width ratios show a relationship between the assemblages. For this test, where N_1=13 and N_2=8, U=19. At the 0.05 level of significance the critical value for rejecting the null hypotheses (that the samples are from the same population) is anything lower than U=24 (Blalock 1972;566). Clearly, this figure shows that flake production differences exist between Polecat Bench and the Acme area. Assuming that my site categories are correct, and that there are differences between the length/width ratios of the assemblages, what is responsible for the difference?

To test this assumption, I compared the length/width ratios for only those sites that have the initial core reduction stage present. Table 5 shows those sites. These data suggest there is a difference in flake shapes between the two assemblages based on core reduction

Table 4 - Flake
Assemblage Length/Width Ratios

Site	N	Length/Width
PH-201	6	0.90
202	13	0.93
203	8	1.13
204	7	0.97
205	11	0.98
206	7	0.65
211	8	1.08
212	12	1.23
PH-111	12	1.23
113	6	0.95
117	8	1.29
118	20	1.10
123	8	1.10
124	10	1.05
125	13	1.14
126	8	1.30
132	21	1.17
134	9	1.08
137	6	1.10
138	10	1.13
140	7	1.33

U=19

Table 5 - Length/Width Ratio Comparison of Initial Core Reduction Sites

Site	Length/Width
PH-201	0.90
202	0.93
203	1.13
204	0.97
205	0.98
211	1.08
PH-111	1.23
118	1.10
123	1.10
125	1.14
132	1.17
137	1.10

U=3
p=.007

stage. The Mann-Whitney score where U=3 and p=0.007 is significant at the 0.05 level of significance indicating that there is a difference in the samples; hence, they are from different population. These results suggest that my site categories are incorrect.

If my site classification is correct and flake shape differences are not related to the core reduction stage, the determining factor could be the raw material type. From Tables 1 and 3,it can be given that initial core reduction sites plus basalt yield the broadest flakes (low length/width ratio) and that final core reduction plus siliceous stone yield the longest flakes (high length/ width ratio). Table 6 shows a comparison of length/width ratios for 100 pecent basalt and siliceous stone collections. This comparison suggests that raw material is a factor in determining flake size. The Mann-Whitney T-test score of U=2 and p=0.008 is significant at the 0.05 level. Again, this indicates that the two artifact samples are from different populations. It appears then, that raw material is an important factor involved in flake size differences.

By taking this argument one step further and comparing the length/ width ratios for Acme sites that have some initial core reduction with the non-initial core reduction Acme sites, no difference is indicated (Mann-Whitney test: U=18, p=.36). Table 7 shows these comparisons. The three highest length/ width ratios appear at noninitial core reduction sites (1.29, 1.30. and 1.33) but, so do the three lowest (0.95, 1.05, and 1.08). The statistics show there is no difference in sample populations; however, why the wide range of variability in the non-initial core reduction site assemblages? This suggests that core

Table 6 - Length/Width Ratio Comparison of 100 Percent Basalt and Siliceous Stone Collections

Basalt		Siliceous	
Site	Length/Width	Site	Length/Width
PH-201	0.90	PH-132	1.17
202	0.93	134	1.08
203	1.13	137	1.10
205	0.98	138	1.13
206	0.65	140	1.33
211	1.08		

U=2
p=.008

Table 7 - Length/Width Ratio Comparison of Initial Core Reduction with Non-initial Core Reduction Acme Sites

Initial Core Reduction		Non-initial Core Reduction	
Site	Length/Width	Site	Length/Width
PH-111	1.23	PH-113	0.95
118	1.10	117	1.29
123	1.10	124	1.05
125	1.14	126	1.30
132	1.17	134	1.08
137	1.10	138	1.13
		140	1.33

U=18
p=.36

reduction stage does not reflect a pattern in flake size.

This conclusion contradicts my earlier comparison that suggests a pattern in length/width ratios based on raw material type for initial core reduction sites.

A partial explanation for the lack of statistical reference to illustrate length/width ratio differences is that the sample sizes are very small, hence, sampling error may be present. Had the artifact assemblages been larger, it is likely that a pattern would have emerged. There is an alternative explanation that may help explain the differences in core reduction stage patterning.

Recent research by Munday (1978) provides another possible explanation for the length/width ratio differences. He has shown from work with Mousterian sites in the Negev of Israel that inter-level and intra-site differences in length/width ratios occur. At Nahal Aqev, a temporal sequence of length/width ratios occurs. The lowest levels produce relatively broad flakes while the middle levels have the longest. The most recent deposits have the broadest flakes. Ratios from other temporally contemporary Mousterian sites in the Negev have been compared with these data and a correlation exists between length/width ratios and temporal association. The sequence of lengh/width radio change also coincides with environmental change. As the area became moister and cooler (increased productivity) flakes became longer; as the area became dryer (less productive) broader flakes are dominant. What this may mean in terms of technological change is that in more productive environemtns more time is released for creative activities. The opposite is true for less productive areas. As a result, technologi-

cally sophisticated flaking techniques producing longer flakes are present in the artifact assemblages from more productive areas.

This research has special significance for northern Wyoming because the same dry-moist-dry sequence occured in this area prehistorically. Of additional significance, the concept of high productivity yielding longer flakes can apply to temporally contemporary areas having different productivity levels. This may be the case for the data presented in this thesis. The Polecat Bench has a harsh desert environment. The average annual precipitation is ca. 15 cm. The Acme area receives an average of 31 cm of yearly precipitation. Reflecting upon Munday's research, I would hypothesize that the difference between the lengh/width ratios for the assemblages from my two study areas may additionally be a reflection of the differential productivity of the two areas; i.e., the inhabitants of the Polecat Bench were putting more time into subsistence activities and less time into tool manufacture and maintenance as compared to the inhabitants of the Acme area. A direct result of these different time outlays would be a production of broader artifacts where less time was put into tool manufacture. This difference would not be apparent for sites within the same productivity zone as is shown in Table 7; providing, of course, that those sites are of the same age.

Conclusions

Results of the data are encouraging and suggest that the site typology used for this research is practical for studies in Northern Plains prehistory. This typology is more useful than others previously used in

this area (Beckes 1976; Fox 1977a, 1977b; Fredland 1977; Gregg 1977) for several reasons. First of all, a sound data base is employed. By using waste debitige it becomes possible to define and measure artifact attributes if collections are made. These attributes result from core reduction and/or tool manufacturing and maintenance processes. Flake attributes are explicitely defined and the observations can be repeated by other field workers.

Secondly, if a non-collection policy is required, this system is flexible enough to be applied in the field. As a result, systematic observation of lithic assemblages can take place at the field level. This will meet the requirements of contracts calling for a non-collection policy and will meet the needs of archaeologists wishing to identify on-site site flaking behavior.

Northern Plains archaeology lags far behind studies in other areas of the United States. With the recent interest in energy development in Montana and Wyoming this is changing. Archaeologists will be developing new research goals for the area. I have hypothesized a relationship between debitage shape and time spent on subsistence acitvities for the Polecat Bench and Acme, Wyoming areas. Evidence needs to be gathered before such a hypothesis can be accepted. The data I presented tentatively suggest that flake lenth/width ratio differed from the two study areas. There does appear to be a relationship between flake shape and the site type. However, some room for discussion is present. Other factors must be involved. I suggested Munday's model which is based on a causal relationship between environmental productivity and resulting changes in subsistence activities and debitage shape.

This thesis specifically looked at the small surface sites which to date have not been adepnately considered in Northern Plains archaeological interpretation and explanation. These sites are important because the data contained in their artifact assemblages enable a researcher to identiy some aspects of prehistoric behavior, e.g., site activity and artifact movement. Most of these sites were occupied for short periods of time - probably for only part of the day. The absence of grinding stones suggests that only male groups occupied these locales, hence, only male activities were identified.

It is clear that what were once thought of as minimal information sites can reflect patterns of prehistoric cultural behavior. For archaeologists, technological systems yield the most useful information. They tell how a group adapted to the surrounding natural and cultural environment. The prehistoric techno-cultural process which appeared on the Northern Plains are just beginning to be recognized. As archaeologists refine their techniques of analysis this information will be more easily obtained.

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APPENDIX

Following are the State of Wyoming site numbers for the sites discussed above:

Polecat Bench Sites	Wyoming Site No.
PH-201	48PA143
PH-202	48PA144
PH-203	48PA118
PH-204	48PA151
PH-205	48PA138
PH-206	48PA122
PH-207	48PA128
PH-209	48PA127
PH-210	48PA153
PH-211	48PA150
PH-212	48PA152

Acme Area Sites	
PH-106	48SH72
PH-109	48SH75
PH-110	48SH76
PH-111	48SH77
PH-113	48SH79
PH-116	48SH82
PH-117	48SH83
PH-118	48SH84
PH-119	48SH85
PH-120	48SH86
PH-123	48SH89
PH-124	48SH90
PH-125	48SH91
PH-126	48SH92
PH-128	48SH94
PH-129	48SH95
PH-132	48SH98
PH-133	48SH99
PH-134	48SH100
PH-135	48SH101
PH-137	48SH103
PH-138	48SH104
PH-140	48SH106
PH-144	48SH110
PH-148	48SH114