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ASSEMBLAGE VARIATION ASSOCIATED WITH
SOUTHWESTERN INTERIOR PLATEAU
MICROBLADE TECHNOLOGY

by

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ABSTRACT

This thesis examines the relationship between prehistoric technological organization and settlement variability associated with the prepared core and microblade technology of the southwestern Interior Plateau, British Columbia. The study addresses methodological issues concerning the interpretation of settlement function from lithic assemblages and has substantive implications for the prehistory of the study area. The extant literature regarding northwestern North American microblade traditions is also reviewed.

Intraregional variation is examined between lithic assemblages from Hat Creek valley and Lochnore-Nesikep locality. Previously constructed historical sequences suggest that these assemblages are representatives of the Early Period of the Nesikep Tradition and may date between 7,000 and 2,900 B.P. Microblades and microcores of the Plateau Microblade tradition have been interpreted as diagnostic of the Early Period.

Initially, patterns of settlement variation are inferred from a review of local environment factors, local aboriginal settlement and subsistence practices, and a general model of hunter-gatherer settlement strategies. The extant literature concerning archaeological depositional patterns resulting from technological organization is also reviewed. A lithic artifact classification that is assumed to correlate with technological roles is devised and tool deposition patterns associated with

settlement are suggested. Microblade attributes that represent reduction variability are also described.

Technological variability is examined first between assemblages representative of upland (Hat Creek valley) and riverine (Lochnore-Nesikep locality) ecological zones through discriminant analyses. The analyses successfully sort assemblages into their respective zones and technological strategies can be interpreted as correlating with environmental location.

Technological variability is also examined among assemblages as a means of interpreting settlement function. Q-mode cluster analysis is utilized to group together similar assemblages. Three groupings are devised, and these can be interpreted in terms of residential and non-residential activities. Further patterns of assemblage variation are defined from metric multidimensional scaling analysis.

In conclusion, the technological organization responsible for the deposition of these assemblages is interpreted to have involved spatial separation of microcore and microblade production and use. The study also interprets the settlement strategy associated with this technology to have been logistically oriented.

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CHAPTER I

INTRODUCTION

The recovery of prepared core and blade artifacts from northwestern North American archaeological sites has inspired a long history of research. Since Nelson (1937) suggested that the microblade industry of Alaska was derived from a similar industry in Mongolia, much research has focused on the interpretation of cultural connections between Asia and North America. Studies have aimed to identify techniques used to manufacture microblades and to document the temporal and geographic distribution of these artifacts. Insight has been gained into the time-space distribution of microblade industries in North America, yet an emphasis on culture-historical problems has left many questions concerning the industry unaddressed. Little attention has been given to explaining why microblade technologies were adopted; how they operated within specific regions; why they differ between so-called traditions; and ultimately, why microblade industries were abandoned. The present study can be viewed as an initial attempt to address some of these problems of cultural behaviour.

These new questions demand alternate explanations of the distribution of and variation among microblade assemblages. In this analysis, culture is viewed as an adaptive system that articulates man-land relationships. Variability in the

archaeological record can be explained as the result of behavioural responses necessary for maintaining human populations in natural and social environments. The technological and economic sphere of culture is believed to be most directly representative of this relationship. Among hunter and gathers, this relationship is manifested archaeologically as a settlement-subsistence pattern. An intraregional perspective on assemblage variability is needed for the identification of such patterns.

Until recently, analyses of microblade industries in terms of settlement and subsistence have not been possible because of a lack of suitable data. Culture-historic studies utilize a research design focused on the excavation of single, stratified sites. While such a design provides for chronological control of assemblage variation, it does not yield a sample of assemblages that reflects regional settlement and subsistence practices. The recovery of numerous microblade assemblages from the southwestern Interior Plateau, north of the confluence of the Fraser and Thompson Rivers in British Columbia, provides a data base for an intraregional perspective on assemblage variation.

The present study explores the relationship between prehistoric technology and settlement as a means of explaining archaeological assemblage variability associated with prepared core and microblade artifacts. A lithic tool classification

that is suggested to be indicative of varying strategies of tool manufacturing, use, and discard is developed and correlations with varying settlement activities are proposed. The classification is based on a model of technological organization developed from previous ethnoarchaeological (Binford 1977, 1979) and archaeological (Camilli 1981, 1982; Matson n.d.) studies. This study applies the classification to nine assemblages from the southwestern Interior Plateau, and the utility of the model of technological organization is evaluated. The settlement strategy represented by the observed patterns of technological organization is inferred and contrasted to that of the historic Interior Salish.

The assemblages selected for study are from archaeological sites in Hat Creek valley (Pokotylo 1978; Beirne and Pokotylo 1979) and the Lochnore-Nesikep locality (Sanger 1970a) along the mid-Fraser River. Sanger's (1968a, 1970b) definition of the Plateau Microblade tradition includes the blade technology of the Lochnore-Nesikep locality. The Hat Creek industry is morphologically similar to the Plateau Microblade tradition. This tradition is diagnostic of the Early Period of the Nesikep Tradition, dating from 7,000 B.P. to 3,000 B.P., as defined for the Lillooet cultural sequence (Stryd 1973:24). The local archaeological sequence and the relationship of the Plateau Microblade tradition to other prepared core and blade industries are discussed in the latter portion of this first

of five chapters around which the study is organized. This discussion introduces problems of specific concern to the thesis.

Models for examining settlement and technological variation are presented in Chapter II. Initially, a review of local environmental factors, local aboriginal settlement and subsistence practices, and a general model of hunter-gatherer settlement strategies suggests patterns of settlement variation that can be expected in the study area. The archaeological sites, lithic tool classification, and microblade attributes used in analyses are then described. The extant literature concerning archaeological depositional patterns resulting from technological organization is also reviewed.

The analyses are presented in the third and fourth chapters. Chapter III examines lithic assemblage variation between upland and riverine ecological zones using both tool class and microblade attribute levels of data. Chapter IV applies the model of technological organization as a means of inferring settlement function. The utility of the model is evaluated, and the settlement strategy represented by the assemblages is proposed.

The fifth and final chapter summarizes the research, explicates problems evident with the study, and proposes directions for further research.

Southwestern Interior Plateau Prehistory

The first complete regional sequence for the southwestern Interior Plateau was proposed by Sanger (1963, 1966, 1968b, 1969, 1970a) following archaeological research conducted at the Lochnore-Nesikep locality between 1961 and 1965. Minor revisions have been suggested. Nonetheless, it remains as the predominant framework through which Plateau prehistory is still interpreted. Previous to Sanger's work, little archaeological research had been conducted in this area. Harlan I. Smith excavated burials near Lytton, Spences Bridge, and Kamloops as a member of the Jesup North Pacific Expedition (Smith 1899, 1900). However, no further archaeological research was conducted until the 1950's when Charles Borden surveyed and excavated sites at Chase (Sanger 1968b) and, further south, along the Fraser Canyon (Borden 1960, 1961). Interest in Plateau archaeology has continued in recent years, and local chronologies have been proposed for various sub-regions (Stryd 1973; Grabert 1974; Turnbull 1977; Wilmeth 1978; Wilson and Carlson 1980). Detailed reviews of Interior Plateau archaeology have been presented elsewhere and include Fladmark (1982), Beirne and Pokotylo (1979), and Pokotylo (1978).

Sanger's proposed sequence is of direct concern to the present study. His interpretation indicates the presence of two separate cultural traditions, the Lochnore Complex and the Nesikep Tradition, on the Plateau. Sanger suggests that

the Lochnore Complex is the earlier tradition and is considered to represent a northward migration onto the Canadian Plateau following deglaciation ca. 8950 B.P. A southward migration of northern populations at about 7,000 B.P. resulted in the replacement of the Lochnore Complex by the Nesikep Tradition (Sanger 1970a:127). No further cultural change indicative of a new tradition is inferred for the Plateau until historic times. Rather Sanger believes that through a gradual adaptation to the Plateau environment, the Nesikep Tradition culminated in the ethnographic Interior Salish (Sanger 1970a:127).

The Lochnore Complex is described by Sanger (1970a:126) as similar to the Old Cordilleran Tradition (Butler 1961; Daugherty 1962) on the bases of shared formal traits. No absolute dates are available for the only representative of the Lochnore Complex, Zone III of the Lochnore Creek site. Formal similarities include leaf-shaped projectile points, edge-battered cobbles, and a macroblade technology. Subsequent research (Richards 1978; Eldridge 1974; Leonhardy 1975) has identified similar complexes in deposits much later than those believed to be representative of the Old Cordilleran Tradition. These data suggest that assemblages typologically similar to the Old Cordilleran Tradition had a greater temporal range than originally proposed.

Sanger (1970a:105) divides the Nesikep Tradition into four arbitrary periods: 1) Early Period (7,000 B.P. to

5,000 B.P.); 2) Lower Middle Period (5,000 B.P. to 3,500 B.P.); 3) Upper Middle Period (3,500 B.P. to 2,000 B.P.); and 4) Late Period (2,000 B.P. to ca. 500 B.P.). A more perspicuous division of the tradition is suggested by Stryd (1973:22-24). He divides the Nesikep Tradition into two periods, Early and Late. They are distinguished by the presence of a microblade industry in the first period and the absence of the industry in the latter period. The transition is dated to 2,950 B.P. Stryd (1973) was primarily concerned with the Late Period for which he defined four phases: 1) Nicola, 2) Lillooet, 3) Kamloops, and 4) Proto-historic.

While the Nesikep Tradition might be accepted as representative of cultural continuity, it is believed to have undergone internal change. Archaeological documentation of temporal variation includes a gradual reduction in projectile point sizes (Sanger 1970a:107); the abandonment of a microblade technology, possibly to be replaced by gravers (Sanger 1970a:110); and the introduction of the pithouse as the typical form of winter dwelling (Sanger 1969:146). The introduction of the pithouse is considered as the major change in settlement practices indicative of the establishment of the historic pattern, and models have been proposed as explanations of this transition (Nelson 1973; Ames and Marshall 1980). The pithouse settlement pattern is suggested to have resulted from

intensified collecting and processing of certain resources that could be stored and would allow larger groups to aggregate for longer periods of time. Nelson (1973) identifies salmon as the key resource, and, in contrast, Ames and Marshall (1980) suggest that the intensification of root-plant collection contributed to the changes involved in Plateau cultural development.

Implicit in explanations of the emergence of ethnographic settlement and subsistence patterns is some interpretation of the Early Period pattern. As yet, however, no substantial attempt has been made to reconstruct this pattern. An objective of the present study is to document aspects of Early Period settlement that may be useful to further studies of cultural development on the Plateau.

Prepared Cores and Microblades in Northwestern

North America

Prepared core and microblade artifacts have been recovered from numerous sites in northwestern North America. Their wide temporal and geographic distribution has led to the interpretation of a variety of time-space constructs. Some researchers have also suggested that a variety of techniques of microcore preparation and microblade production are represented by the industries. The following review presents the interpretations commonly made of this variability. Specifically, the review is concerned with identifying the cultural and technological relationships of the assemblages utilized in

the present study. Figure 1 illustrates the distribution of important microblade sites in northwestern North America.

Plateau Microblade Tradition

Sanger (1968a, 1970a, 1970b) rejected MacNeish's hypothesis that the Northwest Microblade Tradition (described below) expanded southward into interior B.C. through the formulation of a separate tradition for the Plateau. This formulation was based, in large part, on the microblade industry recovered from the Lochnore-Nesikep locality. He agrees that the microblade manufacturing technology of the Plateau Microblade Tradition ultimately had northern sources but argues that it diverged from these sources by at least 9000 B.P. (Sanger 1970a:108).

Sanger believes that a single cultural trait (i.e. microblade technology) can pass between cultures. He is therefore able to identify the presence of the Plateau Microblade tradition within what he believes to be different cultural contexts. Evidence of the tradition is cited from throughout the Interior Plateau south of 54 degrees north latitude and extending into the Columbia Plateau. Sanger (1968a:113) considers it to be more typical of prehistoric cultures of the Canadian Plateau than those from the American Plateau. Sanger cites the earliest discovered appearance of the tradition at 7500 B.P. on evidence from the Drynoch Slide site. It is considered to be clearly on the wane by 2600 B.P. (Sanger 1968a:110).

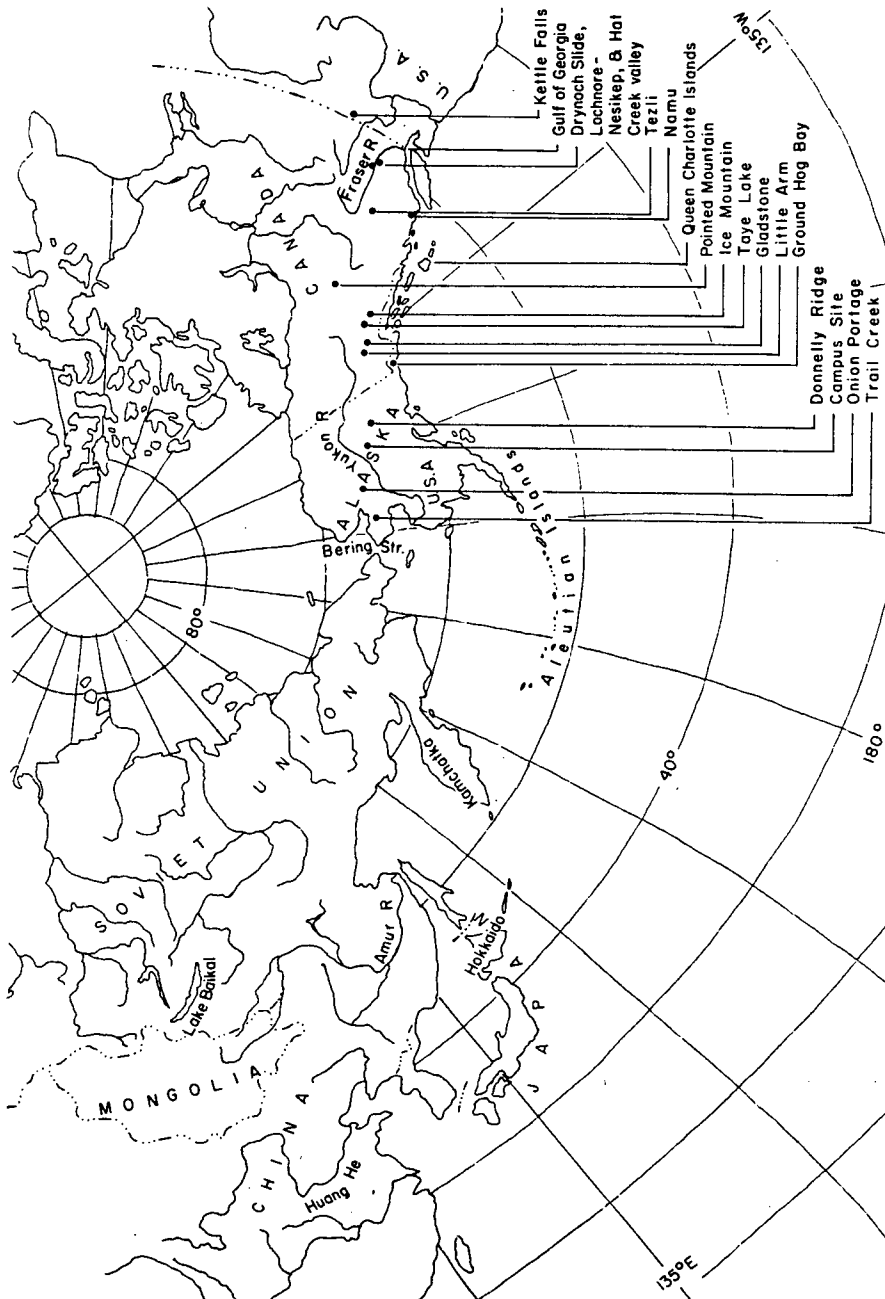


Figure 1. Locations of Microblade Sites Mentioned in the Text.

A microcore technology based upon the following characteristics is identified as representative of the Plateau Microblade Tradition (Sanger 1968a:114). No other artifact classes need be associated:

1. Microblade cores utilizing a weathered surface for a striking platform which is usually modified only at the core edge. Multiple blow striking platform preparation is scarce, and core rejuvenation tablets are not known.
2. Microblades are usually removed from only one end of the core.
3. Core rotation, resulting in more than one striking platform is very unusual.
4. Fluted surfaces commonly contrast to a wedge-shaped keel.
5. The technique of preparing the fluted surfaces is currently unknown, but the apparent absence of ridge flakes may be very important in this respect.

Certain aspects of Sanger's interpretation have been criticized. Magne (1979) noted that Hat Creek microcores did not exhibit the weathered platforms described by Sanger as characteristic of the tradition. During the present study, I also did not observe a weathered surface on any of the Hat Creek or Lochnore-Nesikep microcores. It appears that this attribute is not present in, let alone characteristic of, the tradition.

A number of different dates have been suggested for the termination of the Plateau Microblade tradition. Those arguing for the early demise include: Fladmark (1982:61) who

favours a terminal date of before ca. 4000 B.P.; Donahue (1977:206) who cites evidence for the abandonment of the industry at Tezli by 2400 B.C., corrected from a radio carbon date of 3850^{+140} B.P. (Donahue 1977:150); and Stryd (1973:24;177) who claims that the industry of the Lillooet area was no longer in use by about 1000 B.C. (825^{+85} B.C.). Much more recent terminal dates have also been proposed. A flourishing microblade industry is interpreted as part of Component Clusters I and II at Anahim Lake dated ca. 1950 to 1110 B.P. (Wilmeth 1978:153-157). Grabert (1974) reports microblades dated at 2500 B.P. for the Okanagan, and Chance and Chance (1979:29) report a microblade industry post 1950 B.P. at Kettle Falls. Inferred late microblade industries have usually been recovered from pithouse contexts. Pithouse construction and excavation is subject to complex strata mixing (see Fladmark 1982:52), and it is on this basis that late dates are often rejected. Nonetheless, it is reasonable to expect some regional variation throughout the Plateau.

Fladmark (1982 disagrees with the commonly accepted northern interior origins of the tradition. He proposed instead that "...this technology may have originally penetrated the British Columbia Interior from the west, rather than southwards from the Yukon" (Fladmark 1982:61). This interpretation is based on early dates obtained for microblade industries on the central and northern Pacific Coast and is contingent on the lack of suitably dated sites in the Yukon interior.

Microblade Industries in the New World

Subarctic

Sanger's (1968a, 1970a, 1970b) hypothesis of a unique technological tradition on the Plateau was developed as an attempt to distinguish that industry from those reported further north. Morlan (1970) compared metric and non-metric variability between wedge-shaped cores representative of the Plateau Microblade tradition and a number of Arctic and Subarctic traditions. He identified little distinctive metric variability between cores (Morlan 1970:26-28), but found that he could distinguish between certain traditions according to reduction sequences he inferred for core preparation (Morlan 1970:32-33). Notably, the representatives of the Plateau Microblade tradition were identified as having been produced by a platform-face-flute sequence. This is in contrast to the face-platform-flute sequence identified as more typical of subarctic microcores.

Wedge-shaped cores are not the only type of microblade-producing core identified in northern assemblages. Tabular and conically-shaped cores have also been recovered. However, little research has considered the technological significance of these. In general variation observed between microblade industries has been implicitly stated, the result being the creation of overlapping and conflicting time-space constructs. The following review describes the more common ones.

The Northwest Microblade Tradition was proposed by MacNeish (1954) on the basis of similarities he observed between assemblages from the Pointed Mountain site and the Campus site. Later research conducted in southwestern Yukon resulted in a redefinition of the construct. Components from Little Arm, Gladstone, and Taye Lake were inferred to contain all traits diagnostic of the tradition. Other sites, like Pointed Mountain and Campus, had only some of the diagnostics, and MacNeish (1964:346) then assigned them a tentative membership in the tradition. Because the tradition was defined according to a monothetic set of traits, the identification of the Northwest Microblade Tradition was restricted to a few sites in the interior Yukon. Interpretations of separate traditions in new regions were inevitable.

The Northwest Microblade Tradition was envisioned as a local development characterized by a variety of traits from diverse sources, each acquired by different means:

It would have taken from the Kluane and Flint Creek horizons already in that region such elements as Fort Liard, Flint Creek, and blade burins, end-of the-blade scrapers and conical cores and blades, as well as a few bifacial types and unifacial scrapers. From the northwest-moving Yunoid tradition, it might have acquired the Agate Basin-like and Milnesand-like points, the flake perforator, and perhaps the snub-nosed end scraper. It might have acquired from Asia, tongue-shaped cores, microblades, and unifacial drills. These may have been invented locally, the net sinker (i.e., gill nets), tci-thos, and some variety of fish spear.

(MacNeish 1962:26)

MacNeish (1962:26) interprets this particular combination of traits to be especially well-adapted to a northern interior environment and representative of a settlement pattern based on lake fishing, hunting, and trapping (MacNeish 1964:346). He suggests that, through migration and diffusion, the Northwest Microblade Tradition gradually spread into the Canadian Northwest Territories and northern British Columbia (MacNeish 1962:26).

A date of 1650 B.P. was inferred as the date of a volcanic ash layer lying above Teye Lake components. It was interpreted as the terminal date of the tradition. MacNeish then applied a "long count" to infer the lengths of preceding components and derived a starting date of 7450 B.P. for the Little Arm phase, the first phase of the Northwest Microblade Tradition (MacNeish 1964:312).

MacNeish's construct has long since fallen out of use (Clark 1981:111). Nevertheless, subsequent research has confirmed the presence of a microblade industry in southwestern Yukon. Workman (1978) reports that the Little Arm and Otter Falls sites are each represented by the technology. He believes "...that microblades were imported by the earliest residents...and that the ultimate derivation of this technology roots in Alaska and in Asia" (Workman 1978:257). A terminal date of 4,000 B.P., much earlier than that proposed by MacNeish (1964) is suggested (Workman 1978:256). The

assemblages Workman describes include both wedge-shaped and tabular microcores. He interprets two distinct size populations of microblades as representative of two techniques of wedge-shaped core production (Workman 1978:254).

Microblade complexes recovered from the Onion Portage (Anderson 1968) and Trail Creek (Larsen 1961) sites in northwestern Alaska provided the traits defined for the American Paleoarctic Tradition (Anderson 1968, 1970a, 1970b). A caribou scapula associated with the Akmak complex of Onion Portage was dated to 9857 B.P. \pm 155 (Anderson 1970a:2) and provided the first absolute date that associated microblades with the Beringian period. Characteristic traits identified for the tradition include polyhedral blade cores, Campus-type microblade cores, backed rectangular microblades, large wide blades, preforms for end scrapers and gouges, burins, and utilized flakes (Anderson 1970a:4).

In central Alaska, the Denali complex was defined as representative of an early microblade industry (West 1967). West's definition was based primarily upon the interpretation of a microcore manufacturing technique distinct from any previously reported for North America. The technique is described as being similar to the Yubetsu technique of Japan (Yoshizaki 1961). Cook (1968) suggests that these cores are actually burins. West (1967:360) also included in the complex core tablets, microblades, large biconvex bifacial knives,

end-scrapers, and the Donnelly-type burin.

Denali complex site types include Donnelly Ridge, the Campus site, and two Telkonia River sites.

West interpreted a Russian origin for the complex as an alternative to Nelson's (1937) hypothesis that Campus site cores were from Mongolia (West 1967:378). Also, by including the Campus site cores within this complex, West (1967:374) limited the distributions of the Northwest Microblade Tradition to the Yukon.

Sites located near Mt. Edziza (Fladmark 1981) and Telegraph Creek (Smith 1971, 1974a, 1974b), in northern B.C., have yielded artifacts representing a distinct prepared core and microblade technology. This industry is described as one utilizing bifacially retouched preforms for blade production. Fladmark (1981:309) reports that the assemblages include a few examples of variants of the technique and one possible wedge-shaped core. He attributes most of the variability to stages of core reduction (Fladmark 1981:306).

The obsidian quarry of Bantza Tena (Clark 1972) is the only other North American location known to yield similar artifacts. Fladmark (1981:312-313) interprets the technique not as a direct link with Japan (Smith 1971:211), but as a result of the availability of good quality raw material. The industry is dated between 5000 B.P. or earlier and 3000 to 4000 B.P. (Fladmark 1981:348).

Northwest Coast Microblade Industries

Microblades have also been reported for a variety of coastal sites. A technology distinct from that of northern and interior assemblages is often inferred. Nevertheless, personal observation of some of the Queen Charlotte Island specimens suggested that they may have been produced according to the platform-face-flute sequence representative of interior technologies. Further study is needed to evaluate this interpretation. The following briefly describes coastal microblade traditions as presently understood.

The Moresby Tradition was defined to represent the early cultural components of the Queen Charlotte Islands sequence (Fladmark 1971, 1975, 1982). Diagnostics of the tradition include a pebble core industry utilized for the production of microblades and non-microblade flakes, flake microcores, pebble choppers, and utilized and retouched flakes. The early Queen Charlotte assemblages have no bifaces, and none were associated with a shell midden matrix (Fladmark 1971:21). The Moresby Tradition has been radiocarbon dated to between ca. 7,400 and 5,500 B.P. (Fladmark 1982:23). A northern, coastal origin is proposed, and Fladmark (1971:21) suggests that the microblade industry was replaced by a bipolar percussion technology.

Microblade industries similar to the Moresby Tradition have been reported from Ground Hog Bay (Ackerman et. al. 1979;

Ackerman 1980) and Namu (Hester and Nelson 1978; Carlson 1979). Ackerman (1980) notes a greater range of variation in microblade manufacturing techniques utilized at Ground Hog Bay than on the Queen Charlottes. He suggests that each technique produces microblades to be used in different activities (Ackerman 1980:195).

A microblade tradition distinct from that reported in the north was defined by Mitchell (1968) for the Gulf of Georgia region. Along with microblades, microliths produced from quartz crystals and, possibly, a bipolar percussion technique (Fladmark 1981; Ham 1982) are also found. They are not well distinguished in the literature making it difficult to be sure of the exact nature and extent of the Gulf of Georgia Microblade Tradition. Interior associations have been postulated for the tradition (Borden 1962:17; Sanger 1968a:113). This industry is present in Locarno and Marpole cultural types, dated between ca. 2000 B.C. and 500 A.D. (Mitchell 1971:65). It is much later than industries reported elsewhere.

General Constructs

Many of the traditions described above have been grouped together in broader ranging constructs. Dumond (1977, 1978) proposes that a Paleoarctic Tradition, dated between 10,950 and 7,950 B.P. would explain the occurrence of early prepared core and blade industries throughout Alaska and the Northwest coast. This tradition subsumes the American Paleoarctic Tradition; the Denali complex; and a number of sites in the Yukon-Tanana Uplands, on the Utukok River, and on the Brooks Range

(Dumond 1978:50-51). Dumond redefines MacNeish's Northwest Microblade Tradition to be an element of the Northern Archaic Tradition (Dumond 1978:54). From the presence of notched, stemmed, and lanceolate points, Dumond (1978:54) infers a date of 5,950 B.P. to 4,350 B.P. for this tradition. No connections with the Plateau tradition are suggested.

Fladmark (1982:21) proposes the Early Coast Microblade complex to include

...coastal assemblages radiocarbon dated ca. 5,000/5,500 - 10,000 B.P., and (is) characterized by a microblade industry; flake cores, including pebble tools; a variety of retouched flake tools; rare crude leaf-shaped bifaces (not always present); rare abrasive stones; rare possible ground or notched sinker stones; and non-shell site contexts.

Included in this complex are sites from the central Pacific Coast, Queen Charlotte Islands, Ground Hog Bay, and coastal Alaska. It remains distinct from later and interior microblade industries.

Borden (1975) and Carlson (1979) present somewhat similar constructs, both of which Fladmark (1982) subsumes under his Early Coastal Microblade complex. Borden's (1975: 14) Early Boreal Tradition envisions an early date for the Northwest Microblade Tradition, earlier than that proposed by MacNeish (1964). The early date is necessary to support his northern interior to coast migration hypothesis. Carlson's

(1979) Microblade Tradition includes Yukon sites, but he accepts a late date to support a coastal route of origin. According to Carlson, the Tradition represents "...the ancestors of the Haida-Tlingit-Athabaskan or NaDene speaking peoples" (Carlson 1979:224).

The presence of microblade industries in North America has led other researchers to propose constructs that group Asian and American assemblages into one culture type. Mochanov (1980) suggests that the rapid migratory patterns of the Dyuktai culture, inferred to have originated in the Hwang Ho Basin, was responsible for the early cultural manifestations ca. 23,000 B.P. in Mexico. This same culture is said to have crossed the Bering Strait a second time ca. 10,000 B.P. and is represented by the Denali complex in Alaska.

Abramova (1980) criticizes Mochanov (1980) and MacNeish (1964) for drawing parallels where evidence is lacking. She concurs that early man (pre - 12,000 B.P.) was present in North America, but argues that evidence of close cultural relations between Asia and North America is best provided by microblade industries dated to the late Paleolithic. In Abramova's model, bifacial projectile points are viewed as an independent invention, and a search for a common origin is unnecessary.

West (1980) points out that microblade-based cultures are distinct from other early North American cultures and

are similar to late Paleolithic Asian cultures. He suggests that the Old World term Late Paleolithic be applied to these northern complexes as a means of maintaining the distinction.

A technotypological approach to the study of trans-continental similarities of microblade industries is presented by Smith (1971, 1974a, 1974b). Smith attributes variation in style and form of microblade industries to the use of any of three techniques of core production (see also Morlan 1970, 1976, Yoshizaki 1961). All three techniques are considered by Smith as representative of one tradition, the Northeast Asian - Northwest American Microblade Tradition (NANAMT). This tradition encompasses a number of subtraditions, each showing a preference for at least one of the techniques. Smith (1971:212) believes that variation among the subtraditions is a result of time; chronological sequence of subtraditions should be correlated with the origin of, and migration routes followed by, the bearers of the tradition.

The Dyuktai tradition of the Soviet Far East is interpreted to be the first subtradition of NANAMT. Smith dates its beginnings at 18,000 B.P. By 14,000 B.P. the tradition is inferred to have spread east to Japan and north to Kamchatka; it is said to be represented there by the Asian Inland-Coastal subtradition. The tradition is represented in North America by the American Paleoarctic and Northwest Microblade subtraditions, each defined as separate traditions

by Anderson (1970) and MacNeish (1964) respectively. Developments out of NANAMT include the Arctic Small Tool Tradition and the Plateau Microblade tradition. Smith offers no date for the early North American manifestations (Smith 1974a:351-352), but believes its presence in North America marks the second trans-Beringian migration (Smith 1974a:348).

In summary, microblade technologies have been identified in a variety of geographic and temporal contexts. The Plateau Microblade tradition has been identified as a technology distinct from those identified along the northwest coast and in the subarctic. Its origin has been postulated to have been the northern interior, yet dates obtained recently tend to suggest a coast to interior route of origin. Further research is needed to better explicate the cultural and technological relationships of the technologies. The remainder of this study focuses on the reconstruction of settlement patterns and technological organization of assemblages representative of the Plateau Microblade tradition from the southwestern Interior Plateau.

CHAPTER II

RECONSTRUCTING PREHISTORIC SETTLEMENT PATTERNS

The purpose of this study, as described in the introductory chapter, is to explicate and explain patterns of interassemblage variation in terms of prehistoric settlement practices. The present chapter describes a methodology toward this end.

An explicit research design for reconstructing settlement and subsistence systems is presented by Struever (1968, 1971). Within Struever's design analyses are conducted at two levels, the settlement and the region. Struever (1971: 11) suggests the analysis of the kind, number, and distribution of material elements recovered from an archaeological site could potentially identify tool-kits, activity areas, and activity sets that would aid the interpretation of a settlement type. By assuming that the physical environment is patterned and that culture is adaptive, Struever (1971: 11) expects that the distribution of settlement types within a region will be correlated with the seasonal and geographic distribution of resources. Struever (1968: 135) believes that this "building block" approach, examined at the regional level, will reveal the structure of prehistoric systems that articulates man-land relationships.

The interpretation of settlement types remains a problem. Questions have been raised concerning the accurate identifica-

tion of tool-kits and activity areas. Schiffer (1972) points out that a direct relationship between the systemic context, in which material culture operates, and the archaeological context, in which material remains are found, cannot be assumed. Cultural transformations and natural transformations affect the resulting distribution of material in the archaeological record. According to Schiffer, intrasite assemblage variability in particular is affected by curation (Binford 1973: 342) and discard processes (Schiffer 1976: 30). Because of these transformations, the spatial distribution of artifacts within a site is a distorted image of past activity. Schiffer (1976) and Matson (n.d.) suggest that much of this problem can be alleviated through analyses of intersite assemblage variation.

Patterns of intersite variation are expected to be correlated with settlement function. Binford (1979) proposes that the organization of technological activities will result with the deposition of distinct assemblages at different settlement types and develops a model of technological organization that anticipates varying patterns of tool curation and discard. An objective of this study is to test the utility of Binford's model for interpreting site function.

The first section of this chapter identifies causes of settlement variation. A review of 1) local environmental factors; 2) the traditional Interior Salish settlement and subsistence pattern; and 3) a general model of hunter-gatherer settlement derived from modern ethnoarchaeological research suggest a

pattern of settlement variation that can be expected to be represented by the archaeological assemblages of the study area. There follows a description of the archaeological sites, artifact classification, and microblade attributes that will be used for comparison with the proposed variation. Expected patterns of technological organization are also presented.

Settlement Variation

Natural Environment

The study area is situated north of the confluence of the Fraser and Thompson rivers. Below the confluence, marked by the present day town of Lytton, the Fraser River narrows through a rugged, steep-walled canyon. Landforms of the study area include deeply dissected river terraces, mountain slopes, and highland valleys and plateaux. Climatic and biological variation reflects this vertical dimension. Of specific interest to the present study are the environmental features characteristic of the Lochnore-Nesikep locality and Hat Creek valley (Figure 2).

Two physiographic subdivisions of the Canadian Cordillera of British Columbia are represented within this region: 1) Coast Mountains and 2) Interior Plateau (Holland 1964; Figure 2). The Coast Mountains border the western bank of the Fraser River and reach peaks at 2438 m above sea level. East of the Coast Mountains, two physiographic units of the Interior Plateau merge: 1) the Fraser Plateau and 2) the Thompson Plateau (Holland 1964: 66). These regions are separated by the Clear Range, which reaches heights above 2100

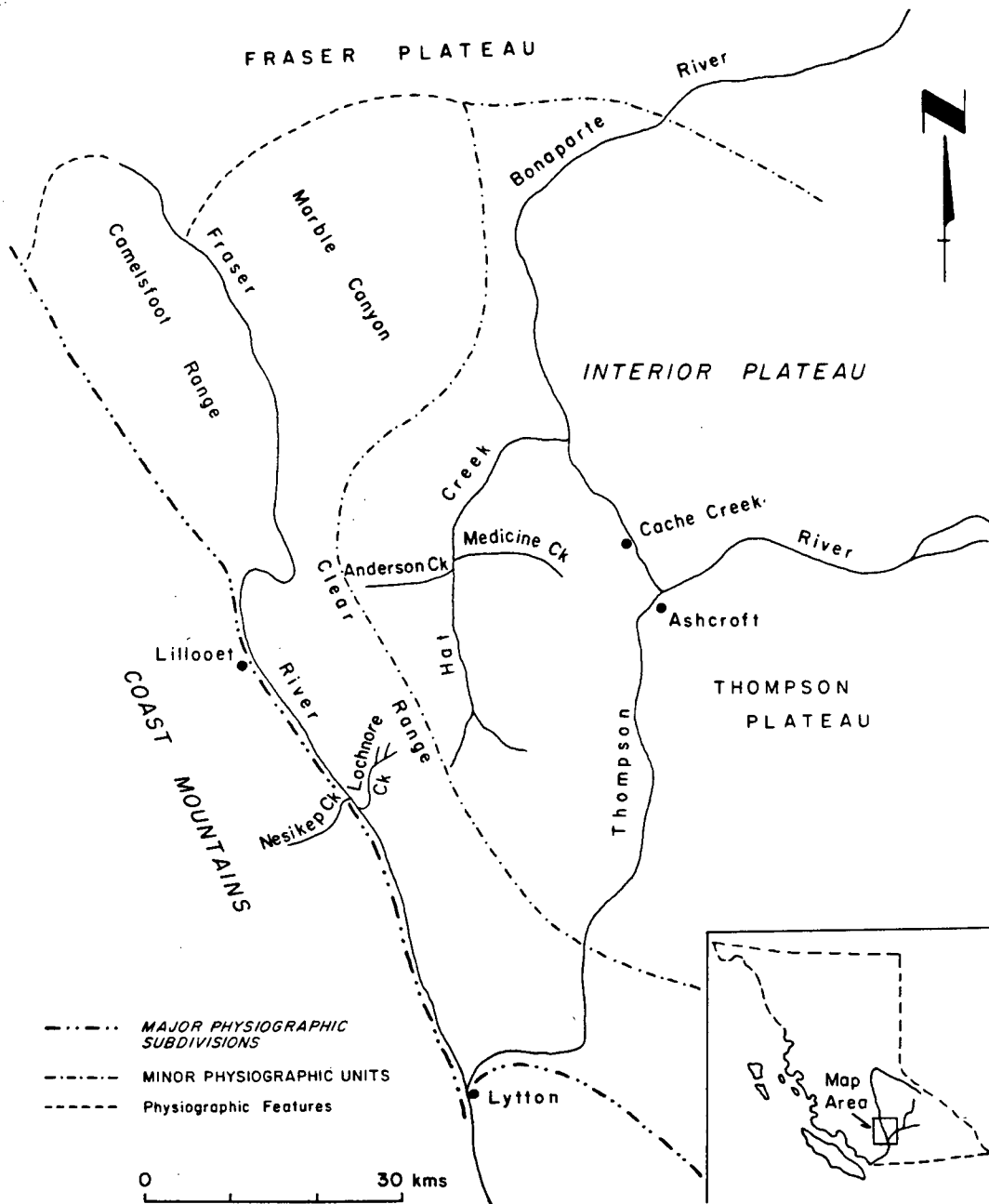


Figure 2. Physiographic Features of the Study Area (after Holland 1964).

m above sea level. The Clear Range rises 1200 m above Hat Creek valley and drops almost 2000 m to the Lochnore-Nesikep locality on the Fraser River. For the sake of brevity, the study area will be referred to as the southwestern Interior Plateau.

The Interior Plateau was covered by an ice mantle, possibly 2450 m thick, during the last glacial period. Pleistocene ice was gone from the Plateau, leaving the area suitable for human habitation, as early as 11,000 B.P. (Ryder 1978:63). Deglaciation occurred by in-place downcutting that created extensive terraces in the Fraser and Thompson river valleys. Outwash deposition caused by increased stream flow resulted in the formation of alluvial fans and fluvial sediments. Sanger (1970a: 8) notes that the alluvial fan deposited by Nesikep Creek has caused some lateral displacement of the Fraser River. Outwash deposits are also evident on the eastern slopes of the Clear Range. Undulating to hummocky moraines are typical of glacial drift deposits in Hat Creek valley. The major causes of post-glacial geomorphological alteration on the Plateau are continued stream entrenchment, Fraser River down-cutting, and aeolian redeposition.

The surficial geology of the Interior Plateau is typified by a sheet of glacial drift occurring to various depths. A thick aeolian mantle of sand and silt covers as much as 95% of the drift (Holland 1964: 70). Bedrock projections, like the Clear Range, and exposures are evident. Developed

soil profiles are rare.

The study area is situated on the leeward side of the Coast Mountains and is exposed in the north to polar winds channeled through the Interior Plateau. A continental weather pattern, characterized by warm summers and cold winters, prevails. Semi-arid conditions occur at lower elevations, and precipitation increases with altitude.

The biogeoclimatic zones (Krajina 1965, 1973) in the study area also change with altitude. A Ponderosa Pine-Bunchgrass zone is present along the Fraser River terraces and within the lower elevations of Hat Creek valley. Interior Douglas Fir, Subalpine Englemann Spruce-Subalpine Fir, and Alpine Tundra zones are present in ascending order.

Analysis of the pollen spectra from a core from Finney Lake in Hat Creek valley indicates that the present-day vegetation pattern was established by 4,500 B.P. (Hebda n.d.:5). Aboreal pollen in other cores from the southern Interior Plateau suggests that a trend towards moist, cool, climatic conditions, similar to those of the present day, began at about 6,000 B.P. (Mathewes and Rouse 1975:752; Alley 1976:1139). This period was preceded by a short, mild, xerothermic interval (Hansen 1955:650; Mathewes and Rouse 1975:752; Alley 1976:1140; Hebda n.d.:3-4). The earliest pollen zone identified on all but the Finney Lake cores is represented by a high arboreal pollen content suggesting a post-glacial coni-

ferous forest environment (Hansen 1955:647-649; Mathewes and Rouse 1975:751; Alley 1976:1140). The Finney Lake core lacks any evidence of this pollen zone.

Distribution of Subsistence Resources

The subsistence resources of the study area include a variety of plant, mammal, and fish species, many of which have restricted seasonal and geographic distributions. A pattern of resource distribution can be distinguished between resources available along the Fraser River and those available at the higher elevations. Figure 3 is a schematic cross-section of the study area illustrating the geographic and seasonal distribution of primary food resources.

The most significant food resource of the Fraser River is anadromous fish. Species of salmon, including pink (Oncorhynchus gorbuscha), coho (O. kisutch), chinook (O. tshawytscha), and sockeye (O. nerka), and steelhead trout (Salmo gairdneri) annually ascend the Fraser River. They are most abundant in the Lytton-Lillooet portion of the river during mid-summer to early fall. Characteristic of the Fraser sockeye run is its seasonal predictability; however, the abundance of the resource fluctuates. Kew (1976:11-12) notes a pattern of quadrennial dominance wherein "...numbers of fish produced are substantially greater in one year out of every four".

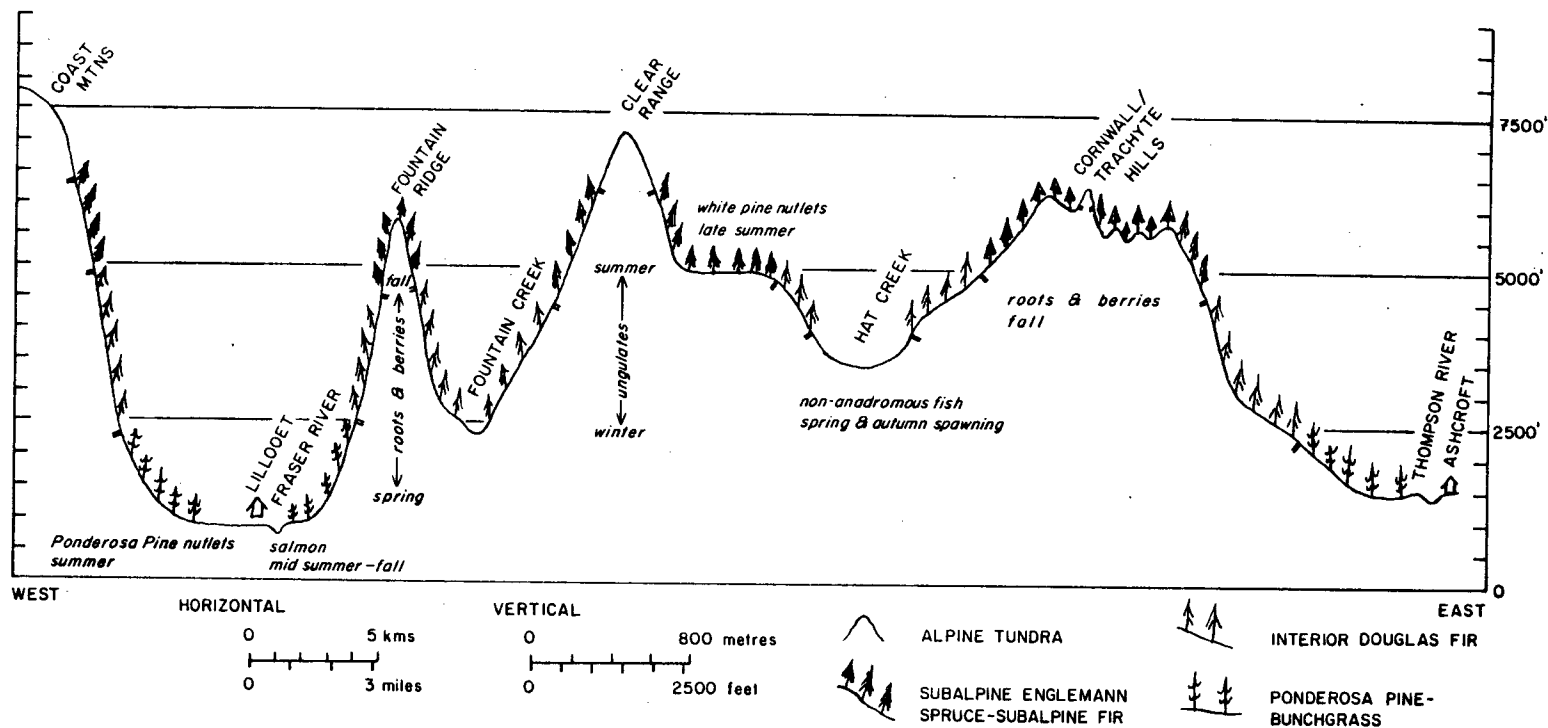


Figure 3. Seasonal and Geographic Distribution of the Major; Local, Subsistence Resources (after Pokotylo 1978).

It is uncertain if anadromous species ever ascended Hat Creek. Access to the creek would have been via the Bonaparte River. Today, the river is blocked by a man-made dam, but a sizeable pink salmon run is downstream from the dam (Pokotylo 1978:67). Mountain creeks and lakes support numerous fresh water fish species. Spring-spawning species include rainbow trout (Salmo gairdneri), cut throat trout (S. clarki), and sucker (Catostomus sp.). Dolly varden (Salvelinus malma) and mountain whitefish (Prosopium williamsoni) are most plentiful during an autumn spawning period (Carl, Clemens and Lindsey 1973).

The Interior Plateau supports a variety of plant species, many of which are significant to traditional subsistence economies. Huhn (1981:132) suggests that almost 70% of the food energy requirements of some Columbia Plateau food-gathering societies was derived from plant resources. The distribution and uses of individual plant species have been documented by a number of ethnobotanical studies (Steedman 1930; Palmer 1975a; Turner 1972, 1974, 1978; see also Teit 1900, 1906, 1909; Dawson 1981). Turner (1978) is the primary reference cited for the following summary of the major subsistence resources traditionally available on the southwestern Interior Plateau.

Roots are available in early spring along the Fraser River terraces and gradually become more plentiful up onto

the mountain slopes as the season progresses. These include nodding onion (Allium cernuum), balsamroot (Balsamorhiza sagittata), bitter-root (Lewisa rediviva), yellow bells (Fritillaria pudica), and mariposa lily (Calochortus macro-sorpus). Early sprouting subsistence herbs include Indian rhubarb (Heracleum lanatum), water parsnip (Sium suave), and fireweed (Epilobium angustifolium). Prickly pear cactus (Opuntia fragilis) is available year round and can be collected from beneath winter snow. By late spring, biscuit root (Lomatium macrocarpum) and spring beauty (Claytonia lanceolata), limited to upland locations, are ready for harvest.

In early summer, berries ripen along the lower slopes and become available in the fall at higher elevations. Service berries (Amelanchier alnifolia) and strawberries (Fragaria virginiana) ripen earliest and are followed by stands of soapberry (Shepherdia canadensis), gooseberry (Ribes sp.), raspberry (Rubus idaeus), wild rose (Rosa sp.), huckleberry (Vaccinium sp.), and bearberry (Arctostaphylos uva-ursi). Mountain blueberries and huckleberries (Vaccinium sp.) begin to ripen by late summer.

Ponderosa pine (Pinus ponderosa), which grows along the lower slopes, produces edible nutlets during mid to late summer, coinciding with the salmon run. In early spring the cambium layer of this pine is also edible. White bark pine

(Pinus albicaulis) produces an edible nut late in the summer and the cambium layer can be scraped in late spring. This pine is limited to higher elevations, usually above 1200 m (Turner 1978:55).

Mammal species of economic importance are also present in the study area. Cowan and Guiguet (1965) provide data concerning the distribution of mammals throughout British Columbia. The short list presented below is derived from local summaries compiled by Mathewes (1978) and Pokotylo (1979).

Mule deer (Odocoileus hemionus) rut and herd in the fall, gradually moving to lower elevations as snows cover the grasses in the higher elevations where they graze most of the year. The present day distribution of mule deer may be more limited than the prehistoric. European-introduced plant species, such as cheat grass (Bromus tectorum), as well as over grazing and the subsequent encroachment of sagebrush (Artemisia tridentata and A. frigida), have reduced the available grassland for herbivores (Tisdale 1947).

Elk (Cervus canadensis) have been introduced to the southern Interior Plateau during historic times. The prehistoric distribution of elk is uncertain, although Kennedy and Bouchard (1978:41) suggest that elk were traditionally hunted by the Lillooet. Other ungulates occupying the mountain regions of the area include mountain goat (Oreamnos americanus), presently restricted to the west side of the

Fraser River, and bighorn sheep (Ovis canadensis), in the Marble Canyon area to the east of the Clear Range.

The study area supports large game mammals such as black bear (Ursus americanus), which feed at berry patches and spawning grounds. Small mammals include snowshoe hare (Lepus americanus), marmot (Marmota flaviventris), squirrel (Tamiasciurus hudsonicus), and porcupine (Erethizon dorsatum).

Wetlands along the smaller creeks and lakes provide a habitat suitable for a variety of waterfowl and game birds. The Hat Creek valley in particular is identified by the Canada Department of Regional Expansion (1970) as having a high waterfowl capability rating. Wetland birds that might be encountered include common loon (Gavia immer), grebe (Podiceps sp.), and whistling swan (Olor columbianus). Upland game birds are represented by blue grouse (Dendragapus obscurus), white-tailed ptarmigan (Lagopus leucurus), and mourning dove (Zenaidura macroura) (Mathewes 1978).

Interior Salish Settlement and Subsistence

At the time of European contact, the southern Interior Plateau was inhabited by populations speaking languages of the Interior Salish linguistic family. The distribution of these groups within the study area is illustrated in Figure 4. Most of the study area is encompassed within the traditional territories of the Thompson-speaking Upper Fraser and Spences Bridge bands. The Shuswap-speaking Pavillion and Bonaparte

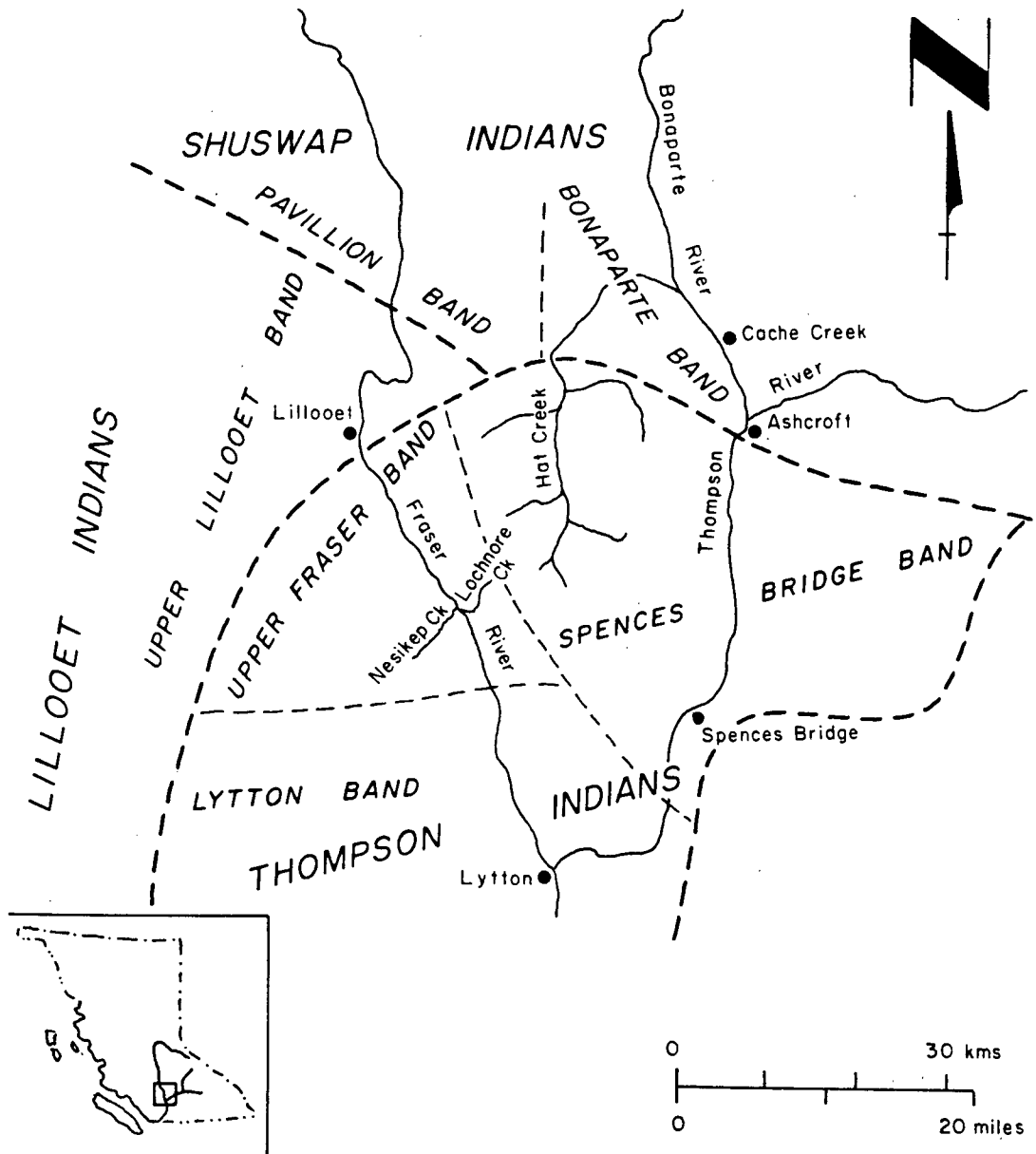


Figure 4. Northern Interior Salish Ethnographic Group Boundaries (after Teit 1900).

bands occupied the territory north of the study area, while the Upper Lillooet Indian band was to the west (Teit 1900:166).

The first written accounts of these native populations occur in the journals of Simon Fraser, who, during his historic exploration of the Fraser River in 1808, camped among the local bands. Fraser noted that European contact was already underway as indicated by the presence of trade goods (Lamb 1960).

No further significant ethnographic data were collected until the 1870's when George Dawson recorded some observations on the Shuswap during his geological fieldwork in the southern Plateau (Dawson 1891). Limited research continued in 1889 with Boas' account of the Shuswap (Boas 1890). Major investigations among the Thompson, Lillooet, and Shuswap were undertaken shortly thereafter by J.A. Teit, a member of Boas' Jesup North Pacific Expedition. The ethnographic data compiled was published in three major monographs (Teit 1900, 1906, 1909). At about the same time, C. Hill-Tout (1899, 1905) recorded observations of the Thompson and Lillooet.

More recent ethnographic research on native groups in the southern Plateau includes: studies of the distribution of cultural traits (Ray 1939, 1942; Jorgensen 1969); compilations of ethnobotanical information (Steedman 1930; Palmer 1975a; Turner 1974, 1978); and reconstruction of precontact cultural ecology (Palmer 1975b). Fieldwork conducted among

the contemporary Lillooet band provides new information concerning traditional lifeways (Kennedy and Bouchard 1975, 1978).

The present study is concerned with identifying traditional strategies for procurement and processing of subsistence resources on the southwestern Interior Plateau. The study area is encompassed within traditional Thompson territory. Nevertheless, data provided in the ethnographies of the Shuswap and Lillooet are pertinent considering the similarities in their lifeways (Jorgensen 1969; Teit 1900, 1906). The following discussion does not attempt to provide a complete Interior Salish ethnographic reconstruction.

Subsistence activities of the Thompson and Shuswap were characterized by an annual cycle of hunting, gathering, and fishing (Boas 1890; Dawson 1891; Teit 1900, 1909). Social groups aggregated and dispersed in accord with resource availability. The pattern was semi-nomadic: villages were established in winter and subsistence was based primarily upon stored foods. Resources distributed between the Fraser River and the upper elevations of the local mountains were utilized at different times in the annual cycle.

The major subsistence activities along the Fraser River were divided between late summer and winter. During late summer, people would congregate along the Fraser to catch migrating salmon. Oil was extracted from some salmon, and some were dried or smoked in preparation for winter. Stores

kept for winter were placed in underground cache pits surrounding the villages (Teit 1906:223).

Population aggregation occurred again in semi-subterranean pithouse villages established along the major river valleys and tributaries during winter (Dawson 1891:8; Teit 1900:192). Stored foods provided the bulk of subsistence during this time, although trapping and ice-fishing yielded some fresh food (Teit 1900:247-252; 1909:247, 248). Teit (1909:477) notes that hides were processed and skin clothing was manufactured in winter villages.

Spring and autumn subsistence activities were conducted by small groups of people predominantly away from the river terraces. Mountain lakes and streams provided spring-spawning fish (Teit 1900:251-252). Green shoots and roots were gathered along the mountain slopes and onto the higher elevation valleys as the season progressed (Teit 1900:231). Deer, elk, goat, and small mammals were also hunted in the spring. Large mammal hunting was intensified during the fall (Teit 1900:245, 1909:521-522). Late summer and fall subsistence activities also included gathering ripening berry and white bark pine nuts (Dawson 1891:22; Teit 1900:223, Teit 1909: 515, 519).

The ethnographies make reference to a variety of settlements established in connection with these economic pursuits. At certain subsistence gathering locations that were revisited

annually, permanent log foundation dwelling structures were constructed (Teit 1900:196, 1909:493). Temporary wood frame lodges, covered with tule mats, brush, bark, or skin, were constructed at short-term seasonal camps (Dawson 1891:8; Teit 1900:195-197). Roots were processed, either by drying, or by baking or steaming in earth ovens, at camps located near the gathering areas (Dawson 1981:9, 12). Hunting lodges were located near deer fences and may have been re-occupied annually (Teit 1909:404). Hides were cleaned at hunting lodges, but were returned to winter villages for further processing (Teit 1909:497).

This summary indicates that there is one period in the annual cycle when a variety of food resources are available in both the uplands and the riverine areas. During late summer through early fall, spawning salmon arrive in the Fraser River. Roots, berries, and nuts may also be collected in the uplands (Dawson 1891).. Pokotylo (1981:98) suggests that:

...some degree of scheduling
(Flannery 1968) on the part of
the female labour force may have
been involved to efficiently inte-
grate plant collection and fish
processing tasks.

The practice of late-summer subsistence scheduling is important considering the pattern of quadrennial dominance of the salmon runs (Kew 1978). Upland activities may have been increased in low years of the cycle, supplementing the

potential decline in salmon availability. The availability of upland summer subsistence resources further suggests that the uplands may have been extensively utilized during the pre-housepit period if salmon resources were not intensively harvested at this time.

Hunter-gatherer Settlement Systems

A settlement typology for hunter-gatherers was proposed by Binford and Binford in 1966. This typology included two settlements: 1) base camps, at which maintenance activities were conducted; and 2) limited activity settlements, utilized primarily for the procurement of resources. Ethnoarchaeological research has subsequently identified a more complex array of settlement patterning.

Binford (1980) proposes that this variation can be viewed along a continuum that contrasts the settlement pattern of the San Bushmen, described as foragers, who practice a "mapping-on" settlement strategy, with that of the Nunamiut Eskimos described as collectors, whose settlement strategy is "logistical" (Binford 1980:10). Logistically-oriented collectors utilize all the elements of a foraging strategy, plus some unique to the settlement strategy. It is the organization involved in the procurement of resources that distinguishes the strategies. In general, foragers move the social group to the locus of subsistence resources. While collectors will at certain times move the social group, they

usually create numerous task groups that bring subsistence resources to the social group. The two strategies therefore are not mutually exclusive; they can be viewed as extremes in settlement organization, from simple to complex.

The spatial distribution of food resources is considered by Binford (1980:14-15) to be a major factor in determining the settlement strategy selected by a particular culture. He suggests that when all critical resources are within range of a residential camp, a foraging strategy will be selected. Within this strategy, residential settlements are moved as local resources are depleted. Environments characterized by a dispersed pattern of resource distribution (either spatial or temporal) pose energy extraction problems that can be resolved by the logistics of a collector strategy. In this situation "hunter-gatherers move near one resource (generally the one with the greatest bulk demand) and procure the other resource(s) by means of special work groups who move the resource to the consumer" (Binford 1980:15). Temporal incongruity can be resolved through storage. Logistically-oriented collectors must then resolve the problem of bulk created through storage by further reducing the number of residential moves.

The variety of settlement types utilized during an annual cycle also differentiates the strategies. For foragers Binford (1980:9) proposes:

...two types of spatial context for the discard or abandonment of artifactual remains. One is in the residential base, which is...the hub of subsistence activities, the locus out of which foraging parties originate and where most processing, manufacturing, and maintenance activities take place.

These sites are likely to be re-occupied annually, resulting in increased archaeological visibility. Foragers will also generate a location.

A location is a place where extractive tasks are exclusively carried out.... since bulk procurement is rare, the use, exhaustion, and abandonment of tools is at a very low rate. In fact, few if any tools may be expected to remain at such places. (Binford 1980:9-10)

Variability among foragers is therefore best manifested at residential sites. These sites "...generally reflect the different seasonal scheduling of activities (if any) and the duration of occupation" (Binford 1980:9-10).

Collectors utilize both residence and location settlement types. Because of the logistical character of their procurement strategy, Binford suggests the use of three additional site types: 1) field camps; 2) stations; and 3) caches. Collector locations may be more visible than forager locations because of the intensity of resource procurement practiced by collectors whose work parties seek resources for the larger social group. Field camps are utilized by task groups as temporary base camps. Variation among field camps should be evident according to the resource the task

group is obtaining. "Stations are sites where special purpose task groups are localized, when engaged in information gathering" and caches are necessary "... in that successful procurement of resources by relatively small groups for relatively large groups generally means large bulk" (Binford 1980:10-12).

The Interior Salish settlement patterns can be interpreted as being more similar to the collector strategy than the strategy described for foragers. The Interior Salish utilized a single winter residence location where subsistence was based primarily upon stored foods. Fresh food could be obtained during the winter by specially organized work parties. Yet, the strategy is not solely logistically-oriented. Residential moves were characteristic of Interior Salish settlement patterns through the remainder of the annual cycle. The seasonal overlap of available food resources in different locations (i.e. salmon, berries, and game during late summer) may have necessitated the organization of task groups for procurement of some resources, while the corpus of the social group remained closest to the most critical resource, salmon. A pattern more typical of foragers was practiced during spring and fall.

As Binford (1980:12) points out, few groups fall at either extreme of the forager/collector continuum, but instead display a combination of strategies. The archaeological identification of strategy differentiation is such that:

...other things being equal, we can expect greater ranges of intersite variability as a function of increases in the logistical components of the subsistence-settlement system.
(Binford 1980:12)

Expected Intersite Variation

Assemblage variation in the study area is expected to be patterned along two dimensions, environment and settlement. The distribution of resources and the utilization of these resources, as reported in the ethnographies, suggest a distinctive land use pattern between upland and lowland ecological zones. Archaeological assemblages are expected to reflect different land use patterns in each zone. Intersite variation is also expected to occur within zones as a result of sites being used for different settlement and subsistence activities.

Given the above dimensions of intersite variability and Binford's (1980) model of hunter-gatherer settlement systems, two distinct patterns of intersite variation can be defined. The first pattern is representative of a foraging settlement strategy, and the second pattern of intersite variation is indicative of a collector strategy. It is assumed that the settlement strategy associated with the southwestern Interior Plateau microblade technology can be interpreted as somewhere between these extremes (See Figure 5). The ethnographic data described above indicated that the Interior Salish settlement

FORAGING STRATEGY

Environment			
Settlement	<table><tr><td>lowland residential</td><td>upland residential</td></tr></table>	lowland residential	upland residential
lowland residential	upland residential		

COLLECTOR STRATEGY

Environment					
Settlement	<table><tr><td>lowland residential</td><td>upland residential</td></tr><tr><td>lowland limited activity</td><td>upland limited activity</td></tr></table>	lowland residential	upland residential	lowland limited activity	upland limited activity
lowland residential	upland residential				
lowland limited activity	upland limited activity				

Figure 5. Patterns of Settlement Variation
Expected for Forager and Collector
Settlement Systems in the Study Area.

pattern was a collector strategy. A settlement strategy more similar to that of foragers is expected during earlier, prehistoric times. Recent models of Plateau cultural development imply that less intensive storage was practised previous to pithouse occupation (Nelson 1973; Ames and Marshall 1980).

Among foragers, the settlement type with the best archaeological visibility is the residential camp. If variation among forager residential camps exists, Binford (1980:9-10) suggests that it is due to seasonally varying subsistence activities and occupation duration. On this basis, it is predicted that intersite variation resulting from a foraging strategy practiced on the southwestern Interior Plateau would be greatest between ecological zones. Two settlement types should be evident: 1) lowland residential camps; and 2) upland residential camps.

Environmental variability is also a factor of intersite variation among collector strategies. Intersite variation is further expected to result from the variety of settlement types utilized for the procurement, processing, and storage of resources. Two such settlement types are recognized: 1) residential camps at which maintenance activities occur; and 2) limited activity camps that include locations, field camps, and stations. Applied to the environmental situation of the southwestern Interior Plateau, a total of four settlement types can be expected: 1) lowland residential camps;

2) upland residential camps; 3) lowland limited activity camps; and 4) upland limited activity camps. The remainder of this chapter describes the archaeological sites and lithic assemblages that will be examined in attempt to interpret settlement function and settlement strategy from the pre-historic record.

Archaeological Data

The Sites

The Lochnore-Nesikep Locality

The Lochnore-Nesikep assemblages utilized in the present study were collected during archaeological research conducted by David Sanger in the early 1960s (Sanger 1963, 1970a). The objective of Sanger's work was to construct a prehistoric cultural chronology for the southern Interior Plateau. This sequence was briefly described in Chapter I.

Sanger (1970a) uses the term 'zone' to describe distinct cultural and natural strata inferred to represent separate episodes of human occupation. Zones are intended to be similar to components (Willey and Phillips 1958:2) and are ordered along a temporal dimension. A single site could potentially yield any number of zones.

The present study works with the archaeological units defined by Sanger (1970a) as zones. This means that not all of the lithic material from each site is included for analysis; only data identified to come from a specific zone

associated with a microblade technology are used. Four Lochnore-Nesikep locality sites yielded assemblages used in this study. One of these, the Nesikep Creek site, was identified as containing two distinct microblade zones. The locations of these sites are indicated in Figure 6. Each is briefly described below.

The Nesikep Creek Site (EdRk 4)

EdRk 4 is a deeply stratified site located on a terrace on the south bank of Nesikep Creek, 65 m above the Fraser River. It is the only site examined in this study situated on the west bank of the Fraser River. The site measures approximately 100 m N-S x 70 m E-W. Excavations conducted in 1962 revealed two zones, inferred to date post 1,000 B.P., located at the southern end of the site, and five zones dating between 7,000 B.P. to 4,500 B.P., in the northeastern end.

Zones IV and VII contain microblades. Each is identified as a separate assemblage for the purposes of the present study. These were recovered from excavation of a 5 m x 5.5 m unit located in the northeast portion of the site. Excavation was conducted in 5 cm arbitrary levels within the natural strata and material was screened through $\frac{1}{4}$ inch mesh (Sanger 1970a:14).

Zone IV was separated from the overlying Zone III by a sterile grey soil of unspecified depth. Zone IV is described as an intrusive pit cut into underlying strata. Sanger suggests

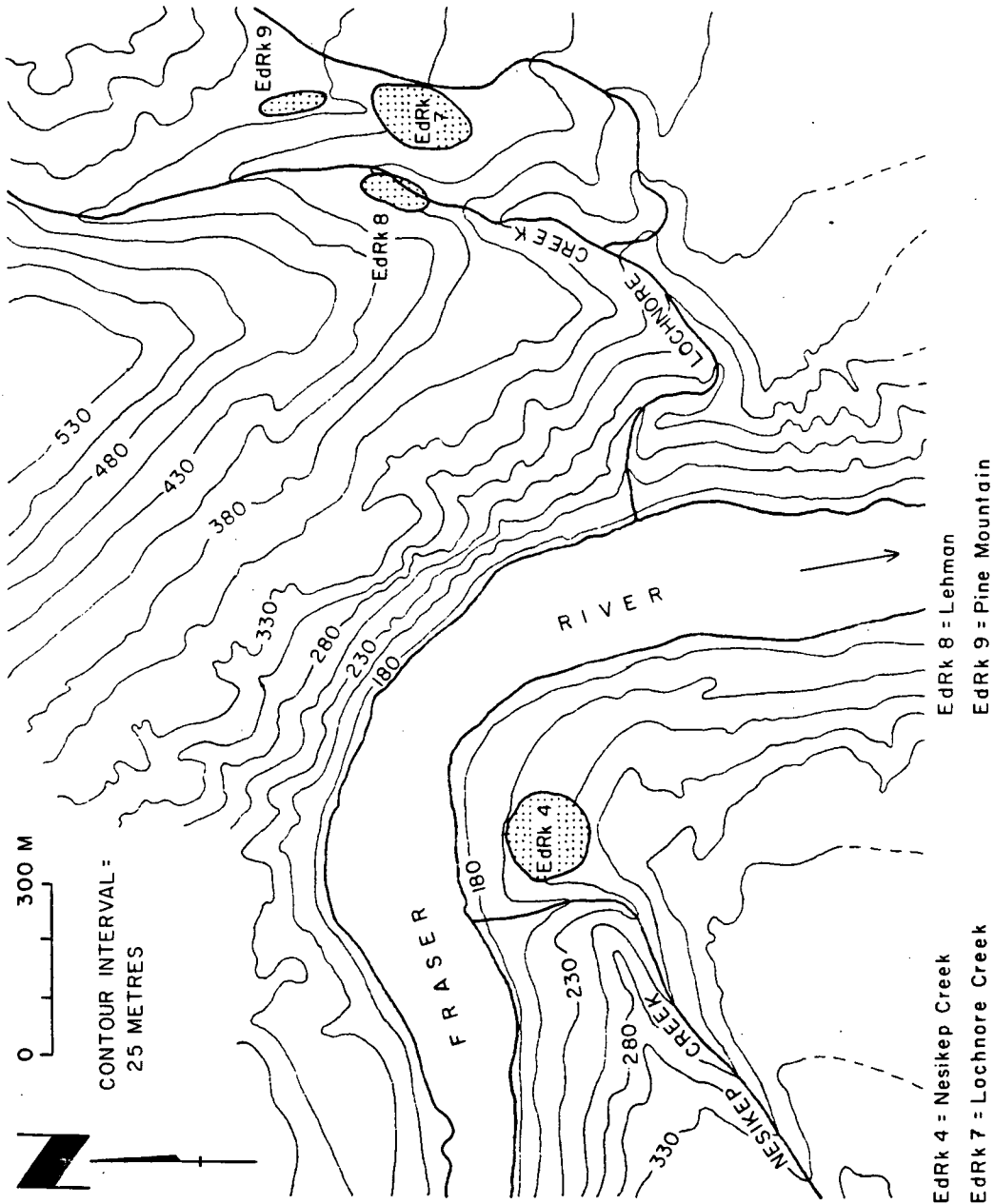


Figure 6. Locations of the Lochnore-Nesikep Microblade Sites Included in the Present Study (after Sanger 1970).

that the intrusion may be a remnant of a semi-subterranean pithouse (Sanger 1970a:14). No flora, faunal, or carbonized matter was collected from Zone IV.

Zones V and VI occur in a 20-40 cm thick deposit of light gray to white, wind-borne, silty sand that separates the microblade zones. Zones V and VI contain cultural deposits, but no microblades. They are not included in the present analysis.

The natural stratum from which the Zone VII cultural deposit was recovered was a medium to coarse brown sand of inferred fluvial origin. It lies immediately above the unsorted gravels of the Nesikep Creek fan (Sanger 1970a:15). Sanger (1970a:17) interprets meat broiling activities from the occurrence of rock concentrations in hearths surrounded by thin stake holes in the zone (Sanger 1970a:17). A concentration of projectile points, bifaces, unifaces, antler, bones, and ochre was recovered and is interpreted as a cache (Sanger 1970a:17). Bone recovered from Zone VII was dated at $5,635 \pm 190$ B.P. (Sanger 1970a:103).

The Lochnore Creek Site (EdRk 7)

The Lochnore Creek site is located on the east side of the Fraser River, approximately 240 m above the present river level. This is a complex housepit site 30 m above the east bank of the Lochnore Creek (Figure 6). The original dimensions of the site are estimated to have been 200 m x 75 m.

The site area, however, was gradually reduced by road construction and agricultural field development until much of the site was destroyed. Four pithouse features were recorded and tested by Sanger, yet in addition, reference is made to a trench excavated through "...portions of buried and un-numbered housepits" (Sanger 1970a:23).

Three zones were identified from the excavation, although Sanger admits to extensive mixing of all strata (Sanger 1970:28). Only Zones I and II contain microblades and are included in this study. Zone III, the lowest component, was recovered from a distinctive grey sand stratum, usually well below the pithouse features. Housepit 2 cut into this stratum, and resulted in redeposition of some Zone III materials. Artifacts coated with sand and carbonates distinctive of Zone III were subsequently removed from the upper zone assemblage.

Differentiation between Zones I and II is also problematic. The Zone II cultural material was deposited in orange-coloured sand and primarily occurred in the eastern portion of the site, away from the housepits. Some intrusion of Zone I into Zone II is noted in this area, and Sanger suggests that "Zone II objects, especially microblades, are undoubtedly interspersed with the Zone I assemblage" (Sanger 1970a:28).

The extent and direction of mixing remains an unresolved problem. Wyatt (1970a:136) reports 55 microblades from Zone I

and 48 from Zone II. The National Museum of Man catalogue, however, indicates a total of 128 microblades from Zone I and 3 from Zone II. The Zone II assemblage described by Wyatt may have included Zone I material; the rationale for such sorting is not made explicit. Because of in-field problems concerning strata identification and discrepancies within the catalogue, Zone I and Zone II artifacts used for the present study are included as a single, though recognizably mixed, assemblage.

Six radiocarbon dates were obtained from Zone I of the Lochnore Creek site. They range in data from $3,280 \pm 125$ B.P. to $1,610 \pm 140$ B.P. (Sanger 1970a:105). Sanger rejects the oldest date because of a discrepancy in dates derived by different laboratories on portions of the same sample. As well, the most recent date is rejected; it appears in a portion of the zone considered by Sanger to be older than the rest (Sanger 1970a:104). A cluster of dates between 2,600 to 2,700 B.P. is preferred. Nonetheless, the site complexity and probable site reoccupation suggest a time span many times longer than 100 years.

The Lehman Site (EdRk 8)

The Lehman site is located on the western terrace of Lochnore Creek, approximately 200 m west of the Lochnore Creek site (Figure 6). Surficial features of the site apparently once included housepits. These have been leveled by years of

ploughing. Archaeological testing of the site was limited to a 18 m x 50 m area of the Lehman garden (Sanger 1970a:31-32).

Six 2 m x 1 m units were excavated in November of 1964. Excavation was conducted in 10 cm arbitrary levels within natural strata. The top stratum, a dark brown soil, varied in depth from 25 cm to 40 cm and appeared to have been disturbed by ploughing. The underlying stratum was composed of yellow sand and clay, apparently easily distinguished from the disturbed stratum.

Sanger (1970a:32) infers that the upper stratum, Zone I, is representative of a pithouse component at this site. No evidence of a microblade technology is reported for the zone. Zone II yielded a large microblade sample, and only lithics from this zone are included in the present study. Lithic artifacts including microcores and blades, were surface collected by Mr. Lehman, and discrepancies between the sample size examined herein and that reported by Sanger are evident because Sanger added patinated items from the site surface to the Zone II assemblage (Sanger 1970a:32).

The collagen content of a sample of bone recovered from Zone II of the Lehman site suggested an absolute date for this zone of about 6,650 \pm 11 B.P. (Sanger 1970a:103). This date is the oldest date obtained for bone and charcoal samples recovered from the Lochnore-Nesikep locality. On the

basis of geological evidence, Sanger reverses the relative chronological order of this zone and Zone VII of the Nesikep Creek site. He believes the collagen date received for Zone II of Lehman to be too old (Sanger 1970a:105).

The Pine Mountain Site (EdRk 9)

The fourth Lochnore-Nesikep site included in the present study is the Pine Mountain site. It is located on a ridge immediately north of the Lochnore Creek site and overlooks the east bank of Lochnore Creek (Figure 6). Surficial features include six housepits distributed across an area 80 m N-S x 20 m E-W.

Excavation was concentrated on two of the pit features, HP1 located at the northern end of the site, and HP5 near the southern end. Three zones are identified for the site. Zone I and II are both from HP1, and Zone III, the microblade component, is unique to HP5. Sanger identifies Zone III as a separate component because of the zone's "...entirely different cultural assemblage..." (Sanger 1970a:35). The integrity of this zone as a single component is questionable considering the potential for mixing in housepit sites. Nevertheless, microblade technology is evident in the Zone III assemblage, and therefore, is included in the present study.

Upper Hat Creek Valley

Archaeological investigations of Hat Creek valley were undertaken by David Pokotylo in preparation for an Environ-

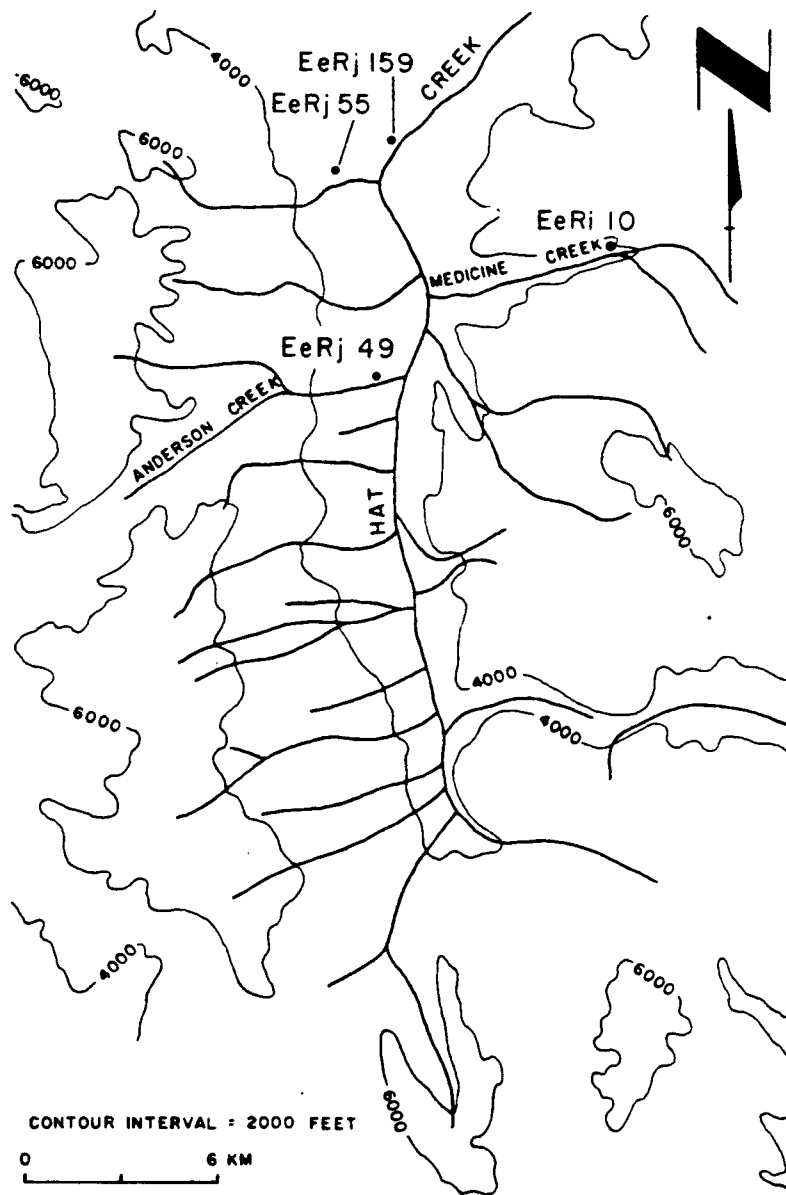
mental Impact Statement on B.C. Hydro's proposed development of the valley's coal resources. Fieldwork was conducted in 1976, 1977, and 1978. Investigation included survey of randomly sampled quadrats and excavation of sites selected according to their potential in assessing the significance of cultural resources in the valley. The results of the study are reported by Beirne and Pokotylo (1979). Pokotylo (1978) also examined intersite variation of lithic assemblage collected from site surfaces in 1976.

A total 199 prehistoric sites were identified in Hat Creek Valley, 20-25% of which indicate the presence of a microblade component (Beirne and Pokotylo 1979:(3)101). Four of the excavated sites, EeRi 10, EeRj 49, EeRj 55, and EeRj 159, revealed substantial microblade components and were selected for the present analysis. The locations of these sites are indicated in Figure 7. Each site is briefly described below.

The Cattle-Cross Site (EeRi 10)

EeRi 10 is a lithic scatter, located in open grassland, at an elevation of 304 m above Hat Creek, on the north bank of an unnamed tributary to Medicine Creek (Figure 8). An esker or moraine lies north of the site, and the area to the south is marshy. The marsh may once have been a lake (McCullough, personal communication, in Beirne 1979a:10).

This site was first recorded during the 1977 field survey (Beirne and Pokotylo 1979:(3) 80-82). The distribution



EeRi 10 = Cattle Cross
EeRj 49 = Anderson Creek

EeRj 55 = Houth Meadows
EeRj 159 = Junction

Figure 7. Locations of the Upper Hat Creek Valley Microblade Sites Included in the Present Study.

of surface materials indicates a site area of 96 m N-S x 60 m E-W. All cultural surface material was collected in 2 m x 2 m grid units. One hundred and seventy artifacts were collected, 140 items of which are debitage. No microblades were recovered from the site surface.

In 1978, ten 2 m x 2 m collection units were randomly sampled for test excavation. Their distribution across the site is illustrated in Figure 8. Excavation was conducted in 5 cm arbitrary levels within natural layers. All matrix was screened through 1/8" mesh. Units were taken down to an average of 15 cm, at which point a sterile clay horizon was uncovered. The top 5 cm of deposit was a dark, silty, and humic horizon, apparently disturbed by grazing cattle. Ranchers report 10 to 15 cm of standing water on the site following spring thaws. This stratum is followed by 10 cm of a lighter sandy silt. Ash lenses were uncovered in units 4 and 6, apparently the result of a large grass fire (McCullough, personal communication in Beirne 1979a:10).

No features and no faunal or floral remains were encountered during excavation. A total of 2402 lithic artifacts were collected. These are predominantly debitage, but include 107 microblades, two microcores and four micro-core fragments distributed throughout the top 15 cm of deposit. Beirne (1979a:32) interprets the deposits at the site to represent a single component. The lithic assemblage recovered

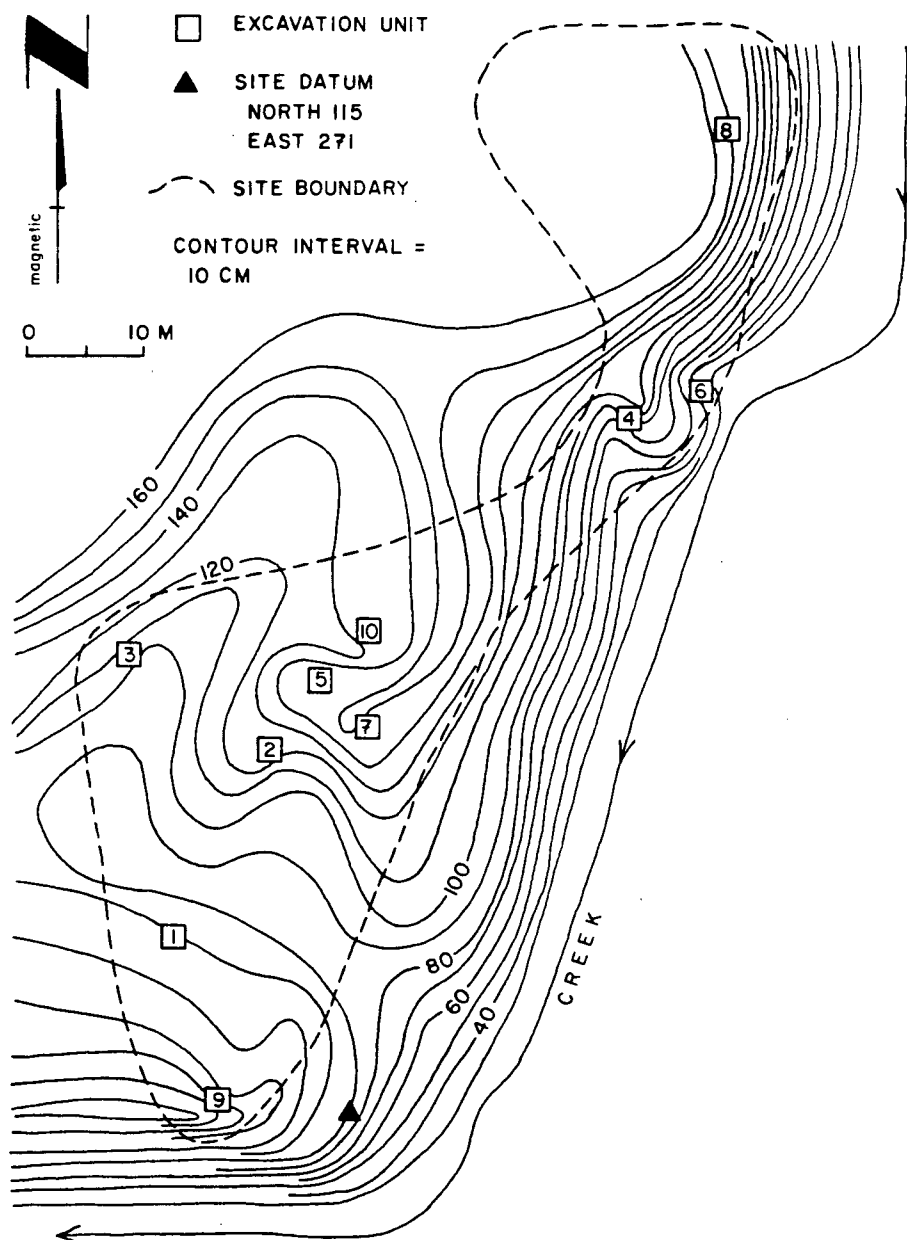


Figure 8. Plan View of EeRi 10, The Cattle Cross Site (after Beirne and Pokotylo 1979).

from all excavated units and from the site surface is included in the present study.

The Anderson Creek Site (EeRj 49)

EeRj 49 is a small lithic scatter site located at an elevation of 90 m above the west bank of Hat Creek. It lies 450 m north of Anderson Creek, which is deeply entrenched. The hummocky moraine of the area is covered by grasses.

One hundred and fifty-four lithic artifacts were collected from the site surface (84 m^2) in 1976. Most of the assemblage is debitage, but includes a chert microblade and a basalt microblade core. Excavation of two 2 m x 2 m units, in 1977, identified a shallow microblade component at the site (Figure 9).

Excavation was conducted in 5 cm arbitrary levels, and all matrix was screened through 1/8" mesh. The cultural deposit occurred primarily in the top 10-15 cm of sandy silt, although limited cultural material, probably intrusive, was recovered from the underlying clay stratum. Sterile clay was uncovered within 20 cm of the present surface.

The two units yielded a total of 190 artifacts, 69.5% of which is lithic debitage. The excavated assemblage also includes 52 microblades, a few retouched flakes, and a micro-core rejuvenation flake. No material suitable for radiocarbon dating was observed, and no cultural features were observed. All surface and sub-surface material is interpreted to repre-

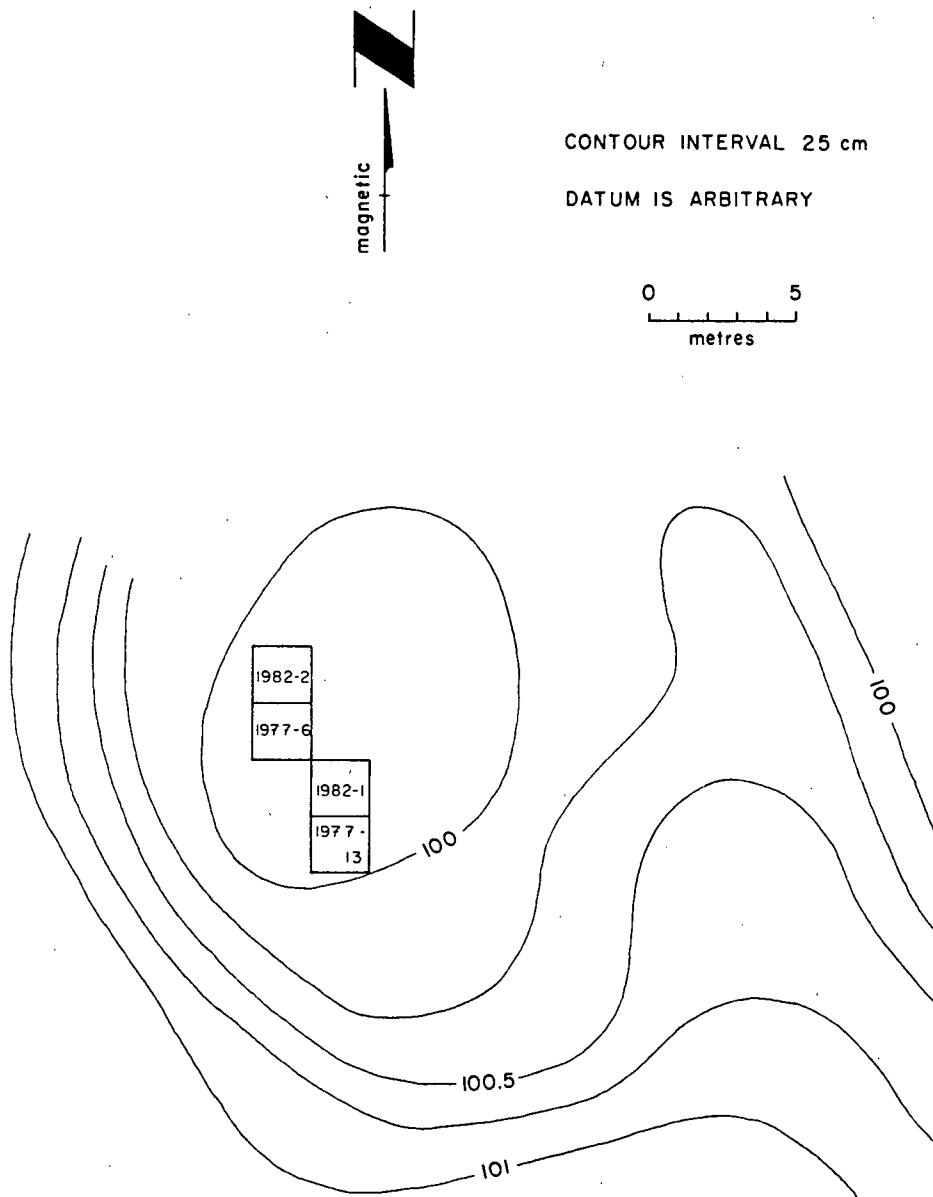


Figure 9. Plan View of Eerj 49,
The Anderson Creek Site

sent a single component (Beirne and Pokotylo 1979:(3)80).

The Houth Meadows Site (EeRj 55)

This site is located in the Houth Meadows at the north end of the valley. An unnamed tributary to Hat Creek flows south-east of the site. EeRj 55 measures approximately 60 m N-S x 20 m E-W (Figure 10).

EeRj 55 was first recorded during field survey in 1976. Three cultural depressions were recorded in the north end of the site (Areas A, C, D), and a lithic scatter (Area B) was collected in the south. Subsequent excavation conducted in 1978 revealed that Area C is a natural depression, the other two depressions, however, are interpreted to be the remains of earth ovens (Beirne and Pokotylo 1979:(3)74-76).

The microblade component at the Houth Meadows site is limited to Area B. One hundred sixty-eight lithic artifacts were collected from the surface of Area B. The surface assemblage comprises predominantly debitage and includes no microblades, although excavation of six 2 m x 2 m units exposed a small microblade component at the site.

The six units in Area B were excavated in 5 cm arbitrary levels within natural layers. Matrix was screened through 1/8" mesh. Site stratigraphy is composed of 20-50 cm of sandy silt above a culturally sterile calcareous till. All cultural material was recovered from the upper stratum. Artifacts were distributed throughout the layer, although most were recovered

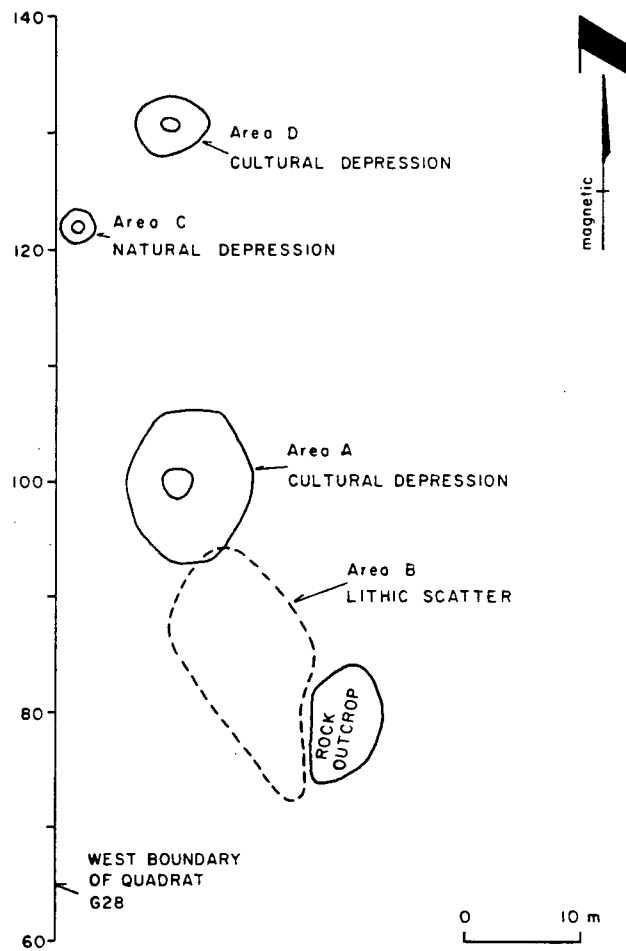


Figure 10. Plan View of EeRj 55, The Houth Meadows Site.

Between 10-20 cm below the surface (Beirne 1979b). The surface and excavated lithic assemblages from Area B are included in the present study. The cultural association between Area B and the earth ovens remains unclear. Nevertheless the occurrence of earth ovens at the site is worthy of note. Beirne and Pokotylo (1979:(3)75) report evidence of "...at least seven separate roasting episodes" in the excavated earth oven. Floral remains associated with the ovens include coniferous charcoal, a root or rhizome fragment, wild onion, and birch bark fragments. Salmon remains wrapped in a birch bark container were found under the rim of a rock pavement. Other identified faunal remains include elk, woodrat, and grouse. A radiocarbon date of 1220 ± 70 B.P. was obtained for the third pavement in Area A. Area D's single pavement yielded a much more recent date of 600 ± 40 B.P. (Beirne and Pokotylo 1979:(3)76).

The Junction Site (EeRj 159)

EeRj 159 is a large, complex site located near Marble Canyon at the north end of Hat Creek valley. Six cultural depressions, including housepits and earthovens, and an extensive lithic scatter are distributed along a scarp 30 m above Hat Creek. The site covers an area approximately 350 m N-S x 250 E-W (Figure 11).

In 1977, 52,290 lithic artifacts were collected from transects established across 14% of the site. Beirne and

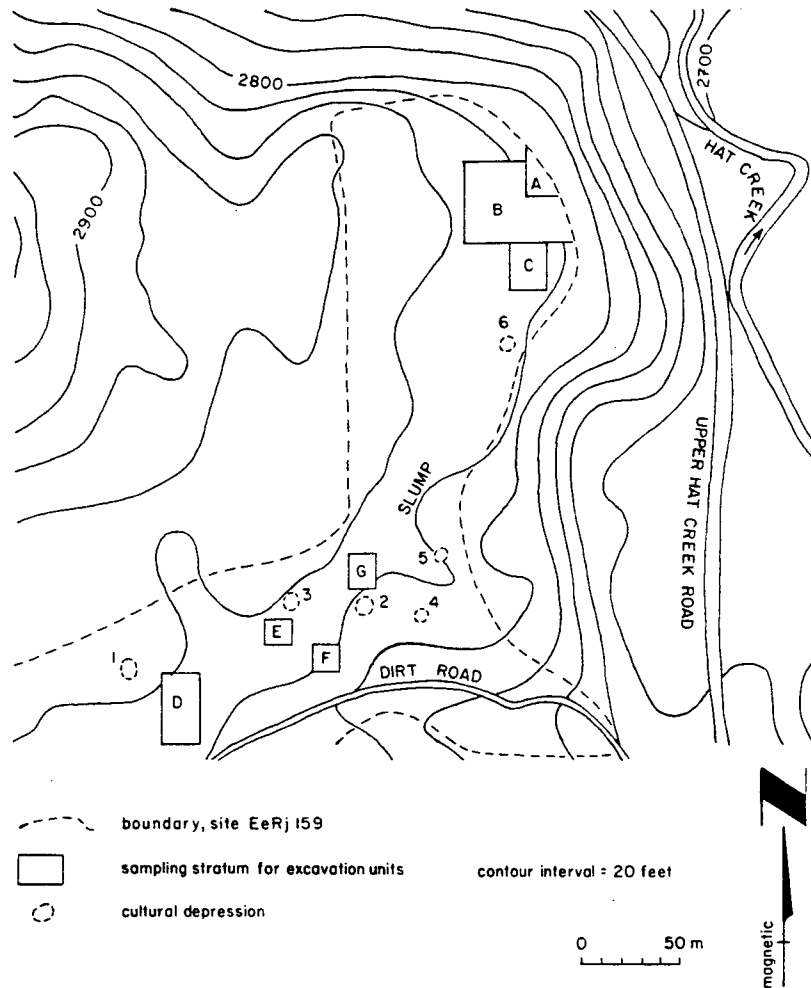


Figure 11. Plan View of EeRj 159, The Junction Site (after Beirne and Pokotylo 1979).

Pokotylo (1979:(3)83-86) defined seven areas, or clusters of artifacts, and the sub-surface deposit of each area was tested in 1978. EeRj 159's microblade component is concentrated in Area A. None of the cultural depressions were tested.

Two 2 m x 2 m units were excavated in 5 cm arbitrary levels within the natural strata of Area A. The matrix was screened through 1/8" mesh. Excavation exposed a compact clay horizon overlain by 35-40 cm of wind blown sandy silt. Most of the cultural material was recovered from the upper 30 cm of deposit. No cultural features were identified in either excavation unit. The units also lacked floral samples; carbon material suitable for radio carbon dating was not recovered. A few bone fragments recovered from unit 1 suggest prehistoric use of mule deer, beaver, other large and small mammals, and bird (Beirne and Pokotylo 1979:(3)86).

The two units excavated in Area A yielded what probably represents the largest collection of microblades recovered to date from the Canadian Interior Plateau. Together, they yielded a total of 953 microblades, 2 microcores, and numerous micro-core fragments. As well, 17,975 pieces of lithic debitage and a variety of biface fragments and retouched flakes were collected. Both the surface and the excavated material recovered from Area A of EeRj 159 are included in this study.

The Lithic Assemblages

Artifact Classification

The purpose of the classification described below is to examine patterns of tool manufacturing and use that may be indicative of settlement function. Studies have shown the importance of debitage, the by-products of stone tool manufacturing, as well as finished tools for identifying behaviour patterns responsible for the formation of lithic assemblages. Debitage is believed to have been produced and discarded within the boundaries of a single site (Collins 1975:19). Pokotylo (1978) has demonstrated that a wider range of site activities can be interpreted from analyses that include debitage assemblages than from similar analyses conducted on tool assemblages alone. Stone tools are subject to a variety of processes that may significantly alter the tool's final form and spatial relationships. Without comparative analyses of associated debitage, tool analyses can lead to observations concerning only the final context of the tool's history. Unfortunately, the debitage from the Lochnore-Nesikep assemblages are not available for study. Therefore, only finished tools could be analyzed.

Collins (1975) presents a linear flow model of lithic reduction that interprets variability among lithic tools and debitage as the result of stages of tool production. Each stage of production results with distinctive output, some of which is deposited directly into the archaeological record while other

output undergoes further reduction. Collins believes that by correlating lithic production by-products with reduction stages, inferences concerning the technological activities occurring at a site can be made. The model also suggests that variability in tool form results from the amount of trimming applied to manufacture the tool and from the amount of subsequent modification applied to maintain the tool. Collins (1975:17) proposes five main stages of reduction:

1. Acquisition of the raw material
2. Core preparation and initial reduction
3. Optional primary trimming
4. Optional secondary trimming
5. Optional maintenance and modification
(*italics mine*)

The continuation of an artifact through each stage depends upon the success of the output produced in the preceding stage. The process can stop following any stage, but no preceding stage can be omitted. This model suggests that certain "simple" tools will be manufactured, used, and then discarded, while more "complex" tools will be modified and maintained through a greater variety of activities. Stage 5, optional maintenance and modification, can continue until the tool has been altered beyond repair. Other things being equal, one can expect that tools undergoing little maintenance will leave the cultural system and enter the archaeological record at greater frequencies per activity than will more highly maintained tools (see also Ammerman and Feldman 1974).

Collins' model is operational in terms of identifying technological variability (see Pokotylo 1978). Nonetheless, the model does not explain why technological variability exists. Specifically, why is primary trimming sufficient for certain tools while others undergo extensive modification and maintenance? The present study proposes that explication of this variability could provide valuable clues for interpreting settlement function. An objective of the following discussion is to identify conditions underwhich tools will be maintained or rapidly discarded so that the effects that this variability will have on the composition of the archaeological record can be examined.

Binford (1977) suggests that distinct technological systems are based on varying degrees of maintenance behaviour. His ethnographic study of the Nunamiut indicates that their technology is extensively planned and curated. Gear is moved between sites in anticipation of tool needs. Binford (1977) contrasts Nunamiut technological organization with one based on a more expedient system of tool manufacture. Within the system, tools are expected to be manufactured, used, and discarded at one site. Although no ethnographic example of an expedient technology is provided, Binford (1979:269) suggests that the Mousterian is represented largely by a non-curved technology. Technological efficiency is believed to increase with increased curation (Binford 1977:34).

Organizational variation among technological systems is

expected to significantly alter the composition of archaeological assemblages. Binford (1977) observed that gear was taken to field camps in anticipation of the activities to be conducted there. However, the gear brought into the camp was rarely left there. Instead, it was returned to the village for repair and future use. Binford (1977:34) suggests that the effects curate behaviour has on the archaeological record will be such that:

- 1) artifact frequencies are not directly correlated with the frequency of site activities, but rather with artifact replacement rates; and
- 2) manufacturing by-products will not be spatially associated with finished tools.

On the basis of his ethnoarchaeological research among the Nunamiut, Binford (1979) suggests that the use of varying amounts of curated and expedient tools within technological systems will influence patterns of assemblage variability. He suggests that the technological "role" in which tools are intended to be used affects the resource procurement strategies, manufacturing, design, and discard patterns associated with each tool. These roles are inferred to be correlated with the function of the settlement within the settlement system.

Three technological roles for tools are proposed:

- 1) personal gear, 2) site furniture, and 3) situational gear (Binford 1979:261). Of these, personal gear is curated and maintained more than either of the other tool roles, and high relative proportions of personal gear are expected within

curated technologies (1979:269). Personal gear is brought to sites in anticipation of specific tool needs. Because personal gear is generally brought in good repair, Binford (1979:263) suggests that it will not be used to exhaustion at the loci of use, but will be returned to the base camp. Personal gear, therefore, should be more common at base camps than limited activity settlements. Extensive tool maintenance will result in generally low frequencies at limited activity sites where the tools are used.

Certain other tools are maintained but are not curated as extensively as personal gear. These tools, termed site furniture (Binford 1979:264), are cached for future use. Site furniture may include such items as hearths, cooking pots, and lithic raw materials. The frequency at which these items generally occur at a site is low because individual items of site furniture are maintained and re-used during a number of site re-occupations. Matson (n.d.:5) suggests that limited activity sites will have site furniture specifically suited to the site's activity. He cites the gaffing pole of the Chilcotin, cached at fishing spots, as an example.

The third role that influences assemblage composition is that of situational gear (Binford 1979:264). Binford defines situational gear as tools expediently manufactured, used, and discarded in response to immediate conditions. Tool design will vary according to the availability of raw material and the demands of the task at hand. If raw material is readily available,

minimum labour will be invested into the manufacture and maintenance of situational gear. When raw material is scarce, personal gear will be modified and maintained to meet the immediate task demands. Binford (1979:267) suggests that situational tool-use conditions are most common to field conditions or special purpose sites. Because manufacturing, use, and discard practices are expedient, it can be expected that the frequency of situational gear is correlated with the frequency of the activity in which these tools were used (Binford 1977:34).

Binford does not attempt to correlate technological roles with observable features of the archaeological record. Research into this problem has been initiated by Camilli (1981, 1982) and independently examined by Matson (n.d.). Both examine archaeological assemblages from Cedar Mesa, Utah. Camilli proposes that by correlating tool classes with technological roles and examining the distributions of these roles among sites, interpretations concerning the settlement role of each site within the settlement system can be made. Her approach is to define distributions for each technological role vis-à-vis its relationship with independent variables of assemblage size, number of locations, and intensity of use. The distribution of tool classes are then examined, and each class assigned membership to the technological role it best fits. Camilli has been able to demonstrate that different tool classes pattern in a manner similar to what might be expected given

the existence of varying technological roles. Her analysis must assume, however, that the assemblage is representative of a planned technology, and that the artifact classification does not mix tools performing different technological roles.

According to Camilli (1982:4) the debris from personal gear should be positively correlated with the intensity of use and with the number of broken and worn tools. Biface fragments, including tips and midsections, were identified as representative of this technological role (Camilli 1982:9). She expects site furniture to be correlated with the number of similar functioning locations. At the same time, site furniture should be negatively correlated with intensity measures. (Camilli 1982:3). Artifact classes representative of site furniture include hammerstones, manos, and metates (Camilli 1982:9). Camilli regards processing tools as situational gear and expects that these tools will be correlated with the intensity of use of the site as measured by food and manufacturing debris. Given that this tool type is expedient in nature (that is, it is manufactured, used, and discarded in situ), the frequency at which these tools occur at a site should be correlated with the frequency of activity in which the tools were used. This activity may or may not be representative of the major processing activities occurring at the site. Camilli (1982:3) assumes that it is. Flake tools, biface ends, unnotched distal fragments, and hammerstone frag-

ments follow the pattern expected of situational gear (Camilli 1982:9).

Matson (n.d.) is concerned with explicating the relationship of site furniture and situational gear with independent variables of settlement occupation length (total amount of time, including all visits, spent at a site) and settlement occupation duration (total amount of time spent during a single occupation of a site). Matson (n.d.:10) suggests and confirms that site furniture, represented by hammerstones and metates, will be more common to larger, more intensively occupied settlements; it will also be better represented proportionally at small, short-term settlements. Situational gear (flake tools) is found to increase proportionally with increased length of occupation, a relationship expected from Camilli's model (Matson n.d.:18). However, this distribution is not observed for settlements of short occupation duration (Matson n.d.:32). Matson (n.d.:29) also found that technological roles of certain tools changed as duration of occupation or site function changed.

The studies described above suggest patterns of assemblage composition that are a result of varying discard practices associated with tool modification and maintenance. Tools that are extensively maintained and curated are expected to be manufactured, used, and discarded in a wide variety of contexts, generally originating and ending at the base camp. High proportions of these tools are expected at base camps. Tools that are

maintained but not extensively curated are expected to have low site frequencies and may be indicative of specific site activities. A greater variety of these classes are expected to be more common at base camps than at limited activity camps; those present at limited activity camps should be represented by high proportions. Finally, tools that are not extensively maintained nor curated should be indicative of the intensity at which certain site activities were conducted at each site. This technological strategy is expected to be most common of strategies practiced at limited activity settlements, but should be represented in higher proportions at residential camps.

The artifact classification described below correlates technological and use attributes with technological roles (Binford 1979). Five categories of tool classes are identified: 1) Extensively retouched artifacts, 2) Extensively retouched artifact fragments, 3) Marginally retouched artifacts 4) Maintenance activity artifacts, and 5) Prepared core and microblade artifacts. The organizational variability that these artifact categories are expected to model is suggested.

1. Extensively retouched artifacts

A variety of projectile point, biface, and uniface classes are included in this artifact category. The classes are grouped due to the common occurrence of extensive retouch on at least one facial surface of each tool. Extensive retouch is

defined as retouch covering 2/3 or more of the tool's surface measured in from the margin (Chapman 1977:378) and is indicative of intensive labour expended in the tool's manufacture. It might also represent continued tool maintenance. In terms of Binford's (1979) model, it is proposed that these artifact classes are similar to personal gear.

Extensively retouched artifacts should occur most frequently at residential camps. Binford's (1979) model suggests that these artifacts were manufactured and maintained at residential camps. They were used at limited activity settlements but were discarded there only if they were damaged. Basal fragments of hafted tools were likely left in the haft, which was returned to the residential camp for retooling (Keeley 1982).

Complete projectile points. Projectile points are bifacially modified artifacts exhibiting a pointed tip at one end and evidence of hafting at the opposite end. Only intact specimens are included in this class. The size and shape of projectile points vary, although there is some tendency for style to be limited in time and space. Projectile points are usually considered to have been part of a hunting tool-kit, used either as tips on the ends of spears or arrows, or as hafted knives.

Only a single complete projectile point is present in the Hat Creek lithic assemblage. It is similar to Sanger's (1970a:38) Group 1: Leaf-shaped type (see Plate 1-a). Sanger

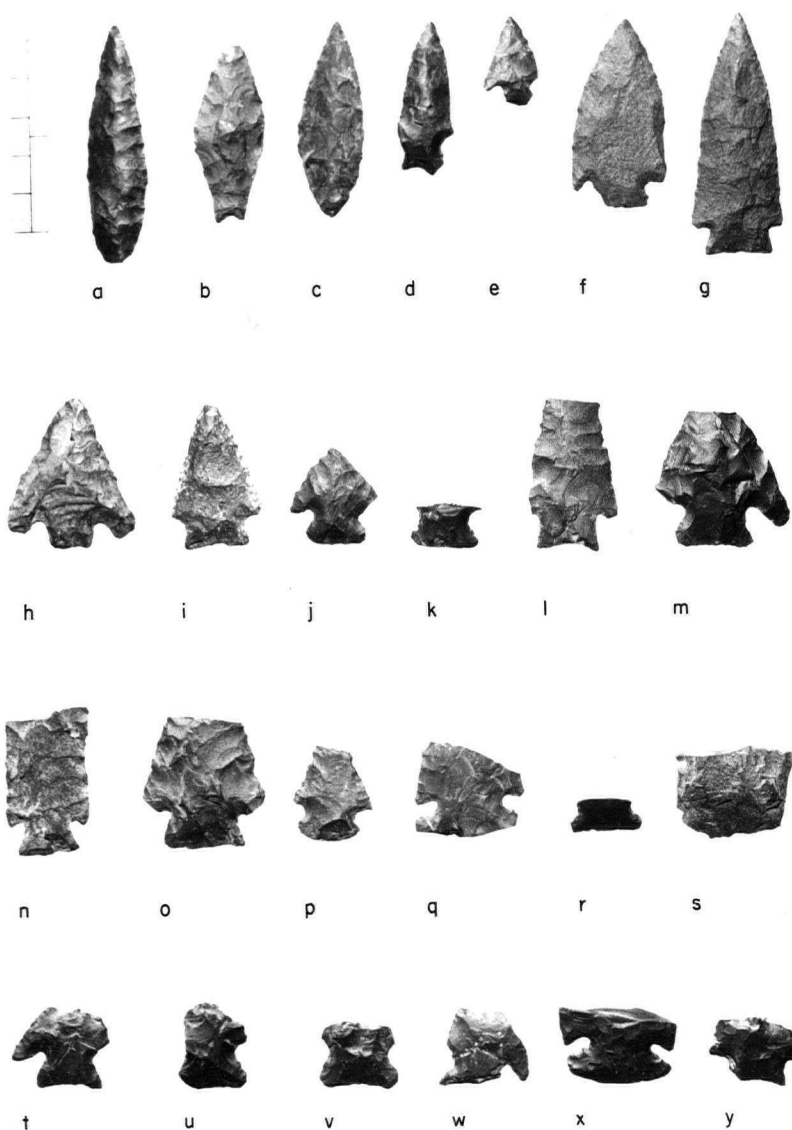


Plate 1. Extensively Retouched Artifacts
a-j: complete projectile points
k-s: projectile point fragments
t-y: modified projectile points

found this type to occur through the entire Lochnore-Nesikep sequence. The Lochnore-Nesikep projectile points are described in Sanger (1970a:36-50). A sample of these artifacts is presented in Plate 1:b-j. Generally, the points are large with neck widths greater than 11 mm and are made of basalt. EdRk 7 exhibits the greatest variety of styles, including a number of smaller type points. No Kamloops Phase points are present in the assemblages.

Projectile point fragments. This artifact class is primarily composed of projectile point basal fragments. Tips are included only if some evidence of the basal notch remains. These fragments do not exhibit any evidence of post-breakage modification. Like the unbroken projectile point class, most fragments also exhibit a neck width of 11 mm or greater. Projectile point fragments are displayed in Plate 1:k-s.

Modified projectile points. These artifacts are similar to projectile point fragments except that each has evidence of post-breakage use or modification. The tips of these artifacts have been snapped, and flake scars occur along the broken edge and on one or both faces. Modification appears as polish on the basal edge of a single specimen (see Plate 1:t-y).

The artifacts in this class include some of those Sanger describes as hafted scrapers (Sanger 1970a:69), as well as certain specimens he classifies as projectile points (Sanger 1970a:41). Sanger includes artifacts in his hafted scraper

class "...on the basis of the shared distinctive base-form attributes" (Sanger 1970a:69). Certain of Sanger's hafted scrapers do not exhibit modification opposite the haft. In the present analysis those artifacts are classified as projectile point fragments. Concern here is with the context of use not the technique of use.

Steep edge bifaces. Steep edge bifaces are identified as artifacts that have been shaped by extensive retouch on both faces. They are distinct from projectile points in that bifaces exhibit no notches, stems, or barbs indicative of basal hafting. All bifaces included in this class are unbroken and have edge angles of 45° or greater. Edge angles were measured similarly for all tool classes. A goniometer was used and the measurement read 2 mm in from the tool margin. Flake scars on the faces of these bifaces are generally large. Morphologies vary (see Plate 2:a-e). Bifaces are often inferred to have been knives.

Acute edge bifaces. The artifacts in this class are similar to the bifaces described above except that the edge angle of acute edge bifaces is less than 45° . These bifaces also exhibit a finer flaking pattern. The morphology of these artifacts is primarily triangular to oval (see Plate 2:f-i).

Steep edge unifaces. Artifacts included in this class exhibit retouch on an entire face, and edge angles are 45° or greater. All are included in Sanger's formed uniface class

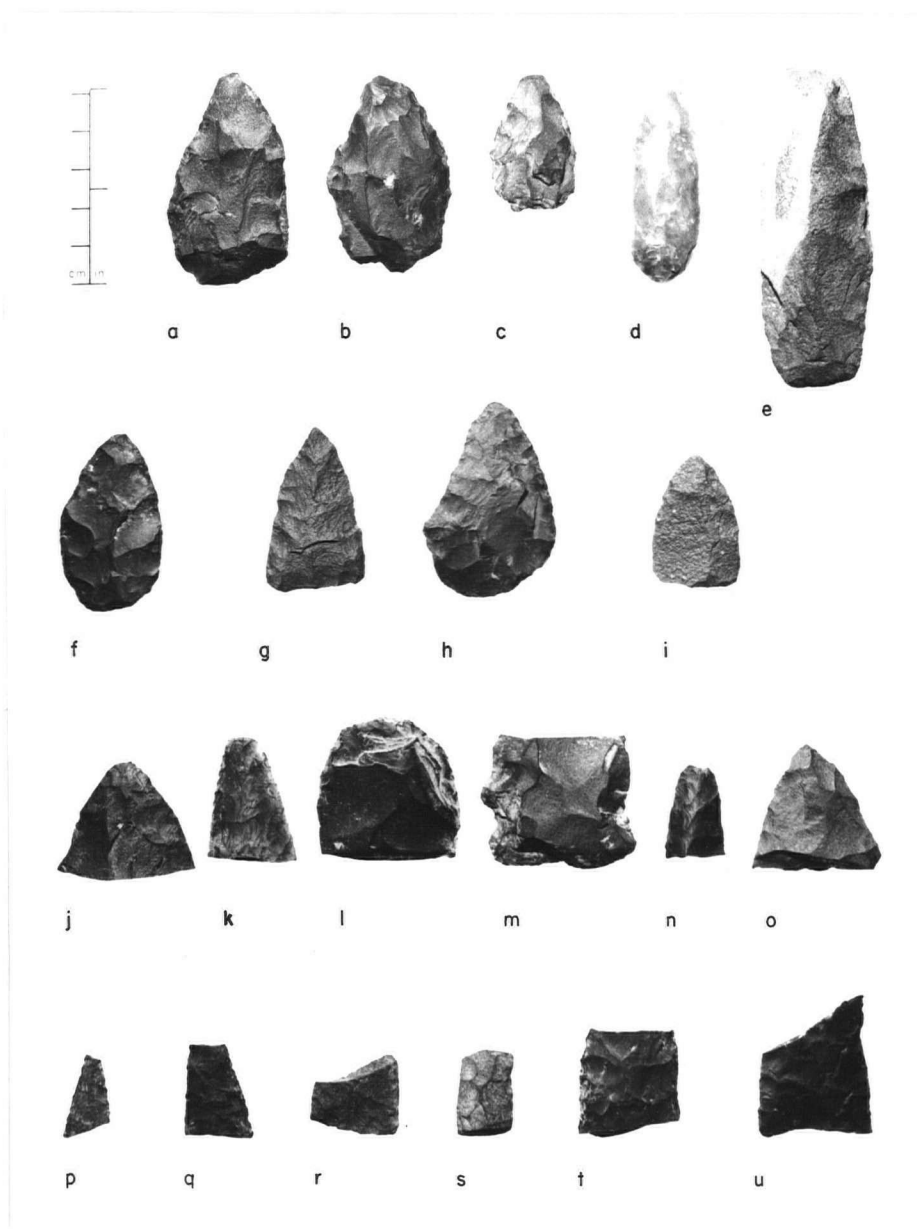


Plate 2. Extensively Retouched Artifacts and Fragments

a-e: steep edge bifaces

f-i: acute edge bifaces

j-o: biface fragments: steep edge

p-u: biface fragments: acute edge

(Sanger 1970a:76-80) (see Plate 3:a-d). These artifacts may have been used as scrapers.

Acute edge unifaces. These implements are similar to those discussed above except that edge angles are less than 45° (see Plate 3:e-f). Acute edge unifaces may have been used in cutting activities.

Combination edge unifaces. These implements exhibit extensive retouch on one face. At least two distinct edges are present on each tool. One is 45° or greater and another is less than 45° (see Plate 3:g-i). The multiple edge characterizes a specialty tool, possibly hafted.

2. Extensively retouched artifact fragments

Two classes of biface fragments are included in this general category of artifacts. It is suggested that broken Bifaces represent artifacts included in Camilli's (1981, 1982) processing tool category. Assuming that tools were broken and discarded in conjunction with use (see also Matson n.d.:3), their frequencies should be correlated with the rate of activity and intensity of settlement occupation. Highest assemblage proportions are expected for settlements occupied for longest lengths of time and for longest durations. These factors can crosscut settlement type classifications.

Biface fragments: steep edge. Biface fragments with steep edges include tips, bases, medial sections, and lateral edges of bifacially reduced tools. Edge angles are equal to

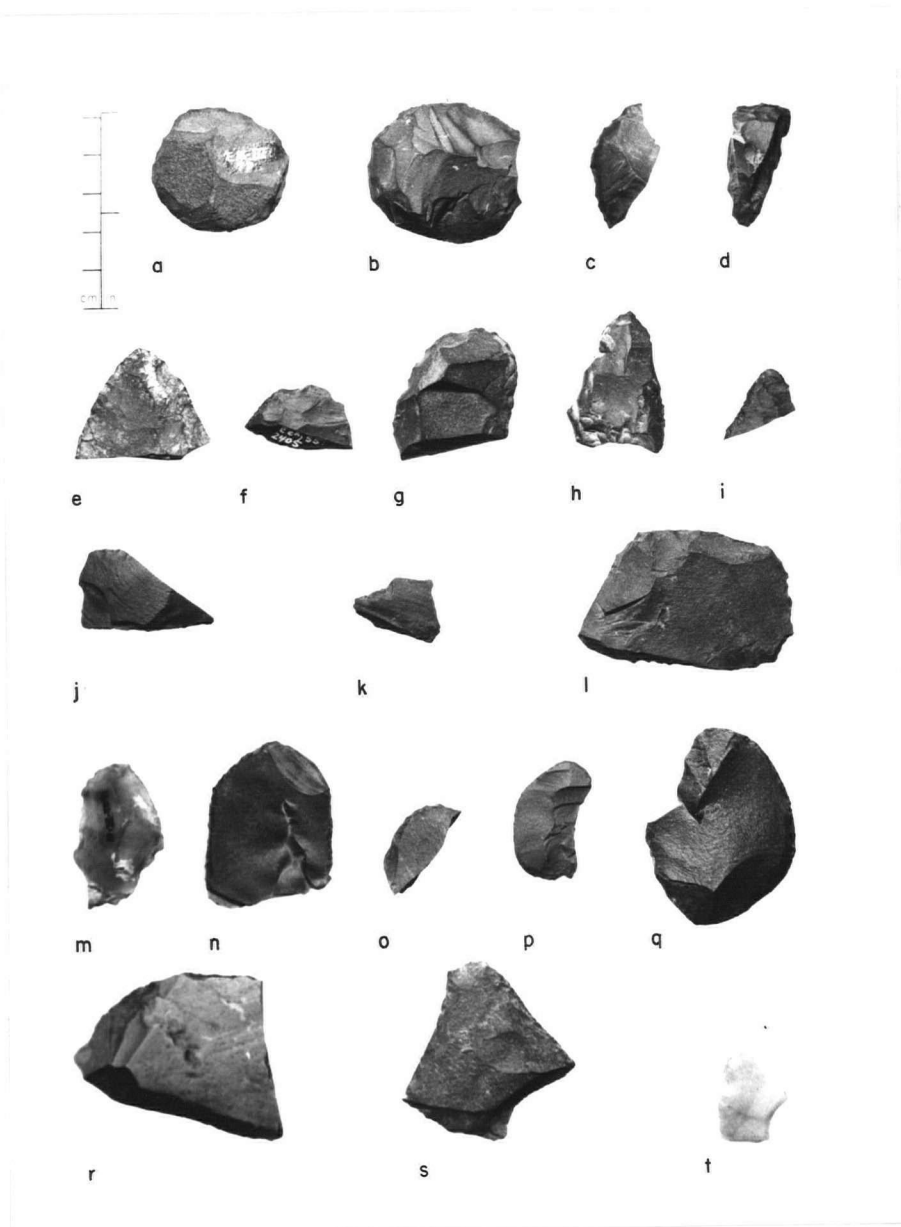


Plate 3. Unifacially and Marginally Retouched Artifacts

a-d: steep edge unifaces

e-f: acute edge unifaces

g-i: combination edge unifaces

j-k: steep edge marginally bifacially retouched flakes

l: acute edge marginally bifacially retouched flakes

m-o: steep edge marginally unifacially retouched flakes

p-q: acute edge marginally unifacially retouched flakes

r-t: combination edge marginally retouched flakes

or greater than 45° . Fragments could be remnants of either bifaces or projectile points (see Plate 2:j-o).

Biface fragments: acute edge. Bifacially retouched tips, bases, and mid-sections, with lateral edges of less than 45° are included in this artifact class. Many of the tips look like projectile point tips, but, without the base, their identification as such is tenuous (see Plate 2:p-u).

3. Marginally retouched artifacts

Little energy was expended during the manufacture of the tools included in the artifact classes of this category. Retouch occurs along the margin of each tool, covering less than 1/3 of its surface. A variety of marginally retouched artifacts are distinguished with respect to edge angles and to the number of faces on which retouch occurs. These classes may represent a variety of functional modes.

Of all the tool classes, those included in this category are most likely to have been manufactured, used, and discarded in situ. It is suggested that they represent expedient tool strategies characteristic of situational gear (Binford 1979: 264) and will be correlated with the intensity of settlement occupation (Camilli 1981, 1982).. These tool classes are expected to be the most common tool classes occurring at limited activity settlements. They are also expected to increase proportionally with increased use of the site. Highest proportions will occur at re-occupied residential camps (Matson n.d.:18)

Steep edge marginally bifacially retouched flakes.

Both faces of the implements in this class have been retouched along one edge margin. The angle of the edge exhibiting retouch is 45° or greater (see Plate 3:j-k). The steep edges of the implements in this class suggest a scraping function, and the retouched edges may be indicative of re-sharpening or edge strengthening.

Acute edge marginally bifacially retouched flakes.

Similar to steep edge marginally bifacially retouched flakes, the retouch on these artifacts is limited to less than 1/3 of each face. In this class, the angle of the retouched edge is less than 45° (see Plate 3:l). Interpretation of these artifacts is also similar to those discussed above, except that a distinct function, probably cutting, is inferred for acute edge marginally bifacially retouched flakes.

Steep edge marginally unifacially retouched flakes.

Steeped edge marginally unifacially retouched flakes are retouched on less than 1/3 of one face. The angle of the retouched edge is greater than 45° . Even though some of these artifacts are described as formed uniface by Sanger (1970a:76-80), they are included in this class because of their lack of extensive retouch (see Plate 3:m-o). The steep edge angle suggests a scraping function.

Acute edge marginally unifacially retouched flakes.

This class is similar to the class described above. The retouched edge of acute edge marginally unifacially retouched

flakes is less than 45° , suggesting a distinct function, probably cutting. Apart from microblades, this artifact class is the most common class in the assemblages (see Plate 3:q).

Combination edge marginally retouched flakes. At least two marginally retouched edges occur on the artifacts included in this class. One is 45° or greater, the other is less than 45° . They occur on either one or both faces. Although expediently manufactured, the multiple edge exhibited on these implements may represent intensive and variable use of a single tool, and curation can be inferred. Nonetheless they are included in this category of artifacts due to their lack of extensive modification (see Plate 3:r-t).

Bipolar implements. Bipolar implements are characterized by crushing and negative bulb scars occurring at opposite ends of the artifact. Some specimens may exhibit a second set of bulb scars perpendicular to the first set. Few exhibit extensive modification. (see Plate 4:h-k).

Binford and Quimby (1963) suggest that bipolar implements are produced as a result of striking the raw material from above while it rests on an anvil. If this is the case, then bipolar implements can be interpreted to be cores, the bipolar technique being particularly suited for reducing small cobbles. MacDonald (1968) suggests that the crushing at opposite ends of these implements is a result of their use as stone wedges, or pièces esquillées, for splitting wood. Certainly, bipolar

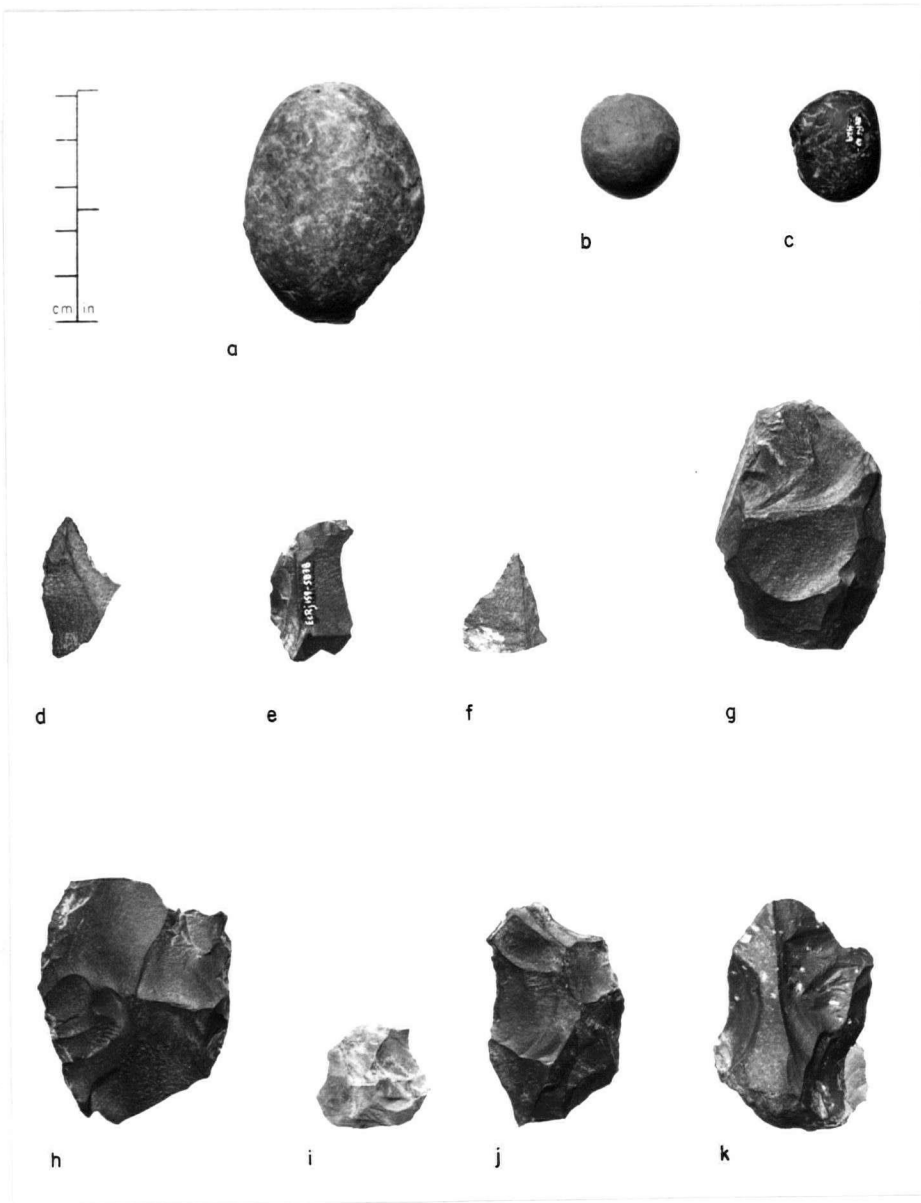


Plate 4. Maintenance Artifacts and
Marginally Retouched Artifacts.
a-c: hammerstones
d-f: graters
g: preforms
h-k: bipolar implements

implements may have been used in either fashion as Hayden (1980) suggests. Nonetheless, the morphological characteristics distinguishing these functional classes are difficult to identify. The present study identifies only one encompassing class of bipolar implements.

Sanger (1970a:84) reports that bipolar implements are rare at the Lochnore-Nesikep locality. However, the present study identified 275 bipolar implements in the Lochnore Creek site alone. It is suspected that Sanger's non-formed biface class includes numerous bipolar implements (Sanger 1970a:76). In any case, the association of these implements with the housepit site suggests a woodworking, maintenance function.

4. Maintenance activity artifacts

Five artifact classes are included in this category. Each class is inferred to be representative of a distinct function, which is often believed to involve the production of other tools. These artifacts are indicative of the maintenance activities occurring at a site. It is expected that their distribution will be similar to that of site furniture. They should be common to residential sites, but will be represented by high proportions at limited activity settlements (Matson n.d.:10).

Gravers. The artifacts in this class may occur in a variety of shapes, but common to each, is a formed projection. Each is unifacially retouched, primarily along either edge of

the projection (see Plate 4:d-f). Gravers are inferred to have been used in the manufacture of bone and antler tools (Sanger 1970a:83).

Preforms. Preforms appear as unfinished bifacially retouched tools exhibiting large areas of at least one face that remain unretouched (see Plate 4:g). They are inferred to have been produced during the initial stages of biface manufacture. Preforms are indicative of tool manufacturing activities.

Hammerstones. Hammerstones are small cobbles with evidence of battering at one or both ends (see Plate 4:d-e). The battering, a concentration of flake scars, is inferred to be the result of the cobble being used as a percussion instrument during the early stages of stone tool production. The presence of hammerstones at a site suggests lithic tool manufacturing activities.

Cobble tools. A variety of cobble tools are in this class and include cobble choppers and spall tools (Sanger 1970a:84-85) (see Plate 5:c-e). They may have been used in a variety of activities; their generally large size suggests heavy duty activities such as wood processing (Sanger 1970a:84) or hide scraping.

Abraders. A few flat sandstone abraders are included in the lithic assemblages. Abraders may have been used in the production of bone and antler tools. They are indicative of

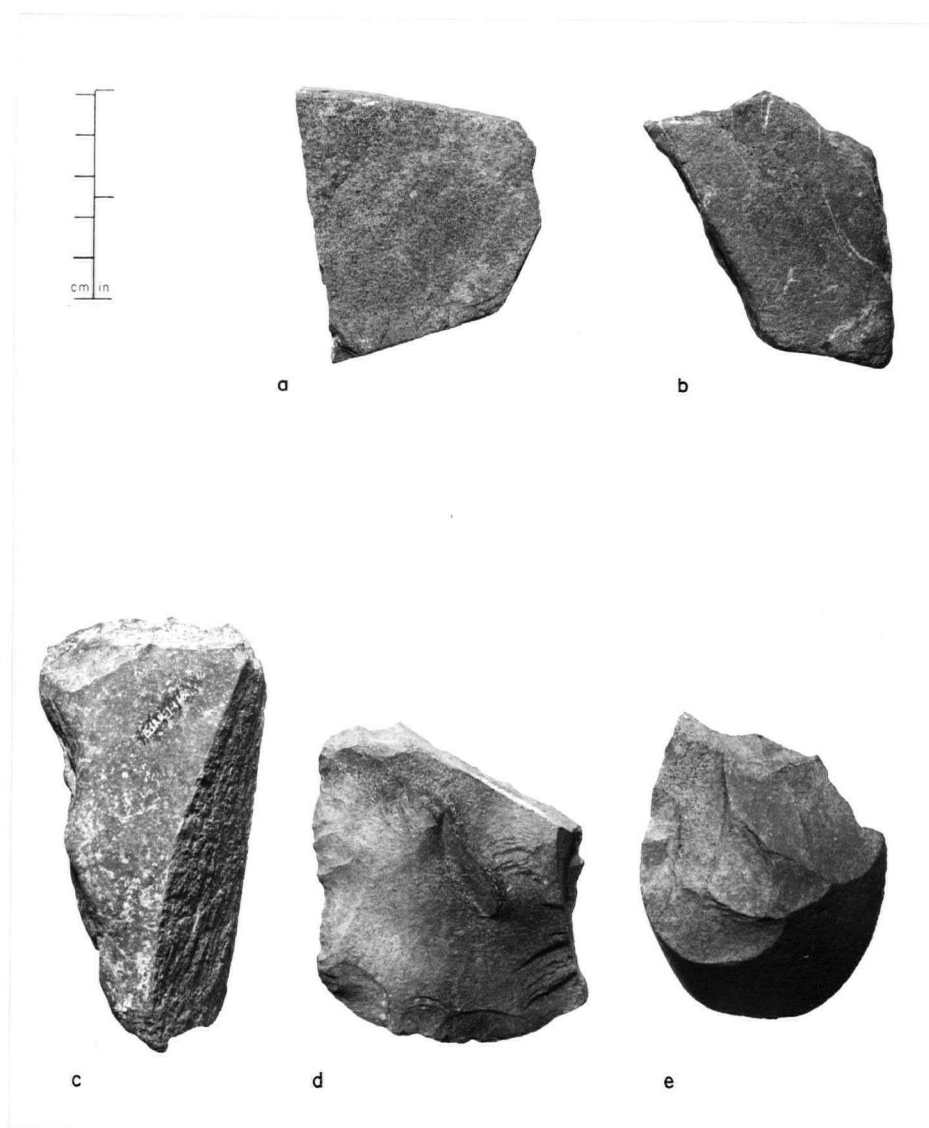


Plate 5. Maintenance Artifacts
a-b: abraders
c-e: cobble tools

maintenance activities (see Plate 5:a-b).

5. Prepared core and microblade artifacts

Artifacts included in this category are representative of a prepared core and microblade technology. A variety of artifact classes that measure aspects of microblade manufacturing, use, and maintenance are defined. Technological organization is expected to be evident from the intersite distribution of these artifact classes.

Microcores are the specially prepared parent material from which microblades are produced. Techniques of microcore production were described in Chapter I. Because of the labour invested into microcore production, it is suggested that microcore production and maintenance are base camp activities. High proportions of microcore debitage and exhausted cores are expected at residential camps. Prepared cores may have been curated as part of personal gear or usable cores may have been left at certain sites as site furniture.

Microblade production, that is the removal of blades from prepared cores, can occur in spatial and temporal contexts separate from microcore production. High proportions of platform remnant bearing microblades are expected at the locus of microblade production.

Usable microcores. Usable microcores are intact cores from which microblades can be removed. They exhibit a prepared platform and blade scars indicative of blade removal.

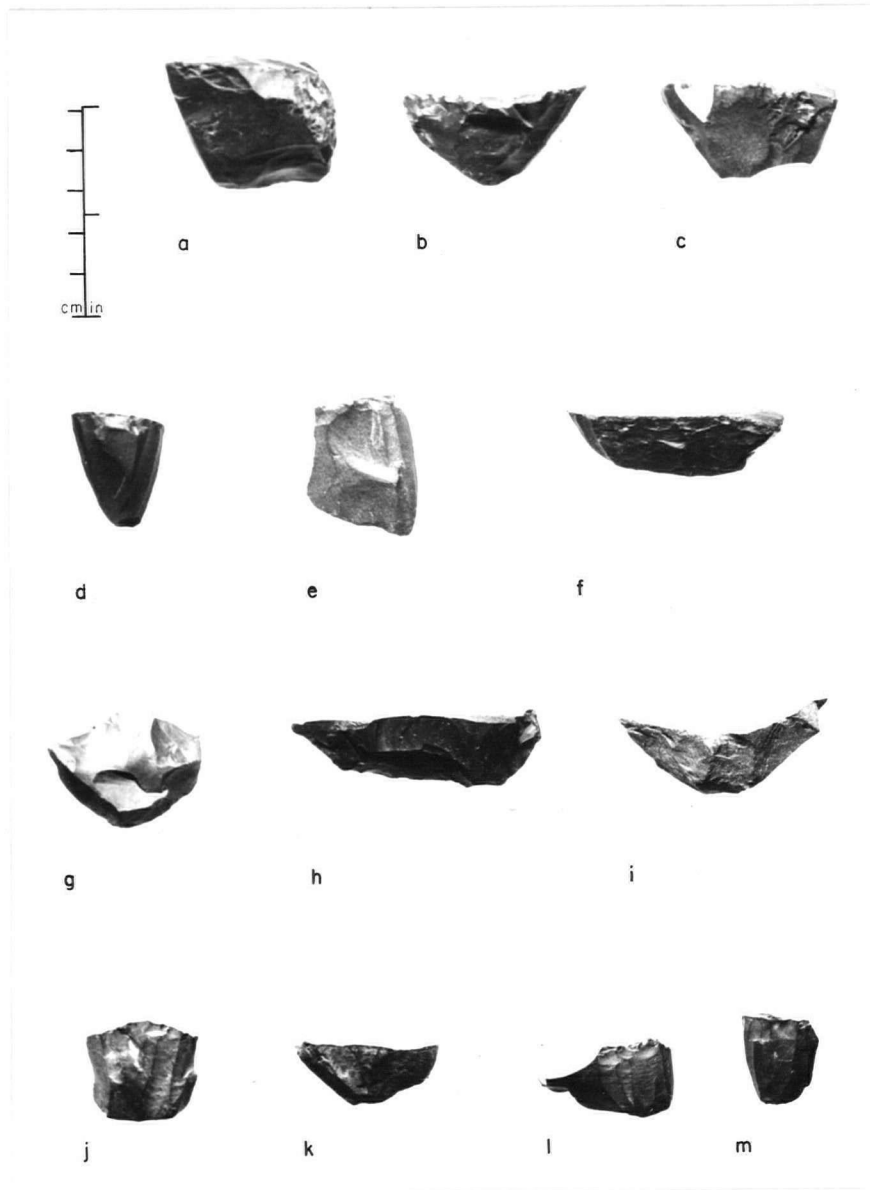


Plate 6. Prepared Core Artifacts
a-m: usable microcores

Microcores from the southwestern Interior Plateau are of the wedge-shaped type defined by Morlan (1970). They are also similar in most part to the Plateau Microblade tradition defined by Sanger (1968a). No weathered platform was identified on the specimens (see Plate 6:a-m).

Exhausted microcores. Exhausted microcores are large, thick microcore fragments. They have been reduced to the point of breakage or exhaustion. Specimens exhibit truncated striking platforms, hinge fractures on the removal face, or the distal end is snapped. It is unlikely that more microblades could be removed from these fragments without major refurbishment (see Plate 7:a-g). The presence of exhausted microcores at a site suggests intensive manufacturing activities.

Microcore debitage. A variety of flakes that can be identified as having been struck from a microcore either during initial core manufacture or rejuvenation constitute this class. These flakes are generally elongated and exhibit negative microblade scars and prepared platforms (see Plate 7:h-q).

Microblade production can be inferred by the presence of microcore preparation and rejuvenation flakes at a site. It is probable that such debitage is discarded at the production loci. Microcore debitage may be under represented among the Lochnore-Nesikep assemblages as a result of sorting procedures conducted prior to the present study.

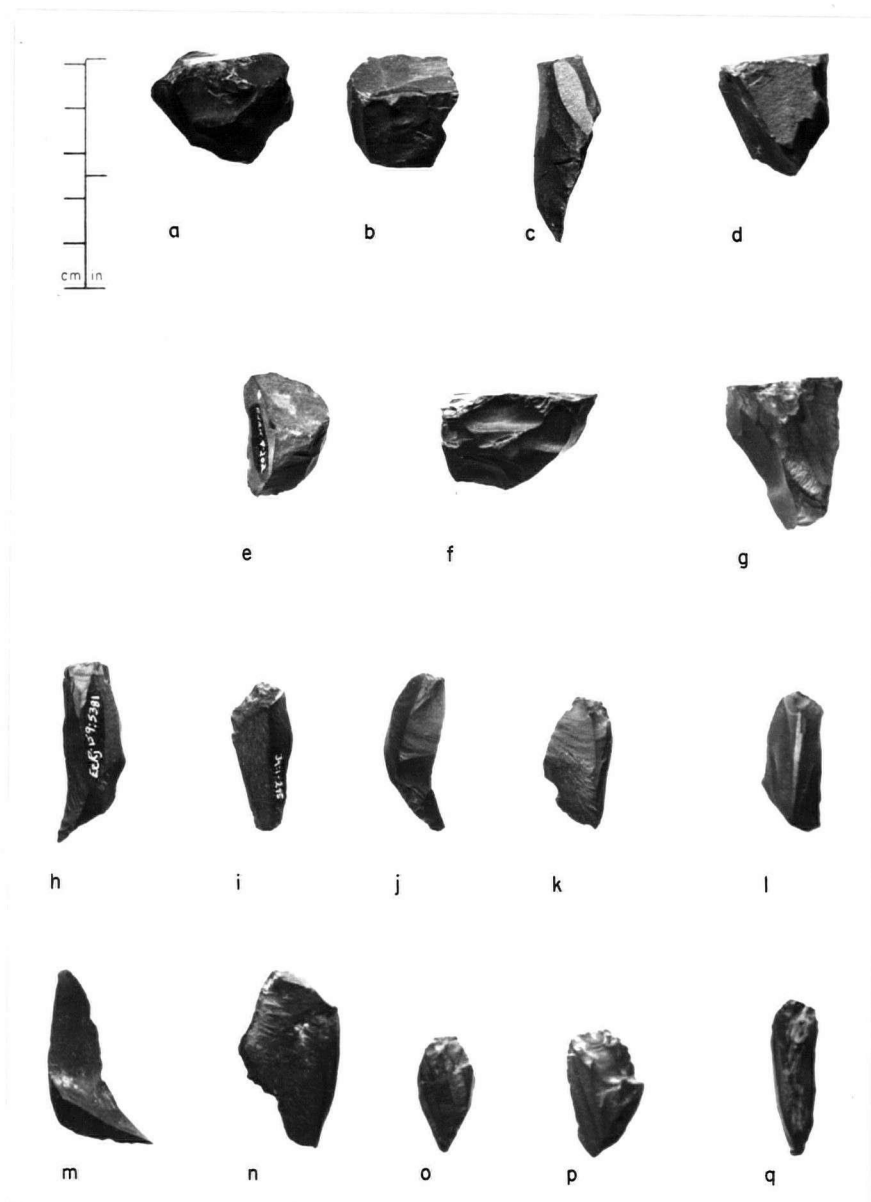


Plate 7: Prepared Core Artifact
a-g: exhausted microcores
h-q: microcore debitage

Complete microblades. Microblades are defined as long, narrow, parallel-sided flakes generally not wider than 11 mm (Taylor 1962). The presence of at least one arris, a flat ventral surface, and a prepared platform supports the inference that they were removed from specially prepared cores. Complete microblades are indicative of successfully removed blades. High proportions of complete microblades suggest intensive microblade manufacturing activities (see Plate 8:a-i).

Complete microblades are divided into four functional classes: 1) no wear; 2) single edge wear; 3) termination wear; and 4) combination wear. No distinction is made between microflaking use wear and flake scars resulting from retouch. Initially, if flake scars occurred at a depth greater than 1 mm from the lateral edge, the scar pattern was coded as retouch. However, few blades in any category exhibited such a pattern, and the regularity of the scar pattern associated with retouch did not appear to be correlated with the size criterion.

The position and placement of wear is indicative of the range of functions for which microblades may have been used. Blades exhibiting no wear may have been used, although not with the same intensity, or not on the same materials as those exhibiting use. A single edge wear pattern supports Larsen's (1968) longitudinal hafting hypothesis (Sanger 1970s: 63). Blades with wear on the termination are similar to the

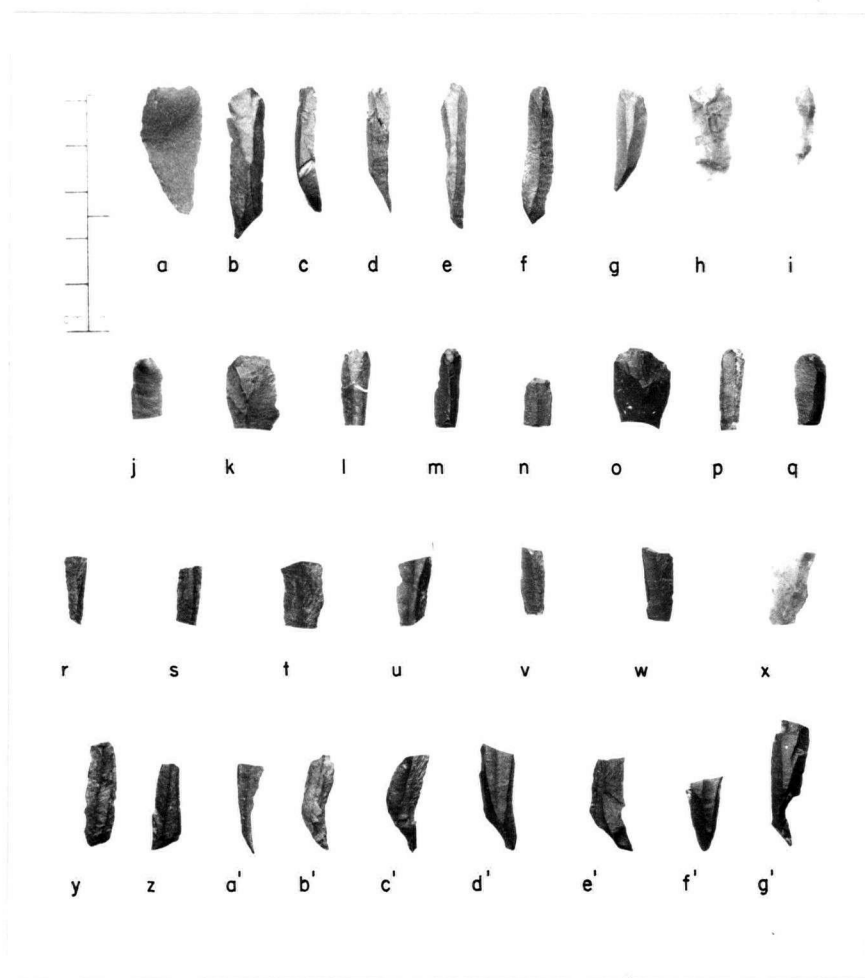


Plate 8. Microblades
a-i: complete microblades
j-q: proximal microblade fragments
r-x: medial microblade fragments
y-g': distal microblade fragments

microblade graters described by Sanger (1970a:65). Combination wear is indicative of intensive and variable microblade use.

Proximal microblade fragments. Proximal fragments are microblades that have been snapped below the platform remnant. The distal end may be snapped because of a number of causes including: 1) manufacturing failure; 2) post-manufacturing breakage; and 3) as part of blade use preparation, possibly for hafting. No criteria were established to distinguish these modes of breakage (see Plate 8:s-q).

Microblade production activities can be measured by the occurrence of proximal fragments. High ratios of proximal ends to medial and distal fragments would suggest intensive manufacturing. Only three functional classes of proximal fragments were defined: 1) no edge wear; 2) single edge wear; and 3) double edge wear. No wear was identified on the snapped ends of these artifacts, otherwise the use wear patterns are similar to those described for complete microblades.

Medial microblade fragments. Medial microblade fragments have both the platform end and the distal portion of the blade removed. Again, breakage may result from any number of causes; Wyatt (1970:138) suggests that thin blades were culturally selected for breakage. Removal of the platform and distal portion might facilitate hafting by creating a thin straight lateral edge. Nevertheless, the possibility that thin blades may be accidentally broken more easily than thick blades cannot

be overlooked (see Plate 8:r-x).

Wear patterns are similar to those identified for proximal fragments and include three medial microblade fragment classes: 1) no wear; 2) single edge wear; 3) combination wear.

Distal microblade fragments. The proximal platform bearing portion has been snapped from the blades included in this set of microblade classes. No specific cause for breakage is ascribed, although removal of distal fragments may facilitate lateral hafting. This end is often skewed towards either the left or right and would not provide a straight edge in a lateral haft. Distal fragments may also have been hafted in a pen-nib style holder (see Plate 8: y-g').

Functional classes include: 1) no wear; 2) single edge wear; 3) termination wear; and 4) combination wear. Scar patterns are similar to those described for complete microblades.

Microblade Attributes Description

Assemblage variation will also be examined at the attribute level. Behavioural strategies associated with the manufacture and use of microblades may be reflected in the distribution of certain microblade attributes between environmental zones and among assemblages.

Little research has been aimed towards the development of behavioural inferences that can be made from microblade

attribute variation. Most of the attributes described below have been examined in previous studies (Wyatt 1970a, 1970b), but the behavioural correlations are usually intuitively defined and are implicit in the studies. Analyses of microblades produced through controlled experiments are needed. Microblade attributes are examined in the present study primarily to identify those that can best sort assemblages between ecological zones and settlement types.

1. Raw material

This attribute identifies the raw material from which the microblade was produced. Three raw material classes were identified: 1) basalt; 2) chert; and 3) other. The assemblages are almost exclusively composed of basalt microblades. All identified cores were also made from basalt.

2. Outline

This attribute distinguishes complete microblades from microblade fragments and identifies the portion of the microblade recovered. Four outline states were identified:

1) complete; 2) proximal; 3) medial; and 4) distal. Only complete and proximal fragments maintain a remnant of the platform from which the core was struck. Medial sections lack both a platform and the distal termination; distal fragments lack a platform. The platform-bearing microblades best represent the number of microblades produced. Medial and distal fragments may be produced by either manufacturing failure

or post-manufacturing breakage, or by purposeful breakage to facilitate hafting.

3. Left lateral edge modification

This attribute identifies the visible modification on the left lateral edge of the microblade positioned with the dorsal surface of the microblade facing up, the proximal end pointing away from the observer, and the distal end pointing toward the observer. The widest tip is considered as the proximal end on medial fragments. Four modification states were recorded: 1) no modification; 2) modification identified as flake scars occurring to a depth of not greater than 1 mm from the edge; 3) modification identified as edge scars occurring to a depth greater than 1 mm from the edge; and 4) bifacial modification. Any distinction between utilization and retouch is considered tenuous.

4. Right lateral edge modification

The modification occurring on the right lateral edge was coded similar to that described above.

5. Termination modification

Modification on the distal portion of a microblade was described by the same set of attribute states presented for left lateral edge. The termination on all outline types was examined, however, termination modification appears to occur only on complete blades and distal fragments.

6. Cross-section

This attribute is similar to that described by Wyatt (1970a:132). Two cross-section states were recorded: 1) triangular and 2) non-triangular. These states distinguish microblades exhibiting a single arris from those with multiple arrises. Although an interval variable of metric counts of arrises was considered, complex patterning suggested that a dichotomous variable would be more practical.

An arris is produced as a result of the removal of two adjoining microblades. A triangular cross-sectioned microblade should be indicative of a blade removed earlier in the manufacturing sequence than one with multiple arrises, if a constant blade width is preferred. Wyatt (1970a:140) found the cross-section class to be unequally distributed among the Lochnore-Nesikep components. Components represented by high proportions of single arris microblades may be indicative of early stages of core preparation.

7. Platform state

Four platform states were recorded for complete microblades and proximal fragments: 1) single facet; 2) double facet; 3) multiple facet; and 4) crushed. Wyatt (1970a) does not describe this attribute for the Lochnore-Nesikep components. Platform facets may be indicative of previously removed microblades, or platform rejuvenation.

8. Platform length

This attribute can only be observed on completes and proximal fragments that exhibit intact platforms. Maximum length is measured to the nearest tenth of a millimeter. Platforms are expected to narrow as the microcore is reduced.

9. Platform preparation

Platform preparation scars occur on the dorsal surface of microblades. The scars originate at the platform and extend toward the distal end. They are considered to be caused by the removal of the core platform overhang that results following microblade removal. The maximum length of platform preparation scars was measured to a tenth of a millimeter on complete microblades and proximal fragments. Long preparation scars are indicative of increased force needed to remove the core overhang resulting from continued blade removal.

10. Platform angle

The angle from the platform to the ventral surface was measured to the nearest 5° using polar graph paper. The angle is expected to become more obtuse as the microcore is reduced.

11. Platform to termination angle

This attribute is measured by placing the blade platform along the horizontal center of circular graph paper and identifying the number of degrees that the distal tip is away

from the vertical center. Parallel-sided blades would measure a platform to termination angle of 0° . Microcore faces indicate that skewed distal tips are most common on flutes occurring along the core sides. Parallel-sided flutes occur in the center of the flute face. This attribute can be measured only on complete and proximal outline types.

12. Maximum length

The maximum length of all microblades was recorded to the nearest tenth of a millimeter. Length is expected to be reduced as microblades are removed from a core. This attribute is also useful for measuring the total amount of edge available per assemblage.

13. Maximum width

The maximum width of all microblades was measured to the nearest tenth of a millimeter. Wyatt (1970a:132) measures width midway between proximal and distal ends. Width, however, appears to be greatest toward the proximal end, and Wyatt's method skews width measurements. The length of a microblade will influence Wyatt's measurement.

Widths may be reduced as more microblades are produced from a single core. Distinctive width modes among the assemblages as well as within a particular assemblage, suggest use of different cores.

14. Maximum thickness

The maximum thickness of all microblades was measured to the nearest tenth of a millimeter. Wyatt (1970:132)

measures thickness at the midpoint between proximal and distal ends. This may not reflect the thickest point. The thick portion of blades may add the strength necessary for blade utilization.

15. Longitudinal thickness

The thickness along the vertical axis of each microblade was measured to the nearest tenth of a millimeter. This attribute can be used to calculate the amount of blade curvature by the following formula:

$$\frac{\text{longitudinal thickness} - \text{maximum thickness}}{\text{length}} \times 100$$

(Wyatt 1970b:97).

The formula standardizes the effect that length has on the longitudinal thickness measurement. Lower curvatures can be expected for hafted specimens and indices would tend to increase as the core is reduced.

16. Weight

Each microblade was weighed to the nearest hundredth of a gram. The attribute measures the amount of raw material invested in microblade technology and can be compared to weights of other tool classes.

CHAPTER III

RIVERINE-UPLAND ASSEMBLAGE VARIATION

This chapter examines the relationship of environmental variability with lithic assemblage contents. The river valley and the uplands are two distinct ecological zones of the Interior Plateau. Different subsistence resources are available at different times in each ecozone, and the traditional settlement and subsistence practices of the Interior Salish Indians also were different in each area. On the assumption that the organization of technological activities is correlated with settlement-subsistence practices, variation can be expected between the lithic assemblages found in each ecozone. This chapter will examine and evaluate the analytic potential of the lithic artifact classification and microblade attributes described in Chapter II to detect differences in upland-riverine land use patterns through an examination of the following hypothesis:

technological organization will result in the deposition of distinct lithic assemblages in each ecological zone. Settlement locations are expected to be correlated with distinct reduction strategies involving varying amounts of tool maintenance behaviour. Microblade production strategies are also expected to be correlated with settlement location.

Artifact Level Analysis

Variation in assemblage contents of Hat Creek and Lochnore-Nesikep sites can be tested through discriminant analysis. Discriminant analysis is a parsimonious method of

identifying criteria for distinguishing among known groups (Anderson 1958). The analysis calculates one or more linear functions, based on calculated weights of each variable, that best sort cases into their respective groups. The calculated weights of discriminating variables are presented as discriminant function coefficients. Each indicates the relative power contributed to the sorting. Discriminant scores are derived for each case by multiplying standardized variable values by their coefficients and summing the products. A group centroid is calculated from the mean of discriminant scores derived for each case within the group. This information can be used to classify cases of unknown group membership. The technique has been used to identify variation in projectile points (Magne and Matson 1982) and for testing the integrity of intuitively defined settlement classifications (Bettinger 1979).

The SPSS subprogram DISCRIMINANT (Klecka 1975) was utilized for the present analysis. Because discriminant analysis has not been widely applied to archaeological data, the analysis was conducted on binary and percentage transformations of the raw counts of artifacts found in each assemblage. Bettinger (1979:461) found that results of analysis conducted on binary data were incongruent with results achieved on frequency data. This is probably because assemblage size variation is magnified by the use of frequency data. High frequencies tend to dominate calculations of similarity measures and result in patterns distinguishing large assemblages from small ones. Considering the nature of the archaeological record, this variation is more

likely to be a reflection of recovery procedures than of prehistoric cultural activity. The problem is better resolved with percentage transformations of raw counts, wherein each variable is examined according to the relative contribution it makes to assemblage composition. Binary and percentage level analysis should be considered as complimentary. Whereas binary analysis will indicate if differences exist in the variety and kind of tool classes common to each ecological zone, the percentage analysis will indicate if there are differences in the relative rates at which tool classes occur in the assemblages of each ecological zone. The 38 artifact classes presently used are described in Chapter II. Table 1 presents the frequency of occurrence of each artifact class per assemblage.

The Mahalanobis distance measure was used for a stepwise method of variable extraction, and each analysis sorted all assemblages into their proper ecological zones. Because the analyses were conducted on two groups, each analysis derived one discriminant function. Different sets of variables formed each function. The analyses will be discussed in turn.

Presence-Absence Data

The discriminant analysis conducted on the binary data matrix calculated a group centroid of 18.4 for the Lochnore-Nesikep assemblages and one of -23.0 for those from Hat Creek. The discriminant scores for each assemblage are clustered tightly about their respective centroids indicating that each

		Lochnore-Nesikep Locality					Hat Creek Valley					
		EdRk 4 Zone IV		EdRk 4 Zone VII		EdRk 7	EdRk 8 Zone II	EdRk 9 Zone III	EdRk 10	EdRk 49	EdRk 55	EdRk 159
1. Extensively retouched artifacts	unbroken projectile points		2	21	2	1	1					
	projectile point fragments	1		19	5	5			2		1	
	modified point fragments			16	2	4						
	steep edge bifaces			9		1			1		1	
	acute edge bifaces		4	2								
	steep edge unifaces	1	5	8	6		3		2			
	acute edge unifaces		1	5	1		1		3			
2. Extensively retouched artifact fragments	combination edge unifaces		3	4		1						3
	biface fragments: steep edge	1	1	109	2	7	3		8		8	
3. Marginally retouched artifacts	biface fragments: acute edge		3	83		7			4		4	
	steep edge marginal bifacial flakes			15		1	1		2		1	
	acute edge marginal bifacial flakes			31	3		1				2	
	steep edge marginal unifacial flakes	3	5	80	12	4	9	6	15		21	
	acute edge marginal unifacial flakes	4	17	532	37	16	7	5	39		27	
	combined edge marginal unifacial flakes		1	22	3	2	2		6			
	bipolar implements	4	7	275	26	26	1	1	3		4	
4. Maintenance activity artifacts	gravers			8	1	1						3
	preforms			4					1			
	hammerstones	1	3	16		3	3					
	cobble tools			38	4	6						
	abraders			9		3						
5. Prepared core and microblade artifacts	usable microcores			4	2	1	2	1				3
	exhausted microcores			4	1	1						1
	microcore debitage			13	5		4	1	1		17	
	complete microblades: no wear			4	13	3	10		1		25	
	complete microblades: edge wear			2	2	2	2				4	
	complete microblades: termination wear	2	1	1	3						4	
	complete microblades: combination wear	1		4	6	2	2				8	
	proximal microblade fragments: no wear	5	2	59	118	36	47	32	18		443	
	proximal microblade fragments: edge wear	1		13	25	10	5	1	1		47	
	proximal microblade fragments: combination wear		2	8	14	6	1				25	
	medial microblade fragments: no wear	12	3	18	49	11	25	13	46		402	
	medial microblade fragments: edge wear			3	7	6		2	1		40	
	medial microblade fragments: combination wear	1		3	9	1		2			15	
	distal microblade fragments: no wear	4		6	17	6	12	3	12		83	
	distal microblade fragments: edge wear			3	2	3	1				11	
	distal microblade fragments: termination wear			1	5						12	
	distal microblade fragments: combination wear			5	4	1	2				15	
SITE TOTALS		41	60	1457	386	177	145	67	166	1230		

Table 1. Artifact Frequencies
Across the Assemblages.

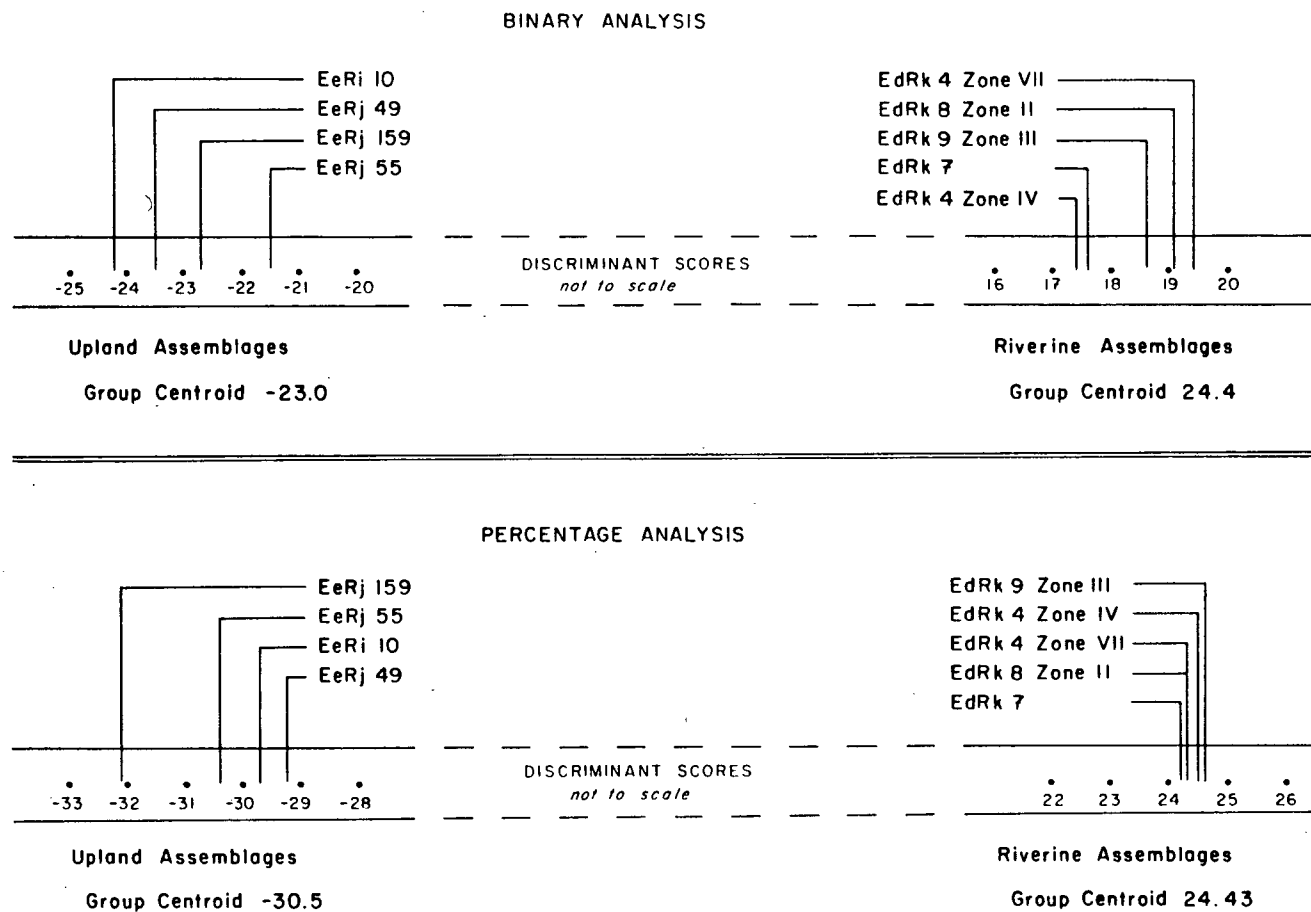
assemblage can be classified as a member of its respective ecological zone (Figure 12).

This analysis suggests that distinct artifact classes are representative of each ecological zone. Those that best sort the assemblages are ordered on the discriminant function as follows: 1) modified projectile points; 2) microcore debitage; 3) complete microblades: termination wear; 4) steep edge unifaces; 5) steep edge marginally bifacially retouched flakes; 6) acute edge bifaces; and 7) proximal fragments: no wear. The standardized discriminant function coefficient and the assemblage distribution of each variable is listed in Table 2. The mathematical sign of each coefficient is ignored when interpreting the relative power contributed by its associated variable (Klecka 1975:443).

The function derived from binary data is dominated by tool classes indicative of intensive tool maintenance strategies. Differences in the variety and type of maintained tools are apparent between ecological zones. Modified projectile point fragments, steep edge unifaces, and acute edge bifaces are common to riverine assemblages. Each is indicative of intensive labour expenditure in its manufacture and maintenance. Few of these tool classes occur in upland assemblages. Instead, upland sites are best represented by a common occurrence of microcore debitage. Microcore debitage is indicative of extensive microcore maintenance and microblade production. Steep edge marginally bifacially retouched flakes is the only other artifact class that occurs more often in upland assemblages

Figure 12.

Distributions of Discriminant Scores Achieved on Binary and Percentage Data.



than in riverine ones. An expedient aspect of upland tool manufacturing strategies is suggested by this distribution.

Riverine assemblages also differ from upland ones according to the distribution of two microblade classes. Complete microblades with termination wear occur at all lowland sites and at only one upland site (EeRj 159), suggesting a preference for the use of this type of microblade in the lowlands, possibly as gravers. Combination type edge use of proximal fragments is also more common in riverine assemblages.

Percentage Data

The discriminant analysis conducted on percentage transformations of artifact occurrences resulted in a greater difference between group centroids than did the binary analysis. Lowland assemblages cluster around a group centroid of 24.4 and the upland assemblages have a centroid of -30.5. This suggests that the percentage level data is a better representative of assemblage differences between the ecozones than is the binary data (Figure 12).

The variables order on the discriminant function in the following manner: 1) biface fragments: steep edge; 2) bipolar implements; 3) preforms; 4) complete microblades: combination wear; 5) microcore debitage; and 6) complete projectile points. Of these, only microcore debitage was identified to distinguish assemblages in the previous analysis. This analysis indicates that, whereas assemblages from each ecozone may share similar artifact classes, certain of

these classes vary according to the relative contribution each makes to assemblage composition. Assemblage proportions of the artifact classes forming this discriminant function are generally higher in riverine assemblages; only microcore debitage and preforms are better represented in the uplands. Assemblage proportions, ecozone means, and standardized discriminant function coefficients are presented for each assemblage in Table 2.

This function is dominated by high coefficients derived for biface fragments with steep edges (-30.44) and bipolar implements (24.43). Biface fragments are representative of extensively retouched tools. Their fragmented state is indicative of use. Bipolar implements, if representative of wood working, suggest that more intensive maintenance activities occur in the lowlands than in the uplands. The distribution of this artifact type may also indicate a preference for bipolar reduction techniques in the lowlands. Broken bifaces and bipolar flakes are expected to increase in frequency with an increase of activity. Their distributions suggest a more intensive occupation of lowland sites than of upland ones. As well as being more intensively occupied, the distribution of complete projectile points suggests that the lowlands were occupied more permanently than the uplands. Complete microblades with combination wear also indicate a preferred use of this microblade type in riverine sites.

		standardized discriminant function coefficients	Hat Creek Valley					Lochnore-Nesikep Locality					
			\bar{x}	EeR1 10	EeR1 49	EeR1 55	EeR1 159	\bar{x}	EdRk 4 Zone IV	EdRk 4 Zone VII	EdRk 7	EdRk 8 Zone II	EdRk 9 Zone III
binary analysis	11.46	modified point fragments	.	.	.	.	.	.	.	.	+	+	+
	-9.64	microcore debitage	.	+	+	+	+	.	.	.	+	+	.
	4.52	complete microblades: termination wear	.	.	.	.	+	.	+	+	+	+	+
	4.10	steep edge unifaces	.	+	.	+	.	.	+	+	+	+	.
	-3.20	steep edge marginally bifacially retouched flakes	.	+	.	+	+	.	.	.	+	.	+
	1.80	acute edge bifaces	.	.	.	.	.	.	.	+	+	.	.
	-1.36	proximal microblades: combination wear	.	+	.	.	+	.	.	+	+	+	+
percentage analysis	-30.44	biface fragments: steep edge	1.85	2.0		4.8	.6	2.76	2.4	1.6	7.4	.5	3.9
	24.43	bipolar implements	1.02	.6	1.4	1.8	.3	12.20	9.7	11.6	18.8	6.7	14.6
	19.18	preforms	.15			.6		.04			.2		
	10.47	complete microblades: combination wear	.47	1.3			.6	1.04			.2	1.5	1.1
	4.61	microcore debitage	5.30	2.7	.6	.6	1.3	.40			.8	1.2	
	2.00	complete projectile points	1.50	6.0				11.40		33.0	14.0	5.0	5.0

Table 2. Variables Identified Through Discriminant Analyses That Can Sort Assemblages Between Ecological Zones.

Microblade production and core rejuvenation, as represented by microcore debitage, appear to be major technological activities of the uplands. Preforms were identified in only two assemblages, one from each ecological zone. They are rare in both assemblages, although proportionally they are better represented in the uplands. This again suggests that some maintenance activity indicative of permanent occupation also occurs in the uplands.

In summary, assemblages were sorted into their respective ecozones 100% of the time using binary and percentage data matrices of the 38 artifact types described in Chapter II. The better separation, measured by the distance between group centroids, was achieved on the percentage data. In each analysis different variables were selected by the Mahalanobis stepwise method to sort the groups. Nonetheless, interpretations of these variables suggested a consistency among the analyses.

The discriminant analyses supported the hypothesis that different lithic assemblages would be representative of each ecological zone. Distinct technological activities were inferred. Analysis conducted on binary data suggested that the kind and variety of maintained tools distinguished assemblages. Riverine assemblages were represented by a greater variety of intensively manufactured tools. Upland sites were better represented by microcore rejuvenation and expediently manufactured tools. Proportions of certain tools common to each ecological

zone also distinguished assemblages. Tools inferred to be indicative of intensive activity contributed most to the function derived from percentage data. Their distribution suggested more intensive occupation of riverine sites than of upland ones. Microcore rejuvenation was again identified as a major technological activity of the uplands. The microcore debitage indicated some permanence of occupation of the uplands. Compared with the riverine sites, however, this occupation was inferred to be more limited.

Microblade Attribute Analysis

This analysis is concerned with identifying the variation of microblade attributes between ecological zones. The previous analyses indicated that lithic assemblage variation at the artifact level can be correlated with variation between upland and riverine settlements. The analyses further suggested that microblade production is an activity better represented in upland assemblages than in riverine ones. Hence, it can be expected that variation in microblade attributes will be similarly patterned.

Variable Description

Fifty-six variables, measured at the assemblage level, were utilized for the present analysis. These are divided among: 1) the relative proportions of eight nominal attributes, 2) eight descriptive statistics of platforms, and 3) 10 descriptive statistics for each of four microblade outline types (see Table 3).

	nominal microblade attributes								platform attributes							
	% basalt	% used	% single edge use	% termination use	% combination use	% single aris	% single faceted platforms	% platform remnant bearing	platform \bar{x} length	c.v. platform length	platform preparation \bar{x} length	platform preparation c.v. length	\bar{x} platform angle	c.v. platform angle	\bar{x} platform to termination angle	c.v. platform to termination angle
EeRt 10	92.5	12.1	7.4	0.0	4.6	47.7	56.7	62.6	2.8	39.2	1.9	42.1	95.8	11.7	4.5	117.7
EeRj 49	69.8	9.4	5.6	0.0	3.7	47.2	66.6	62.3	2.9	41.3	1.9	57.8	93.0	11.5	4.2	114.2
EeRj 55	77.2	2.5	2.5	0.0	0.0	74.7	50.0	25.3	4.1	63.4	2.0	45.0	100.3	9.6	3.7	121.6
EeRj 159	94.5	15.9	8.9	9.8	5.5	50.3	59.3	49.0	2.6	34.6	1.9	42.1	94.7	12.1	4.1	126.8
EdRk 4 Zone IV	100.0	15.0	3.8	28.5	7.6	61.5	77.7	34.6	2.6	34.6	2.0	65.0	96.4	19.5	4.7	68.0
EdRk 4 Zone VII	87.5	37.5	0.0	100.0	2.5	50.0	60.0	62.5	4.3	37.2	1.8	38.8	93.3	24.6	5.4	77.7
EdRk 7	92.3	33.0	16.1	7.6	15.3	40.8	68.1	70.0	3.1	29.0	2.4	66.6	91.0	14.3	3.7	108.1
EdRk 8 Zone II	90.1	28.1	13.1	15.3	12.0	56.2	63.5	66.0	2.8	28.5	2.1	57.1	93.9	11.7	4.2	97.6
EdRk 9 Zone III	98.9	35.6	2.4	0.0	11.4	40.2	59.3	67.8	2.8	25.0	1.9	42.1	97.2	8.2	5.1	98.0

Table 3. Assemblage Level Statistics Calculated on Microblade Attributes.

	complete microblades										proximal fragments									
	\bar{x} length	c.v. length	\bar{x} width	c.v. width	\bar{x} thickness	c.v. thickness	\bar{x} curvature	c.v. curvature	\bar{x} weight	c.v. weight	\bar{x} length	c.v. length	\bar{x} width	c.v. width	\bar{x} thickness	c.v. thickness	\bar{x} curvature	c.v. curvature	\bar{x} weight	c.v. weight
EerI 10	21.5	28.8	6.5	24.6	1.7	23.5	2.7	70.3	0.24	70.8	14.5	35.8	6.3	20.6	1.5	20.0	0.9	111.1	0.15	46.6
EerJ 49	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.0	11.2	37.5	7.2	30.5	1.7	41.1	0.8	175.0	0.19	105.2
EerJ 55	27.8	0.0	11.9	0.0	4.6	0.0	0.0	0.0	1.19	0.0	14.1	29.0	8.5	27.0	1.8	38.8	1.7	94.1	0.26	84.6
EerJ 159	22.6	27.4	6.9	31.8	2.3	34.7	3.3	84.8	0.39	64.1	13.8	40.5	6.5	24.6	1.6	25.0	0.9	122.0	0.17	70.5
EdRk 4 Zone IV	30.9	9.0	6.8	19.1	1.9	5.2	2.3	8.6	0.33	12.1	19.3	32.1	6.0	15.0	1.5	20.0	1.1	54.5	0.22	81.8
EdRk 4 Zone VII	31.4	0.0	15.4	0.0	4.0	0.0	5.7	0.0	1.90	0.0	23.1	29.8	7.5	17.3	1.6	18.7	1.2	75.0	0.29	48.2
EdRk 7	22.8	25.0	6.2	19.3	1.9	26.3	4.5	57.7	0.30	46.6	19.0	27.3	7.6	22.3	1.9	31.5	1.7	105.8	0.32	71.8
EdRk 8 Zone II	24.0	22.0	7.0	17.1	2.2	31.8	3.8	50.0	0.37	56.7	17.9	25.1	6.7	28.3	1.8	22.2	1.6	100.0	0.25	52.0
EdRk 9 Zone III	26.7	17.9	7.1	12.6	2.4	16.6	5.0	62.0	0.44	34.0	17.6	20.4	6.7	14.9	1.7	29.4	1.3	92.3	0.22	40.9

Table 3 (cont'd) Assemblage Level Statistics Calculated on Microblade Attributes.

	medial fragments										distal fragments									
	\bar{x} length	c.v. length	\bar{x} width	c.v. width	\bar{x} thickness	c.v. thickness	\bar{x} curvature	c.v. curvature	\bar{x} weight	c.v. weight	\bar{x} length	c.v. length	\bar{x} width	c.v. width	\bar{x} thickness	c.v. thickness	\bar{x} curvature	c.v. curvature	\bar{x} weight	c.v. weight
EeR1 10	10.4	40.3	5.5	23.6	1.4	28.5	0.8	187.5	0.12	75.0	17.8	39.3	5.8	36.2	1.8	33.3	2.2	86.0	0.23	139.0
EeRj 49	11.5	26.0	7.1	29.5	1.8	33.3	0.9	111.1	0.20	90.0	13.8	55.0	6.6	25.7	1.5	20.0	1.2	116.6	0.13	69.2
EeRj 55	11.3	43.3	5.9	33.8	1.4	42.8	0.7	157.1	0.13	130.7	13.5	34.0	6.9	23.1	2.1	38.0	1.5	166.6	0.18	72.2
EeRj 159	10.5	32.3	5.8	22.4	1.4	28.5	0.6	183.3	0.11	72.7	14.3	33.5	6.0	28.3	1.7	35.2	2.1	100.0	0.17	88.2
EdRk 4 Zone IV	16.1	27.3	5.8	29.3	1.5	26.6	1.6	81.2	0.19	89.4	14.7	39.4	5.6	35.7	1.4	50.0	1.7	164.7	0.15	106.6
EdRk 4 Zone VII	14.8	38.5	6.0	58.3	1.6	37.5	0.5	160.0	0.18	77.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.0
EdRk 7	19.1	29.3	7.3	28.7	2.0	35.0	2.1	95.2	0.30	80.0	24.1	48.1	8.8	29.5	2.4	29.1	1.9	126.3	0.53	83.0
EdRk 8 Zone II	15.3	22.8	6.4	17.1	1.6	18.7	1.3	107.6	0.19	52.6	19.7	24.3	6.6	18.1	1.9	31.5	2.9	58.6	0.26	69.2
EdRk 9 Zone III	16.2	31.4	6.6	24.2	1.7	29.4	1.4	107.1	0.21	61.9	22.3	28.6	6.6	18.1	1.9	26.3	2.2	104.5	0.25	44.0

Table 3. (cont'd) Assemblage Level Statistics Calculated on Microblade Attributes.

I. Nominal Attributes

The relative proportions of the occurrences of eight nominal level attributes were calculated for each of the assemblages. These are described below.

1. Assemblage Percentage of Basalt Microblades: This is calculated by dividing the basalt microblades present by the total number of microblades in the assemblage and multiplying by 100. High proportions of basalt are represented by high percent values.
2. Assemblage Percentage of Used Microblades: This is calculated by dividing the number of blades that have any evidence of use by the total number of microblades in the assemblage and multiplying by 100. A high value would indicate that a high proportion of microblades within the assemblage were used.
3. Assemblage Percentage of Single Edge Use Microblades: This measures the relative proportion of microblades exhibiting modification on a single lateral edge. It is calculated by dividing the number of microblades with single edge use by the total number of microblades and multiplying by 100. A high value would indicate a preference for this use type within an assemblage.

4. Assemblage Percentage of Termination Use Microblades:

This attribute is evident only on distal fragments and complete microblades. It is calculated by dividing the number of complete microblades and distal fragments with termination wear by the total number of completes and distals and multiplying by 100. High percent values would indicate a preference for this use type in an assemblage.

5. Assemblage Percentage of Combination Microblades: The percentage of combination use microblades is calculated by dividing the number of microblades exhibiting modification either on two edges, on one edge and the termination, or on two edges and the termination by the total number of blades in the assemblage and multiplying by 100. A high value would indicate that most of the microblades in the assemblage were used in a variety of modes.

6. Assemblage Percentage of Single Arris Microblades: This index is calculated by dividing the number of single arris microblades by all microblades and multiplying by 100. The predominance of single arris microblades in an assemblage is represented by a high percent value.

7. Assemblage Percentage of Single Faceted Microblade Platforms: The total number of complete microblades and proximal fragments that have a single faceted

platform is divided by the total number of complete microblades and proximal fragments in each assemblage and then multiplied by 100 to arrive at this value. A high platform facet percent would indicate little variability in the platform states of the assemblage.

8. **Assemblage Percentage of Platform Microblades:** This is calculated by dividing the number of complete and proximal microblades in an assemblage by the assemblage total of microblades and then multiplying by 100. A high value is indicative of a high assemblage representation of microblades with intact platforms. These are indicative of microblade production.

II. Platform Attributes

A series of means and coefficients of variation were calculated for each of four metric attributes on the platforms of complete microblades and proximal fragments. These attributes include: 1) platform length, 2) length of platform preparation, 3) platform angle, and 4) platform to termination angle. Means are computed by dividing the sum of each attribute by the number of cases, and coefficients of variation are calculated for each assemblage by dividing the standard deviation of each attribute by the mean and multiplying by 100 (Sokal and Rohlf 1981: 59). The mean is indicative of the average size of each of the attributes, while the coeffi-

cient of variation indicates the range of variation occurring within each assemblage, standardized so that differences in mean values do not affect the coefficient.

III. Outline Attributes

Descriptive statistics were calculated separately for each of four microblade outline types: complete, proximal, medial, and distal. Means and coefficients of variation were calculated for each of five attributes. These include: 1) maximum length, 2) maximum width, 3) maximum thickness, 4) index of curvature, and 5) weight.

Attribute Distribution

The null hypothesis that the ecological zones represent similar populations of the 56 variables was tested by Wilcoxon or Mann-Whitney U-test (Siegel 1956: 110). This analysis examines each variable independently and rank orders variables for each assemblage. A mean rank is calculated for each ecological zone. A great difference between the mean ranks would indicate a difference between the distributions of the variables within each group. The null hypothesis was rejected if the difference between the populations occurred by chance less than 5% of the time (i.e., at the .05 level of significance).

Of the 56 variables, nine were identified as having been derived from separate populations. Table 4 presents these variables, their mean ranks in each ecozone, and the calculated significance level.

Variable	Mean Rank		Significance Level
	Lochnore-Nesikep	Hat Creek	
% used	5.0	2.7	.02
c.v. platform length	3.3	7.1	.03
c.v. platform to termination	3.0	7.5	.01
\bar{x} proximal length	7.0	2.5	.01
c.v. proximal length	3.4	7.0	.05
c.v. proximal curvature	3.4	7.0	.05
\bar{x} medial length	7.0	2.5	.01
c.v. medial curvature	3.4	7.0	.05
\bar{x} distal length	6.2	2.7	.04

Table 4. Microblade Variables Derived From Separate Riverine and Upland Populations.

The percentages of used microblades are differently distributed in the upland from that in the riverine assemblages. A higher proportion of microblades are used in lowland sites. Two platform attributes were also identified by the analyses: 1) coefficient of variation of the platform length, and 2) coefficient of variation of the platform to termination angle. In both cases, the range of variation is higher in the uplands and may be correlated with a wider range of core reduction activities, and this may explain why different percentages of used microblades occur within each zone. Should more microblade production have occurred in the uplands than in the lowlands, then more waste blades would also have been produced in the uplands. Unused, possibly waste, microblades would in turn lower the percentage of used microblades in each upland assemblage.

The mean lengths of proximal, medial, and distal fragments were all found to have been derived from separate populations. In each case, fragments from the uplands are smaller than those from the riverine assemblages. This may be due to the use of smaller size screen mesh during excavation in Hat Creek valley. Complete microblades were found to be similar between upland and riverine assemblages. Only the coefficient of variation of length of proximal fragments is found significant, indicating that proximal lengths vary more in upland assemblages than in lowland ones. The final two variables that differentiate upland and riverine assemblages are the co-

efficients of variation of the curvature indices for both proximal and medial fragments. Each has a higher mean rank among upland assemblages. This may again indicate a greater range in core reduction activities in the uplands than in the lowlands.

In all, very few microblade attributes sort the assemblages according to their environmental location. The variation that does exist suggests that Hat Creek microblades are more variable among themselves than they are compared to those from Lochnore-Nesikep. More used microblades occur in the lowlands, and this could be due to less reduction and subsequently less production of waste microblades in the lowlands. This variation may be correlated to a wider range of microcore reduction in the Hat Creek sites. It might also be the result of use of smaller sized screens and subsequent recovery of small microblades and fragments. As well, the Lochnore-Nesikep assemblages were initially sorted by David Sanger, and criteria different from that defined for the present analysis may have been applied to distinguish microblades from debitage. The identification of a wider range of microcore reduction activities in the uplands is consistent with the interpretation, resulting from the discriminant analyses, of microcore rejuvenation as a major technological activity of the uplands. Nevertheless, confident interpretation of this variability must await analyses that are conducted on better controlled data.

CHAPTER IV

INTERASSEMBLAGE VARIATION

This chapter examines artifact variation between lithic assemblages. Interassemblage variation can be expected as a result of settlement strategy, the organization of settlement and subsistence activities among sites. The review of Interior Salish settlement and subsistence presented in Chapter II indicated that these activities are patterned; different settlement and subsistence activities occur at different site locations. Environmental variability was identified as a factor of interassemblage variation, and Chapter III demonstrated that this variation could be identified among lithic assemblages between ecological zones. The organization of a variety of activities within ecological zones should result in further differentiation of assemblages. On the assumption that technological organization is correlated with settlement and subsistence activities, this chapter examines the hypothesis that:

the organization of technological activities associated with subsistence will result in the deposition of distinct lithic assemblages among settlements. Assemblage variation will be characterized by residential and non-residential aspects of technological organization.

Settlement Classification

The first analysis of intersite variation aims to identify the type and variety of settlements represented by the selected assemblages. Assemblages sharing similar structures of material remains are assumed to represent a single settlement type (Struever 1971:11), and variety of settlement types is expected to indicate settlement strategy (Binford 1980:12). Hence, the objective of this analysis is to group like assemblages.

The present study utilizes a Q-mode cluster analysis to create discrete groups of assemblages. Cluster analysis is a hierarchical grouping technique that joins cases (assemblages) at decreasing levels of similarity until all are combined in a single group. Previous studies have indicated the usefulness of this technique for intersite comparisons in creating settlement classifications (see Matson and True 1974; Matson et al. n.d.; Pokotylo 1978). Bettinger (1979:455-456) argues against the use of multivariate quantitative techniques "...as a first step toward establishing settlement categories and settlement function in a regional context...". He fears that qualitative differences among settlement types cannot be adequately represented by mathematical manipulations. He prefers an intuitively defined classification based on the identification of certain variables that he believes differentiate settlement types. The rationale behind the selection of these variables is never

made explicit; neither are the criteria for including or excluding border-line cases presented.

The utility of cluster analysis as a preliminary grouping method is evident (see Matson 1980). It is particularly useful for the present study due to the nature of the archaeological remains; few floors or features that would aid intuitive classification exist, and the abundance of lithic artifacts demands rigorous criteria for sorting assemblages. The technique only aids the recognition of groups. The interpretation of these groups as distinct settlement types must be based on an explicit rationale. This has been presented in Chapter II.

The present study analyzed both binary and percentage data sets. Both analyses produced similar groupings of assemblages: 2 clusters were defined by the binary analysis while the percentage study divided one of those groupings and resulted with three clusters (see Figures 13 and 14). The percentage analysis is inferred to have yielded the better resolution of assemblage variation and is of prime concern in the following discussion.

The three cluster solution indicated in Figure 14 was derived from an initial data matrix composed of the frequency of occurrence of 38 artifact classes across the 9 assemblages (Table 1). The raw frequency of each type was converted to a percentage and then standardized, before a City Block distance measure (Sneath and Sokal 1973:154) was calculated between each pair of assemblages. A Ward's Error Sum of Squares

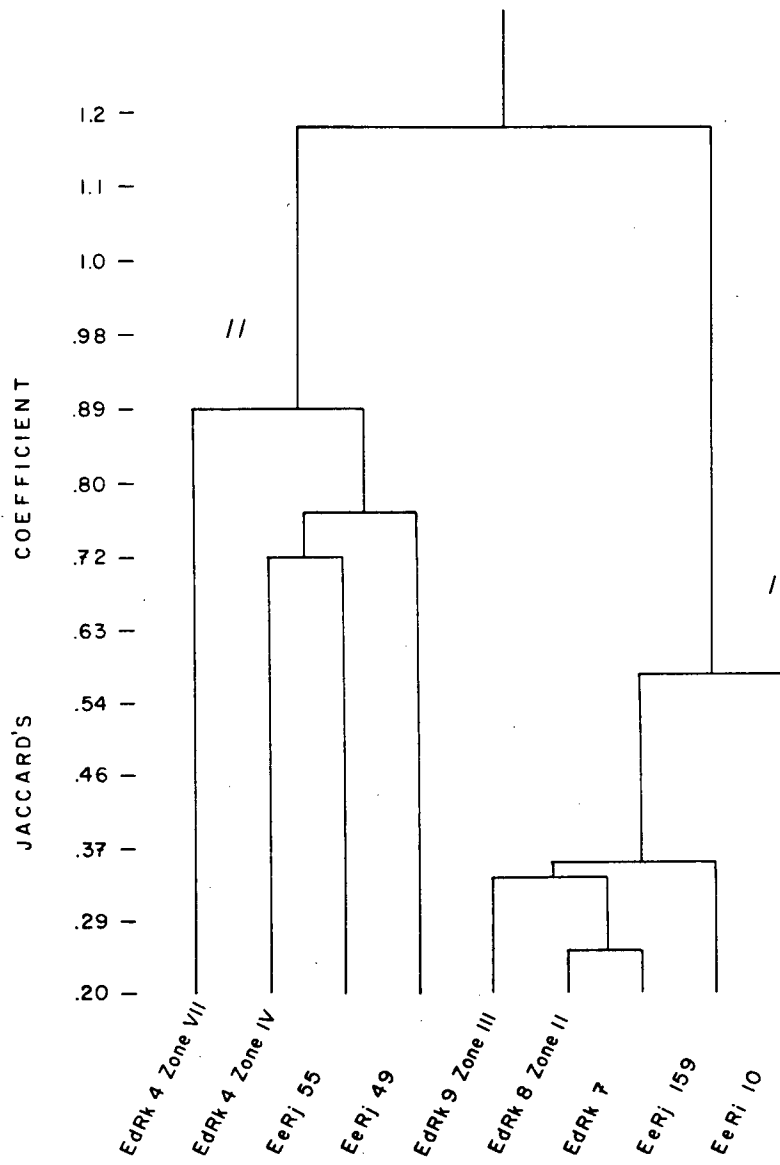


Figure 13. Ward's Error Sum of Squares Cluster Solution on Binary Data.

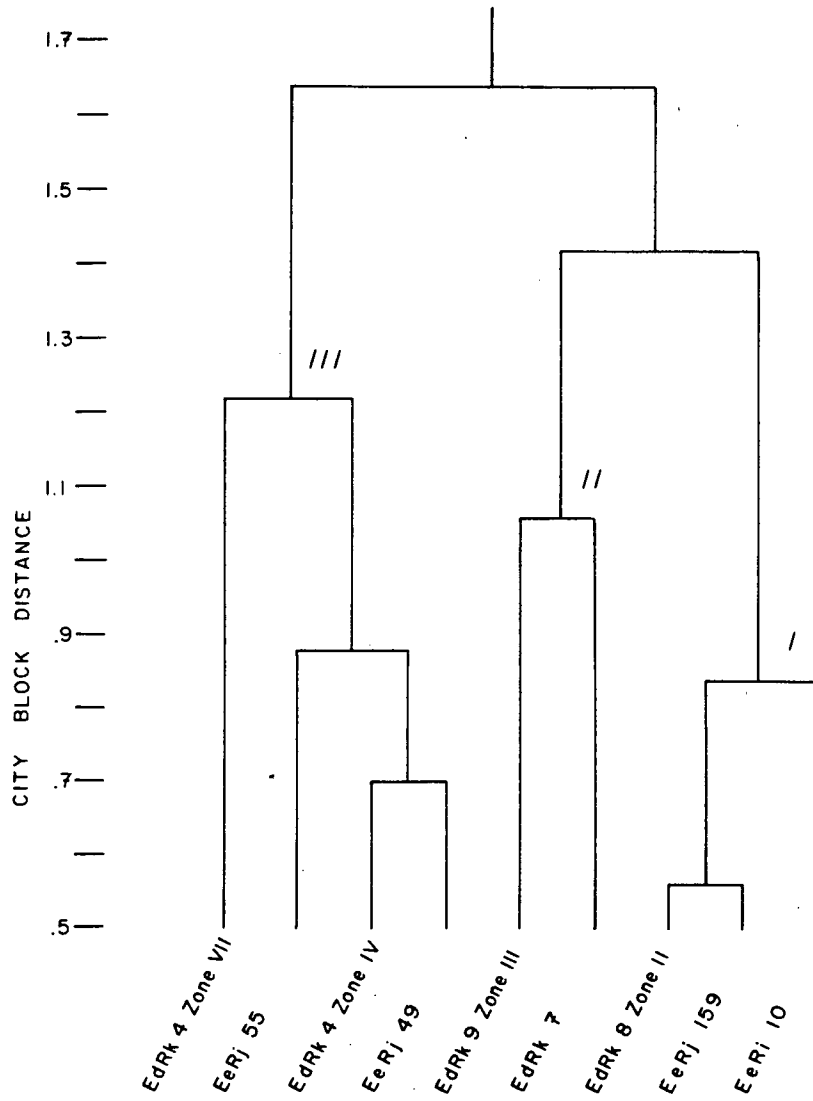


Figure 14. Ward's Error Sum of Squares
Cluster Solution on Percentage
Data.

clustering technique (Ward 1963) was applied to the distance matrix and resulted in the three cluster solution (Figure 14). Wood (1973) provided the cluster program.

Of the three clusters, only cluster II is exclusive to riverine locations. The binary analysis indicated that cluster II members share a similar variety and kind of tool classes with cluster I members. The relative frequencies at which these artifacts occur vary between the clusters. Both members of cluster II are assemblages representing pithouse occupations: Zone I and II from EdRk 7, the Lochnore Creek site, and Zone III from EdRk 9, the Pine Mountain site. The two upland assemblages associated with cultural depressions (EeRj 159 and EeRj 55) divide between the first and third clusters. Only the cultural depressions from EeRj 55 have been excavated; they can be interpreted as earthovens. The first cluster is composed of one riverine assemblage (EeRk 8 Zone II), and two upland assemblages (EeRj 10 and EeRj 159). Two riverine assemblages (EdRk 4 Zone IV and EdRk 4 Zone VII) join with two upland assemblages (EeRj 49 and EeRj 55) in the third cluster.

The clusters can be distinguished according to the number of different artifact classes represented in each assemblage. With a cluster mean of 34 different artifact classes, the two assemblages of cluster II comprise the greatest variety of artifact classes of any of the clusters. This abundance of artifact classes is expected for pithouses if they are, as the

ethnographic data suggest, base camps. While the cultural historic association of microblades with pithouses can be questioned, it is significant that these assemblages are more similar to each other than they are to other assemblages and that they have a high variety of artifact classes. The lowest variety of artifact classes is evident in cluster III. The four assemblages of this cluster have a mean of 15 different artifact classes. Cluster I is more similar to cluster II, as indicated by a mean of 27 artifact classes.

Discriminant analysis (Klecka 1975:434) and Kruskal-Wallis (Siegal 1956:184) tests of significance were computed to identify artifact classes that separate the clusters. The discriminant analysis utilized a Mahalanobis stepwise method of variable selection and identified two functions on which the clusters could be separated. The first function extracted 99.6% of the variance. Six artifact classes, which maintain a coefficient above 1.0, are ordered on the first function: 1) distal fragments: combination wear; 2) abraders; 3) cobble tools; 4) complete microblades: no wear; 5) microcore debitage; and 6) hammerstones. Kruskal-Wallis tests indicated significant differences (measured at .05) among the rank sums of all but one of these classes. Hammerstones were not found to be significant; they also have the weakest discriminant power. Five additional tool types were derived from separate populations in each of the clusters: 1) modified projectile point fragments; 2) steep edge, marginally unifacially retouched

flakes; 3) exhausted microcores; 4) complete microblades: edge wear; and 5) distal fragments: edge wear. The percentage of each assemblage represented by each artifact class is presented in Table 5. Assemblages are regrouped according to cluster membership; and significant artifact classes are starred.

The most apparent characteristic of the distribution of the artifact classes found to be significant is that they have the highest mean rank in either the first or second cluster. Not only do these artifacts have the lowest mean rank in the third cluster, but they are usually absent from it. The only exception is the high representation of steep edge marginally unifacially retouched flakes. The assemblage proportion of this tool class is higher for each assemblage in cluster III than for any other assemblage. This suggests that most variation among the clusters is due to an accumulation of artifact variety and not to a replacement of one artifact class by another. Twenty-six of the 38 artifact classes do not have significantly different distributions among the clusters.

The category of artifacts best represented by the classes found to be significant is the prepared core and microblade category. Six of the 12 significant classes are from this group, however this distribution can be expected since almost half of all artifact classes are so included. Nonetheless, different technological activities can be inferred. As described

		Cluster I		Cluster II		Cluster III				
		EzR1 10	EzR1 159	EzRk 8 Zone II	EzRk 9 Zone III	EzRk 7	EzRk 4 Zone VII	EzRk 55	EzRk 4 Zone IV	EzRk 49
1. Extensively retouched artifacts	unbroken projectile points	.7	.5	.6	1.4	3.3				
	projectile point fragments		.1	1.3	2.8	1.3		1.2	2.4	
	modified point fragments *			.5	1.0	1.1				
	steep edge bifaces		.1		.6	.6		.6		
	acute edge bifaces					.1	6.7			
	steep edge unifaces	2.1				.5	8.3	1.2	2.4	
	acute edge unifaces	.7		.2		.3	1.7	1.8		
2. Extensively retouched artifact fragments	combination edge unifaces		.2		.6	.3	5.0			
	biface fragments: steep edge	2.1	.6	.5	3.9	7.5	1.7	4.8	2.4	
	biface fragments: acute edge		.3		3.9	5.7	5.0	2.4		
3. Marginally retouched artifacts	steep edge marginal bifacial flakes	.7	.1		.6	1.0		1.2		
	acute edge marginal bifacial flakes	.7	.2	.8		2.1				
	steep edge marginal unifacial flakes *	6.2	1.7	3.1	2.2	5.5	8.3	9.0	7.3	8.9
	acute edge marginal unifacial flakes	4.8	2.2	9.6	9.0	36.5	28.3	23.5	9.6	7.5
	combined edge marginal unifacial flakes	1.4		.8	1.1	1.5	1.7	3.6		
	bipolar implements	.7	.3	6.7	14.7	18.9	11.7	1.8	9.6	1.5
4. Maintenance activity artifacts	gravers *		.2	.2	.6	.5				
	preforms					.3		.6		
	hammerstones *	2.1			1.7	1.1	5.0		2.4	
	cobble tools *			1.0	3.4	2.6				
	abraders *				1.7	.6				
5. Prepared core and microblade artifacts	usable microcores	1.4	.2	.5	.6	.3				1.5
	exhausted microcores *		.1	.2	.6	.3				
	microcore debitage *	2.7	1.4	1.3		.9		.6		1.5
	complete microblades: no wear *	6.9	2.0	3.4	1.7	.3		.6		
	complete microblades: edge wear *	1.4	.3	.5	1.1	.1				
	complete microblades: termination wear		.3	.8		.1	1.7		4.9	
	complete microblades: combination wear	1.4	.7	1.6	1.1	.3			2.4	
	proximal microblade fragments: no wear	32.4	36.0	30.6	20.3	4.0	3.3	10.8	12.1	47.8
	proximal microblade fragments: edge wear	3.4	3.8	6.5	5.6	.9		.6	2.4	1.5
	proximal microblade fragments: combination wear	.7	2.0	3.6	3.4	.5	3.3			
	medial microblade fragments: no wear	17.2	32.7	12.7	6.2	1.2	5.0	27.7	29.3	19.4
	medial microblade fragments: edge wear		3.3	1.8	3.4	.2		.6		3.0
	medial microblade fragments: combination wear		1.2	2.3	.6	.2			2.4	3.0
	distal microblade fragments: no wear	8.3	6.7	4.4	3.4	.4		7.2	9.6	4.5
	distal microblade fragments: edge wear *	.7	.9	.5	1.7	.2				
	distal microblade fragments: termination wear		1.0	1.3		.1				
	distal microblade fragments: combination wear *	1.4	1.2	1.0	.6	.3				
SITE TOTALS		100.1	99.8	99.7	98.7	99.7	100.0	99.8	99.2	100.1

Table 5. Assemblage Percentages of Artifact Classes, Arranged by Clusters.

above, cluster III lacks most artifact classes (Table 5). Specifically, the cluster is poorly represented by usable microcores, exhausted microcores, and used varieties of complete microblades and microblade distal fragments. The cluster displays limited occurrences of microcore debitage and is well represented by microblade proximal and medial fragments. This distribution suggests that microblade production and limited microcore rejuvenation are some of the technological activities responsible for the deposition of the cluster III assemblages; microcore production and complete core reduction are not. Both the former and the latter activities can be inferred as common to the settlements represented by clusters I and II. Also, cluster III assemblages display a more limited array of microblade use modes. Most common to these assemblages is an edge type of microblade use. Termination type of use, possibly as graters, is included in the microblade use modes characteristic of clusters I and II.

The differences between technological activities represented by cluster I and cluster II are more difficult to assess. Higher proportions of microblades are evident among the cluster I assemblages and may indicate that intensive microblade production is characteristic of these assemblages. However, because cluster II is represented by a greater variety of artifact classes than is cluster I, high microblade proportions in cluster I also may be a construction of the closed array. An

examination of the ratios of platform remnant-bearing microblades to usable microcores supports the interpretation that intensive microblade production characterizes the depositional patterns of cluster I assemblages. More microblades per core tend to occur in cluster I assemblages. EeRj 159 has the highest ratio at 186:1. This is followed by EdRk 8 Zone II, which has 91 platform microblades per core. EeRi 10 has the lowest ratio for this cluster, 33:1. Cluster II assemblages display relatively lower ratios, 59:1 (EdRk 9 Zone III) and 22:1 (EdRk 7). High ratios would result also if microcores are removed from the context of microblade production. Therefore, both clusters may represent equal amounts of microblade production, the differences observed being due to core curation. High proportions of microcore debitage among the cluster I assemblages suggest intensive microblade production.

This problem would be better resolved through further study of the relationships between debitage and microcore production. At present, it appears that more microblades are being produced per core at the settlements represented by cluster I assemblages than at those of cluster II.

Four of the five maintenance activity artifact classes have significant distributions among the clusters, suggesting that this artifact category is important for distinguishing patterns of assemblage variability. These artifact classes are assumed to represent specific tool manufacturing and

maintenance activities expected most frequently at base camps. They may be organized similar to site furniture (Binford 1979:263).

Maintenance activity artifacts occur less frequently among the cluster III assemblages than in either of the other clusters. Relative proportions, however, are highest in cluster III. According to Matson (n.d.:13), this distribution is expected if cluster III assemblages are the result of limited activity settlements. Variation between cluster I and cluster II does not fit the site furniture model. Maintenance activity artifacts occur more frequently and at higher proportions among the cluster II assemblages. This suggests that a greater variety of maintenance types of activities were more frequent to the occupations represented by cluster II than those represented by cluster I. The site furniture model is in need of more study, yet the distribution observed here may be the result of more densely populated occupations in the cluster II settlements. Because cluster I and cluster II share a great variety of maintenance activity artifacts, relative to cluster III, both can be interpreted as residential camps. Cluster I is designated a lithic scatter residential camp due to the absence of associated surficial features. Accordingly, cluster II is designated a pithouse residential camp.

Only one extensively retouched artifact class, modified point fragments, is found to significantly distinguish assemblages with respect to clusters. The distribution of this

class supports the interpretation of settlement classifications described above. Modified point fragments are best represented at base camp assemblages (cluster I and II) and are absent from assemblages interpreted as limited activity settlements (cluster III). They are most common to pithouse base camps.

The distribution of the remaining extensively retouched artifacts is worthy of note. The personal gear model (Binford 1979:262) suggests that the artifacts are curated and returned to residential camps. The distribution observed in this study suggests that extensively modified artifacts were discarded in a variety of contexts. Further study of assemblage debitage would aid interpretations of the manufacturing loci of extensively retouched artifacts.

Steep edge marginally unifacially retouched flakes also display distinct distributions among the clusters (Table 5). This artifact class is representative of expedient gear (Binford 1979:264) and may be a measure of the intensity of processing activities (Camilli 1981, 1982). Highest proportions are evident among the cluster III assemblages, and this may be due to the relatively infrequent occurrences of other artifact classes. Expedient tools represent the predominant technological strategy that produced cluster III assemblages. An examination of Table 5 indicates that other artifact classes common to this cluster include projectile point fragments, biface fragments, and unifaces. These arti-

facts are indicative of resource procurement and processing activities and, along with the paucity of maintenance type tools, support the interpretation that cluster III is representative of assemblages resulting from limited activity settlements. Pokotylo (1978:224-276) also interpreted assemblages displaying similar patterns of low tool diversity as limited occupation settlements.

Cluster I and cluster II assemblages are clearly differentiated on the basis of relative proportions of marginally retouched artifacts. The mean assemblage proportion of all marginally retouched flakes is 13.3% for cluster I, 46.5% for cluster II, and 28.3% for cluster III. The assemblages representing pithouse residential camps (cluster II) display the highest proportions, and this distribution is expected according to Camilli's (1982) model. Ethnographic data suggest that pithouse villages were the locus of occupations of relatively long duration. The relatively low proportions of these artifact classes among the cluster I assemblages suggests that these assemblages were deposited during much shorter occupations.

In summary, the Q-mode cluster analysis identified 3 groupings of the selected assemblages. Variation among the clusters was due to an accumulation of artifact variety resulting in increased internal assemblage diversity. The least variety of artifact classes occurred among the cluster III assemblages, and no artifact class was unique to the cluster.

Artifact classes most common to cluster III assemblages were tool fragments and expediently manufactured tools, which suggested that this cluster was representative of assemblages resulting from limited activity settlements. High proportions of microblade proximal fragments suggested that microblade production was included among the technological activities of these settlements.

The common occurrence of a variety of maintenance type tools suggested that both cluster I and cluster II were representative of base camp settlements. The greater range of assemblage diversity was identified among the cluster II assemblages. Because both assemblages of cluster II were associated with pithouse features, the cluster was designated as a pithouse base camp settlement type. Cluster I was termed a lithic scatter base camp. Higher proportions of certain microblade classes were found among cluster I assemblage than among cluster II ones. It was suggested that this resulted from more intensive microblade manufacturing at the settlement represented by cluster II assemblages. This variation also might be due to strata mixing resulting from pithouse construction. The distribution of marginally retouched flakes suggested that, relative to cluster II, cluster I assemblages were deposited during very short durations of occupation. This difference may be accounted for, in part, as a result of the closed array. Cluster I assemblages display high proportions

of microblades.

Further Patterns of Assemblage Variation

This analysis seeks to identify additional underlying patterns of variation among the assemblages. The City Block distance matrix utilized in the settlement classification can be subjected to Torgerson's metric multidimensional scaling (TMDS) (Torgerson 1958). Whereas cluster analysis groups assemblages into a single classification, a Q-mode TMDS will order assemblages along a number of dimensions until all of the variation in the initial data set is accounted for. Each dimension is interpreted separately. However, the importance of each dimension, as per the amount of variance it accounts for, is reduced as subsequent roots are extracted. TMDS should confirm the assemblage patterning identified by the cluster analysis and may identify other patterns of variation among the assemblages.

The program TSCALE (Matson 1978) was applied to the City Block distance matrix for the present analysis. Since none of the 84 triangular tests for inequalities was violated, the assumption that the data matrix is metric is upheld. Ninety-eight percent of the variation was extracted by 6 dimensions. The first 3 dimensions accounted for 79.3% of the variation. Only these need be considered in the following discussion because little distance remains and no interpretation was possible in the final dimensions.

Dimension 1

The order of assemblages on the first dimension is presented in Figure 15. This dimension accounts for 34.5% of the trace and distinguishes cluster I assemblages from those of cluster III. Cluster I assemblages fall on the far left of the dimension and cluster III assemblages are ordered toward the right. The cluster II assemblages separate and fall on either side of the dimension: EdRk 7 is located in the middle of the limited activity settlements, and EdRk 9 Zone III appears amidst the lithic scatter base camp settlements.

The first dimension indicates that most of the variation occurring among these assemblages distinguishes cluster I from cluster III assemblages, which have been interpreted to represent a lithic scatter base camp/limited activity settlement dichotomy. The variation represented by this grouping also characterizes differences between the assemblages of cluster II. The cluster analysis grouped EdRk 9 Zone III and EdRk 7 apparently due to the common occurrence of a wide variety of tool classes including specialty tools indicative of base camp activities. The scaling analysis further suggests that EdRk 9 Zone III has characteristics similar to cluster I, while the assemblage of EdRk 7 has aspects similar to assemblages from cluster III.

What makes EdRk 7 different from other assemblages interpreted as base camps and similar to assemblages interpreted as

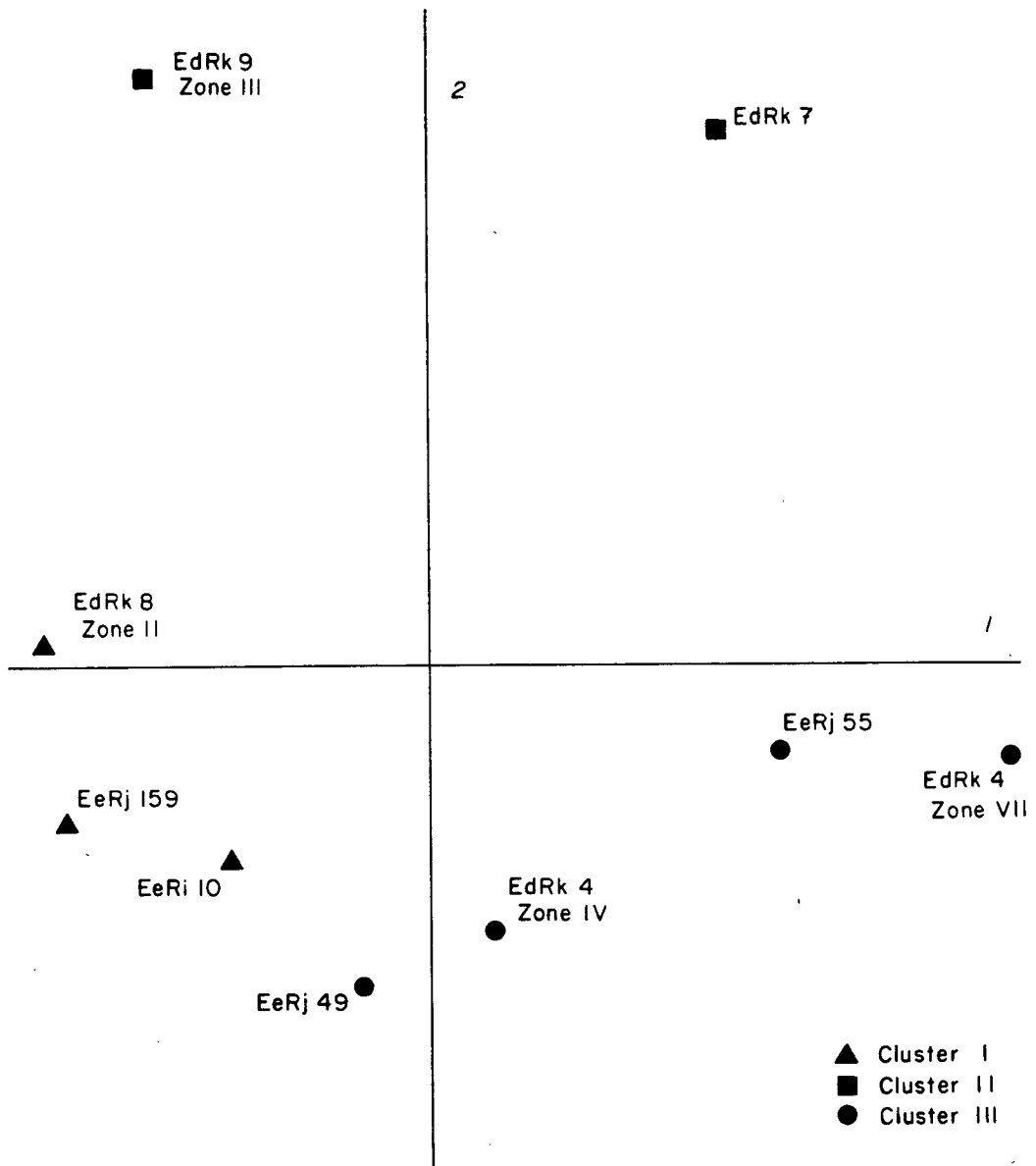


Figure 15. Torgerson's Metric Multi-dimensional Scaling of the Lithic Assemblages, Dimensions 1 and 2.

limited activity settlements is a high proportion of marginally retouched tools and a low proportion of microblades and microblade debitage (see Table 5). If the assemblage percentages of the five classes of marginally retouched flakes are added together for each assemblage, this distribution is made obvious. The base camp assemblages on the far left of this dimension have assemblage percentages ranging between 3.9% and 14%. The two Cluster III assemblages on the left of EdRk 7 each comprise approximately 17% expediently manufactured tools. EdRk 7 yields the highest rate at 46.5%, and the figure decreases slightly to 37.2% and 38.2% in the remaining assemblages. Conversely, if assemblage percentages of all microblade, microcore, and debitage classes are added together, high figures fall on the left of the dimension and low figures on the right. A Spearman's rank ordered correlation coefficient (Conover 1971:245) was calculated between these two variables and yielded a coefficient of -0.7815, significant at .006, thus supporting interpretation of an inverse relationship between the variables.

In general, this pattern is in agreement with that expected to distinguish base camps from limited activity settlements and was identified in the previous analysis. The high proportion of expedient tools in the EdRk 7 assemblage is indicative of another factor of settlement variation. Camilli (1982:10) found that expediently manufactured tools are

strongly correlated with independent measures of the intensity of site uses, when site function is controlled. If her interpretations can be applied to the present data, it appears that the cluster II assemblages vary according to intensity of occupation. Cluster III assemblages can be similarly distinguished. EeRj 49 and EdRk 4 Zone IV have lower proportions of expediently manufactured tools than the remaining cluster III assemblages, which fall on the right of the dimension. Little variation on this dimension occurs among the cluster I assemblages.

Dimension 2

The order of the assemblages along the second dimension is illustrated on the vertical axis of Figure 15. Almost as important as the first dimension, the second dimension accounts for 32.4% of the variance. This dimension distinguishes cluster II assemblages from all other assemblages. Both cluster II assemblages group at the top of the dimension, and cluster I and III assemblages order toward the bottom.

This distribution can be interpreted as representative of the variety of non-microblade artifact classes present within the assemblages. A Spearman's rank order correlation coefficient (Conover 1971:245) was calculated between the assemblage total of non-microblade artifact classes and the rank order of each assemblage on this dimension. A coefficient of -0.9407, significant at .001 supports this interpretation. The first 2 assemblages, EdRk 9 Zone III and EdRk 7, have the

most non-microblade artifact classes with 16 and 21 respectively. Conversely, EeRj 49 is ranked ninth on the scale and has only 3 non-microblade tool classes present.

This dimension indicates that the assemblages associated with prepared core and microblade technologies are highly variable and may also suggest that the activities associated with microblade production and use are also variable. As expected, the pithouse base camp assemblages of cluster II exhibit the greatest variety of other artifact classes. Less non-microblade tool variety is evident among the remaining assemblages and suggests that the greatest variation between cluster I lithic scatter base camps and cluster II limited activity settlements is in their relative proportions of microblades. Similarly, Pokotylo (1978:274-276) found that microblades were represented among the assemblages of three of five assemblage clusters. This suggests that microblade technology cannot be restricted to a single, functional interpretation.

Dimension 3

The third and final interpretable dimension accounts for only 12.4% of the trace, less than half of that accounted for by either of the preceding dimensions. For the most part, this dimension is indicative of environmental location. All but one of the riverine assemblages order at the top of the dimension; upland assemblages occur in the lower half (see

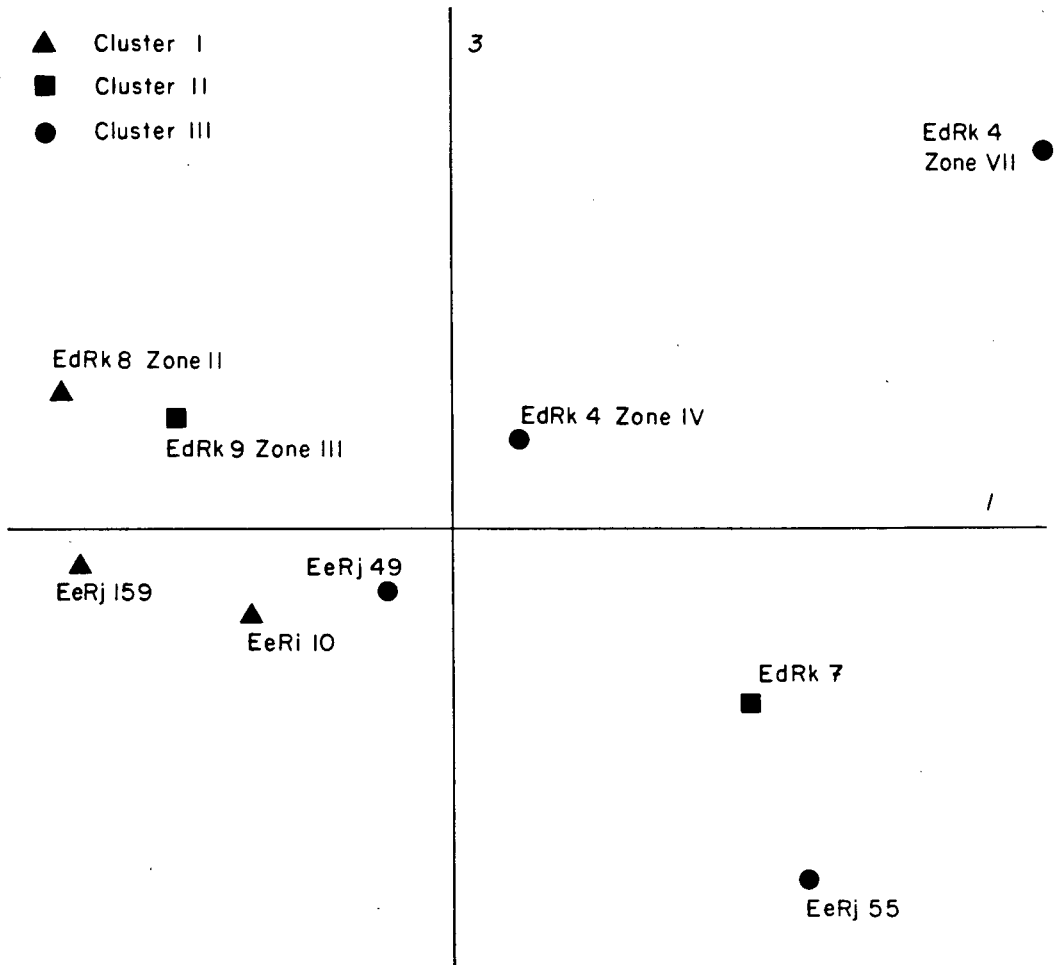


Figure 16. Torgerson's Metric Multi-dimensional Scaling of the Lithic Assemblages, Dimensions 1 and 3.

Figure 16). Best represented by this dimension is the variation that distinguished EdRk 4 Zone VII from EeRj 55, both identified as limited activity settlements and each tending to be grouped with the other on the other dimensions.

The expedient aspect of EdRk 7 identified on the first dimension is again evidenced by its placement amidst the up-land assemblages. Steep edge marginally bifacially retouched flakes tend to increase in proportion toward the bottom of the scale with the highest proportions occurring in EdRk 7 and EeRj 55. None is present in EdRk 4 Zone VII or EdRk 8 Zone II, which are placed at the top of the scale.

In summary the Torgerson's metric multidimensional scaling analysis identified 3 dimensions responsible for variation among the selected assemblages. The first dimension indicated that most assemblage variation is represented by the lithic scatter base camp/limited activity settlement dichotomy. High proportions of microblades are common to the assemblages of base camp settlements and high proportions of expediently manufactured tools are present in limited activity settlement assemblages. The second dimension separated cluster II assemblages, representative of a pithouse base camp settlement, from the other assemblages. This distinction is made according to a high occurrence of non-microblade artifact classes among cluster II assemblages and fewer classes among the remainder. The difference between cluster I and cluster III was therefore interpreted to be

primarily due to relative differences in microblade proportions. The dimension further suggested that microblades are associated with a wide range of activities as represented by highly variable assemblages. Environmental location appeared to correlate with the distribution of assemblages on the third dimension.

Interpretation of Settlement Strategy

Models of cultural development on the Interior Plateau have suggested that resource intensification resulted in the semi-sedentary pattern of settlement identified with pithouse occupation (Nelson 1973; Ames and Marshall 1980). Implicit in these models is an assumption of a highly mobile life style as characteristic of pre-pithouse occupation. The local cultural sequence suggests that microblades may be diagnostic of this early pattern (Strydom 1973). The present study examined variation among microblade assemblages as a means of identifying the settlement strategy characterized by these assemblages.

The model of hunter-gatherer settlement strategies presented in Chapter II contrasted the sedentary residential pattern of collectors with a more mobile pattern of foragers. Variation in the study area was expected to depict either strategy. The traditional Interior Salish pattern was inferred as more similar to that of collectors. Few residential moves characterized the pattern and additional resources were procured and processed at limited activity settlements. Further,

it was expected that if the prehistoric pattern represented by microblade assemblages was evidence of a more mobile strategy, assemblage variability would characterize a variety of residential settlements.

Initially, assemblage variation was examined among assemblages from distinct ecological zones. It was expected that differentiation of settlement practices resulting from seasonal and geographic variation of resource availability would result in distinct lithic assemblages between upland and riverine assemblages. Analyses supported the hypothesis and indicated that upland assemblages were characterized by microcore maintenance and expedient technological activities, whereas a greater variety of maintenance type tools were identified common to riverine settlements. Riverine occupations were also interpreted to have been of longer duration than upland ones.

The second hypothesis examined suggested that variation among assemblages could further be expected as a result of settlements within ecological zones being used for different activities. Three assemblage groupings were identified. These were interpreted to have been deposited in association with:

- 1) lithic scatter base camps, 2) pithouse base camps, and
- 3) limited activity settlements. Only the pithouse base camps were exclusive to an ecological zone, the riverine location.

Patterns of variation examined among the settlement groupings indicated: 1) an accumulation of artifact variety, 2) an

inverse relationship between microblades and expedient tools, 3) a range of the variety of non-microblade tool classes, and 4) a distribution of assemblages according to environmental location.

These analyses suggest that while variation between ecological zones exists, stronger patterns of variation cross-cut environmental boundaries. Similar settlement types, as defined according to lithic assemblage contents, occur in either ecological zone. Assemblage variation observed through examination of the first hypothesis appears to be the result of pithouse occupation in the river valleys. Further study is needed to determine the contemporaneity of the pithouse base camps with the other settlements inferred to be associated with microblade technology.

The strongest pattern of variation among the assemblages is that which distinguished lithic scatter base camps from limited activity settlements. To repeat, this variation is characterized by an inverse relationship between relative proportions of microblades and expedient tools. Since maintenance type tools occur more often among the lithic scatter base camps, and few similar tools occur among the limited activity settlements, the interpretation of these groupings as distinct settlement types was suggested.

Nonetheless, it must be noted that all patterns expected to distinguish base camps from limited activity settlements

were not observed. Specifically, cluster I exhibited lower proportions of maintenance activity artifacts than expected. As well, extensively modified tools were not as restricted to base camps (clusters I and II) as initially expected. Finally, relatively low proportions of marginally retouched tools among the cluster I assemblages suggested a much less intensive occupation than was expected for base camps.

A number of factors that may account for these observations can be suggested. Further study is needed to adequately assess them. Primarily, analyses were conducted on percentage level data and the percentage matrix is a closed array. Recognizing the high proportions of microblades among cluster I assemblages, it must be expected that proportions of other artifact classes will decrease. On the assumption that this variation is not a direct function of sampling strategy, the inverse relationship between microblades and expediently manufactured tools may suggest a characteristic unique to the technological organization responsible for the deposition of these assemblages. That is, these assemblages may be indicative of the occurrence of two distinct and almost mutually exclusive indicators of occupation intensity: microblades and marginally retouched tools. The patterns observed herein suggest that where microblades and microcores are intensively produced, relatively less use is made of marginally retouched tools. In contrast, microblades may be produced at other

settlements, but production will cease either before or when the core is in need of extensive modification. In this situation, marginally retouched artifacts represent the predominant technological strategy. It is expected that frequencies of these tool classes will increase with increased occupation. It is apparent that a spatial separation of microcore and microblade manufacturing and use activities existed. The hypothesis put forth suggests that intensive prepared core and microcore production is characteristic of base camp activities. High proportions of microblades should also be indicative of intensive occupation. If the present study has identified the occurrence of distinct but interrelated intensity measures, direct applications of the models presented by Camilli (1981, 1982) and Matson (n.d.) must be closely examined. Further study could prove informative.

To summarize, what do these patterns of assemblage variation suggest regarding prehistoric settlement strategy? The settlement strategy interpreted from the present analysis appears to be one characterized by two residential moves supported by a variety of limited activity settlements. This pattern is more similar to that expected for collectors than that expected for foragers. If these assemblages are representative of an Early Period settlement system, it appears that organizational features characteristic of the Late Period settlement system were in place prior to the inferred period of transition and intensification.

CHAPTER V

SUMMARY AND CONCLUSIONS

The objective of this study was the reconstruction of patterns of settlement associated with the microblade technology of the southwestern Interior Plateau of British Columbia. In so doing, it was hoped that a contribution could be made to the understanding of local prehistory and to the study of lithic assemblage formation processes associated with settlement activities.

The production of microblades from prepared cores involves a distinctive technology, and this technology has been reported from numerous geographic and temporal contexts. Chapter I presented a review of the pertinent literature for northwestern North America and revealed that relatively little concerning the cultural behaviours responsible for the archaeological deposition of microblades and their associated assemblages is understood. Previous research had focused on the cultural historical aspects of this technology and included some study of the variation in techniques used among prepared core and blade technologies. The literature review found that no attention had been given to explicating the prehistoric technological organization responsible for the deposition of the aforementioned assemblages.

The review indicated that in large part, previous studies were unable to address problems of cultural behaviour because

no data base reflecting regional variability had been collected. Culture-historic studies utilize a research design focused on the excavation of single, stratified sites. Microblade assemblages recently recovered from Hat Creek valley (Beirne and Pokotylo 1978), as well as those from Lochnore-Nesikep locality (Sanger 1970a), were identified as an opportune data base on which to conduct the needed analyses.

A review of the prehistoric cultural sequence developed for the study area indicated that microblades often have been considered diagnostic of the Early Period of the Nesikep Tradition, dated between about 7,000 and 2,800 years before present. The introduction of the pithouse and the demise of microblade technology mark the advent of the Late Period (Stryd 1973). Sanger (1968b, 1969, 1970a) interpreted the Nesikep Tradition as representative of a gradual adaptation to the Plateau environment, culminating in the ethnographic Interior Salish Tradition. This adaptation has been understood to have involved the intensification of food resources and the establishment of pithouse villages (Nelson 1973; Ames and Marshall 1980). The review of the local archaeological literature indicated that virtually nothing was understood of the settlement pattern out of which pithouse villages developed. An objective of the present study, therefore, was to document aspects of Early Period settlement that may be useful to future studies of cultural development on the Interior Plateau.

The conceptual framework in which the problem of Plateau cultural development was to be addressed was presented in Chapter II. Ethnographically-reported patterns of Interior Salish settlement and subsistence and local environmental factors were utilized in conjunction with Binford's (1980) model of hunter-gatherer settlement systems in order to identify dimensions on which patterns of intersite variation could be observed. The distribution of subsistence resources and the utilization of these resources, as reported in the ethnographies, suggested a distinctive land use pattern between upland and lowland ecological zones. Hunter-gatherer settlement systems were further expected to vary according to the variety of logistical components composing their settlement and subsistence organization. Binford (1980) characterizes this variation by contrasting foraging with collecting settlement strategies. For the purposes of the present study, it was suggested that a greater variety of settlement types would be representative of collectors than would be of foragers. The Interior Salish settlement pattern, based on stored winter food supplies, was inferred to be similar to the collector strategy. Because models of cultural development on the Plateau imply that relatively little storage behaviour was characteristic of pre-pithouse occupation, the settlement pattern of the Early Period was expected to be similar to a foraging strategy.

The second part of Chapter II was concerned with expli-

cating the relationship between cultural dynamics and archaeological data. The specific issues addressed concerned cultural behaviours presently understood to be responsible for the formation of lithic assemblages. Initially, the research designs and collection procedures of the Hat Creek and Lochnore-Nesikep archaeological projects were described. Major differences in screen sizes, sampling strategies, and classification and sorting techniques were identified. Little floral or faunal material was preserved in the sites, and debitage from Lochnore-Nesikep was not available for study. Therefore, an artifact classification based on lithic tools was devised.

Based on Collins' (1975) model of lithic tool reduction, variation among lithic tools was interpreted to be a result of the amount of trimming applied to tool manufacture, and from the amount of subsequent modification applied to maintain tools. Conditions under which tools were expected to be maintained or rapidly discarded were proposed. The identification of these conditions was based on a study of technological organization conducted among the Nunamiut (Binford 1977, 1979) and ongoing research applying similar ideas to archaeological assemblages from the American Southwest (Camilli 1981, 1982; Matson n.d.). An objective of this study was to examine the utility of these interpretations of lithic assemblage formation processes for interpreting settlement functions.

A total of 38 artifact classes were described. These were

subdivided into five major categories expected to be indicative of independent patterns of technological activities related to settlement organization. The five categories included 1) extensively retouched artifacts, 2) extensively retouched artifact fragments, 3) marginally retouched artifacts, 4) maintenance activity artifacts, and 5) prepared core and microblade artifacts. Sixteen microblade attributes were also described. It was suggested that these attributes were indicative of various reduction stages involved in microblade production.

Patterns of assemblage variation that distinguished assemblages according to environmental locations were examined in Chapter III. Differences between upland and riverine assemblages were identified through discriminant analyses conducted on binary and percentage data matrices of the 38 artifact classes. Each analysis correctly sorted assemblages according to their respective ecological zones, and the discriminant functions could be interpreted according to technological activities that distinguished upland from lowland settlements.

The binary discriminant function identified variation among the kind and variety of maintained tools common to each ecological zone. Modified point fragments, bifaces, and unifaces loaded on this function. Each were more common to riverine assemblages. Upland assemblages were represented by frequent occurrences of microcore debitage indicative of microcore maintenance. The discriminant function derived from per-

centage level data suggested a greater intensity of occupation in the lowlands than in the uplands. This function was dominated by biface fragments with steep edges and bipolar implements, artifact classes expected to rapidly accumulate with frequency of activity. The discriminant analyses also indicated a preference for expediently manufactured artifacts among upland assemblages and for termination and combination type uses of microblades in the lowlands.

The identification of microblade production as representative of upland technological activities suggested that upland and lowland assemblages would also display distinct microblade attributes indicative of varying stages of microblade production. Assemblage level statistics of 56 microblade attributes were compared between ecological zones. Mann-Whitney U-tests identified significantly different distributions for nine of these attributes. Their distributions suggested that Hat Creek microblades were more variable among themselves than they were compared to those from Lochnore-Nesikep. However, the interpretation of this was tenuous. It was unclear whether the pattern observed was a result of a wider range of microcore reduction in the Hat Creek sites or simply a fabrication of excavation strategies.

Chapter IV sought to identify the variety of settlement types represented by the lithic assemblages and to delineate patterns of technological organization that distinguished

settlement groupings. An interpretation of the settlement strategy represented by these groupings was also suggested.

Initially, Q-mode cluster analyses were applied to binary and percentage level data matrices of the 38 artifact classes. Two clusters were formed from the binary data, whereas the percentage data divided one of these and resulted in three clusters. The additional cluster was the only cluster exclusive to an ecological zone, the river valley, and both of its members were associated with pithouse occupations.

Discriminant analysis and a series of Kruskal-Wallis tests were applied as a means of identifying artifact classes that best distinguished the clusters. Examination of the distribution of the classes identified suggested that a major difference among the clusters was due to an increase in artifact variety. The least variety of artifact classes was evident among the cluster III assemblages. No artifact class was unique to the cluster. Cluster II, representative of the pithouse occupations, had the most variety of artifact classes.

Artifact classes representative of maintenance activities and prepared core and microblade technology regularly distinguished the clusters. Marginally retouched artifact classes and extensively retouched artifacts and fragments were less often distributed differently among the clusters. Nonetheless, the distribution suggested that technological activities represented by the artifact classes varied among the clusters.

The clusters could be interpreted as representative of assemblages deposited in association with distinct settlement functions.

Artifact classes most common to cluster III assemblages were tool fragments and expediently manufactured tools. It was suggested that this cluster was indicative of limited activity settlements. Microblades were interpreted to have been manufactured at these sites, although the sample suggested that microcores were not. The common occurrence of a variety of maintenance activity artifacts suggested that both cluster I and cluster II were representative of lithic assemblages resulting from base camp settlements. Cluster I was designated a lithic scatter base camp, and cluster II, a pithouse base camp. The differences between clusters I and II were recognized as higher proportions of microblades among the cluster I assemblages and higher proportions of expediently manufactured and maintenance artifacts among the cluster II assemblages. The distribution of these artifacts suggested that intensive microblade manufacturing was associated with the deposition of cluster I assemblages. Cluster II assemblages were indicative of longer and more intensive settlement occupations.

Additional underlying patterns of assemblage variation were identified through Torgerson's metric multidimensional scaling (TMDS). The technique was applied to the City Block distance matrix calculated for the cluster analysis. Three

dimensions could be interpreted, and together they accounted for 79.3% of the variation.

The first dimension distinguished cluster I assemblages from those of cluster III. This pattern was interpreted as indicative of an inverse relationship between relative proportions of microblades and marginally retouched tools. The distribution of EdRk 9 Zone III and EdRk 7 on this dimension suggested that cluster II assemblages varied according to the intensity of their associated occupations. Dimension two separated cluster II assemblages from those of clusters I and III. The dimension was interpreted as representative of the variety of non-microblade artifact classes. Environmental location correlated with the distribution of assemblages on the third dimension.

As interpreted, the patterns of variability indicated that the lithic assemblages were deposited in association with a settlement strategy characterized by two residential moves supported by a variety of limited activity settlements. Differences between upland and riverine assemblages identified in Chapter III were suggested to have resulted from pithouse occupations in the lowlands. It was noted that further study is needed to correctly identify the temporal relationships of the residential settlements. The identification of a variety of limited activity settlements that cross-cut environmental boundaries indicated that at least some logistical components

of settlement organizations were in place prior to the period inferred as representative of a subsistence pattern based on intensive utilization and storage of certain resources.

In conclusion, the study identified patterns of technological organization that aided interpretations of settlement function from analyses of lithic assemblage variation. Nonetheless problems with the study are evident and directions for further research can be suggested.

It was noted that the observed patterns of technological variation were not consistent with expectations of technological organization proposed here. This variation may be due to a number of causes. Initially, it is apparent that a variety of research strategies were applied in recovering the assemblages studied. Sampling biases resulting from these procedures may be responsible for some of the distributions observed. Interpretations suggested by this study should be substantiated by analyses conducted on better controlled data, and additional study should include corroborative evidence based on independent analyses of lithic and food debris.

The study also suggested that a pattern of technological organization unique to prepared core and microblade technologies may be responsible for the discrepancies. Primarily, it was suggested that high proportions of microblades are as indicative of intensive activity and settlement occupation as has been suggested for flake tools (Camilli 1981, 1982;

Matson, n.d.). However, it was suggested that microblades were most commonly used on base camps, whereas marginally retouched flakes were used at limited activity settlements. The high proportions of marginally retouched artifacts in the pithouse assemblages may be indicative of a shift in technological strategy associated with the abandonment of microblade production and use. If microblades are an alternate measure of the intensity of settlement occupation, analyses conducted within a closed array would yield results in variance with the model originally expected. Further study of the technological organization responsible for the deposition of microblade assemblages, as per the method developed by Camilli (1981, 1982), is needed to substantiate this hypothesis. The study could provide a better understanding of lithic assemblage formation processes that is necessary for the confident interpretation of prehistoric lifeways.

Finally, the identification of logistical components involved in the organization of pre-pithouse settlement should not be viewed with surprise. Binford's (1980) model of hunter-gatherer settlement strategies implies that the temperate climate of the Interior Plateau could not support a truly, foraging strategy. Nonetheless, the results have implications for future studies.

This study was also concerned with the delineation of patterns of lithic assemblage variation and to interpret those patterns in terms of settlement activity. In order that these interpretations be given relevance, the study was placed within a developmental framework. However, it is by no means assumed that the problem of the historic context of microblade technology on the Plateau has been resolved. This is left for further study. What the study has recognized is that models, more refined than that provided by Binford (1980), are needed to identify and explain variation among collector strategies. If this study has identified a pre-pithouse settlement organization based on a logistically-oriented collector strategy, future studies would benefit from the explication of variables that distinguish this strategy from that practiced during later periods. Demography, the subsistence base, and the duration of occupation are but a few that may prove fruitful.

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