University of Alberta

Late Side-Notched Projectile Points on the Northwestern Plains

by

©

Trevor Richard Peck

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DEDICATION

For my Mother and Father

ABSTRACT

This thesis reexamines the classification system for Late Side-notched projectile points on the Northwestern Plains. This classification system, which was established by MacNeish (1954, 1958) and Wettlaufer (1955, 1960) and culminated with the work of Forbis (1960) and Kehoe (1966), is illustrated to be inappropriate for classifying Late Side-notched projectile point morphological variability.

An analysis of discrete and continuous attributes from projectile point assemblages in Alberta and Saskatchewan suggests that, from ca. 1250 B.P. to 650 B.P., Late Side-notched projectile points exhibited relatively similar values among sites in the study area. About 650 B.P., however, there was an abrupt change in Late Side-notched projectile point morphology at some of the sites in the study area. Projectile points in the eastern half of the study area quite suddenly exhibited differences from earlier specimens in both discrete and continuous attributes, and then remained unchanged into the Historic Period. In the western half of the study area, no abrupt change from the earlier specimens was manifested. Instead, the continuous attributes continued along previous lines; those continuous attributes that exhibited gradual change through time continue to do so, and those continuous attributes which did not exhibit change through time remain unchanged. Discrete attributes exhibited change in their frequencies of occurrence between the early period and the late period; however, they exhibited the strongest similarity and continuity to the western sites.

A reclassification of Late Side-notched projectile points labels the western sites as containing Cayley Series projectile points and the eastern sites as containing Mortlach

Group projectile points. Cayley Series projectile points are illustrated to be associated with Saskatchewan Basin Complex: Late Variant pottery (Byrne 1973). This provides the basis for a redefinition of the Old Women's Phase. Similarly, Mortlach Group projectile points are shown to be associated with Mortlach pottery (Walde 1995), thus redefining the Mortlach Phase.

Coinciding geographic distributions and ethnographic records are used to support the contention that Cayley Series projectile points, and therefore the Old Women's Phase, were produced by the ancestors of the historically known Blackfoot peoples. Using the same approach, the Mortlach Group projectile points, and the Mortlach Phase, are considered to reflect the ancestors of the historically known Assiniboine.

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INTRODUCTION

Aim of the Study

Late Side-notched projectile points on the Northwestern Plains have provided a conundrum for scholars of Plains Archaeology. While authorities generally share the view that Late Side-notched projectile points can be classified as either Prairie Side-notched or Plains Side-notched projectile point types, they also admit to a broad range of morphological variability that has escaped both classification and explanation (e.g., Whelan 1976:5; Brink et al. 1985:105-136; Brumley and Dau 1988:48-49).

In terms of classification, the only thorough efforts towards deciphering the morphological variability of Late Side-notched projectile points on the Northwestern Plains occurred in the 1960s. Before this time, Richard MacNeish (1954:39-40) provided the first terminology used in classifying projectile points on the Northern Plains. Even with MacNeish's efforts, ensuing scholars were still inclined to describe projectile points as triangular, small, and ubiquitous or "...too generalized to be useful in either detailed chronological or in ethnic-affiliated studies" (Kehoe 1966:827; Kehoe and McCorquodale 1961:179).

This began to change with the announcement of "...a readily distinguishable type..." which was considered "...a horizon marker for the Canadian Plains: the Avonlea point" (Kehoe and McCorquodale 1961:179). In fact, almost everywhere on the Northwestern Plains the Avonlea projectile point type immediately antedates Late Side-notched projectile points.

Then, Richard G. Forbis (1962:94-179), working at the Old Women's Buffalo Jump near Cayley, Alberta, produced a chronostratigraphic typology isolating seven key projectile point types other than the Avonlea type. His projectile point types were based on six continuous attributes (i.e., length, width at base, width of body, width at neck, notch width, and height of basal edge) that proved to be chronostratigraphically useful (Forbis 1962:85).

The culmination of Forbis' (1962) identifications was realized in excavations at the Gull Lake Bison Drive site. Thomas F. Kehoe (1966) proposed that the Gull Lake Bison Drive site consisted of a stratigraphic sequence in which essentially the projectile point types defined by Forbis (1962) were found to be stratigraphically above the Avonlea projectile point type proposed by Kehoe and McCorquodale (1961). Kehoe (1966:829-830) further defined the Avonlea projectile point type and subdivided it into three varieties of chronostratigraphic significance. Moreover, while downgrading Forbis' (1962) projectile point types to varieties and adding a few new varieties of his own, Kehoe re-established the terms Prairie Side-notched and Plains Side-notched projectile points types originally used by MacNeish (Kehoe 1966:830).

Together, Forbis' (1962) and Kehoe's (1966) work resulted in the basic structure of the existing classification system. The Avonlea projectile point type is the earliest Late Prehistoric projectile point, appearing approximately 1750 B.P. and persisting until roughly 1250 B.P. (Kehoe 1966). Late Side-notched projectile points constitute the diagnostic projectile points that post-date the Avonlea projectile point type; Prairie Side-notched projectile points date ca. 1250 B.P. to 650 B.P. followed by Plains Side-notched projectile points, which date ca. 650 years B.P. to the Historic Period (Kehoe 1966).

Given that Late Side-notched projectile points have been classified in this form, or a form closely resembling it, since the mid-1960s, it is not surprising that the classification system has met with support, objection, modification, and ambivalence. In addressing the classification of Late Side-notched projectile points, many authors have adhered to the two type distinction (i.e., Prairie Side-notched and Plains Side-notched projectile point types) without addressing the issue of the varieties (e.g., Rushowick 1975:6; Reeves 1978:166; Dyck 1983:126-13; Wilson 1984:12, 21; Linnamae 1988:109; Walker 1988:78). Some authors have merged the two types and rejected the use of varieties as valid classificatory units (e.g., Brumley and Dau 1988:48). A few authors have offered additions to the classification system (e.g., Quigg 1974:101-110; Adams 1975:157; Adams 1977:173-174; Nicholson 1976:57;

Ball 1987:38). Others have found harmony between the classification system and their projectile point data (e.g., Kehoe 1967:40-50; Shumate 1967:12; Brumley 1971:24-34; Millar et al. 1972:31-33; Brumley 1976:26-36; Nicholson 1976:72; Milne Brumley 1978:40-61). Still other researchers have found few aspects of the classification system acceptable and have suggested their own systems of classification (e.g., Whelan 1976:15; Brink et al. 1985:105-136).

Explanations of the variable nature of Late Side-notched projectile point morphology have met with even less success than attempts at classification. The results of classifying Late Side-notched projectile points on the Northwestern Plains have often been explained as indicators of ethnicity. For example, Forbis (1962:70), when he stated "...the [Old] Women's Jump was almost certainly a Blackfoot site, at least in the most recent period" indirectly attributed the most recent Late Side-notched projectile points types as Blackfoot in origin. More recently, however, Forbis (1992:31-32) has clarified his position on the relationship between projectile point types and ethnicity by refuting any direct correlation between the two.

Kehoe (1966:839-840) suggested Prairie Side-notched and Plains Side-notched projectile point types reflect Algonquian and Siouan speaking people, respectively. Reeves (1978, 1983) used the presence of Prairie Side-notched and Plains Side-notched projectile points in defining the archaeological unit called the Old Women's Phase, which he believes is ancestral to the Blackfoot. Similarly, Greaves (1981:24-33) tentatively identified Late Side-notched projectile points, from the Old Women's Buffalo Jump and Head-Smashed-In Buffalo Jump, as Blackfoot. In contrast, Greaves also noted that "Taylor (1973) suggested that the Pekisko and Paskapoo varieties occurring at Site 24LN517 on the Kootenai River in Montana are related to a Kutenai occupation" (in Greaves 1981:20). Dyck (1983:132), in comparing Late Side-notched projectile points from the Northern Plains with projectile points from the Middle Missouri, noted similarities he felt suggested strong connections between the Northern Plains bison hunters and Plains villagers. Greaves (1981:22), in summarizing the attempts at explaining projectile point morphological variability, stated "All seven varieties [i.e., Forbis' types: High River, Irvine, Lewis, Nanton, Paskapoo, Pekisko, and Washita] have, at one time or another, been identified with Blackfoot or Gros Ventre, and some have been associated with Kutenai, Crow, and Shoshone..." (Greaves 1981:22).

Few explanations of projectile point morphological variability have been proposed that do not rely solely on ethnicity as the explanatory mechanism. Studies of morphological variability that have suggested explanations beyond ethnic indicators (e.g., Flenniken and Raymond 1986; Dawe 1994; Brink and Dawe 1989:208-209; Stanfill 1990; Duke 1991:164) have often been disregarded.

It is the purpose of this thesis to address the lack of consensus concerning the classification of Late Side-notched projectile points on the Northwestern Plains. This objective will be achieved through an evaluation of the classification system by way of an attribute analysis of Late Side-notched projectile point morphological variability. Then, in light of the evaluation, explanations of Late Side-notched projectile point morphological variability will be reviewed with a focus on ethnicity.

Following this brief introduction of the differing views on the classification and explanation of Late Side-notched projectile points on the Northwestern Plains, the remainder of the chapter will describe the study area and the archaeological context ascribed to Late Side-notched projectile point types. Chapter Two describes, in more detail, the developmental history of the classification system used for Late Side-notched projectile points on the Northwestern Plains. Chapter Three states the methodological approach of the analysis. Chapter Four presents the results of the evaluation of the classification system. In Chapter Five, I present a reclassification of Late Side-notched projectile points on the Northwestern Plains. In Chapter Six, I make use of the reclassification to reconsider ethnicity as the primary explanatory mechanism of the morphological variability. Conclusions concerning the classification and explanation of Late Side-notched projectile points on the Northwestern Plains will be presented in the final chapter.

The Study Area

For the purposes of this evaluation, the study area for Late Side-notched projectile points on the Northwestern Plains is dictated by site locations at which the classification system has been applied. The classification system has largely had its genesis through work at sites on the Plains of Alberta, Saskatchewan, and Montana (Forbis 1962; Kehoe 1966). Subsequently, the classification system has been applied to projectile point assemblages on the Plains of the western Dakotas (e.g., Walde 1994) and the Prairies of southwestern Manitoba (e.g., Nicholson 1976; Walde 1994; Whelan 1976).

The study area described above roughly parallels Waldo Wedel's (1961:240) definition of the Northwestern Plains. At the same time, it differs in some noteworthy ways from Wedel's (1961:240) definition. The southwestern prairie of Manitoba, which is not usually included in a description of the Northwestern Plains, is included in this study. Manitoba's inclusion in this study results principally from applications of the classification system to projectile point assemblages from the prairies found in the southwestern corner of the province.

Wyoming, normally considered part of the Northwestern Plains, is not included in this study because the classification system has not been applied to projectile points in this area. In Wyoming, authorities acknowledge the classification system for Late Side-notched projectile points from the Northwestern Plains, but do not choose to describe projectile points using this classification system (e.g., Reher and Frison 1980:25-28; Frison 1991:211-232).

Archaeological Context

In order to place Late Side-notched projectile points into perspective with regard to the archaeological record on the Northwestern Plains, it is necessary to provide a brief introduction to the paleocultural sequence for the area. Traditionally, the archaeological record on the Northwestern Plains has been divided into segments of time called "periods."

Periods are differentiated based primarily on changes in projectile point morphology that are thought to reflect changes in weapon technology (e.g., Mulloy 1958:204-223; Wormington and Forbis 1965:183-198; Forbis 1970; Dyck 1983; Reeves 1983:35-37; Vickers 1986:10-13). Vickers' (1986:10-13) framework, outlined below, provides a recent synthesis of the paleocultural sequence for the Northwestern Plains:

The Early Prehistoric Period (11,500 B.P. to 7,500 B.P.) is distinguished by the presence of large, lanceolate projectile points inferred to have been hafted as tips on thrusting spears. The Middle Prehistoric Period (7,500 B.P. to 1,750/1,250 B.P.) is distinguished by medium-sized side-notched, corner-notched, and stemmed projectile points understood to have been hafted as tips on darts and propelled by atlatls. The Late Prehistoric Period (1,750/1,250 B.P. to 250 B.P.) is distinguished by small side-notched, corner-notched, and triangular projectile points inferred to have been hafted as tips on arrows and propelled by bows (Late Side-notched projectile points primarily occur in the Late Prehistoric Period but do persist into the Protohistoric Period). The Protohistoric Period (250 B.P. to 76 B.P.) is characterized by the addition of European trade goods to Late Prehistoric material culture with the former ultimately replacing the latter.

Each "period" is further subdivided into a number of "phases." A phase is defined as "...an archaeological unit possessing traits sufficiently characteristic to distinguish it from all other units similarly conceived, whether of the same or other cultures or civilizations, spatially limited to the order of magnitude of a locality or region and chronologically limited to a relatively brief time" (Willey and Phillips 1958:22). Reeves (1983:39), in applying the concept of the "phase" to the Northwestern Plains, modified the spatial limitations such that:

> ...a phase does not necessarily correlate with a locality, region, or even an area. The area occupied by a phase may change through time and it may in fact be found in two environmentally distinct areas. (Reeves 1983:39)

Artifact assemblages are assigned to specific phases largely by the presence of "diagnostic" projectile points and/or pottery (Vickers 1994:7). I have already noted that Late Side-notched projectile points only occur in the Late Prehistoric and Protohistoric Periods, hence, my discussion will be limited to the phases of these periods. The phases to be discussed include the Avonlea, Old Women's, Mortlach, One Gun, and the Highwood phases. I will also discuss two other archaeological units, from the parkland/boreal forest periphery of the Northwestern Plains, as they are often cited as containing Late Side-notched projectile points--namely the Blackduck Cultural Unit and the Selkirk Composite.

The Avonlea Phase

The Avonlea Phase is not a focus of this study but is mentioned here as it generally antedates the phases containing Late Side-notched projectile points on the Northwestern Plains. The Avonlea Phase is the earliest phase in the Late Prehistoric Period and is characterized by the Avonlea projectile point type which includes the Head-Smashed-In Corner-notched and Timber Ridge Side-notched varieties (Reeves 1983:161-162). The Avonlea projectile point type is often interpreted as indicating the introduction of the bow and arrow on to the Plains (Reeves 1983:162). The Avonlea Phase is also characterized as containing asymmetric bifaces, fabric or net-impressed ceramics with punctate designs, distinctive lithics in the northern Montana-Saskatchewan Basin, and perhaps a pit burial pattern of interment (Reeves 1983:161-162). More recently, parallel-grooved ceramics have been added to the inventory of Avonlea material culture (e.g., Tratebas and Johnson 1988; Johnson 1988; Quigg 1988).

In both Saskatchewan and Alberta, the Avonlea Phase dates ca. 1750 B.P. to 1150 B.P. (Dyck 1983:122; Vickers 1986:90). In Manitoba, Avonlea projectile points are usually recovered as surface finds and the Avonlea phase has been described as "ephemeral and poorly understood" (Joyes 1988:227). However, a recent exception to this is the Miniota site, which is a single occupation campsite that contained Avonlea projectile points and ceramics as well as producing radiocarbon dates that corroborate an Avonlea designation (Fedirchuk McCullough and Associates 1994). In Montana, Greiser (1994:41-44) dates the Avonlea Phase between ca. 1200 B.P. and 950 years B.P. and indicates that it does not really penetrate south of the Missouri River. In the Dakotas, Avonlea projectile points are relatively rare and, at least in South Dakota, seem to date between ca. 1530 B.P. to 1300 B.P. (Hannus and Nowak 1988:189).

In terms of ethnic identification, Kehoe (1966:839), based partly on evidence from lexical-statistical calculations, suggested Avonlea Phase material represented Athapaskans migrating south. In contrast, Reeves (1983:20, 166) placed Avonlea within his Tunaxa cultural tradition, which he ultimately related to the historic Kutenai. Morgan (1979:220), after examining Avonlea pottery from the Garratt site, Saskatchewan, considered a relationship to the Upper Missouri.

Before discussing the phases that are characterized by Late Side-notched projectile points, clarification of terminology is needed. The term I use to refer to the wide variety of projectile points that immediately succeed Avonlea projectile points on the Northwestern Plains is "Late Side-notched projectile points."

The use of a single term for such a wide variety of projectile points is not meant to diminish the morphological and/or historical differences between the projectile points. Rather, the term supplies an heuristic classification for projectile points that have otherwise been known by a wide variety of names (e.g., Vickers 1986:95). Kehoe's (1966) usage of the terms Prairie Side-notched and Plains Side-notched projectile points has most commonly been retained in the literature to refer to projectile points that postdate Avonlea projectile points. Therefore, Kehoe's (1966) Prairie Side-notched and Plains Side-notched projectile points can be considered synonymous with Late Side-notched projectile points.

The Old Women's Phase

The Old Women's Phase immediately succeeds the Avonlea Phase over a large portion of the Northwestern Plains. The phase occurs on the Plains of Alberta (Reeves

1983), Saskatchewan (Meyer 1988), and possibly Montana (Brumley and Rennie 1993:35). Most recently, Brumley and Dau (1988:50) characterized the Old Women's Phase as containing Kehoe's (1966:830-834) Prairie Side-notched and/or Plains Side-notched projectile points in conjunction with Byrne's (1973:331-335, 355-356) Late Variant pottery of the Saskatchewan Basin Complex.

In Alberta, the Old Women's Phase occurs as early as 1400 B.P. and continues into the Protohistoric Period (Vickers 1986:95-104). On the Saskatchewan plains, Meyer (1988) suggested only an early expression of the Old Women's Phase (ca. 1150 B.P. to 650 B.P.) is represented in the archaeological record. After 650 B.P., the Old Women's Phase is supplanted by the Mortlach Phase on the eastern Saskatchewan Plains (Meyer 1988). Meyer (1988:60) does suggest, however, that a later expression of the Old Women's Phase might have been present in west-central Saskatchewan. In Montana, the existence of the Old Women's Phase has been questioned (Brumley and Dau 1988:55-57; Brumley and Rennie 1993:35-43), because while Prairie Side-notched and Plains Side-notched projectile points occur in Montana, there is disagreement as to whether the associated pottery should be classified as Late Variant pottery of the Saskatchewan Basin Complex (Byrne 1973:413, 1980; Keyser 1980; Brumley and Dau 1988:55-56).

In terms of ethnic affiliations, Reeves (1983:20) identifies the Old Women's Phase as directly ancestral to the Blackfoot. Likewise, Byrne (1973:530), basing his argument on historic, traditional, and linguistic evidence, recognized the Blackfoot as the most likely architects of the Late Variant pottery of the Saskatchewan Basin Complex and, therefore, the Old Women's Phase. Vickers (1986:101-102) summarizes the problem of identifying the authors of the Old Women's Phase "While most local archaeologists would probably not dispute a Blackfoot-Old Women's Phase correlation (cf., McCullough 1982:41ff), demonstration of that correlation has remained frustratingly elusive" (Vickers 1986:101-102).

The Mortlach Phase

As noted above, the Mortlach Phase succeeds the Old Women's Phase on the eastern plains of Saskatchewan (Meyer 1988:60). The Mortlach Phase also occurs in southwestern Manitoba, northwestern North Dakota, and northeastern Montana (Walde 1994: 101-102, 243, 282). The phase is characterized by Plains Side-notched projectile points and pottery exhibiting attributes derived from the Middle Missouri region (Joyes 1973; Meyer 1988:62; Walde 1994).

Determining the duration of the Mortlach Phase has presented problems owing to the paucity of absolute dates (Walde 1994:105-106). Nevertheless, a tentative temporal span from 350 B.P. into the Protohistoric Period has been suggested (Walde 1994:106). Recently, Walde (1994) has identified the Mortlach Phase as ancestral to the historic Assiniboine based on a comprehensive analysis of Mortlach sites in Saskatchewan, Manitoba, Montana, and North Dakota.

The One Gun Phase

The One Gun Phase is coeval with the most recent expression of the Old Women's Phase in the South Saskatchewan River Basin of Alberta, but is absent to the south in the Milk River Basin and to the north in the North Saskatchewan Basin (Byrne 1973:366-367,699; Vickers 1986:106). The One Gun Phase is characterized by projectile point varieties of the Plains Side-notched type (Kehoe 1966; Byrne 1973:473-374; Forbis 1977:51-57), pottery of the Cluny Complex (Byrne 1973:335-338), scapula "squash" knives, pitted handstones (nutstones), grinding slabs, and bell-shaped pits. Byrne (1973:479) noted a number of One Gun Phase similarities to Old Women's Phase lithic artifacts, including projectile points, scrapers, drills, grooved shaft smoothers, and mauls, and to Old Women's Phase bone artifacts, including beads, pendants, punches, awls, quill flatteners, and hide grainers.

The One Gun Phase has largely been defined on materials recovered from the Cluny site, a fortified village near Cluny Alberta, and the Morkin site, an open air campsite in the Porcupine Hills of Southern Alberta (Byrne 1973:471-504). Small quantities of Cluny Complex pottery have also found in sites that are otherwise characterized by Old Women's Phase material culture (i.e., they contain substantial amounts of Late Variant pottery of the Saskatchewan Basin Complex) (Byrne 1973:477).

Byrne (1973:481-482), noting the similarity of Cluny Complex pottery to both Mortlach pottery and Middle Missouri pottery, suggested "...the One Gun phase probably represents the result of a migration of a group or groups from that area [Middle Missouri] through southern Saskatchewan to southern Alberta" (Byrne 1973:535). The One Gun Phase occurs in the Protohistoric Period ca. 230 B.P. to 200 B.P. (Byrne 1973:503).

The Highwood Phase

The Highwood Phase is focused in central Montana between the Missouri and Yellowstone Rivers (Brumley and Dau 1988:58). Brumley and Rennie (1993:43-46) characterize the Highwood Phase as containing high frequencies of Buffalo Gap Single-Spurred and Emigrant Basal-Notched varieties of the Plains Side-notched projectile point type (Kehoe 1966). The projectile points assemblages are commonly made of obsidian, porcellanite, and Madison Formation chert (Brumley and Rennie 1993:44) and are said to often exhibit superior craftsmanship (Brumley and Rennie 1993:57). In addition, Intermountain Tradition pottery (Mulloy 1958:196), in association with the aforementioned projectile points, is assumed to characterize the Highwood Phase (Brumley and Rennie 1993:43).

Originally, the Highwood phase was dated between ca. 650 B.P. to 450 B.P. (Brumley and Dau 1988:58). More recently, Brumley and Rennie (1993:44) have revised the dating of the Highwood phase by suggesting it begins ca. 600 B.P. and persists, possibly, into the Protohistoric Period. Based on previously suggested relationships between basal-notched projectile points and/or Intermountain pottery with a historically known ethnic group (Mulloy 1958; Frison 1991), Brumley and Rennie (1994:43) affiliate the Highwood Phase with historic Shoshone groups.

The Blackduck Cultural Unit

The Blackduck Cultural Unit appears to have originated in the forest and forest edge of northern Minnesota and subsequently spread northward into northwestern Ontario, southern Manitoba, and central Saskatchewan, as well as expanding southward into central Minnesota and eastward along the northern shores of Lake superior as far as northern Michigan (Meyer and Hamilton 1994). Syms (1977:104) provided an outline of the material culture of the Blackduck Cultural Unit which has recently been reiterated (i.e., Meyer and Hamilton 1994:113-114) "The Blackduck Horizon has been identified primarily on the basis of distinctive decorative traits on thin-walled, globular vessels with flared rims; however, other traits are small triangular notched and unnotched projectile points, end and side scrapers, awls, tubular pipes, occasional unilateral harpoon and socketed bone projectile points, bone spatulates, fleshers, copper beads and awls, beaver incisor gouges, and burial mounds generally containing seated burials."

Projectile points attributed to the Blackduck cultural unit have been described as "...consistently small, triangular notched and unnotched forms with shallow rounded side notches similar to the Plains Side-notched variants defined for the Plains" (Syms 1977:104). Similarly, Prairie Side-notched projectile points have been identified within the Blackduck cultural units at the Stott Mound in Manitoba (Nicholson 1976:53; Syms 1977:99), and possibly at the Stendall site (Rushowick 1975, Syms 1977:102). In contrast, projectile points from the Brockinton site (Syms 1977:103) have been used to argue against the applicability of the existing classification system to Northern Plains projectile point assemblages (Whelan 1976).

Generally, the Blackduck Cultural Unit occurs between ca. 1200 B.P. and 450 B.P. (Meyer and Hamilton 1994). In terms of ethnic identification, the Blackduck Cultural Unit has been assigned to both Siouan-speaking Assiniboine and Algonquian-speaking Ojibwa (Syms 1977:97,107; Meyer and Hamilton 1994).

The Selkirk Composite

The Selkirk Composite largely occurs in the parkland-periphery of the Northwestern plains and throughout an enormous portion of the boreal forest in Central Canada. The Composite is defined by its distinctive pottery vessels (Meyer and Russell 1987). Projectile points are not considered diagnostic of the Composite, however, some investigators have identified Kehoe's (1966) Prairie Side-notched and Plains Side-notched projectile point types within Selkirk Composite assemblages (Rajnovich 1983:22 in Meyer and Russell 1987:8; Hlady 1971:23). Meyer and Russell (1987) have suggested the Selkirk Composite originated in central/northern Manitoba about A.D. 1100. Furthermore, they stated "...it is very likely that the peoples who produced the Selkirk complex were Northern Algonquians, direct ancestors of those people who became known as the Crees during the fur trade era" (Meyer and Russell 1987:27).

Summary

The existing classification system divides Late Side-notched projectile points on the Northwestern Plains into two temporally significant types, the Prairie Side-notched projectile point type (ca. 1250 B.P. to 650 B.P.) and the Plains Side-notched projectile point type (ca. 550 B.P. to the Historic Period), both of which are composed of a number of varieties of projectile points. Explanations of the resultant classification often ascribe ethnic affiliations to the projectile point types.

Despite the implications of the existing classification system for both chronology and ethnicity, only limited research has been devoted to this topic, with the work of Forbis (1962) and Kehoe (1966) remaining the most substantial contributions to date. The dearth of research might be owing to the fact that those researchers who have criticized the existing classification system have done so without consequence (e.g.., Whelan 1976; Brink et al. 1985). These criticisms have gone unnoticed and the existing classification system has become profoundly entrenched in the literature.

Nonetheless, growing discontent among researchers has arisen over the broad range of morphological variability that is not accounted for by the Prairie Side-notched and Plains Side-notched projectile point types. In addition, these projectile point types are apparently found simultaneously in numerous archaeological phases, yet, each phase is often attributed with different ethnic identities. Not only does the existing classification fail to account for all the morphological variability within the Late Side-notched projectile points, but the apparent generic nature of the projectile point types nullifies the desired ethnic explanations of their morphological variability.

CHAPTER TWO

DEVELOPMENT OF THE CLASSIFICATION SYSTEM

Introduction

In order to provide a context for evaluating the existing classification system used for Late Side-notched projectile points on the Northwestern Plains, a review of the developmental history of the classification system is appropriate. This review will begin with the work of Richard MacNeish (1954, 1958), who helped pioneer the classification of projectile points from the Northern Plains, and provided some descriptions and terminology for dealing with projectile points. MacNeish's (1954) work influenced Boyd Wettlaufer (1955, 1960), who worked in Saskatchewan during the 1950s and 1960s. Wettlaufer (1955, 1960), building on MacNeish's (1954) work, set a precedent in the terminology used for describing Late Side-notched projectile points found in Saskatchewan. Wettlaufer, in turn, influenced Forbis (1962) and Kehoe (1966), the archaeologists most responsible for the development of the projectile point classification system used for Late Side-notched projectile points on the Northwestern Plains.

The review will end by examining more recent and diverse views concerning the appropriate classification system for Late Side-notched projectile points on the Northwestern Plains (e.g., Brumley 1971:34; Millar et al. 1972:31-33; Quigg 1974:101-100; Adams 1975:172; Rushowick 1975:6; Whelan 1976:5; Dyck 1983:126-139; Wilson 1984:12; Brumley and Dau 1988:48-49; Linnamae 1988:109; Walker 1988:78). Nonetheless, it will be demonstrated that the basic infrastructure that was established by MacNeish and Wettlaufer, and culminated with Forbis and Kehoe's work, has been retained.

Projectile Point Systematics on the Northwestern Plains

MacNeish

In 1952, Richard S. MacNeish conducted excavations at the Stott Mound and Village near Brandon, Manitoba. Among the recovered materials were one hundred and forty-five projectile points or point fragments (MacNeish 1954:38). MacNeish established four projectile point types "...on the basis of comparison with thirteen points from levels 1 to 5 at Lockport, and 54 from the upper levels of the Avery Lake Site..." (MacNeish 1954:38).

The four types were named Plains Triangular, Prairie Side-notched, Plains Side-notched, and the Stott Corner-notched projectile point types. Continuous measurements of the projectile point types were provided in the form of ranges and estimates of the average for the attributes of length, width, and thickness. Descriptions of discrete attributes were also given for each of the four types (MacNeish 1954:38-40).

In a subsequent article, MacNeish (1958:103-104) provided a summary of the archaeology of southeastern Manitoba and further refined his definitions of Plains Side-notched and Prairie Side-notched projectile point types. However, this refinement offered little in the way of new analyses over the original definitions. The significance of MacNeish's contributions to projectile point classification, as far as the classification of projectile points on the Northwestern Plains is concerned, lies in the influence he had on the terminology used by a contemporary of his working in Saskatchewan, this being Boyd Wettlaufer.

Wettlaufer

In 1955, Boyd Wettlaufer applied MacNeish's (1954) classification system to the projectile point assemblages he recovered from the Mortlach site in south-central Saskatchewan (Wettlaufer 1955:86-91). In 1960, he applied the same classification system to materials recovered at the Long Creek site in southeastern Saskatchewan (Wettlaufer 1960). At both of these sites, three of the types proposed by MacNeish

(1954, 1958) were found including the Plains Triangular, Plains Side-notched, and Prairie Side-notched projectile point types.

Later, Kehoe (1966:830) suggested that for both the Mortlach site (Wettlaufer 1954:86-91) and the Long Creek site (Wettlaufer 1960:31,39) the classification and terminology proposed by MacNeish (1954:38-40) had been incorrectly applied. Even with his criticism of Wettlaufer's (1955, 1960) application of the terms Plains Side-notched and Prairie Side-notched projectile points, Kehoe (1966:830) used both terms in later classification systems because of their earlier usage. The term Plains Triangular, however, along with a plethora of other terms referring to small unnotched triangular forms, has since been dropped when referring to completed projectile points as increasingly investigators have come to recognize them simply as preforms for projectile points (e.g., Fredlund 1981:81-95; Brink et al. 1985:116-117; Dawe 1988).

Forbis

In 1962, Richard G. Forbis offered the first chronostratigraphic classification of projectile points on the Northwestern Plains as a result of his excavations at the Old Women's Buffalo Jump near Cayley, Alberta. Forbis (1962:854) recognized that certain attributes of the Old Women's Buffalo Jump projectile point assemblage changed consistently with the stratigraphy.

Forbis (1962:85) was able to determine which attributes were chronostratigraphically significant by recording the percentage values, in the case of discrete attributes, or mean values, in the case of continuous attributes, of an attribute by each level. He then plotted these values in stratigraphic order to establish whether an attribute displayed consistent change through time. Using this methodology he determined that the following continuous attributes were significant: length, width at base, width at body, width at neck, notch width, and height of basal edge (Forbis 1962:85-86); as well, notch position and basal edge shape, both discrete attributes, were also demonstrated to exhibit temporal patterning (Forbis 1962:93).

Having isolated the attributes of chronostratigraphic significance, Forbis (1962:94) maintained that specific combinations of attributes would generate valid types. "As with individual features [attributes], the types had to prove their historicity; this was regarded as established if types, when graphed by percentages in stratigraphic order, produced normal curves reflecting consistent change in frequency through time" (Forbis 1962:94). This approach produced seven types, each with a distinctive historical trend (i.e., Forbis 1962:95). Table 1 (Appendix A; all future table references will be to Appendix A) provides descriptions of the diagnostic attributes of each of Forbis' types.

Subsequently, Vickers (1986:98) offered some refinements to Forbis' original typology. The main aspect of Forbis' (1962) classification system to which Vickers (1986:98) offered refinement was the relationship between maximum width of base and maximum width of body (Table 2). In Forbis' (1962) classification system the relationship between maximum width of base and maximum width of body was described as follows "The base may be wider or narrower than the body; if the difference in width is less than one millimeter, they are considered equal" (Forbis 1962: 87). With Vickers' (1986:98) refinements to the classification system, differences of width between maximum width of base and maximum width of body of less than one millimeter were not considered equal.

In fact, Vickers' changes, concerning the relationship between maximum width of base and maximum width of body, were initially implemented by Kehoe (1966). The chief difference between the two approaches was that Kehoe (1966:832) suggested Pekisko projectile points could have a maximum width of base equal to or greater than maximum body width while Vickers (1986:98) indicated that Pekisko projectile points could have a maximum width of base greater than, but not equal to, maximum body width.

Kehoe

In 1966, Thomas F. Kehoe, building largely upon the work of his predecessors, developed a system of classifying projectile points that must be considered the most elaborate projectile point classification on the Northwestern Plains. Kehoe (1966:827) grounded his system of classification on his observations of numerous of projectile points from controlled stratigraphic excavations at sites in Alberta, Montana, and Saskatchewan. These sites included the Gull Lake Bison Drive and the Walter Felt site in Saskatchewan, both excavated by Kehoe (1973); the Old Women's Buffalo Jump in Alberta, excavated by Forbis (1962); the Boarding School Bison Drive in Montana, excavated by Kehoe (1967); and the Hagen site and Pictograph Cave site in Montana, both excavated by Mulloy (1942, 1958).

Kehoe (1966) objectively ordered the projectile points guided by Rowe's (1959) concept of the feature [attribute] which is "...any characteristic or detail of an object which can be observed and isolated, whether of material or workmanship or decoration" (Rowe 1959:4-5). Again following Rowe (1959), Kehoe stated that "When the selection of significant features [attributes] is based upon careful observation of an actual sequence, the coincidence of features upon an artifact is a more precise, and probably more reliable chronological index than is recognition of the type in which the artifact may be classed" (Kehoe 1966:828).

Kehoe (1966:828) then suggested that the projectile points have significant attributes that are chronologically sensitive. He maintained that the projectile points were "...bound by their common function...", and that "...the history of each feature [attribute] represents the history of experimentation with the function expressed through the feature [attribute]" (Kehoe 1966:828). Kehoe (1966:829) lists flaking, notching, base, edge, size, shape, and mineral as significant features that chronologically order the projectile points. Superimposed onto the chronological ordering was the type-variety concept of classification. The type-variety classification provided the ability to delimit temporal periods and indicate culture areas (Kehoe 1966:828).

Applying this approach to the previously mentioned projectile point assemblages, Kehoe (1966) derived the "Small Side-Notched Point System of the Northern Plains" consisting of three projectile point types, with each projectile point type composed of numerous varieties. The earliest type was the Avonlea type, dated from "early in the Christian era" to A.D. 700, and composed of three varieties: Gull Lake, Carmichael Wide-eared, Timber Ridge Sharp-eared.

The Prairie Side-notched type replaces the Avonlea type about A.D. 700 and lasts until A.D. 1300. The varieties of the Prairie Side-notched type include the Shaunavon Truncated-base, Swift Current Fish-tail, High River Small Corner-notched, Tompkins Side-Corner-notched, Lewis Rounded Base, and Nanton Wide Rounded Base.

The final projectile point type is the Plains Side-notched type, which replaces the Prairie Side-notched type about A.D. 1300 and is present until the Historic Period. The varieties of the Plains Side-notched type include Paskapoo Square-ground Base, Pekisko Concave-base V-notched, Buffalo Gap Single-Spur, Cut Bank Jaw-notched, Emigrant Basal-notched, Billings Double-spur Basal-notched, and Washita Triangular. Kehoe's (1966) definitions of the Prairie Side-notched and Plains Side-notched projectile points are presented in Tables 3 and 4, respectively.

Various Applications

As alluded to above, the classification system for Late Side-notched projectile points on the Northwestern Plains became most elaborate after the work of MacNeish (1954, 1958) and Wettlaufer (1955, 1960), with the classification systems of Forbis (1962) and Kehoe (1966). Subsequent to this culmination, there have been 30 years of support, objection, modification, and ambivalence towards the classification system. The following is a brief review of some of the various applications of, and developments within, the classification system used for Late Side-notched projectile points on the Northwestern Plains.

Deviations from the classification system were found almost immediately. For example, at the Wahkpa Chu'gn site in northcentral Montana, Davis and Stallcop

(1966:26) noted that some of the recovered Late Side-notched projectile points were not accounted for in Forbis' (1962) classification system for projectile points from the Old Women's Buffalo Jump. Although Davis and Stallcop (1966:26,28) also noted that some of the types defined by Forbis (1962) did occur at the Wahkpa Chu'gn site.

In spite of this initial indication of the inadequacies of the classification system, investigators most commonly found harmony rather than discordance between new data and the recently created classification system. For example, Kehoe (1967:40-50) reinforced his classification system with material from the Boarding School Bison Drive Site in northwestern Montana. Brumley (1971), again excavating at the Wahkpa Chu'gn site in north central Montana, classified projectile points according to Forbis' (1962) classification system. However, Brumley (1971) also classified the projectile points as Avonlea, Plains Triangular, Prairie Side-notched, and Plains Side-notched projectile point types after Kehoe and McCorquodale (1961) and MacNeish (1954), respectively. Elsewhere in Montana, Joyes (1973:72-75) was able to classify all the projectile points from the Shippe Canyon site as varieties of Plains Side-notched projectile points including Pekisko, Washita, Paskapoo, and triangular points.

A preliminary report from the Estuary Bison Pound site in southwestern Saskatchewan (Millar et al. 1972:31-33) indicated that both the Avonlea type and the Prairie side-notched type (i.e., Lewis variety) occurred at the site. Similarly, in a full report on the Estuary Bison Pound site, Adams (1977) compared the recovered projectile points with those in the "Small Side-Notched Point System." At the Stott site in southwestern Manitoba, Nicholson (1976:72) stated "An examination of the Stott projectile points indicates that 'The Small Side-notched Point System of the Northern Plains' developed by Kehoe (1966) constitutes an adequate basic typology for the classification of the major body of projectile points at the Stott site."

At the Ramillies Bison Kill site in southeastern Alberta, Brumley (1976:26-26) faithfully applied Forbis' classification system. Again in southeastern Alberta, Milne Brumley (1978:40-61) working at the Saamis site indicated the projectile point assemblage corresponded better to Forbis' (1962) "scheme" than to Kehoe's (1966) "scheme."

In reporting a survey of the Belly River valley in southwestern Alberta, Quigg (1974:101-110) classified the projectile points he recovered under a slightly different system than that proposed in the "Small Side-Notched Point System." Under Quigg's (1974:101-110) system, the Avonlea phase had two projectile point "trial" types: the Avonlea Triangular "trial" type (which is an unnotched arrow tip), and the Timber Ridge side-notched "trial" type. The Plains Triangular "trial" type was another unnotched projectile point. The Plains Side-notched point type consisted of four "trial" types. The Prairie Side-notched point type was a "trial" type in itself, and had no concomitant divisions. Finally, Quigg (1974:105-6) suggested a completely new category called "flake arrow points."

At the Bakken-Wright site in southwestern Saskatchewan, Adams (1975:151-159) had few problems classifying projectile points using Kehoe's (1966) classification system. However, he did offer a new projectile point called the Bracken Constricted Base variety of the Prairie Side-notched type. Similarly, projectile points found at the Pincher Creek Buffalo Jump in southern Alberta, led Ball (1987) to suggest two new projectile point varieties of the Plains Side-notched type, namely the Pincher Creek Side-notched and the Pincher Creek Double-notched projectile points.

More recently, the trend in the classification of projectile points from the Northwestern Plains has been to apply only type designations to projectile points (i.e., Avonlea, Plains Side-notched, and Prairie Side-notched) and ignore the varieties of types (e.g., Rushowick 1975:6; Reeves 1978:166; Dyck 1983:122-139; Wilson 1984:12,21; Nicholson 1986:47; Linnamae 1988:109; Linnamae et al. 1988:166-171; Walker 1988; Stuart 1990:152). It follows that this conservative application of the classification system is the current standard. The Avonlea point is the oldest Late Prehistoric projectile point type appearing about 2100 B.P. and possibly persisting until 550 B.P. (Morlan 1988). The Prairie Side-notched and Plains Side-notched projectile point types constitute the diagnostic points that postdate the Avonlea type, roughly occurring from 1350 B.P. to the Historic Period (Morlan 1988).

Along with these more conservative applications of the classification system has been the rise of even deeper discontent with the existing classification system. Whelan (1976), as a result of "dissatisfaction with the existing typologies," outlined a new classification system based on projectile points from the Brockinton site in southwestern Manitoba. He suggested that Forbis (1962) and Kehoe (1966) "...either de-emphasized individuality in their average indices or overemphasized it in establishing types or varieties based on minimal samples" (Whelan 1976:15). He suggested a more holistic approach in which the differentiation was based on the entire artifact, not just on "...minute basal oriented features." Hence, he attempted to avoid de-emphasizing or overemphasizing individuality (Whelan 1976:15).

Some difficulties with the existing classification system were expressed more subtly. Brink et al. (1985:105-136), in attempting to classify projectile points from Head-Smashed-In Buffalo Jump in southwestern Alberta, stated "Considerable difficulty was encountered in classifying the small side and corner notched projectile points using these typologies (Forbis 1962, 1977; Kehoe 1966, 1973) as some disharmony was evident in the definitions of the particular varieties described." Consequently, they employed typological designations where possible (e.g., Plains Side-notched) and used morphological descriptions to classify the remaining projectile points (e.g., Small notched, small stemmed, etc.) (Brink et al. 1985:105-136).

More recently, Brumley and Dau (1988:39) noted that few researchers have employed Forbis' (1962) and Kehoe's (1966) classification system, and that they, themselves, use only two types of Late Prehistoric projectile points: the Avonlea projectile point type and a combined Plains/Prairie Side-notched projectile point type. It is noteworthy that this is in contrast to researchers in Saskatchewan who repeatedly differentiate between Prairie Side-notched or Plains Side-notched projectile points as well as distinguishing Avonlea projectile points.

Summary

The classification for Late Side-notched projectile points on the Northwestern Plains has undergone a number of developmental changes. Initially, MacNeish (1954) developed a classification system and terminology that was used for dealing with projectile points from the Northern Plains. MacNeish's (1954) work influenced Boyd Wettlaufer (1955), who worked in Saskatchewan in the 1950-60s. Wettlaufer's (1955, 1960) application of MacNeish's (1954) terminology set the precedent in labeling Late Side-notched projectile points found in Saskatchewan. This precedent influenced the predominant researchers in the development of the projectile point classification system used for Late Side-notched projectile points on the Northwestern Plains, those individuals being Richard Forbis (1962) and Thomas Kehoe (1966). Subsequently, other authors have applied Forbis' (1962) and Kehoe's (1966) classification systems with varying success.

Currently, a number of authors have used a more restricted application of classification in which Prairie Side-notched and Plains Side-notched projectile point types are recognized as valid, but the varieties of these types are generally not recognized. More profound dissatisfaction with the existing classification system has been expressed by still other authors who have suggested new projectile point varieties, amalgamation of projectile point types, and alternative classification systems.

Brumley and Dau (1988:48) provided a statement I feel summarizes the present status of the classification of Late Side-notched projectile points on the Northwestern Plains. They said:

> It should be emphasized that the Plains/Prairie projectile point complex, as used here, encompasses a broad range of stylistic and metric projectile point variation. Subsequent research is anticipated to meaningfully sort out this variability and to indicate it has regional, cultural and temporal significance. However, as noted, the presently rather poor description of these cultural materials generally available in the

literature for the region make this crude Plains/Prairie complex category the only realistic way of dealing with the material at this time.

(Brumley and Dau 1988:48-49)

CHAPTER THREE
METHODOLOGY

Introduction

In this chapter I will present a program of analysis for Late Side-notched projectile points on the Northwestern Plains that will develop a database of attributes based on projectile point assemblages from Alberta and Saskatchewan. An analysis of the attribute database will be used to evaluate the existing projectile point classification system.

I will first discuss the methodological approach of this analysis. Second, I will review the reasoning by which sites were selected to build the projectile point database. Third, I will outline the projectile point attributes chosen for this analysis. Fourth, I will describe the method by which the attributes on each projectile point were evaluated. Finally, I will address some limitations of the present study.

Methodological Approach

Two methods for the classification of archaeological material have been distinguished, namely paradigmatic/typological and taxonomic classification systems (Conklin 1964: 40; Read 1989:173). Typological classification (Conklin 1964:40; Krieger 1944; Rouse 1972:54-55; Read 1989:171-173) has been the preferred method of classifying Late Side-notched projectile points on the Northwestern Plains (e.g., Forbis 1962; Kehoe 1966). Typological classification "...produces a separate classification on each level which takes account of the fact that artisans are free to draw ideas or cultural norms from many previously made artifacts, not just those included in the higher class of the hierarchy, and thus incorporates all possible combinations of attributes on each level" (Byrne 1973:28). Typological and paradigmatic classification, while having formal similarities, differ since within the latter "...the entities to be classified provide the necessary contrasts from which relevant and defining attributes are derived..." while in the former the process is reversed (Conklin 1964:40).

In contrast, taxonomic classification "...proceeds by the division of the initial class into hierarchically smaller subclasses on the basis of ever more stringent determinants, and hence results in the formation of units on each level which are composed of mutually exclusive combinations of attributes" (Byrne 1973:28).

There are three advantages in using a typological approach for this analysis. First, for comparative purposes it is necessary to use the typological approach since Forbis (1962) and Kehoe (1966) have already set the precedent of a typological approach in classifying Late Side-notched projectile points on the Northwestern Plains. Second, typological classification does not allow for mutual exclusion of attributes at levels in the hierarchy, as occurs in taxonomic classification. Typological classification rejects mutual exclusion by taking into account the ability of artisans to freely combine ideas concerning form. Hence, under the assumption that attributes are the physical manifestations of ideas concerning form, typological classification allows for any combination of attributes at any level. Third, the free derivation of attributes for inclusion in artifacts is a key concept found in the theory of style which I propose best explains the morphological variability found in Late Side-notched projectile points. I will expand my ideas concerning style at a more appropriate time (i.e., Chapter Six).

Selection of Sites

In selecting sites for this analysis, I began by choosing projectile point assemblages that were used in the original development of the existing classification system. Recall that Forbis (1962) relied solely on the projectile points from the Old Women's Buffalo Jump in developing his classification system. Kehoe (1966) based his classification system on the Gull Lake Bison Drive, then tested and modified the classification by comparing it to the sequences at the Walter Felt site in Saskatchewan, the Old Women's Buffalo Jump in Alberta, and the Boarding School Bison Drive, the Hagen, and Pictograph Cave sites in Montana (Kehoe 1966:827).

I selected projectile point assemblages that were used in developing the existing classification system to ensure that the evaluation of Late Side-notched projectile points could be related directly back to the existing classification system. For this purpose, the projectile point assemblages from the Old Women's Buffalo Jump (see, Plates 1 and 2, Appendix C; all future Plate references will be to Appendix C) and the Walter Felt site (see, Plates 4 to 9) were analysed. The projectile points from the Gull Lake Bison Drive (see, Plate 16) became available late during the period in which I collected raw data. As such, I was unable to fully analyze them for inclusion in this study. Nonetheless, some initial findings, based on samples from Gull Lake Bison Drive site projectile point assemblage, will be presented. The projectile point assemblage from the Boarding School Bison Drive site was not available. In addition, the projectile point assemblages from the Hagen site and the Pictograph Cave site have small sample sizes and lack good stratigraphic separation. Therefore, the sample from the Boarding School Bison Drive, the Hagen, and the Pictograph Cave sites were not included in this analysis.

Several projectile point assemblages used in this analysis were not involved in developing the existing classification system, but were classified using the existing classification system. These include the South Kill of Head-Smashed-In Buffalo Jump (see, Plate 3), the Ross site, the Junction site (see, Plate 10), the Lake Midden site (see, Plate 11), the Stony Beach site (see, Plate 12), EeNd-3 (see, Plate 13), the Bill Richards site (see, Plate 14), and the Sanderson site (see, Plate 15)(Figure 1, Appendix B illustrates the geographic location of these sites; all future Figure references will be to Appendix B). The archaeological sites from which these projectile point assemblages were recovered are described in Appendix D.

The projectile point assemblages from this latter group of sites were included in the analysis for a number of reasons. First, they provide large samples of projectile points, which are essential for a more refined evaluation of the classification system. Second, the specific locations from which these projectile point assemblages were excavated provide geographic representativeness. Third, most of these assemblages, but not all, were excavated from stratified context and/or are radiometrically dated. Incorporating such sites into the analysis increases the number of chronologically controlled samples for evaluating the temporal aspects of the existing classification system. Last, and perhaps most importantly, these projectile point assemblages provide an independent sample with which to evaluate the existing classification system precisely because none of the aforementioned projectile point assemblages were used in developing the existing classification system.

Selection of Attributes

There is, as of yet, no generally accepted set of attributes for describing and classifying Late Side-notched projectile points on the Northwestern Plains. Forbis (1962), in his description of Late Side-notched projectile points from the Upper Member of the Upper Pit at the Old Women's Buffalo Jump, identified six chronologically sensitive continuous attributes. These attributes were: length, width at base [base width], width at body [blade width], width at neck, notch width [notch height], and height of basal edge [base height] (Forbis 1962:85). In addition, two discrete attributes (i.e., notch position [notch type], and basal edge shape) also exhibited chronological significance.

Kehoe (1966), building on Forbis' (1962) work at the Old Women's Buffalo Jump, offered the "Small Side-notched Projectile Point System Of The Northern Plains" for classifying Late Prehistoric projectile points based on samples from Alberta, Saskatchewan, and Montana. He considered the following continuous attributes to be significant features: the height of the notch above the base (base height), width of notch (notch height), neck width, depth of notches, basal concavity, base width, length, width at the end of the blade (blade width), thickness, and weight (Kehoe 1966). The discrete attributes he considered to be significant features include flaking, notch shape (notch form), basal edge shape, edge shape, projectile point shape (outline form), and mineral content (raw material type) (Kehoe 1966).

Forbis (1962) and Kehoe (1966) provided the only comprehensive efforts toward classifying Late Side-notched projectile points on the Northwestern Plains. Therefore, to facilitate comparability between our analyses, I have selected a similar complement of attributes, plus several that I felt intuitively might exhibit temporal and/or spatial significance.

A total of 23 attributes were selected (i.e., 15 continuous attributes, 7 discrete attributes). The continuous attributes selected are: base height (left and right), proximal base width, distal base width, maximum base width, blade width, length, neck width, notch depth (left and right), notch height (left and right), shoulder height (left and right), thickness, weight, distal base angle (left and right), proximal base angle (left and right), and shoulder angle (left and right). The discrete attributes included: basal edge shape, notch form, notch type, flaking pattern, cross-section, outline symmetry, and base form. In addition to these attributes, I also recorded the Borden site number, the catalogue number, the provenience, and the color (i.e., using the Munsell color chart) of each projectile point. A succinct description and/or a diagram illustrating the location and nature of each of the attributes is provided in Appendix E.

Building the Database

A total of 2327 projectile points were analysed. The description of the projectile points required that each specimen be placed with reference to a standard orientation. The projectile point is oriented with the base toward the analyst and the tip pointing away from the analyst. In this position, the base is considered to be proximal while the tip is considered to be distal (Reeves 1970:i).

Furthermore, the dorsal surface was oriented upward and the ventral surface downward. By definition, the dorsal side has a more convex cross-section and is usually more heavily flaked, whereas the ventral surface tends to be relatively less convex and exhibits less scarring (Reeves 1970:i). Often the ventral or dorsal side cannot be distinguished and an arbitrary assignment is necessary. For this analysis, when side could not be distinguished, the margin of a projectile point that is the most intact is considered to be the left side. The left side of a projectile point is always to the analyst's left if the projectile point is in standard orientation.

Limitations of the Study

Initially, in selecting sites for this analysis, I had hoped to include only sites interpreted as bison kill sites in order to limit the functional context of the projectile points. Hence, any projectile point morphological variability across space or through time would theoretically be more readily attributable to "stylistic" rather than "functional" considerations.

Unfortunately, there are not a large number of excavated well-stratified Late Prehistoric bison kill sites on the Northwestern Plains with large samples of projectile points. Therefore, in this analysis projectile point assemblages from bison kill sites include Head-Smashed-In Buffalo Jump, the Old Women's Buffalo Jump, the Junction site, the Walter Felt site, and the Bill Richards site. The remaining sites--Ross, Stony Beach, Lake Midden, EeNd-3, and Sanderson--have been interpreted as occupation/camp sites.

The limitations that variability in site types might place on my study are difficult to assess. Notwithstanding this caveat, I do not know of any study that demonstrates that projectile points from kill sites differ substantially from those related to occupation sites, or for that matter, to any other type of functionally specific site.

I confronted a similar problem in establishing geographically representative samples across the study area. Keeping in mind the need for large sample sizes, stratigraphic separation, and dated components, I attempted to select sites distributed over the plains of Alberta and Saskatchewan. The only sure way to establish whether these sites are geographically representative, however, is to test my conclusions against other sites on the Northwestern Plains study area as defined in Chapter One. Therefore, following my evaluation of the existing classification system I do compare and contrast my results with numerous previously excavated sites across the study area. In fact, it is at this point that I will present the initial results of my evaluation of samples of projectile points from the Gull Lake Bison Drive.

The selection of attributes presented the opposite problem to the one presented in selecting sites. That is to say, in selecting sites, the choices were limited. In contrast, when selecting attributes, the choices were considerably less limited. As mentioned, for comparative purposes, my selection of attributes was guided by the previous selections of Forbis (1962) and (Kehoe 1966). The purpose of my intuitive selection of attributes was an attempt at presenting a more representative selection of attributes from the limitless choices of attributes available.

Summary

This program of analysis outlines the means by which projectile point assemblages from sites in Alberta and Saskatchewan will be used to evaluate the classification system of Late Side-notched projectile points on the Northwestern Plains. Descriptions of the archaeological sites from which the projectile point assemblages came are presented in Appendix D.

In the course of this analysis, the attributes of 2327 Late Side-notched projectile points were recorded from 10 sites. The attributes selected generally parallel those used in the existing classification. This approach has been taken in order to facilitate comparisons between the observed spatial and temporal patterns in the attributes with the expected spatial and temporal patterns within the attributes of the classification system. As with the existing classification system, typological classification will be used to represent the relationship between the attributes.

CHAPTER FOUR
EVALUATION OF THE CLASSIFICATION SYSTEM

Introduction

In this chapter I present an evaluation of the existing classification system for Late Side-notched projectile points on the Northwestern Plains. As explained in Chapter Three, the evaluation will be accomplished by way of an attribute analysis of projectile point assemblages from sites in Alberta and Saskatchewan. The attribute analysis will provide the data necessary to evaluate the temporal and spatial patterns in the attributes as expected by the existing classification system.

I will first provide a framework that illustrates how the projectile point assemblages were positioned in time. Second, I will provide an evaluation of the discrete attributes used in the existing classification system by comparing the frequency of the various forms of each attribute within each assemblage with the expected frequency of the existing classification system. Third, I will provide an evaluation of the continuous attributes used in the existing classification system by comparing the distribution of values for each attribute within each assemblage with the expected distribution of values of the existing classification system. Finally, I will summarize the findings of the evaluation.

Temporal Distribution of the Assemblages

As already noted, the existing classification system of Late Side-notched projectile points on the Northwestern Plains uses temporal changes in attributes to establish projectile point types. Therefore, due to the time-transgressive nature of some of the attributes, it is necessary to place the projectile point assemblages in a temporal framework before undertaking any comparisons or evaluations.

Figure 2 summarizes the temporal distribution of the projectile point assemblages. The dates and dating techniques used in producing this figure are presented in Appendix D. Figure 2 is not meant to provide a precise chronology but, rather, it is meant to present a schematic representation of the temporal distribution of the various projectile point assemblages.

In separating the projectile points into "clusters" of chronological significance for the attribute analysis, the method of "clustering" varied depending on whether the attribute was discrete or continuous. For discrete attributes, all the projectile point assemblages were designated to one of two time periods--either 1250 B.P. to 650 B.P. or 650 B.P. to the Historic Period. Here, I am following the precedent set by Kehoe (1966) when he provided frequencies of occurrence for discrete attributes for his Prairie Side-notched projectile point type (ca. 1250 B.P. to 650 B.P.) and his Plains Side-notched projectile point type (ca. 650 B.P. to the Historic Period). Forbis (1962:85), working at a single site, did not require a methodology for temporally equating projectile points from different sites.

Following Kehoe (1966), the assemblages I have attributed to the time period ca. 1250 B.P. to 650 B.P. include those from levels 8 to 14 at the Old Women's Buffalo Jump, levels 6 to 7B at Head-Smashed-In Buffalo Jump, and levels 6 to 7 at the Walter Felt site (Figure 2). The assemblages I have attributed to the time period ca. 650 B.P. to the Historic Period include those from levels 1 to 7 of the Old Women's Buffalo Jump, levels 1 to 5 of Head-Smashed-In Buffalo Jump, levels 1 to 2 of the Junction site, levels 1 to 3 of the Ross site, levels 1 to 5 of the Walter Felt site, levels 1 to 6 of the Sanderson site, and all the projectile points from the Lake Midden site, the Bill Richards site, the Stony Beach site, and EeNd-3 (Figure 2).

For continuous attributes, I tried to leave as many assemblages as possible in their original level designations. For statistical reasons, however, some clustering of levels occurred within the Old Women's Buffalo Jump, Head-Smashed-In Buffalo Jump, and the Sanderson site assemblages (see Appendix D). Originally, Forbis (1962) recorded the mean values of continuous attributes and then plotted the values in stratigraphic order to establish whether an attribute displayed consistent change through time. "Because some layers yielded substantially the same results when graphed, and because some did not contain sufficient numbers of projectile points for analysis, adjacent layers were grouped into clusters: 1 to 4, 5 to 6, 7 to 8, 9 to 10, 11 to 14, and 15 and below" (Forbis 1962:85). With the Gull Lake Bison Drive, Kehoe (1966) took a somewhat different approach in that he grouped adjacent levels based on their association with perceived bone layers. The levels that he grouped together include levels 6 to 8 (bone layer 1), 15 (bone layer 2), 18 (bone layer 3), 22 (bone layer 4), and 24 (bone layer 5). The numbered layers missing from this sequence are not presented as they did not contain cultural material.

As alluded to above, for the present study I will depart slightly from previous work (i.e., Forbis 1962, Kehoe 1966). Where possible, I will provide a level-by-level analysis of the distribution of values for each continuous attribute. A level-by-level analysis is a refinement over the previous method of clustering levels, as the time-transgressive trends or other changes in the continuous attributes can be presented at more numerous increments over the same period of time.

Evaluation of Discrete Attributes

The following provides an evaluation of discrete attributes used in the existing classification system by comparing the frequency of occurrence of the various forms of each discrete attribute, within each assemblage, with the expected frequency of the existing classification system. The evaluation is a three-step process. First, I examine the classification systems of Forbis (1962) and Kehoe (1966) for their results concerning the nature of each discrete attribute. Second, I compare the observed frequencies of occurrence for the various forms of each discrete attribute in the assemblages with the expectations of the existing classification systems. Third, I provide a synthesis of the observed frequencies of each of the various forms for each discrete attribute through time and across space. The discrete attributes in this evaluation include basal edge shape, notch type, notch form, flaking pattern, outline form, cross-section, and base form.

Basal Edge Shape

Both Forbis (1962:94) and Kehoe (1966:829, 830, 832) used basal edge shape as one of the discrete attributes for differentiating between the various projectile point types in their classification systems. Forbis (1962:94) produced indices that indicate convex basal edge shapes are more prominent in the earliest levels containing Late Side-notched projectile points, while concave basal edge shapes are more prominent in the most recent levels containing Late Side-notched projectile points. He reflected this trend in his projectile point types. The earliest types tend to have convex or straight basal edge shapes. The Lewis type has straight or convex basal edge shapes, but rarely concave basal edges shapes; the High River type has straight to highly convex basal edge shapes; and the Irvine type usually has straight, but rarely concave or convex basal edge shapes (Forbis 1966:101-103). The more recent types tend to have concave or straight basal edge shapes; the Paskapoo type usually has straight or concave basal edge shapes, and seldom only slightly convex basal edge shapes; the Pekisko type has straight to concave basal edge shapes; and the Washita type usually has concave basal edge shapes, but sometimes straight basal edge shapes (Forbis 1962:96-99).

Rather than indices that indicated general trends, Kehoe (1966:82-834) provided the actual frequency at which the various basal edge shapes occurred for both of his projectile point types. Therefore, Kehoe's frequency values will be the main focus for the comparison between the selected sites and the existing classification system. Kehoe (1966:830) indicated that within the Prairie Side-notched projectile points (ca. 1250 B.P. to 650 B.P.) straight basal edge shapes occur at a frequency of 55.4%, concave basal edge shapes at 29.0%, and convex basal edge shapes at 15.6%. Plains Side-notched projectile points (ca. 650 B.P. to the Historic Period) have a frequency distribution in which straight basal edge shapes occur at a rate of 84.0%, concave basal edge shapes occur at a frequency of 16.0%, convex basal edge shapes do not occur, and spurred and notched basal edge shapes occur at undisclosed frequencies (Kehoe 1966:832,834). In calculating his frequencies, Kehoe did not include frequency values for "unknown" basal edge shapes. Therefore, in the presentation below, all basal edge shape frequencies have been calculated from a total less the number of unknown values. Table 5 provides a summary of the raw counts for each of the various basal edge shapes by site for projectile point assemblages dating ca. 1250 B.P. to 650 B.P. Table 6 provides the summary for projectile point assemblages dating ca. 650 B.P. to the Historic Period.

As shown in Figure 3, for the projectile point assemblages designated to the time period ca. 1250 B.P. to 650 B.P., straight basal edge shapes are the most frequent at the Old Women's Buffalo Jump (54.5%), followed by Head-Smashed-In Buffalo Jump (48.9%) and the Walter Felt site (36.8%). The former two assemblages are similar to the expected frequency of 55.4%. The latter assemblage has a somewhat smaller frequency, however, the discrepancy might be accounted for by the sample size (n=19).

Concave basal edge shape has an expected frequency of 29.0% for the time period from ca. 1250 B.P. to 650 B.P. Again, projectile point assemblages from both the Old Women's Buffalo Jump (22.1%) and Head-Smashed-In Buffalo Jump (32.4%) have reasonably similar frequencies to the expected value (Figure 3). The Walter Felt site (15.8%) has a somewhat lower frequency than expected; as above, the sample size (n=19) is suspect.

This trend is repeated for convex basal edge shape. The expected frequency of 15.6% agrees with the observed values at the Old Women's Buffalo Jump (18.2%) and Head-Smashed-In Buffalo Jump (15.5%) (Figure 3). At the Walter Felt site, the observed frequency (42.1%) is substantially higher than the expected frequency. Again, the sample size (n=19) is suspect.

Other basal edge shapes (i.e., oblique, spurred, and notched basal edge shapes) are not expected to occur in this time period. This is true for the Old Women's Buffalo Jump projectile point assemblages. At Head-Smashed-In Buffalo Jump, however, a single projectile point with a notched basal edge shape (0.5%) and a single projectile point with an oblique basal edge shape (0.5%) occur. Similarly, at the Walter Felt site a single notched basal edge shape (5.3%) occurs (Table 5).

For projectile point assemblages dating ca. 650 B.P. to the Historic Period, the sites located in the east (Henceforth these sites will be referred to as the "eastern" sites) have high relative frequencies of straight basal edges including Walter Felt (66.9%), Lake Midden (72.7%), Stony Beach (75.9%), EeNd-3 (90.6%), Bill Richards (80.0%), and Sanderson (75.0%) (Figure 4). These frequencies are comparable to the expected frequency of 84.0%. In contrast, sites in the western half of the study area (Henceforth these sites will be referred to as the "western" sites) have relatively low frequencies of straight basal edge shapes that never exceed 51.0%; the western sites include Head-Smashed-In (49.4%), the Old Women's (48.5%), Junction (47.4%), and Ross (50.7%).

Concave basal edge shapes, on the other hand, are more frequent on projectile points from the western sites (Figure 4). These sites have higher frequencies than the expected frequency of 16.0%, including the Old Women's (37.7%), Head-Smashed-In (37.3%), Junction (32.0%), and Ross (35.0%). The sites in the eastern half of the study area have lower frequencies of concave basal edge shapes that are more similar to the expected value (Figure 4, Table 6); the eastern sites include Walter Felt (25.3%), Lake Midden (22.7%), Stony Beach (14.3%), EeNd-3 (0.0%), Bill Richards (17.1%), and Sanderson (19.0%).

Convex basal edge shapes occur at low frequencies in most of the sites. This is in contrast to Kehoe's (1966) expectation that convex basal edge shapes would not occur in this period, and supports Forbis' (1962:94) stance that convex basal edges occur throughout the time period with diminishing numbers in more recent times. As Figure 4 illustrates, the western sites have low frequencies of convex basal edge shape including Old Women's (6.3%), Head-Smashed-In (7.8%), Junction (14.4%), and Ross (6.4%). By comparison, convex basal edge shapes occur at even lower frequencies in the eastern sites: Walter Felt (5.1%), Stony Beach (4.5%), EeNd-3 (3.1%), and Sanderson (4.3%). In harmony with the expected value, convex basal edges are completely absent from the Lake Midden site and Bill Richards site.

Kehoe (1966:832-834) indicates that notched and spurred basal edge shapes occur among Late Side-notched projectile points but he did not report expected frequencies for these basal edge shapes. In the western sites, the combined frequency of occurrence of notched, oblique, and spurred basal edge shapes is 3.3% at the Old Women's Buffalo Jump, 3.6% at Head-Smashed-In Buffalo Jump, 0.3% at the Junction site, and 2.1% at the Ross site. Of the eastern sites, only the Walter Felt site (0.6%) and the Stony Beach site (1.8%) contained any notched, and/or oblique, and/or spurred basal edges (Table 6).

In summary, for the time period ca. 1250 B.P. to 650 B.P. the Old Women's Buffalo Jump, Head-Smashed-In Buffalo Jump, and the Walter Felt site have similar frequencies for the various forms of basal edge shape. In contrast, for the time period ca. 650 B.P. to the Historic Period, there are two groups with distinct frequencies of basal edge shapes. All the sites in the west (i.e., the Old Women's Buffalo Jump, Head-Smashed-In Buffalo Jump, the Ross site, and the Junction site) have remarkably comparable frequencies for the various basal edge shapes. During the same time period, frequencies of basal edge shape in the eastern sites (i.e., Walter Felt site, Lake Midden site, Stony Beach site, EeNd-3, Bill Richards site, and Sanderson site) are different from those in the west.

At the Walter Felt site, large differences in the frequency of occurrence of the various forms of basal edge shapes between the early period and the late period suggest discontinuity in the technique of basal edge shape manufacture. In contrast, the early and late period at the Old Women's Buffalo Jump and Head-Smashed-In Buffalo Jump have relatively comparable frequencies for the various basal edge shapes suggesting continuity in the technique of basal edge shape manufacture.

Notch Type

Both Forbis (1962) and Kehoe (1966) used notch type to distinguish their projectile point types. Forbis (1962:93) indicated that corner notching decreases in frequency through time. Forbis' (1962:94-103) earlier types are defined by their strong tendency towards corner notching; the Lewis type is usually corner-notched with some specimens tending towards side-notched, the Irvine type is side-notched, and the High River type is corner notched (Forbis 1962:101-102). The most recent types--Washita, Pekisko, Paskapoo, and Nanton--are all side-notched (Forbis 1962:6-99). Forbis (1962:95, Figure 11) illustrated the frequency of each projectile point type, and since each projectile point type had only one notch type, the illustration approximated the frequency distribution of the associated notch types. The figure reinforces Forbis' (1962:93) assertion that corner-notching decreases through time.

Recall that Kehoe (1966) downgraded Forbis' (1962) types to varieties of either the Prairie Side-notched or the Plains Side-notched projectile point type. Kehoe followed Forbis' typology in that his earlier type, the Prairie Side-notched projectile point type, had laterally-inclined corner notches that grade into true side notches (Kehoe 1966:830). His later type, the Plains Side-notched projectile point type, had true side-notches, sometimes with an associated basal notch. Kehoe (1966) envisioned Plains Side-notched projectile points replacing Prairie Side-notched projectile points. In contrast, Forbis (1962:95) illustrated his types as overlapping in time as they gradually increased or decreased in frequency.

Table 7 provides a summary of the raw counts for each of the various notch types by site for projectile point assemblages dating ca. 1250 B.P. to 650 B.P. Similarly, Table 8 provides the summary for projectile point assemblages dating ca. 650 B.P. to the Historic Period.

As shown in Figure 5, for projectile point assemblages dating ca. 1250 B.P. to 650 B.P., side-notching is the most common. A range of variation occurs in which Head-Smashed-In Buffalo Jump (90.1%) has the highest frequency, followed by the Walter Felt site (82.4%), and the Old Women's Buffalo Jump (75.6%).

As demonstrated by Forbis (1962), corner notches occur at relatively high frequencies in the lower part of the Upper Member of the Upper Pit of the Old Women's Buffalo Jump. For the time period discussed here, corner notching occurs at a frequency of 12.8% at the Old Women's Buffalo Jump. At Head-Smashed-In

Buffalo Jump and the Walter Felt site, however, corner notching is more rare occurring at frequencies of 1.3% and 0.0%, respectively. In contrast with expectations, at these two sites corner notching increases slightly in more recent times (i.e., ca. 650 B.P. to the Historic Period).

Side/corner notching is an equivalent term for Forbis' (1962:100) "...corner-notched, some tending to be side-notched...", and Kehoe's (1966:830) "...laterally-inclined corner-notches grade into true side notches..." Figure 5 illustrates that side-corner notching occurs at similar frequencies at all three sites. The frequency of side/corner notching is 11.6% at the Old Women's Buffalo Jump, 7.6% at Head-Smashed-In Buffalo Jump , and 17.6% at the Walter Felt site. All other notch types occur at such low frequencies there is no need for them to be discussed here (Table 7).

For the time period ca. 650 B.P. to the Historic Period, side notching most frequently occurs in the eastern sites, including the Walter Felt Site (97.7%), the Lake Midden site (100%), the Stony Beach site (96.9%), EeNd-3 (100%), the Bill Richards site (100%), and the Sanderson site (98.2%) (Figure 6). By comparison, sites in the west have very similar, but slightly lower, frequencies that never exceed 96.5%, including the Old Women's Buffalo Jump (96.4%), Head-Smashed-In Buffalo Jump (92.5%), the Junction site (73.5%), and the Ross site (73.5%). The difference between these groups, while mutually exclusive, is not overwhelming.

Corner notching occurs at low frequencies in the Old Women's Buffalo Jump (0.5%), Head-Smashed-In Buffalo Jump (2.3%), the Junction site (5.9%), the Ross site (2.7%), the Walter Felt site (0.6%), the Stony Beach site (1.0%), and the Sanderson site (1.8%). Corner notching is absent at the Lake Midden site, EeNd-3, and the Bill Richards site. As with the frequencies for side notching, there is not an enormous difference between the two groups.

Side/corner notching is most prominent in the western sites including the Old Women's Buffalo Jump (1.9%), Head-Smashed-In Buffalo Jump (4.0%), the Junction site (18.1%), and the Ross site (2.7%). In the eastern sites, side/corner notching only occurs at low frequencies (Walter Felt site, 1.1%; Stony Beach site 1.0%). Side/corner notching is absent from the other eastern sites (i.e., Lake Midden, EeNd-3, Bill Richards, and Sanderson). While a slight difference can be perceived between the eastern and western groups, the Junction site, with a very high frequency of side-corner notching, is conspicuously distinguished.

Table 8 illustrates that the other notch types, such as side and corner, side and basal, and stemmed, are more likely to occur in the western sites than the eastern sites. In the western sites these notch types account for 3.6% (n=36) of the total notch types while among the eastern sites they account for only 0.4% (n=2) of the total notch types.

To summarize, in the period dating ca. 1250 B.P. to 650 B.P., the Old Women's Buffalo Jump, Head-Smashed-In Buffalo Jump, and the Walter Felt site have very similar frequencies of notch types. In the period dating 650 B.P. to the Historic Period, sites in the west exhibit differences, albeit rather weak differences, in notch type frequencies from those in the east. In comparing the notch type frequencies between the two time periods (i.e., the early period ca. 1250 to 650 B.P. and the late period ca. 650 B.P. to the Historic Period), the early period notch type frequencies are more similar to the notch type frequencies of the western late period sites than the eastern late period sites.

Notch Form

Both Forbis (1962) and Kehoe (1966) used notch form to differentiate between their types. Forbis (1962:93) noted that acute notches (i.e., notches in which notch depth is greater than notch height) became increasingly prevalent through time at the Old Women's Buffalo Jump. This is reflected in his typology, as Lewis and High River projectile points types have wide notches, and the Irvine projectile point type has wide or acute notches (Forbis 1962:101-102). The Nanton projectile point type has "...wide, or rarely, acute notches..." (Forbis 1962:99). The more recent projectile point types (i.e., Washita, Pekisko, and Paskapoo) have either acute or wide notches.

Similarly, Kehoe (1966:830) indicated that Prairie Side-notched projectile points (ca. 1250 B.P. to 650 B.P.) had large, wide, and shallow V- to U-shaped notches. Prairie Side-notched projectile points were replaced by Plains Side-notched projectile points (ca. 650 B.P. to the Historic Period). Plains Side-notched projectile points had small, deep, narrow, acute, U-shaped notches (Kehoe 1966:832). This was slightly different from Forbis' expectations, as he had indicated there a gradual transition between "wide" and "acute" notch forms through time.

In my analysis, wide notch forms (i.e., notches which appear to have larger notch heights than notch depths) include angular broad, round shallow, V-shaped broad, rectangular broad, and U-shaped broad notch forms. This classification would be roughly equivalent to Forbis' (1962:96-113) wide notches and to Kehoe's (1966:830) Prairie Side-notched projectile point type notches which are "...large, wide, shallow, V- to U- shaped side notches." I use the term narrow notches for notch forms that appear to have larger notch depth than notch height, including angular narrow, round deep, V-shaped narrow, rectangular narrow, and U-shaped narrow. This term encompasses Forbis' (1962:93, 96-113) acute notches and Kehoe's (1966) Plains Side-notched projectile point types notches which are "...small, deep, and narrow, and acute U in shape."

Table 9 provides a summary of the raw counts for each of the various notch forms, by site, for projectile point assemblages dating ca. 1250 B.P. to 650 B.P. Similarly, Table 10 provides the summary for projectile point assemblages dating ca. 650 B.P. to the Historic Period.

For projectile point assemblages dating between ca. 1250 B.P. to 650 B.P., wide notch forms are substantially more frequent than acute narrow forms (Figure 7). Wide notch forms occur at a frequency of 96.4% at the Old Women's Buffalo Jump, 97.9% at Head-Smashed-In Buffalo Jump, and 94.7% at the Walter Felt site.

Specifically, V-shaped broad notch forms occur at high frequencies at the Old Women's Buffalo Jump (61.4%), and at lower frequencies at Head-Smashed-In Buffalo Jump (40.3%) and the Walter Felt site (21.1%) (Figure 8). In a similar but opposite trend, round shallow notch forms occur at high frequencies at the Walter Felt site (57.9%), and have lower frequencies at Head-Smashed-In Buffalo Jump (33.2%) and the Old Women's Buffalo Jump (19.3%).

Angular broad notch forms occur at similar frequencies in all three sites (Figure 8). Likewise, the frequencies of U-shaped narrow notch forms occur at similar frequencies at all three sites (Figure 8).

For projectile points assemblages dating to the time period ca. 650 B.P. to the Historic Period, the eastern sites have high frequencies of narrow notch forms, including the Walter Felt site (62.3%), the Lake Midden site (36.3%), the Stony Beach site (61.4%), EeNd-3 (61.3%), the Bill Richards site (82.9%), and the Sanderson site (52.0%) (Figure 9) . By comparison, the western sites have lower frequencies of narrow notch forms, including the Old Women's Buffalo Jump (16.5%), Head-Smashed-In Buffalo Jump (14.4%), the Junction site (8.9%), and the Ross site (20.7%). For wide notch forms this trend is reversed; the eastern sites have a correspondingly low frequency of wide notch forms and the western sites have a correspondingly high frequency of wide notch forms.

More specifically, U-shaped narrow notch forms are particularly frequent in the eastern sites and noticeably less frequent in the western sites (Figure 10). In the eastern sites U-shaped narrow notch forms occur at a frequency of 58.1% at the Walter Felt site, 22.7% in the Lake Midden site, 46.6% in the Stony Beach site, 51.6% at EeNd-3, 82.9% at the Bill Richards site, and 46.9% at the Sanderson site. While in the western sites, U-shaped narrow notch forms occur at a frequency of 8.8% at the Old Women's Buffalo Jump, 8.7% at Head-Smashed-In Buffalo Jump, 7.1% at the Junction site, and 16.5% at the Ross site.

V-shaped broad notch forms occur in moderate frequencies at the Old Women's Buffalo Jump (40.9%), Head-Smashed-In Buffalo Jump (37.2%), the Junction site (39.2%), and the Ross site (30.6%). In contrast, V-shaped broad notch forms occur in lower frequencies in the eastern sites, including the Walter Felt site (7.2%), the Lake

Midden site (18.2%), the Stony Beach site (6.8%), EeNd-3 (3.2%), the Bill Richards site (0.0%), and the Sanderson site (7.1%).

Similarly, the frequencies of angular broad notch forms at the Old Women's Buffalo Jump (24.1%), Head-Smashed-In Buffalo Jump (18.6%), the Junction site (14.8%), and the Ross site (29.8%), are substantially higher than the frequencies of angular broad notch forms at the Walter Felt site (3.6%), the Stony Beach site (10.2%), EeNd-3 (6.5%), the Bill Richards site (0.0%), and the Sanderson site (9.2%) (Figure 10). The Lake Midden site, with a angular broad notch form frequency of 13.6%, could fit into either of these two categories. Given the trends distinguished earlier within the attributes of this site, as well as its geographic location, I suspect it is correctly placed with the eastern sites.

It is noteworthy that the remaining notch forms--angular narrow, round shallow, round deep, V-shaped narrow, rectangular broad, rectangular narrow, and U-shaped broad--do not cast geographic patterns like the three aforementioned notch forms.

To recapitulate, the sites ascribed to the early period all have generally similar notch form frequencies regardless of their geographic location. In the late period, there are two groups of sites with different notch form frequencies. The western sites (i.e., Old Women's Buffalo Jump, Head-Smashed-In Buffalo Jump, Ross, and Junction) exhibit strong differences in the frequency of angular broad, V-shaped broad, and U-shaped narrow notch forms when compared with the eastern sites (Walter Felt, Lake Midden, Stony Beach, Bill Richards, and Sanderson). In comparing the frequency of notch forms between the two time periods, the sites in the early time period are most similar to the western sites of the late time period. In contrast, a sharp distinction is evident between the sites from the early period and the eastern sites from the late period as the former has frequent wide notch forms and the later most commonly exhibits narrow notch forms.

Flaking Pattern

Both Forbis (1962) and Kehoe (1966) addressed projectile point flaking in their classification systems. Forbis (1962:94-102) addressed flaking in a very general sense. He indicated which of his projectile point types had bifacial dressing and the quality of the chipping technique. Kehoe (1966) provided descriptions of projectile point flaking. He indicated that Prairie Side-notched projectile points exhibit "...very mediocre bifacial flaking that often leaves portions of the original surface of the blank unretouched" (Kehoe 1966:830). In contrast he considered the flaking patterns on Plains Side-notched projectile points as "...usually well executed, approaching the Avonlea standard, and always bifacial, though it is not uncommon for some areas of the original blank to remain unretouched" (Kehoe 1966:832).

My approach to analysing flaking patterns on projectile points is different from that of Forbis (1962) and Kehoe (1966). Instead of describing the overall "quality" of the flaking, I only address the pattern left by flake removal (i.e., the flaking pattern). For definitions of the various flaking patterns recognized in this study see Appendix E. As with the previous discrete attributes, in presenting the frequencies of the various flaking patterns the "unknown" category has been left out. Therefore, the frequencies have been determined from a total less the number of unknown values.

Table 11 presents the raw counts and frequencies of the various flaking patterns for projectile points from assemblages dating between ca. 1250 B.P. and 650 B.P. Table 12 presents the raw counts and frequencies of the various flaking patterns for projectile points from assemblages dating between ca. 650 B.P. to the Historic Period.

Assemblages dating between ca. 1250 B.P. and 650 B.P. have similar frequencies for all the various forms of flaking pattern, including double diagonal, diagonal oblique, parallel, edge modified, and irregular (Table 11). This is illustrated in Figure 11. Irregular, patterned (i.e., double diagonal, diagonal oblique, and parallel), and edge modified flaking patterns occur at similar frequencies in the Old Women's Buffalo Jump, Head-Smashed-In Buffalo Jump, and the Walter Felt site.

Projectile point assemblages from sites dating ca. 650 B.P. to the Historic Period, have similar frequencies of edge modified flaking patterns (Figure 12). The frequency of irregular flaking patterns, however, are slightly lower in western sites compared to the eastern sites (Figure 12). That is to say, the Old Women's Buffalo Jump (79.8%), Head-Smashed-In Buffalo Jump (79.2%), the Junction site (77.4%), and the Ross site (69.7%) have negligibly lower frequencies of irregular flaking pattern than the Walter Felt site (81.4%), the Lake Midden site (82.6%), the Stony Beach site (79.5%), EeNd-3 (78.1%), the Bill Richards site (81.1%), and the Sanderson site (80.9%).

Patterned flaking (i.e., double diagonal, diagonal oblique, and parallel) occurs at slightly higher frequencies in the western sites (i.e, Old Women's Buffalo Jump (11.9%), Head-Smashed-In Buffalo Jump (8.0%), Junction site (9.2%), and Ross site (16.4%). (Figure 12). By comparison, patterned flaking occurs at negligibly lower frequencies at the Walter Felt site (7.3%), the Lake Midden site (4.3%), the Stony Beach site (4.1%), EeNd-3 (6.3%), and the Sanderson site (5.3%). The exception for eastern sites, with a relatively high frequency for patterned flaking, is the Bill Richards site (18.9%).

Once again, the sites in the early period show very similar frequencies of flaking patterns. In the later period I have suggested the possibility that weak, but consistent, trends distinguish the western sites (i.e., Old Women's, Head-Smashed-In, Ross, and Junction) from the eastern sites (i.e., Walter Felt, Stony Beach, Lake Midden, EeNd-3, Bill Richards, and Sanderson). The relationships between the frequency of flaking patterns between sites in the early and late periods are difficult to distinguish owing to their similarity to flaking pattern frequencies in both the eastern and western sites. In fact, the differences in the frequencies of flaking patterns either east/west or early/late are probably negligible.

Outline Form

Forbis (1966) did not address outline form in his discussion of the projectile points from the Upper Member of the Upper Kill of the Old Women's Buffalo Jump. Kehoe

(1966:829-832), on the other hand, indicated that Prairie Side-notched projectile points are irregular in outline and describes Plains Side-notched projectile points as exhibiting more marked symmetry, as well as achieving the general level of manufacturing quality displayed in Avonlea projectile points. Kehoe (1966:834) also suggested that some Plains Side-notched projectile points are intentionally asymmetrical. Table 13 presents the raw counts and frequencies of the various outline forms for projectile points from assemblages dating between ca. 1250 B.P. and 650 B.P. Table 14 presents the raw counts and frequencies of the various outline forms for projectile points from assemblages dating between ca. 650 B.P. to the Historic Period.

As indicated by Kehoe (1966), projectile point assemblages dating ca. 1250 B.P. to 650 B.P. have very high frequencies of asymmetrical outline forms (Figure 13). The Walter Felt site best matches his description as all cases (i.e., 100 %) have asymmetrical outlines. It is followed by the Old Women's Buffalo Jump with 95.0% asymmetrical and 5.0% symmetrical forms and Head-Smashed-In Buffalo Jump with 93.9% asymmetrical, 5.1% symmetrical, and 1.0% intentionally asymmetrical forms.

As shown in Figure 14, all projectile point assemblages dating between ca. 650 B.P. to the Historic Period have similar frequencies of both asymmetrical and symmetrical outline forms. Intentional asymmetrical outline forms, however, occur more frequently in low frequencies in the western sites including the Old Women's Buffalo Jump (2.6%), Head-Smashed-In Buffalo Jump (1.8%), the Junction site (1.3%), and the Ross site (0.8%). By comparison, among the eastern sites only the Stony Beach site (1.0%) has intentional asymmetrical outline forms, which are otherwise absent from the Walter Felt, the Lake Midden, EeNd-3, the Bill Richards, and the Sanderson sites.

To sum up, the sites ascribed to the early period possess remarkably similar frequencies of the various outline forms. The sites in the late period also have very similar outline form frequencies. There is a slight difference in the presence of intentional asymmetrical outline forms between the western and eastern sites as they are infrequent in the western sites but are nearly absent in the eastern sites.

Cross-section

Neither Forbis (1962) nor Kehoe (1966) specifically addressed the attribute of cross-section. Forbis (1962:96-102) indicated that some of his earlier types (i.e., High River and Lewis) had variable-to-poor chipping, while the more recent types (i.e., Washita, Pekisko, and Paskapoo) had bifacial dressing with generally good chipping techniques.

Likewise, Kehoe indicated Prairie Side-notched projectile points "...bear very mediocre bifacial flaking that often leaves portions of the original surface of the blank unretouched" (Kehoe 1966:830). He further indicated that lumps, rough areas, and hinge fractures are common (Kehoe 1966:830). Plains Side-notched projectile points were noted to always be bifacially flaked, although, some areas of the original blank may have remain unretouched (Kehoe 1966:830). In addition, he states that symmetry was not as fully achieved as it was in Avonlea projectile points (Kehoe 1966:832).

These accounts suggest that specimens that lack bifacial retouch (i.e., biplano, plano-triangular, and plano-convex) should occur more frequently in the earlier levels and specimens that have bifacial retouch (i.e., convex symmetrical, and convex asymmetrical) should occur more frequently in the more recent levels. Table 15 summarizes the raw counts and the frequencies of the various forms of cross-section for projectile point assemblages dating ca. 1250 B.P. to 650 B.P. Similarly, Table 16 provides the raw counts and frequencies of the various forms of cross-section for projectile point assemblages dating ca. 650 B.P. to the Historic Period.

For projectile points dating ca. 1250 B.P. to 650 B.P., Table 15 shows that the various forms of cross-section have relatively similar frequencies of occurrence at the Old Women's Buffalo Jump and Head-Smashed-In Buffalo Jump. Frequencies of cross-section forms for the Walter Felt site are somewhat different from the aforementioned sites, but this difference might be a result of the small sample size. Figure 15 illustrates this similarity for plano-convex, convex asymmetrical, and convex symmetrical cross-sections especially at the Old Women's Buffalo Jump and

Head-Smashed-In Buffalo Jump. Again, the Walter Felt site is somewhat aberrant for the other two sites in this time period. This aberrance is most clearly illustrated by the complete lack of convex symmetrical cross-section forms at the Walter Felt site. Above, I inferred that the bifacial retouching involved in producing convex symmetrical and convex asymmetrical cross-sections might be a rare occurrence given the remarks of Forbis (1962) and Kehoe (1966). These cross-sections, in contrast with what we might expect from Forbis and Kehoe's expectations, occur in fairly high frequencies at all three sites.

For projectile point assemblages dating ca. 650 B.P. to the Historic Period, plano-convex cross-sections occur at higher frequencies in the western sites. The frequency is 27.9% at the Old Women's Buffalo Jump, 31.8% at Head-Smashed-In Buffalo Jump, 55.4% at the Junction site, and 25.3% at the Ross site. By comparison, plano-convex cross-sections occur less frequently at the Walter Felt site (9.5%), the Lake Midden site (8.7%), the Stony Beach site (12.1%), EeNd-3 (12.5%), the Bill Richards site (8.1%), and the Sanderson site (16.3%).

As shown in Figure 16, convex asymmetrical cross-sections occur in lower frequencies at the Old Women's Buffalo Jump (46.9%), Head-Smashed-In Buffalo Jump (49.5%), the Junction site (29.4%), and the Ross site (37.4%). Convex asymmetrical cross-sections occur at higher frequencies in the eastern sites including the Walter Felt (74.9%), the Lake Midden (69.6%), the Stony Beach (71.8%), EeNd-3 (71.9), and the Bill Richards (78.4%) sites. An anomaly among the eastern sites is the Sanderson (13.0%) site, which has a very low frequency of convex asymmetrical cross-sections.

The anomalously low frequency of convex asymmetrical cross-sections at the Sanderson site is coupled with an anomalously high frequency of convex symmetrical cross-sections (69.6%). Otherwise, convex symmetrical cross-sections occur at low frequencies in the eastern sites including Walter Felt (3.9%), Lake Midden (4.3%), Stony Beach (2.0%), EeNd-3 (0.0%), and Bill Richards (13.5%). In the western sites, with the exception of the Junction site (4.0%), convex symmetrical cross-sections occur at higher frequencies than they do in the eastern sites. The frequencies for the western sites are, for the Old Women's Buffalo Jump, 16.4%, for Head-Smashed-In Buffalo Jump, 12.3%, and for the Ross site, 28.1%.

To summarize, in the early period, both the Old Women's Buffalo Jump and Head-Smashed-In Buffalo Jump have similar cross-section frequencies. The Walter Felt site, on the other hand, has somewhat aberrant cross-section frequencies from the aforementioned sites, although these differences may be a product of the small sample size. In the late period, the Old Women's Buffalo Jump, Head-Smashed-In Buffalo Jump, the Ross site, and the Junction site are similar enough to be distinguished from the Walter Felt site, Lake Midden, the Stony Beach site, EeNd-3, and the Bill Richards site. Anomalously, the Sanderson site, usually exhibiting similarity to the eastern sites, does not appear to have similar cross-section frequencies comparable to the sites in the east or in the west.

Base Form

Neither Forbis (1962) nor Kehoe (1966) discussed the discrete attribute of base form in their projectile point classification systems. I created the base form attribute in order to describe the overall shape of the base in a manner that would allow base forms to be compared between projectile points, and ultimately, compared between sites.

Table 17 provides the raw counts and frequencies of the various base forms, by site, for projectile points dating ca. 1250 B.P. to 650 B.P. Similarly, Table 18 provides the raw counts and frequencies of the various base forms, by site, for projectile points dating ca. 650 B.P. to the Historic Period.

For projectile point assemblages attributed to the period ca. 1250 B.P. to 650 B.P., Figure 17 illustrates that very general trends occur at the Old Women's Buffalo Jump and Head-Smashed-In Buffalo Jump in terms of the frequencies of base forms # 2, 5, 6, and 13. The Walter Felt site does not exhibit parallel trends in base form frequencies to either the Old Women's Buffalo Jump or Head-Smashed-In Buffalo Jump.

For projectile point assemblages that date between ca. 650 B.P. to the Historic Period, Figure 18 illustrates some base forms that exhibit different frequencies. Base form #2 and #5 occur in high frequencies in the western sites and relatively lower frequencies in the eastern sites. Base form #6, on the other hand, occurs in high frequencies in the eastern sites and at lesser frequencies in the western sites. The frequency of other base forms parallel this distribution pattern including base form #18, which is only present in the western sites, and base form #25, which is only present in the eastern sites (Table 18).

To summarize, in the early period the Old Women's Buffalo Jump, Head-Smashed-In Buffalo, and the Walter Felt site have fairly different frequencies of the various base forms. In the later period, the majority of the base forms occur with essentially equivalent frequencies across all the sites. Beyond these base forms a limited number of base forms distinguish the western sites (i.e., Old Women's, Head-Smashed-In, Ross, and Junction) from the eastern sites (i.e., Walter Felt, Lake Midden, Stony Beach, EeNd-3, Bill Richards, and Sanderson). In comparing the base form frequencies of the early period sites with the two groups of later period sites, the former are more similar to the western late period sites than the eastern late period sites.

Evaluation of Continuous Attributes

The following section provides an evaluation of continuous attributes used in the existing classification system by comparing the distribution of values for each continuous attribute within each assemblage with the expected distribution of values of the existing classification system. The continuous attributes have been divided into Linear, Weight, and Angular attributes.

The evaluation is a three-step process. First, the classification systems of Forbis (1962) and Kehoe (1966) are examined for views concerning the nature of each continuous attribute. Second, the observed distribution of values for each continuous attribute are compared amongst the assemblages and against the expectations of the existing classification system. For this comparison, I illustrate the distribution of values using boxplots (Boxplots are explained in Figure 19). As well, for the well-stratified sites (i.e., Head-Smashed-In Buffalo Jump, Old Women's Buffalo Jump, and Walter Felt site), I mathematically evaluate my interpretations of the boxplots using a One-Way ANOVA Post Hoc Multiple Comparisons test. Lastly, a summary is provided of the observed distribution of values for each continuous attribute across space and through time.

Before continuing there are two notes I wish to make. First, in the section entitled "Selection of Attributes," I indicated that both left and right values were recorded for base height, notch depth, notch height, shoulder height, distal base angle, proximal base angle, and shoulder angle. Table 19 provides the two-tailed significance values of t-tests between left and right values for the aforementioned attributes. These significance values almost invariably indicate that there are no significant differences in the distribution of values between the left and the right side for any given attribute. This suggests that left and right values for an attribute can be combined into a single attribute.

There are two reasons for combining left and right values for any given attribute (by "combining" I simply mean treating left cases and right cases under one attribute, rather than as separate attributes). First, combining the left and right cases of a given attribute under a single attribute abbreviates presentation by half without compromising content. Second, combining the left and right cases for any given attribute effectively doubles the sample size of that attribute as all left and right cases are pooled as one attribute.

Second, I feel it is necessary to provide further explanation concerning my application of a One-Way ANOVA Post Hoc Multiple Comparisons test in evaluating my interpretations of the boxplots. This test is a special version of an analysis of variance (ANOVA) test. Basically, I will be testing whether the observed variability within values of an attribute from various levels in a stratified site (which is schematically illustrated by boxplots) can be attributed to just the natural variability among the mean values of the levels or whether it is reasonable to believe that the values of an attribute from the various levels of a stratified site come from populations with different means.

In a regular ANOVA, the null hypothesis is that population means are equal. This is determined by examining:

> ...the variability of the observations within each group as well as the variability between the group means. Based on these two estimates of variability, you draw conclusions about the population means. (Norusis 1993:269)

ANOVA indicates only that the samples are, or are not, equal. If there are samples that are different, the test does not indicate which samples appear to come from populations with different means. Furthermore, the null hypothesis (i.e., that all the samples come from populations with the same mean) is rejected if any two means are unequal. Hence, this type of test can provide little assistance in evaluating the distribution of values of a given attribute across a number of levels in a stratified site as any application of the ANOVA would simply indicate that either (1) the samples are equal across all levels, or (2) that the samples are not equal without indicating which samples have different means.

To determine which means are significantly different from each other one uses a special ANOVA test called multiple comparison procedures. Simply, a multiple comparisons test indicates which level (i.e., distribution of values of an attribute on projectile points from a given level) exhibits significant differences from other levels in the site. This information is usually printed in tabular form. An explanation of how to interpret such tables is provided in Table 20.

The continuous attributes in this evaluation include Linear Attributes (i.e., base height, base width, blade width, length, neck width, notch depth, notch height, shoulder height, and thickness), the Weight Attribute (i.e., weight), and Angular Attributes (i.e., distal base angle, proximal base angle, and shoulder angle).

Linear Attributes

Base Height

Forbis (1962:90-91), based on Late Side-notched projectile points excavated from the Old Women's Buffalo Jump, demonstrated that average base height gradually increases through time. He found the smallest average base height value, 1.79 mm, in the oldest levels (levels 11-14), while subsequent levels had gradually increasing values with the largest average base height value, 4.41 mm, in the youngest levels (levels 1-4) (Forbis 1962:90-91). Later, Kehoe's (1966:835) analysis of projectile points from the Gull Lake Bison Drive site supported Forbis' (1962) interpretation of a time-transgressive trend in base height values.

My observations of base height in the Old Women's Buffalo Jump projectile point assemblages also suggest there is a strong tendency for base height to increase through time. Figure 20 illustrates this trend using boxplots that schematically represent the distribution of base height values, level-by-level, at the Old Women's Buffalo Jump. Additional evidence that base height increases through time is provided in Table 21. This table illustrates the mathematical relationships across each level for base heights values. Table 21 supports the interpretation that base height increases through time by demonstrating which projectile point assemblages come from populations that have the same mean; the most recent levels exhibit the largest mean base heights, followed by the middle levels with slightly lower mean base height values, and the smallest mean base height values are in the oldest levels. The only anomaly, level 7, has the largest mean base height value and is included with the most recent levels.

Within the Head-Smashed-In Buffalo Jump projectile point assemblage, base height values also increase through time. Figure 21 provides boxplots of these base height values, level-by-level, that visually illustrate this trend. Table 21 indicates which levels from Head-Smashed-In Buffalo Jump have significantly different mean values for base height. As with the Old Women's Buffalo Jump, the most recent levels at Head-Smashed-In Buffalo Jump exhibit the largest mean base heights, followed by middle levels with slightly lower mean base height values, and the smallest mean base height values in the oldest levels. The distribution of base height values, and the dates for the levels associated with particular base height values, roughly correlate between Head-Smashed-In Buffalo Jump and the Old Women's Buffalo Jump in the manner illustrated by Figure 2.

The boxplots representing the distribution of base height values for the Walter Felt site suggest two distinct groups; Levels 1 to 5 have large, fairly consistent base height values in contrast to levels 6 and 7 which have lower base height values (Figure 22). Base height values are relatively equal in the most recent levels of the Old Women's Buffalo Jump, Head-Smashed-In Buffalo Jump, and the Walter Felt site. Moving back in time, the Old Women's Buffalo Jump (i.e., levels 1 to 5) and Head-Smashed-In Buffalo Jump (i.e., levels 1 to 4) exhibit parallel trends of decreasing base heights while in an approximately comparable period of time the Walter Felt site (i.e., levels 1 to 5) base height values remain relatively unchanged. In levels 6 and 7 of the Walter Felt site, however, the base height values once again roughly correlate with base height values of comparable age in the Old Women's Buffalo Jump and Head-Smashed-In Buffalo Jump.

Table 21 indicates that levels 1 to 5 of the Walter Felt site are base height values from populations with similar means, as are levels 6 and 7. Additionally, Table 21 indicates levels 4 and 6 have similar means.

The fact that levels 4 and 6 could be derived from populations with similar means is in contradiction with my interpretation of the boxplots. Nonetheless, I retain my initial inference that the distribution of base height values at the Walter Felt site indicates two distinct groups. My reasons for this are three-fold. First, my evaluation of discrete attributes strongly suggests that levels 1 to 5 are different from levels 6 to 7. Second, my foreknowledge of trends in other continuous attributes (i.e., notch depth, notch height, distal base angle, proximal base angle, and shoulder angle) in the

Walter Felt site projectile point assemblages, that are yet to be presented, also suggest two distinct groups. Lastly, both the dates associated with the assemblages in levels 6 and 7, and the distributions of base height values for levels 6 and 7 correspond nicely with the sequences in the Old Women's Buffalo Jump and Head-Smashed-In Buffalo Jump while levels 1 to 5 of the Walter Felt site do not follow the same time-transgressive trend in base height values as the aforementioned sites.

Turning now to other assemblages, for the Ross site, boxplots (Figure 23) illustrating the distribution of base height values are suggestive of increasing base height values through time. Furthermore, the distribution of values approximate those in the most recent levels of Head-Smashed-In Buffalo Jump, the Old Women's Buffalo Jump, and the Walter Felt site. Forbis' (1960:158-159) inferences about the age of these levels support this interpretation. Nevertheless, Vickers (1986:74) has supplied a radiocarbon date for component III of 540 ± 135 B.P. (S-2038), (i.e., Forbis' level 1) that does not support this interpretation (for a more complete discussion see Appendix D).

Figure 23 also illustrates the distribution of base height values for the Junction site and bolsters the argument that base height values increase through time. The distribution of base height values in the Junction site correlate with similar distributions of values from the middlemost levels of the Old Women's Buffalo Jump and Head-Smashed-In Buffalo Jump. The concomitant dates of the base height values are also comparable, thus supporting their similitude (Figure 2). At the Walter Felt site, however, the middle levels have larger base height values than the distribution of the base height values from levels in the Junction site of a comparable age.

Both the Lake Midden site and the Bill Richards site have distributions of base height values that correlate with the most recent levels of the Old Women's Buffalo Jump, Head-Smashed-In Buffalo Jump, and the Walter Felt site (Figure 24). This interpretation is supported by the dates for the sites. Both sites have dates equivalent to the most recent levels at the Old Women's Buffalo Jump, Head-Smashed-In Buffalo Jump, and the Walter Felt site.

The Stony Beach site and EeNd-3 have similar distributions of base height values and these distributions roughly correlate with the most recent levels of the Old Women's Buffalo Jump, Head-Smashed-In Buffalo Jump, and the Walter Felt site (Figure 24). The Stony Beach site and EeNd-3 do not have absolute dates, but have been dated as post-650 B.P. based on projectile point morphology (Kehoe 1966; Walde 1994). Like the Lake Midden site and Bill Richards site (and without more accurate dates) it is difficult to evaluate whether they match the trend toward increasing base height values through time found in the Old Women's Buffalo Jump, Head-Smashed-In Buffalo Jump, the Walter Felt site (i.e., 6 and 7), the Ross site, and the Junction site, or with the unchanging base height values of the Walter Felt site (i.e., 1 to 5).

The Sanderson site does not appear to exhibit a trend toward increasing base height values back in time (Figure 25). The morphology of the projectile points suggests a post- 650 B.P. age for the material. This is supported by an uncorrected radiocarbon date of 310 ± 75 B.P. (S-2967), as well as the recovery of historic goods from all but the lowest level of the site. The base height values seem to correlate with the recent levels at the Old Women's Buffalo Jump, Head-Smashed-In Buffalo Jump, and the Walter Felt site as would be expected given age estimates for these levels.

In summary, at the Old Women's Buffalo Jump and Head-Smashed-In Buffalo Jump parallel trends of increasing base height values through time were observed. In the middle and most recent levels of the Walter Felt site (i.e., 1 to 5), base height does not follow the trend of increasing base height values through time. In the most recent levels of the Walter Felt site, base height values are very similar to the base height values in the most recent levels of the Old Women's Buffalo Jump and Head-Smashed-In Buffalo Jump. Nonetheless, the time-transgressive nature of base height values already noted for the Old Women's Buffalo Jump and Head-Smashed-In Buffalo Jump is absent in the middle levels of the Walter Felt site (i.e., levels 1 to 5). Moving backward in time, base height values at the Walter Felt site remain unchanged until about ca. 650 B.P. (i.e., levels 1 to 5). The base height values in the oldest levels at the Walter Felt site (i.e., levels 6 and 7), however, correlate well with comparably dated levels in both the Old Women's Buffalo Jump and Head-Smashed-In Buffalo Jump. Similarly, the Junction site correlates well in time and in base height values with the aforementioned sites. The recent dates, or lack of dates, for the remaining sites allows them to correlate with both the trend of increasing base height values through time and the trend of unchanging base height values through time.

Base Width

Forbis (1962:87) predicted that base width should increase through time for Late Side-notched projectile points. At the Old Women's Buffalo Jump: "In the Upper Member, the base diminishes gradually in width, going back in time, from an average of 13.5 mm in layers 1 to 4 to an average of 12.1 mm in layers 11 to 14" (Forbis 1962:87).

Kehoe (1966:834) did not directly state whether he concurred with Forbis. Nevertheless, for his analysis of the projectile points from the Gull Lake Bison Drive site he used a concept from Forbis' (1966) typology (i.e., the base-body index), a concept requiring one accept that base width increases through time (Kehoe 1966:834-835).

My observations of the boxplot of base width values for projectile points from the Old Women's Buffalo Jump suggest the most recent levels have base width values that are distributed over slightly higher values than the earlier levels (Figure 26). In fact, statistically, no two levels are significantly different (Table 22).

The distribution of base width values at Head-Smashed-In Buffalo Jump suggests the most recent level (i.e., level 1-2) might have higher values than earlier levels (Figure 27). Significant differences between the means of level 1-2 and level 6 were calculated (Table 22). Regardless, visual inspection of the distributions of base width values through time at the Old Women's Buffalo Jump and Head-Smashed-In Buffalo Jump indicate most of the values fall between 10 mm and 16 mm and that the sequences are roughly equivalent.

Similarly, most of the base width values at the Walter Felt site occur between 10 mm and 16 mm, although a number of base width values in level 1-2 fall above this range (Figure 28). Statistically, the mean of level 1-2 is only significantly different from that of level 6 (Table 22). The sample sizes of level 1-2 (n=8) and level 6 (n=5) are probably partly reflected in this difference. Otherwise, base width values at the Walter Felt site occur over the same range of values as those at the Old Women's Buffalo Jump and Head-Smashed-In Buffalo Jump.

Visual inspection of the distribution of base width values at both the Junction site and the Ross site suggested no difference from the distribution of values from the aforementioned sites (Figure 29). As above, the majority of the base width values are distributed between 10-16 mm.

Similarly, the Lake Midden site, the Stony Beach site, EeNd-3, and the Bill Richards site have the majority of their base width values distributed between 10-16 mm (Figure 30). As well, base width values at the Sanderson site remain constant regardless of the stratigraphic level from which they came (Figure 31). Again, the base width values tend to cluster between the 10-16 mm range. All these sites exhibit comparable distributions of base width values.

In summary, base width values occur over roughly equivalent ranges at every site including the Old Women's Buffalo Jump, Head-Smashed-In Buffalo Jump, the Junction site, the Ross site, the Walter Felt site, the Lake Midden site, the Stony Beach site, EeNd-3, the Bill Richards site, and the Sanderson site. Thus, this attribute does not appear to be chronologically or geographically sensitive.

Blade Width

Forbis (1962:87) indicated that the mean blade width in levels 1 to 8 remained constant at 12.8-12.9 mm, but increased in levels 9 to 14. Kehoe (1966:834) did not directly discuss blade width during his analysis of the projectile points from the Gull Lake Bison Drive site. He did, however, accept Forbis' conclusions concerning the relationship between blade width and base width. This suggests that he agreed with Forbis' conclusions concerning the nature of blade width as well.

A visual inspection of the blade width values from the various levels at the Old Women's Buffalo Jump suggests the values are distributed over very similar ranges (Figure 32). Statistically, none of them are significantly different from the each other (Table 23). The majority of blade width values occur between 10-16 mm.

My observations of projectile points from Head-Smashed-In Buffalo Jump suggest blade width remains relatively constant throughout the sequence (Figure 33). This interpretation is supported by the fact that none of the means from the various levels are significantly different (Table 23). As with the Old Women's Buffalo Jump, the majority of blade width values occur between 10-16 mm.

Similarly, at the Walter Felt site, blade width values almost invariably occur between 10-16 mm (Figure 34). As with the aforementioned sites, no two levels at the Walter Felt site have significantly different means (Table 23).

At both the Junction site and the Ross site, a visual inspection of the distribution of blade width values suggests no difference from the distribution of values from the sites mentioned above (Figure 35). In addition, the majority of the blade width values are distributed between 10-16 mm as they were in the previously mentioned sites.

Likewise, the Lake Midden site, the Stony Beach site, EeNd-3, and the Bill Richards site have the majority of their blade width values distributed between 10-16 mm (Figure 36). Visual inspection suggests these sites exhibit blade widths that are comparable to those described above.

At the Sanderson site, the distribution of blade width values remains relatively constant regardless of the stratigraphic level from which they came (Figure 37). As above, blade width values tend to cluster between 10-16 mm. Therefore, the Sanderson site has blade widths comparable to the other sites in the study.

In summary, blade width values occur over very similar ranges at every site, including the Old Women's Buffalo Jump, Head-Smashed-In Buffalo Jump, the Junction site, the Ross site, the Walter Felt site, the Lake Midden site, the Stony Beach site, EeNd-3, the Bill Richards site, and the Sanderson site. Thus, like base width, this attribute does not appear to be chronologically or geographically sensitive.

The trend in inter-site similarity found for base width and blade width also occurs for the attributes length, neck width, thickness. In other words, the attributes of length, neck width, and thickness do not exhibit differences in the distribution of values across the sites. Therefore, for the sake of brevity, the lack of chronological and geographical sensitivity of these attributes (i.e., length, neck width, and thickness) is noted here and a further review will not be presented in either the text or in an appendix.

Notch Depth

Forbis (1962) does not discuss the attribute of notch depth in his classification system. Kehoe (1966:829-832) included notch depth among the significant features of his types (i.e., Prairie Side-notched and Plains Side-notched projectile points). The Prairie Side-notched projectile point type has notch depths ranging between 0.5-4.0 mm, with a mean depth of 2.0 mm (Kehoe 1966:830), while the Plains Side-notched projectile point type has notch depths ranging between 1.0-4.0 mm, with a mean of 2.4 mm (Kehoe 1966:832).

My analysis of the projectile points from the Old Women's Buffalo Jump suggests notch depth is consistent through time (Figure 38). The majority of the values occur between 1.5 to 2.5 mm, regardless of the level from which they came. Furthermore, Table 24 indicates that no two levels have significantly different means.

In contrast, notch depth values at Head-Smashed-In Buffalo Jump appear to increase through time (Figure 39). Levels 1 to 5 have notch depth values that range between 1.5 to 2.5 mm, while levels 6 to 7B have notch depth values that range between 1.0 to 2.0 mm. Statistically, levels 1 to 5 are not significantly different. Similarly, levels 6 to 7B are not significantly different. In comparing levels 1 to 5 and levels 6 to 7B, however, these two groups do have significantly different means from each other (Table 24). Levels 1 to 5 have similar notch depth values to those in Old

Women's Buffalo Jump, while levels 6 to 7B have values distributed over slightly lower values.

At the Walter Felt site, projectile points from levels 1 to 5 appear to have slightly larger notch depth values than levels 6 and 7 (Figure 40). Table 24, however, indicates that almost all the levels have similar notch depth values; the exception is level 7 which is significantly different from levels 1, 3, and 5. Levels 1 to 5 have notch depth values that largely range between 2.0 to 3.0 mm; these values are anomalously large compared to other sites discussed thus far. Levels 6 and 7 have similar notch depth values to tne temporally equivalent levels in the Old Women's Buffalo Jump and Head-Smashed-In Buffalo Jump.

For the Ross and Junction sites, notch depth values appear fairly consistent between levels within and between the sites (Figure 41). Furthermore, the distribution of values, the majority of which occur between 1.5 and 2.5 mm, parallel roughly equivalent values as those in the Old Women's Buffalo Jump and the most recent levels of Head-Smashed-In Buffalo Jump.

The Lake Midden site, the Stony Beach site, EeNd-3, and the Bill Richards site have similar distributions of notch depth values (Figure 42). The majority of the values occur between 2.0 and 3.0 mm roughly correlating with levels 1 to 5 of the Walter Felt site.

Similarly, all the levels of the Sanderson site appear to exhibit comparable distributions of notch depth values (Figure 43). The majority of the values occur between 1.5 to 3.0 mm which correlates with the levels 1 to 5 of the Walter Felt site.

In summary, notch depth changes relatively little throughout the sequence at the Old Women's Buffalo Jump. Sites with similar distributions of values include the Ross site, the Junction site, levels 1 to 5 of Head-Smashed-In Buffalo Jump, and levels 6 and 7 of the Walter Felt site. Levels 6 to 7B at Head-Smashed-In Buffalo Jump have somewhat smaller notch depth values than the aforementioned sites. Levels 1 to 5 of the Walter Felt site, as well as the Lake Midden site, the Stony Beach site, EeNd-3, the

Bill Richards site, and the Sanderson site have somewhat higher notch depth values than the other sites.

Notch Height

Both Forbis (1962) and Kehoe (1966) discuss the attribute notch height in their classification systems. Forbis (1962:90) indicated that, at the Old Women's Buffalo Jump, notch height decreases through time. "Notch width [notch height] increases in average from an even 3 mm in levels 1 to 4 to 4.14 mm in layers 11 to 14" (Forbis 1962:90).

Kehoe (1966:836) substantiated Forbis' interpretation based on an analysis of projectile points at the Gull Lake Bison Drive site. Furthermore, Kehoe (1966:86) indicated that notch height is a significant feature of his types (i.e., Prairie Side-notched and Plains Side-notched projectile point types). The Prairie Side-notched projectile point type has notch heights that "...range from 1 to 7 mm, averaging 4.2 mm..." (Kehoe 1966:830), and the Plains Side-notched projectile point type has notch height values that "...range from 2.0 to 8.0 mm, averaging 3.6 mm..." (Kehoe 1966:832).

My observations of projectile points from the Old Women's Buffalo Jump led to a similar conclusion (Figure 44). Table 25 indicates that four subsets of similar means occur in the notch height data. The subset of levels with the smallest means includes the most recent levels, which grade back in time with increasing notch height values until the subset of levels with the largest means which includes the oldest levels.

At Head-Smashed-In Buffalo Jump, it is difficult to determine whether notch height values exhibit a slight trend towards decreasing through time (Figure 45) Statistically, most of the levels have similar means (Table 25). The exception is level 5, which is significantly different from levels 3, 6, and 8. The distribution of notch height values from Head-Smashed-In Buffalo Jump correlates well with the eight most recent levels at the Old Women's Buffalo Jump. Recall that the most recent levels at Head-Smashed-In Buffalo Jump were considered to exhibit similar means. To be meaningful, this correlation would require that levels 11 to 14 at the Old Women's Buffalo Jump antedate levels 1 to 7B at Head-Smashed-In Buffalo Jump. This temporal relationship, however, contradicts my interpretation of the radiocarbon dates for these sites (see Figure 2).

At the Walter Felt site, notch height values decrease through time, but in a step-like fashion (Figure 46). This abrupt change in notch height suggests one "type" of projectile point is being supplanted by another, rather than a gradual decrease in notch height values through time as witnessed in the Old Women's data. Statistically, levels 1 to 5 form a subset of means that are not different from each other (Table 25). Similarly, levels 6 and 7 form a subset of means that do not differ. Levels 1 to 5 and levels 6 and 7, nevertheless, are different from each other. Levels 1 to 5 have notch height values that tend to occur between 1.5 to 3.0 mm. In contrast, levels 6 and 7 have the majority of their notch height values between 3.0 and 5.0 mm. For levels 6 and 7, the distribution of notch height values, as well as the dates for the levels, correlate well with the earlier levels of the Old Women's Buffalo Jump, as well as being quite similar to the earliest levels from Head-Smashed-In Buffalo Jump.

Both the Ross site and the Junction site do not exhibit a change in notch height through time (Figure 47). This is not surprising as these sites are dated to the most recent period of time when notch heights do not appear to change much at any site. The majority of the notch height values occur between 2.0 to 4.0 mm, as they do in levels 1 to 8 at the Old Women's Buffalo Jump and levels 1 to 7B at Head-Smashed-In Buffalo Jump.

The Stony Beach site, the Lake Middle site, EeNd-3, and the Bill Richards site all have similar distributions of notch height values (Figure 48). The majority of values occur between 1.5 to 3 mm. This distribution of notch height values is comparable to levels 1 to 5 of the Walter Felt site.

The Sanderson site exhibits similar distributions of notch height values regardless of the level from which they came (Figure 49). The majority of the values occur between 1.5 and 3.0 mm. Given this distribution of notch height values, I infer that the notch height values at the Sanderson site are roughly equivalent to those at the Stony Beach site, the Lake Midden site, EeNd-3, the Bill Richards site, and levels 1 to 5 at the Walter Felt site.

In summary, notch height at the Old Women's Buffalo Jump is relatively unchanging back in time, until ca. 950 B.P., at which time notch height begins to increase somewhat. Paralleling this trend, the notch height values at Head-Smashed-In Buffalo Jump are unchanging going back in time. Yet, Head-Smashed-In Buffalo Jump does not exhibit the increase in notch height in the earliest portion of its sequence. At the Walter Felt site, levels 1 to 5 have unchanging distributions of notch height values; however, these notch height values also occur over a lower range of values than the aforementioned sites. In contrast, the levels 6 and 7 at the Walter Felt site have substantially higher notch heights and correlate well with comparably dated levels in both the Old Women's Buffalo Jump and Head-Smashed-In Buffalo Jump. Similarly, the Ross site and the Junction site correlate well in time and in notch height values with the Old Women's Buffalo Jump and Head-Smashed-In Buffalo Jump. In the same manner, the Lake Midden site, the Stony Beach site, EeNd-3, the Bill Richards site, and the Sanderson site have small notch height values dated to time periods that correlate well with levels 1 to 5 at the Walter Felt site.

Shoulder Height

Neither Forbis (1962) nor Kehoe (1966) discussed the shoulder height attribute. In essence, shoulder height is the sum of base height and notch height on a given side of a projectile point. Both authors agreed that base height decreased going back in time (Forbis 1966:90, Kehoe 1966:835), and that notch height increased over the same time span (Forbis 1966:90, Kehoe 1966:836). Therefore, shoulder height should provide a measure of which phenomenon is occurring more rapidly through time.

For the Old Women's Buffalo Jump, my visual inspection of the distribution of shoulder height values suggests that there may be a slight decrease in shoulder height earlier in time (Figure 50). Table 26 indicates somewhat ambiguous results as most, but not all, of the levels have similar means. The exceptions include level 11, which has a significantly different mean than levels 1-2, 3, and 4, and level 8, which also has a significantly different mean than level 4. These differences may be indicating that the most recent levels have slightly higher shoulder heights than the earliest levels. The lack of a strong pattern in the stratigraphic position of the significantly different levels, however, does not entirely support this scenario. Nonetheless, the differences do not seem to be attributable to problematic sample sizes.

At Head-Smashed-In Buffalo Jump, shoulder height values also appear to diminish with greater age (Figure 51). As with the Old Women's Buffalo Jump, most of the levels have similar means. The exceptions are level 1-2, which has the largest mean and is significantly different from the means of levels 5, 6, 7A, and 7B, and level 7B, which has the smallest mean and is significantly different than the means from levels 1-2, 3, and 4 (Table 26). Unlike the analysis of the Old Women's Buffalo Jump, these results suggest shoulder height at Head-Smashed-In Buffalo Jump diminishes slightly going back in time.

My observations of projectile points at the Walter Felt site suggested that shoulder height might diminish with increasing age (Figure 52). Surprisingly, no two levels exhibited significantly different means (Table 26). Given the somewhat contrasting results from the Old Women's Buffalo Jump and Head-Smashed-In Buffalo Jump I find it difficult to decide whether my impression of the distribution of values or the statistical analysis is most reliable.

My examination of both the Junction site and the Ross site suggests that the distribution of shoulder height values exhibits no difference from the distribution of values from the sites mentioned above. This is evidenced by the distribution of shoulder height values that do not change through time and by the majority of the values occurring in the range of 5.5-8.0 mm (Figure 53).

This argument can be applied to the distribution of shoulder height values for the Lake Midden site, the Stony Beach site, EeNd-3, and the Bill Richards site. As with the previous sites, the shoulder height values in these sites exhibit no change through time and the majority of the values occur between 5.5-8.0 mm (Figure 54).

At the Sanderson site, the distribution of shoulder height values remain relatively constant regardless of the level from which they came (Figure 55). As with the sites described above, shoulder height values tend to cluster between 5.5-8.0 mm. Based on this, I infer that the Sanderson site projectile points have shoulder height values that are relatively equivalent to the projectile points at other sites in this study.

To sum up, predominantly there are few differences between the shoulder height values across the sites. Nonetheless, visual inspection and statistical analysis of both the Old Women's Buffalo Jump and Head-Smashed-In Buffalo Jump hint that the earliest levels might have larger shoulder height values than the later levels.

Weight Attribute

Forbis (1962) did not discuss the attribute of weight in his classification system. In contrast, Kehoe (1966:829-832) included weight among the significant features of his projectile point types (i.e., Prairie Side-notched and Plains Side-notched projectile point types). The Prairie Side-notched projectile point type has weight values that range between 0.3 to 3.8 g, averaging 1.1 g (Kehoe 1966:831). The Plains Side-notched projectile point type has weight values that range from 0.3 to 2.0 g, and average 1.3 g. (Kehoe 1966:832).

My observations of projectile points from the Old Women's Buffalo Jump indicated the majority of weight values fall between 0.25 and 1.5 g. This led me to believe there was little variation in weight values through time (Figure 56). This inference is supported by the fact that no two levels have significantly different means for weight values (Table 27).

Similarly, at Head-Smashed-In Buffalo Jump, the distribution of weight values does not appear to change through time and the majority of the weight values occur between 0.25 and 1.5 g (Figure 57). A means test indicates that most of the levels have similar mean values (Table 27). The exception is level 1-2 which is significantly different from levels 3, 6, 7, and 8. I attribute this discrepancy to the small sample size of level 1-2 (n=10).

At the Walter Felt site, visual inspection suggests weight values do not change through time (Figure 58). This is supported by the fact that no two levels have significantly different means (Table 27). As with the Old Women's Buffalo Jump and Head-Smashed-In Buffalo Jump the majority of weight values at the Walter Felt site fall between 0.25 to 1.5 g. In terms of weight, this strongly suggests the projectile points from the Walter Felt site are comparable to the projectile points from both the Old Women's Buffalo Jump and Head-Smashed-In Buffalo Jump.

Similarly, my examination of both the Junction site and the Ross site suggests the distribution of weight values exhibit no difference from the distribution of values from the sites mentioned above. This is evident in the lack of change in the distribution of weight values through time and the clustering of values between 0.25-1.5 g (Figure 59).

This argument can be applied to the distribution of weight values for the Lake Midden site, the Stony Beach site, EeNd-3, and the Bill Richards site. As with the previous sites, the weight values in these sites exhibit no change through time and the majority of the values occur between 0.25-1.5 g (Figure 60).

At the Sanderson site, the distribution of weight values remains relatively constant regardless of the level from which they came (Figure 61). As with the sites described above, weight values tend to cluster between 0.25-1.5 g. Based on this, I infer that the Sanderson site projectile points have weight values that are relatively equivalent to the projectile points at other sites in this study.

Angular Attributes

Distal Base Angle

Neither Forbis (1962) nor Kehoe (1966) discussed the attribute of distal base angle in their classification systems. Distal base angle, nevertheless, does exhibit some temporal and geographic patterning.

My observations of projectile points from the Old Women's Buffalo Jump suggested distal base angle is distributed over similar values in the most recent levels (i.e., 1 to 9-10). The majority of the values occur between 100° and 130°. Values may increase slightly in the earliest levels (i.e., 11-12 to 13-14), where they range from 100° to 160° (Figure 62). Table 28 indicates that levels 1-2, 3, 4, 5, 6, 7, 8, 9-10, and 13-14 have equal means as do levels 8, 11-12, and 13-14. These findings reinforce the visual interpretation of the boxplots since the subset of younger levels have smaller mean values than the subset of older levels, which have larger mean values.

Projectile points from Head-Smashed-In Buffalo Jump also exhibit distal base angles with a slight tendency towards decreasing going back in time (Figure 63). As above, the majority of distal base angle values are distributed between 100° to 130°. Table 28 indicates that no two levels have different means from each other. Given the similarity of distal base angle values through time, I infer equivalence between Head-Smashed-In Buffalo Jump and the Old Women's Buffalo Jump. My only reservation is the disparate distribution of values found in level 11-12 at the Old Women's Buffalo Jump.

At the Walter Felt site, distal base angles are substantially smaller in levels 1 to 5 than the aforementioned sites, but increase in levels 6 and 7 (Figure 64). This interpretation is supported by statistics. Table 28 indicates that levels 1-2, 3, 4, and 5 form a subset of means that are not different from each other, as do levels 6 and 7. In levels 1-2, 3, 4, and 5 the majority of the values range between 90° and 110°, while in levels 6 and 7 the majority of the values range between 100° to 130°. The range of distal base angle values in levels 6 and 7 is remarkably similar to those at the Old Women's Buffalo Jump and Head-Smashed-In Buffalo Jump.

Distal base angle measurements were not taken for either the Ross site or the Junction site. This is owing to the fact that, at the time I analysed these assemblages it was not apparent that distal base angle might exhibit geographic and/or temporal patterning (Figure 65).

The Stony Beach site, the Lake Midden site, EeNd-3, and the Bill Richards site all have very similar distributions of distal base angle values (Figure 66). The majority of the values occur between 90° and 110°. These values correspond well with those from levels 1 to 5 at the Walter Felt site.

Distal base angle values at the Sanderson site are all distributed over very similar values, regardless of level (Figure 67). The majority of the values occur between 90° and 110°. As above, these values are very comparable to levels 1 to 5 at the Walter Felt site, the Stony Beach site, the Lake Midden site, EeNd-3, and the Bill Richards site.

In summary, relatively large distal base angles occur in all the sites with material pre-dating ca. 650 B.P. (i.e., Old Women's Buffalo Jump levels 8 to 14 , Head-Smashed-In Buffalo Jump levels 6 to 7B, and the Walter Felt site levels 6 to 7). Equivalent values continue into the more recent levels of the sites located in the western part of the study area including the Old Women's Buffalo Jump (i.e., levels 1 to 7) and Head-Smashed-In Buffalo Jump (i.e., levels 1 to 5). Relatively smaller distal base angle values occur in the more recent levels of the sites in the eastern part of the study area including the Lake Midden site, the Stony Beach site, EeNd-3, the Bill Richards site, the Sanderson site, and levels 1 to 5 of the Walter Felt site.

Proximal Base Angle

As with distal base angle, neither Forbis (1962) nor Kehoe (1966) discussed proximal base angle in their classification systems. Again, like distal base angle, proximal base angle exhibits distinct temporal and geographic patterning.

My observations of the Old Women's Buffalo Jump projectile point assemblages suggest proximal base angle values remain relatively constant through time (Figure 68). Table 29 indicates that most of the levels have similar means. Both levels 5 and 9, however, are significantly different from levels 1 and 3. Given the otherwise overwhelming trend towards homogeneity in proximal base angle values, I suspect these discrepancies are a problem of sampling. Regardless, the majority of the values occur between 90° and 120°.

Projectile points from Head-Smashed-In Buffalo Jump provide some evidence for decreasing proximal base angles through time (Figure 69). Table 29 indicates that most projectile point assemblages from Head-Smashed-In Buffalo Jump have similar mean values for proximal base angle. Level 6 is significantly different from levels 1-2, 3, 4, and 5. Like the Old Women's Buffalo Jump, the overwhelming trend is toward homogeneity. Level 6 generates most of the dissimilarity. I suspect the aberrant nature of level 6 is a sampling problem. Furthermore, the majority of proximal base angle values occur between 90° and 120° making them very similar to those found at the Old Women's Buffalo Jump.

The boxplots representing the distribution of proximal base angle values for the Walter Felt site suggest two distinct groups; levels 1 to 5 have small proximal base values in contrast to the larger base angle values of levels 6 and 7 (Figure 70). Table 29 indicates that levels 1 to 5 have similar means, as do levels 6 and 7. These would be distinct subsets except that levels 4 and 7 are also indicated to have similar means. I retain my initial inference, nonetheless, that the distribution of proximal base angle values at the Walter Felt site indicates two distinct groups. My reasons for this are two-fold. First, the evaluation of discrete attributes strongly suggest that levels 1 to 5 are different from levels 6 and 7. Second, a number of continuous attributes, including base height, notch depth, notch height, distal base angle, and shoulder angle, strongly suggest that they are distinct.

Proximal base angle measurements were not taken for either the Ross site or the Junction site. This is owing to the fact that, at the time I analysed these assemblages it was not apparent that proximal base angle might exhibit geographic and/or temporal patterning (Figure 71).

The Lake Midden site, the Stony Beach site, and the Bill Richards site have very similar distributions of proximal base angle values (Figure 72). Like levels 1 to 5 at the Walter Felt site, the majority of their proximal base angle values range from 80° and 100°.

The Sanderson site exhibits proximal base height values that are distributed over a similar range of values regardless of the level from which they came (Figure 73). The majority of the proximal base angle values occur between 80° and 100°. These values correspond well with those from the Lake Midden site, the Stony Beach site, EeNd-3, the Bill Richards site, and levels 1 to 5 of the Walter Felt site.

In summary, like distal base angle, proximal base angle values are relatively large in the early portions of all the sites (i.e., levels 8 to 14 of the Old Women's Buffalo Jump, levels 6 to 7B of Head-Smashed-In Buffalo Jump, and levels 6 and 7 of the Walter Felt site). Relatively similar values continue into the more recent levels of the sites located in the western part of the study area including the Old Women's Buffalo Jump (i.e., levels 1 to 7) and Head-Smashed-In Buffalo Jump (i.e., levels 1 to 5). Again, like distal base angle, relatively smaller proximal base angle values occur in the more recent levels of the sites in the eastern part of the study area including the Lake Midden site, the Stony Beach site, EeNd-3, the Bill Richards site, the Sanderson site, and levels 1 to 5 of the Walter Felt site.

Shoulder Angle

Shoulder angle is another attribute not discussed by either Forbis (1962) or Kehoe (1966) in their classification systems. Shoulder angle, like distal and proximal base angles, exhibits distinct temporal and geographic patterning.

At the Old Women's Buffalo Jump, visual inspection of the distribution of shoulder angle values suggests that there is little change through time (Figure 74). Table 30 indicates that most of the levels have similar means and that the majority of shoulder angle values occur between 90° and 120°. Level 6, however, has a relatively, small mean value which is significantly different than levels 1-2, 3, 5, 8, and 11. Given the homogeneity of the shoulder angles among other levels, I attribute the aberrant nature of level 6 to sampling error.

My observations on projectile points from Head-Smashed-In Buffalo Jump suggest shoulder angle values in levels 1 to 5 are similar, while those values in levels 6 to 7B are slightly higher (Figure 75). Table 30 illustrates that three subsets of means are significantly different from each other. These three subsets are levels 1, 3, 4, and 5, levels 1 and 6, and levels 6, 7A, and 7B. Levels 1, 3, 4, and 5 have values that largely occur between 90° to 120° like the distribution in the Old Women's Buffalo Jump. Levels 6 to 7B have relatively large values, mainly ranging between 100° to 130°, and appear to be a separate phenomenon.

The shoulder angle values at the Walter Felt site suggest two distinct groups. Levels 1 to 5 have small values that largely occur between 80° and 110°, compared to levels 6 and 7 which have values that largely occur between 110° and 130° (Figure 76). Statistically, levels 1 to 5 form a subset of means that are not significantly different from each other but are different from levels 6 and 7, and vice versa (Table 30). Interestingly, levels 6 and 7 are most similar to the distributions of values in levels 6, 7A, and 7B at Head-Smashed-In Buffalo Jump.

The Ross site and the Junction site have similar distributions of shoulder angle values that do not appear to change through time (Figure 77). Furthermore, the majority of the values occur between 90° and 120°. This is similar to the shoulder angle values at the Old Women's Buffalo Jump and the most recent part of Head-Smashed-In Buffalo Jump (i.e., levels 1 to 5).

The Lake Midden site, the Stony Beach site, EeNd-3, and the Bill Richards site have very similar distributions of shoulder angle values (Figure 78). The majority of shoulder angle values occur between 80° to 110°. Given this distribution of shoulder angle values, these sites are most comparable to levels 1 to 5 of the Walter Felt site.

Similarly, at the Sanderson site, the distribution of shoulder angle values do not appear to change through time and the majority of the values occur between 80° to 110° (Figure 79). From this I infer that the Sanderson site has a remarkably comparable distribution of shoulder height values to the Lake Midden site, the Stony Beach site, EeNd-3, the Bill Richards site, and levels 1 to 5 of the Walter Felt site.

To summarize, the Old Women's Buffalo Jump, Head-Smashed-In Buffalo Jump, the Ross site, the Junction site, and levels 6 and 7 of the Walter Felt site have very comparable distributions of shoulder angle values. Likewise, the Lake Midden site, the Stony Beach site, EeNd-3, the Bill Richards site, the Sanderson site, and levels 1 to 5 of the Walter Felt site exhibit very similar distributions of shoulder angle values.

Summary

Several attributes on projectile points from the Northwestern Plains have exhibited geographic and/or temporal patterning. This patterning is found in both discrete and continuous attributes.

The discrete attributes that exhibit geographic and/or temporal patterning include basal edge shape, notch form, cross-section, and base form. Discrete attributes which possibly exhibit very weak patterning include notch type, flaking pattern, and outline forms.

The continuous attributes that exhibit patterning include base height, notch depth, notch height, distal base angle, proximal base angle, and shoulder angle. Continuous attributes that did not exhibit any geographic and/or temporal patterning include base width, blade width, length, neck width, shoulder height, thickness, and weight.

The patterning exhibited within the discrete and continuous attributes indicated that the earliest levels of the Old Women's Buffalo Jump (i.e., 8 to 14), Head-Smashed-In Buffalo Jump (i.e., 6 to 8), and the Walter Felt site (i.e., levels 6 and 7) exhibit relatively similar projectile point assemblages. The assemblages from both the Old Women's Buffalo Jump and Head-Smashed-In Buffalo Jump show continuity from their earliest levels into the most recent levels. Furthermore, the most recent levels of the Old Women's Buffalo Jump (i.e., 1 to 7) and Head-Smashed-In Buffalo Jump (i.e., 1 to 5) also exhibit strong similarities to the Ross site and the Junction site.

At the Walter Felt site, however, continuity does not occur between the earliest levels (i.e., 6 to 7) and the most recent levels (i.e., 1 to 5). Instead, the most recent levels of the Walter Felt site can not only be differentiated from its earliest levels but can also be differentiated from all the contemporary material at the Old Women's Buffalo Jump, Head-Smashed-In Buffalo Jump, the R[illegible]s site, and the Junction site. Still, other projectile point assemblages that are contemporary with the most recent levels of the Walter Felt site exhibit very similar patterning in their attributes including the Lake Midden site, Stony Beach site, EeNd-3, Bill Richards site, and the Sanderson site.

CHAPTER FIVE

RECLASSIFICATION OF LATE SIDE-NOTCHED PROJECTILE POINTS

Introduction

Initially, the classification system for Late Side-notched projectile points on the Northwestern Plains described projectile point morphological variability using a select number of attributes that change gradually through time (i.e., Forbis 1962). Kehoe's (1966) modification of Forbis' (1962) classification system described an abrupt difference in some of the attribute trends through time. This temporal split in attribute trends was embodied within the distinction between Prairie Side-notched projectile point types (ca. 1250 B.P. to 650 B.P.) and Plains Side-notched projectile points types (ca. 650 B.P. to the Historic Period) (Kehoe 1966). This classification system has persisted in describing Late Side-notched projectile point assemblages across the Northwestern Plains and its parkland/forest periphery during the past 30 years.

Notwithstanding this long history, my evaluation of the existing classification system of Late Side-notched Projectile Points on the Northwestern Plains has demonstrated certain inadequacies. In Chapter Four, I established that from ca. 1250 B.P. to 650 B.P., Late Side-notched projectile points appear to have relatively similar discrete and continuous attributes among sites in the study area. After about 650 B.P. there is an abrupt change in Late Side-notched projectile point morphology at some of the sites in the study area. Projectile points in the eastern half of the study area quite suddenly exhibit differences from earlier specimens in both continuous and discrete attributes, and then remain unchanged until the historic period. In the west half of the study area, no abrupt change is manifested. Instead, the continuous attributes of the projectile points continue previous trends: those continuous attributes that exhibited gradual change through time continue to do so, and those continuous attributes which did not exhibit change through time continue unchanged. Similarly, discrete attributes in the western sites exhibit the strongest continuity and similarity to the frequency of discrete attributes of the early period rather than contemporary frequencies of discrete attributes found in the eastern sites.

Thus far, I have called the assemblages exhibiting gradual change through time and continuity from the earliest times to the most recent times the "western" sites (i.e., Old Women's, Head-Smashed-In, Ross, and Junction). I have called the sites that exhibit an abrupt break from the aforementioned continuity the "eastern" sites (i.e., Sanderson, Stony Beach, Lake Midden, EeNd-3, Bill Richards). Situated between the western and eastern sites is the Walter Felt site. The Walter Felt site has early occupations with Late Side-notched projectile points in which some attributes exhibit gradual change through time and strongly resemble those found in the earliest occupations of the "western" sites. The more recent occupations at the Walter Felt site contain Late Side-notched projectile points exhibiting an abrupt shift from the earlier material. These specimens are demonstrably most similar to the "eastern" sites.

These distinctive trends in the attributes of Late Side-notched projectile points are not revealed by the existing classification system. I feel these findings justify a reclassification of Late Side-notched projectile points on the Northwestern Plains.

Therefore, in this chapter, the projectile point assemblages I have referred to thus far as "western" will be labeled the "Cayley Series projectile points" and will then be defined. Then, the projectile point assemblages I have referred to thus far as "eastern" will be labeled the "Mortlach Group projectile points" and will then be defined. Finally, I will make a selective review of the literature and briefly comment on other projectile point assemblages classified under the existing classification system.

Cayley Series Projectile Points

In Chapter Four I demonstrated that the projectile points from the Old Women's Buffalo Jump, Head-Smashed-In Buffalo Jump, the Ross site, the Junction site, and levels 6 to 7 of the Walter Felt site exhibited similar trends in their continuous and discrete attributes. These attribute trends distinguish these projectile point assemblages from the remaining assemblages in the study area including the Lake

Midden site, the Stony Beach site, EeNd-3, the Bill Richards site, the Sanderson site, and levels 1 to 5 in the Walter Felt site. As declared above, the existing classification system for Late Side-notched projectile points does not recognize this distinction. Therefore, the following offers a reclassification in order to rectify the inadequacy.

Traditionally, Late Side-notched projectile points from the Northwestern Plains have received their names from townsites in Alberta, Saskatchewan, and Montana. Considering that the first thorough attempt at classifying projectile points with these trends was by Richard G. Forbis (1962) at the Old Women's Buffalo Jump near the town of Cayley, Alberta, I feel it is appropriate to refer to these projectile points as the Cayley Series (I use the term "series" to denote the gradational variation in projectile point morphology through time and across space). Hence, the projectile point assemblages from the Old Women's Buffalo Jump, Head-Smashed-In Buffalo Jump, the Ross Site, the Junction Site, and levels 6 to 7 of the Walter Felt Site will be referred to as containing Cayley Series projectile points (an idealized illustration of some Cayley Series projectile points and their spatial/temporal relationship with Mortlach Group projectile points is presented in Figure 80).

General Characteristics

The following provides the parameters of the Cayley Series projectile points by summarizing the variability within each of the attributes. For discrete attributes the frequency of occurrence for the various forms of each attribute is provided. For continuous attributes the mean, the standard deviation, the minimum, and the maximum values for each of the attributes are provided. In the text below, the attributes that appear in **bold letters** are the most useful in differentiating between Cayley Series and Mortlach Group projectile points.

Discrete Attributes

Basal edge shape

- **ca. 1250 B.P. to 650 B.P.- the preference was for straight (49.5%) basal edge shapes, followed by concave (28.9%), and convex (17.8%) basal**

edge shapes. Notched (0.6%), oblique (0.3%), spurred (0.0%), and irregular (2.9%) basal edge shapes are rare.

- **ca 650 B.P. to the Historic Period - straight (48.6%) basal edge shapes are still common, concave (35.4%) basal edge shapes have increased in occurrence, while convex (9.2%) basal edges decrease in occurrence. Notched (0.6%), oblique (0.8%), spurred (0.6%), and irregular (4.7%) basal edge shapes are still rare.**

Notch types

- ca. 1250 B.P. to 650 B.P. - both corner notching (4.3%) and side-corner notching (9.2%) occur in the early period and side notching (85.9%) is prevalent. Side and Basal (0.3%), stemmed (0.0%), and side and corner (0.3%) notching occur infrequently.
- ca. 650 B.P. to the Historic Period - corner notching (2.9%) and side-corner notching (7.5%) decrease in occurrence while side notching (86.0%) increases in occurrence. Side and basal (0.4%), stemmed (0.1%), and side and corner (3.1%) notching occur infrequently.

Notch Form

- **ca 1250 B.P. to 650 B.P. - high occurrences of V-shaped broad (44.5%), round shallow (31.1%), and angular broad (19.5%) notch forms. All other notch forms including angular narrow (0.3%), round deep (0.3%), V-shaped narrow (0.0%), rectangular broad (0.0%), rectangular narrow (0.3%), U-shaped broad (2.1%), and U-shaped narrow (1.8%), occur infrequently.**
- **ca. 650 B.P. to the Historic Period - V-shaped broad (38.4%), angular broad (20.7%), and round shallow (20.7%) notch forms occur frequently. All other notch forms including angular narrow (1.5%), round deep (1.0%), V-shaped narrow (2.1%), rectangular broad (0.1%), rectangular narrow (0.3%), U-shaped broad (5.9%), and U-shaped narrow (9.2%), occur very infrequently.**

Flaking Pattern

- ca. 1250 B.P. to 650 B.P. - irregular flaking (79.1%) occurs most frequently, followed by edge modified (11.4%), parallel (5.6%), double diagonal (3.2%), and diagonal oblique (0.8%) flaking patterns.
- ca 650 B.P. to the Historic Period - irregular flaking (76.9%) remains the most common, followed by edge modified (12.8%), double diagonal (5.6%), parallel, (4.2%), and diagonal oblique (0.6%) flaking patterns.

Outline form

- ca. 1250 B.P. to 650 B.P. - tends to be asymmetrical (94.6%), with few symmetrical outline forms (4.8%), and very rarely intentional asymmetrical outline forms (0.7%).
- ca. 650 B.P. to the Historic Period - asymmetrical outline forms (91.0%) remain most frequent, while both symmetrical outline forms (7.2%), and intentional asymmetry (1.8%) outline forms increase slightly in frequency.

Cross-section

- ca. 1250 B.P. to 650 B.P. - convex asymmetrical (60.4%) cross-sections occur most frequently, followed by plano-convex (26.2%), biplano (6.7%), convex symmetrical (5.2%), and plano-triangular (1.6%) cross-sections. Apparently, convex triangular cross-sections do not occur.
- ca. 650 B.P. to the Historic Period - cross-section frequencies are highest for convex asymmetrical (40.3%), followed by plano-convex (37.2%), convex symmetrical (13.4%), plano-triangular (4.9%), biplano (3.7%), and convex triangular (0.5%) cross-sections.

Base Forms

- **ca. 1250 B.P. to 650 B.P. - base forms tend to be "fish-tailed" (#2, 20.6%), "oblong" (#3, 7.2%), "barn-shaped" (#4, 6.2%), "pie-pan" shaped (#5, 21.3%), rectangular (#6, 2.1%), and "lens" shaped (#13, 11.7%). Other base forms occur in very low frequencies.**
- **ca. 650 B.P. to the Historic Period - the "fish-tailed" base form (#2, 21.8%), "oblong" (#5, 5.6%), "barn-shaped" (#4, 4.6%), "pie-pan" shaped (#5, 21.5%), rectangular (#6, 5.3%), and "lens" shaped (#13, 4.2%) continue to be common. As in the early period, other base forms continue to occur in low frequencies.**

Continuous Attributes

Base Height

- **base height values gradually increase through time.**
- **in the earliest assemblages, the mean base height value is 1.98 mm, the standard deviation of the base height value is 1.10 mm, the minimum base height value is 0.00 mm (i.e., corner notched), and the maximum base height value is 3.66 mm.**
- **in the most recent assemblages, the mean base height value is 3.97 mm, the standard deviation of the base height value is 1.36 mm, the minimum base height value is 0.19 mm, and the maximum base height value is 7.84 mm.**

Base Width

- base width values remain relatively unchanged through time.
- the mean base width value is 12.63 mm.
- the standard deviation of base width values is 2.15 mm.
- the minimum base width value is 0.31 mm, the maximum base width value is 18.49 mm.

Blade Width

- blade width values remain fairly consistent through time.
- the mean blade width value is 12.81 mm.
- the standard deviation of blade width values is 1.98 mm.
- the minimum blade width value is 7.34 mm, the maximum blade width value is 22.55 mm.

Length

- length values remain relatively unchanged through time.
- the mean length value is 20.64 mm.
- the standard deviation of length values is 5.34 mm.
- the minimum length value is 10.21 mm, the maximum length value is 42.69 mm.

Neck width

- neck width values are very consistent through time.
- the mean neck width value is 8.71 mm.
- the standard deviation of the neck width values is 1.44 mm.
- the minimum neck width value is 0.71 mm, the maximum neck width value is 14.58 mm.

Notch Depth

- notch depth values remain constant through time.
- the mean notch depth value is 1.80 mm.
- the standard deviation of the notch depth value is 0.66 mm.
- the minimum notch depth value is 0.18 mm, the maximum notch depth value is 4.09 mm.

Notch Height

- **notch height values tend to remain constant through time, with a possible increase in values in the earliest assemblages.**
- **the mean notch height value is 3.21 mm.**
- **the standard deviation of notch height values is 1.06 mm.**
- **the minimum notch height value is 0.39 mm, the maximum notch height value is 10.14 mm.**

Shoulder Height

- shoulder height values remain fairly constant through time with a hint that values may decrease slightly back in time.
- the mean shoulder height value is 6.45 mm.
- the standard deviation of the shoulder height values is 1.39 mm.
- the minimum shoulder height value is 1.31 mm, the maximum shoulder height value is 14.16 mm.

Thickness

- thickness values are very constant through time.
- the mean thickness value is 3.38 mm.
- the standard deviation of the thickness values is 0.67 mm.
- the minimum thickness value is 1.4 mm, the maximum thickness value is 7.45 mm.

Weight

- weight values are fairly consistent through time
- the mean weight value is 0.88 grams.
- the standard deviation of weight values is 0.44 grams.
- the minimum weight value is 0.2 grams, the maximum weight values is 3.5 grams.

Distal base angle

- **distal base angle values are relatively constant with a possible tendency to increase back in time.**
- **the mean distal base angle value is 112.4°.**
- **the standard deviation of distal base angles is 17.3°.**
- **the minimum distal base angle value is 11.0°, the maximum distal base angle value is 180°.**

Proximal base angle

- **proximal base angle values remain relatively constant through time.**
- **the mean proximal base angle is 105.2°.**
- **the standard deviation of proximal base angles is 17.5°.**
- **the minimum proximal base angle value is 16.0° , the maximum proximal base angle is 153.0°.**

Shoulder angle

- **shoulder angle values exhibit little change through time.**
- **the mean shoulder angle value is 106.7°.**
- **the standard deviation of shoulder angle values is 16.7° .**
- **the minimum shoulder angle value is 11.0°, the maximum shoulder angle value is 162.0°.**

This outline of the general characteristics of Cayley Series projectile points, while establishing parameters for each of the attributes, also indicates that there is a substantial amount of variability within the attributes. Forbis (1962) addressed the problem of projectile point variability by dividing the Late Side-notched projectile points from the Old Women's Buffalo Jump into types based on specific morphological attributes. Similarly, Kehoe (1966) addressed morphological variability by subdividing his types into varieties based on specific morphological attributes. Given the variability described for the Cayley Series projectile points, a more thorough evaluation of the manner by which the existing classification system addresses projectile point variability follows.

Morphological Variability

In addressing morphological variability within Late Side-notched projectile points, both Forbis (1962) and Kehoe (1966) used comparisons between base height and notch height, as well as blade width and base width, to establish their various types and varieties, respectively.

Forbis (1962:87) noted that base width and body width [blade width] were chronologically sensitive. From this observation he suggested "...a still more significant figure is derived by dividing the average body width [blade width] by the average base width...and multiply by 100" (Forbis 1962:87) to produce the base-body index. "A base-body index below 100 indicates that the base is wider than body; above 100, the body is wider than the base" (Forbis 1962:87).

Similarly, he derived an index for base height and notch height in which: "...the relationship of the basal edge [base height] to the notch width [notch height] is reckoned by dividing the average height of the basal edge [base height] by average notch width [notch height] and multiplying by 100" (Forbis 1962:90) to produce the base height-notch height index. "A figure over 100 indicates that the basal edge height [base height] is greater than notch width [notch height]; less than 100, the notch width [notch height] is greater" (Forbis 1962:90).

Based on principles used in deriving these indices, both Forbis (1962) and Kehoe (1966) subdivide the morphological variability found in Late Side-notched projectile points into types and varieties, respectively. Washita and Pekisko projectile points have base heights that are greater than the notch heights while their base widths are greater than the blade widths. The main difference is that Washita projectile points have flaring basal edges while Pekisko projectile points do not. Similarly, Paskapoo projectile points also have base heights that are larger than notch heights but their base widths are equal to their blade widths.

Nanton projectile points, on the other hand, exhibit base heights which are equal to, or less than notch heights, and base widths that are equal to or greater than blade widths. Similarly, Lewis projectile points have base heights that are less than notch heights but base widths that are narrower than blade widths. Irvine projectile points have base heights that can be greater than or less than notch heights while base widths are less than blade widths. Finally, High River projectile points, being corner notched (i.e., base height is zero or absent), have base heights smaller than notch heights and base widths narrower than blade widths.

Therefore, projectile points with base heights larger than notch heights (i.e., base height-notch height index greater than 100) include Washita, Pekisko, Paskapoo, and Irvine. Plotting the frequencies of these types/varieties of projectile points by their base-body indices, the majority of specimens would be expected to cluster together where base width is greater than blade width (i.e., more Washita and Pekisko than Paskapoo or Irvine projectile points). At the very least, an irregular curve should be generated in which specimens are clustered along the axis of the base-body index where base width is greater than blade width (i.e., Washita and Pekisko), base width is equal to blade width (i.e., Paskapoo), and base width is less than blade width (i.e., Irvine).

Figure 81 illustrates the frequency of projectile points with left and right base height values greater than notch height values, plotted against their base-body indices. Instead of the expected irregular curve, a curve more similar to a normal curve is present. This suggests a fairly homogeneous distribution of projectile points with base heights larger than notch heights, across the various base-body index values.

Projectile points in which the base height is smaller than notch height (i.e., base height-notch height index less than 100) include Nanton, Lewis, Irvine, and High River. Plotting the frequencies of the types/varieties of projectile points by their base-body index, the majority of specimens would be expected to cluster where base width is less than blade width (i.e., more Lewis, Irvine, and High River rather than Nanton). At the very least, an irregular curve should be expected in which clusters of specimens should occur along the axis of the base-body index. A smaller cluster should appear where base width is greater or equal to blade width (i.e., Nanton), and a relatively larger cluster where base width is less than blade width (i.e., Irvine, Lewis, and High River).

Figure 82 illustrates the frequency of projectile points with left and right base height values smaller than notch height values, plotted against the base-body index.

As above, the curve is similar to a normal curve, although noticeably skewed, and suggests a fairly homogeneous distribution of projectile points with base heights smaller than notch height, across the various base-body index values.

These distributions suggest that the types/varieties of projectile points defined by the existing classification have been forced onto the data through the creation of arbitrary divisions in a continuum of data values. Variation within these attributes is interpreted as normally distributed, and not susceptible to further subdivisions. Further examination of internal morphological variability is beyond the scope of this thesis.

Indices

Forbis (1962:87-92), having noted that certain attributes were chronologically sensitive, plotted level-by-level average values for both the base-body index and the base height-notch height index to demonstrate level-by-level trends in the indices for Late Side-notched projectile points at the Old Women's Buffalo Jump. It is my contention that these trends are found in the Cayley Series projectile points. As evidence of this, the following compares Forbis' indices for the Old Women's Buffalo Jump to the indices of Head-Smashed-In Buffalo Jump, the Junction site, the Ross site, as well as the data for the reevaluated Old Women's Buffalo Jump. First, I will review the base-body index, followed by the base height-notch height index. I will finish by introducing another chronologically sensitive figure--the notch depth-notch height index.

Recall that "...a [base-body] index below 100 indicates that the base is wider than the body [blade]; above 100, the body [blade] is wider than the base" (Forbis 1962:87). At the Old Women's Buffalo Jump, Forbis (1962:87) noted that the base-body index gradually decreased through time indicating the blade was becoming narrower relative to the base through time. The data from the reevaluation of the Old Women's material produced a similar trend, with comparable index values (Figure 83) to Forbis' (1962:88, Figure 7) original assessment. Similarly, at Head-Smashed-In Buffalo

Jump, the base-body index decreases through time. Interestingly, in the earliest levels it drops off slightly, exhibiting a trend also found in the reevaluation of the Old Women's material (Figure 84). The base-body indices at the Junction site and Ross site do not change substantially through time (Figure 85). As expected given the ages of the assemblages, the indices for both sites are comparable to the values from the middle levels of the Old Women's Buffalo Jump and Head-Smashed-In Buffalo Jump.

The nature of the base height-notch height index is that "...a [base height-notch height index] figure over 100 indicates that the basal edge height [base height] is greater than the notch width [notch height]; less than 100, the [notch height] is greater" (Forbis 1962:90). Forbis (1962:90) demonstrated that the index increased consistently from early to late times at the Old Women's Buffalo Jump indicating that, through time, base height is increasing relative to notch height.

The reevaluation of the Old Women's material (Figure 86) produced very comparable results to Forbis' (1962:91, Figure 9) original findings. The indices from Head-Smashed-In Buffalo Jump followed the trend in the earliest levels but were not as comparable in the most recent levels (Figure 87). The Ross site exhibited the trend towards increasing index values through time (Figure 88). As expected, the Ross index values correlate well with the most recent levels of the Old Women's Buffalo Jump. The Junction site also produced indices that increase through time (Figure 88). Predictably, the indices correlate well with the indices from the middle levels at the Old Women's Buffalo Jump.

The last index I wish to discuss is the notch depth-notch height index. This index has not been used elsewhere but is included here owing to its chronological sensitivity. The notch depth-notch height index is derived by dividing notch depth by notch height and multiplying by 100. A notch depth-notch height index over 100 indicates that the notch depth is greater than the notch height; less than 100, the notch height is greater than the notch depth.

At the Old Women's Buffalo Jump, the index gradually increases through time until the most recent levels when it changes very little (Figure 89). Similarly, at

Head-Smashed-In Buffalo Jump, in the earlier levels there is a trend towards an increase in the index values through time with little change in the index values in the most recent levels (Figure 90). The indices from the Ross site are fairly consistent (Figure 91). This is expected as the age of the site is comparable to the more recent levels of the Old Women's Buffalo Jump and Head-Smashed-In Buffalo Jump, which exhibit consistent index values. Indices at the Junction site exhibit a tendency to increase through time (Figure 91). Again, the indices correlate best with index values from the middle levels of the Old Women's Buffalo Jump and Head-Smashed-In Buffalo Jump.

Comparable Assemblages

A review of the literature indicates that there are a number of sites with projectile point assemblages exhibiting considerable similarity to the Cayley Series projectile points. At the outset, however, I wish to clarify that most researchers have not recorded attributes in a manner that is entirely compatible with the database in this study. Therefore, any remarks concerning comparisons and/or contrasts are conditional and preliminary. Notwithstanding these reservations, the projectile point assemblages considered comparable to the Cayley Series projectile points come from sites in Saskatchewan (including the Garratt site, the Tschetter site, the Lucky Strike site, the Bakken-Wright site, the Estuary Bison Drive site, and the Gull Lake Bison Drive), sites in Alberta (including the Ramillies site, the Majorville Medicine Wheel site, the Saamis site), and sites in Montana (including the Bootlegger Trail Site, the Boarding School Bison Drive site, the Galata site, and the Antonsen site).

At the Garratt site, near Moose Jaw in south-central Saskatchewan, the uppermost components date from 1150 B.P. to 650 B.P. (Meyer 1988) and contain Late Side-notched projectile points (Morgan 1979). These projectile points have been classified as Prairie Side-notched (n=19), Plains Side-notched (n=2), and Plains Triangular [preforms] (n=8) projectile point types under the existing classification system (Morgan 1979:263-267).

Morgan (1979:264-265) recorded mean, minimum, and maximum values for length, width [blade width], thickness, basal width [base width], notch width [notch height], neck width, and ear thickness [base height]. These values fall within the range of the Cayley Series projectile points. Base height, being a time-transgressive continuous attribute, suggests the site dates more recently than 1150 B.P. to 650 B.P. In contrast, the various forms of basal edge shape occur at frequencies that indicate an early date for the site. This is owing to the high frequency of convex basal edge shapes and an associated low frequency of concave basal edge shapes. An examination of the illustration of projectile points with broad shallow notches, low base heights, and narrow bases relative to their blade widths, lead me to suspect an early date (i.e., 1250 B.P. to 650 B.P.) for the projectile points from the Upper Components of the Garratt site (Morgan 1978, Plate 1 and 2).

The Tschetter site, near Saskatoon in central Saskatchewan, is a bison pound kill site that dates to approximately 1150 B.P. to 950 B.P. (Prentice 1983). The Late Side-notched projectile points recovered from the Tschetter site have been classified as Prairie Side-notched projectile points (Prentice 1983:32, 99-102). Of the discrete attributes, only cross-section and basal edge shape were recorded in a comparable method to those used in this study. The various forms of both attributes have strikingly similar frequencies to the early period (1250 B.P. to 650 B.P.) of Cayley Series projectile points.

For continuous attributes, length, width of body [blade width], width of neck [neck width], width of base [base width], thickness, length of notch [notch height], depth of notch [notch depth], length of basal edge [base height], and weight were recorded. The similarity between the values of the continuous attributes at the Tschetter site with those of the Cayley Series projectile points is again striking. This is especially true of base height values, which are relatively small suggesting an early period date. This inference is supported by radiocarbon dates of 1005 $\pm$ 75 B.P. (s-669) and 914 +/- 45 B.P. (NMC-1265) (Prentice 1983:32).

The Lucky Strike site is located in the parkland of central Saskatchewan and contains both a large northerly habitation area and a smaller southerly habitation area (Wilson 1984). The latter has a radiocarbon date of 1020 ± 90 B.P. (s-2281) and the former has a radiocarbon date of 875 ± 95 B.P. (S-2280) (Wilson 1984:24). The projectile points (n=4) from both habitation areas have been classified as Prairie Side-notched projectile points (Wilson 1984:21-23).

A review of the continuous attributes for the Lucky Strike projectile points indicates they are not dissimilar to the Cayley Series projectile points. Unfortunately, these attributes (i.e., length, width, thickness) are not useful in differentiating between Cayley Series and Mortlach Group projectile points. In contrast to the continuous attributes, the discrete attributes can distinctly assign the projectile points to the Cayley Series projectile points. This is witnessed in broad shallow notch forms and the occurrence of high frequencies of convex basal edge shapes (Wilson 1984).

The Estuary Bison Pound site, located along the South Saskatchewan River in southwestern Saskatchewan, contains Late Side-notched projectile points classified as Prairie Side-notched in its uppermost level (Adams 1977). Dates for this level include a radiocarbon date of 1020 ± 80 B.P. (GaK-3809) and a collagen date of 1070 ± 70 B.P. (S-640) (Adams 1977:38).

The discrete attributes of these projectile points conform best to the pattern for the early period of the Cayley projectile points. This is witnessed in the high frequency of convex basal edge shapes (42.3%), and moderate frequencies of concave (34.6%) and straight (23.1%) basal edges shapes (Adams 1977:46).

Continuous attributes used in the analysis of the Estuary projectile points include length, shoulder to base [shoulder height], maximum width [blade width], width of base [base width], thickness, notch length [notch depth], notch depth [notch height]. All but one of the continuous attributes fall within the range of both Cayley Series and Mortlach Group projectile points. The exception, notch height, is most comparable to Cayley Series projectile points. In addition, an inspection of a photographic plate (Adams 1977, Figure 18) further confirms my suspicion these are Cayley Series projectile points. Most notably similar to the Cayley Series projectile points are the obtuse base and shoulder angles on specimens in the Estuary assemblage.

The Bakken-Wright site is a multicomponent bison kill site located along the Frenchman River in southwestern Saskatchewan. Component A, the uppermost component, is sterile; components B and C contain projectile points classified as Plains and Prairie Side-notched projectile points, while components D, E, and F contain Prairie Side-notched and Avonlea projectile points (Adams 1975).

Unfortunately, the Bakken-Wright projectile points are first separated into varieties based on Kehoe's (1966) classification (Adams 1975). Then, a summary of projectile point data for each projectile point variety is offered. This makes comparing the Bakken-Wright projectile point data to my stratigraphically summarized data very difficult. Nonetheless, illustrations of the Late Side-notched projectile points from the Bakken-Wright site lead me to classify the specimens as examples of early Cayley Series projectile points. I base my designation on the obtuse shoulder and base angles, broad shallow notch forms, and apparently small base heights.

The Gull Lake Bison Drive, located in southwest Saskatchewan, is one of the few well stratified sites that contain Late Side-notched projectile points that are comparable to the Cayley Series projectile points. Kehoe (1966) classified the projectile points from levels 6 to 14 (ca. 650 B.P. to the Historic Period) as Plains Side-notched projectile points and those from levels 15 to 24 (ca. 1250 B.P. to 650 B.P.) as Prairie Side-notched projectile points.

In the earliest levels containing Late Side-notched projectile points (i.e. levels 15-24), convex (48.6%) and straight (39.3%) basal edge shapes are common while concave (11.7%) basal edge shapes are rare (Kehoe 1973:66-67). These frequencies are most comparable to the basal edge shape frequencies of the early Cayley Series projectile points. In the more recent levels (i.e., levels 6-8), however, straight (80.0%) basal edge shapes are most common and convex (5.7%) and concave (14.3%) are rare (Kehoe 1973:66-67). Somewhat surprisingly, these levels have basal edge frequencies most similar to the Mortlach Group projectile points.

Continuous attributes of the Late Side-notched projectile points from the Gull Lake Bison Drive site that are useful in differentiating the Cayley Series projectile points from the Mortlach Group projectile points include notch height, notch depth, and base height. Notch height values are distributed over roughly the same range of values as the Cayley Series projectile points. The mean notch height values are slightly larger than those expected for the Cayley Series projectile points but substantially larger than those expected for the Mortlach Group projectile points. In addition, like the Cayley Series projectile points, notch height values appear to increase slightly back in time.

The notch depth values on Late Side-notched projectile points from the Gull Lake Bison Drive site have levels which exhibit mean and range values similar to both the Cayley Series and Mortlach Group projectile points. The mean base height values follow the Cayley Series projectile point pattern and increase through time. Base heights are never as low as those in the earliest levels described for the Cayley Series projectile points, however.

Indices provide another line of evidence for the similarity between Gull Lake projectile points and the Cayley Series projectile points. Kehoe (1966:34-838) demonstrates the similarity in the trends of the Gull Lake indices (i.e., base-body index and base height-notch height index) and the trends Forbis (1962) found for the Old Women's Buffalo Jump. I have already demonstrated the indices at the Old Women's Buffalo Jump and the Cayley Series projectile points are very similar. An ensuing discussion on Mortlach Group projectile point indices demonstrates they are not comparable to either the Old Women's Buffalo Jump or other sites with the Cayley Series projectile points.

An inspection of photographic plates of the Late Side-notched projectile points from the Gull Lake Bison Drive site supports the contention that these projectile points are very comparable to the Cayley Series projectile points (Kehoe 1973, Plate 13, 14). The projectile points exhibit obtuse shoulder and base angles, a wide range of basal edge shapes, and the notch forms tend to be broad and shallow.

My preliminary reexamination of a sample of Late Side-notched projectile points (n=72) from the Gull Lake Bison Drive site indicated that the attribute trends approximate those of the Cayley Series projectile points. Base height values increase through time from an average of 1.8 mm in level 24, to 2.6 mm in level 18, 3.4 mm in level 15, and finally 4.3 mm in level 6-8. These base height values roughly correlate with base height values from levels of comparable ages in other sites with Cayley Series projectile points. Likewise, other continuous attributes on projectile points from the Gull Lake Bison Drive site exhibit similarity to trends in the Cayley Series projectile points. In levels 6-8, 15, 18, and 24, average notch depth values (2.4 mm, 2.0 mm, 1.7 mm, 2.0 mm, respectively), notch height values (2.4 mm, 3.9 mm, 3.8 mm, 4.3 mm, respectively), shoulder angle values (111°, 111°, 109°, 114°, respectively), distal base angle values (112°, 110°, 113°, 112°, respectively), and proximal base angle values (109°, 106°, 108°, 122°, respectively) remain fairly constant through time and closely approximate values of the Cayley Series projectile points. As before, the remaining continuous attributes (i.e., length, thickness, base width, blade width, neck width, and shoulder height) occur over values common to both the Cayley Series and Mortlach Group projectile points.

Discrete attributes also strongly suggest the Gull Lake Bison Drive site contains Cayley Series projectile points. For the early period at the Gull Lake Bison Drive site (levels 15, 18, and 24), straight basal edge shapes occur at a frequency of 40%, concave basal edge shapes at 20%, convex basal edge shapes at 30%, and irregular basal edge shapes at 10 %. Although not identical, these frequencies closely approximate the values prescribed for the early period of the Cayley Series projectile points (ca. 1250 B.P. to 650 B.P.). Similarly, in the late period (ca. 650 B.P. to the Historic Period), straight (53.6%), concave (21.4%), convex (14.3%), oblique (7.1%), and irregular (3.6%) basal edge shape frequencies roughly correspond to values found in the late Cayley Series projectile points. Other discrete attributes (i.e., outline form, notch type, cross-section, and flaking pattern) occur at frequencies similar to both the Cayley Series projectile points and Mortlach Group projectile points.

Continuing my survey of comparable assemblages to the Cayley Series projectile points, the Ramillies bison kill site, located in southeastern Alberta, had a major period of site occupancy between ca. 1800 B.P. and 1000 B.P. by people of the Avonlea and Old Women's Phases (Brumley 1976). Late Side-notched projectile points were attributed to occupations I and II and classified after Forbis (1962). The attributes were summarized using Forbis' types, not by stratigraphic level, making them difficult to compare to the database in this study. Nonetheless, an examination of photographic plates illustrating the Late Side-notched projectile points strongly suggests the specimens are similar to those dating roughly to the middle of the Cayley Series projectile point sequence. Shoulder and base angles are obtuse, notch forms are broad and shallow, base heights appear to be moderately low, and numerous base widths appear to be narrower than the blade widths. This inference is supported by the radiocarbon date associated with these projectile points of 965 ± 65 B.P. (S-1015).

The Majorville Medicine Wheel, located in south-central Alberta, consists of a central cairn from which spokes radiate out to an encircling ring (Calder 1977). A continuous sequence dating back to the Oxbow Phase was suggested. Late Side-notched projectile points, attributed to the Old Women's Phase, were largely recovered from the uppermost layers of the accretional dome of the central cairn (Calder 1977:230). The projectile points were classified using Forbis' (1962) typology. Unfortunately, the attributes were summarized under Forbis' types, not by accretional levels, making it difficult to compare the information to the database in this study.

An illustration of the Late Side-notched projectile points from the Majorville Medicine Wheel leads me to suggest these projectile points are Cayley Series projectile points (Calder 1977:248-249, Figure 32). In fact, the entire sequence of Cayley Series projectile points appears to be represented. I say this because of the presence of obtuse shoulder and base angles, base heights ranging from corner notching to very high base heights, and blade widths which range from much wider than base width to much narrower than base width.

The Saamis site is a protohistoric campsite in southeastern Alberta at which two temporally segregated terraces were occupied (Milne Brumley 1978). The Late Side-notched projectile points were classified using Forbis' (1962) typology. Unfortunately, temporal separation of the cultural material was ignored and the projectile point assemblages were summarized together using Forbis' typology. As above, this makes it difficult to compare the information to the database in this study.

An illustration of the Late Side-notched projectile points from the Saamis site leads me to suggest they are very comparable to the Cayley Series projectile points (Milne Brumley 1978:185). More specifically, these projectile points could be attributed to the most recent period of Cayley Series projectile points owing to apparently large base heights, the frequent occurrence of projectile points with base widths that are wider than blade widths, and the general lack of convex basal edges.

The Boarding School Bison Drive, in northwestern Montana, is a highly stratified site containing Late Side-notched projectile points (Kehoe 1967). The projectile points have been classified as Plains Side-notched (n=180) and Prairie Side-notched (n=32) projectile points (Kehoe 1967: 40-46). The attributes of the projectile points were summarized under the variety designations and not by stratigraphic levels. This makes it difficult to compare the frequency and values of attributes to the database in this study.

Plates 11 and 12 illustrate the Late Side-notched projectile points at the Boarding School Bison Drive site. The presence of obtuse shoulder and base angles, moderately broad and moderately deep notch forms, moderately high base heights, a strong tendency for base widths to be as wide or wider than blade widths suggests that these projectile points are most similar to the more recent Cayley Series projectile points.

A site geographically close to the Boarding School Bison Drive site, the Bootlegger Trail site, consists of two cultural levels that contain Late Side-notched projectile points (Roll and Deaver 1978). The levels are expected to date between 550 B.P. and 450 B.P., with level I being more recent than level II.

The continuous attributes of the projectile points exhibit values that are comparable to both the Cayley Series and Mortlach Group projectile points and, therefore, are not useful in differentiating between them (Roll and Deaver 1978:111-113). In terms of discrete attributes, the frequency of basal edge shapes in level II are most similar to the frequency of basal edge shapes of the early period (1250 B.P. to 650 B.P.) of the Cayley Series projectile points, while level I basal edge shapes are most similar to the most recent period (650 B.P. to the Historic Period) of the Cayley Series projectile points (Roll and Deaver 1978: 113).

At the Taft Hill Buffalo Jump, located south of the Bootlegger site in northwestern Montana, Shumate (1967) classified the Late Side-notched projectile points using Forbis' (1962) typology. In correlating projectile point types with those in the Old Women's Buffalo Jump, Shumate (1967) suggested the site may have been used as early as 1000 B.P. Based on illustrations of the projectile points, I agree with Shumate on the similarity of these projectile points to the Old Women's projectile points and assign them to the Cayley Series projectile point. Furthermore, I concur with Shumate's estimate of the age of the initial occupation.

The Galata site, in northwestern Montana, appears to be a single component occupation dating to 270 ± 60 B.P. (SI-89) (Long 1965 in Byrne 1973:387, Miller 1963). The site contained Late Side-notched projectile points, however, neither continuous nor discrete attributes of these projectile points were recorded. Plate 43 illustrates the projectile points from the Galata site (Miller 1963). The projectile points exhibit at least superficial similarity to the Cayley Series projectile points. This is suggested by the presence of both broad deep and broad shallow notch forms, the predominance of concave and straight basal edge shapes, and the occurrence of obtuse shoulder and base angles. The apparent presence of oblique flaking patterns on a number of the Galata specimens, however, is unusual for Cayley Series projectile points. With some reservations, I assign these specimens as Cayley Series projectile points.

At the Antonsen site, in southwestern Montana, excavations in Area A exhibit cultural deposits consisting of two continuous but inconsistently separated levels (Davis and Zeier 1978). These deposits were attributed to the Old Women's Phase and the projectile points were classified using formal attributes described by Forbis (1962) and Kehoe (1966). A bone collagen date of less than 180 radiocarbon years (I-7849) led Davis and Zeier (1978:234) to suggest an age of post-A.D. 1770 for the Old Women's Phase material. Neither continuous nor discrete attributes were presented for the projectile points. Regardless, an inspection of the photographic plates of the specimens indicates narrow deep notch forms, predominantly concave and straight basal edges shapes, and base widths wider than blade widths (Davis and Zeier 1978:230, Figure 21.8). Like the Galàta material, it is with some reservation that I assign these projectile points to the Cayley Series projectile points.

Cayley Series Projectile Points and the Old Women's Phase

Using the Late Side-notched projectile point samples analysed in this study (i.e., Old Women's, Head-Smashed-In, Junction, Ross, Walter Felt, Lake Midden, Stony Beach, EeNd-3, Bill Richards, and Sanderson) I have demonstrated that projectile points I have labeled as Cayley Series were present on the plains of southern Alberta and southern Saskatchewan, between ca. 1250 B.P. and 650 B.P. Subsequent to this period, from ca. 650 B.P. to the Historic Period, the Cayley Series projectile points are apparently only found in southern Alberta, while in southern Saskatchewan, projectile points I have labeled as Mortlach Group projectile points replaced Cayley Series projectile points.

Each of the projectile point assemblages I have labeled as Cayley Series projectile points are from sites attributed to the Old Women's Phase. The Old Women's Phase, as I noted in Chapter One, is defined by the presence of Late Variant pottery of the Saskatchewan Basin Complex (Byrne 1973), as well as Prairie Side-notched and/or Plains Side-notched projectile points (Brumley and Dau 1988:55).

Pottery from the Old Women's Buffalo Jump (Byrne 1973:365), the Ross site (Byrne 1973:365), and the Junction site (Unfreed pers. comm.) has been classified as Late Variant pottery of Saskatchewan Basin Complex. At Head-Smashed-In Buffalo Jump, pottery has not been recovered from the kill site, but Late Variant pottery of the Saskatchewan Basin Complex has been recovered from the processing areas below. Pottery in levels 6 and 7 at the Walter Felt was initially classified as Woodland ceramic tradition by Kehoe and Kehoe (1968:31-32). Presumably they are referring to Wascana Ware of the Pisamiks Tradition. The Pisamiks Tradition also included Ethridge Ware--pottery, which Byrne (1973:528) regarded as corresponding to the description of the Late Variant pottery of the Saskatchewan Basin. More recently, however, Walde (1994:305) has noted the similarity of the pottery in levels 6 and 7 to the Mortlach pottery in levels 1 to 5. Their stratigraphic position is explained as possibly a result of artifact mixing.

At the aforementioned sites, the reclassification of Prairie Side-notched and Plains Side-notched projectile points with Cayley Series projectile points produces an association between Cayley Series projectile points and Late Variant pottery of the Saskatchewan Basin Complex. This suggests the Old Women's Phase requires redefinition. In support of this hypothesis, the sites which were considered to have comparable projectile point assemblages to the Cayley Series projectile points will be examined for pottery which can be attributed to the Late Variant of the Saskatchewan Basin Complex.

Recently, Meyer (1988:57) in a synthesis of Saskatchewan sites exhibiting thick-walled pottery and Prairie Side-notched and/or Plains Side-notched points, has suggested the pottery from the Garratt site closely resembles the Late Variant pottery of the Saskatchewan Basin Complex and assigned the material to the early period (1150 B.P. to 650 B.P.) of the Old Women's Phase.

Initially, pottery at both the Tschetter site (Prentice 1983:133-134) and the Lucky Strike site (Wilson 1984:11-12) was attributed to the Early Variant pottery of the Saskatchewan Basin Complex. More recently, Meyer (1988:59) has suggested the pottery from these sites most closely resembles pottery from the early Old Women's Phase (1150 B.P. to 650 B.P.).

At the Estuary Bison Pound site and the Bakken-Wright site, pottery was recovered but were not classified (Adams 1973:147-151, Adams 1977:97). Therefore, it is not possible to determine whether the pottery from these sites correspond to those classified as Late Variant pottery of the Saskatchewan Basin Complex. Regardless, I still contend the projectile points from the Estuary and Bakken-Wright site are best described as Cayley Series projectile points.

In the complete report of the Gull Lake Bison Drive site, all the pottery associated with Late Side-notched projectile points was initially classified as Ethridge Ware assigned to the Pisamiks Tradition (Kehoe 1973:118-125). Subsequently, Byrne (1973:528) suggested: "...the Ethridge Ware definition appears to correspond to the approximate description of the Late Variant of the Saskatchewan Basin Complex." Interestingly, in a previous report on Gull Lake pottery some simple stamped sherds were recovered from the surface and one sherd bearing an incised rainbow motif was recovered from the upper layers of the site; a southern origin was suggested for these ceramics (Kehoe and Kehoe 1968:31-33). This potsherd, however, was not mentioned in the pottery section of "The Gull Lake Bison Drive" report (Kehoe 1973:118-125)

Pottery at the Ramillies site was considered akin to pottery of the Saskatchewan Basin Complex (Brumley 1976:60). At the Majorville Medicine Wheel, the majority of ceramic sherds were classified as Late Variant pottery of the Saskatchewan Basin Complex (n=13) while the remaining sherds were classified as Early Variant pottery of the Saskatchewan Basin Complex (n=8). Problems in stratigraphic interpretation make it difficult to determine the relationship between the pottery and the projectile points.

At the Saamis site, the vast majority of the pottery was classified as Saskatchewan Basin Complex (97.8%) while the remaining pottery was classified as Cluny Complex (2.2%). Within the Saskatchewan Basin Complex, the greatest number of sherds were attributed to the Late Variant (Milne Brumley 1978:109-126).

Pottery was not recovered from the Boarding School Bison Drive site (Kehoe 1967). Brumley and Rennie (1993:36-41) suggest the Boarding School Bison Drive, among other sites in northern Montana, is part of a cultural unit exhibiting Prairie and/or Plains Side-notched projectile points, mandibles exhibiting green tooth wear, and possibly pottery that remains to be recovered and described. They have labeled this cultural unit the Saddle Butte Complex. Until a firsthand analysis of the Boarding School Bison Drive projectile points has been conducted, and a full description of the Saddle Butte Complex pottery is published, it is difficult to be certain about the phase designation for this site.

Pottery from the Bootlegger Trail site was considered comparable to pottery of the Late Variant pottery of the Saskatchewan Basin Complex (Roll and Deaver 1978:141). Likewise, at the Taft Hill Buffalo Jump "...most pottery from both the jump and associated campsite, seems to bear a close resemblance to ceramics from the Oldman River Region [Ross site] in southern Alberta and to Ethridgeware of the upper Marias River drainage in northcentral Montana" (Shumate 1967:23-24). I have already noted that the Ross site pottery and Ethridge Ware have been classified as Late Variant pottery of the Saskatchewan Basin Complex. Pottery from the Galata site also appears to be very similar to the Late Variant of the Saskatchewan Basin Complex (Byrne 1973:386-387).

Lastly, the published report on the Antonsen site does not mention pottery (Davis and Zeier 1978). This is unfortunate as I tentatively assigned the Antonsen projectile points as Cayley Series projectile points. Therefore, without information concerning the pottery or a firsthand examination of the projectile points from the site, any phase designation is fairly speculative.

Based on the above discussion, a tentative spatial-temporal distribution of the Old Women's Phase can be outlined. Following Meyer (1988), an early expression of the Old Women's Phase (ca. 1250 B.P. to 650 B.P.) can be found across south-central and southwestern Saskatchewan, southern Alberta, and possibly northern Montana. The later expression of the Old Women's Phase is found in southwestern Saskatchewan, southern Alberta, and possibly northcentral Montana.

Mortlach Group Projectile Points

As demonstrated in Chapter Four, the projectile points from the Stony Beach site, the Lake Midden site, EeNd-3, the Bill Richards site, the Sanderson site, and levels 1 to 5 of the Walter Felt Site exhibit similar trends in their continuous and discrete attributes. Furthermore, these attribute trends distinguish these projectile points from the remaining assemblages at the Old Women's Buffalo Jump, Head-Smashed-In Buffalo Jump, the Ross Site, the Junction Site, and levels 6-7 of the Walter Felt Site. Since the existing classification system for Late Side-notched projectile points does not recognize this distinction I offer a reclassification of the projectile points to correct the inadequacy.

As mentioned above, traditionally, Late Side-notched projectile points from the Northwestern Plains have received their names from the townsites in Alberta, Saskatchewan, and Montana. Because the first formal attempt at classifying projectile points of this type was by Boyd Wettlaufer (1956) at the Mortlach site, near the town of Mortlach, Saskatchewan, I feel it is appropriate to refer to these projectile points as "Mortlach." Hence, the projectile point assemblages from the Stony Beach site, the Lake Midden site, EeNd-3, the Bill Richards site, the Sanderson site, and levels 1 to 5 of the Walter Felt site will be referred to as Mortlach Group projectile points.

General Characteristics

The following provides the parameters of the attributes of the Mortlach Group projectile points by summarizing the values of each of the attributes. For discrete attributes I provide the frequency of occurrence for the various forms of each attribute. For continuous attributes I provide the mean, standard deviation, minimum, and maximum values for each of the attributes. As above, the attributes and descriptions in the text below that have **bold lettering** are the most useful in differentiating between Cayley Series and Mortlach Group projectile points (an idealized illustration of some Mortlach Group projectile points and their spatial/temporal relationship with Cayley Series projectile points is presented in Figure 80).

Discrete Attributes

Basal edge shape

- **the preference was for straight (73.5%) basal edge shape, followed by concave (19.0%), and convex (4.0%) basal edge shape. Notched (0.2%), oblique (0.2%), spurred (0.2%), and irregular (2.8%) basal edge forms occur infrequently.**

Notch types

- side-notches (98.1%) are the most common, while both corner notching (0.8%) and side-corner notching (0.6%) occur in very low frequencies. Side and basal (0.2%) and side and corner (0.2%) occur are very infrequent. Apparently, stemmed notched types do not occur.

Notch Form

- **U-shaped narrow (53.1%) notch forms occur in very high frequencies, while at lower frequencies, U-shaped broad (12.0%), round shallow (11.8%), V-shaped broad (6.8%), and angular broad (6.6%) notch forms are also common. All other notch forms, angular narrow (1.1%), round deep (3.2%), V-shaped narrow (0.9%), rectangular broad (2.7%), and rectangular narrow (1.8%) occur infrequently.**

Flaking Pattern

- irregular (80.6%) flaking patterns occurs most frequently, followed by edge modified (12.5%), parallel (2.9%), double diagonal (2.9%), and diagonal oblique (0.9%) flaking patterns.

Outline symmetry

- asymmetrical (93.1%) outline forms are most common, with few symmetrical outline forms (6.6%), while intentionally asymmetrical outline forms (0.2%) occur infrequently.

Cross-section

- convex asymmetrical (63.8%) occurs most frequently, followed by convex symmetrical (14.5%), plano-convex (11.5%), plano-triangular (9.8%), and convex triangular (0.4%). Apparently, biplano cross-sections are absent.

Base Forms

- **the most common base form is "rectangular" (#6, 53.8%), followed by "fish-tailed" (#2, 9.6%), "oblong" (#3, 1.8%), "barn" shaped (#4, 3.3), "pie pan" shaped (#5, 5.4%), and "double-hooked" shaped (#25, 3.1%) base forms. The remaining base forms occur at very low frequencies.**

Continuous Attributes

Base Height

- **base height values remain relatively constant through time.**
- **the mean base height value is 4.11 mm.**
- **the standard deviation of base height value is 1.21 mm**
- **the minimum base height value is 0.0 mm, the maximum base height value is 8.5 mm.**

Base Width

- base width values remains relatively unchanged through time.
- the mean base width value is 14.61 mm
- the standard deviation of the base width values is 2.45 mm
- the minimum base width value is 1.69 mm, the maximum base width value is 24.47 mm.

Blade Width

- blade width values remains fairly consistent through time.
- the mean blade width value is 13.82 mm.
- the standard deviation of blade width is 2.25 mm.
- the minimum blade width value is 1.56 mm, the maximum base width value is 20.81 mm.

Length

- length values remain relatively unchanged through time.
- the mean length value is 21.28 mm.
- the standard deviation of length values is 4.24 mm.
- the minimum length value is 8.0 mm, the maximum length value is 35.9 mm.

Neck width

- neck width values are very consistent through time.
- the mean neck width value is 9.56 mm.
- the standard deviation of neck width values is 4.85 mm.
- the minimum neck width value is 4.95 mm, the maximum neck width value is 17.0 mm.

Notch Depth

- notch depth values remain constant through time.
- the mean notch depth value is 2.29 mm.
- the standard deviation of notch depth values is 0.65 mm.
- the minimum notch depth value is 0.3 mm, the maximum notch depth value is 4.35 mm.

Notch Height

- **notch height values tend to remain constant through time.**
- **the mean notch height value is 2.52 mm.**
- **the standard deviation of notch height values is 0.81 mm.**
- **the minimum notch height value is 1.05 mm, the maximum notch height value is 7.46 mm.**

Shoulder Height

- shoulder height values remain constant through time.

- the mean shoulder height is 6.82 mm.
- the standard deviation of shoulder height values is 1.16 mm.
- the minimum shoulder height value 2.49 mm, the maximum shoulder height value is 11.34 mm.

Thickness

- thickness values are very constant through time.
- the mean thickness value is 3.57 mm.
- the standard deviation of thickness values is 1.40 mm
- the minimum thickness value is 0.82 mm, the maximum thickness value is 6.28 mm.

Weight

- weight values are fairly consistent through time.
- the mean weight value is 1.18 grams.
- the standard deviation of weight values is 1.54 grams
- the minimum weight value is 0.30 grams, the maximum weight value is 6.00 grams.

Distal base angle

- **distal base angle values are very constant through time.**
- **the mean distal base angle is 99.06°.**
- **the standard deviation of distal base angle values is 99.06°.**
- **the minimum distal base angle is 10.0°, the maximum distal base angle is 180.0°.**

Proximal base angle

- **proximal base angle values remain very constant through time.**
- **the mean proximal distal base angle is 95.07°.**
- **the standard deviation of proximal base angle is 10.34°.**
- **the minimum proximal base angle value is 60°, the maximum proximal base angle value is 152°.**

Shoulder angle

- **shoulder angle values exhibit little change through time.**
- **the mean shoulder angle is 91.77°.**
- **the standard deviation of shoulder angle values is 15.21°.**
- **the minimum shoulder angle value is 0.0°, the maximum shoulder angle value is 146.0°.**

The above establishes the parameters of the Mortlach Group projectile points and indicates a substantial amount of variability within the attributes. As with the review of the morphological variability within the Cayley Series projectile points, I will address the Mortlach Group projectile point morphological variability using indices.

Morphological Variability

Above, in the section on Cayley Series projectile points entitled "Morphological Variability," the inadequacy of both Forbis' (1962) and Kehoe's (1966) approach to defining internal variability was demonstrated. Nonetheless, for comparative purposes to the Cayley Series projectile points, I present complementary information on projectile point variability for the Mortlach Group projectile points.

Figure 92 illustrates the frequency of projectile points with left and right base height values greater notch height values, plotted by their base-body indices. As with the Cayley Series projectile points, the distribution of values is similar to normal distributions.

Figure 93 illustrates the frequency of projectile points with left and right base height values smaller than notch height values, plotted by their base-body indices. This leptokurtic, or peaked distribution is in contrast to previous distributions. The values appear to cluster more than those of a normal distribution. As well, the number of specimens in which the base heights are smaller than notch heights appears to be disproportionately low in the Mortlach Group projectile points.

As above, variation within these attributes is interpreted as normally distributed and does not appear susceptible to further subdivision. Further examination of internal morphological variability in the attributes is beyond the scope of this thesis.

Indices

Index values have already been introduced in the section discussing the Cayley Series projectile points. Recall that three indices were discussed: (1) a base-body index, (2) a base height-notch height index, and (3) a notch depth-notch height index.

For Cayley Series projectile points, base-body indices exhibited a trend towards decreasing forward through time. In the Mortlach Group projectile points, however, the indices do not appear to change through time. At the Walter Felt site, levels containing projectile points labeled as Mortlach Group (i.e., levels 1 to 5) exhibit base-body indices that remain relatively constant (Figure 94). Specimens attributed as Cayley Series projectile points (i.e., levels 6 to 7) have indices that are in stark contrast to the Mortlach Group indices. The indices for the projectile points from levels 6 and 7 at the Walter Felt site are most comparable to the indices of comparable age (i.e., the earliest period) in the Cayley Series projectile points.

The base-body indices for the Sanderson site are comparable to those for the Mortlach Group projectile points at the Walter Felt site (Figure 95). Level 5-6, however, has an anomalous large index value for which I cannot account. The index values for the Lake Midden site, the Stony Beach site, EeNd-3, and the Bill Richards site are very comparable to each other, as well as to the Sanderson site and levels 1 to 5 at the Walter Felt site (Figure 96).

The base height-notch height index has previously been described as consistently increasing through time for the Cayley Series projectile points. For the Mortlach Group projectile points, the base height-notch height index does not exhibit change through time. Levels 1 to 5 at the Walter Felt site, have indices with values that are higher than any of those for the Cayley Series projectile points (Figure 97). In contrast, specimens in the Walter Felt site that have been attributed as Cayley projectile points (i.e., 6 to 7) exhibit substantially smaller index values which are most comparable to indices of the earliest levels of the Cayley Series projectile points.

The Sanderson site exhibits base height-notch height indices that are very comparable to the most recent levels of the Walter Felt site (Figure 98). That is to say, the base height-notch height indices are relatively consistent through time and occur over higher ranges of values than expected for Cayley Series projectile points. Likewise, the Stony Beach site, EeNd-3, and the Bill Richards site have base height-notch height indices that are most comparable to the indices of the Sanderson site and the most recent levels of the Mortlach site (Figure 99). The Lake Midden site exhibits a somewhat lower index value, which is still larger than most indices determined for the Cayley Series projectile point, but close enough to Mortlach Group indices not to be overly anomalous.

Lastly, for Cayley Series projectile points, notch depth-notch height indices exhibit little change in the most recent levels but, in the earliest levels the indices gradually increase through time. Compared to the Cayley Series indices, the indices for the Mortlach Group projectile points have higher values and remain relatively consistent through time. This is evidenced in the levels 1 to 5 of the Walter Felt site, where Mortlach Group projectile points have consistent and high index values (Figure 100). In contrast, the Cayley Series projectile points at the Walter Felt site (i.e., levels 6 and 7) have substantially lower index values, which are most comparable to indices in the earliest levels of the Old Women's Buffalo Jump and the Head-Smashed-In Buffalo Jump.

The notch depth-notch height index values for the Sanderson site are relatively large and consistent through time; the indices are very comparable to most recent levels of the Walter Felt site (Figure 101). As well, the Lake Midden site, the Stony Beach site, EeNd-3, and the Bill Richards sites have indices that are most comparable to the Sanderson site and levels 1 to 5 of the Walter Felt site (Figure 102).

Comparable Assemblages

A review of the literature indicates there are a number of sites with projectile point assemblages exhibiting remarkable similarity to the Mortlach Group projectile points. The sites I will discuss include the Mortlach site, the Long Creek site, and the Shippe Canyon site. The reservations outlined above concerning the comparability of my database to those in the literature also apply to any discussions concerning the Mortlach Group projectile points.

The Mortlach site, in south-central Saskatchewan, was interpreted as a campsite with an associated bison pound killsite (Wettlaufer 1955). The excavation at the campsite was reported while the work at the bison pound killsite was not. Levels 1A, 1B, 2A, 2B, and 3A of the campsite contained Late Side-notched projectile points that were classified as Plains Side-notched, Prairie Side-notched, and Plains Triangular projectile points after MacNeish (1954). Visual inspection of a photographic plate

(Wettlaufer 1955, Plate 1) leads me to suggest the projectile points are very similar to the Mortlach Group projectile points as defined here. Specimens 6 and 7 exhibit rectangular bases forms (#25) and right angled shoulder angles, proximal base angles, and distal base angles. In addition, these specimens have deep notches high on the blade, and straight and concave basal edges.

The Long Creek site is located in southeastern Saskatchewan. Level 1A and 1B contained the Late Side-notched projectile points which were classified after MacNeish (1954) as Plains Side-notched, Prairie Side-notched, or Plains Triangular. My visual inspection of the illustrated specimens from level 1A (Wettlaufer 1960:30; Plate 7: #1, 2, and 3) suggests that these projectile points are extraordinarily similar to those from the Mortlach Group projectile points. They exhibit shoulder angles, distal base angles, and proximal base angles all near right angles, producing the overall impression of a rectangular base forms (#25). Furthermore, the notches appear high on the base, with the notch depth being substantially deeper than the notch height. In level 1B, one specimen (Wettlaufer 1960:32 Plate 8, #1) exhibits strong similarity to the Mortlach Group projectile points while the remaining Late Side-notched projectile points (n=2) somewhat resemble early Cayley Series projectile points.

The Shippe Canyon site, located in the northeastern Montana, contains a single cultural occupation zone. Historic goods recovered from the occupation zone suggest a Protohistoric Period date for the site (Joyes 1973:80). Late side-notched projectile points were also recovered from this zone and were classified as Pekisko, Washita, and Paskapoo varieties of the Plains Side-notched projectile point type (Joyes 1973:72).

The continuous attributes are very comparable to those outlined for the Mortlach Group projectile points. Most importantly, the base height values were quite large while the notch height values remained quite small (Joyes 1973:74, Table 3). Visual inspection of the illustrated projectile points indicates that right angles are prevalent on the base and shoulders, basal edge shapes tend to be straight or slightly concave, and that U-shaped narrow notch forms are frequent. All these attributes suggest strong similarities to the Mortlach Group projectile points.

Mortlach Group Projectile Points and the Mortlach Phase

Above, I have argued that the projectile points I have labeled as Mortlach Group existed on the plains of southern Saskatchewan between ca. 650 B.P. and the Historic Period. The projectile points that were replaced by the Mortlach Group points I have labeled Cayley Series projectile points (the Cayley Series projectile points were common in southern Alberta and southern Saskatchewan between ca. 1250 B.P. to 650 B.P. but were replaced ca. 650 B.P., after which time they appear to have been restricted to southwestern Saskatchewan and southern Alberta to the Historic Period).

Presently, each of the projectile point assemblages I have labeled as Mortlach Group projectile points are from sites attributed to the Mortlach Phase (Walde 1994). The Mortlach Phase, as I noted in Chapter One, is defined by the presence of pottery exhibiting attributes derived from the Middle Missouri region as well as the Plains Side-notched projectile point (Joyes 1973; Meyer 1988:62; Walde 1984).

Pottery from the Lake Midden site, the Stony Beach site, EeNd-3, the Bill Richards site, the Sanderson site, and levels 1 to 5 of the Walter Felt site have been classified as pottery of the Mortlach Phase (Walde 1994). At the aforementioned sites, the reclassification of the Prairie Side-notched and Plains Side-notched projectile points as Mortlach Group projectile points produces the co-occurence of Mortlach Group projectile points and Mortlach pottery. This suggests the Mortlach Phase requires redefinition. In support of this hypothesis, the sites which were considered to have comparable projectile point assemblages to the Mortlach Group projectile points will be examined for pottery which can be classified as Mortlach pottery.

Wettlaufer's excavations at the Mortlach site led him to an initial definition of Mortlach pottery (Wettlaufer 1955). More recently, Walde (1994) has included the pottery from the Mortlach site within his definition of the Lozinsky Subphase, which is the Plains expression of the Mortlach Phase.

At the Long Creek site, pottery from the uppermost component was initially attributed to the Fall River Culture (Wettlaufer 1960:100). Subsequently, Joyes

(1973) has assigned pottery from layer 1 of the Long Creek site to the Mortlach Phase. Similarly, Walde (1994) attributed the Long Creek pottery to the Lozinsky Subphase of the Mortlach Phase. Along these same lines, pottery from the Shippe Canyon site was attributed to the Mortlach Phase (Joyes 1973). Walde (1994) apparently concurs with Joyes (1973) as he assigns the Shippe Canyon site pottery to the Lozinsky Subphase of the Mortlach Phase.

Furthermore, in his recent synthesis of the Mortlach Phase, Walde (1994) discusses a number of unpublished sites. Given the pattern established here, that Mortlach pottery occurs in association with Mortlach Group projectile points, I suspect the unpublished material will conform. To strengthen this stance, I note that in his synthesis, Walde (1994:87-88), in referring to projectile points associated with Mortlach pottery, stated that "...these points led me to suspect that they were significantly different in lithic raw materials used and in size and shape from other Plains Side Notch points associated with the Old Women's Phase in Alberta and from those recovered from Selkirk components in north-central Saskatchewan."

Based on the above discussion and Walde's (1994) recent synthesis of the Mortlach Phase, a tentative spatial-temporal distribution for the phase can be outlined. The Mortlach Phase occurs between ca. 650 B.P. to the Historic Period in southern Saskatchewan, northeastern Montana, northwestern North Dakota, and southwestern Manitoba.

Other Late Side-notched Projectile Points on the Northwestern Plains

Thus far I have argued that attribute trends in Late Side-notched projectile points from Alberta and Saskatchewan do not support the existing classification system. In other words, it is no longer tenable to classify projectile points under the rubrics of Prairie Side-notched and Plains Side-notched projectile points. Accordingly, I have reclassified the Prairie Side-notched and Plains Side-notched projectile points occurring in sites attributed to the Old Women's phase as Cayley Series projectile points and those occurring in Mortlach Phase sites as Mortlach Group projectile points.

Still, numerous other archaeological phases on the Northwestern Plains contain projectile points that have been classified as Prairie Side-notched and/or Plains Side-notched projectile points (i.e., Blackduck, Selkirk, Highwood, and One Gun). This begs the question: If the Prairie Side-notched and Plains Side-notched rubrics are no longer valid for Late Side-notched projectile points from Alberta and Saskatchewan, are they valid for other Late Side-notched projectile points on the Northwestern Plains? In dealing with this question, I will briefly discuss Prairie Side-notched and/or Plains Side-notched projectile point assemblages associated with the Blackduck Cultural Unit, the Selkirk Composite, the Highwood Phase, and the One Gun Phase.

The Blackduck Cultural Unit (ca. 1200 B.P. to 450 B.P.) occurs largely in the forest and forest edge of northern Michigan, eastern Minnesota, southern Manitoba, central Saskatchewan, and southwestern Ontario. Distinctive decorative traits on ceramics largely identify Blackduck material. As well, secondary traits occur such as triangular notched projectile points, tubular pipes, bone spatulates, and copper beads, to name a few.

At the Brockinton site, located along the Souris River in southwestern Manitoba, there is a Blackduck Cultural Unit occupation (occupation two) with a date of ca. 750 B.P. I concur with Whelan (1976) when he argued against classifying these projectile points as Prairie Side-notched and Plains Side-notched projectile points.

My inspection of the illustrations of the Brockinton projectile points indicate they are not comparable to the Cayley Series and Mortlach Group projectile points (Whelan 1976:17, Plate 6). Their dissimilarity from both the existing and current classification systems is illustrated by that fact that basal edges are almost invariably straight, blade widths tend to be greater than base widths, proximal base angles appear to be right angles, distal base angles and shoulder angles appear to be obtuse, base heights are fairly high, notch shapes are largely V-shaped broad, and mean length (mean=23.21 mm; occupation two, Brockinton) is relatively large.

The Stott site, located on the Assinibione River Valley in southwestern Manitoba, has been interpreted as largely a single component, multi-occupation site of the Blackduck Cultural Unit (Hamilton 1982). The site has radiocarbon dates of 1110 ± 60 (S-1272) and 1040 ± 45 (S-1273) (Syms 1977:102). Nicholson (1976:72) found Kehoe's (1966) typology provided "...an adequate basic typology for the classification of the major body of projectile points at the Stott site."

Plates of Stott projectile points suggest a striking difference from the Cayley Series and Mortlach Group projectile points but a similarity to the Brockinton projectile points. Plates 1-6 illustrates that the Stott site projectile points largely have straight basal edges, blade widths that tend to be greater than base widths, proximal base angles that appear to be right angles, distal base angles and shoulder angles that appear to be obtuse, base heights which are fairly high, and notch shapes which are largely V-shaped broad (Nicholson 1976).

The Selkirk Composite occurs largely in the parkland periphery of the Northern Plains and throughout an enormous portion of the Boreal forest in Central Canada. The Composite dates from ca. 850 B.P. to the Historic Period, and is largely defined by distinctive pottery vessels. Projectile points are not considered diagnostic and are also rare in Selkirk Composite assemblages.

Walde's (1994) observation that projectile points associated with the Mortlach Phase were different from those associated with the Old Women's Phase and the Selkirk Phase has already been noted. My initial observations of illustrated specimens suggested that the projectile points were comparable to Mortlach Group projectile points (Meyer 1981, Figures 5, 6, 8, 10, 12). Similar attributes included a tendency towards straight basal edge shapes, fairly high base heights, U-shaped narrow notch forms, and blade widths that are equal to or narrower than base widths.

Upon closer examination these similarities break down. For example, a number of projectile points have concave basal edge shapes (n=5) and convex basal edges shapes (n=2), while the remaining basal edge shapes are straight (n=6). Although it could not be quantified, it is apparent that base heights exhibit great variability from fairly high to quite low on the blade. Likewise, notch forms, while exhibiting a number of U-shaped narrow notch forms, also occurred as U-shaped broad notch forms, angular broad notch forms, and V-shaped broad notch forms. Lastly, a number of blade widths are present that are greater than the associated base width (Figure 5 h; figure 6 f; figure 8 h).

A formal analysis is required to demonstrate more fully the nature of the projectile points associated with the Selkirk Phase. This may be difficult, however, given the small sample sizes available. Regardless, from my limited review of illustrated projectile points, I believe that these projectile points show only superficial similarities to Mortlach Group projectile points, and even fewer similarities to Cayley Series projectile points.

The Highwood Phase, dating ca. 600 B.P. to the Historic Period, is centred in central Montana. The defining characteristics include Intermountain Tradition pottery and Buffalo Gap Single-Spurred and Emigrant Basal-Notched varieties of the Plains Side-notched projectile point type (Brumley and Rennie 1993). These defining characteristics are based on three sites in northern Montana--the Highwood Kill, the Morrow-Bateman bison kill, and the Square Butte campsite.

Brumley and Rennie (1993:43-44) state that projectile points recovered from the Highwood and the Morrow-Bateman bison kills are characteristically late varieties of the Plains Side-notched projectile point types which exhibit high frequencies of obsidian, porcellanite, and Madison Formation cherts. The authors note that the late varieties of Plains Side-notched projectile points, while common in Highwood Phase assemblages, occur only rarely in contemporary assemblages. In fact, within the Cayley Series projectile points only 1.1% (n=14) exhibit basal spurs or basal notches, while, within the Mortlach Group projectile points only 0.4% (n=2) exhibit basal spurs or basal notches.

The Square Butte campsite is also a type site of the Highwood Phase. The site consists of a surface collection of Intermountain pottery (Brumley and Rennie

1993:43). It is unclear, however, whether the Buffalo Single-Spurred and/or Emigrant Basal-notched projectile points are present in the Square Butte assemblage.

The Antonsen site, in southwestern Montana, is a bison kill site. The site contains a substantial number of basal notched projectile points of which the majority came from Area B. Interestingly, I have attributed projectile points in an adjacent area, Area A, to the Cayley Series projectile points. Obsidian hydration rates suggest the basal notched projectile points immediate postdate the Cayley Series projectile points (Davis and Zeier 1978:232). Using Kehoe's (1966) typology, the basal notched projectile points are classified as Emigrant Basal-notched and Billings Double-Spurred Basal-notched projectile points (Davis and Zeier 1978:231, Figure 21.9). The high frequency of basal notched projectile points occurring in a restricted distribution with associated dates that postdate Cayley Series projectile points suggests to me they are indeed a separate phenomenon. As such, I speculate that these projectile points should be assigned to the Highwood Phase.

The One Gun Phase (ca. 230 B.P.- 200 B.P.) is coeval with the most recent expression of the Old Women's Phase on the Alberta Plains. The phase is distinguished by Cluny Complex pottery, scapula hoes, "squash" knives, pitted handstones, grinding slabs, and bell-shaped pits.

The One Gun Phase has largely been defined on materials recovered from the Cluny fortified village site and the Morkin site in southern Alberta. Projectile points from the Cluny site have been classified as Nanton, Pekisko, Paskapoo, and Washita projectile point types (Forbis 1977:51-57). Based on illustrations of these projectile points, as well as tables of attributes, I cannot discriminate the Cluny projectile points from Cayley Series projectile points (Forbis 1977:56-57, Figure 18, Table 9). Similarly, a firsthand examination of the Late Side-notched projectile point assemblage from the Morkin site (located at the Provincial Museum of Alberta) leads me to conclude they do not exhibit significant differences from the Cayley Series projectile points.

Summary

This chapter provided a reclassification of Late Side-notched projectile points on the Northwestern Plains. The reclassification was justified by the analysis in Chapter Four, which illustrated that the observed trends in the projectile point attributes did not conform to the expected trends of the existing classification system. The reclassification identified two distinct groups of projectile points--the Cayley Series projectile points and the Mortlach Group projectile points.

The general characteristics of both projectile point groups were outlined in terms of their discrete and continuous attributes. This was followed by a discussion of the morphological variability within the projectile point groups. Here, it was demonstrated that the manner by which the existing classification system addresses projectile point variability, by producing 'types' and 'varieties', was arbitrarily forced onto the data.

Then, I compared the original index values in the existing classification system to the values derived for the Cayley Series and Mortlach Group projectile points. The indices derived for the Cayley Series projectile points closely match the original values derived from the Old Women's Buffalo Jump. All the sites attributed with Cayley Series projectile points (i.e., Head-Smashed-In, Junction, and Ross) produced indices most similar to those from the Old Women's Buffalo Jump. In contrast, the indices derived for sites with Mortlach Group projectile points were quite different than the aforementioned indices.

This was followed by a review of the literature for comparable projectile point assemblages to both the Cayley Series and Mortlach Group projectile points. Sites with projectile point assemblages similar to the Cayley Series projectile points are found in Saskatchewan (including the Garratt site, the Tschetter site, the Lucky Strike site, the Bakken-Wright site, the Estuary Bison Drive site, and the Gull Lake Bison Drive), Alberta (including the Ramillies site, the Majorville Medicine Wheel site, the Saamis site), and Montana (including the Bootlegger Trail Site, the Boarding School Bison Drive site, the Galata site, and the Antonsen site). Sites with projectile point assemblages similar to the Mortlach Group projectile points are found in Saskatchewan (including Mortlach and Long Creek) and Montana (including Shippe Canyon).

Given the association between Saskatchewan Basin Complex: Late Variant pottery and Cayley Series projectile points, I then argued for a redefinition of the Old Women's Phase. In the same vein, the association of Mortlach pottery and Mortlach Group projectile points led to a redefinition of the Mortlach Phase.

The chapter was concluded by reviewing the literature for other Late Side-notched projectile points not covered in this study. Based on published projectile point attributes and photographic plates, I suggested that projectile points associated with the Blackduck Cultural Unit were different from both of the groups present here. Similarly, projectile points associated with the Selkirk Composite, although rare, appear to be discernible from the Cayley Series and Mortlach Group projectile points. The Highwood Phase predominantly contains Buffalo Gap Single-Spurred and Emigrant Basal-Notched varieties of the Plains Side-notched projectile point type; these projectile point types are very rare in both the Cayley Series and Mortlach Group projectile points. Lastly, I was unable to differentiate between the projectile points recovered from One Gun Phase sites (i.e., the Cluny fortified village site and the Morkin site) and the Cayley Series projectile points.

CHAPTER SIX
EXPLANATIONS OF VARIABILITY

Introduction

As the preceding chapters have shown, Late Side-notched projectile points on the Northwestern Plains can be divided into two groups--Cayley Series projectile points and Mortlach Group projectile points. This chapter is concerned with the explanation of the variability both within and between these projectile point groups. To address the explanation of Late Side-notched projectile point variability I will begin by reviewing existing endeavours to explain variability within projectile points on the Northwestern Plains. Then, in light of my reclassification of Late Side-notched projectile points, I will use elements from a literature review to provide an explanation of the morphological variability within Cayley Series projectile points and Mortlach Group projectile points.

Explanations of Late Side-notched Projectile Point Variability

Most frequently, researchers on the Northwestern Plains have offered ethnicity as an explanatory mechanism for the variability within Late Side-notched projectile points, although there have been a number of alternative explanations of projectile point variability. Explanations of projectile point variability based on ethnicity often rely on coincidental geographic distributions in forming the basis for an association between the projectile points and historically known Native groups. Most commonly, approaches of this nature fail to provide a theoretical context for linking projectile point variability and ethnicity beside that of coincidental geographic distributions.

For example, Kehoe (1966:839-840) suggested that Prairie Side-notched and Plains Side-notched projectile point types reflected Algonquian speaking people and Missouri village tribes, respectively. The relationship between projectile point types and ethnicity, although never stated explicitly, appears to be based on the extrapolated movements of historically known ethnic/linguistic groups (Kehoe 1966:839-840).

In Alberta, Sheila Greaves (1981) also used ethnicity to explain projectile point variability. More specifically, she tested "...the hypothesis that ethnic affiliation is a source of continuous variability in Late Plains Side Notched projectile points" (Greaves 1981:iii). Toward this end she tentatively identified Late Side-notched projectile points from the Old Women's Buffalo Jump and Head-Smashed-In Buffalo Jump as Blackfoot (Greaves 1981:24-33). In her study, ethnicity was attributed to a projectile point assemblage by "...previous identification, albeit tentative, of the site's most recent native occupants on the basis of ceramics" (Greaves 1981:25).

Dyck (1983:132), in comparing Plains Side-notched projectile points from the Saskatchewan Plains with specimens from the Middle Missouri, noted similarities that suggested strong connections between the Northern Plains bison hunters and Plains villagers. Brumley and Rennie (1995:53), working in Montana, attributed Buffalo Gap Single-Spur and Emigrant Basal-Notched varieties of the Plains Side-notched projectile point type to Shoshonean groups.

Turning to explanations of projectile point variability beyond ethnicity, Flenniken and Raymond (1986) suggested that some variation in projectile points can be attributed to damage sustained during use. They subjected 30 projectile points to an experimental hunting situation in which many points were damaged and the salvageable specimens were rejuvenated (Flenniken and Raymond 1986:607). The authors noted that rejuvenation often changed the projectile point morphology, creating the potential for reclassification of a specimen as a type other than the original designation.

There can be little doubt that the rejuvenation of artifacts has occurred within the sample of Late Side-notched projectile points analysed for this study as would be expected for my large sample of points (e.g., Hoffman 1985). Nonetheless, it is difficult to envision the manner by which an analysis might control for such variation. It has been noted, however, that "the stem of a projectile point is rarely affected significantly by the resharpening process" and that "the size, morphology, and technological characteristics of the stems of points, rather than their blades, may have more relevance in some assemblages for establishing point typologies reflective of social units possessing spatial and temporal significance" (Hoffman 1985:574,607). Hence, my analysis has focused largely on attributes found on the stem.

In an innovative study, Dawe (1987) suggested that the trade of projectile point preforms might account for the variability, or the lack thereof, within projectile points. He observed that a large number of unnotched triangular projectile points, made of exotic materials, are common artifacts in campsites and processing areas on the Northwestern Plains. He interprets these triangular forms as projectile point preforms (Dawe 1987:152-153) and suggests: "The trade of projectile point preforms may have been a regular means of acquiring replacements for broken points where the materials for the manufacture of such were not available" (Dawe 1987:162). The argument for projectile point preforms consists of the following statements:

> 1) Unnotched, triangular preforms should be present in the assemblage.
> 2) There should be a lack of primary and secondary reduction debris of the exotic lithic materials from which these preforms were manufactured.
> 3) Evidence of manufacturing breakage on unfinished arrowheads should be the result of notching failure.
> 4) Projectile points of roughly contemporary age and made of a specific exotic material would tend to share similar attributes excluding those associated with notching.
> 5) Contemporary projectile points made of lithics from different quarries would tend to have different planform characteristics but similar notching characteristics.
> (Dawe 1987:155-158)

While attractive, the preform trade hypothesis does not reflect archaeological reality. For example, arguments one through three could be equally true of preforms made by local artisans working with exotic materials, rather than distant craft specialists. Furthermore, while arguments four and five may be valid indicators of the preform trade hypothesis, my analysis of Late Side-notched projectile points indicates that only a small proportion of specimens were manufactured on exotic lithic materials (n=342 of a total of 2327, 14.7% of assemblage). This suggests that if preform trade did exist, it did so at restricted levels. Perhaps the most compelling argument against the existence of preform trade lies in the fact that precontact peoples would undoubtedly have to be capable of manufacturing a functionally adequate projectile point at any moment, not just in conjunction with trade. In all fairness to Dawe (1987:155), the argument for the Preform Trade Hypothesis was proposed largely as an explanation of the remarkable regularity found within Avonlea projectile points, although he did apply it to Late Prehistoric projectile points as a whole.

In a subsequent paper, Dawe (1994; see also, Brink and Dawe 1989:208-209) noted that there are large numbers of tiny unifacially flaked projectile points found in archaeological sites on the Northern Plains. Upon examination, he considered these specimens to be too small to satisfy design requirements of standard bow and arrow technology. He argued that some of these small projectile points should be interpreted as toys. This argument was based on functional considerations of diminutive projectile points, ethnographic accounts of toy bows and arrows, and archaeological evidence of toy projectile points exhibiting disproportionate distributions in favour of areas expected to be more frequented by children (i.e., campsite areas as opposed to kill site areas).

This model is a well-argued explanation of a special case within projectile point variability. Some of the Late Side-notched projectile points analysed in this study could be attributed to "child's play", though the majority of the specimens cannot be accounted for using this model. The model predicts that toys are more likely to be recovered from campsites rather than kill sites as children are more likely to frequent the former. Within the sites selected for my analysis, kill sites contain 73.3 % (n=1531) of the specimens, while all other sites, including campsites, account for 26.7 % (n=558) of the specimens. The large percentage of projectile points from kills sites in my study suggests toy projectile points would not contribute substantially to projectile point morphological variability.

In a very different vein, Warburton and Duke (1995) outlined a contextual analysis of style within projectile points. They began with a review of the ethnographic record which focused on the symbolic role of the arrow in Blackfoot culture. Their review suggested that "The arrow acts as a revelatory dualistic symbol in both the Blackfoot natural world and supernatural world" (Warburton and Duke 1995:223). Then, they provided a series of arguments surrounding the analysis of the symbolic content in prehistoric projectile points. Their arguments suggested that: (1) stone, being durable, has added symbolic importance as its messages can transcend generations; (2) style consists of both the traditional definition, "a way of doing something," as well as the meaning attached to the artifact; (3) meanings evoked by artifacts can change as individuals redefine those meanings and as the use of the artifact changes; and (4) the degree to which artifacts are altered by use, reuse, and retouch requires contextual analysis (Warburton and Duke 1995:226-227).

The authors concluded "...that the multitude of meanings recoverable from the ethnographic record will not be matched by those recoverable archaeologically" (Warburton and Duke 1995:225). They further noted that "at this stage of investigations, [their arguments] can serve only as counterpoints to prevailing paradigms to demonstrate that alternative paradigms must be considered to achieve as full a knowledge of the past as possible..." (Warburton and Duke 1995:225) and that their arguments were not testable but rather accommodative, provisional, inductive, and contextual.

As with explanations of projectile point variability based on ethnicity, these alternative explanations do not provide comprehensive theoretical contexts for understanding projectile point variability. Part of the reason for this might rest on the fact that explanations beyond ethnicity often address specific problems in projectile point variability and, thus, do not address projectile point morphological variability as a whole. Regardless, the problem remains that explanations based on ethnicity, or otherwise, rarely explicate "...why specific patterns in material culture characterize human social groups and reflect the nature and degree of their interrelationships"

(Sackett 1986:267). To this end, the next section suggests an explanatory mechanism of projectile point variability in the context of the social group.

Reconsidering Explanatory Mechanisms

In this section I will review a sample of the ethnographic literature from the plains concerning ethnicity and its relationship to other social processes with the intent of producing an explanation for both the nature and patterning of variability within Late Side-notched projectile points. Then I will review the archaeological and ethnological evidence that supports this explanation.

An Explanatory Mechanism

As indicated above, I intend to review some of the ethnographic literature from the plains in order to join ethnicity to other social processes in explaining aspects of projectile point variability. This approach might come as a surprise to some readers considering that, in the preceding section, I argued many explanations of projectile point variability often failed to address why ethnicity might be reflected in material culture (Sackett 1986:267). To avoid this failing, I shall begin this attempt at producing an explanatory mechanism of variability within Late Side-notched projectile points by providing a line of reasoning for linking variation within material culture and ethnicity. Sackett argued that:

> ...while there ordinarily exists a broad spectrum of possible ways of designing classes of material objects [i.e., isochrestic variation], any given fraternity (or sorority) of artisans uses only a handful of options chosen from this spectrum. The choices they make, whether conscious or not, are largely dictated by the craft traditions within which they have been enculturated as members of social groups. These choices tend to be quite specific and consistently expressed at any given time and place, but they are nonetheless subject to revision as a result of changes in the patterns of social interaction (and hence exposure to alternative options) among the artisans who carry on the traditions. Variation in material culture that is socially bounded in this manner is

> consequently idiomatic or diagnostic of ethnicity, and it is as such variation that we perceive as style. (Sackett 1986:267)

In other words, the link between material culture and ethnicity lies in the manner by which an individual is enculturated into his or her social group, especially with respect to the socially bound options, selected from isochrestic variation, that their group uses in manufacturing items of material culture. Therefore, patterning in material culture is related to, in some manner, the enculturation of individuals.

Traditionally, enculturation in Plains Indian societies is stated to occur at a number of levels within the social structure. From smallest to largest, these levels of social structure include the elementary family, the extended family, the band, and the tribe (e.g., Eggan 1955:82-83; Lowie 1982:86-90).

The elementary family consists of a male parent, a female parent, and their children. Additionally, the elementary family is said to be where the strongest kinship ties are found, and where "Informally a parent would give instruction to the children of his or her own sex, who were thus initiated into the skills necessary in life" (Lowie 1982:81).

The extended household is composed of a number of elementary families and considered the primary socio-economic unit, as well as being oriented towards subsistence and procreation usually through patrilocal residence. Furthermore, uncles and aunts are often said to have specific duties and privileges with regard to children even though this relationship exists outside of the elementary family (Lowie 1982:82).

The band is composed of a number of extended families, usually somewhat amorphous, and often given to change. Marriage typically destined the males in a band to be related while the females may be related or may be from outside the band.

In contrast, the tribe is considered to be a definite social unit even though it is composed of a number of amorphous bands. The tribe is considered the closest thing to what one might call an ethnic group.

This discussion suggests that instruction in the manufacture of projectile points would likely occur at the level of the extended family by the father of a boy, and/or the uncles of a boy (the man's brothers), and/or the grandfather of a boy (the man's father). The importance of the extended family as the most influential unit of enculturation affecting the patterning of projectile point variability is evident when the principles of group formation are examined. As Wissler indicated:

> When a band begins, it may be a group of two or three brothers, fathers, and grandfathers, or a small family band (which means the same thing); later, friends or admirers of the head man in this family may join them until the band becomes very large. Bands may split in dissention [sic], one part joining another or forming a new one. (Wissler 1911:19)

Hence, groups of related males were likely to be the nucleus of a band. Therefore, young males learning to manufacture projectile points in such an environment were likely to receive comparable instruction from these male band members as, they too, were enculturated in a band whose nucleus consisted of related males, and so on.

However, these extended families attracted outside members if the head man was competent to form a "band". As well, the band could split apart if disagreements arose. These mechanisms allowed people, and their ideas about projectile point manufacture, to come together, mix, and be separated.

In this same vein, Dempsey (1982) suggested other social mechanisms that operate to move people within Plains Indian society. In a discussion of the Blood Indians, he debunked the norm of patrilocality by indicating that "...a matrilocal practice appeared to be quite common where the girl was from a more affluent band and particularly if her father was a chief" (Dempsey 1982:95). Furthermore, while he indicated that marriage within Blood Indian bands was frowned upon as many individuals in a band were related yet there were adopted individuals, widowed individuals and the many other nonrelatives found in a band who were considered eligible mates (Dempsey 1982:94-95).

Through mechanisms operating around the level of the extended family, such as adoption marriage, levirate and sororate, and fictive kin relationships, heterogeneity within projectile point manufacture could be introduced. Still other factors that might contribute to projectile point variability include personal idiosyncrasies, innovation, and inaccurate transmission of options. The significance of the social dynamism found at the extended family/band level of social organization is that, barring social controls on the manufacture of projectile points, it provided mechanisms for generating and spreading the way in which projectile points were to be made and, ultimately, the resultant projectile point variability.

Social controls that limit the innovation and spread of variability within projectile point populations might occur through sodalities or as the result of craft specialization. This kind of centralization in the enculturation process could restrict the set of socially bound options that influenced the manner by which projectile points were made, thus leading to homogeneity within projectile points variability.

The tribe, as a social unit, would have tended to have provided a limit or a boundary to the transmission of the way projectile points should be made. In other words, the vast majority of projectile point variation would fail to be transmitted beyond the tribal level and, as such, reflect ethnicity. Nonetheless, the transmission of the socially bound set of options likely did, at times, penetrate beyond the level of the tribe. Similarly, the transmission of the socially bound set of options used by other groups, no doubt, encroached on one's own group. Such intercultural borrowing, in terms of the pattern of variability within material culture, might be exhibited in the archaeological record by an aspect of variability being predominant within a specific geographic area and only occurring irregularly in another nearby area.

Before continuing, I need to clarify why I am using the extended family as the primary socio-economic unit that influences the patterning of projectile point morphology. In many ethnohistorical documents the band is attributed with the role of the primary socio-economic unit (e.g., Dempsey 1982). Nonetheless, I suspect social structure operated at a different level in prehistory. Partial evidence for suggesting this alternative comes from tipi ring investigations. Analyses of tipi rings indicate that low frequencies of tipi rings (i.e., 1-5 rings) per tipi ring site are the most common groupings found (Brumley et al. 1983:214; Kehoe 1960:442; Quigg 1978:14).

Inferring from historical records that a single tipi tended to house a family, the tipi ring data suggests that regularly only a few families (i.e., 1 to 5 families) camped together. It is not a substantial leap to then infer that the relationships between these people were similar to ethnohistoically known peoples and that the small clusters of rings represent the camps of extended families; single families would have left fewer tipi rings while a band composed of several families would likely have left substantially more tipi rings. To pursue this line of thinking is beyond the scope of this thesis but is important to note the inferences which lead me to use the extended family as the level of social structure which most influenced the patterning in projectile point variability.

The Archaeological Evidence

Currently, evidence supporting the ideas discussed above are scarce. Regardless, I will begin by providing evidence for coinciding geographic distributions between the projectile point types and historically known Native groups. Then, I will review the anecdotal evidence from ethnographic sources that suggest links between the projectile point groups and historically known Native groups. Following this discussion of ethnicity, I will present evidence for linking aspects of social structure with projectile point variability in the archaeological record.

Numerous researchers have examined historical records, linguistics, and oral traditions for insight into the locations of Native groups in late prehistory and early history. While researchers often concur over the general location of a number of historically known groups, the evidence also provides ample ambiguity and uncertainty that alternative interpretations are possible. Therefore, a brief review of this literature is appropriate.

Byrne (1973:515-531) reviewed several lines of evidence in determining the tribal distributions in southern Alberta. In fact, his immediate interest was in determining a tribal distribution that coincided with his newly defined Saskatchewan Basin Complex: Late Variant pottery (in the previous chapter, I argued Byrne's (1973) Saskatchewan Basin Complex Late Variant pottery is associated with the Cayley

Series projectile points necessitating a redefinition of the Old Women's Phase). He considered three candidates for the occupation of protohistoric southern Alberta including the Blackfoot, the Kutenai, and the Shoshone (Byrne 1973).

Byrne's review of the evidence that the Kutenai inhabited southern Alberta was restricted to oral tradition and linguistics. He noted that contemporary Kutenai live in northwestern Montana, northern Idaho, and adjacent British Columbia but maintain that they once lived east of the Rocky Mountains as part of the Peigan (Byrne 1973:518). Some linguistic evidence supports the Kutenai claim of an Alberta homeland in that the Kutenai language, although distinct, is possibly related to the Algonquian-Wakashan language family (Turney-High 1941:10).

Byrne's (1973) assessment of the evidence for a Shoshone occupation in southern Alberta was based on Saukamappee's life story as transcribed by David Thompson. Saukamappee, a Cree Indian, twice joins with the Peigan in campaigns against the Snake Indians in southern Alberta. The Snake Indians are commonly assumed to be Shoshone (e.g., Brink 1986; Magne 1988), although other ethnic affiliations have been suggested (Byrne 1973; Vickers 1994).

Byrne (1973:520) further noted that there was an absence in Shoshone oral tradition of southern Alberta as a former homeland. Similarly, archaeological materials such as Intermoutain pottery, normally associated with the Shoshone, have never been found north of Great Falls (Mulloy 1958).

Byrne (1973:530) argued the Blackfoot were the most likely candidates for a long residency in southern Alberta. This conclusion was based on linguistics, oral tradition, and historic accounts. He interpreted Anthony Henday's A.D. 1754 meeting with the Archithinue Indians as an encounter with the Blackfoot which apparently occurred near present-day Red Deer, Alberta. At this time an Archithinue spokesman, in responding to Henday's request for the Archithinue to travel off the plains to trade at the Hudson Bay Company posts, stated "...they could not live without Buffalo flesh; and that they could not leave their horses, etc., and many other obstacles, though all might be got over if the were acquainted with a canoe, and could eat fish, which they never do [sic]" (Henday 1907). Byrne (1973:518) reiterated Forbis' (1963:7) observation that "...these are strange words indeed for a group which supposedly moved out of the bush country onto the plains."

Again arguing for the longevity of the Blackfoot in Southern Alberta, Byrne (1973:517), citing Kroeber (1939:81-2), argued for a lengthy time since divergence between the Blackfoot, the Arapaho, and other Algonquian speakers. This distant divergence in language, however, does not necessarily indicate the Blackfoot spent their lengthy period of separation from other Algonquians in southern Alberta. Lastly, he noted contradictory evidence in Blackfoot oral tradition that indicated migration into the southern Alberta 'homeland' from every direction but west (Byrne 1973:518).

In 1986, the Saskatchewan-Alberta Dialogue symposium, held in Edmonton, provided an opportunity to "...merge archaeological evidence, historic literature, anthropological theory and common sense regarding Native group distributions in the early historic period..." (Magne 1987:220). Five blank maps of western Canada, dated at fifty year intervals between A.D. 1700 to A.D. 1850, were sent out to 25 researchers in Saskatchewan and Alberta. The returned maps were assembled and published (Magne 1987).

Magne (1987:224) produced a composite map of Native distributions at A.D. 1700 that illustrated the Blackfoot along the North Saskatchewan and Red Deer River, the Gros Ventres inhabiting the Forks area of the Saskatchewan, the Kutenai in the Rocky Mountains of southwestern Alberta, the Cree in the northeastern edge of Alberta and most of northern Saskatchewan, and the Assiniboine in the Forks area of Saskatchewan and along the northeastern edge of the plains. Magne (1987:225) also noted an Hidatsa expansion northwestward at ca. A.D. 1725. This expansion is believed to be archaeologically evidenced by the Cluny fortified village site on the Bow River near Cluny, Alberta, and by distinctive pottery occurrences in southern Alberta and Saskatchewan. The Snake, although not identified as a known historic group, were depicted in the form of raiding parties into southern Alberta as far north as the Red Deer River and over much southwestern Saskatchewan (Magne 1987:225).

Meyer and Russell (1987), working in the boreal forest of central Canada, recounted the evidence for the inhabitants of this area in the early historic period. They noted that maps and documents of the late 1600s indicate the Cree at least visited areas west of the Manitoba escarpment, a place where the Assiniboine were well established; since the forest north and west of this area was not known by Europeans at this time, the position of the Cree in this area was not known (Meyer and Russell 1987:26). "Eighteenth century Hudson Bay Company records provide evidence that several Cree regional bands occupied the forests and parklands of central Manitoba and Saskatchewan until their collapse under the ravages of the small pox epidemic of 1781-1782" (Meyer and Russell 1987:26). Based on the strong correlation between the distribution of regional Cree bands in the early historic period with the distribution of some of the localized Selkirk ceramic styles, Meyer and Russell stated: "We consider it very likely that the peoples who produced the Selkirk complex were Northern Algonkians, direct ancestors of those who became known as the Crees during the fur trade era." (Meyer and Russell 1987:27)

Russell (1991) provided the most exhaustive ethnohistorical examination of the distribution of Native groups to date. His main objective was to rectify the accepted notion that the Cree and Assiniboine penetrated West with the fur trade after A.D. 1690. Russell (1991:172-186) demonstrated that, although the western limits of the Cree and Assiniboine in the early A.D. 1700 are unclear, their distribution extends as far West as the traders had knowledge. The Assiniboine appeared to be far west along the Saskatchewan River both preceding and independent of the fur trade. The Cree appeared to occupy an adjacent distribution in the boreal forest, still preceding the fur trade, but at a later date than that of the Assiniboine.

Russell (1991:94) identified the Archithinue as the Blackfoot and their allies (i.e., the Blackfoot, Blood, Peigan, Sarcee, and Gros Ventres) and placed them well established in south-central Alberta by at least A.D. 1754. Saukamappee's account extended the occupation of the Blackfoot to about A.D. 1730. While not identifying the Snake with an historically known group, Russell (1991:194-195) noted the lack of evidence for their occupation of southern Alberta and Saskatchewan and that the "Eagle Hill" area was the northern terminus of Snake raiding parties. He also suggested an Hidatsa group occupied southeastern Saskatchewan while the Atsina inhabited the southwest; however, it is not clear which, if either of these groups, occupied the Forks area of the Saskatchewan River (Russell 1991:200-210).

Walde (1994:132-141) examined historic documents in order to establish a candidate for the precontact/early contact Mortlach Phase archaeological remains centered largely in southern Saskatchewan (in the previous chapter I argued Walde's (1994) Mortlach pottery is associated with the Mortlach Group projectile points necessitating a redefinition of the Mortlach Phase). Walde (1994:135) dismissed the idea that this area was inhabited by the Atsina as he attributed their presence to visitation for trade . Similarly, he dismissed accounts of Hidatsa in the area as nothing more than raiding parties (Walde 1994:135). The Assiniboine, on the other hand, were noted to be well in sight of the Rocky Mountains at the time of Henday's visit to central Alberta (1754-55). Walde suggested that the Assiniboine, in A.D. 1690, occupied the area "...from the Branches of the Saskatchewan south to the lower Assiniboine..." (Russell 1991:361 in Walde 1994:126). He concluded: "The earliest written records, then, place the Assiniboine groups on the northern, eastern, and southern boundaries of his study area [i.e., largely southeastern Saskatchewan] and are either silent or ambiguous as to the ethnicity of the inhabitants of the study area at the earliest recorded times" (Walde 1994:141).

Most recently, Klassen (1995) reviewed historic documents to determine cultural distributions in southern Alberta with the intent of establishing a likely candidate for the producers of the rock art found at Writing-On-Stone along the Milk River. His findings suggested that, between A.D. 1754 to A.D. 1771, the Assiniboine occupied the northeastern margins of the Northern Plains, the Archithinue (i.e., Atsina, the Blackfoot, Peigan, Blood, and Sarcee) inhabited lands to the west, while the Snake, enemies of both the Archithinue and Assiniboines, were identified as either the Shoshone or possibly a Siouan speaking group (Klassen 1995:100-101). Klassen

(1995:101) concluded by stating that "Although the documentary evidence is unable to provide substantial evidence for long-term ethnic continuities on the Northwestern Plains, neither does it support the hypothesis of a major displacement of the Shoshone at any point during the contact transition."

To summarize, there is general agreement that the Blackfoot were resident in southern Alberta at, and immediately preceding, historic contact. Hence, the distributions of Cayley Series projectile points and Saskatchewan Basin Complex: Late Variant pottery (i.e., the Old Women's Phase) appear to coincide with the distribution of the Blackfoot peoples, or more properly the Nitsitapii (i.e., Piikani, Kainaa, and Siksika). Similarly, the Assiniboine, in the early historic period, appear to be located in western Manitoba, central Saskatchewan, and northern North Dakota. Therefore, it appears the distribution of historic Assiniboine coincides with the distribution of Mortlach Group projectile points and Mortlach pottery (i.e., the Mortlach Phase).

The Cree were apparently present at least as far west as the Manitoba escarpment in A.D. 1690. Considerable evidence suggested that regional Cree bands of the early historic period, living in the boreal forest of central Canada, can be linked to the archaeologically known Selkirk Composite.

The Snake, traditionally identified as the Shoshone, appear to occur only in Alberta in the form of raiding parties from further south in Montana. For central Montana, Brumley and Rennie (1993) have suggested that the Highwood Phase, consisting of Intermountain pottery and Buffalo Gap Single-spurred and Emigrant Basal-notched projectile points, exhibit a distribution that coincides with the distribution of the historically known Shoshone. However, some authors have suggested certain Siouan speaking people are also reasonable candidates for the Snake (Byrne 1973, Vickers 1994).

For the Kutenai, Gros Ventre, and Hidatsa there are substantially less secure associations with archaeological material. There is some evidence the Kutenai occupied southern Alberta in the past but the evidence of this scenario is currently limited to oral tradition and possibly linguistics. The historic location of the Gros Ventre is unclear; one possible location is the Forks area of Saskatchewan while another is southwestern Saskatchewan. Similarly, the location of the Hidatsa, north of the Middle Missouri area, is not clear. One argument suggested the Hidatsa occupied southeastern Saskatchewan (Russell 1991:200-210) while another interpretation argued such occupations were limited to raiding parties (Walde 1994:135) .

Thus far I have presented evidence meant to link projectile point variability to ethnicity. Evidence linking other aspects of social structure beyond ethnicity to projectile point variability is increasingly speculative. For this reason, the following should be read as a proposal for further research rather than a demonstration of proof.

In a previous discussion I suggested that projectile point variability, owing to its transmission via enculturation, might reflect social structure. Using ethnographic analogy from historically known Plains Indians, I argued that the extended family was the socio-economic unit within which an individual was likely to be enculturated. I also noted that the nucleus of the extended family was often consanguineal kindred in the male line (i.e., genetic brothers). These individuals would likely have shared an upbringing and their knowledge of projectile point manufacture would be expected to be similar. As they transferred this knowledge on to the next generation, one would again expect a level of synchronic and diachronic homogeneity in projectile point variability as a result of the comparable enculturating environments.

Introduction of variability would likely come from nonrelatives entering the extended family/band, this variability owing to their different upbringing. Such individuals might enter the extended family/band as a result of marriage (including sororate and levirate), as fictive kin, or due to band amalgamation. In addition, introduction of new ideas concerning the manufacture of projectile points could occur when extended families/bands came together for the purpose of communal hunting and ceremony. Further variation could be introduced as a result of personal idiosyncrasies, independent innovation, and differential transmission of social heritage.

Hence, while the presence of relatives in the male line likely promoted homogeneity in cultural transmission of knowledge concerning projectile point manufacture, there were numerous other social dynamics that likely introduced novelty to this knowledge. For, while related males from one extended family may be creating homogeneity in projectile point variability, the exogamous nature of these groups dispersed knowledge in one extended family into others. Following this process through time, one might expect that, initially, a certain socially bound set of options, or styles, of projectile points would occur very infrequently within a fairly specific area. Then, this coherent set of options would gradually increase in frequency and occurrence across space. Finally, the frequency at which the social bound set of options occur would diminish and eventually disappear.

Such trends closely reflect the battleship shaped curves that Forbis (1962:95, Figure 11) produced for his classification of Late Side-notched projectile points at the Old Women's Buffalo Jump (recall that I have demonstrated Forbis' (1962) divisions in his classification were arbitrary; regardless, the overall distribution of values and trends in the data do not change). Specifically, I am suggesting that the battleship shaped curves, in a very real sense reflect demography. Homogeneity in projectile point variation, as a result of knowledge transmitted via related males, initially would occur in low frequencies. As this knowledge of making projectile points was illustrated to young males in the extended family/band (both kin and nonkin, alike), and the band prospered, the occurrence of "this variability" would have begun to grow. The distribution of "this variability" would increase due to group fission, differential marriage residency, group interaction, etc. Ultimately, other ways to manufacture projectile points would have gained favour and the variability discussed above would occur less and less frequently. This is the scenario I suggest produced the patterning of variability in the Cayley Series projectile points.

It is important to note that I am not suggesting projectile point variability directly reflects kin groups and their movements. While kin groups likely form the initial basis for the transmission of projectile point knowledge, the highly dynamic movements of people within and between bands makes such a scenario unlikely. Rather, I suspect the pattern of projectile point variation reflects the transmission of knowledge concerning projectile points and its dispersal in time and space as a result of the aforementioned social dynamics within and between extended families groups at the level of kinship and beyond. For the moment, however, this hypothesis remains speculative.

In contrast to the Cayley Series projectile points, which exhibit substantial variability, a striking feature of the Mortlach Group projectile points is their relative uniformity. Here I suggest this uniformity might be the product of ideas originating at the tribal level of organization. The uniformity exhibited by the projectile points might be a product of some form of social control often exhibited by sodalities perhaps as the result of craft specialization.

The Assiniboine had relatively recently left a more sedentary life in the eastern woodlands. The social organization within these eastern groups is known to have been more structured than Native groups on the Northwestern Plains. Perhaps craft specialization in the manufacture of projectile points survived as a remnant of this previously structured past.

A final issue that I feel requires some discussion concerns the transmission of socially bound options into and out of ethnic groups. Tentative evidence for transmission of this sort is suggested by basally notched and basally spurred specimens within both the Cayley Series projectile points (n=14 or 1.1%) and the Mortlach Group projectile points (n=2 or 0.2%). More significant frequencies of basal notching and basal spurring specimens have been recorded in central Montana and, as such, aid in defining the Highwood Phase (Brumley and Rennie 1993). While these low frequencies for basally notched and spurred projectile points in the Cayley Series and Mortlach Group projectile points may reflect the transmission of socially bound options from the manufacturers of projectile points in the Highwood Phase, it is also possible they reflect projectile points lost by people who produced the Highwood Phase material during raiding parties, etc. Here I am speculating that basally notched and spurred projectile points might represent a set of socially bound options that may have been transmitted across tribal boundaries. However, without more evidence such speculation could continue endlessly.

The reality of these speculations may be found to be far more simplistic or infinitely more complex than what has been presented here. Regardless, these issues await more comprehensive analyses of the archaeological record and more thorough reviews of ethnographic sources.

Summary

In this chapter I have illustrated that explanations of the morphological variability within Late Side-notched projectile points on the Northwestern Plains have largely been restricted to ethnicity. Beyond coinciding geographic distributions, however, theoretical foundations linking projectile point variability and ethnicity are almost invariably absent. Explanations that reach beyond ethnicity usually address specific cases in projectile point variability and, therefore, do not address the larger framework within projectile point variability.

In a reconsideration of the explanatory mechanism of projectile point variability I reviewed some ethnographic literature in order to join ethnicity to other social processes in explaining aspects of projectile point variability. I began by indicating that those individuals who manufacture items select options from a large spectrum of possible choices. I argued that within Plains Indian society, the transmission of this knowledge concerning the manner in which projectile points should be made largely occurs within the extended family/band. I further suggested that the social dynamics at the extended family/band level that produced much of the patterning in the variability of Late Side-notched projectile points. The tribal level of organization tends to represent the most extensive dispersion of knowledge concerning the manufacture of projectile points. As such, variability within material culture, to some degree, must reflect ethnicity.

I concluded the chapter by attempting to provide support of my views concerning the explanation of variability within the Late Side-notched projectile points. I attributed the Cayley Series projectile points to the historically known Blackfoot (i.e., Piikani, Kainaa, and Siksika) and the Mortlach Group projectile points to the historically known Assiniboine. Evidence for these associations were suggested by coinciding geographic distributions as well as ethnographic anecdotes.

I further speculated that the variability within the Cayley Series projectile points is a product of enculturation and, as such, is reflected in social structure. Similarly, I speculated the relative uniformity within the Mortlach Group projectile points was possibly produced by craft specialization. Craft specialization, a manner of material culture manufacture not commonly found on the northwestern plains, was argued to be a vestige of the social organization more common in the eastern woodlands.

CHAPTER SEVEN
CONCLUSIONS

Introduction

The aim of this study was twofold. The first aim was to address the lack of consensus concerning the classification of Late Side-notched projectile points on the Northwestern Plains. The second aim was to review explanations of Late Side-notched projectile point morphological variability and provide an alternative explanatory mechanism. I believe the former has largely been achieved while substantial insight has been provided into the later.

Cayley Series Projectile Points and Mortlach Group Projectile Points

The existing classification system of Late Side-notched projectile points on the Northwestern Plains prescribes an abrupt change in some attribute trends through time. This temporal split in attribute trends was presented as two distinct projectile point types--Prairie Side-notched projectile points (ca. 1250 B.P. to 650 B.P.) and Plains Side-notched projectile points (ca. 650 B.P. to the Historic Period).

An evaluation of continuous and discrete attributes on Late Side-notched projectile points from a number of sites on the Northwestern Plains (i.e., Old Women's Buffalo Jump, Head-Smashed-In Buffalo Jump, Ross, Junction, Walter Felt, Lake Midden, Stony Beach, EeNd-3, Bill Richards, and Sanderson) indicated inadequacies in the existing classification system. The evidence from the aforementioned sites suggested that, from ca. 1250 B.P. to 650 B.P., Late Side-notched projectile points exhibited relatively similar discrete and continuous attributes among sites across the study area. About 650 B.P., however, there was an abrupt change in Late Side-notched projectile point morphology at some of the sites in the study area. Projectile points in eastern half of the study area quite suddenly exhibited differences from earlier specimens in both continuous and discrete attributes, and then remained unchanged into the historic period. In the western half of the study area, no abrupt change was manifested;

instead, the continuous attributes continued along previous trends. Those continuous attributes that exhibited gradual change through time continue to do so, and those continuous attributes which did not exhibit change through time remain unchanged. Discrete attributes exhibited a slight change in their frequency of occurrence between the early period and the late period; however, they exhibited the strongest similarity and continuity within the western sites.

The western assemblages (i.e., Old Women's Buffalo Jump, Head-Smashed-In Buffalo Jump, Ross, and Junction) that exhibited gradual change through time and continuity from the earliest times to the most recent times have been labeled the Cayley Series projectile points. The eastern assemblages (i.e., Stony Beach, Lake Midden, EeNd-3, Bill Richards, and Sanderson) that exhibited an abrupt break from the aforementioned continuity at about 650 B.P. have been labeled the Mortlach Group projectile points. Situated between the western and eastern sites is the Walter Felt site. This site has early occupations with Late Side-notched projectile points which closely resembled the early Cayley Series projectile points. The more recent occupations at the Walter Felt site contained Late Side-notched projectile points exhibiting an abrupt shift from the earlier material. These specimens were demonstrably most similar to the Mortlach Group projectile points.

The discrete attributes that best differentiate Cayley Series projectile points and Mortlach Group projectile points include basal edge shape, notch form, cross-section, and base form. The basal edge shape forms that discriminate between Cayley Series and Mortlach Group projectile points are straight, concave, and convex basal edge shape. Less powerful discriminating ability can be found in notched, oblique, and spurred basal edge shapes. Wide and narrow notch forms provide strong differentiation ability between the two projectile point groups. More specifically, V-shaped broad and angular broad notch forms occur more frequently in the Cayley Series projectile points than Mortlach Group projectile points while the converse is true of U-shaped narrow notch forms. Cross-section forms that are useful in differentiating between Cayley Series and Mortlach Group projectile points are plano-convex, convex asymmetrical, and convex symmetrical. Base forms that occur more frequently within the Cayley Series projectile points are oblong (#2) and pie-pan shaped (#5) base forms. Base forms that occur more frequently within the Mortlach Group projectile points are rectangular (#6) and double-hooked shape (#25) base forms.

The attributes of notch type, flaking pattern, and outline form may exhibit weak abilities to differentiate between Cayley Series and Mortlach Group projectile points. Within notch types, the side-notched forms largely account for the variation in the Mortlach Group projectile points, while the Cayley Series projectile points seem to exhibit slightly larger frequencies of corner notched, side-corner notched, side and corner, side and basal, and stemmed notch types. Similarly, for the various forms of flaking pattern, irregular flaking appears to occur slightly more frequent in the Mortlach Group projectile points, patterned flaking may be more frequent in the Cayley Series projectile points, while edge modified flaking appears to occur at similar frequencies in both projectile point groups. Also intentional asymmetry outline forms may occur slightly more frequently in the Cayley Series projectile points.

Continuous attributes that best differentiate between the Cayley Series projectile points and Mortlach Group projectile points are base height, notch depth, notch height, distal base angle, proximal base angle, and shoulder angle. Base height values in the Cayley Series projectile points gradually increase through time while in the Mortlach Group projectile points base height values remain relatively constant through time. Notch depth values vary little through time in the Cayley Series projectile points. These notch depth values are slightly lower than those for the Mortlach Group projectile points which also vary little through time. Notch height values in the Cayley Series projectile points decreases slightly in the earliest period and then remain constant. Notch height values are slightly lower in the Mortlach Group projectile points. Lastly, distal base angle, proximal base angle, and shoulder angle values generally occur over a higher range of values in the Cayley Series projectile points than the Mortlach Group projectile points.

Conclusions

The redefinition of Late Side-notched projectile points presented numerous implications for archaeology on the Northwestern Plains. Aspects of Late Side-notched projectile points requiring reexamination included morphological variability within the projectile point groups, the association between the projectile point groups and other archaeological material, and explanations of Late Side-notched projectile point morphological variability.

My analysis characterized the projectile point assemblages as containing a large degree of variability within each projectile point group. The existing classification system, as proposed by Forbis (1962) and Kehoe (1966), addressed projectile point variability by producing projectile point types and varieties. This approach was demonstrated to be arbitrarily forced onto the data.

In the existing classification system, index values were derived to illustrate the time-transgressive nature of some of the continuous attributes. The original index values in the existing classification system, derived from the Old Women's Buffalo Jump, were compared to the values derived for the Cayley Series and Mortlach Group projectile points. The indices derived in a reevaluation of the Old Women's Buffalo Jump projectile point assemblage closely matched the original index values. Likewise, all the sites attributed to Cayley Series projectile points (i.e., Head-Smashed-In, Junction, and Ross) produced indices similar to those derived for the Old Women's Buffalo Jump. In contrast, the indices derived for sites with Mortlach Group projectile points were quite different from the aforementioned indices.

In comparing the Cayley Series and Mortlach Group projectile points to other Late Side-notched projectile points on the Northwestern Plains, I argued that several types could be differentiated. The Blackduck Cultural Unit and the Highwood Phase had their own distinctive sets of attributes. Given the age of the sites, projectile point assemblages associated with the Blackduck Cultural Unit appear to have high frequencies of straight basal edges, as well as a tendency towards points with blade widths greater than base width, right angled proximal base angles, and obtuse distal base angles and shoulder angles. Highwood Phase projectile point assemblages can be differentiated by their high frequency of basal spurred and basal notched projectile points.

Projectile point assemblages within the Selkirk Composite also appeared to exhibit distinct suites of attributes. Yet, owing to the paucity of specimens, a difference could not be positively discerned. Perhaps the most interesting comparison was between the Cayley Series projectile points and the projectile point assemblages attributed to the One Gun Phase. The projectile points associated with the Cluny fortified village and the Morkin site could not be differentiated from the Cayley Series projectile points despite the clear ties One Gun Phase ceramics and the Cluny site layout have with archaeological cultures far to the southeast.

In reexamining the association of Cayley Series projectile points and other archaeological material, the spatial and temporal distribution of Cayley Series projectile points was demonstrated to coincide with the Saskatchewan Basin Complex, Late Variant pottery (Byrne 1973). To accommodate these results, the Old Women's Phase was redefined as consisting of those sites characterized by the Cayley projectile points and/or Saskatchewan Basin Complex: Late Variant pottery (Byrne 1973). Similarly, the spatial and temporal distribution of Mortlach Group projectile points was demonstrated to coincide with Mortlach pottery (Walde 1994). Accordingly, the Mortlach Phase was redefined as those sites characterized by Mortlach Group projectile points and/or Mortlach pottery (Walde 1994).

To explain the morphological variability within the Late Side-notched projectile points I reviewed the literature for explanatory mechanisms. This literature review illustrated the tendency to explain variability in terms of ethnic indicators. In general, explanations using ethnicity failed to provide a theoretical foundation for linking variability in material culture and ethnicity. Explanations that went beyond ethnicity tended to focus on specific cases in variability. In doing so, they often failed to address the big picture.

I proposed an alternative explanatory mechanism of projectile point variability. I began by indicating that those individuals who manufacture items select options from a large spectrum of possible choices. In Plains Indian society, the transmission of this knowledge concerning the manner in which projectile points are made largely occurs at the extended family level of social organization. The tribal level of organization represents the most extensive dispersion of the knowledge concerning projectile point manufacture. As such, variability within material culture, to some degree, must reflect ethnicity.

To conclude, I have tried to flesh-out the model by illustrating the coincident distribution of the Cayley Series projectile points with the historically known Blackfoot. Similarly, I have suggested that the Mortlach Group projectile points exhibit a coinciding distribution, in space and time, with the historically known Assiniboine. Evidence for these associations came in the form of coinciding geographic distributions and ethnographic anecdotes. I also speculated on the significance of variability within the two projectile point groups. The variability within the Cayley Series projectile points was attributed to the dynamic interplay within social structure. The relative uniformity within the Mortlach Group projectile points was attributed to craft specialization.

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APPENDIX A:

TABLES

TYPE	DIAGNOSTIC FEATURES
1) Washita	1) maximum width of base > maximum width of body 2) height of basal edge > or = height of notch opening 3) flaring basal edge
2) Pekisko	1) maximum width of base > maximum width of body 2) height of basal edge > height of notch width 3) contracting base
3) Paskapoo	1) maximum width of base = maximum width of body* 2) height of basal edge > height of notch width
4) Nanton	1) maximum width of base > or = maximum width of body 2) height of basal edge < or = height of notch width
5) Lewis	1) maximum width of base < maximum width of body 2) height of basal edge < height of notch width 3) rounded basal edge
6) Irvine	1) maximum width of base < maximum width of body 2) relationship between height of basal edge to height of notch opening is not specified 3) angular basal edge
7) High River	1) maximum width of base < maximum width of body 2) no basal edge 3) corner notched

* -- maximum width of base = maximum width of body when the difference is less than 1 mm

(adapted from Forbis 1962:96-102)

Table 1 - Types generated by Forbis.

TYPE	DIAGNOSTIC FEATURES
1) Washita	1) maximum width of base > maximum width of body 2) height of basal edge > or = height of notch opening 3) flaring basal edge
2) Pekisko	1) maximum width of base > maximum width of body 2) height of basal edge > height of notch width 3) contracting base
3) Paskapoo	1) maximum width of base = maximum width of body* 2) height of basal edge > height of notch width
4) Nanton	1) maximum width of base > or = maximum width of body 2) height of basal edge < or = height of notch width
5) Lewis	1) maximum width of base < maximum width of body 2) height of basal edge < height of notch width 3) rounded basal edge
6) Irvine	1) maximum width of base < maximum width of body 2) relationship between height of basal edge to height of notch opening is not specified 3) angular basal edge
7) High River	1) maximum width of base < maximum width of body 2) no basal edge 3) corner notched

* -- maximum width of base = maximum width of body when the difference is less than 1 mm

(adapted from Vickers 1986:98)

Table 2 - Vickers' Refinements of Forbis' Types.

PRAIRIE SIDE-NOTCHED TYPE		
Significant Features	Flaking	irregular in outline, with poorly defined angles, mediocre bifacial flaking leave some original blank surface untouched, flake scars are broad and conchoidal
	Notching	large, wide, shallow, V- and U- Shaped side notches, sometimes so low on blade to be corner notches, notches never more than half as deep as they are wide, base height ranges from 1.0 to 9.0 mm, averaging 3.3 mm
	Base	predominantly narrower than the proximal end of blade corner always rounded, except Irvine and corner notched specimens, straight and concave bases, some convex
	Edge	very sharp but irregular, not purposefully serrated
	Size	Length - ranges from 11.0 to 41.0 mm, averaging 23.0 mm
		Width - ranges from 9.0 to 22.0 mm, averaging 13.7 mm
		Thickness -ranges from 2.0 to 7.5 mm, averaging 3.5 mm
		Neck Width - ranges from 4 to 15 mm, averaging 9.3 mm
		Weight - ranges from 0.3 to 3.8 gms, averaging 1.1 gms
	Shape	not mentioned
	Mineral	Petrified wood (32.1%), Knife River Flint (21.1%), coarse white chert (10.0%), and others (36.8)
Varieties	Swift Current Fish-tail	like Carmichael variety but cruder flaking, less symmetrical outline, larger notches, and greater thickness, small rounded ears project at 65° angle to longitude of point, concave base
	Irvine Narrow Square Base	base narrower than body, basal corners and lower edges of notches form sharp angle, base is straight or concave, notches are wide and shallow
	Shaunavon Truncated-base	longer than most Prairie S-N, widest-deepest notches like very wide U or V that connects with what appears to be the truncated corner of the base
	High River Small Corner-notched	smallest and lightest in weight of Prairie type, wide corner notches extending to base which is narrower than proximal end of blade, base usually straight, sometimes convex.
	Lewis Narrow Rounded Base	convex or straight rounded base, narrower than the proximal end of the blade, concave base is rare, narrowness of base produces appearance of corner-notching but base has measurable lateral edges
	Tompkins Side / Corner-notched	slightly smaller than most Prairie types, base usually as wide or wider than the proximal end of the blade, notches wide and shallow and on one side meeting basal edge at sharp angle (forming a corner notch), other side terminating above a high rounded basal corner
	Nanton Wide Rounded Base	medium sized Prairie type, has base equal to or wide than proximal end of the blade, and wide V or U notches, usually straight base but also convex and concave, notches medium height above base with rounded lower edges, rounded basal corners producing appearance of rounded ears

(adapted from Kehoe 1966:830-832)

Table 3 - Kehoe's Prairie Side-notched projectile point type and associated varieties.

PLAINS SIDE-NOTCHED TYPE		
Significant Features	Flaking	well defined outline with sharp angles at bases and notches, symmetry was valued, flaking approaches Avonlea type standards
	Notching	notches are usually shallow and deep, and narrow, an acute U in shape placed fairly high on the blade, notches usually as deep as they are wide, in later varieties often deeper than they are wide, and forming acute angles, notches usually symmetrically opposed, base height ranges from 3.0 to 6.0 mm, averaging 4.14 mm
	Base	as wide or wider than the proximal end of the blade, w with preference for base wider than blade in later periods, corners of base are square or form acute angles, no convex bases , most straight some concave
	Edge	very sharp, fairly regular, almost never serrated
	Size	Length - ranges from 10.0 to 33.5 mm, averaging 22.7 mm
		Width - ranges from 9.0 to 18.0 mm, averaging 13.4 mm
		Thickness- ranges from 2.0 to 7.0 mm, averaging 3.5 mm
		Neck Width - ranges from 5.5 to 18.0 mm, averaging 8.9 mm
		Weight - ranges from 0.3 and 2.0 gms, averaging 1.3 gms.
	Shape	Triangular
	Mineral	Chert (22%), Coarse white chert (14%), Knife River Flint (8%), Chalcedony (16%), and others (40%).
Varieties	Paskapoo Square- ground base	straight, usually heavily ground base, equal in width to the proximal end of the blade, notches are large, round and shallow, located high on the blade, flaking is competent but irregular
	Pekisko Concave- base V-notched	large V-shaped notches high on the blade, usually concave base (occasionally straight but never convex), lateral basal edges sloping inward and downward producing a wide W-shaped for the base as a whole, base usually equal to or wider than the proximal end of the blade
	Emigrant Basal- notched	typical Plains Side-notched type marked by notch in center of the straight base in addition to two lateral side notches
	Billings Double- spur Basal-notched	base proportionately larger in relation to the blade than typical for Plains Side-notched type, base is concave, and a notch which is somewhat wider and shallower than lateral notches
	Buffalo Gap Single-spur	identical to Washita Triangular variety except one of the lateral basal edges extends to form a definite spur
	Cut Bank Jaw-notched	identical to Washita Triangular variety except that notches are rounded in shape and narrower at the edge of the blade than toward the centre
	Washita Triangular	shape is very symmetrical isosceles triangular, creating flaring basal edge wider than proximal blade, flaking is irregular but care for outline, base usually concave, notches are deep, narrow, rectangular, and placed very high on the blade with angles near right angles

(adapted from Kehoe 1966:832-834)

Table 4 - Kehoe's Plains Side-notched projectile point type and associated varieties.

Site	Concave	Convex	Straight	Notched	Oblique	Spurred	Irregular	Total
EcPl-1	17(22.1)	14(18.2)	42(54.5)	0(0.0)	0(0.0)	0(0.0)	4(5.2)	77(100)
DkPj-1	71(32.4)	34(15.5)	107(48.9)	1(0.5)	1(0.5)	0(0.0)	5(2.3)	219(100)
EcNm-8	3(15.8)	8(5.3)	7(36.8)	1(5.3)	0(0.0)	0(0.0)	0(0.0)	19(100)

Table 5 - Raw counts of the various forms of basal edge shape from projectile point assemblages ca. 1250 B.P. to 650 B.P. (values in parentheses indicate percentages of total assemblage).

Site	Concave	Convex	Straight	Notched	Oblique	Spurred	Irregular	Total
EcPl-1	125(37.7)	21(6.3)	161(48.5)	2(0.6)	5(1.5)	3(0.9)	15(4.5)	332(100)
DkPj-1	62(37.3)	13(7.8)	82(49.4)	3(1.8)	1(0.6)	2(1.2)	3(1.8)	166(100)
DkPi-2	98(32.0)	44(14.4)	145(47.4)	1(0.3)	0(0.0)	0(0.0)	18(5.9)	306(100)
DlPd-3	49(35.0)	9(6.4)	71(50.7)	0(0.0)	2(1.4)	1(0.7)	8(5.7)	140(100)
EcNm-8	45(25.3)	9(5.1)	119(66.9)	1(0.6)	0(0.0)	0(0.0)	4(2.2)	178(100)
EfNg-1	5(22.7)	0(0.0)	16(72.7)	0(0.0)	0(0.0)	0(0.0)	1(4.5)	22(100)
EdNh-1	16(14.3)	5(4.5)	85(75.9)	0(0.0)	1(0.9)	1(0.9)	4(3.6)	112(100)
EeNd-3	0(0.0)	1(3.1)	29(90.6)	0(0.0)	0(0.0)	0(0.0)	2(6.3)	32(100)
FaNp-9	6(17.1)	0(0.0)	28(80.0)	0(0.0)	0(0.0)	0(0.0)	1(2.9)	35(100)
DhMs-12	22(19.0)	5(4.3)	87(75.0)	0(0.0)	0(0.0)	0(0.0)	2(1.7)	116(100)

Table 6 - Raw counts of the various forms of basal edge shape from projectile point assemblages ca. 650 B.P. to the Historic (values in parentheses indicate percentage of total assemblage).

Site	Side	Corner	Side-corner	Side and corner	Side and basal	Stemmed	Total
EcPl-1	65(75.6)	11(12.8)	10(11.6)	0(0.0)	0(0.0)	0(0.0)	86(100)
DkPj-1	201(90.1)	3(1.3)	17(7.6)	1(0.4)	1(0.4)	0(0.0)	223(100)
EcNm-8	14(82.4)	0(0.0)	3(17.6)	0(0.0)	0(0.0)	0(0.0)	17(100)

Table 7 - Raw counts of the various notch types from projectile point assemblages ca. 1250 B.P. to 650 B.P. (values in parentheses indicate percentages of the total assemblage).

Site	Side	Corner	Side-corner	Side and corner	Side and basal	Stemmed	Total
EcPl-1	351(96.4)	2(0.5)	7(1.9)	1(0.3)	2(0.5)	1(0.3)	364(100)
DkPj-1	160(92.5)	4(2.3)	7(4.0)	1(0.6)	1(0.6)	0(0.0)	173(100)
DkPi-2	236(73.5)	19(5.9)	58(18.1)	7(2.2)	1(0.3)	0(0.0)	321(100)
DlPd-3	119(79.9)	4(2.7)	4(2.7)	22(14.8)	0(0.0)	0(0.0)	149(100)
EcNm-8	171(97.7)	1(0.6)	2(1.1)	0(0.0)	1(0.6)	0(0.0)	175(100)
EfNg-1	23(100)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	23(100)
EdNh-1	93(96.9)	1(1.0)	1(1.0)	1(1.0)	0(0.0)	0(0.0)	96(100)
EeNd-3	33(100)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	33(100)
FaNp-9	35(100)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	35(100)
DhMs-12	112(98.2)	2(1.8)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	114(100)

Table 8 - Raw counts of the various notch types from projectile point assemblages ca. 650 B.P. to the Historic Period (values in parentheses indicate percentages of the total assemblage).

Site	Angular		Round		V-Shaped		Rectangular		U-shaped		Total
	Broad	Narrow	Shallow	Deep	Broad	Narrow	Broad	Narrow	Broad	Narrow	
EcPl-1	13(15.7)	0(0.0)	16(19.3)	0(0.0)	51(61.4)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(3.6)	83(100)
DkPj-1	49(21.7)	0(0.0)	75(33.2)	1(0.4)	91(40.3)	0(0.0)	0(0.0)	1(0.4)	6(2.7)	3(1.3)	226(100)
EcNm-8	2(10.5)	1(5.3)	11(57.9)	0(0.0)	4(21.1)	0(0.0)	0(0.0)	0(0.0)	1(5.3)	0(0.0)	19(100)

Table 9 - Raw counts of the various notch forms for projectile point assemblages dating ca. 1250 B.P. to 650 B.P. (values in parentheses indicate percentages of the total assemblage).

Site	Angular		Round		V-Shaped		Rectangular		U-shaped		Total
	Broad	Narrow	Shallow	Deep	Broad	Narrow	Broad	Narrow	Broad	Narrow	
EcPl-1	85(24.1)	7(2.0)	54(15.3)	4(1.1)	144(40.9)	13(3.7)	1(0.3)	3(0.9)	10(2.8)	31(8.8)	352(100)
DkPj-1	32(18.6)	4(2.3)	43(25.0)	3(1.7)	64(37.2)	3(1.7)	0(0.0)	0(0.0)	8(4.7)	15(8.7)	172(100)
DkPi-2	48(14.8)	2(0.6)	87(26.9)	2(0.6)	127(39.2)	2(0.6)	0(0.0)	0(0.0)	33(10.2)	23(7.1)	324(100)
DlPd-3	36(29.8)	2(1.7)	17(14.0)	1(0.8)	37(30.6)	2(1.7)	0(0.0)	0(0.0)	6(5.0)	20(16.5)	121(100)
EcNm-8	6(3.6)	2(1.2)	15(9.0)	1(0.6)	12(7.2)	1(0.6)	4(2.4)	3(1.8)	26(15.6)	97(58.1)	167(100)
EfNg-1	3(13.6)	0(0.0)	5(22.7)	3(13.6)	4(18.2)	0(0.0)	1(4.5)	0(0.0)	1(4.5)	5(22.7)	22(100)
EdNh-1	9(10.2)	0(0.0)	9(10.2)	7(8.0)	6(6.8)	1(1.1)	6(6.8)	5(5.7)	4(4.5)	41(46.6)	88(100)
EcNd-3	2(6.5)	0(0.0)	4(12.9)	3(9.7)	1(3.2)	0(0.0)	0(0.0)	0(0.0)	5(16.1)	16(51.6)	31(100)
FaNp-9	0(0.0)	0(0.0)	3(8.6)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(8.6)	29(82.9)	35(100)
DhMs-12	9(9.2)	3(3.1)	16(16.3)	0(0.0)	7(7.1)	2(2.0)	1(1.0)	0(0.0)	14(14.3)	46(46.9)	98(100)

Table 10 - Raw counts of the various notch forms for projectile point assemblages dating ca. 650 B.P. to the Historic Period (values in parentheses indicate percentages of the total assemblage).

Site	Double Diagonal	Diagonal Oblique	Parallel	Edge Modified	Irregular	Total
EcPl-1	5(6.0)	1(1.2)	4(4.8)	7(8.3)	67(79.8)	84(100)
DkPj-1	6(2.2)	0(0.0)	16(5.8)	35(12.8)	217(79.2)	274(100)
EcNm-8	1(5.0)	2(10.0)	1(5.0)	1(5.0)	15(75.0)	20(100)

Table 11 - Raw counts of flaking patterns by site for projectile point assemblages dating ca. 1250 B.P. to 650 B.P. (values in parentheses indicate percentages of the total assemblage).

Site	Double Diagonal	Diagonal Oblique	Parallel	Edge Modified	Irregular	Total
EcPl-1	5(6.0)	1(1.2)	4(4.8)	7(8.3)	67(79.8)	84(100)
DkPj-1	6(2.2)	0(0.0)	16(5.8)	35(12.8)	217(79.2)	274(100)
DkPi-2	20(5.4)	4(1.1)	10(2.7)	49(13.3)	285(77.4)	368(100)
DlPd-3	18(11.8)	0(0.0)	7(4.6)	21(13.8)	106(69.7)	152(100)
EcNm-8	10(4.5)	0(0.0)	6(2.7)	25(11.4)	179(69.7)	220(100)
EfNg-1	1(4.3)	0(0.0)	0(0.0)	3(13.0)	19(82.6)	23(100)
EdNh-1	2(1.4)	2(1.4)	2(2.1)	23(15.8)	116(79.5)	146(100)
EeNd-3	0(0.0)	0(0.0)	2(6.3)	5(15.6)	25(78.1)	32(100)
FaNp-9	2(5.4)	1(2.7)	4(10.8)	0(0.0)	30(81.1)	37(100)
DhMs-12	1(1.1)	2(2.1)	2(2.1)	13(13.8)	76(80.9)	94(100)

Table 12 - Raw counts of flaking patterns by site for projectile point assemblages dating ca. 650 B.P. to the Historic Period (values in parentheses indicate percentages of the total assemblage).

Site	Asymmetrical	Symmetrical	Intentional Asymmetry	Total
EcPl-1	76(95.0)	4(5.0)	0(0.0)	80(100)
DkPj-1	186(93.9)	10(5.1)	2(1.0)	198(100)
EcNm-8	16(100)	0(0.0)	0(0.0)	16(100)

Table 13 - Raw counts of the various outline forms, by site, for projectile point assemblages dating ca. 1250 B.P. to 650 B.P. (values in parentheses indicate percentages of the total assemblage).

Site	Asymmetrical	Symmetrical	Intentional Asymmetry	Total
EcPl-1	264(85.7)	36(11.7)	8(2.6)	308(100)
DkPj-1	151(92.6)	9(5.5)	3(1.8)	163(100)
DkPi-2	291(94.8)	12(3.9)	4(1.3)	307(100)
DlPd-3	116(92.8)	8(3.9)	1(0.8)	125(100)
EcNm-8	144(92.3)	12(7.7)	0(0.0)	156(100)
EfNg-1	18(94.7)	1(5.3)	0(0.0)	19(100)
EdNh-1	95(93.1)	6(5.9)	1(1.0)	102(100)
EeNd-3	24(88.9)	3(11.1)	0(0.0)	27(100)
FaNp-9	27(87.1)	4(12.9)	0(0.0)	31(100)
DhMs-12	85(97.7)	2(2.3)	0(0.0)	87(100)

Table 14 - Raw counts of the various outline forms, by site, for projectile point assemblages dating ca. 650 B.P. to the Historic Period (values in parentheses indicate percentages of the total assemblage).

Site	Biplano	Plano-triangular	Plano-convex	Convex Asymmetrical	Convex Triangular	Convex Symmetrical	Total
EcPl-1	5(5.7)	1(1.1)	27(31.0)	43(49.4)	0(0.0)	11(12.6)	87(100)
DkPj-1	21(7.6)	4(1.4)	69(24.8)	175(62.9)	0(0.0)	9(3.2)	278(100)
EcNm-8	0(0.0)	1(4.8)	5(23.8)	15(71.4)	0(0.0)	0(0.0)	21(100)

Table 15 - Raw counts of cross-sections, by site, for projectile point assemblages dating ca. 1250 B.P. to 650 B.P. (values in parentheses indicate percentages of the total assemblage).

Site	Biplano	Plano-triangular	Plano-convex	Convex Asymmetrical	Convex Triangular	Convex symmetrical	Total
EcPl-1	26(6.7)	8(2.1)	109(27.9)	183(46.9)	0(0.0)	64(16.4)	390(100)
DkPj-1	10(4.5)	3(1.4)	70(31.8)	109(49.5)	1(0.5)	27(12.3)	220(100)
DkPi-2	0(0.0)	41(10.9)	209(55.4)	111(29.4)	1(0.3)	15(4.0)	377(100)
DlPd-3	7(4.0)	5(2.9)	44(25.3)	65(37.4)	4(2.3)	49(28.1)	174(100)
EcNm-8	0(0.0)	27(11.7)	22(9.5)	173(74.9)	0(0.0)	9(3.9)	231(100)
EfNg-1	0(0.0)	4(17.4)	2(8.7)	16(69.6)	0(0.0)	1(4.3)	23(100)
EdNh-1	0(0.0)	20(13.4)	18(12.1)	107(71.8)	1(0.7)	3(2.0)	149(100)
EeNd-3	0(0.0)	4(12.5)	5(15.6)	23(71.9)	0(0.0)	0(0.0)	32(100)
FaNp-9	0(0.0)	0(0.0)	3(8.1)	29(78.4)	0(0.0)	5(13.5)	37(100)
DhMs-12	0(0.0)	0(0.0)	15(16.3)	12(13.0)	1(1.1)	64(69.6)	92(100)

Table 16 - Raw counts of cross-sections by site for projectile point assemblages dating ca. 650 B.P. to the Historic Period (values in parentheses indicate percentages of the total assemblage).

Site	EcPl-1	DkPj-1	EcNm-8
Asymm.	7(9.9)	34(16.7)	4(23.5)
2	9(12.7)	50(24.6)	1(5.9)
3	10(14.1)	10(4.9)	1(5.9)
4	3(4.2)	12(5.9)	3(17.6)
5	20(28.2)	41(20.1)	1(5.9)
6	2(2.8)	4(2.0)	0(0.0)
7	1(1.4)	1(0.5)	1(5.9)
8	6(8.5)	0(0.0)	0(0.0)
9	3(4.2)	3(1.5)	0(0.0)
10	4(5.6)	2(1.0)	0(0.0)
11	0(0.0)	6(3.0)	0(0.0)
12	1(1.4)	2(1.0)	0(0.0)
13	5(7.0)	24(11.8)	5(29.4)
14	0(0.0)	0(0.0)	0(0.0)
15	0(0.0)	9(4.4)	1(5.9)
16	0(0.0)	0(0.0)	0(0.0)
17	0(0.0)	1(0.5)	0(0.0)
18	0(0.0)	0(0.0)	0(0.0)
19	0(0.0)	2(1.0)	0(0.0)
20	0(0.0)	0(0.0)	0(0.0)
21	0(0.0)	1(0.5)	0(0.0)
22	0(0.0)	0(0.0)	0(0.0)
23	0(0.0)	0(0.0)	0(0.0)
24	0(0.0)	1(0.5)	0(0.0)
25	0(0.0)	0(0.0)	0(0.0)
26	0(0.0)	0(0.0)	0(0.0)
Total	71(100)	203(100)	17(100)

Table 17 - Raw counts of the various base forms, by site, for projectile point assemblages dating ca. 1250 B.P. to 650 B.P. (values in parentheses indicate percentages of the total assemblage).

Site	EcPl-1	DkPj-1	DkPi-2	DlPd-3	EcNm-8	EfNg-1	EdNh-1	EcNd-3	FaNp-9	DhMs-12
Asymm	45(14.1)	27(17.3)	65(22.8)	22(19.5)	20(12.0)	5(22.7)	5(12.0)	1(3.3)	2(5.9)	11(9.8)
2	71(22.3)	34(21.8)	65(22.8)	20(17.7)	18(10.8)	2(9.1)	5(6.0)	0(0.0)	4(11.8)	14(12.5)
3	9(2.8)	4(2.6)	4(11.2)	32(2.7)	1(0.6)	3(4.5)	1(1.2)	1(3.3)	0(0.0)	2(1.8)
4	15(4.7)	10(6.4)	3(1.1)	12(10.6)	0(0.0)	0(0.0)	4(4.8)	1(3.3)	4(11.8)	6(5.4)
5	60(18.8)	35(22.4)	72(25.3)	21(18.6)	10(6.0)	1(4.5)	3(3.6)	1(3.3)	1(2.9)	8(7.1)
6	28(8.8)	5(3.2)	4(1.4)	9(8.0)	85(50.8)	10(45.5)	45(54.2)	22(73.3)	20(58.8)	59(52.7)
7	2(0.6)	2(1.3)	1(0.4)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(2.9)	0(0.0)
8	2(0.6)	2(1.3)	9(3.2)	2(1.8)	0(0.0)	0(0.0)	1(1.2)	0(0.0)	0(0.0)	0(0.0)
9	13(4.1)	3(1.9)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
10	1(0.3)	2(1.3)	5(1.8)	1(0.9)	0(0.0)	0(0.0)	1(1.2)	0(0.0)	0(0.0)	0(0.0)
11	2(0.6)	1(0.6)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
12	1(0.3)	3(1.9)	6(2.1)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
13	15(4.7)	6(3.8)	12(4.2)	4(3.5)	3(1.8)	0(0.0)	0(0.0)	1(3.3)	0(0.0)	1(0.9)
14	2(0.6)	2(1.3)	0(0.0)	1(0.9)	0(0.0)	0(0.0)	1(1.2)	0(0.0)	0(0.0)	0(0.0)
15	7(2.2)	6(3.8)	2(0.7)	4(3.5)	12(7.2)	1(4.5)	3(3.6)	0(0.0)	1(2.9)	2(1.8)
16	10(3.1)	3(1.9)	2(0.7)	3(2.7)	2(1.2)	0(0.0)	2(2.4)	0(0.0)	0(0.0)	1(0.9)
17	4(1.3)	1(0.6)	1(0.4)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
18	14(4.4)	8(5.1)	3(1.1)	8(7.1)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
19	3(0.9)	0(0.0)	1(0.4)	1(0.9)	7(4.2)	1(4.5)	4(4.8)	0(0.0)	0(0.0)	4(3.6)
20	9(2.8)	1(0.6)	1(0.4)	0(0.0)	3(1.8)	0(0.0)	0(0.0)	1(3.3)	0(0.0)	0(0.0)
21	5(1.6)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
22	1(0.3)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
23	0(0.0)	1(0.6)	0(0.0)	1(0.9)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
24	0(0.0)	0(0.0)	1(0.4)	1(0.9)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
25	0(0.0)	0(0.0)	0(0.00	0(0.0)	4(2.4)	1(4.5)	3(3.6)	2(6.7)	1(2.9)	3(2.7)
26	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(1.2)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.9)
Total	319(100)	156(100)	285(100)	113(100)	167(100)	22(100)	83(100)	30(100)	34(100)	112(100)

Table 18 - Raw counts of the various base forms, by site, for projectile point assemblages dating ca. 650 B.P. to the Historic Period (values in parentheses indicate percentages of the total assemblage).

Site	Level	Base Angle Distal	Base Angle Proximal	Shoulder Angle	Notch Depth	Notch Height	Base Height	Shoulder Height
DkPj-1	1	0.19	0.98	0.53	0.8	0.23	0.13	0.49
DkPj-1	2	0.27	0.64	0.68	0.34	0.89	1	0.03
DkPj-1	3	0.26	0.16	0.84	0.77	0.19	0.23	0.54
DkPj-1	4	0.33	0.08	0.21	0.25	0.92	0.67	0.39
DkPj-1	5	0.27	0.49	0.31	0.22	0.13	0.31	0.95
DkPj-1	6	0.5	0.77	0.78	0.79	0.88	0.83	0.12
DkPj-1	7a	0.86	0.02	0.75	0.9	0.65	0.85	0.02
DkPj-1	7b	0.72	0.79	0.44	0.48	0.84	0.32	0.43
DkPi-2	1	NA	NA	0.37	0.98	0.97	0.29	0.35
DkPi-2	2	NA	NA	0.15	0.69	0.36	0.7	0.97
DlPd-3	1	NA	NA	0.52	0.74	0.04	0.39	0.97
DlPd-3	2	NA	NA	0.14	0.89	0.4	0.14	0.25
DlPd-3	3	NA	NA	0.58	0.29	0.09	0.43	0.73
DhMs-12	1	0.23	0.23	0.3	0.98	0.65	0.41	0.37
DhMs-12	2	0.49	0.91	0.35	0.28	0.8	0.07	0.95
DhMs-12	3	0.03	0.08	0.21	0.15	0.25	0.39	0.21
DhMs-12	4	0.77	0.49	0.04	0.72	0.48	0.32	0.61
DhMs-12	5-6	0.42	0.96	0.31	0.71	0.95	0.83	0.67
EcPl-1	1-2	0.59	0.18	0.14	0.92	0.48	0.13	0.13
EcPl-1	3	0.86	0.59	0.04	0.16	0.3	0.62	0.29
EcPl-1	4	0.56	0.36	0.59	0.26	0.05	0.3	0.88
EcPl-1	5	0.17	0.46	0.73	0.32	0.06	0.93	0.31
EcPl-1	6	0.93	0.11	0.37	0.74	0.12	0.01	0.17
EcPl-1	7	0.66	0.11	0.05	0.44	0.11	0.58	0.03
EcPl-1	8	0.73	0.71	0.09	0.81	0.92	0.45	0.26
EcPl-1	9	0.75	0.09	0.15	0.21	0.68	0.26	0.88
EcPl-1	10	0.32	0.49	0.74	0.28	0.01	0.92	0.04
EcPl-1	11-12	0.23	0.86	0.77	0.02	0.3	0.54	0.27
EcPl-1	13	0.46	0.87	0.34	0.92	0.87	0.96	0.47
EcPl-1	14	0.85	0.98	0.85	0.82	0.27	0.21	0.17

Table 19 - Two-tailed significance values for each attribute, within each level, for each site.

Site	Level	Base Angle Distal	Base Angle Proximal	Shoulder Angle	Notch Depth	Notch Height	Base Height	Shoulder Height
EcNm-8	1-2	0.16	0.9	0.1	0.55	0.93	0.8	0.91
EcNm-8	3	0.96	0.03	0.4	0.71	0.89	0.09	0.8
EcNm-8	4	0.97	0.88	0.11	0.13	0.5	0.47	0.81
EcNm-8	5	0.01	0.22	0.38	0.68	0.23	0.16	0.25
EcNm-8	6	0.6	0.16	0.33	0.79	0.42	0.17	0.74
EcNm-8	7	0.12	0.32	0.34	0.63	0.72	0.63	0.3
EdNh-1	NA	0.77	0.95	0.85	0.4	0.94	0.62	0.76
EeNd-3	NA	0.05	0.11	0.81	0.3	0.51	0.2	0.11
EfNg-1	NA	0.26	0.69	0.53	0.48	0.02	0.43	0.29
FaNp-9	NA	0.37	0.87	0.61	0.58	0.28	0.43	0.09

Table 19 (cont.) - Two-tailed significance values for each attribute, within each level, for each site (continued from page 161).

Site 1		Site 2	
Level	Scheffe grouping	Level	Scheffe grouping
13-14	A	7B	A
11-12	A	6	A
8	A B	7A	A B
9-10	A B	5	B C
6	B C	3	C
5	B C	4	C
1	C D	1-2	C
3	C D		
4	C D		
7	D		
ANOVA F = 22.64		ANOVA F =18.95	
F Prob. < 0.0001		F Prob. < 0.0001	

Table ###- One-way Analysis of variance of base height using Scheffe test.

In example above, Table ### , the "A's" in the first column (Site 1) indicate that the means of levels 13-14, 11-12, 8, and 9-10 are not significantly different from each other but are significantly different from 6, 5, 1, 3, 4, and 7. Similarly, the 'Bs' in the first column indicate that the means of levels 8, 9-10, 6, and 5 are not significantly different from each other but they are significantly different from levels 13-14, 11-12, 1, 3, 4, and 7. The 'Cs' in the first column indicate that the means of levels 6, 5, 1, 3, and 4 are not significantly different from each other but are significantly different from 13-14, 11-12, 8, 9-10, and 7. The 'Ds' in the first column indicate that the means of levels 1, 3, 4, and 7 are not significantly different from from each other but are significantly different form levels 13-14, 11-12, 8, 9-10, 6, and 5.

In the second column (Site 2), the 'As' indicate that the means of levels 7B, 6, and 7A are not significantly different from each other but are significantly different from levels 5, 3, 4, and 1-2. And so on...

The Scheffe test was used as: "This test is conservative for pairwise comparisons of means and reqires larger differences between means for significance than the other multiple comparison tests" (Norusis 1993:278).

Table 20 - Interpreting One-way ANOVA Post Hoc Multiple Comparisons Tables

Old Women's Buffalo Jump		Head-Smashed-In Buffalo Jump		Walter Felt site	
Level	Scheffe grouping	Level	Scheffe grouping	Level	Scheffe grouping
13-14	A	7B	A	7	A
11-12	A	6	A	6	A B
8	A B	7A	A B	4	B C
9-10	A B	5	B C	3	C
6	B C	3	C	5	C
5	B C	4	C	1-2	C
1	C D	1-2	C		
3	C D				
4	C D				
7	D				
ANOVA F = 22.64		ANOVA F =18.95		ANOVA F = 15.51	
F Prob. < 0.0001		F Prob. < 0.0001		P < 0.0001	

Table 21 - One-way Analysis of variance of base height using Scheffe test.

Old Women's Buffalo Jump		Head-Smashed-In Buffalo Jump		Walter Felt site	
Level	Scheffe grouping	Level	Scheffe grouping	Level	Scheffe grouping
1-2	A	6	A	7	A
3	A	7B	A B	6	A B
4	A	5	A B	4	A B
5	A	7A	A B	3	A B
6	A	3	A B	5	A B
7	A	4	A B	1-2	B
8	A	1-2	B		
9-10	A				
11-12	A				
13-14	A				
ANOVA F = 3.91		ANOVA F = 2.42		ANOVA F = 3.58	
F Prob. = 0.0001		F Prob. = .0269		F Prob. = 0.0045	

Table 22 - One-way analysis of variance of base width using Scheffe test.

Old Women's Buffalo Jump		Head-Smashed-In Buffalo Jump		Walter Felt site	
Level	Scheffe grouping	Level	Scheffe grouping	Level	Scheffe grouping
1-2	A	1-2	A	1-2	A
3	A	3	A	3	A
4	A	4	A	4	A
5	A	5	A	5	A
6	A	6	A	6	A
7	A	7A	A	7	A
8	A	7B	A		
9-10	A				
11-12	A				
13-14	A				
ANOVA F = 1.19		ANOVA F = 2.56		ANOVA F = 1.04	
F Prob. = 0.3015		F Prob. < 0.0193		F Prob. = 0.3951	

Table 23 - One-way analysis of variance of blade width using Scheffe test.

Old Women's Buffalo Jump		Head-Smashed-In Buffalo Jump		Walter Felt site	
Level	Scheffe grouping	Level	Scheffe grouping	Level	Scheffe grouping
1-2	A	7B	A	7	A
3	A	7A	A	6	A B
4	A	6	A	4	A B
5	A	3	B	3	B
6	A	5	B	5	B
7	A	4	B	1-2	B
8	A	1-2	B		
9-10	A				
11-12	A				
13-14	A				
ANOVA F = 3.64		ANOVA F = 20.54		ANOVA F = 5.01	
F Prob =0.0002		F Prob. < 0.0001		F Prob. = 0.0002	

Table 24 - One-way analysis of variance of notch depth using Scheffe test.

Old Women's Buffalo Jump		Head-Smashed-In Buffalo Jump		Walter Felt site	
Level	Scheffe grouping	Level	Scheffe grouping	Level	Scheffe grouping
3	A	5	A	1-2	A
1-2	A	4	A B	3	A
4	A	1-2	A B	4	A
6	A B	7A	A B	5	A
5	A B C	3	A B	6	B
7	A B C	7B	A B	7	B
8	A B C D	6	B		
9-10	B C D				
11-12	C D				
13-14	D				
ANOVA F = 14.41		ANOVA F = 4.84		ANOVA F =14.70	
F Prob. < 0.0001		F Prob. = 0.0001		F Prob. < 0.0001	

Table 25 - One-way analysis of variance of notch height using Scheffe test.

Old Women's Buffalo Jump		Head-Smashed-In Buffalo Jump		Walter Felt site	
Level	Scheffe grouping	Level	Scheffe grouping	Level	Scheffe grouping
11-12	A	7B	A	1-2	A
8	A B	5	A B	3	A
13-14	A B C	7A	A B	4	A
9-10	A B C	6	A B	5	A
7	A B C	4	B	6	A
6	A B C	3	B C	7	A
5	A B C	1-2	C		
3	B C				
1-2	B C				
4	C				
ANOVA F = 5.82		ANOVA F = 11.73		ANOVA F = 3.10	
F Prob. < 0.0001		F Prob. < 0.0001		F Prob. = 0.0096	

Table 26 - One-way analysis of variance of shoulder height using Scheffe test.

Old Women's Buffalo Jump		Head-Smashed-In Buffalo Jump		Walter Felt site	
Level	Scheffe grouping	Level	Scheffe grouping	Level	Scheffe grouping
1-2	A	7A	A	1-2	A
3	A	6	A	3	A
4	A	7B	A	4	A
5	A	3	A	5	A
6	A	5	A B	6	A
7	A	4	A B	7	A
8	A	1-2	B		
9-10	A				
11-12	A				
13-14	A				
ANOVA F = 0.9186 F Prob. =0.5105		ANOVA F = 5.90 F Prob. < 0.0001		ANOVA F = 0.14 F Prob. = 0.1435	

Table 27 - One-way analysis of variance of weight using Scheffe test.

Old Women's Buffalo Jump		Head-Smashed-In Buffalo Jump		Walter Felt site	
Level	Scheffe grouping	Level	Scheffe grouping	Level	Scheffe grouping
4	A	1-2	A	1-2	A
5	A	3	A	3	A
6	A	4	A	5	A
3	A	5	A	4	A
1-2	A	6	A	7	B
7	A	7A	A	6	B
9-10	A	7B	A		
8	A B				
13-14	A B				
11-12	B				
ANOVA F =13.56 F Prob. < 0.0001		ANOVA F = 1.47 F Prob. = 0.1855		ANOVA F = 14.97 F Prob. = 0.0000	

Table 28 - One-way analysis of variance of distal base angle using Scheffe test.

Old Women's Buffalo Jump		Head-Smashed-In Buffalo Jump		Walter Felt site	
Level	Scheffe grouping	Level	Scheffe grouping	Level	Scheffe grouping
1-2	A	1-2	A	1-2	A
3	A	4	A	3	A
4	A	3	A	5	A
11-12	A B	5	A	4	A B
8	A B	7B	A B	7	B C
6	A B	7A	A B	6	C
7	A B	6	B		
13-14	A B				
5	B				
9-10	B				
ANOVA F = 7.61		ANOVA F = 7.65		ANOVA F = 16.77	
F Prob. < 0.0001		F Prob. < 0.0001		F Prob. < 0.0001	

Table 29 - One-way analysis of variance of proximal base angle using Scheffe test.

Old Women's Buffalo Jump		Head-Smashed-In Buffalo Jump		Walter Felt site	
Level	Scheffe grouping	Level	Scheffe grouping	Level	Scheffe grouping
6	A	5	A	1-2	A
4	A B	4	A	3	A
9-10	A B	3	A	5	A
7	A B	1-2	A B	4	A
13-14	A B	6	B C	7	B
3	B	7A	C	6	B
5	B	7B	C		
1-2	B				
8	B				
11-12	B				
ANOVA F = 5.91		ANOVA F = 18.37		ANOVA F =15.13	
F Prob. < 0.0001		F Prob < 0.0001		F Prob. < 0.0001	

Table 30 - One-way analysis of variance of shoulder angle using Scheffe test.

APPENDIX B:

FIGURES

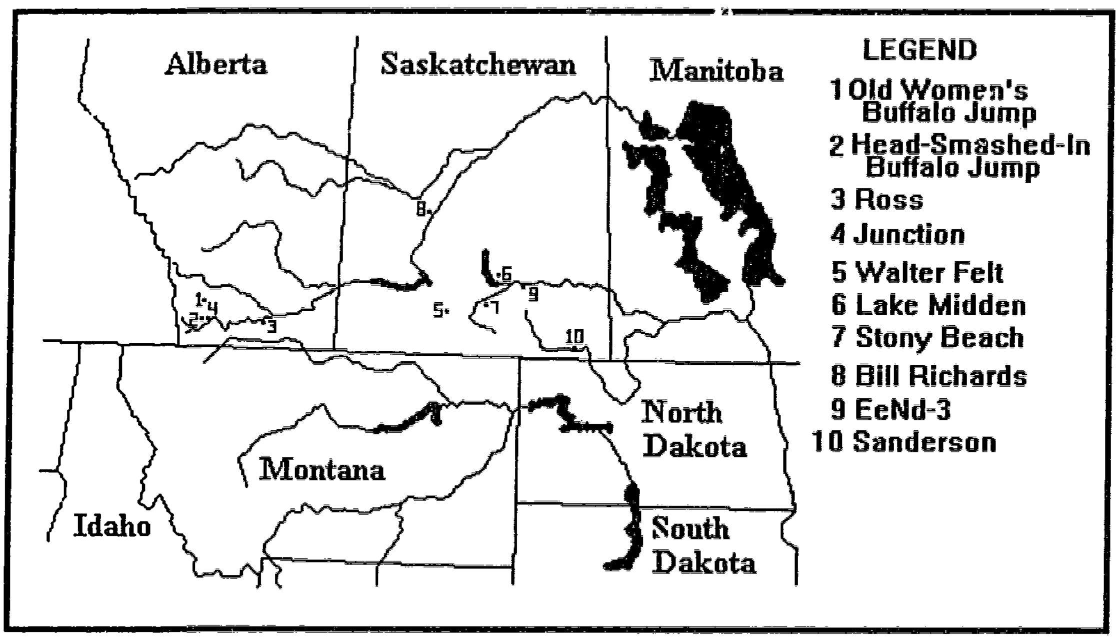


Figure 1 - Map illustrating location of sites used in this study.

Figure 2- Temporal distribution of projectile point assemblages.
(see over for table)

OWBJ - Old Women's Buffalo Jump
HSI - Head-Smashed-In Buffalo Jump
Junction - Junction site
Ross- Ross site
Walter Felt - Walter Felt site
Lake Midden - Lake Midden site
Sanderson - Sanderson site
Bill Richards - Bill Richards site
Stony Beach - Stony Beach site
EeNd-3 - EeNd-3

* - estimated age

- radiometric age

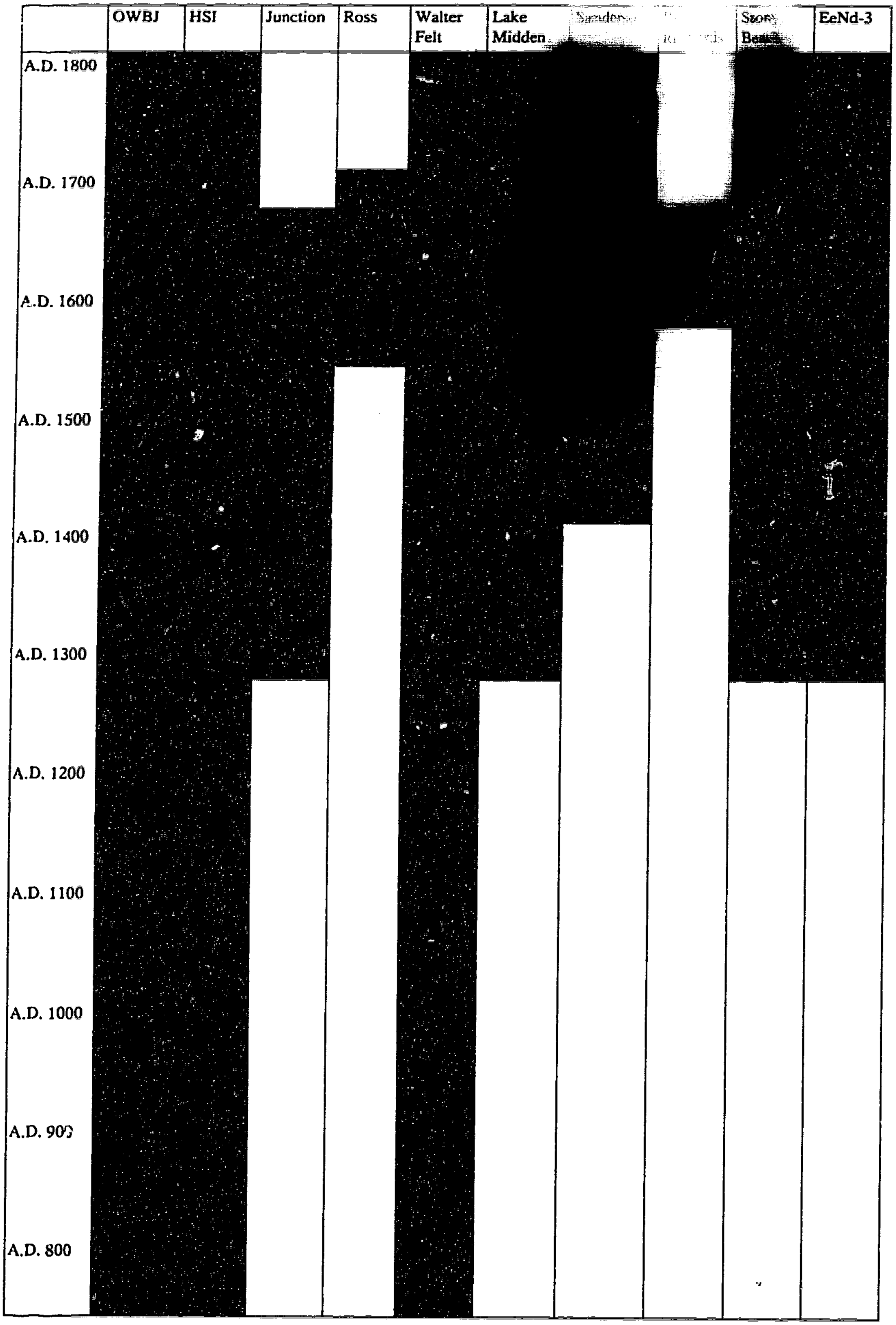


Figure 2 - Temporal distribution of projectile point assemblages.

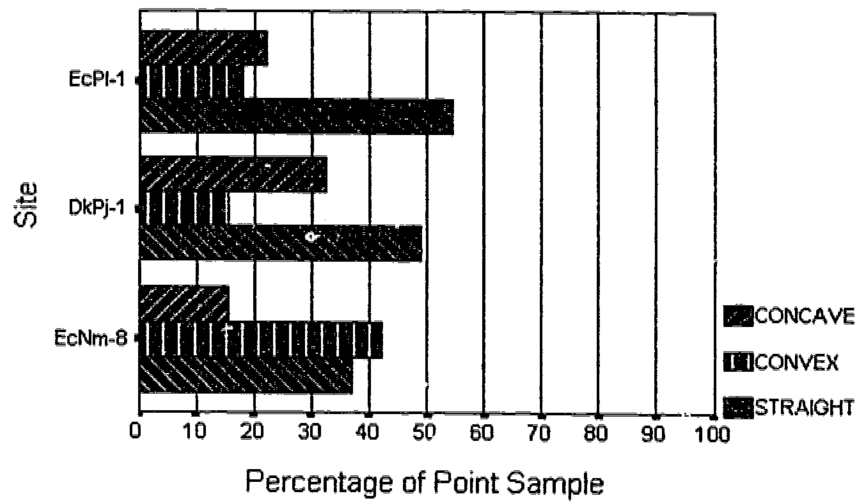


Figure 3 - Frequency of straight, concave, and convex basal edge shapes at sites dating ca. 1250 B.P. to 650 B.P. including EcPl-1 (n=77), DkPj-1 (n=219), and EcNm-8 (n=19).

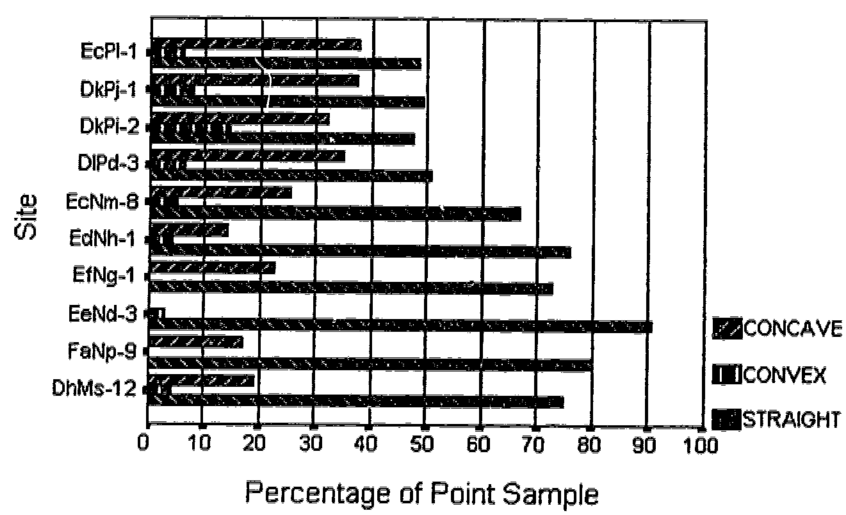


Figure 4 - Frequency of straight, concave and convex basal edge shapes at sites dating ca. 650 B.P. to the Historic Period including EcPl-1 (n=332), DkPj-1 (n=166), DkPi-2 (n=302), DlPd-3 (n=140), EcNm-8 (n=178), EfNg-1 (n=22), EdNh-1 (n=112), EeNd-3 (n=32), FaNp-9 (n=35), and DhMs-12 (n=116).

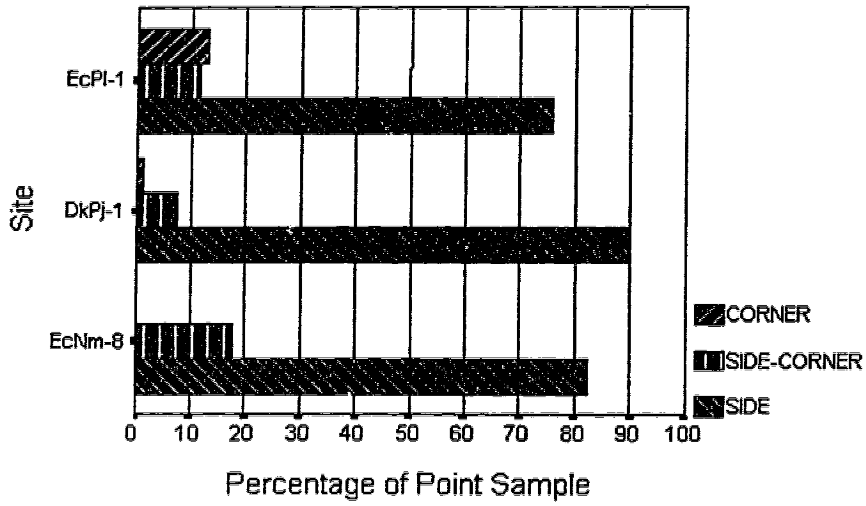


Figure 5 - Frequency of corner notches, side-corner notches, and side notches at sites dating ca. 1250 B.P. to 650 B.P. including EcPl-1 (n=86), DkPj-1 (n=223), and EcNm-8 (n=17).

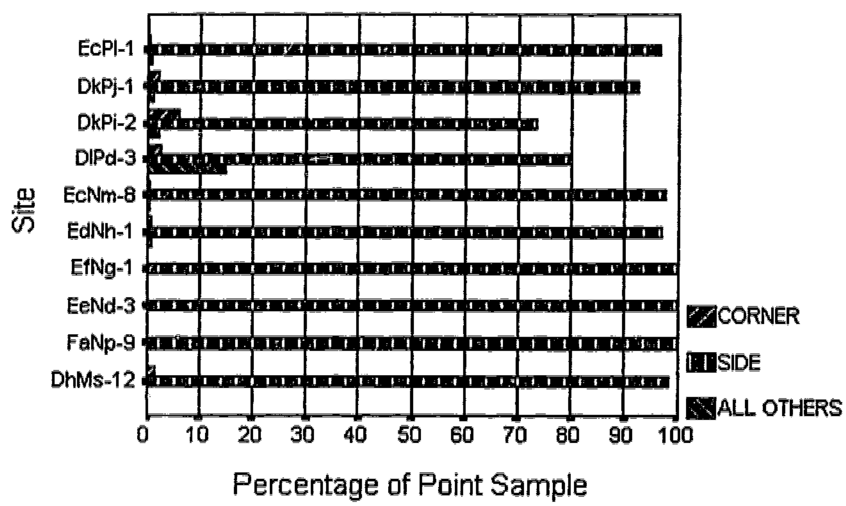


Figure 6 - Frequency of corner notches, side notches, and all other notch types together at sites dating ca. 650 B.P. to the Historic Period including EcPl-1 (n=364), DkPj-1 (n=173), DkPi-2 (n=236), DlPd-3 (n=149), EcNm-8 (n=175), EfNg-1 (n=23), EdNh-1 (n=96), EeNd-3 (n=33), FaNp-9 (n=35), and DhMs-12 (n=114).

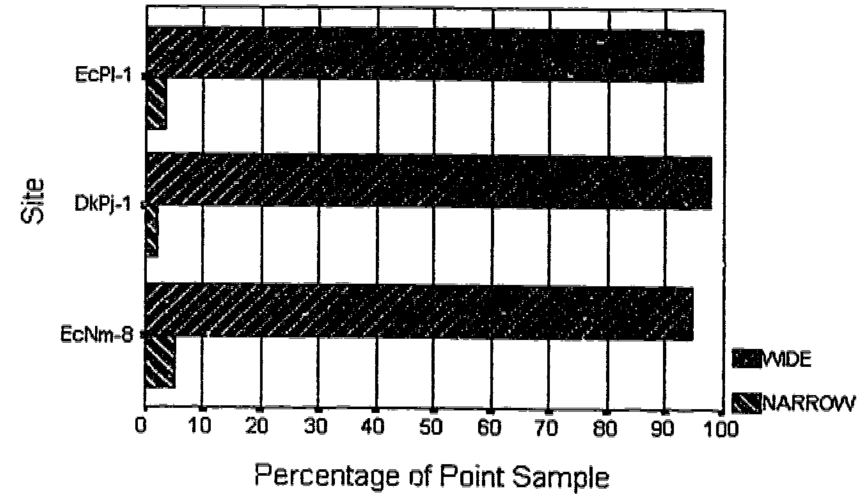


Figure 7 - Frequency of wide and narrow notch forms for sites dating ca. 1250 B.P. to 650 B.P. including EcPl-1 (n=83), DkPj-1 (n=226), and EcNm-8 (n=19).

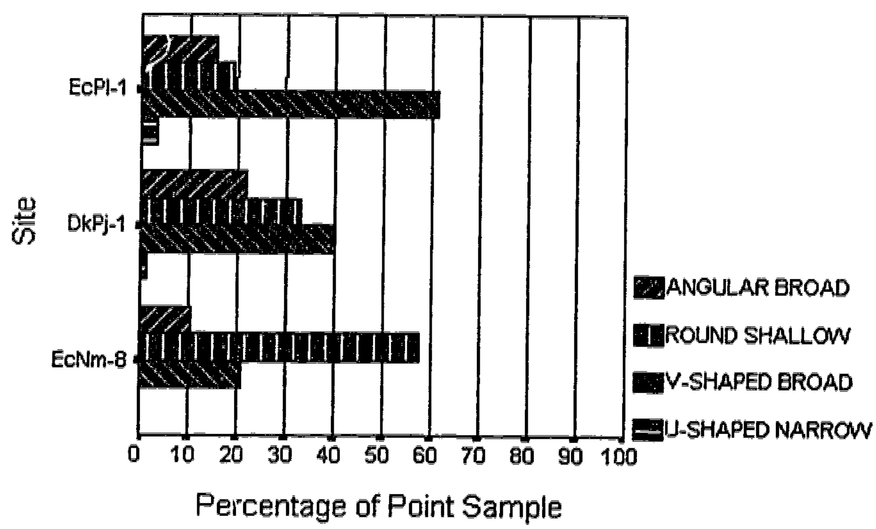


Figure 8 - Frequency of angualr broad, round shallow, V-shaped broad, and u-shaped narrow notch forms for sites dating ca. 1250 B.P. to 650 B.P. including EcPl-1 (n=83), DkPj-1 (n=226), and EcNm-8 (n=19).

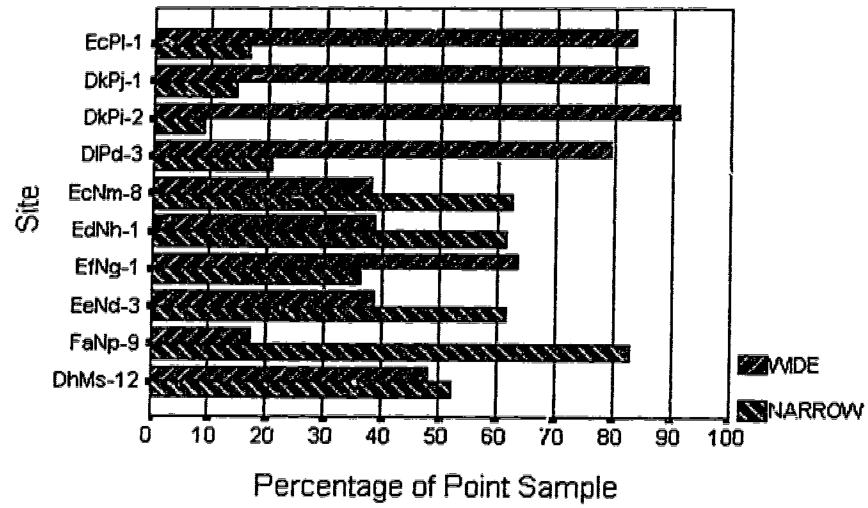


Figure 9 - Frequency of wide and narrow notch forms for sites dating ca. 650 B.P. to the Historic Period including EcPl-1 (n=352), DkPj-1 (n=172), DkPi-2 (n=324), DlPd-3 (n=121), EcNm-8 (n=167), EfNg-1 (n=22), EdNh-1 (n=88), EeNd-3 (n=31), FaNp-9 (n=35), and DhMs-12 (n=98).

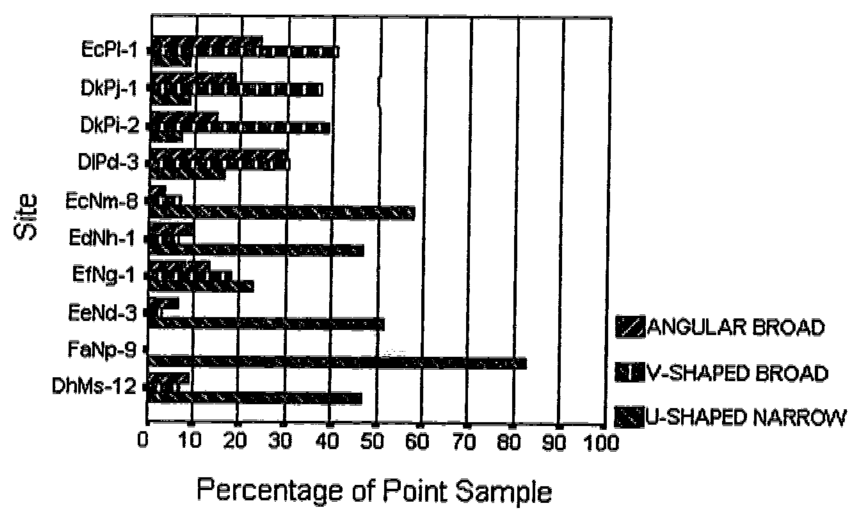


Figure 10 - Frequency of angular broad, V-shaped broad, and U-shaped narrow notch forms for sites dating ca. 650 B.P. to the Historic Period including EcPl-1 (n=352), DkPj-1 (n=172), DkPi-2 (n=324), DlPd-3 (n=121), EcNm-8 (n=167), EfNg-1 (n=22), EdNh-1 (n=88), EeNd-3 (n=31), FaNp-9 (n=35), and DhMs-12 (n=98).

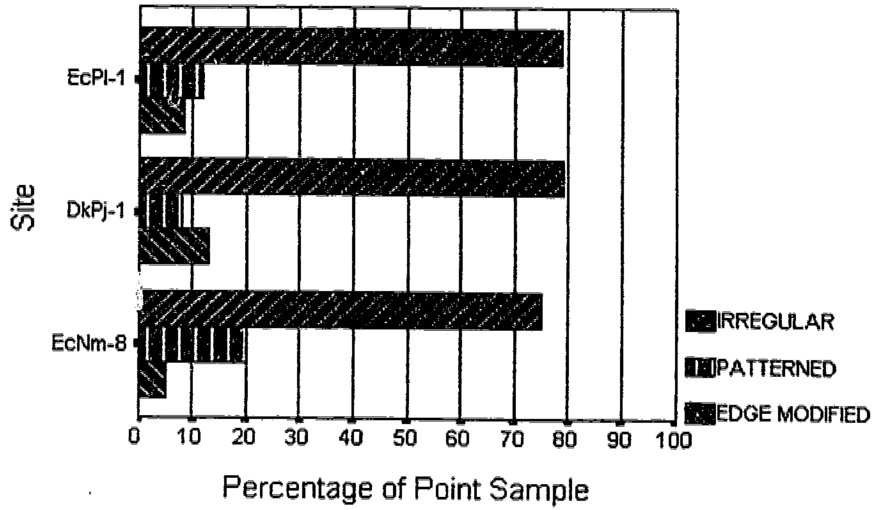


Figure 11 - Frequency of irregular, patterned, and edge modified flaking patterns for sites dating ca. 1250 B.P. to 650 B.P. including EcPl-1 (n=84), DkPj-1 (n=274), and EcNm-8 (n=20).

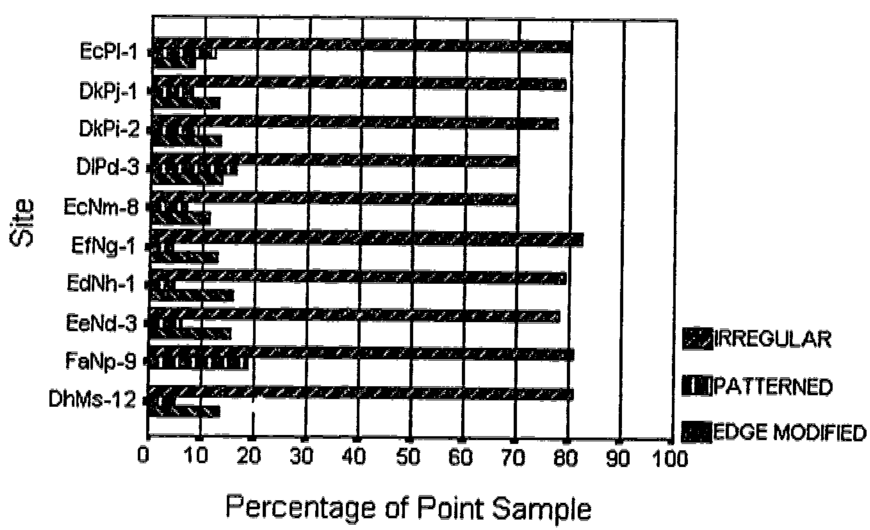


Figure 12 - Frequency of irregular, patterned, and edge modified flaking patterns for sites dating ca. 650 B.P. to the Historic Period including EcPl-1 (n=84), DkPj-1 (n=274), DkPi-2 (n=368), DlPd-3 (n=152), EcNm-8 (n=220), EfNg-1 (n=23), EdNh-1 (n=146), EeNd-3 (n=32), FaNp-9 (n=37), and DhMs-12 (n=94).

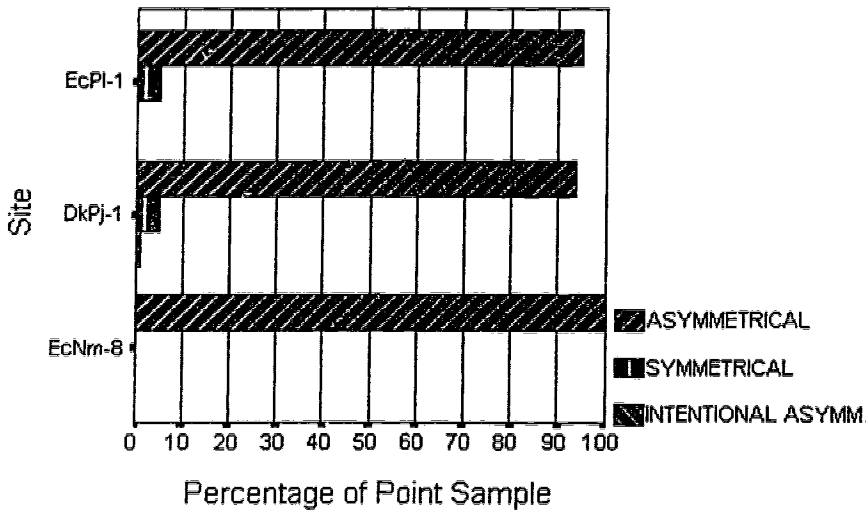


Figure 13 - Frequency of asymmetical, symmetrical, and intentional asymmetircal outline forms for sites dating ca. 1250 B.P. to 650 B.P. including EcPl-1 (n=80), DkPj-1 (n=198), and EcNm-8 (n=16).

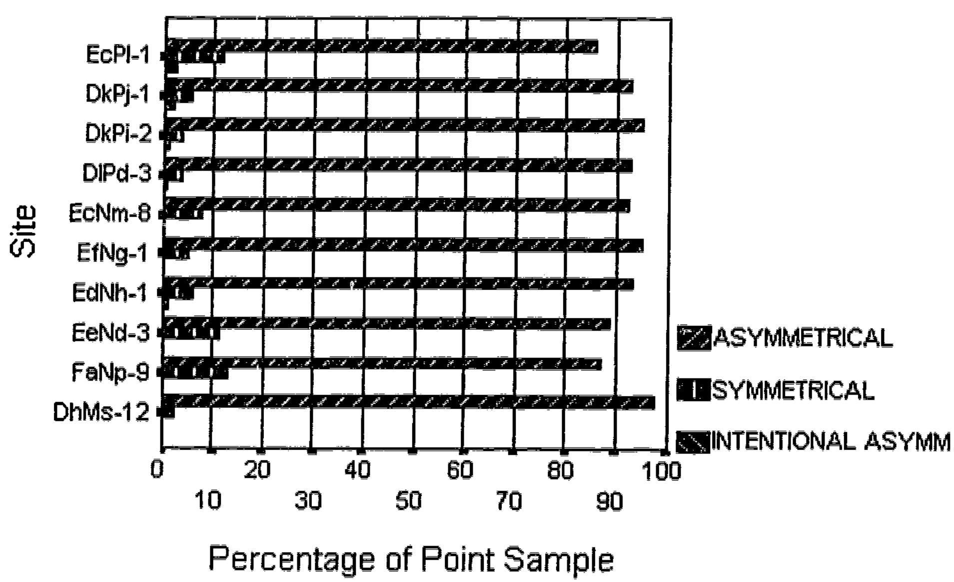


Figure 14 - Frequency of asymmetrical, symmetrical, and intentionally asymmetrical outline forms for sites dating ca. 650 B.P. to the Historic Period including EcPl-1 (n=308), DkPj-1 (n=163), DkPi-2 (n=307), DlPd-3 (n=125), EcNm-8 (n=156), EfNg-1 (n=19), EdNh-1 (n=102), EeNd-3 (n=27), FaNp-9 (n=31), and DhMs-12 (n=87).

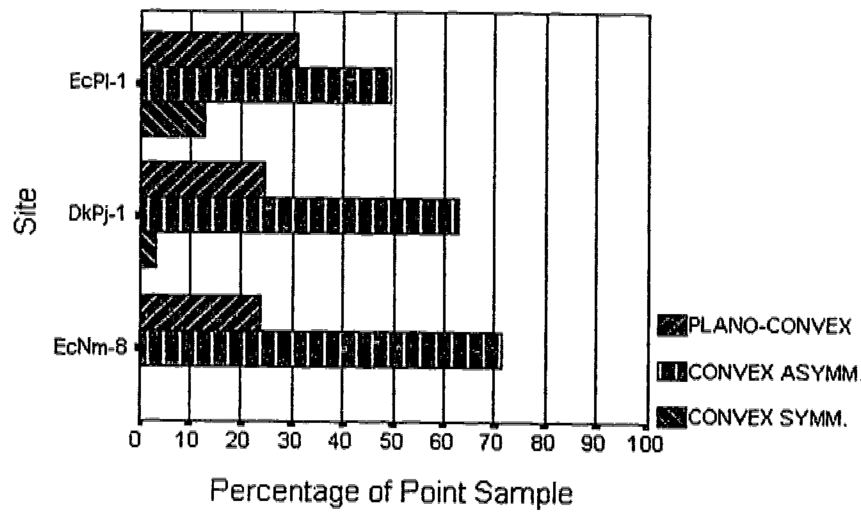


Figure 15 - Frequency of plano-convex, convex asymmetrical, and convex symmetrical, cross-sections at sites dating ca. 1250 B.P. to 650 B.P. including EcPl-1 (n=87), DkPj-1 (n=278), and EcNm-8 (n=21).

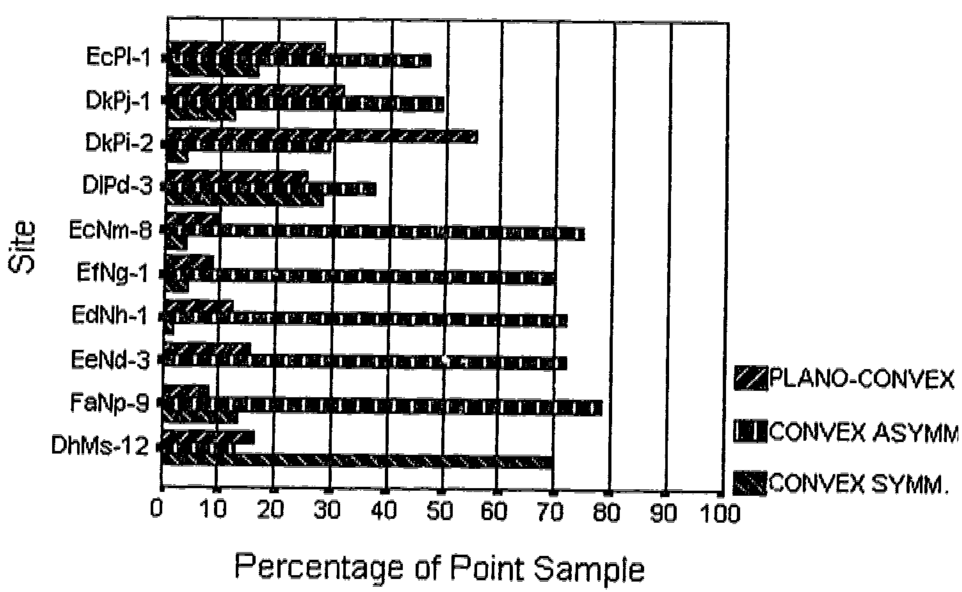


Figure 16 - Frequency of plano-convex, convex asymmetrical, and convex symmetrical, cross-sections at sites dating ca. 650 B.P. to the Historic Period including EcPl-1 (n=390), DkPj-1 (n=220), DkPi-2 (n=377), DlPd-3 (n=174), EcNm-8 (n=231), EfNg-1 (n=23), EdNh-1 (n=149), EeNd-3 (n=32), FaNp-9 (n=37), and DhMs-12 (n=92).

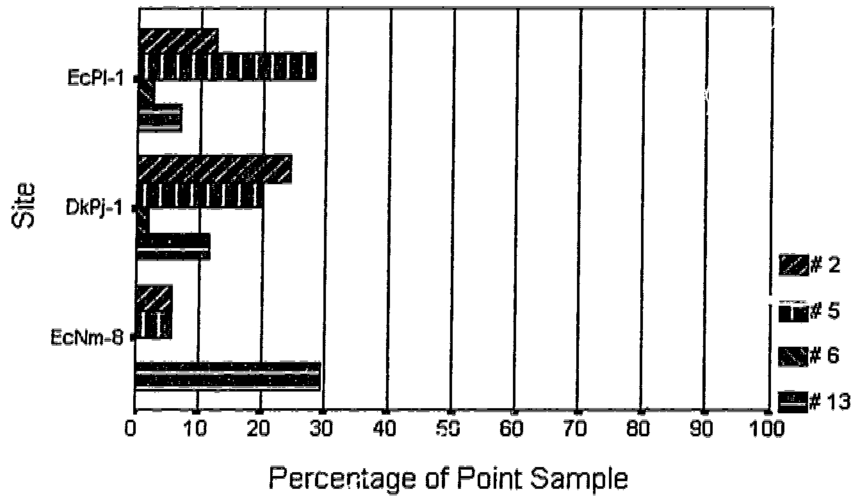


Figure 17 - Frequency of base form # 2, # 5, # 6, and # 13 at sites dating ca. dating 1250 B.P. to 650 B.P. including EcPl-1 (n=71), DkPj-1 (n=203), and EcNm-8 (n=17).

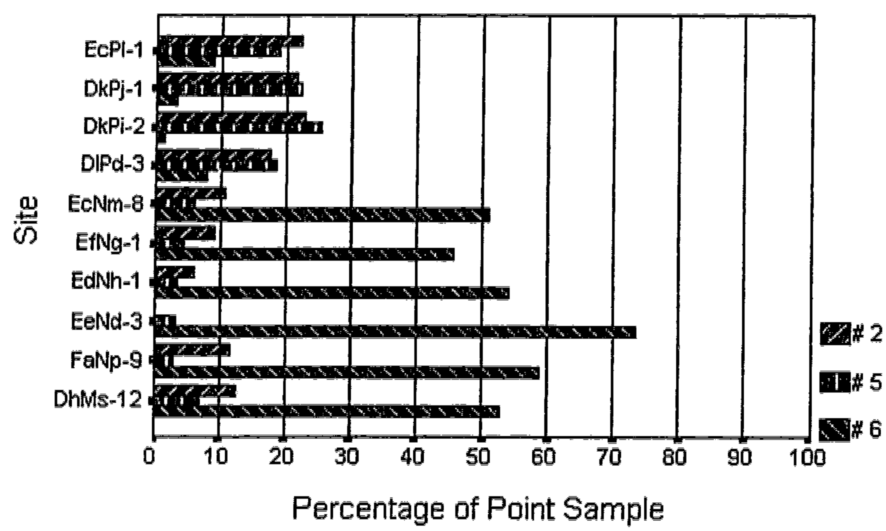


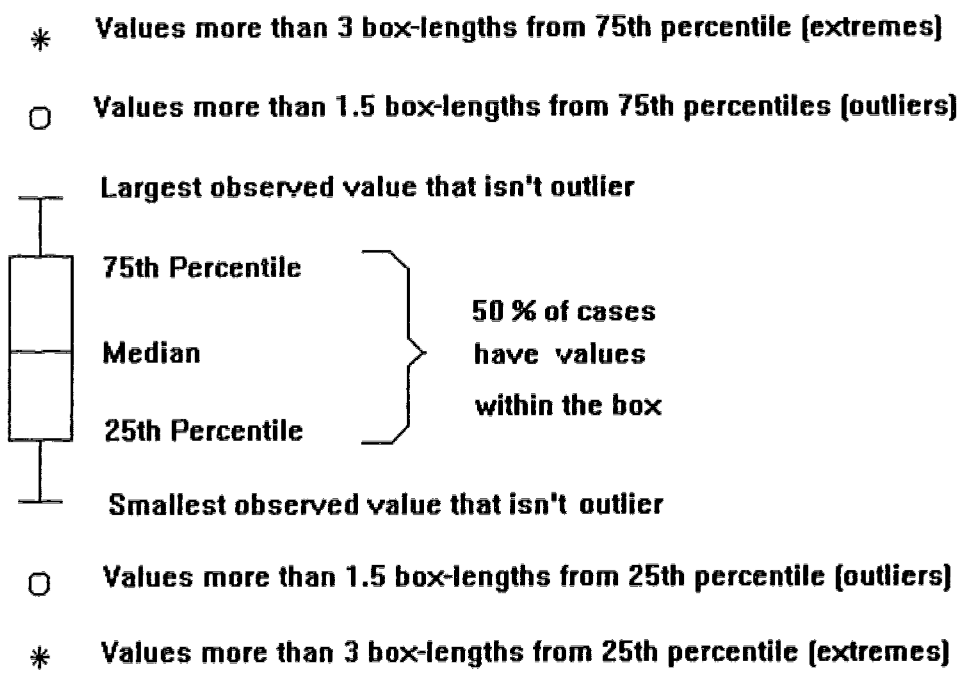
Figure 18 - Frequency of base form # 2, # 5, and # 6 at sites dating ca. dating 650 B.P. to the Historic Period including EcPl-1 (n=319), DkPj-1 (n=156), DkPi-2 (n=285), DlPd-3 (n=113), EcNm-8 (n=167), EfNg-1 (n=22), EdNh-1 (n=83), EeNd-3 (n30), FaNp-9 (n=34), and DhMs-12 (n=112).

Boxplots

A boxplot is a display that summarizes information about the distribution of the values. Instead of plotting the actual values, a boxplot displays summary statistics for the distribution. It plots the median, the 25th percentile, the 75th percentile, and the values that are far removed from the rest.

The figure below shows an annotated sketch of a boxplot. The lower boundary of the box is the 25th percentile and the upper boundary is the 75th percentile. (These percentiles, sometimes called Tukey's hinges, are calculated a little differently from ordinary percentiles.) The horizontal line inside the box represents the median. Fifty percent of the cses have values within the box. The length of the box corresponds to the interquartile range, which is the difference between the 75th and 25th percentiles.

The boxplot includes two categories of cases with outlying values. Cases with values that are more than 3 box-lengths from the upper or lower edge of the box are called extreme values. On the boxplot, these are designated with an asterisk (*). Cases with values that are between 1.5 and 3 box-lengths from the upper and lower edge of the box are called outliers and are designated with a circle. The largest and smallest observed values that aren't outliers are also shown. Lines are drawn from the ends of the box to these values. (These lines are sometimes called whiskers and the plot is called a box-and-whiskers plot.)



(adapted from Norusis 1993:186)

Figure 19 - Annotated sketch of a boxplot.

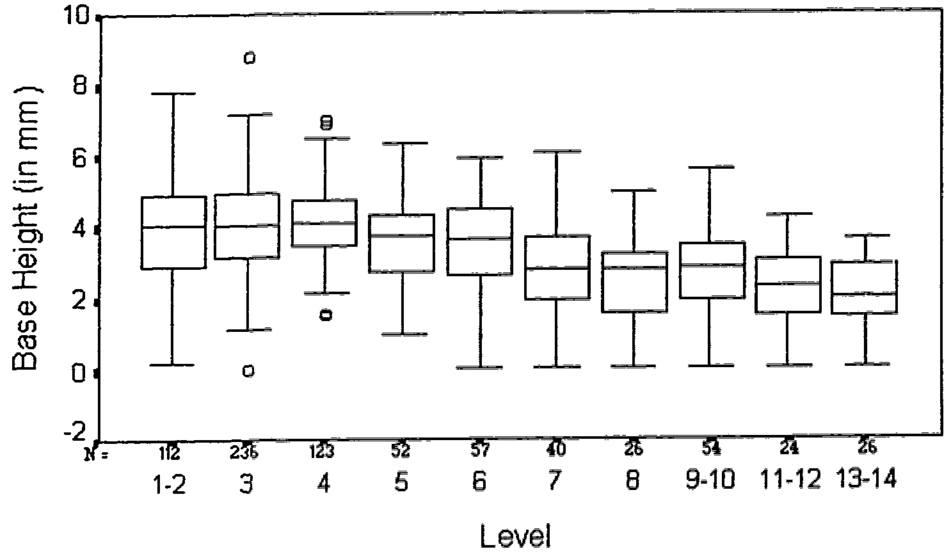


Figure 20 - Boxplot showing distribution of base height values (in mm), by each level, for projectile points from the Old Women's Buffalo Jump.

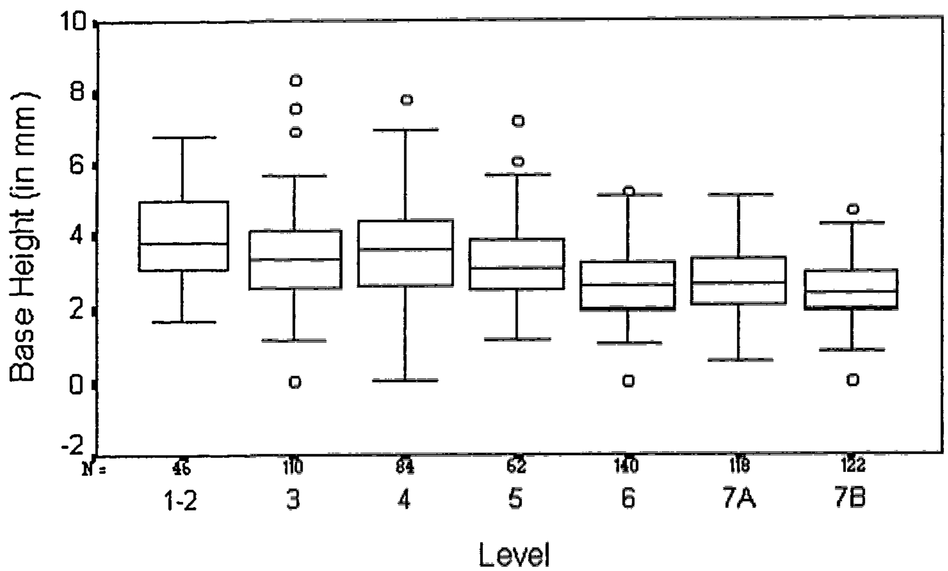


Figure 21 - Boxplot showing distribution of base height values (in mm), by each level, for projectile points from Head-Smashed-In Buffalo Jump.

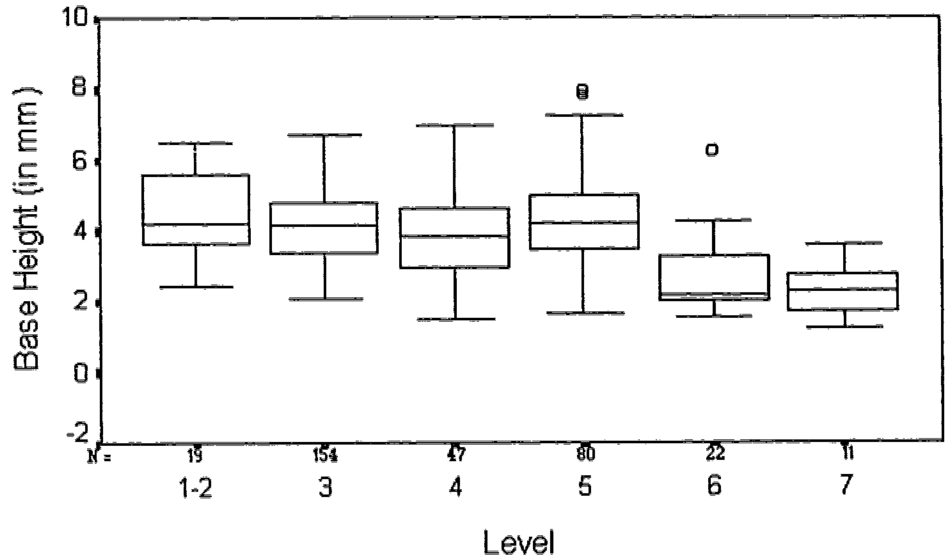


Figure 22 - Boxplot showing distribution of base height values (in mm), by each level, for projectile points from the Walter Felt site.

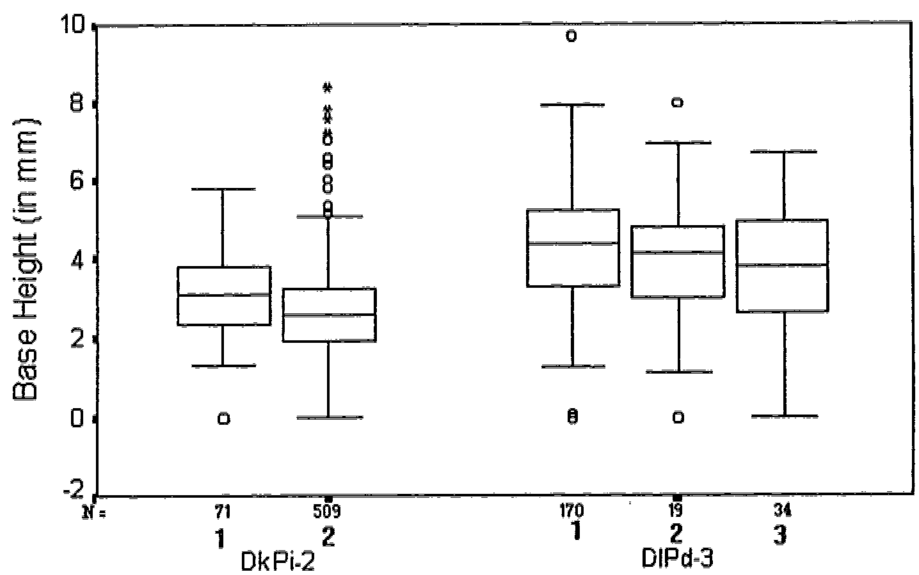


Figure 23 - Boxplot showing distribution of base height values (in mm), by each level, for projectile points from both the Junction site and the Ross site.

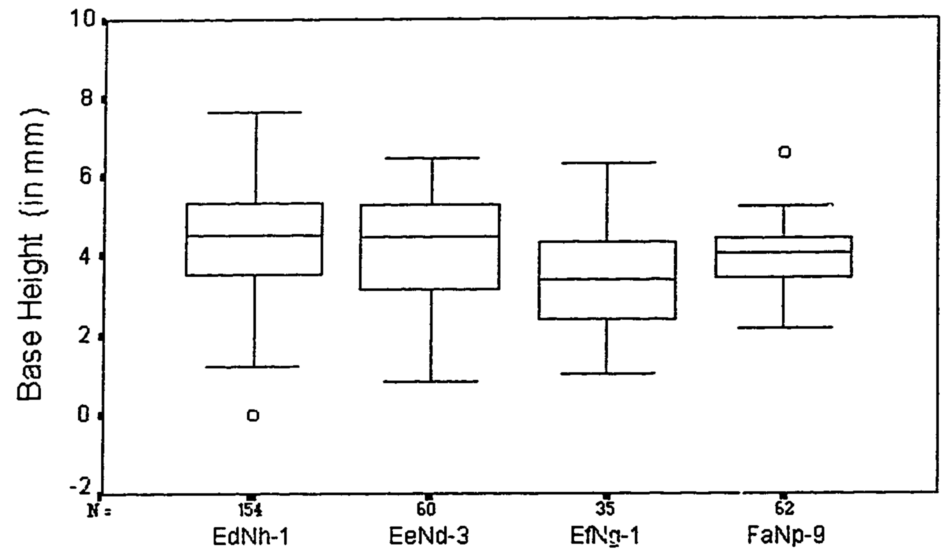


Figure 24 - Boxplot showing distribution of base height values (in mm), by each level, for projectile points from the Stony Beach site (EdNh-1), EeNd-3, the Lake Midden site (EfNg-1), and the Bill Richards site (FaNp-9).

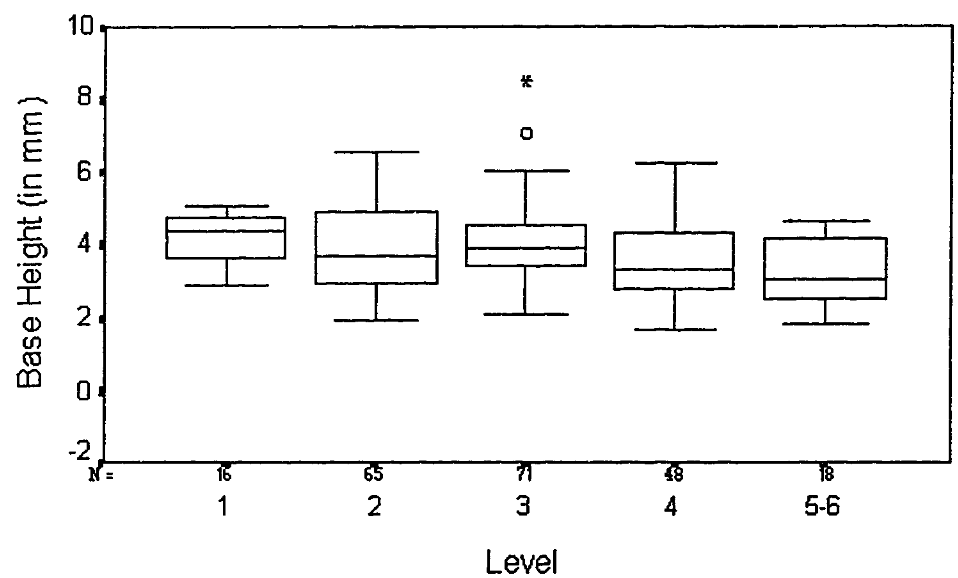


Figure 25 - Boxplot showing distribution of base height values (in mm), by each level, for projectile points from the Sanderson site.

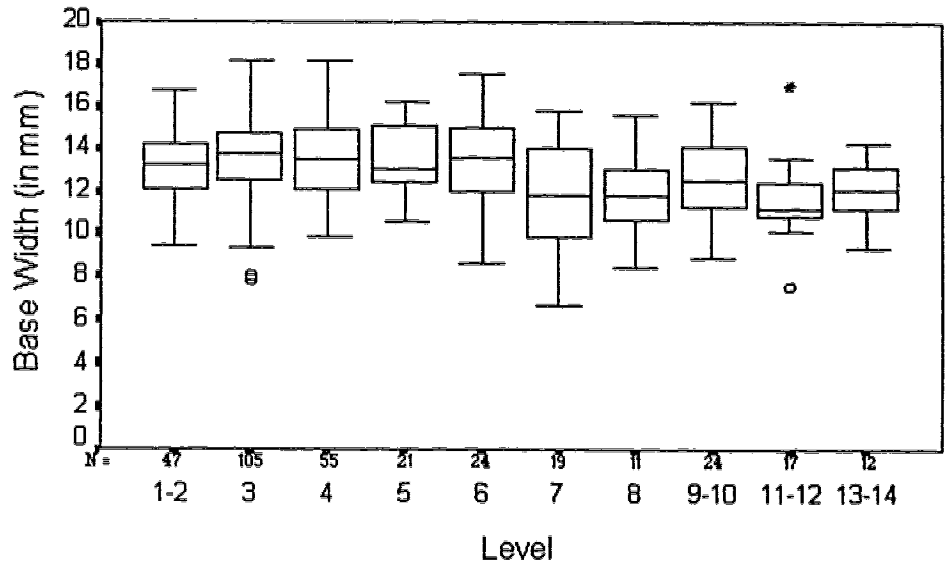


Figure 26 - Boxplots showing the distribution of base width values (in mm), by each level, for projectile points from the Old Women's Buffalo Jump.

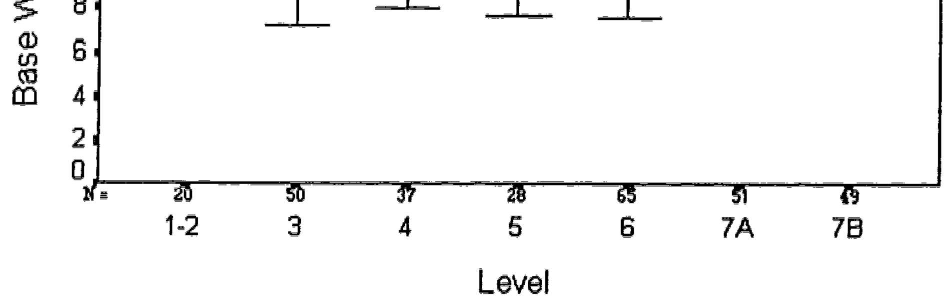


Figure 27 - Boxplots showing the distribution of base width values (in mm), by each level, for projectile points from Head-Smashed-In Buffalo Jump.

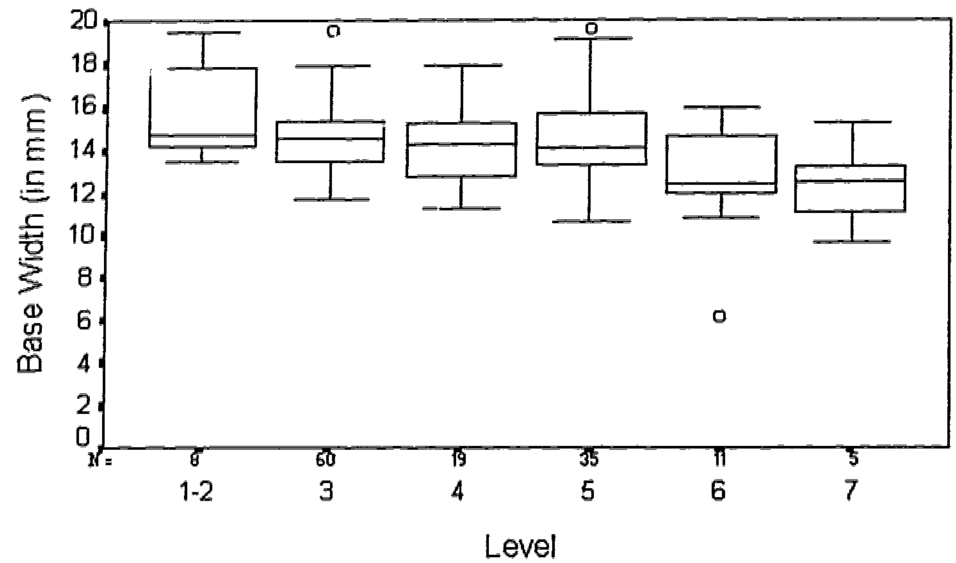


Figure 28 - Boxplots showing the distribution of base width values (in mm), by each level, for projectile points from the Walter Felt site.

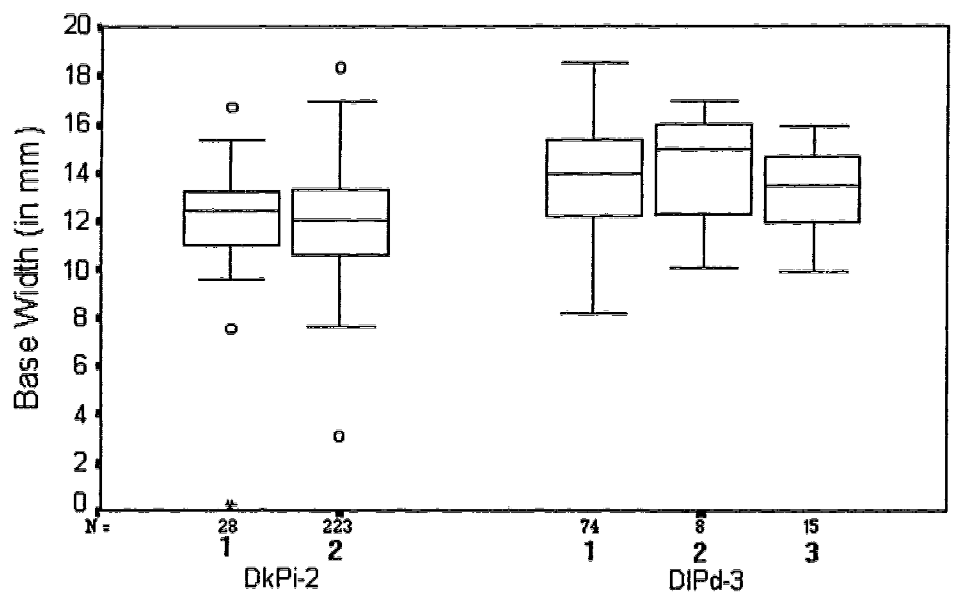


Figure 29 - Boxplots showing the distribution of base width values (in mm), by each level, for projectile points from both the Junction site and the Ross site.

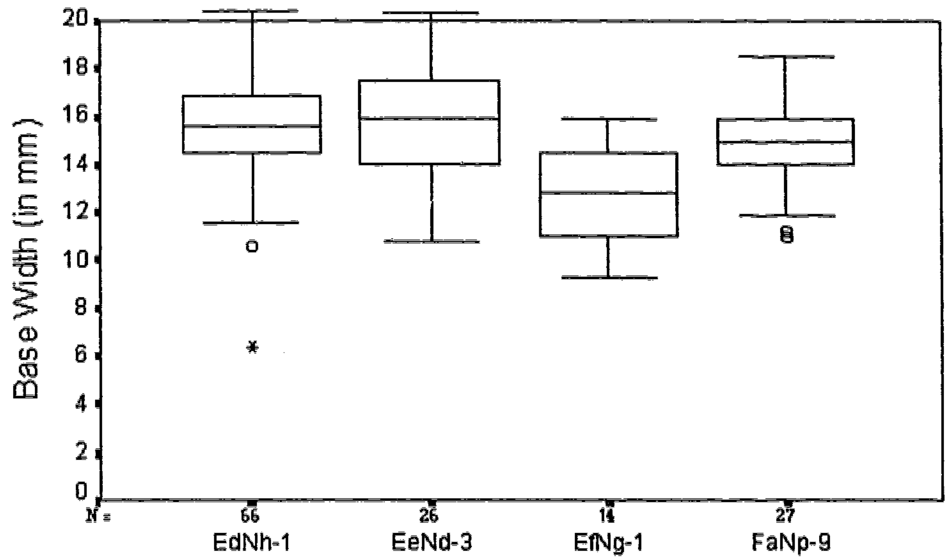


Figure 30 - Boxplots showing the distribution of base width values (in mm), by each level, for projectile points from the Stony Beach site (EdNh-1), EeNd-3, the Lake Midden site (EfNg-1), and the Bill Richards site (FaNp-9).

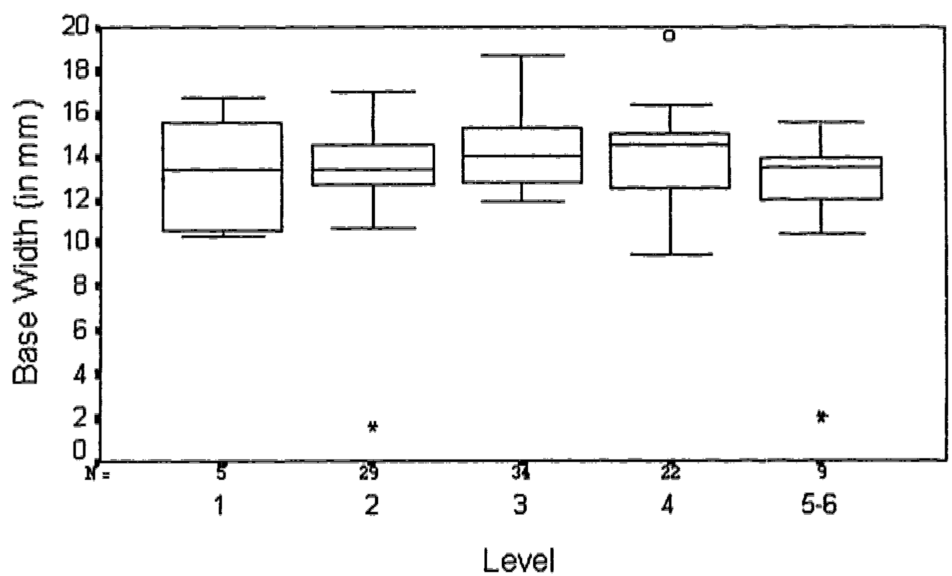


Figure 31 - Boxplots showing the distribution of base width values (in mm), by each level, for projectile points from the Sanderson site.

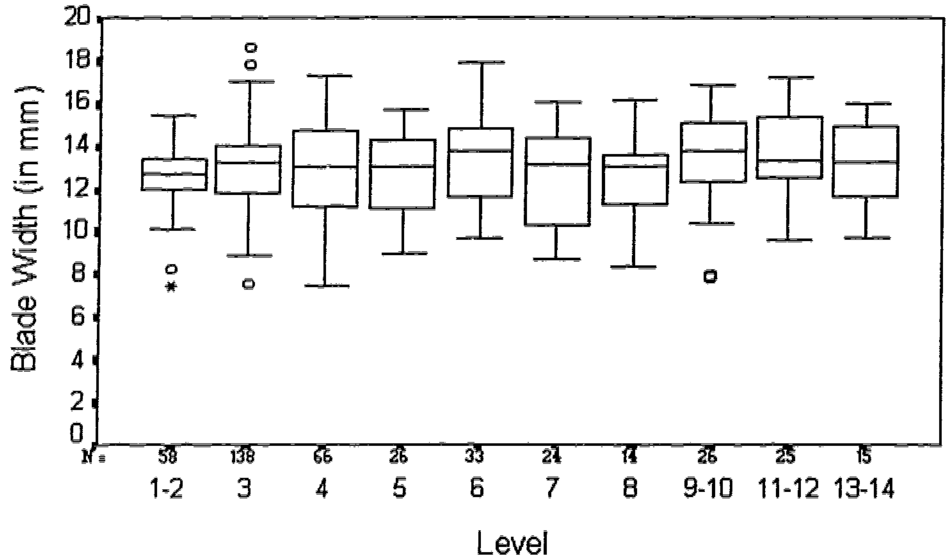


Figure 32 - Boxplots showing the distribution of blade width values (in mm), by each level, for projectile points from the Old Women's Buffalo Jump.

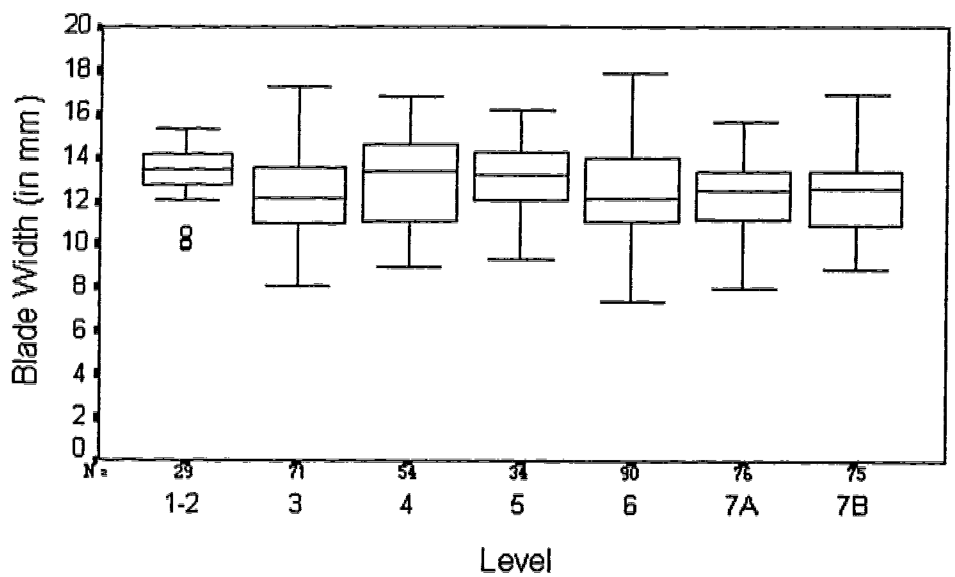


Figure 33 - Boxplots showing the distribution of blade width values (in mm), by each level, for projectile points from Head-Smashed-In Buffalo Jump.

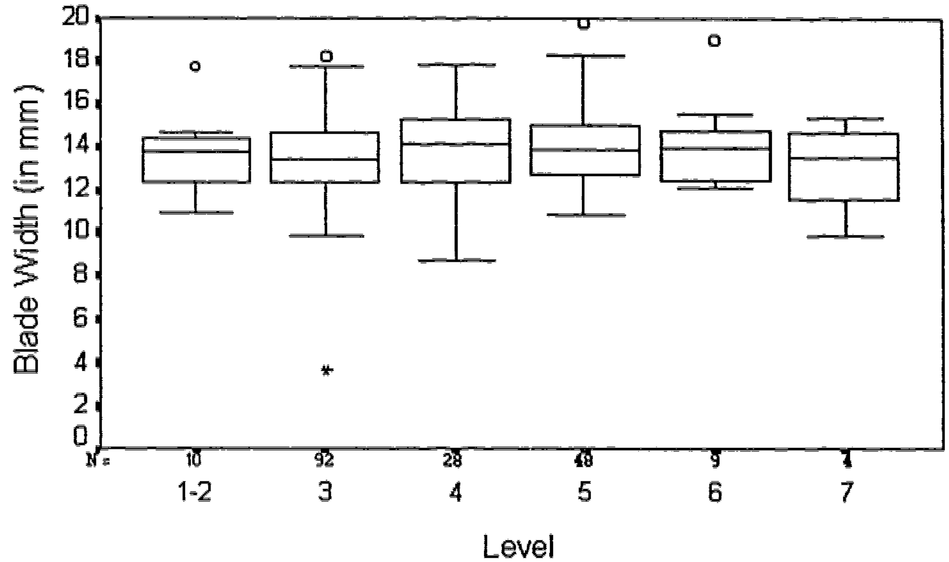


Figure 34 - Boxplots showing the distribution of blade width values (in mm), by each level, for projectile points from the Walter Felt site.

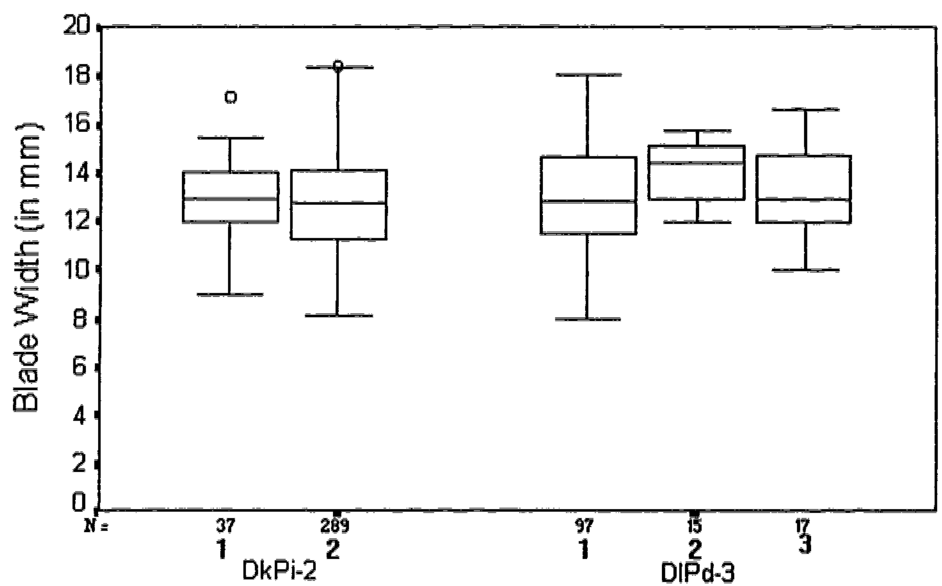


Figure 35- Boxplots showing the distribution of blade width values (in mm), by each level, for projectile points from both the Junction site and the Ross site.

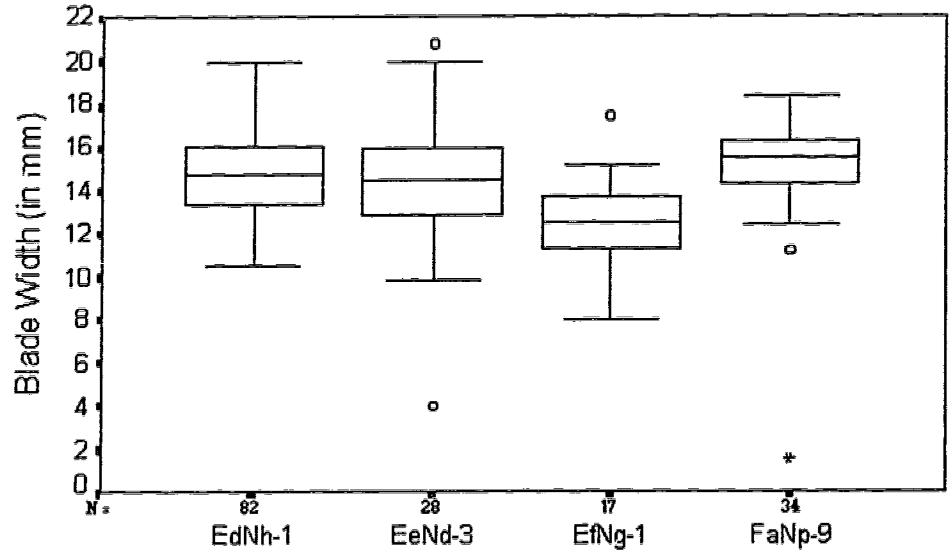


Figure 36 - Boxplots showing the distribution of blade width values (in mm), by each level, for projectile points from the Stony Beach site (EdNh-1), EeNd-3, the Lake Midden site (EfNg-1), and the Bill Richards site (FaNp-9).

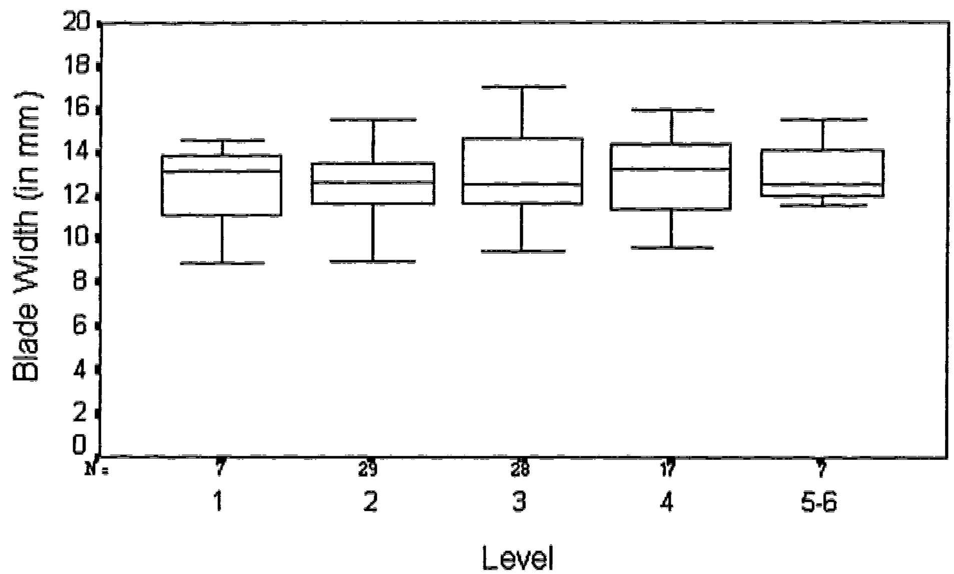


Figure 37 - Boxplots showing the distribution of blade width values (in mm), by each level, for projectile points from the Sanderson site.

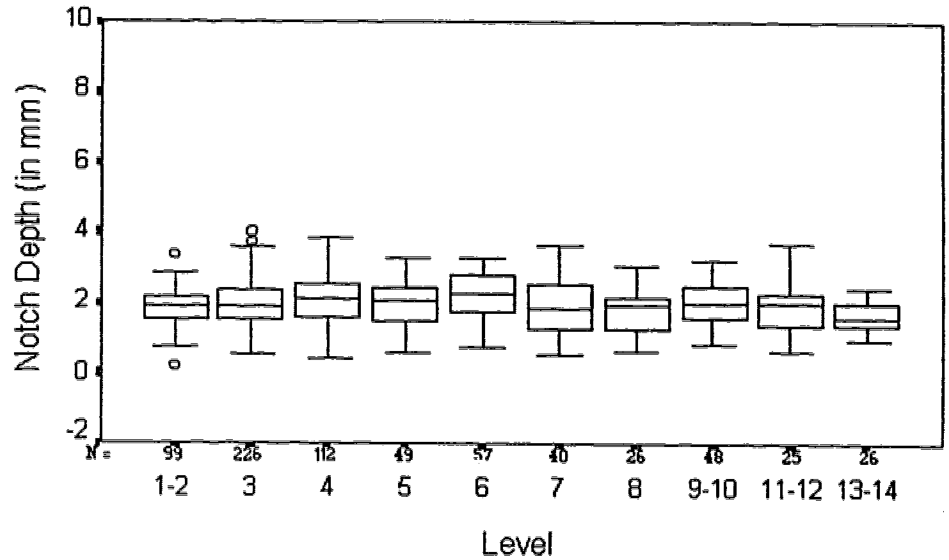


Figure 38 - Boxplots showing distribution of notch depth values (in mm), by each level, for projectile points from the Old Women's Buffalo Jump.

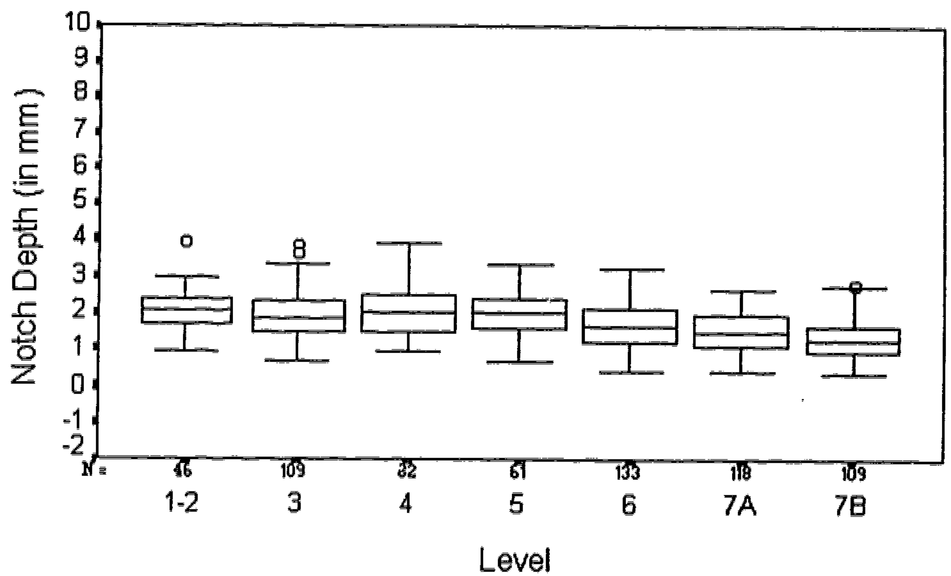


Figure 39 - Boxplots showing distribution of notch depth values (in mm), by each level, for projectile points from Head-Smashed-In Buffalo Jump.

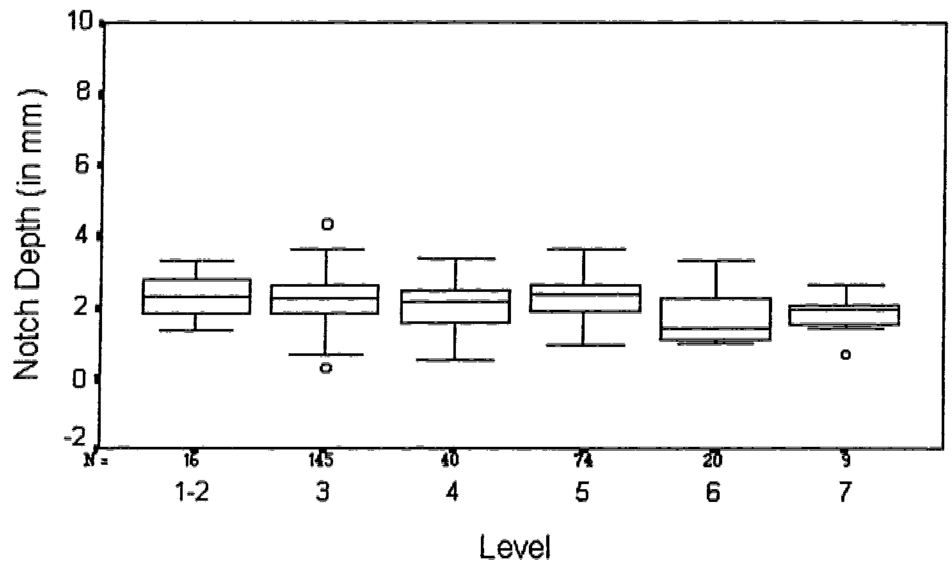


Figure 40 - Boxplots showing distribution of notch depth values (in mm), by each level, for projectile points from the Walter Felt site.

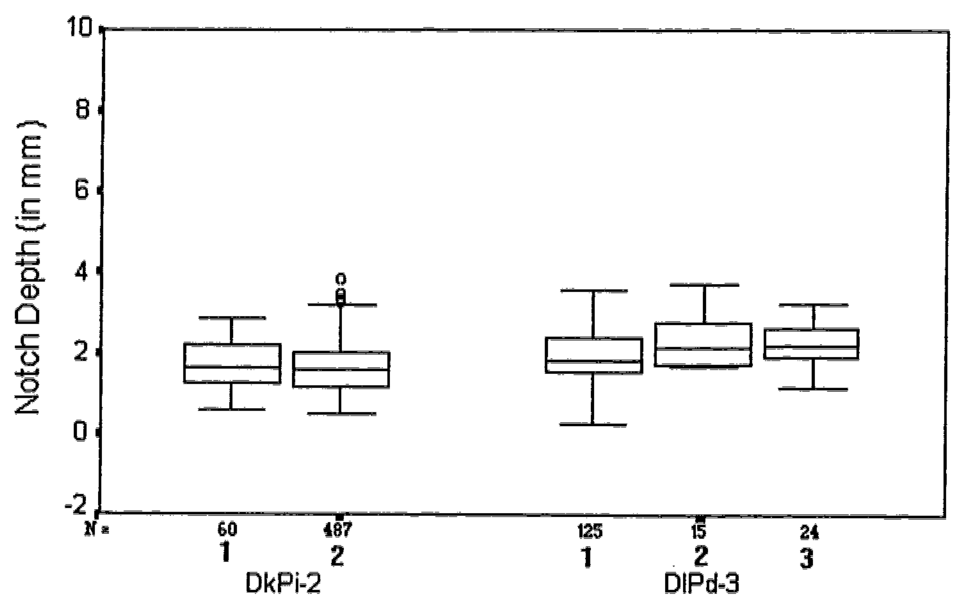


Figure 41 - Boxplots showing distribution of notch depth values (in mm), by each level, for projectile points from the Junction site (DkPi-2) and the Ross site (DlPd-3).

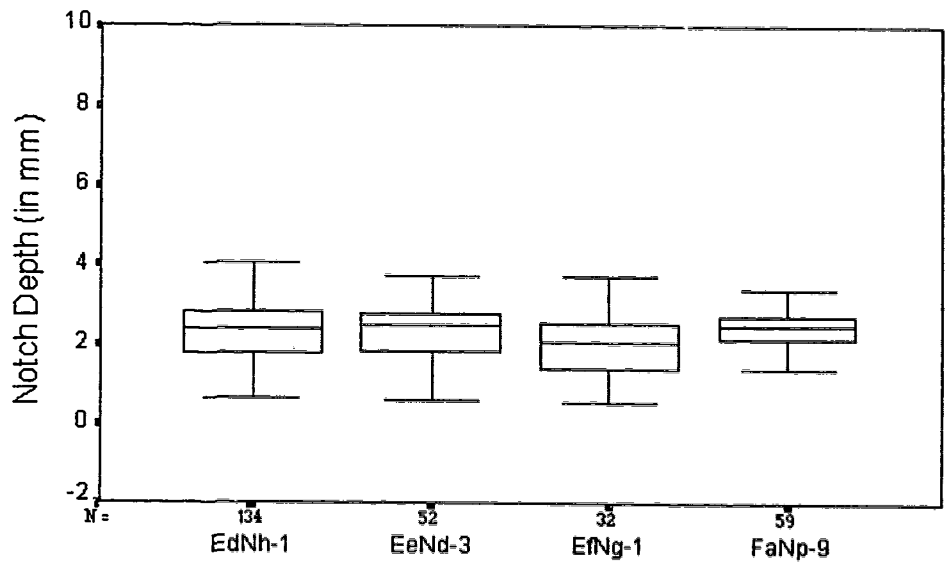


Figure 42 - Boxplots showing distribution of notch depth values (in mm) for projectile points from the Stony Beach site (EdNh-1), EeNd-3, the Lake Midden site (EfNg-1), and the Bill Richards site.

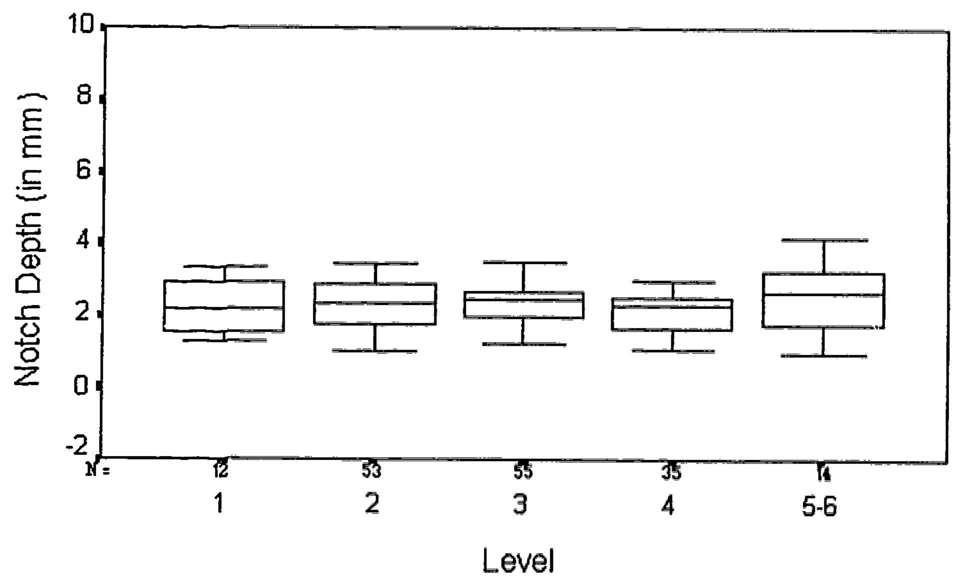


Figure 43 - Boxplots showing distribution of notch depth values (in mm), by each level, for projectile points from the Sanderson site.

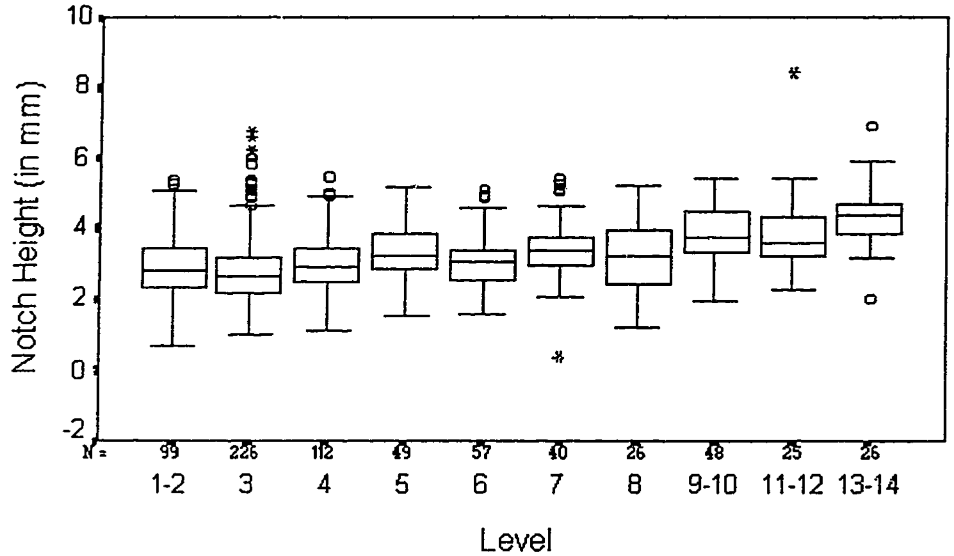


Figure 44 - Boxplots showing distribution of notch height values (in mm), by each level, for projectile points from the Old Women's Buffalo Jump.

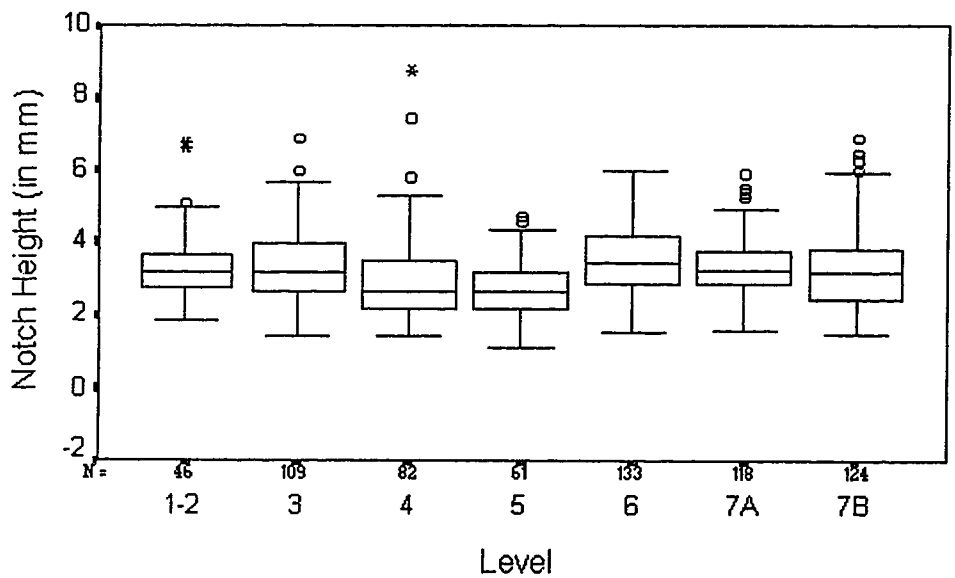


Figure 45 - Boxplots showing distribution of notch height values (in mm), by each level, for projectile points from Head-Smashed-In Buffalo Jump.

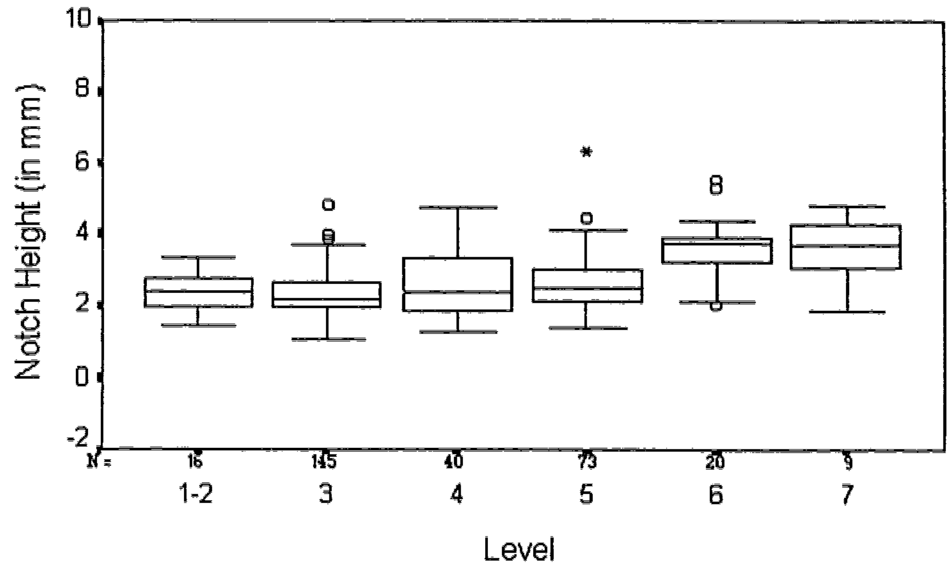


Figure 46 - Boxplots showing distribution of notch height values (in mm), by each level, for projectile points from the Walter Felt site.

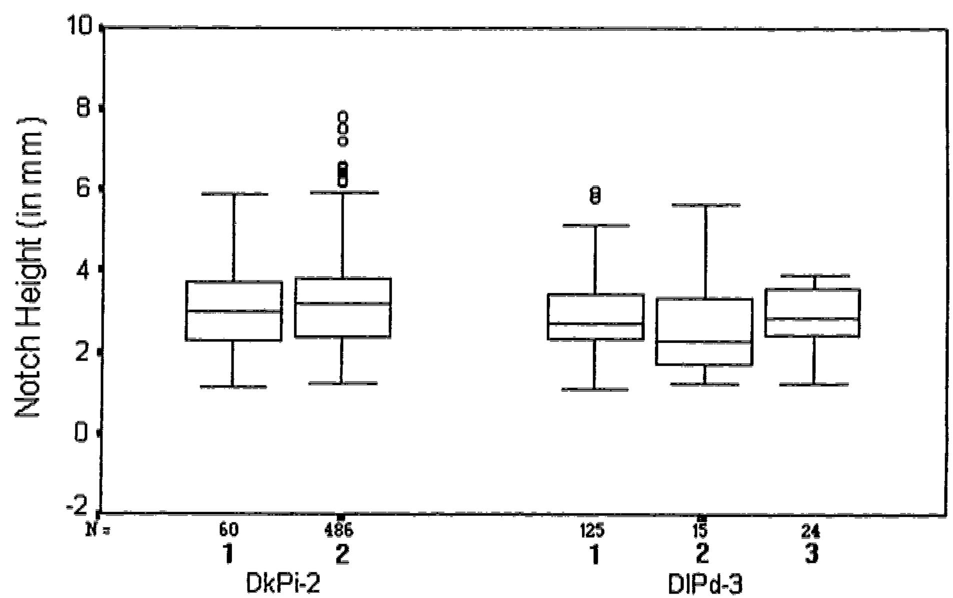


Figure 47 - Boxplots showing distribution of notch height values (in mm), by each level, for projectile points from the Junction site (DkPi-2) and the Ross site (DlPd-3).

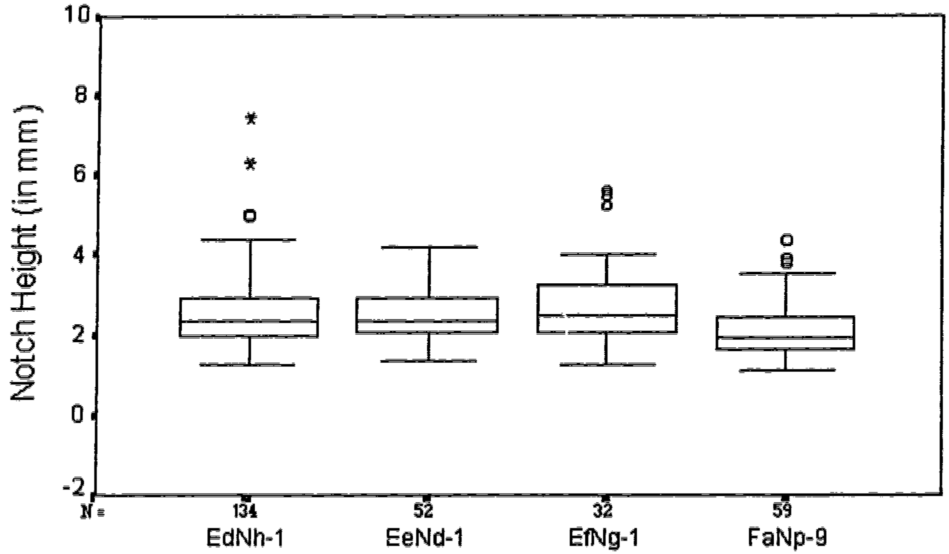


Figure 48 - Boxplots showing distribution of notch height values (in mm) for projectile points from the Stony Beach site (EdNh-1), EeNd-3, the Lake Midden site (EfNg-1), and the Bill Richards site (FaNp-9).

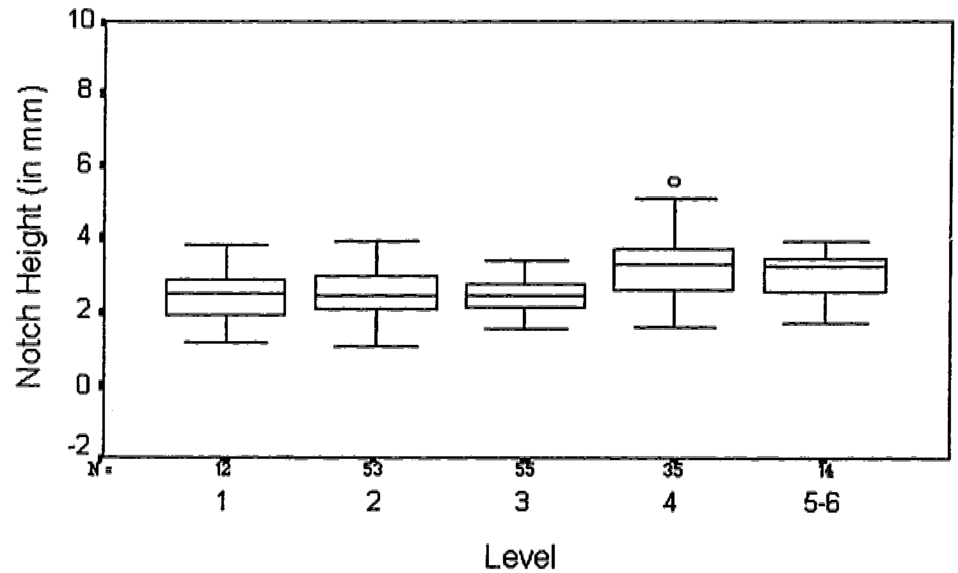


Figure 49 - Boxplots showing distribution of notch height values (in mm), by each level, for projectile points from the Sanderson site.

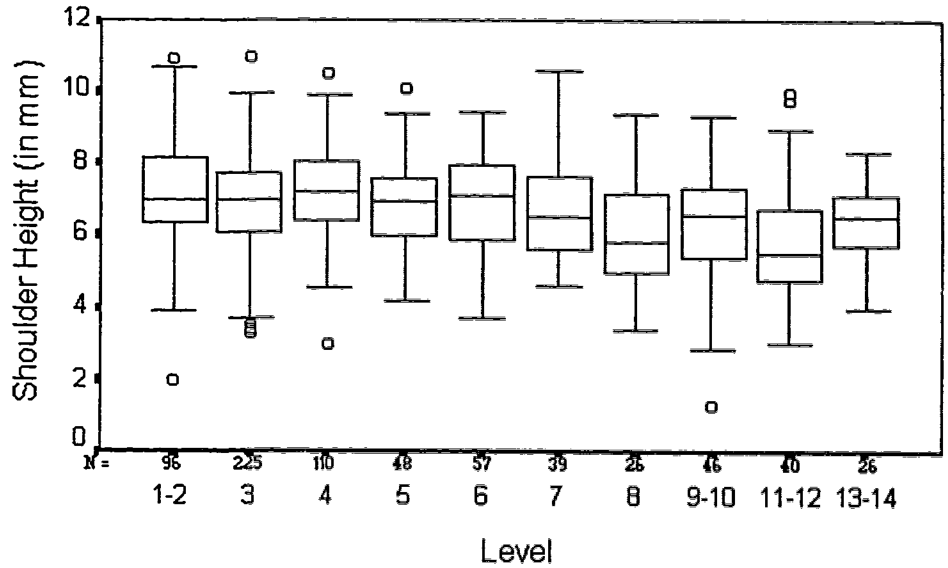


Figure 50 - Boxplots showing the distribution of shoulder height values (in mm), by each level, for projectile points from the Old Women's Buffalo Jump.

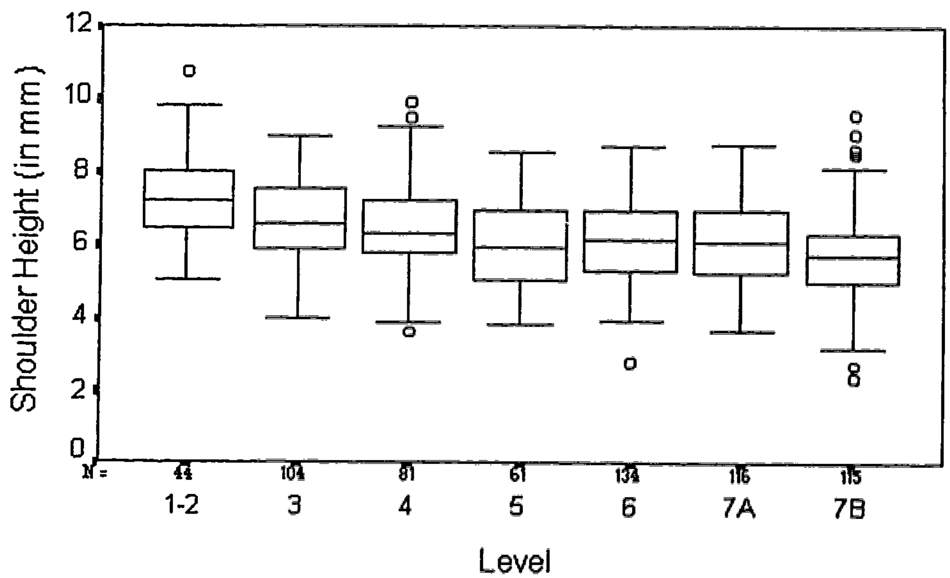


Figure 51 - Boxplots showing the distribution of shoulder height values (in mm), by each level, for projectile points from Head-Smashed-In Buffalo Jump.

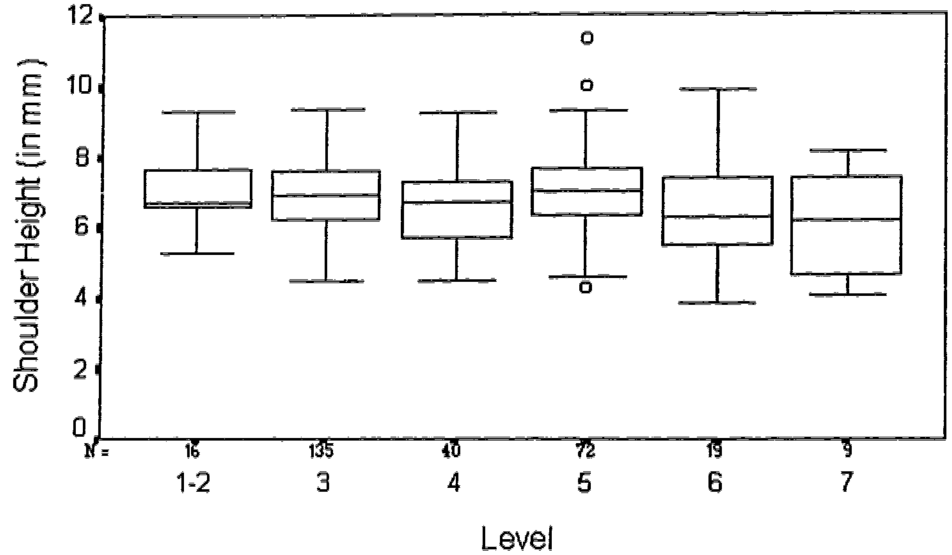


Figure 52 - Boxplots showing the distribution of shoulder height values (in mm), by each level, for projectile points from the Walter Felt site.

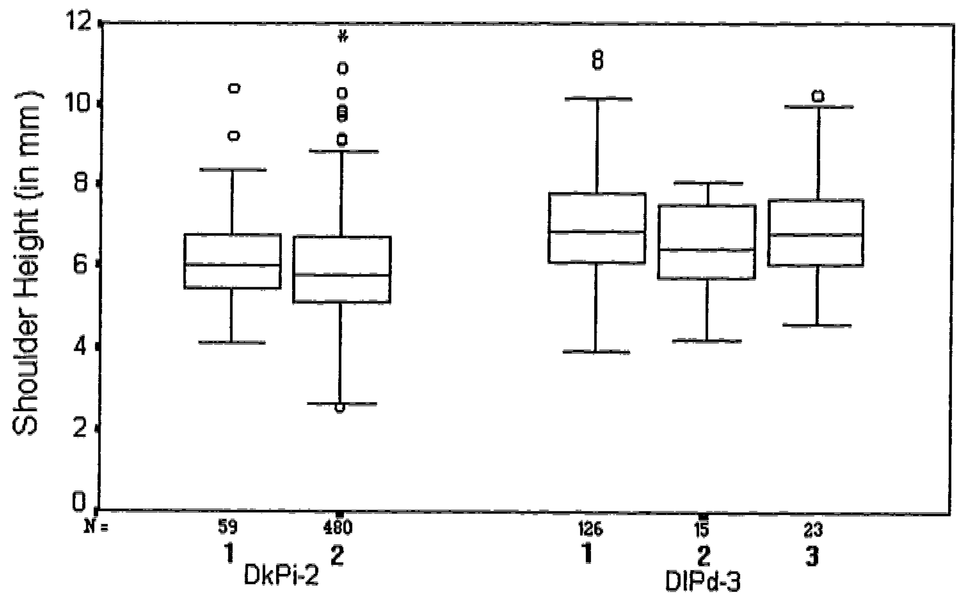


Figure 53 - Boxplots showing the distribution of shoulder height values (in mm), by each level, for projectile points from both the Junction site (DkPi-2) and the Ross site (DlPd-3).

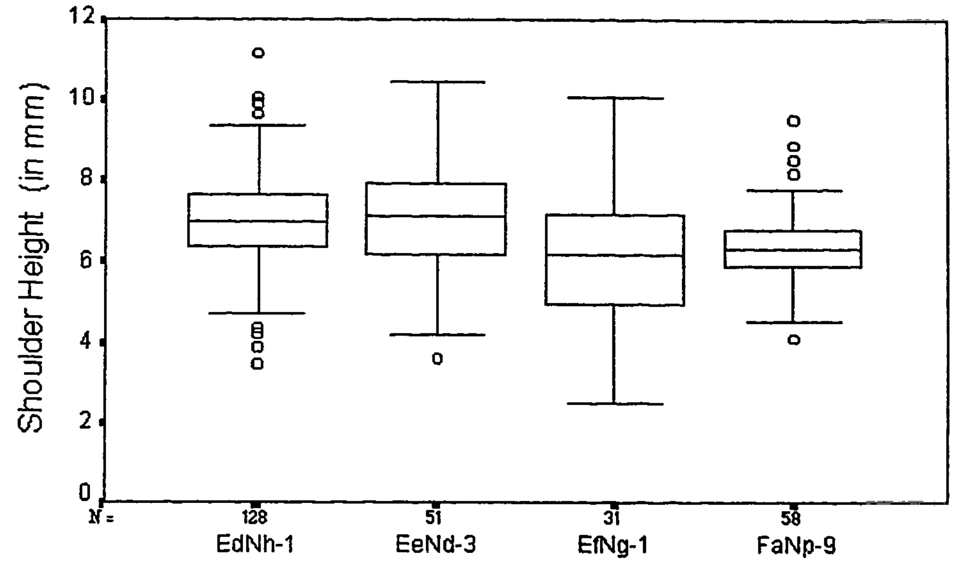


Figure 54 - Boxplots showing the distribution of shoulder height values (in mm), by each level, for projectile points from the Stony Beach site (EdNh-1), EeNd-3, the Lake Midden site (EfNg-1), and the Bill Richards site (FaNp-9).

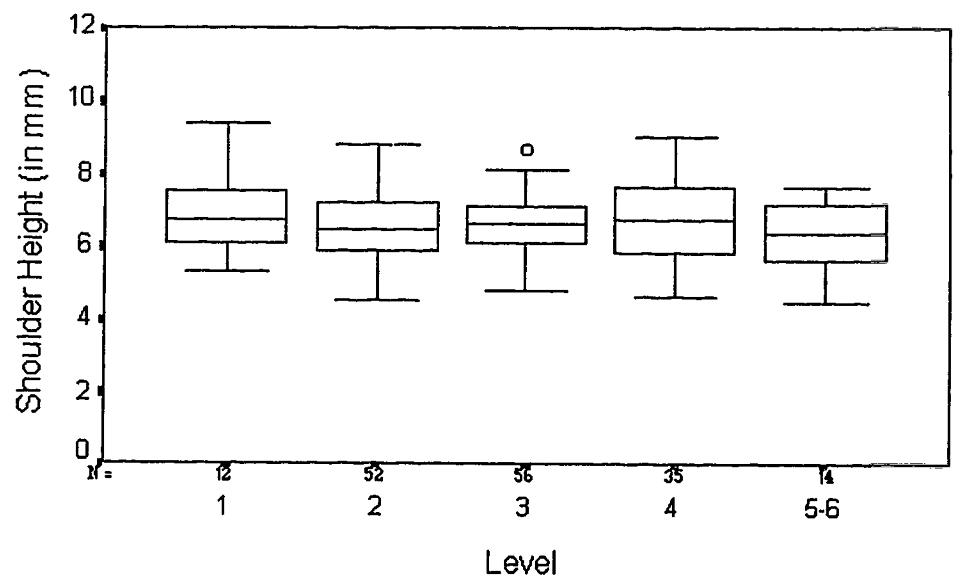


Figure 55 - Boxplots showing the distribution of shoulder height values (in mm), by each level, for projectile points from the Sanderson site.

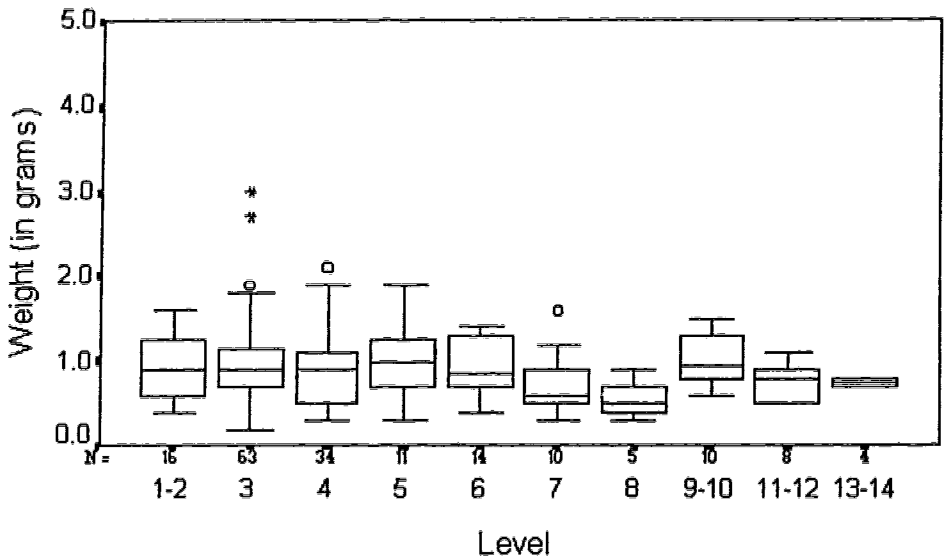


Figure 56 - Boxplots showing distributions of weight values (in grams), by each level, for projectile points from the Old Women's Buffalo Jump.

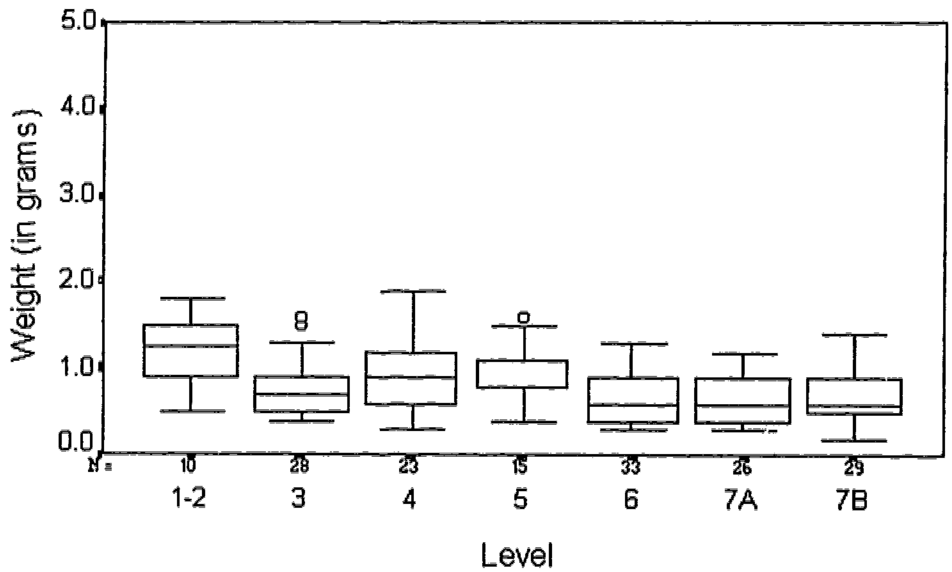


Figure 57 - Boxplots showing distributions of weight values (in grams), by each level, for projectile points from Head-Smashed-In Buffalo Jump.

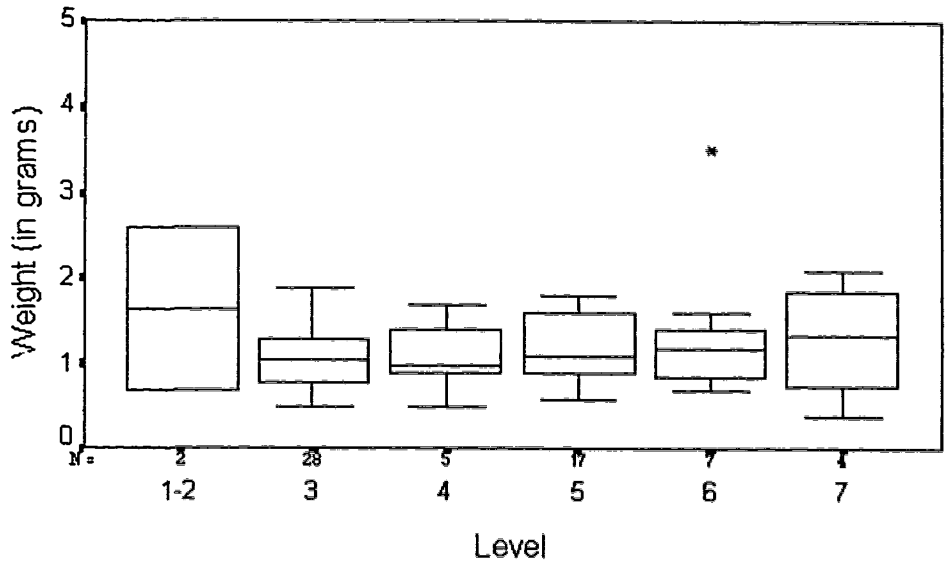


Figure 58 - Boxplots showing distributions of weight values (in grams), by each level, for projectile points from the Walter Felt site.

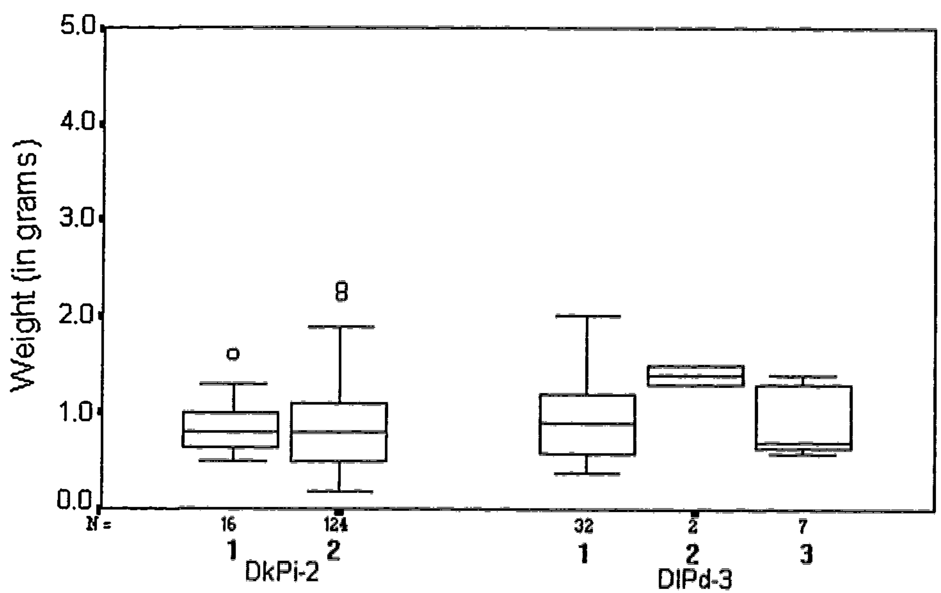


Figure 59 - Boxplots showing distributions of weight values (in grams), by each level, for projectile points from both the Junction site (DkPi-2) and the Ross site (DlPd-3).

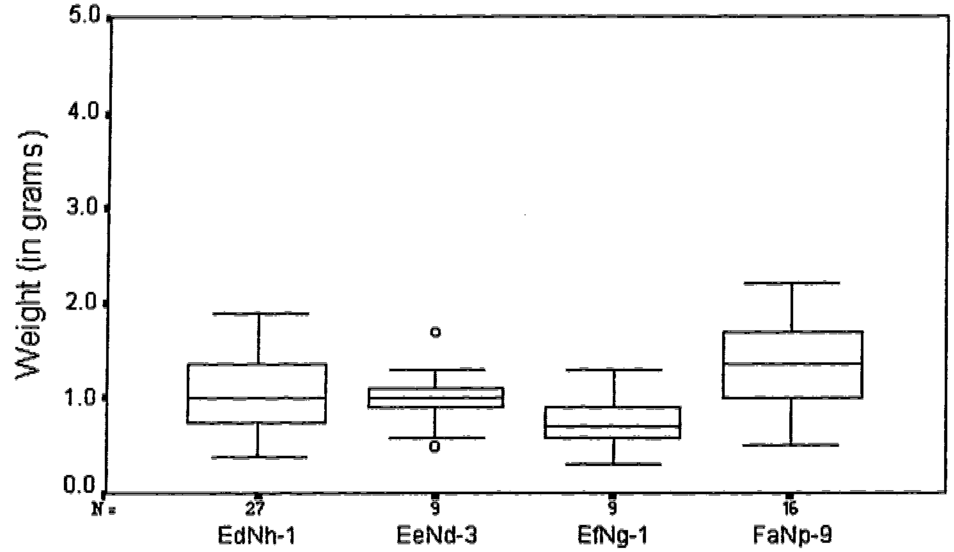


Figure 60 - Boxplots showing distributions of weight values (in grams) for projectile points from the Stony Beach site (EdNh-1), EeNd-3, the Lake Midden site (EfNg-1), and the Bill Richards site (FaNp-9).

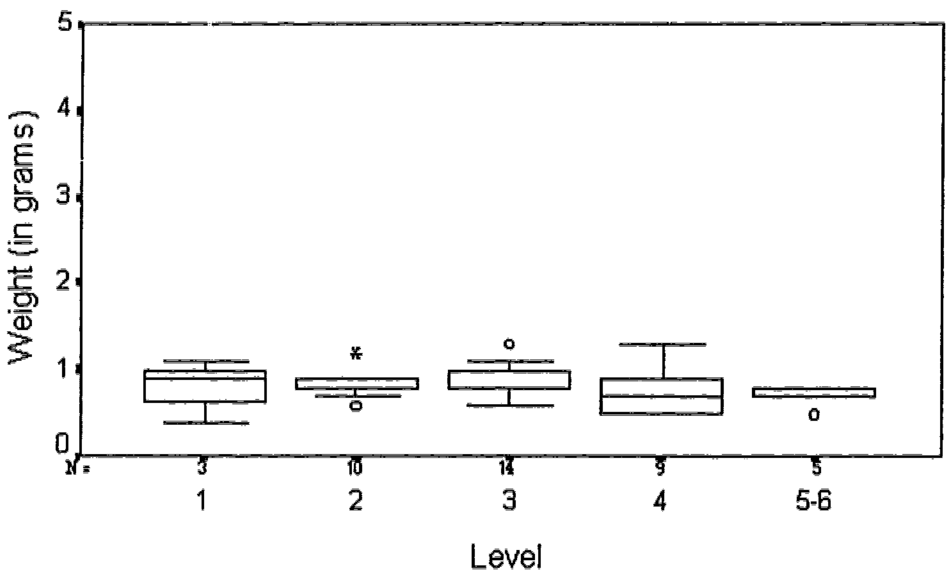


Figure 61 - Boxplots showing distributions of weight values (in grams), by each level, for projectile points from the Sanderson site.

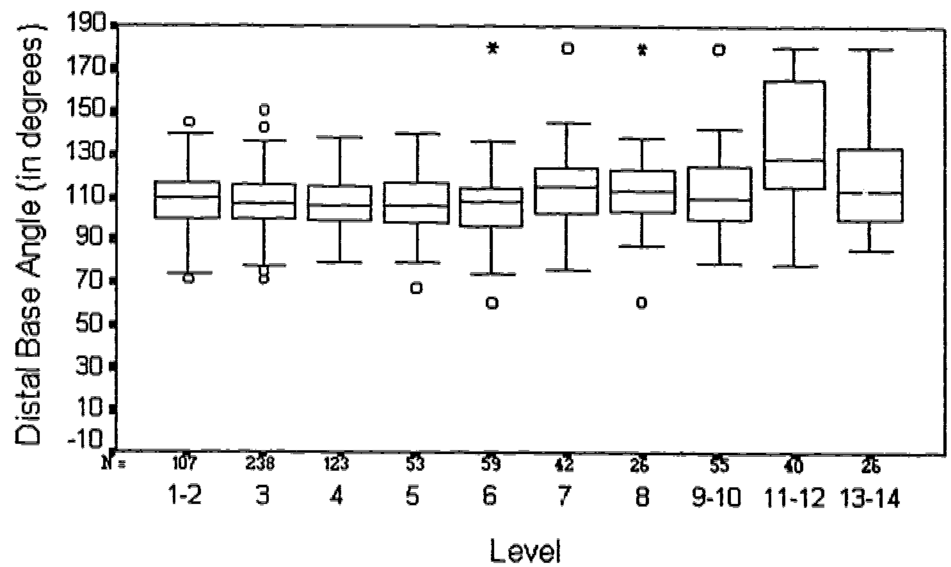


Figure 62 - Boxplots showing the distribution of distal base angle values (in degrees), by each level, for projectile points from the Old Women's Buffalo Jump.

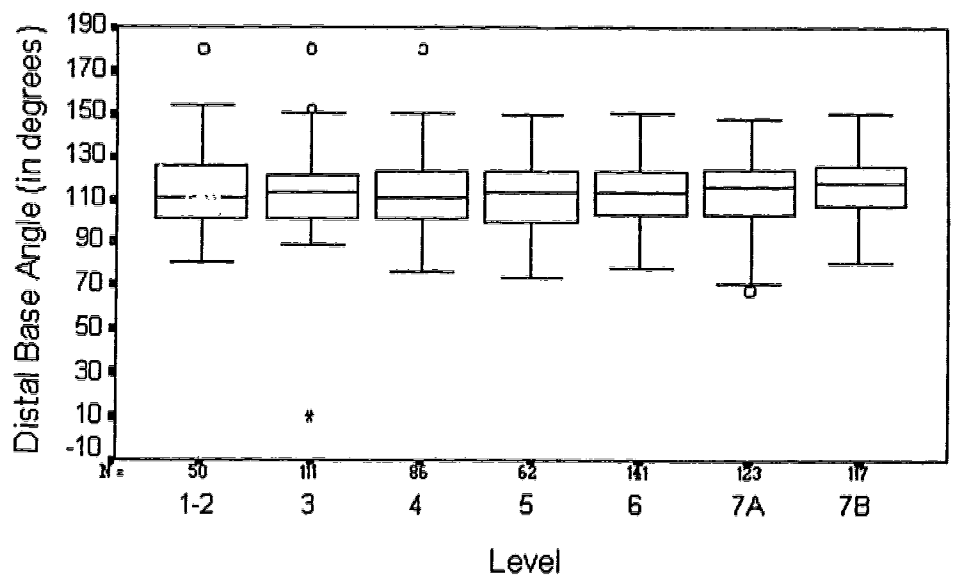


Figure 63 - Boxplots showing the distribution of distal base angle values (in degrees), by each level, for projectile points from Head-Smashed-In Buffalo Jump.

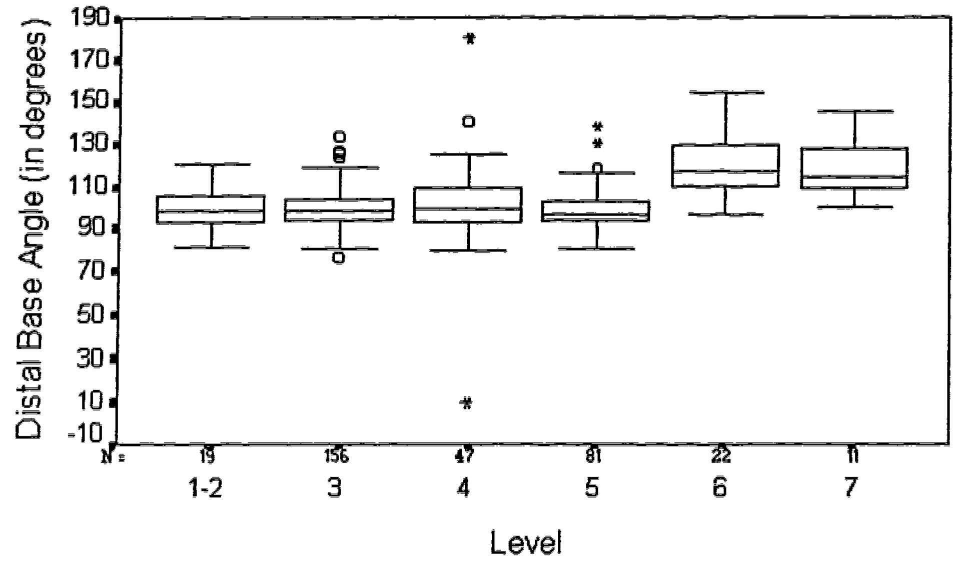


Figure 64 - Boxplots showing the distribution of distal base angle values (in degrees), by each level, for projectile points from the Walter Felt site.

No data were collected.

Figure 65 - Boxplots showing the distribution of distal base angle values (in degrees), by each level, for projectile points from both the Junction site and the Ross site.

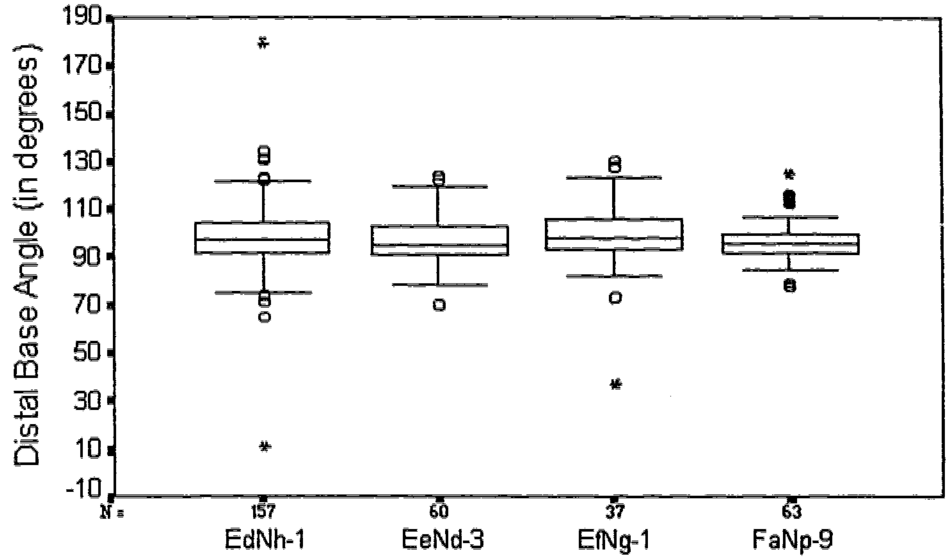


Figure 66 - Boxplots showing the distribution of distal base angle values (in degrees), by each level, for projectile points from the Stony Beach site (EdNh-1), EeNd-3, the Lake Midden site (EfNg-1), and the Bill Richards site (FaNp-9).

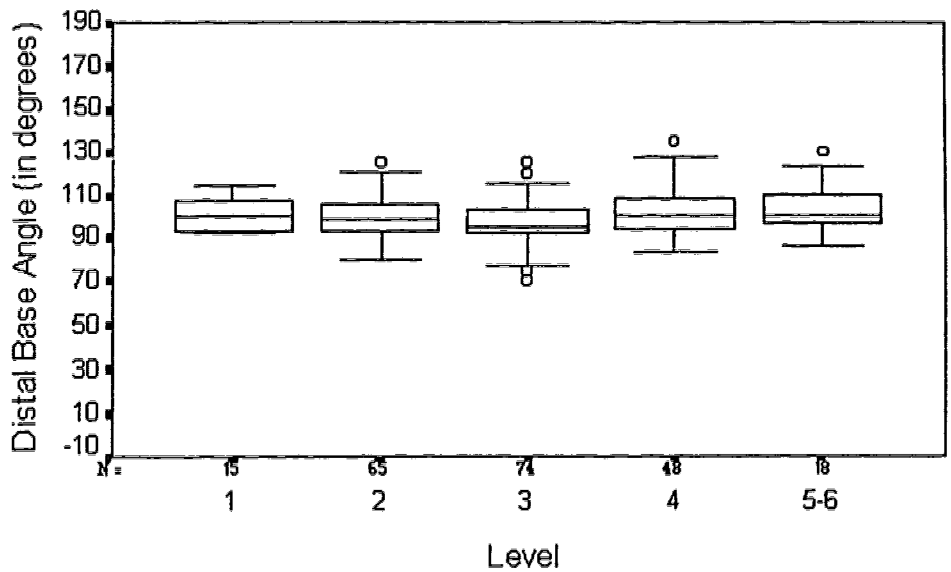


Figure 67 - Boxplots showing the distribution of distal base angle values (in degrees), by each level, for projectile points from the Sanderson site.

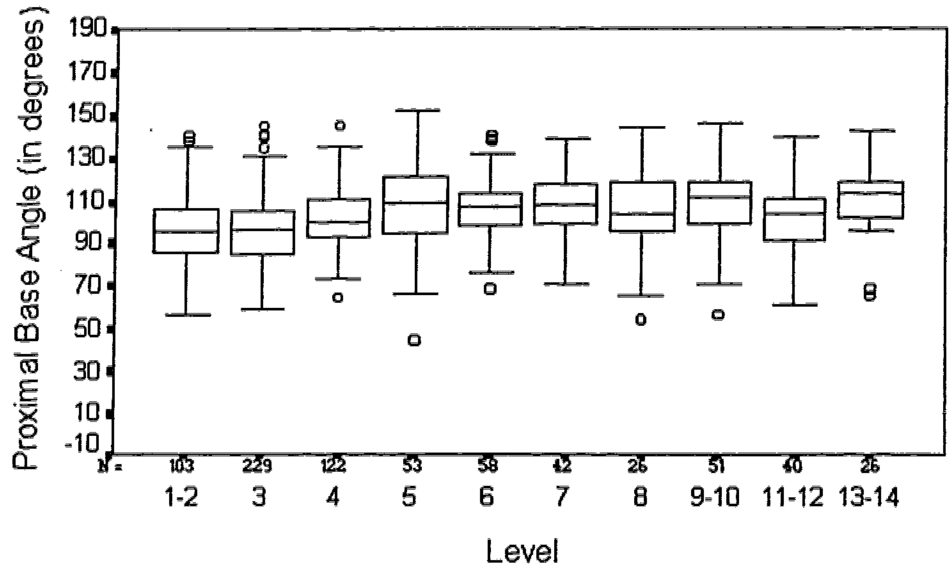


Figure 68 - Boxplots showing the distribution of proximal base angle values (in degrees), by each level, for projectile points from the Old Women's Buffalo Jump.

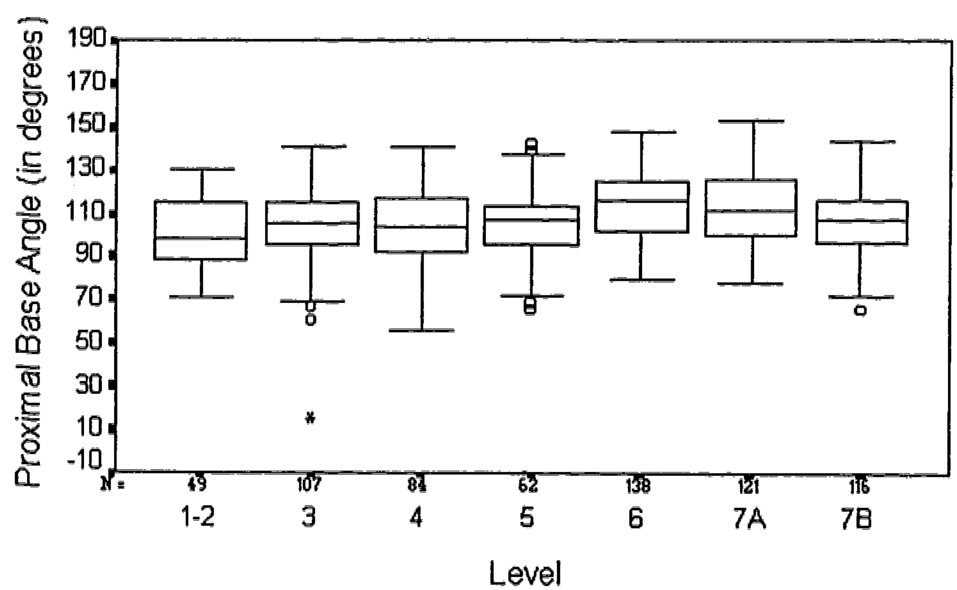


Figure 69 - Boxplots showing the distribution of proximal base angle values (in degrees), by each level, for projectile points from Head-Smashed-In Buffalo Jump.

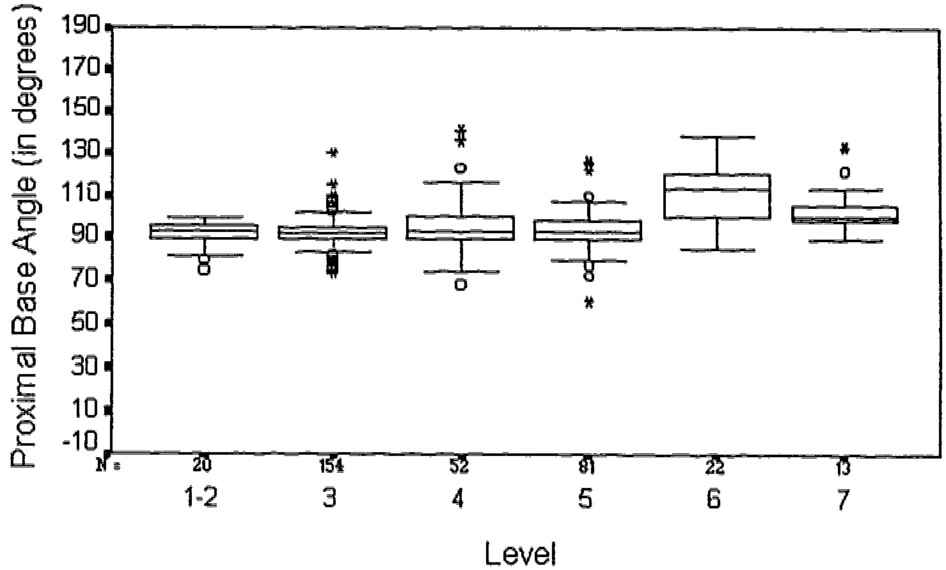


Figure 70 - Boxplots showing the distribution of proximal base angle values (in degrees), by each level, for projectile points from the Walter Felt site.

No data were recorded.

Figure 71 - Boxplots showing the distribution of proximal base angle values (in degrees), by each level, for projectile points from both the Junction site (DkPi-2) and the Ross site (DlPd-3).

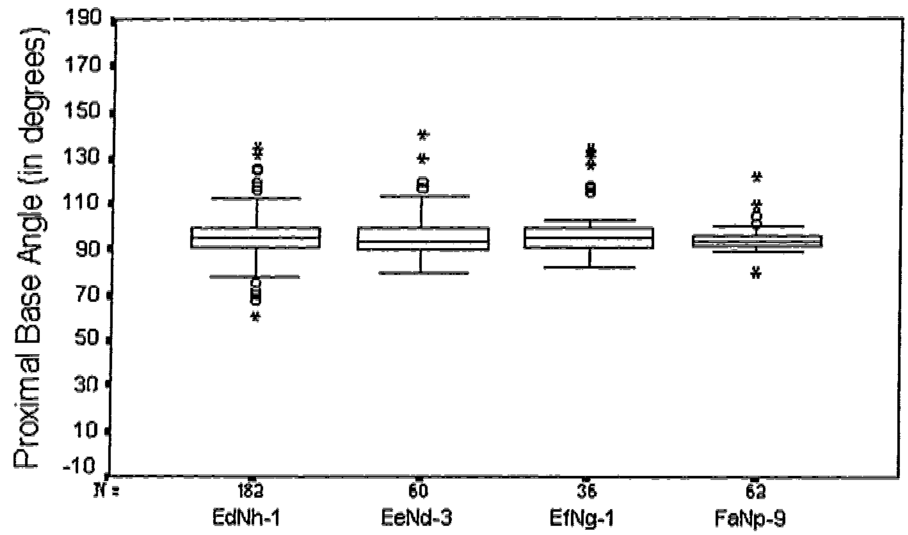


Figure 72 - Boxplots showing the distribution of proximal base angle values (in degrees) for projectile points from the Stony Beach site (EdNh-1), EeNd-3, the Lake Midden site (EfNg-1), and the Bill Richard site (FaNp-9).

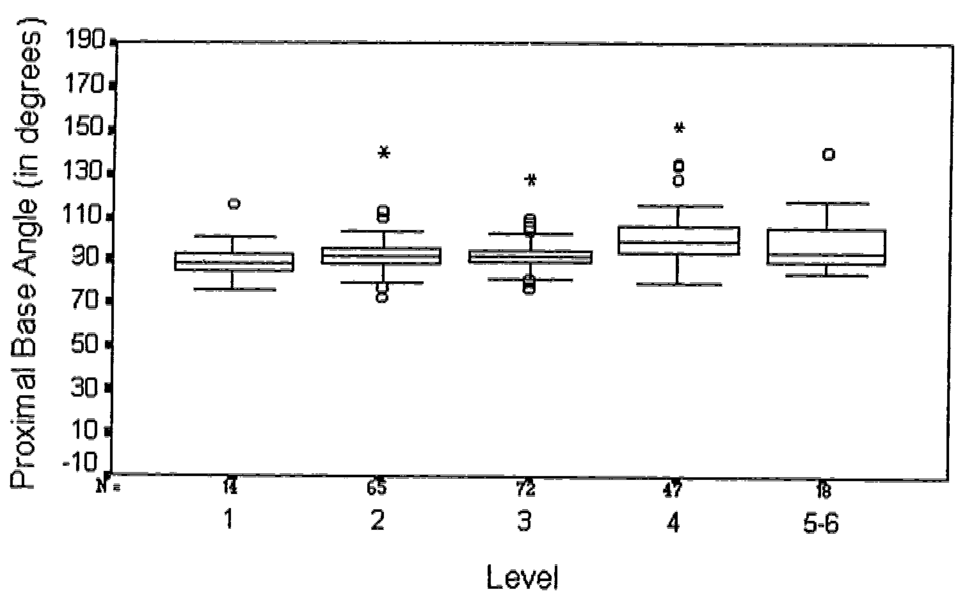


Figure 73 - Boxplots showing the distribution of proximal base angle values (in degrees), by each level, for projectile points from the Sanderson site.

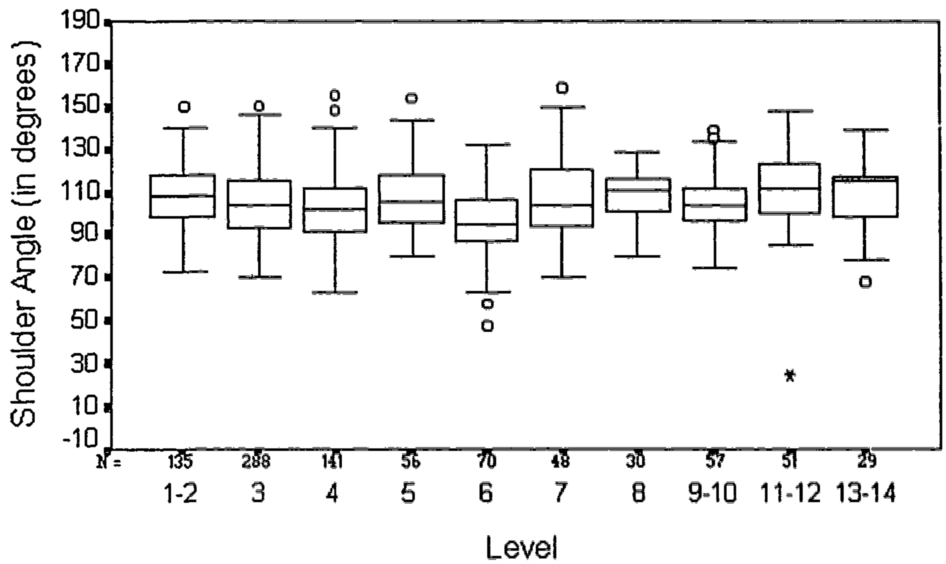


Figure 74 - Boxplots showing the distribution of shoulder angle values (in degrees), by each level, for projectile points from the Old Women's Buffalo Jump.

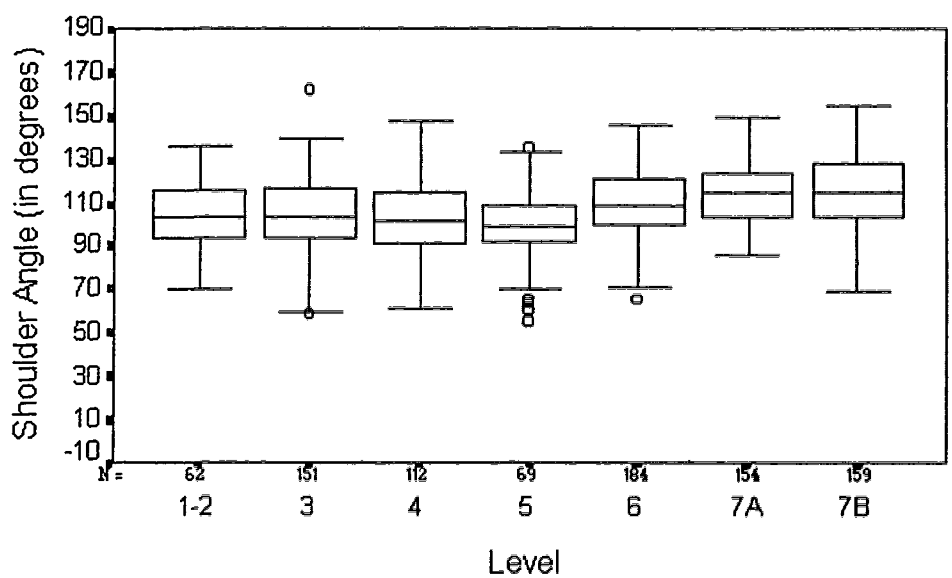


Figure 75 - Boxplots showing the distribution of shoulder angle values (in degrees), by each level, for projectile points from Head-Smashed-In Buffalo Jump.

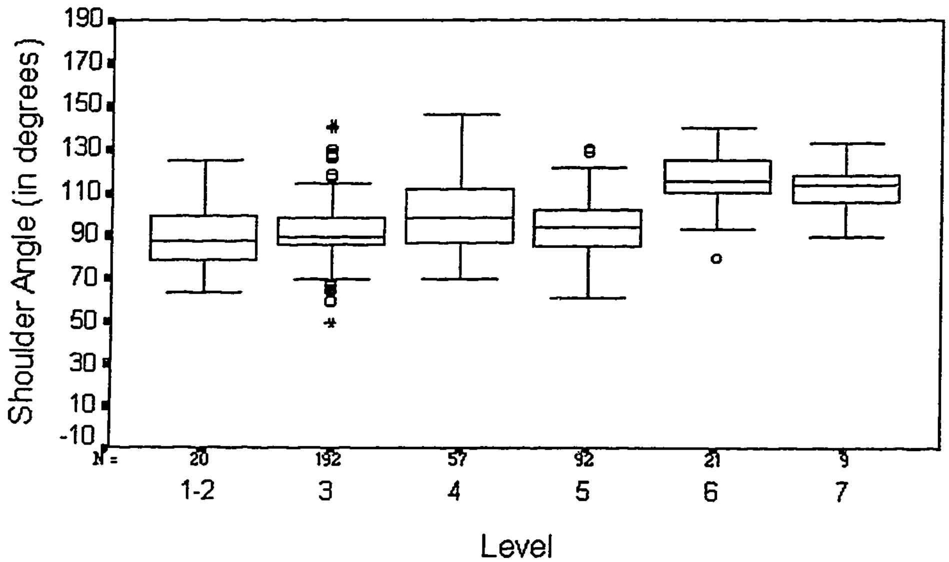


Figure 76 - Boxplots showing the distribution of shoulder angle values (in degrees), by each level, for projectile points from the Walter Felt site.

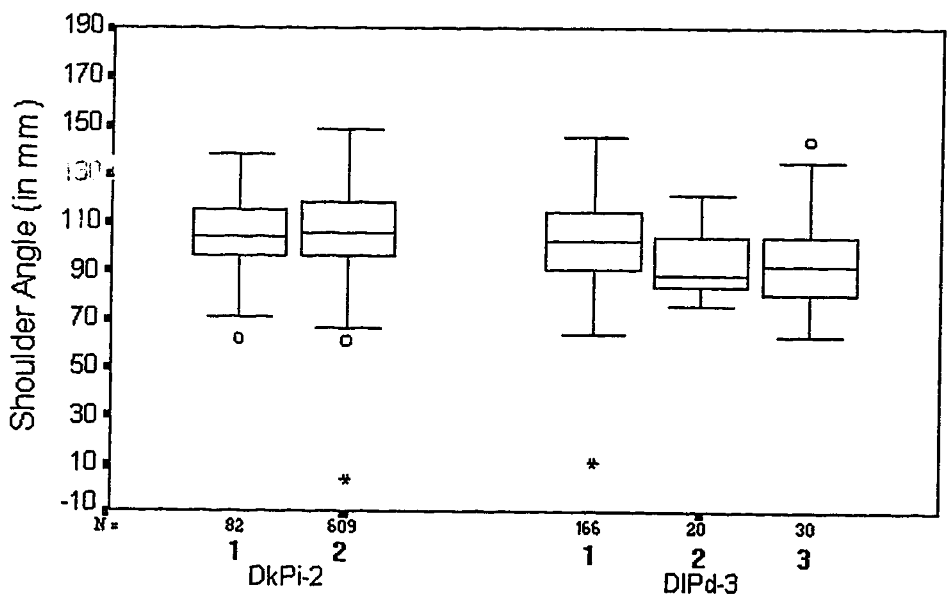


Figure 77 - Boxplots showing the distribution of shoulder angle values (in degrees), by each level, for projectile points from both the Junction site (DkPi-2) and the Ross site (DlPd-3).

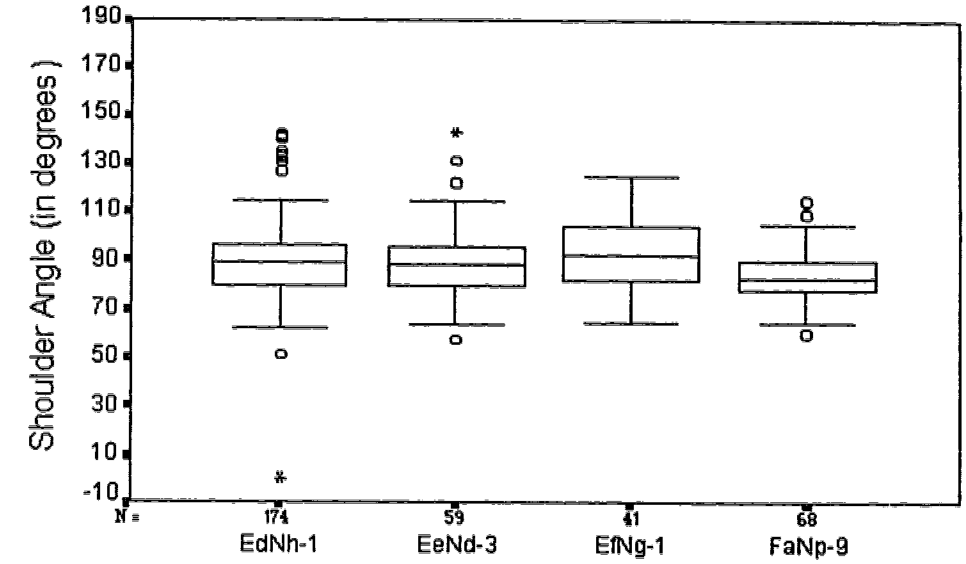


Figure 78 - Boxplots showing the distribution of shoulder angle values (in degrees) for projectile points from the Stony Beach site (EdNh-1), EeNd-3, the Lake Midden site (EfNg-1), and the Bill Richards site.

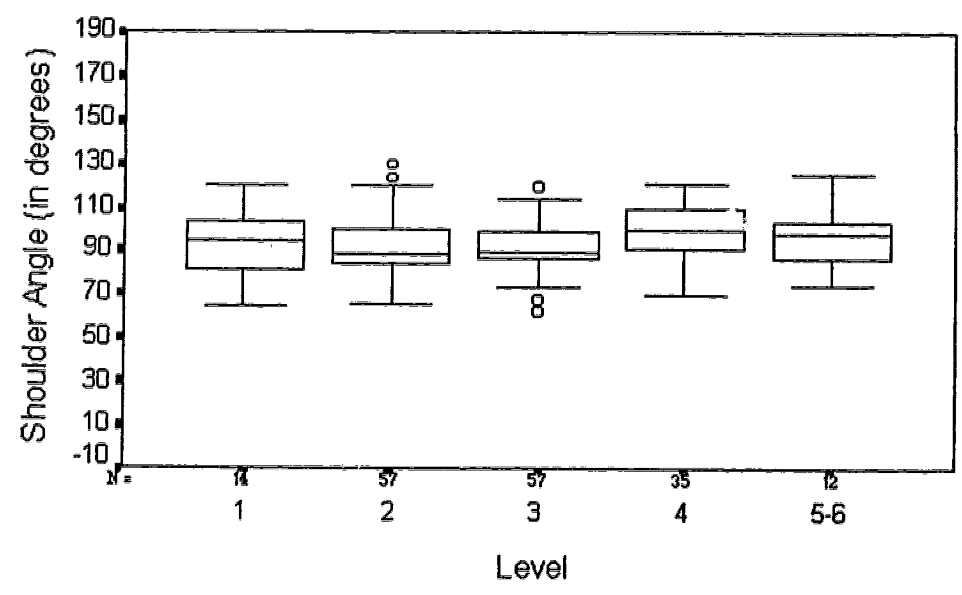


Figure 79 - Boxplots showing the distribution of shoulder angle values (in degrees), by each level, for projectile points from the Sanderson site.

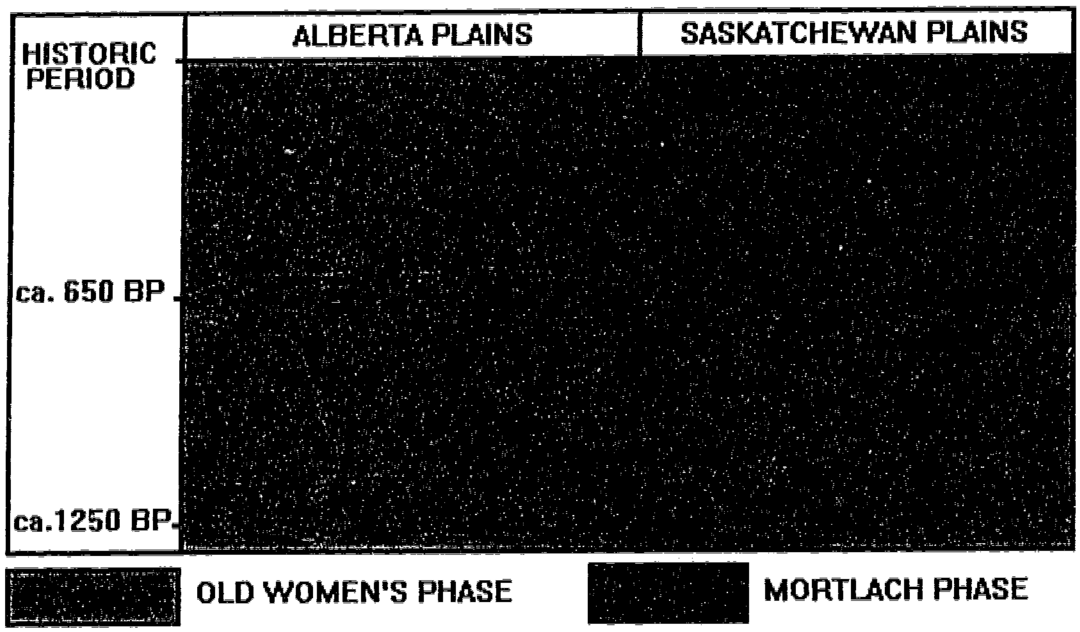


Figure 80 - Idealized Cayley Series and Mortlach Group projectile points and their spatial/temporal relationship.

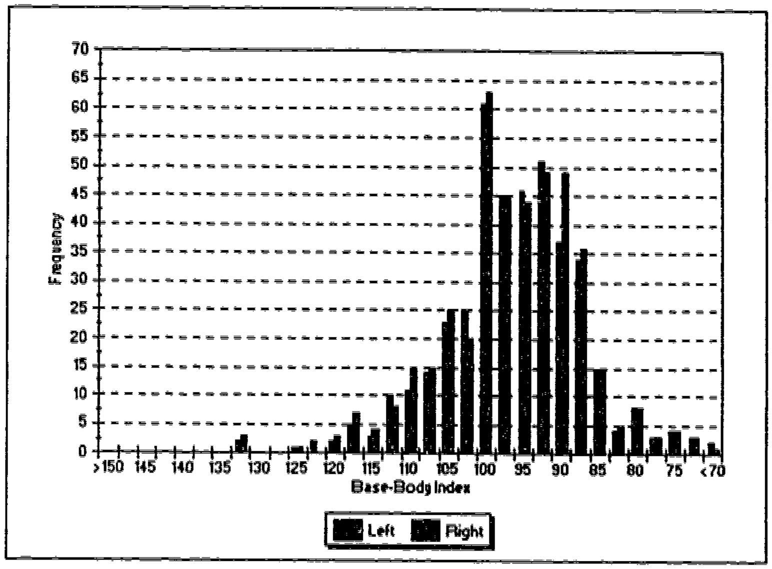


Figure 81 - Frequency of Cayley Series projectile points with left and right base height values larger than notch height values, plotted base-body index values.

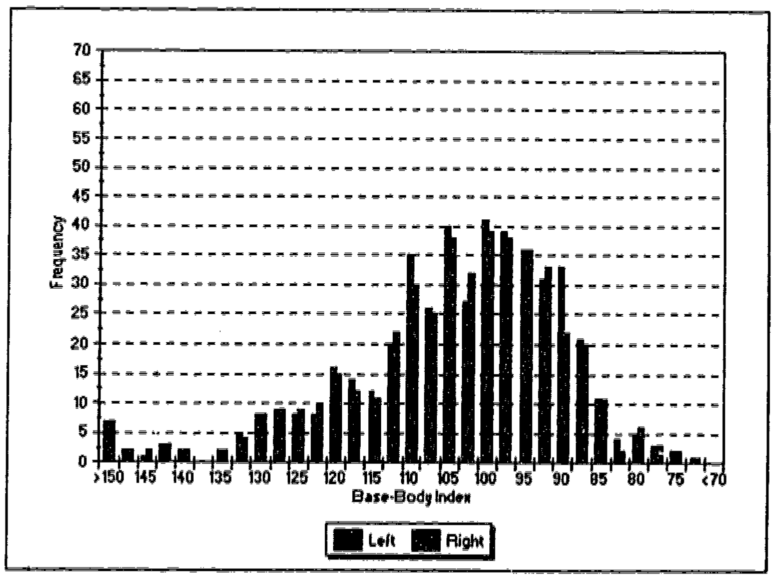


Figure 82 - Frequency of Cayley Series projectile points with left and right base height values smaller than notch height values, plotted by base-body index values.

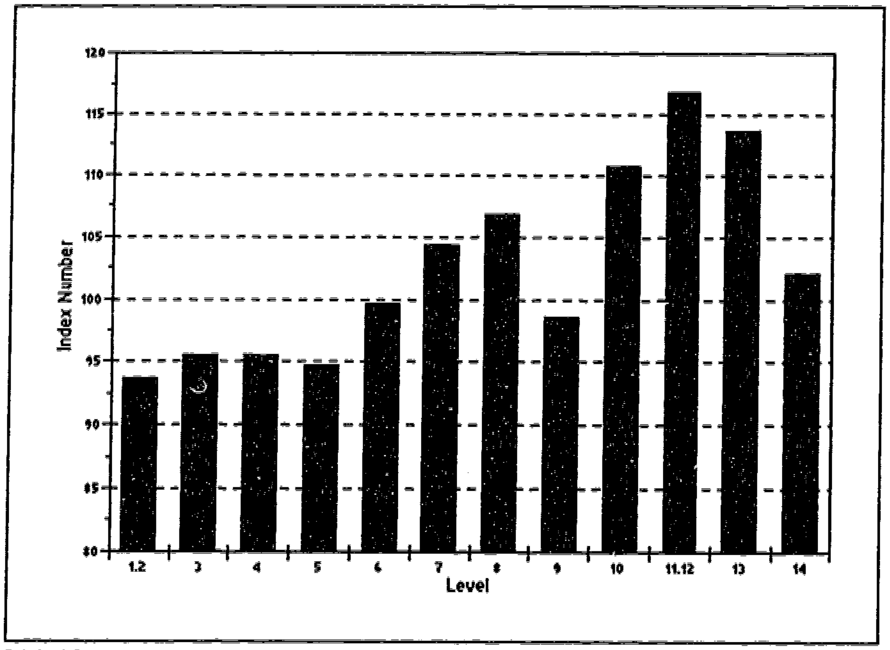


Figure 83 - Old Women's Buffalo Jump base-body indices plotted by level.

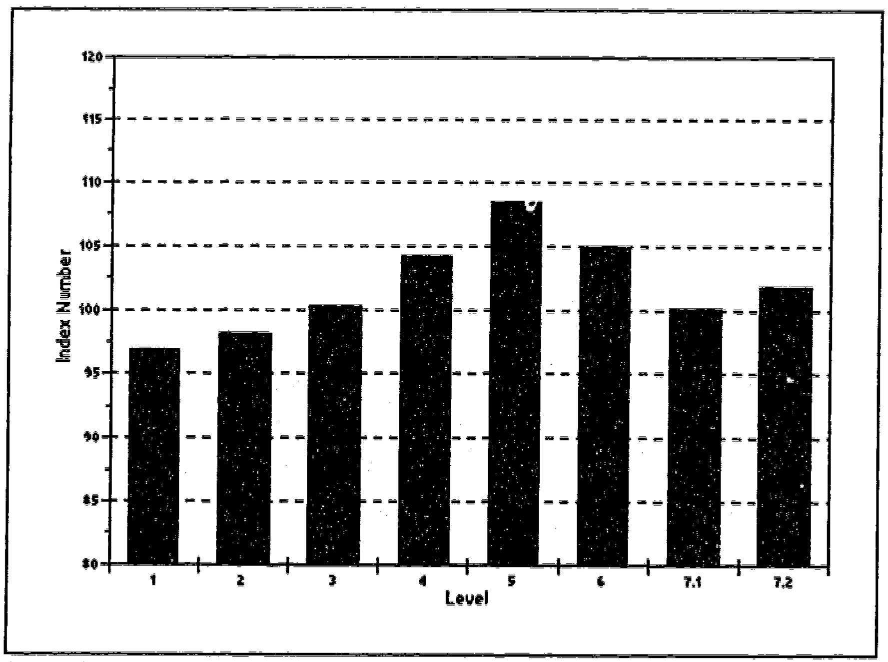


Figure 84 - Head-Smashed-In Buffalo Jump base-body indices plotted by level.

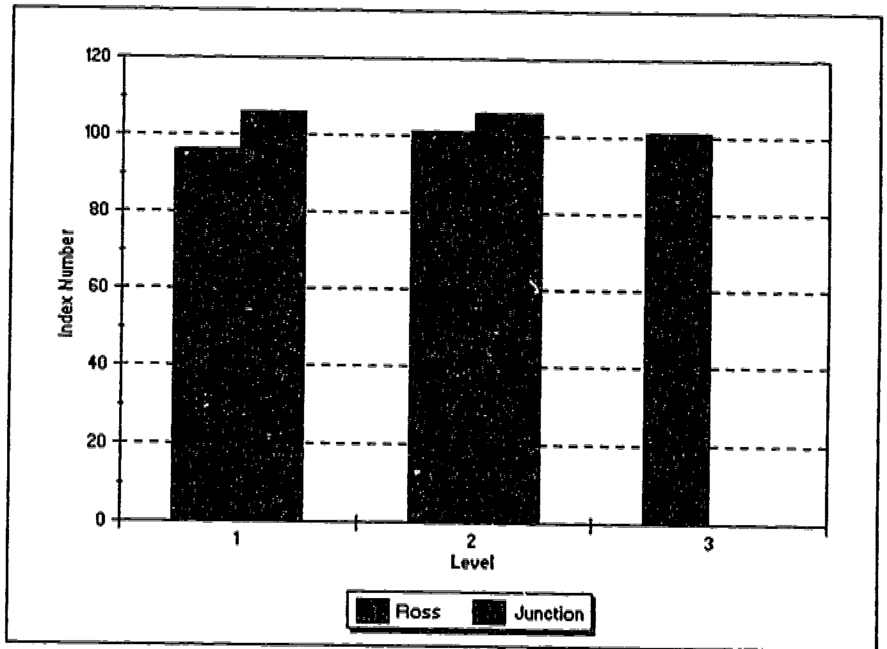


Figure 85 - Junction site and Ross site base-body indices plotted by level.

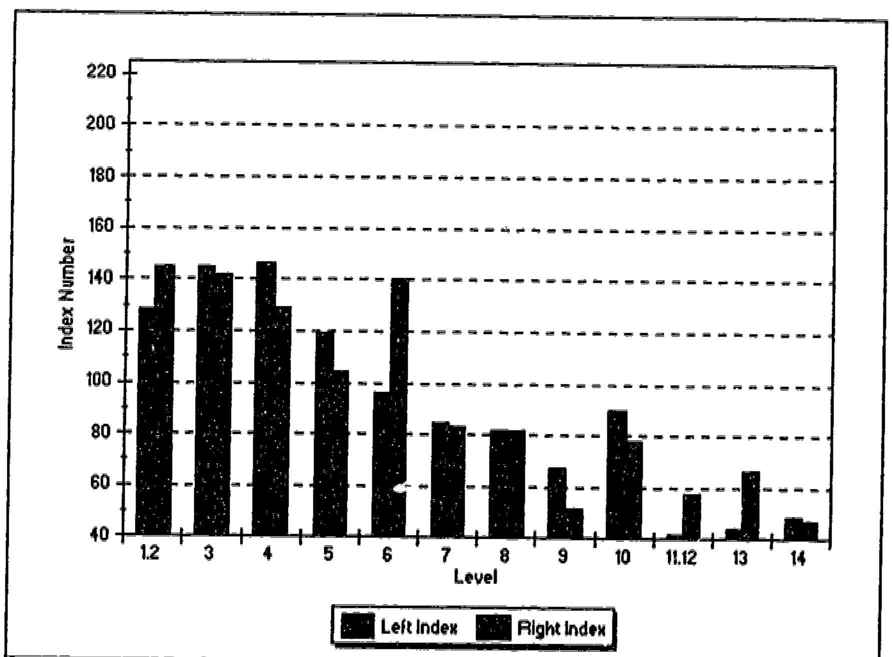


Figure 86 - Old Women's Buffalo Jump left and right base height-notch height indices plotted by level.

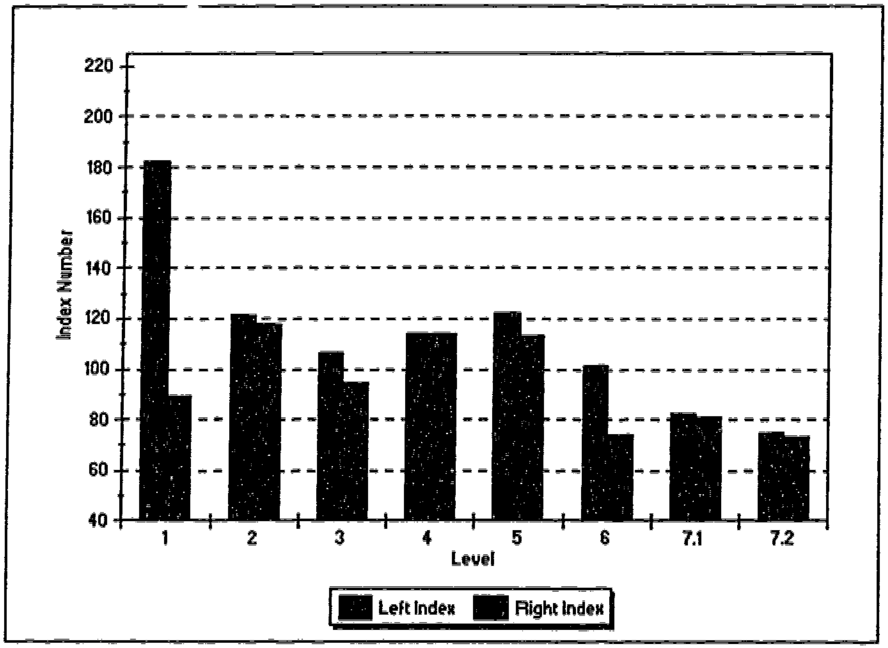


Figure 87 - Head-Smashed-In Buffalo Jump left and right base height-notch height indices plotted by level.

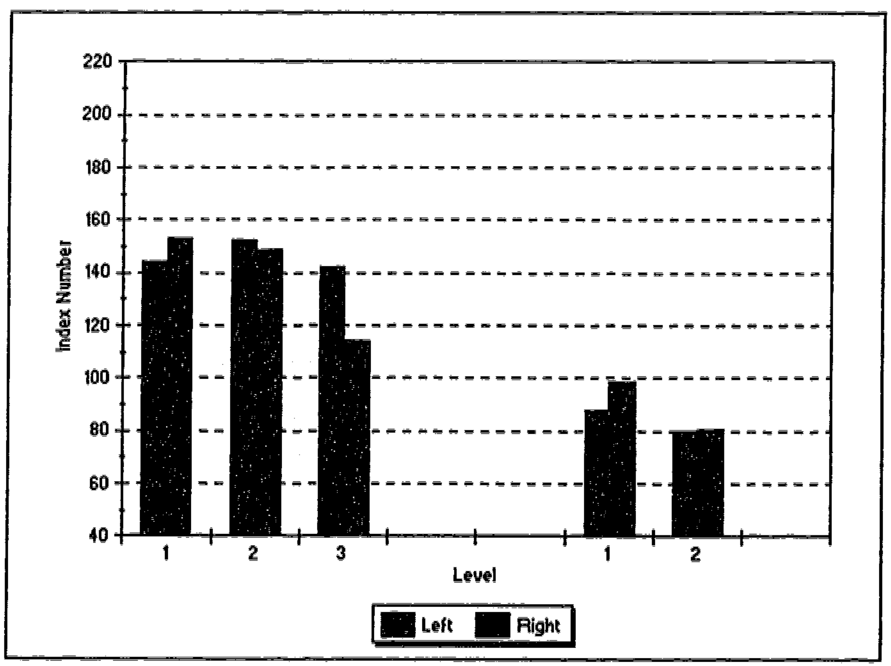


Figure 88 - Junction site and Ross site left and right base height-notch height indices plotted by level.

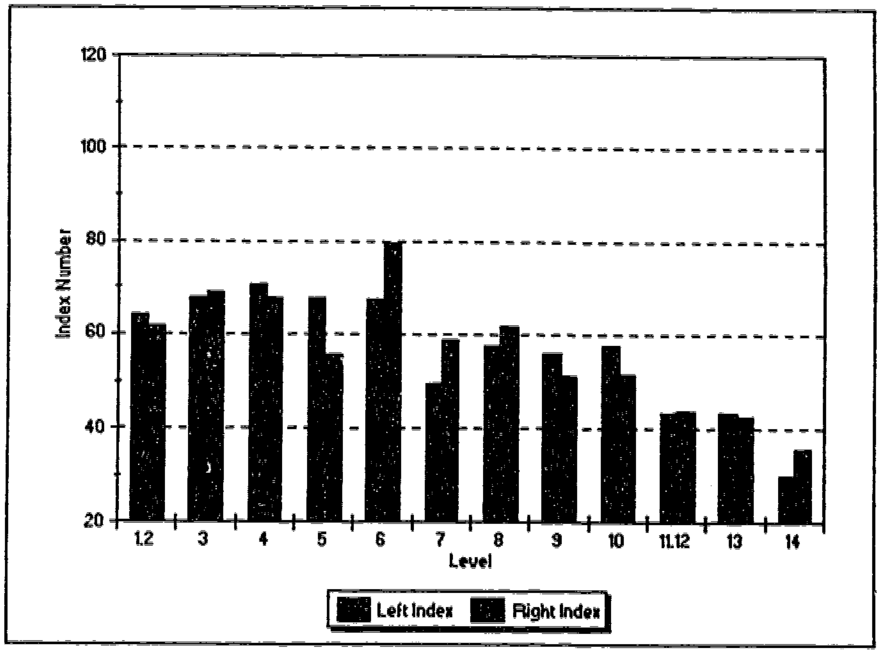


Figure 89 - Old Women's Buffalo Jump left and right notch depth-notch height indices plotted by level.

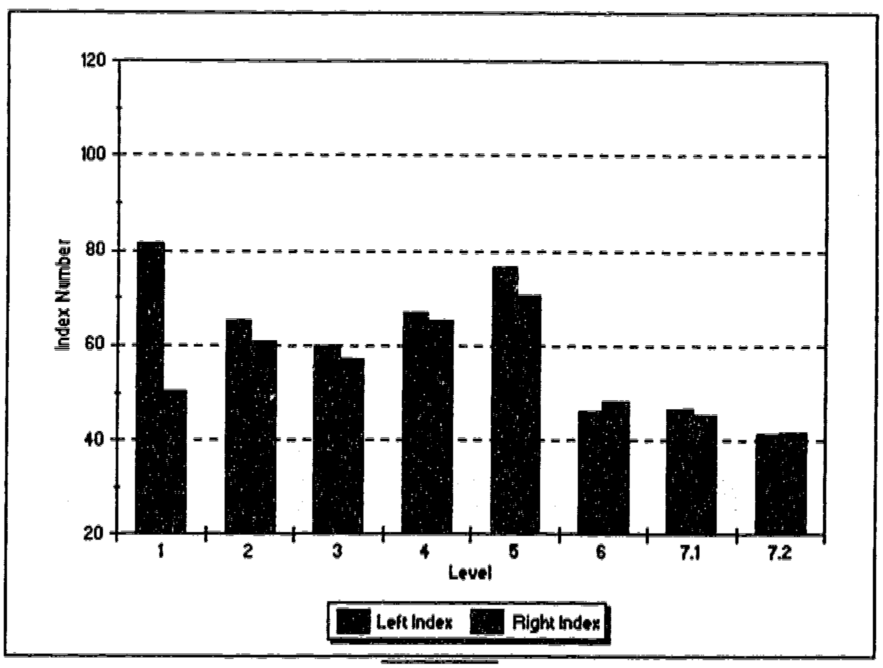


Figure 90 - Head-Smashed-In Buffalo Jump left and right notch depth-notch height indices plotted by level.

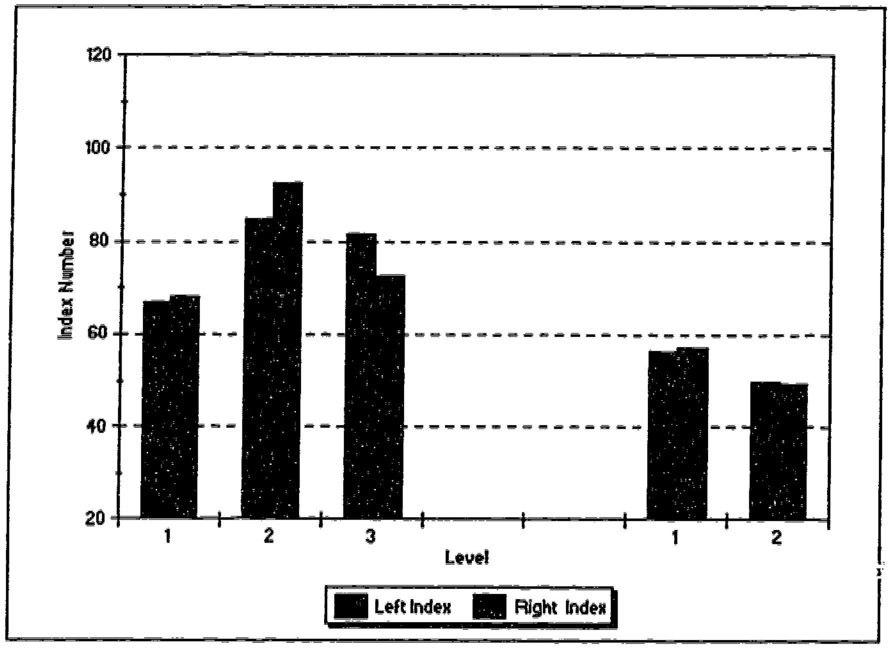


Figure 91 - Junction site and Ross site left and right notch depth-notch height indices plotted by level.

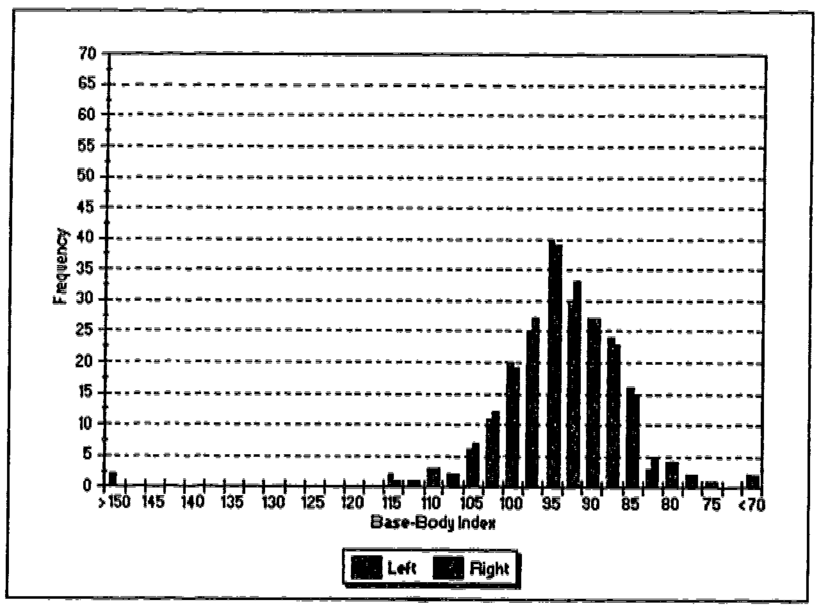


Figure 92 - Frequency of Mortlach projectile points with left and right base height values larger than notch height values, plotted by values of base-body index values.

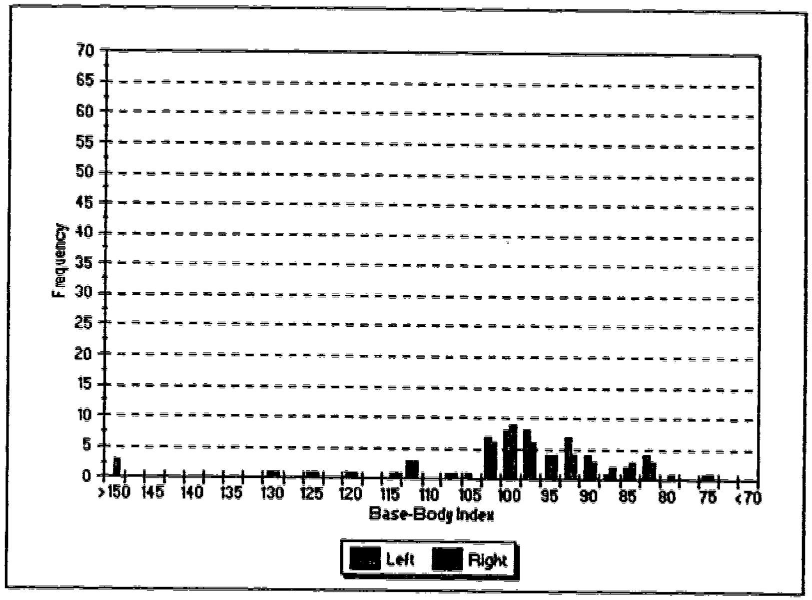


Figure 93 - Freqency of Mortlach projectile points with left and right base height values smaller than notch height values, plotted by base-body index values.

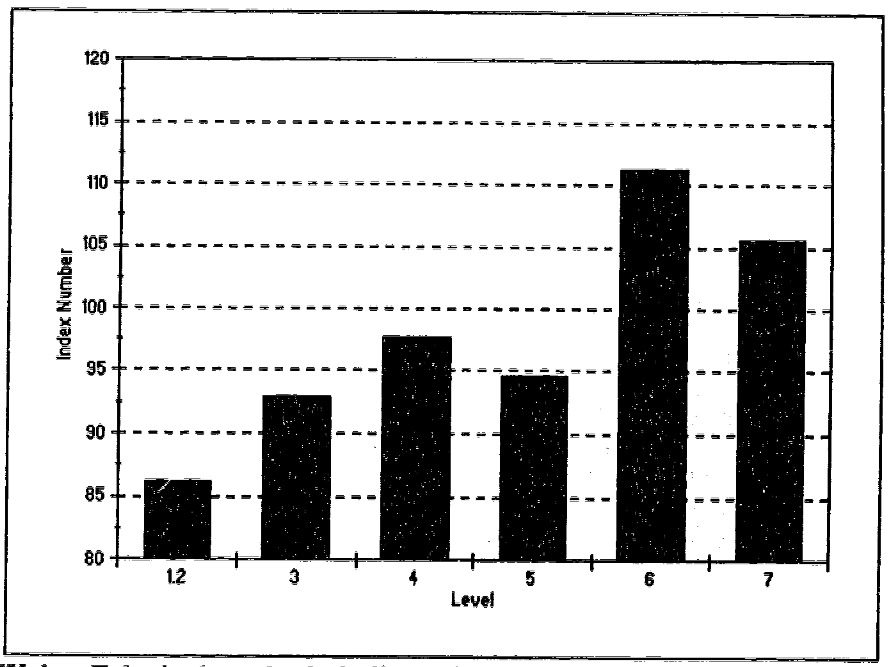


Figure 94 - Walter Felt site base-body indices plotted by level.

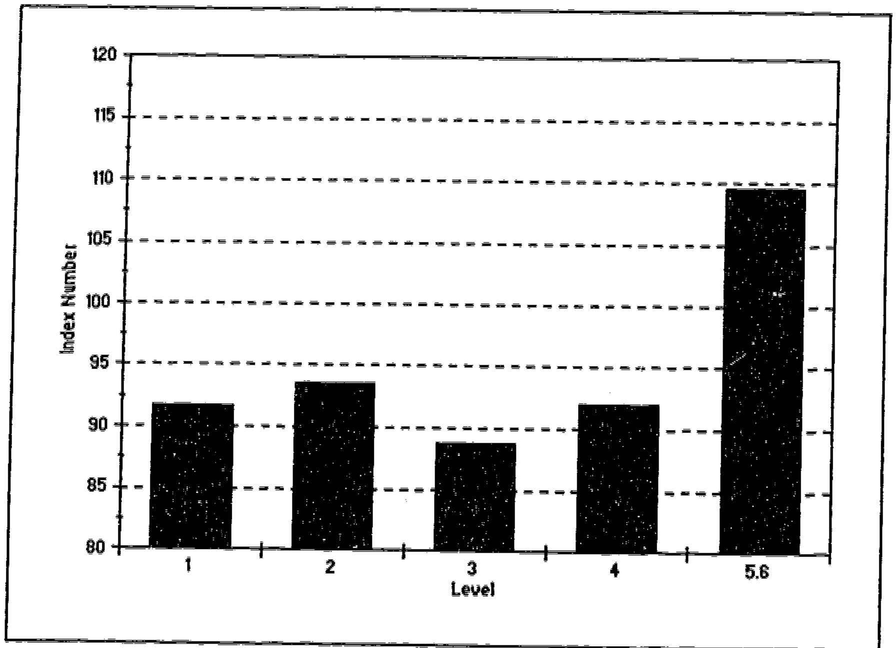


Figure 95 - Sanderson base-body indices plotted by level.

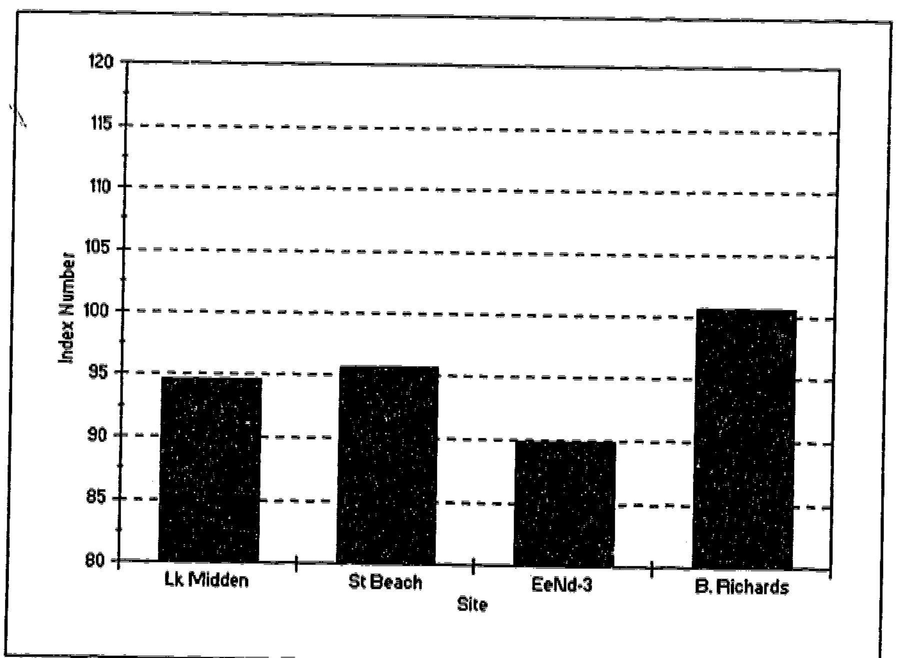


Figure 96 - Lake Midden, Stony Beach, EeNd-3, and Bill Richards base-body indices plotted by site.

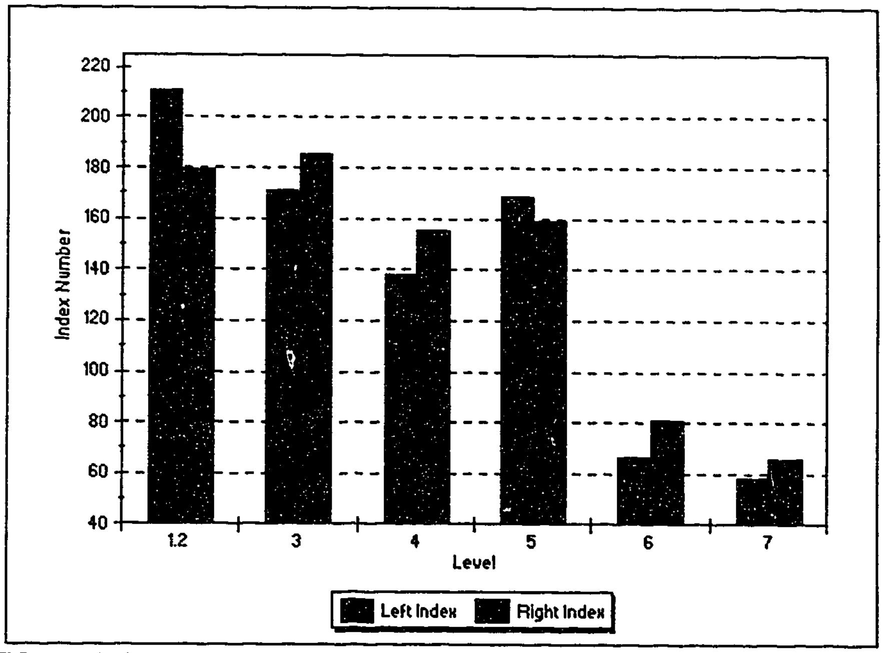


Figure 97 - Walter Felt site left and right base height-notch height indices plotted by level.

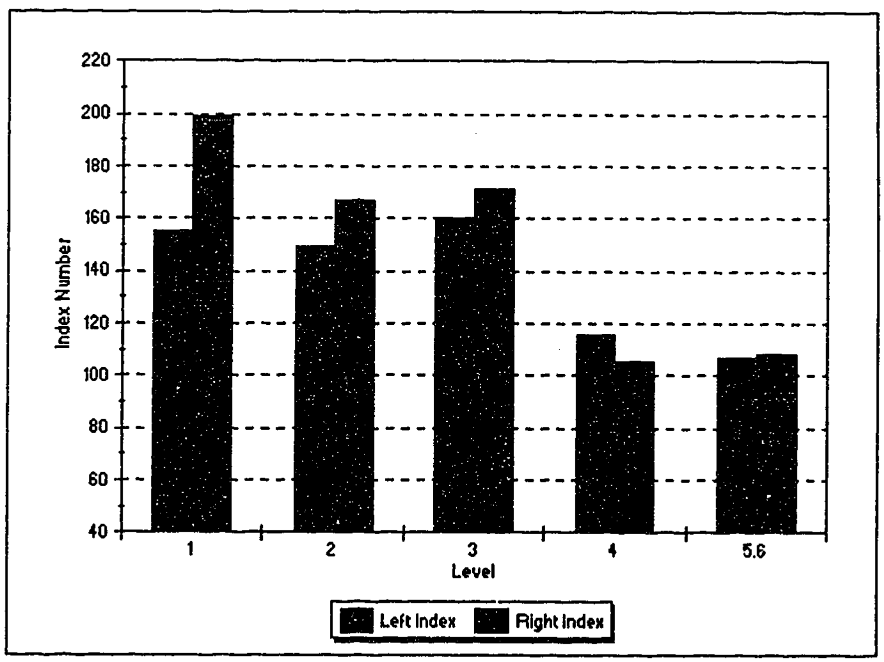


Figure 98 - Sanderson site left and right base height-notch height indices plotted by level.

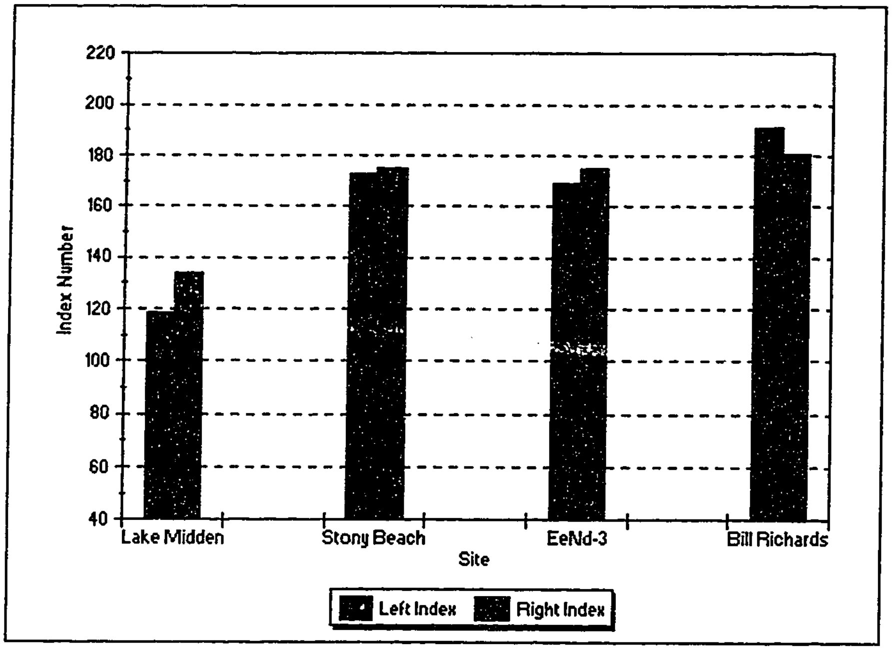


Figure 99 - Lake Midden, Stony Beach, EeNd-3, Bill Richards left and right base height-notch height indices plotted by site.

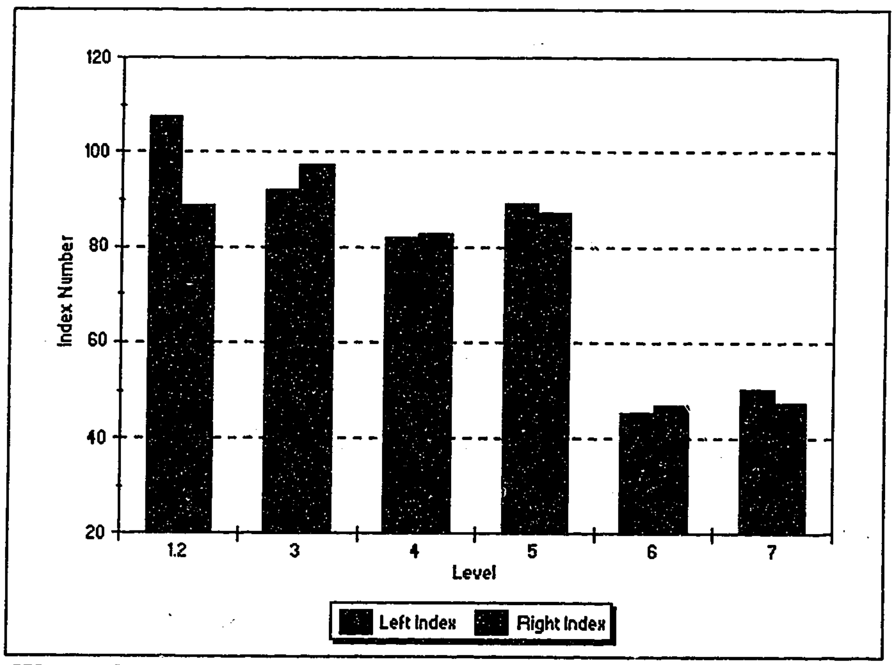


Figure 100 - Walter Felt site left and right notch depth-notch height indices plotted by level.

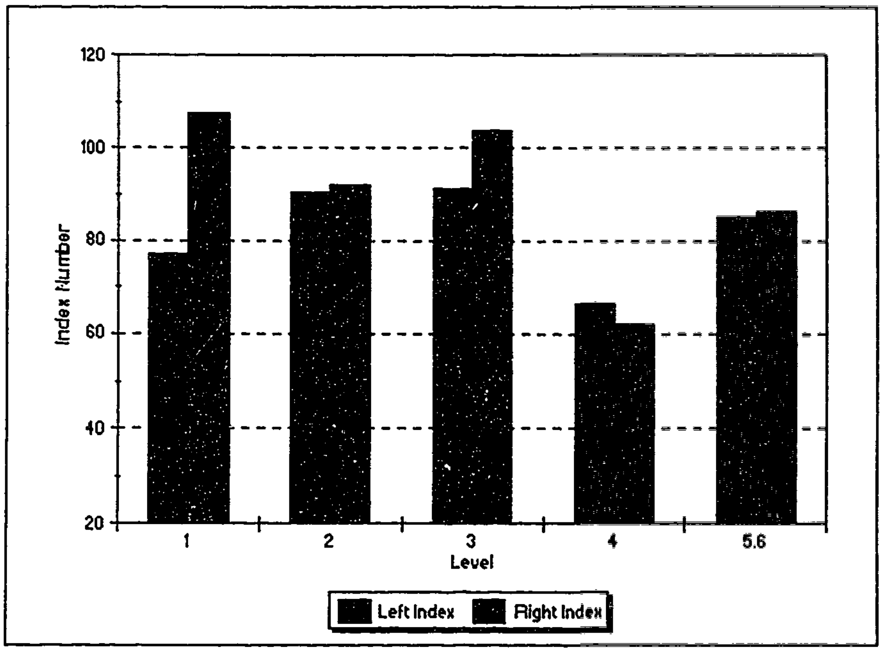


Figure 101 - Sanderson site left and right notch depth-notch height indices plotted by level.

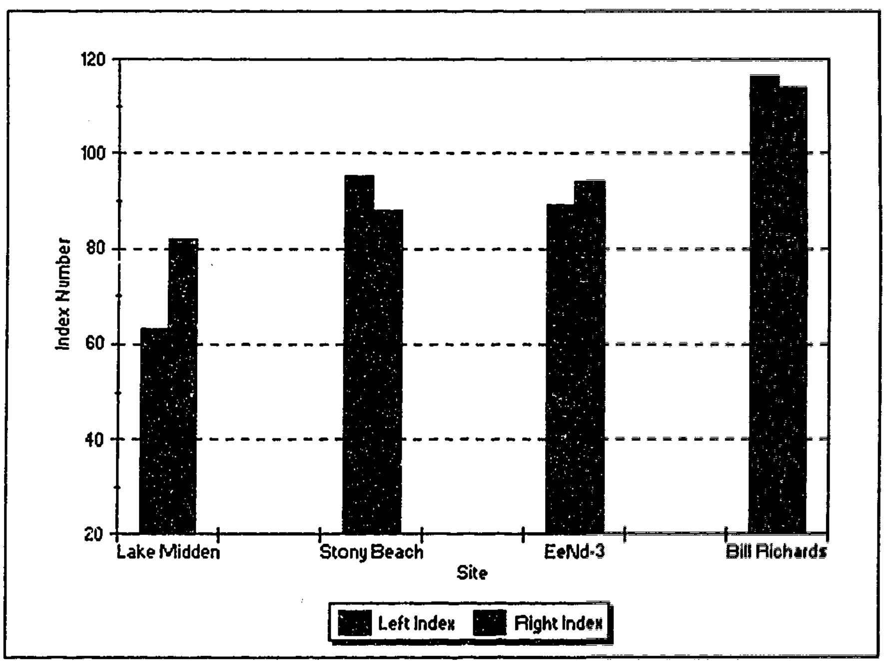


Figure 102 - Lake Midden, Stony Beach, EeNd-3, Bill Richards left and right notch depth-notch height indices plotted by site.

APPENDIX C:

PLATES

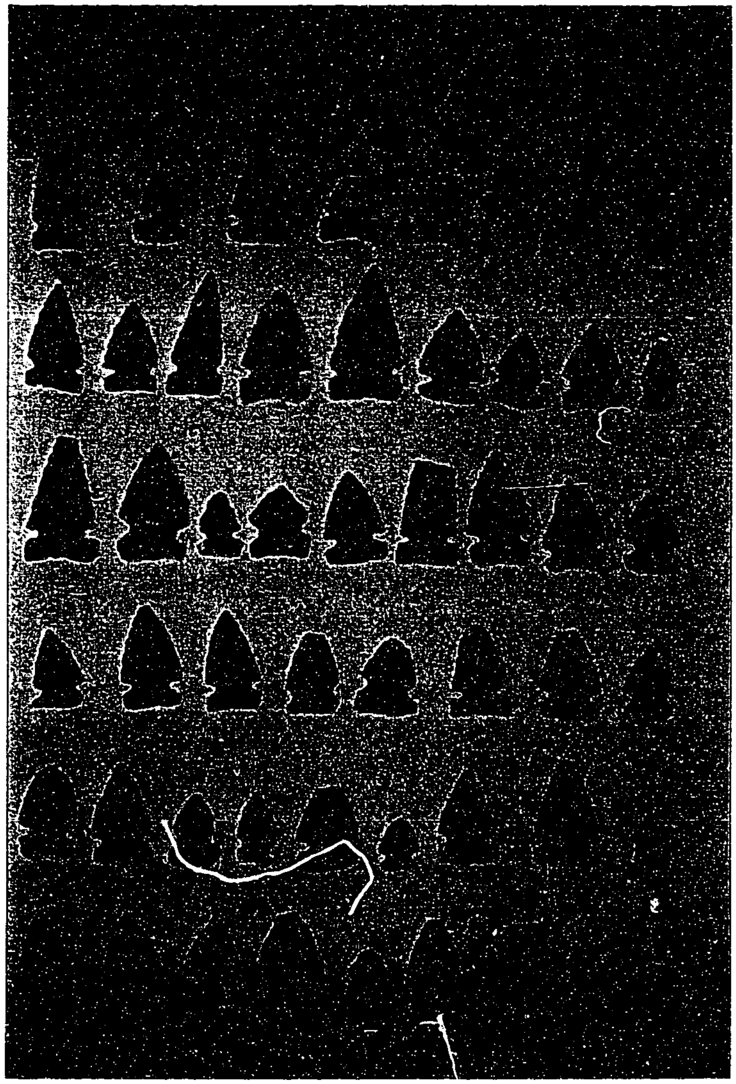


Plate 1. Projectile points from levels 1 (top row) to 7 (bottom row) of the Old Women's Buffalo Jump

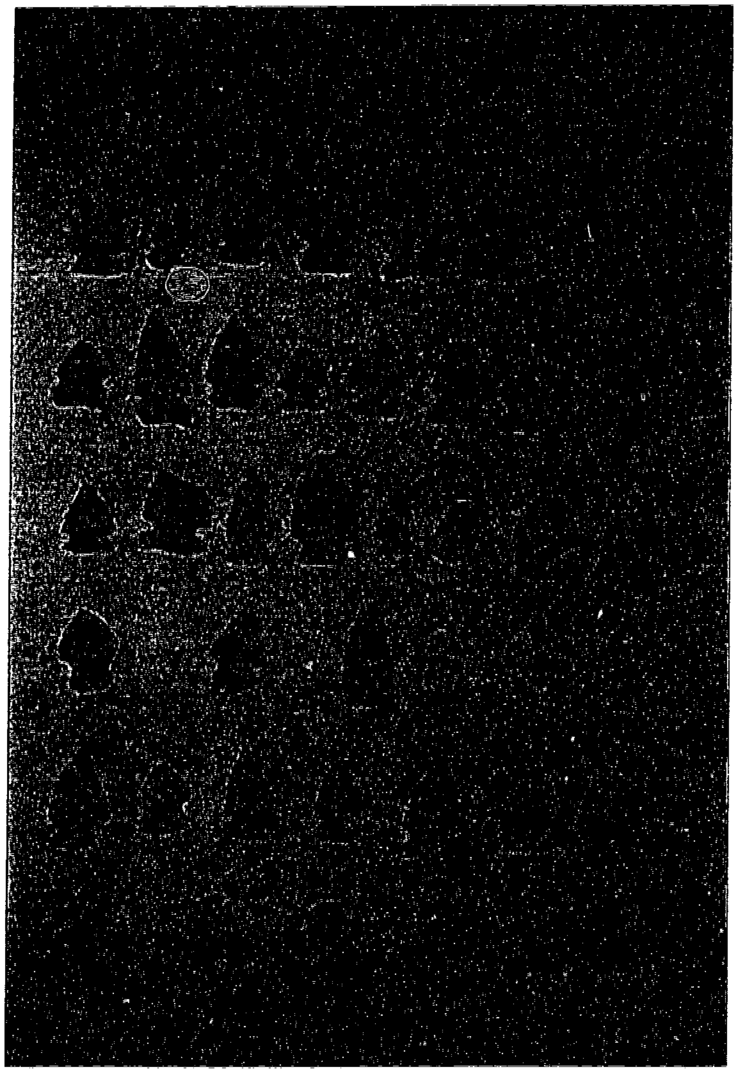


Plate 2. Projectile points from levels 8 (top row) to 14 (bottom row) of the Old Women's Buffalo Jump

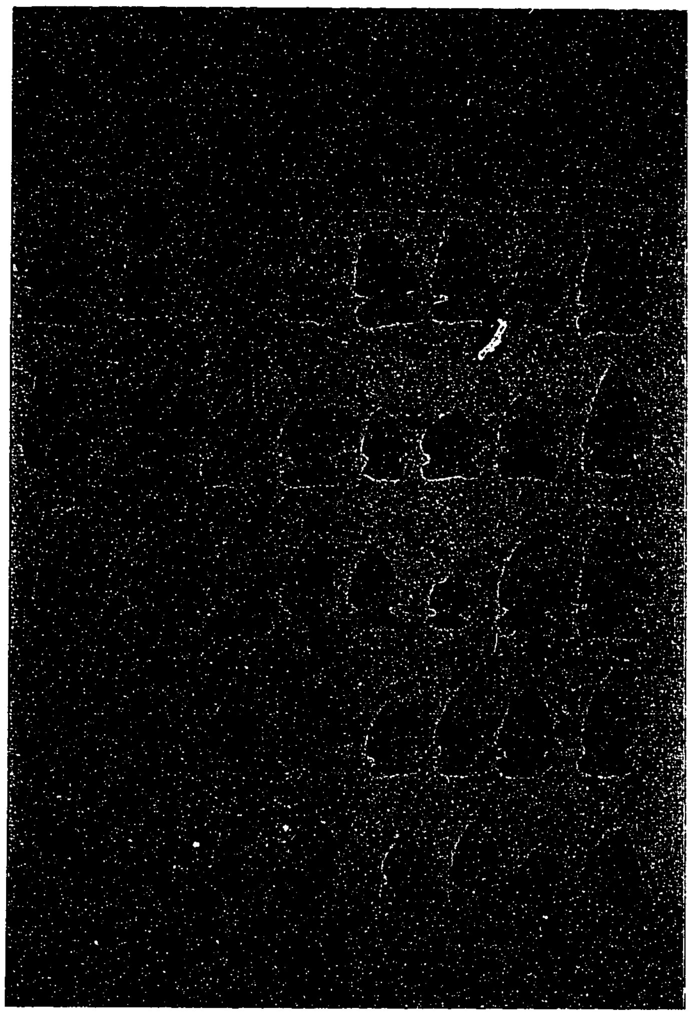


Plate 3. Projectile points from levels 1 (top row) to 7 (bottom row) of Head-Smashed-In Buffalo Jump

Plate 4. Projectile points from levels 1 and 2 of the Walter Felt site

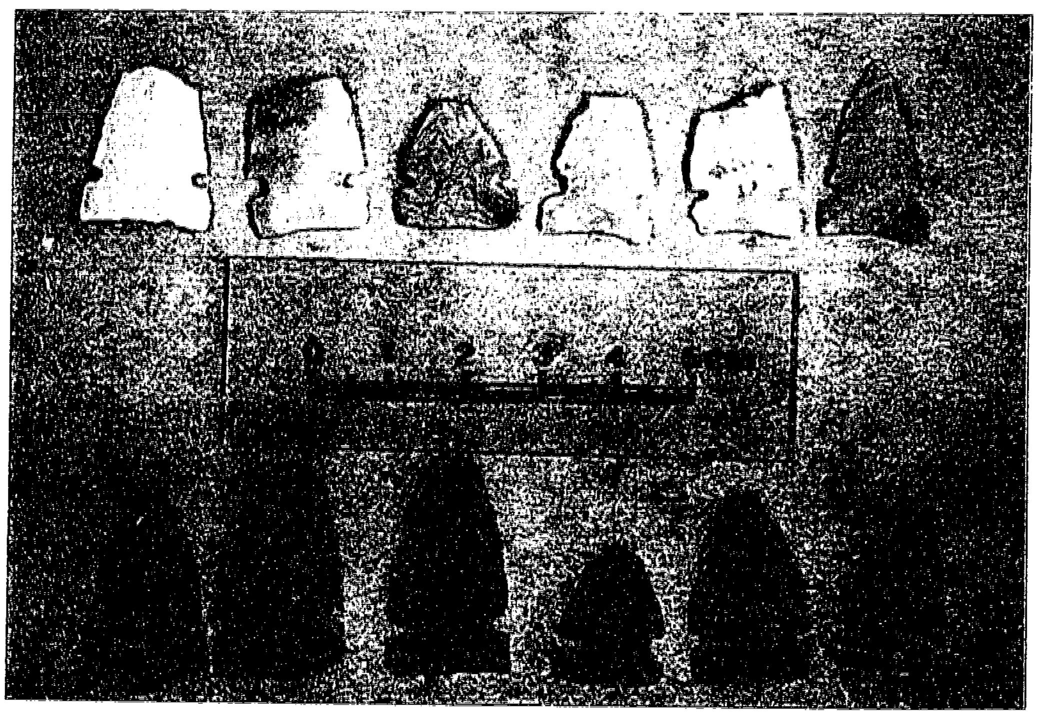


Plate 5. Projectile points from level 3 of the Walter Felt site

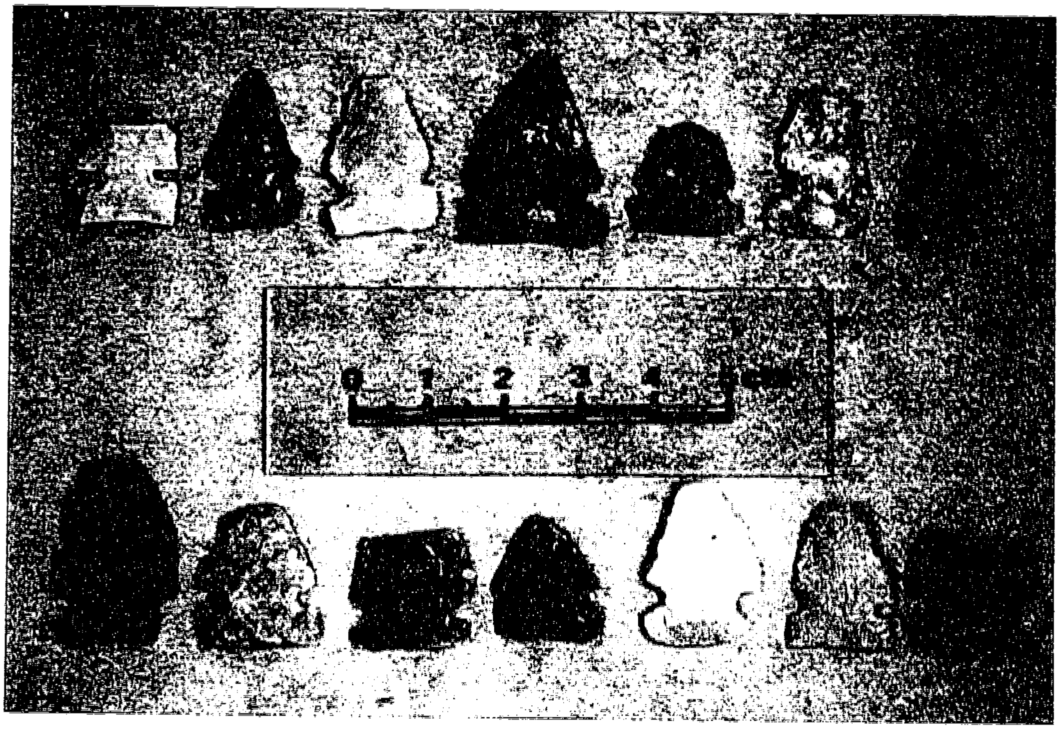


Plate 6. Projectile points from level 4 of the Walter Felt site

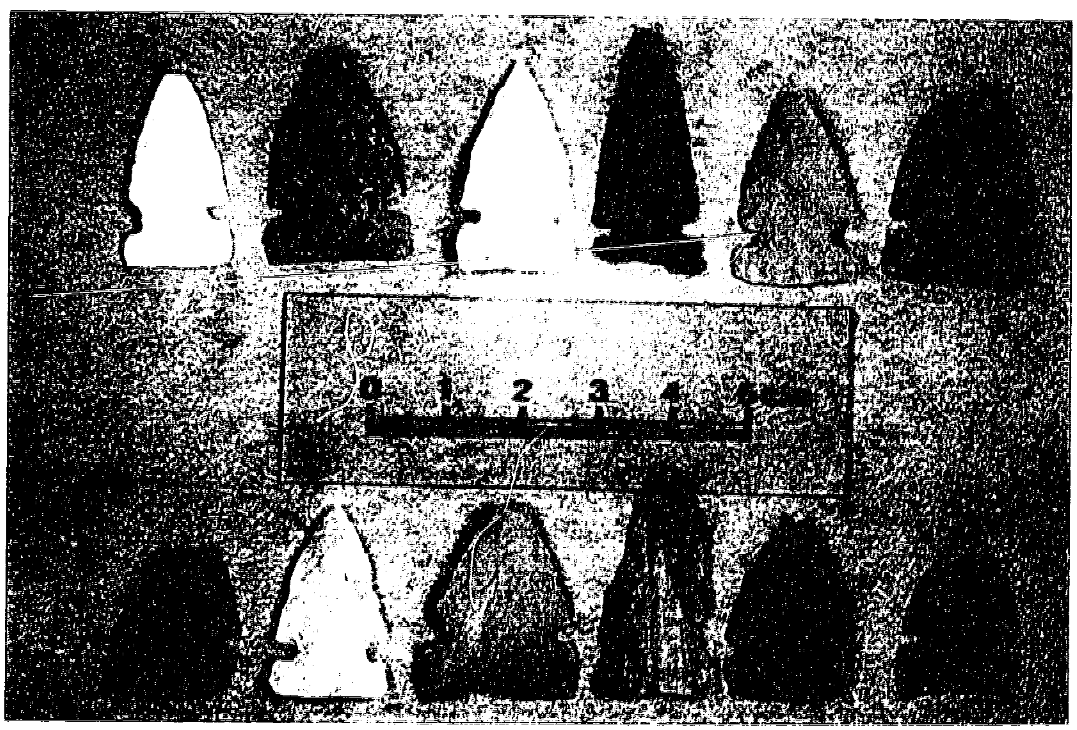


Plate 7. Projectile points from level 5 of the Walter Felt site

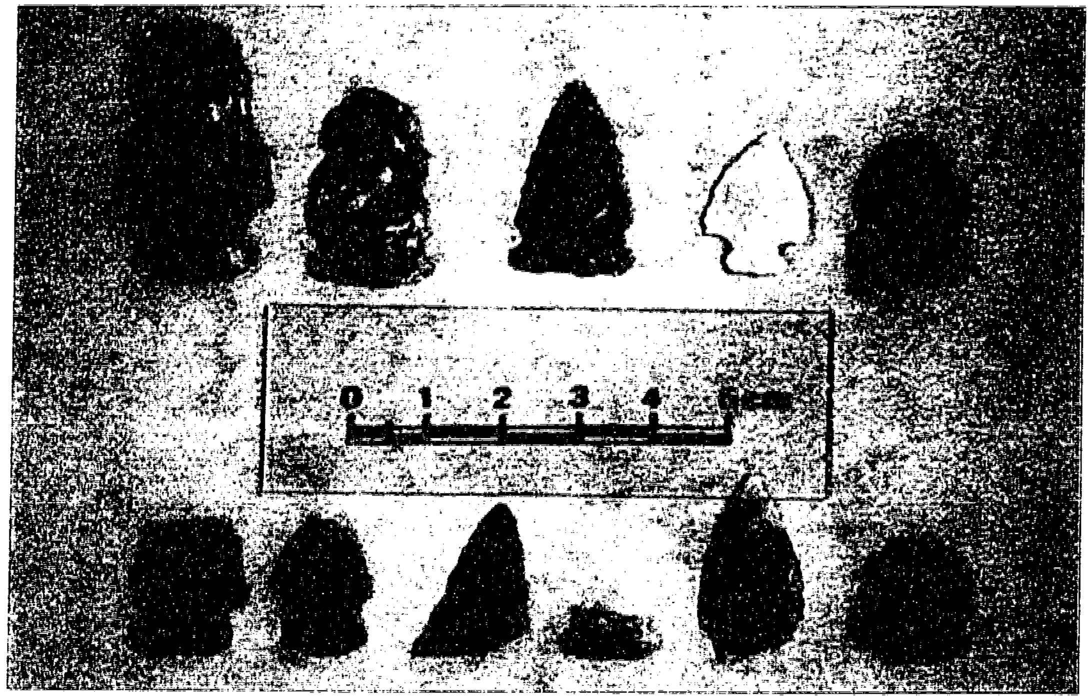


Plate 8. Projectile points from level 6 of the Walter Felt site

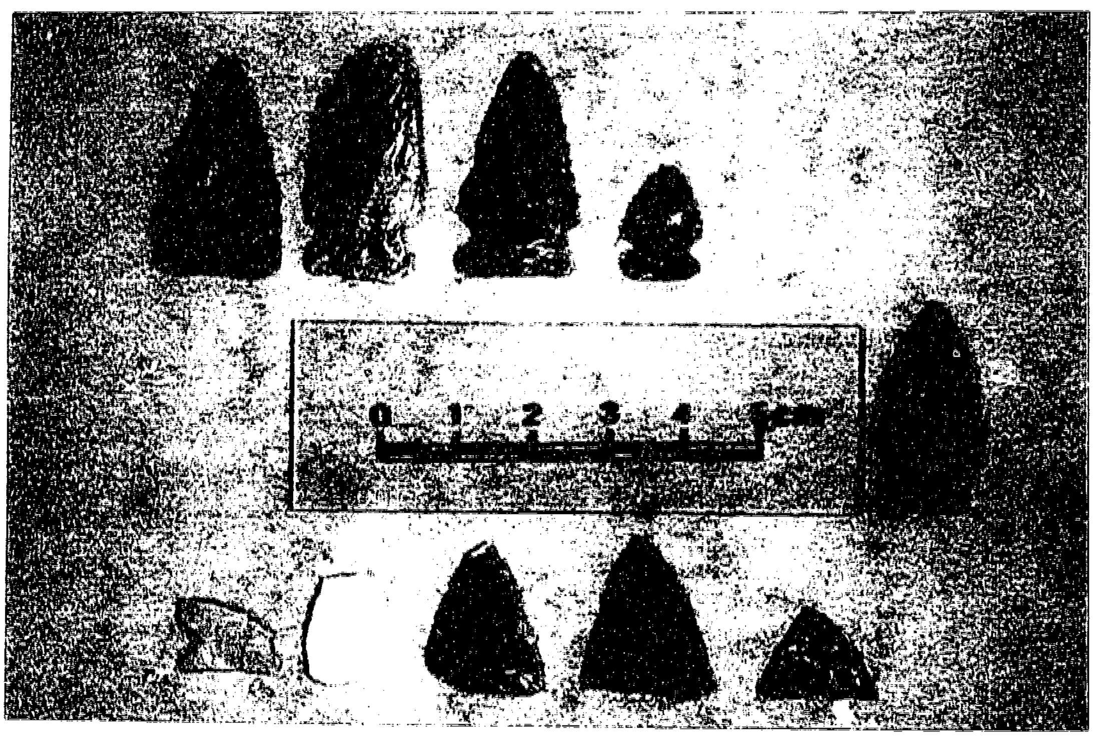


Plate 9. Projectile points from levels 7 and 8 of the Walter Felt site

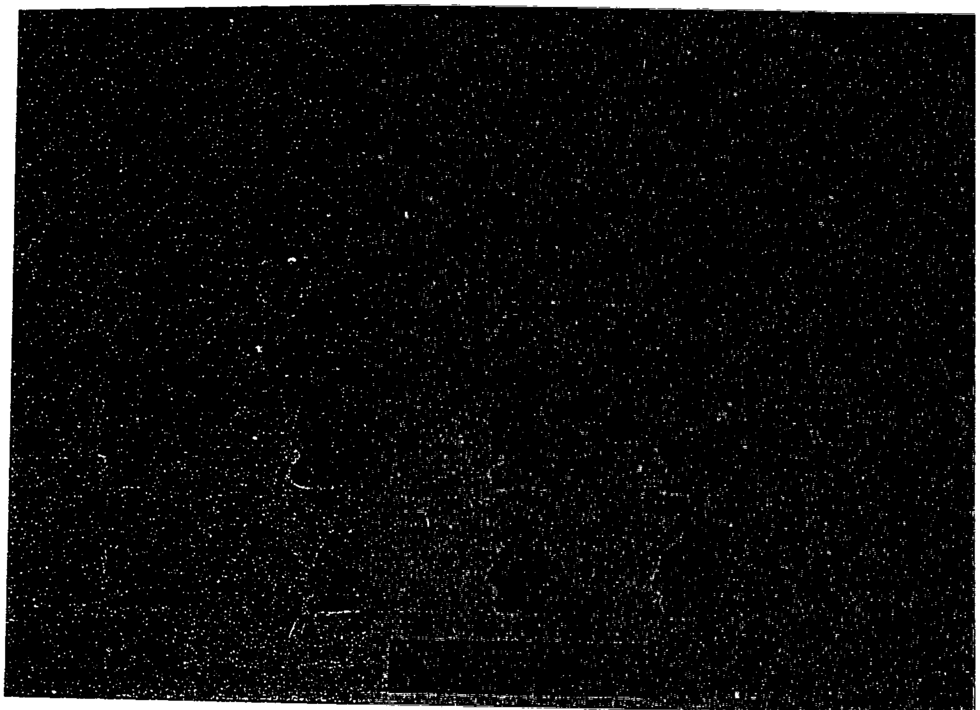


Plate 10. Projectile points from the levels 1 (top two rows) and 2 (bottom two rows) of the Junction site

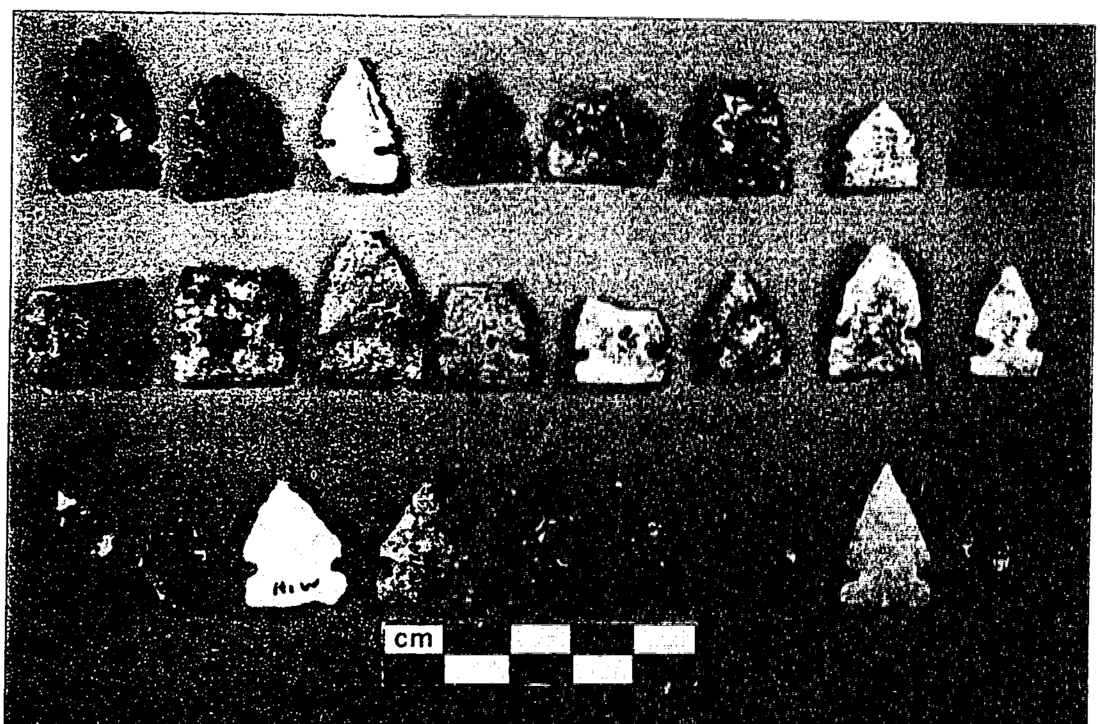


Plate 11. Projectile points from the Lake Midden site

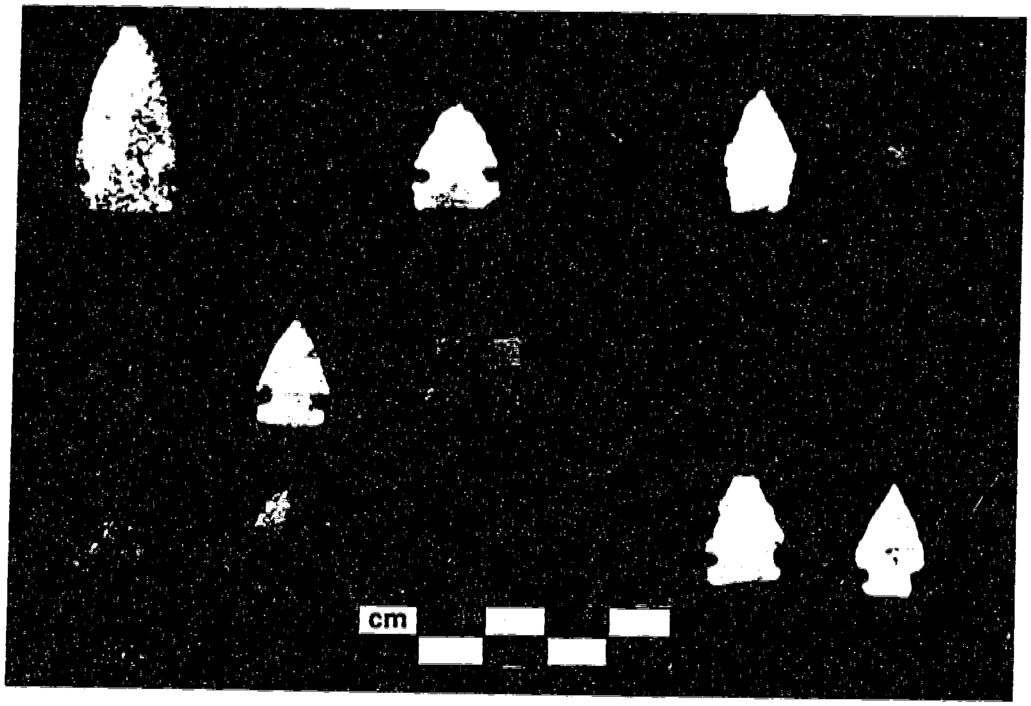


Plate 12. Projectile points from the Stony Beach site

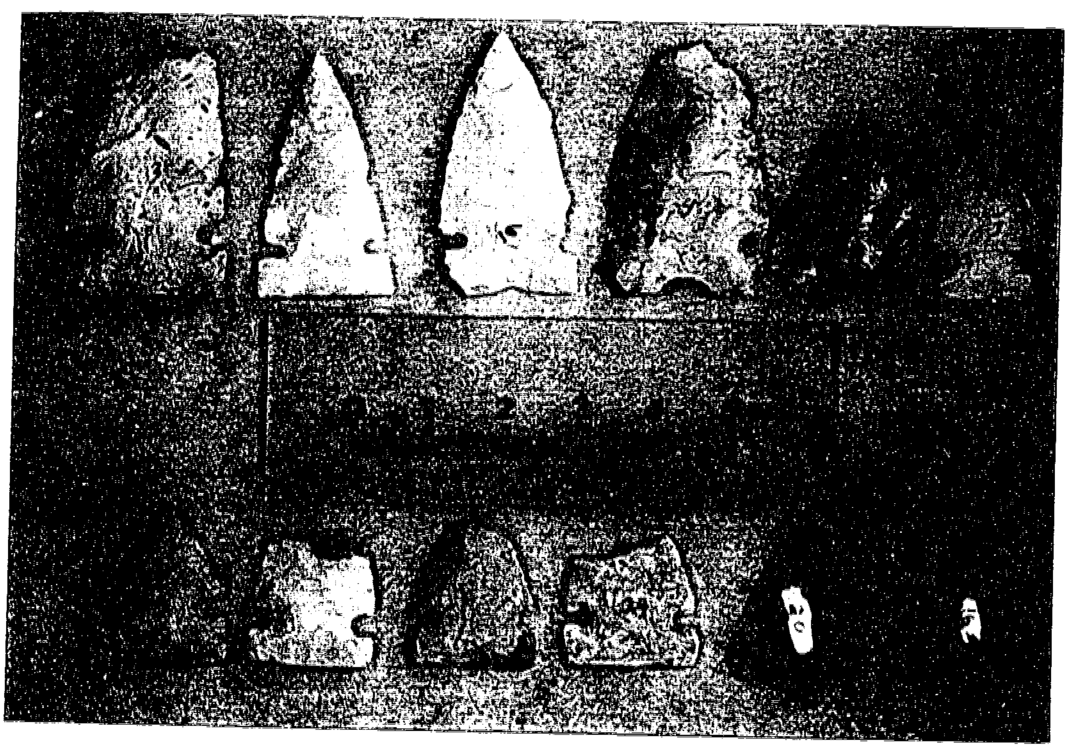


Plate 13. Projectile points from EeNd-3

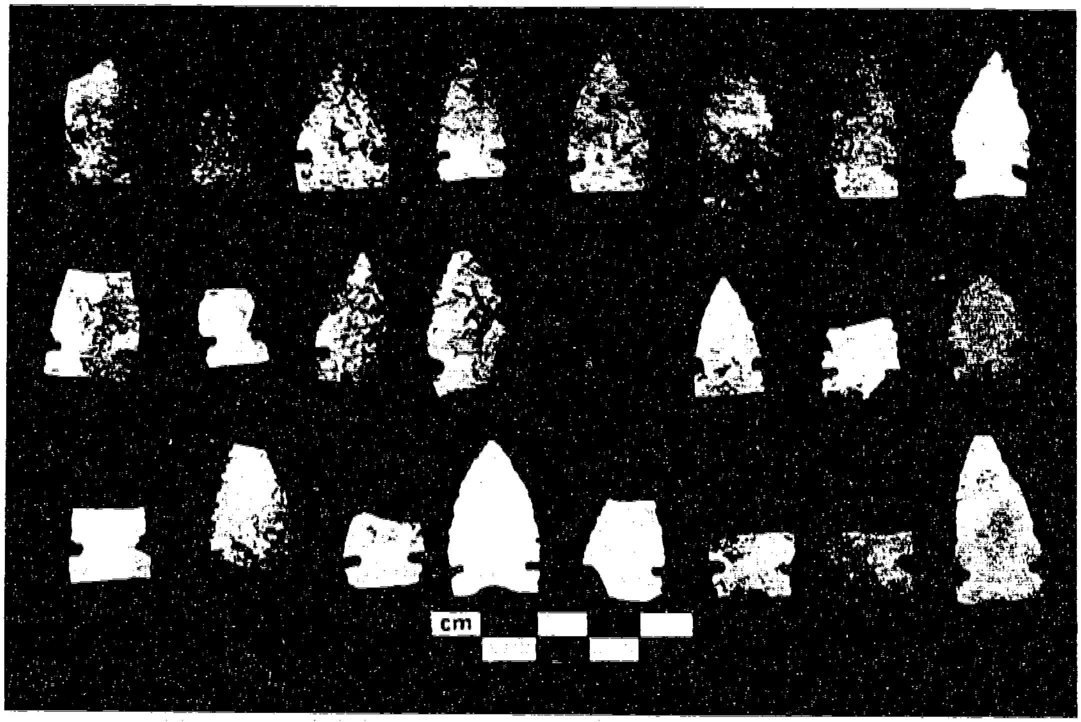


Plate 14. Projectile points from the Bill Richards site

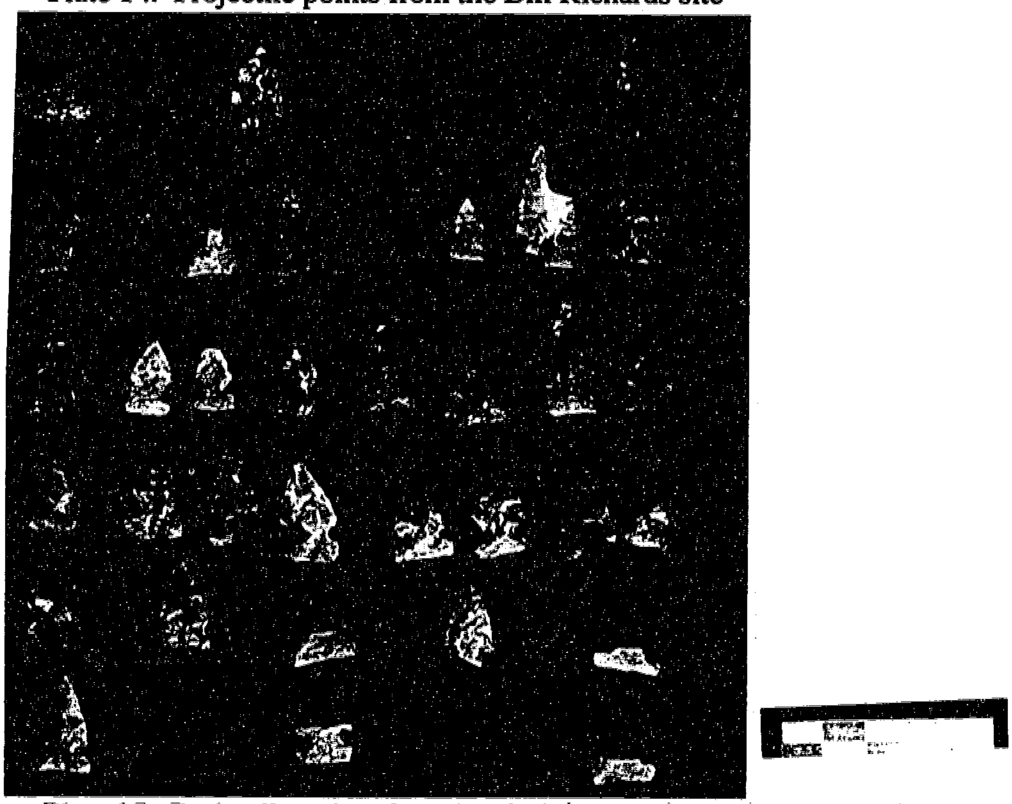


Plate 15. Projectile points from levels 1 (top row) to 6 (bottom row) of the Sanderson site

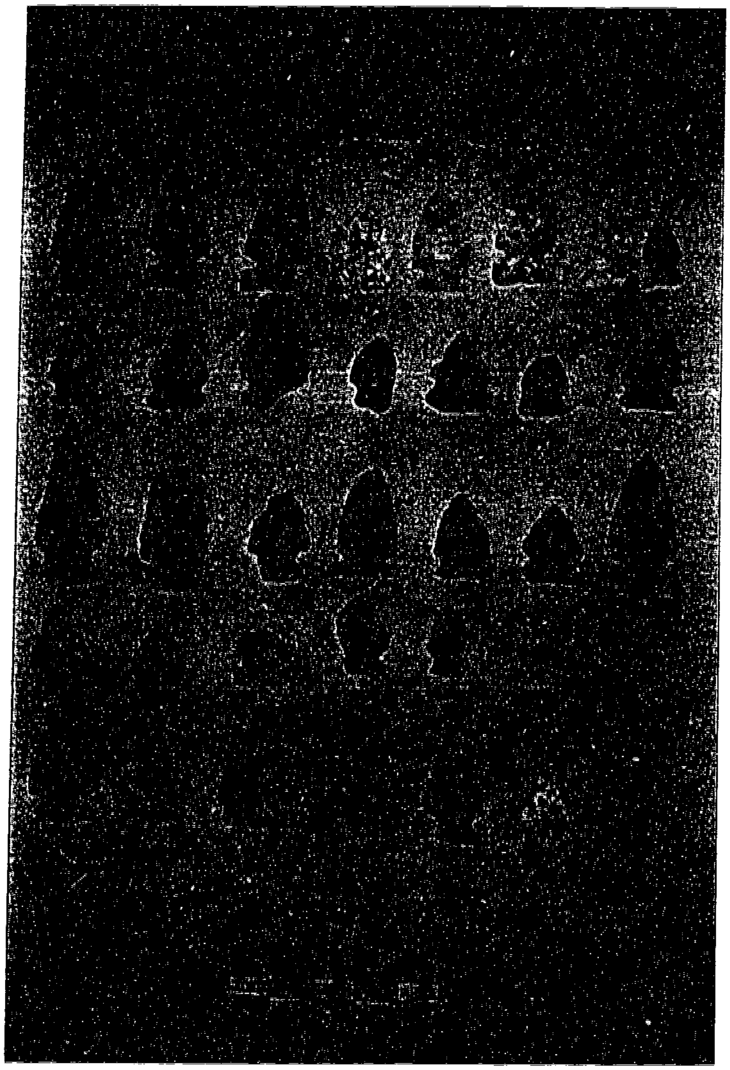


Plate 16. Projectile points from levels 6-8 (top two rows), 15 (third and fourth rows), 18 (fifth row), and 24 (bottom two rows) of the Gull Lake site

APPENDIX D:

DESCRIPTION OF ARCHAEOLOGICAL SITES

Introduction

This appendix describes the archaeological sites, located in both the Alberta and the Saskatchewan portion of the Northwestern Plains, from which the projectile points used in this study were excavated. The archaeological sites that will be described from the Alberta portion of the Northwestern Plains include the Old Women's Buffalo Jump (EcPl-1), the south kill of Head-Smashed-In Buffalo Jump (DkPj-1), the Junction Site (DkPi-2), and the Ross Site (DlPd-3). The archaeological sites that will be described from the Saskatchewan portion of the Northwestern Plains include the Walter Felt Site (EcNm-8), the Sanderson Site (DhMs-12), the Lake Midden Site (EfNg-1), the Stony Beach Site (EdNh-1), the Bill Richards Site (FaNp-9), and EeNd-3.

The Old Women's Buffalo Jump (EcPl-1)

Background

The Old Women's Buffalo Jump (EcPl-1) has also been called the Cayley Kill (Forbis 1962:57). It is located on the south bank of the Squaw Coulee, about 3 km northwest of the town of Cayley, and 90 km south of Calgary, Alberta (Forbis 1962:57), Vickers 1986:97). The site consists of low sandstone cliffs creating a 6 to 7 metre drop to the slope deposits and bone beds which extend to the bottom of the valley of Squaw Coulee (Forbis 1962:57). The site was discovered during the summer of 1952 when a flash flood washed through deposits in the Squaw Coulee in which a series of bison kills had been preserved (Forbis 1962: 57).

During the summers of 1957 through to 1959, Richard G. Forbis (1962) conducted an excavation at the Old Women's Buffalo Jump. Forbis' (1962) excavation has been the only systematic investigation to have occurred at the site. The excavation consisted of an Upper Pit in the "heart of the bone bed," and a Lower Pit about 40 feet downhill from the upper pit (Forbis 1962:71-74). This discussion will be confined to the Upper Pit as it exhibited the best stratigraphic separation. Based on the nature of the cultural remains, Forbis (1962:74) divided the deposits in the Upper Pit into an Upper Member and a Lower Member. The Upper Member consisted of the deposits from the surface down to level 14. These deposits contained the vast majority of the small projectile points that were inferred to be arrow points (Forbis 1962:76). The Lower Member consisted of levels 15 to 30. The projectile points were "comparatively large and heavy" and were inferred to be dart points (Forbis 1962:76). Site maps and stratigraphic profiles are available (i.e., Forbis 1962).

Four radiocarbon dates from three layers in the Upper Pit were obtained for the excavation: two for layer 13, one for layer 17, and one for layer 25. Respectively, the uncorrected radiocarbon dates are 1100 ± 80 B.P. (S-87), 1020+/-80 B.P. (S-89), 1650 ±60 B.P. (S-90), and 1840±70 B.P. (S-91) (Forbis 1962:81). Age estimates were provided for levels without dates (Forbis 1962:83). The age estimates were inferred from the radiocarbon dates and taking into account the physical stratigraphy and topographic change (Forbis 1962:82-83).

Lithic artifacts recovered from the site include projectile points, drills, semilunar bifaces, end scrapers, unifaces, choppers, and hammerstones (Forbis 1962). Some aberrant lithic artifacts include a ground stone pendant (Forbis 1962:118) and a ground stone steatite bead (Forbis 1962:121). Non-lithic material recovered from the site include a few sherds of pottery (Forbis 1962:118), which were later classified as Saskatchewan Basin Complex Late Variant (Byrne 1973:365). Other non-lithic material recovered include lumps of ochre (Forbis 1962:118) and a possible bone tool (Forbis 1962:118).

Discussion

Only projectile points from the Upper Member of the Upper Pit (i.e., levels 1 to 14) were used in the analysis. The reason for focusing on the Upper Member of the Upper Pit are two-fold. First, as mentioned above, the Upper Member of the Upper Pit has the best stratigraphic separation. Second, the Upper Member of the Upper pit contained a much larger sample of arrowheads (n=388) compared to the coeval levels in the Lower Pit (n=133) (Forbis 1962:96, 104).

Since the initial excavation, five additional radiocarbon dates have been obtained. These new dates (provide below in uncorrected form) support both the initial radiocarbon dates and age estimates for the Old Women's Buffalo Jump. Two of the additional dates are from level 3, one date of 270±70 (1898C) and another at 180±70 (1899C), both on bison hair. A bone from level 7 provided a date of 320±70 (1897C). Two additional dates were obtained from level 13, one on bison horn sheath at 910±70 (1894C), and another on piece of wood at 1120±70 (1896C).

Finally, for statistical reasons levels 1 and 2, 9 and 10, 11 and 12, and 13 and 14 have been combined in addressing metric attributes.

Head-Smashed-In Buffalo Jump, South Kill (DkPj-1)

Background

Head-Smashed-In Buffalo Jump (DkPj-1) has also been called the Spring Point Jump, Fort Macleod Jump, McLean Jump, Calderwood Jump, Dirsch Jump, and the Elgin Jump (Reeves 1978:151). It is located in southwestern Alberta, about 4 km north of the Old Man River and 18 km west of Fort Macleod, on the southeastern edge of the Porcupine Hills (Reeves 1978:151).

Junius Bird first mentioned the site in the literature in 1939 (Reeves 1978:151). In 1949, Boyd Wettlaufer, having visited the site earlier, returned to carry out the first scientific excavation at the site and in the province (Reeves 1978:152). In the late 1960s and early 1970s, Brian Reeves, of the University of Calgary, conducted excavations in the kill site and the campsite. The following discusses Brian Reeves' excavations and the projectile points he recovered from the South Kill of Head-Smashed-In Buffalo Jump.

Head-Smashed-In Buffalo Jump is a bison kill complex consisting of the jump created by a sandstone outcrop running a lateral distance of 350 m with drops averaging 11- 13 m; a kill site/bone midden on the slump terrace below the cliff, an associated processing/campsite about 20 m below the cliff, and gathering basins and drive lanes to the west of the jump (Reeves 1978:151-153).

Reeves (1978:155) excavated at Head-Smashed-In Buffalo Jump in 1965, 1966, and 1972. He focused his excavations in three areas: the South Kill area, the North Kill area, and the processing/camp area in the east. This discussion will focus on the South Kill excavation area since it has the best stratigraghic separation and the largest number of Late Side-notched projectile points. The south excavation is located in the southern portion of the kill area about 10 m from the base of the sandstone cliff. The excavation consists of a number of units (A, B, C, X, Y, and Z), the largest of which were Units A, a 10 x 20 ft area reaching a depth of 26 ft; and B, a 10 x 20 ft area taken to a depth of 4 ft. Units A, B, C, Y, and Z were used to form a composite stratigraphic profile for the south area (Reeves 1978 156-158, 167).

In the composite stratigraphy, the Late Prehistoric Period is represented by the Old Women's Phase which stratigraphically overlays the Avonlea Phase. The Late Side-notched projectile points, attributed to the Old Women's Phase, primarily occur in levels 1 through 7B, and the Avonlea points, attributed to the Avonlea Phase, primarily occur in levels 8 through 10.

A number of uncorrected radiocarbon dates are available for the Late Prehistoric levels from the south kill excavation at Head-Smashed-In Buffalo Jump. Dates attributed to the Old Women's Phase include a date on burned bone/charcoal from level 5 of 700±170 B.P. (GSC-992), and a date on burned bone from level 7B of 1190 ±90 B.P. (RL-257). "Trade goods and metal points appear in the latest component to indicate that the jump was used in the Historic Period, probably by the Peigan, until the mid-1800s" (Reeves 1978:166)

Lithic artifacts recovered from the site include projectile points, bifaces, end scrapers, pieces esquillees, cobble choppers, flake choppers, anvils, and hammers (Reeves 1978). Besides the occurrence of massive bone beds, and trade goods in the latest component, Reeves (1978) does not mention the occurrence of other cultural artifacts. Pottery was not found within the original excavation. However, subsequent excavations in the processing/campsite area, located on the flats below the kill site, have recovered ceramics. The excavators attributed the ceramics to either the Saskatchewan Basin Ceramic Complex or the Cluny Ceramic Complex (Brink et al. 1985:213-215).

Discussion

As alluded to, subsequent excavations have occurred at Head-Smashed-In Buffalo Jump. These excavations have been conducted by both the staff of Archaeological Survey of Alberta, and Brian Kooyman of the University of Calgary. The research by the Archaeological Survey of Alberta involved mitigative investigations preparatory to the installation of the Head-Smashed-In Buffalo Jump Interpretive Centre (Brink et al. 1983, 1986). The majority of the on-site research conducted by Alberta Culture focused on the primary or core processing area. This area lacks abundant numbers of projectile points from well-defined stratigraphic levels, and is not directly applicable to this discussion. Brian Kooyman conducted a 6 m x 6 m excavation at the North

Kill of Head-Smashed-In Buffalo Jump in the summers of 1988 through to 1991. The excavation recovered numerous projectile points, however, concerns over the integrity of the stratigraphic levels prohibited the use of the North Kill projectile points in this analysis (Kooyman, pers. comm. 1994).

Finally, for statistical reasons levels 1 and 2 have been combined in addressing metric attributes.

The Ross Site (DlPd-3)

Background

The Ross site (DlPd-3) was originally excavated by Dr. Richard Forbis, then of the Glenbow Foundation, in the summer of 1957 (Forbis 1960:119). The site is located in south-central Alberta on the south bank of the Oldman River, about 4 km upstream from its confluence with the Little Bow River (Forbis 1960:119). The Ross site consists of several cultural levels exposed by the undercutting of the bank (Forbis 1960:119). Forbis (1960:119-121) interprets the site as a campsite, and points out its similarity to a nearby kill site called the Lower kill.

Forbis described the Ross site as consisting of "...three occupation layers containing hearths, faunal remains, and cultural debris" (Forbis 1960:119). These occupations were labeled I, II, and III from bottom to top, respectively. Forbis (1960:121, 158-159) estimated the age of level III at A.D. 1600 or 1700, and the age of level I at A.D. 1400 or 1500. However, in a subsequent publication he estimated the age of layer III between A.D. 1500 to 1700 (Forbis 1962:105).

Chipped stone tools recovered from the Ross site included projectile points, knives, awls, drills, chisels, endscrapers, spokeshaves, gravers, and choppers. The only ground stone tools recovered from the Ross site included shaftsmoothers, and a single ground stone bead. Bone tools found at the site include punches, awls, quill flatteners, shaft straightners, and flakers. Objects of adornment include a ground stone bead (mentioned above), bone beads, elk incisors, and various shell beads (Forbis 1960:132). Ceramic sherds were recovered from all three levels of the Ross site (Forbis 1960:124), these were later classified as Saskatchewan Basin Complex Late Variant (Byrne 1973:365). Miscellaneous objects recovered from the Ross Site include an ammonite septa (buffalo stone) and a hair brush (Forbis 1960:1960).

Discussion

In 1980, J. Roderick Vickers, of the Archaeological Survey of Alberta, "...conducted a brief test excavation programme..." meant "...to determine if the site was sufficiently intact to warrant designation as a Provincial Historical Resource (Vickers 1989). Recall that Forbis (1960:119) noted three levels and labeled the levels I through III from bottom to top. Vickers (1989:25) distinguished nine components and labeled them I through VII (i.e., I, II, IIA, IIIA, III, IV, V, VI, VII) from bottom to top. Vickers (1989:25) correlates Forbis' level III with his component III, but is less certain about correlating levels I and II. However, based on correlations between stratigraphic position and assemblage size Vickers inferred that Component I corresponds to Forbis' level I.

The significance of these correlations is that Vickers (1989:56) obtained an uncorrected radiocarbon date of 615±120 years B.P. (approximately A.D.1335) for Component II, and 540±135 years B.P. (approximately A.D. 1410) for Component III. A rejected radiocarbon date of "younger than 100 years" was obtained for Component I. The date for Vickers' Component III suggests Forbis' age estimate of A.D. 1700 for level III is too late. Vickers' (1989:56), however, cautions reinterpretations owing to the large standard deviation for the date for Component III, but concludes by suggesting "...that both Components II and II may date about 100 years earlier than previously estimated.

To maintain continuity with the previous site descriptions, Forbis' levels I, II, III (from oldest to youngest) will be renumbered 3, 2, 1, respectively. In other words, Forbis' level III, the most recent level, is relabeled level 1; Forbis' level II is relabeled level 2, and Forbis' level I, the oldest level, is re-labelled level 3.

The Junction Site (DkPi-2)

Background

The Junction site is located on the Oldman River about 5 km upstream from the town of Fort Macleod (Unfreed 1992). The site consists of two distinct topographic zones, an upper prairie level and a lower river terrace. Excavations focus on the lower terrace as it contained bison kill and butchering/processing deposits.

The stratigraphy was divided into three components. Component III contained historic material while Components II and III contained Old Women's Phase material. Component I was separated from component II by a layer of fluvial sands. Based on thirty-three radiocarbon dates, a date between 500 B.P. and 700 B.P was suggested for Component I and a date between 300 B.P. and 500 B.P. for Component II (Unfreed pers. comm. 1993).

Artifacts recovered from the Junction site include projectile points, bifaces, scrapers, choppers, wedges, core, flakes, and numerous expedient tools. Bone and antler tools, shell ornaments, and ceramics were also recovered from the site. The ceramics have been classified as Late Variant pottery of the Saskatchewan Basin Complex.

Discussion

A sample of 394 projectile points were analysed from the Junction site.

The Walter Felt Site (EcNm-8)

Background

The Walter Felt site (EcNm-8) is a pound site located in south-central Saskatchewan, about 9 km south of the town of Mortlach, and about 16 km southwest of the Mortlach site (Kehoe 1974:103,164; Byrne 1973:393; Malainey 1991:180). The site is located in the "Prairie-Plains border ecological zone" (Kehoe 1974:103), slightly below the Missouri Coteau, on a wooded terrace (Kehoe 1973:164)

Thomas Kehoe (1965:164) indicated that he and a crew from the Saskatchewan Museum of Natural History excavated the site in 1962 and 1965. However, Malainey

(1991:180) noted that work continued at this site until 1967. "The multicomponent site yielded twelve layers of artifact material, usually separated by sterile layers or zones" (Kehoe 1974:103). Prairie Side-notched projectile points occur in layers 6 and 7 (Kehoe 1974:164) and Plains Side-notched projectile points occur in levels 1 through 5 (Kehoe 1966:831).

Three radiocarbon dates were obtained for the levels with Late Side-notched projectile points. Layer 4 has an uncorrected radiocarbon date of 400±40 B.P. (S-280) [A.D. 1550], layer 6 has an uncorrected radiocarbon date of 700±80 B.P. (S-203) [A.D. 1250], and layer 7 has an uncorrected radiocarbon date of 1260±70 B.P. (S-202) [A.D.690] (Kehoe 1974:164). Kehoe (1968:33) suggested a probable eighteenth century date for the topmost occupation based on the occurrence of a single trade bead.

Pottery was recovered from the site. The pottery in the Prairie Side-notched layers was suspected of belonging to the Woodland ceramic tradition (Kehoe 1968:31). The pottery exhibits grit-temper; surface roughening by woven or twined bags, cord-wrapped paddle, or cord-wrapped stick with few designs. It also exhibits a tendency towards flat rims which are sometimes decorated; and sherd colors ranging between dark gray to orange (Kehoe 1968:31-32). In contrast, sherds from more recent levels were more uniformly dark gray or brown (Kehoe 1968:32). Kehoe (1968:32-33) indicated that the pottery in the upper layers, in association with Plains Side-notched projectile points, is Mortlach Check-stamped and Late Prehistoric surface roughened ware. Since a comprehensive site report has not been published a more complete discussion of the artifact assemblage is not possible. An unpublished manuscript concerning the site was also unavailable.

Discussion

Since the initial excavation and analysis of the Walter Felt site, the pottery has been re-examined by Mary Malainey (1991) and Dale Walde (1994). Recall that Kehoe (1968:31-33) indicated the pottery in the upper most layers of the Walter Felt site was different from the pottery in levels 6 and 7. Malainey (1991:180), unlike Kehoe (1968:31-31), found little reason to differentiate sherds found in levels 1 through 7. Malainey (1991:366-369) divided the pottery from the Saskatchewan Plains in Wascana Ware (south-central Saskatchewan) and Mortlach Aggregate Pottery (south of the Qu'Appelle Valley). Furthermore, she associated these pottery groups with the Astina and Hidatsa, respectively (Malainey 1991:373). For the Walter Felt Site, Malainey (1991:367) suggests that the pottery likely includes Wascana Ware which is yet to be separated from the Mortlach Aggregate Pottery that is also found at the site.

Walde (1994:305), concurs with Malainey concerning the similarity of pottery from levels 1 through 7 at the Walter Felt site. He suggests, however, that pot sherds may have been mixed from the Plains layers into the Prairie layers. Unlike Malainey, Walde (1994:172) considers the pottery from the Saskatchewan Plains to belong to a single classificatory group--the Mortlach Phase. Walde (1994:172) divided the Mortlach phase into two subphases: the Lozinsky Subphase and the Lake Midden

Subphase. Then, based on geographic coincidence, he suggested that the Mortlach Phase and its pottery was produced by ancestors of Assiniboine peoples.

For statistical reasons levels 1 and 2 have been combined for addressing metric attributes.

It was difficult to determine the original sample size recovered from the site, however, this analysis examines 278 projectile points and projectile point fragments, all of which were available by the Royal Saskatchewan Museum in Regina.

The Lake Midden Site (EfNg-1)

Background

The Lake Midden Site (EfNg-1) has also been known as the Swanson Site and the Bulyea Site (Watrall 1979:24). The site is located about 9 km east of Last Mountain Lake, and about 14 km from the town of Bulyea, in the bottom of a 60 m wide tributary coulee (Kehoe 1973:163, Malainey 1991:63). Kehoe (1973:163) interpreted the Lake Midden Site as a bison pound site with an associated camp site located in a poplar grove to the east. More recently, however, investigations have suggested the Lake Midden Site is "...a fall-winter-spring habitation site whose main activity was concerned with bison processing activities..." (Watrall 1979:30-31).

A.E. Swanston was reported to have discovered the site (Kehoe 1973:163), and he, along with F. Robinson and W. J. Orchard, extensively collected from the site in the mid-1930s (Watrall 1979:24). Such investigations continued into the 1970s until Charles Watrall of the University of Regina Anthropology Department arranged for exclusive excavation permission (Watrall 1979:24). Under the direction of Watrall (1979:25-26) the University of Regina Anthropology Department conducted an investigation of the Lake Midden Site including: surface surveys, programs of photographic documentation, evaluations of public collections, and archaeological excavations. The excavations occurred in the form of field schools in 1977, 1978, and 1993. Watrall (1979:29) suggests a single component occupation is present based on by the homogeneity of the projectile point assemblage. Furthermore, Watrall (1979:31) proposes an age estimate between A.D. 1000 and A.D. 1500 for the Lake Midden Site. This age estimate is probably based on the projectile point assemblage in which "side-notched projectile points characteristic of the late prehistoric period were dominant" (Watrall 1979:29).

Lithic artifacts recovered from the site include projectile points, blades, tool fragments, and waste flakes (Watrall 1979). Non-lithic artifacts recovered from the site include large numbers of pottery sherds, faunal materials, worked bone, and decorative objects of shell and bone (Watrall 1979:27). Byrne (1973:426), working with collections from the National Museum of Man, attributed the Lake Midden pottery to the Mortlach Check Stamped ware which he suggested was related to the pottery at the Cluny earthlodge village.

Later, the excavated sherds of pottery from the Lake Midden Site were compared to material from Montana, Wyoming, southwest Manitoba, and Alberta. Specifically, the Lake Midden Site pottery was noted as different from the Cluny Village Site in

Alberta, contrary to Byrne (1973:431), as well as different from the late prehistoric materials from the Knife and Heart River area of North Dakota (Watrall 1979:29).

Discussion

Since the initial excavations conducted in 1977 and 1978, Ian Dyck (1983:111) has reported an uncorrected radiocarbon date of 380±100 B.P. (S-2246) [A.D. 1570] for the Lake Midden Site. Furthermore, it has also been related that "some historic goods may have been recovered by avocational archaeologists which may indicate a later occupation" (Malainey 1991:63).

Recent evaluations of the Lake Midden pottery have been undertaken by Mary Malainey (1991) and Dale Walde (1994). Malainey (1991:367-368) organized the Saskatchewan Plains pottery into Wascana Ware, found in the Qu'Appelle Valley and north, and Mortlach Aggregate pottery, found south of the Qu'Appelle Valley. She classifies the Lake Midden pottery as Wascana ware which she suggested is associated with the historically known Atsina.

More recently, Walde (1994:172) interpreted the pottery from the Saskatchewan Plains as belonging to a single phase...the Mortlach Phase. The Mortlach Phase is divided into two subphases, the Lozinsky Subphase on the Plains of Northern Saskatchewan, and Lake Midden Subphase on the Plains of Southern Saskatchewan, northeastern Montana, and northwestern North Dakota. He classified Lake Midden pottery as belonging to the Lake Midden Subphase which he associates with the southern subdivision of Saskatchewan Assiniboine (Walde 1994:172-173).

The following analysis describes the projectile points from the excavations conducted by the University of Regina Anthropology Department in 1977, 1978, and 1993. The size of the original sample of projectile points was difficult to determine from the catalogue records, however, this analysis examines 25 projectile points and point fragments.

The Stony Beach Site (EdNh-1)

Background

The Stony Beach Site (EdNh-1) has also been called Moose Jaw Creek No. 1 (Kehoe 1973:163). The site is located at the head of a coulee, about 50 km west of Regina; the coulee extends west and unites with the Moose Jaw Creek about 3 km above its confluence with the Qu'Appelle River (Kehoe 1973:161,163). "In 1951, Boyd Wettlaufer reported that the site was discovered in 1930 and that collectors had been digging at the site continuously since then" (Malainey 1991:240). Kehoe (1973:163) indicated the site is a bison pound site presumably basing his designation on the extent of faunal material spread at the bottom of the slope.

In the late 1950s and early 1960s, John Hodges directed amateur archaeologists in a systematic excavation of the site (Kehoe 1973:163, Malainey 1991:240). Kehoe (1973:163), in discussing Hodges' excavation, indicated that there are two occupation levels separated by a sterile layer in which the upper layer is more extensive. However, Walde (1994:334) recent reinterpreted Hodges' excavations as a single component (1 metre thick), possibly with multiple occupations. "Hodges willed his extensive collection from the site to the University of Regina, Department of Anthropology" (Malainey 1991:240). In 1979, the only other "official" excavation occurred at the Stony Beach Site. The excavation was a field school conducted by George Arthur for the Department of Anthropology at the University of Regina (E. Watrall, pers comm 1994). Kehoe (1973:162) estimated an age for the site between A.D. 1750 to A.D. 1880. The reasoning behind this age estimate were not disclosed.

Discussion

None of the work at the Stony Beach Site has been published. Lithic artifacts at the Stony Beach Site include Plains Side-notched projectile points (David Meyer, pers comm 1993). While faunal material was usually not collected by the excavators, a single foetal humerus found with the collection suggests a fall to early winter occupation (Walde 1994:334). Ceramics were abundant at the Stony Beach site and have recently been evaluated by both Mary Malainey (1991) and Dale Walde (1994).

Malainey (1991:367) suggested the pottery on the Saskatchewan Plains can be divided into Wascana Ware and Mortlach Aggregate Ware; she classifies the pottery from the Stony Beach site as Wascana Ware (Malainey 1991:367). Wascana ware is primarily located within and north of the Qu'Appelle Valley. She associated it with the historically known Atsina, while she located Mortlach Aggregate Ware primarily south of the Qu'Appelle Valley and associated it with the historically known Hidatsa (Malainey 1991:366-373).

More recently, Walde (1994:107-108), examining the same assemblages as Malainey (1991), included the Stony Beach pottery in the Lake Midden Subphase of the Mortlack Phase. For Walde (1994:173), the Mortlach Phase is composed of the Lake Midden Subphase on the southern plains of Saskatchewan, northwestern North Dakota, and northeastern Montana, which he associated with southern subdivision of Saskatchewan Assiniboine groups. He associated the Lozinsky Subphase on the northern plains of Saskatchewan with the northern subdivision of the Saskatchewan Assiniboine groups. A total of 164 projectile points and projectile point fragments were examined.

EeNd-3

Background

EeNd-3 is located about 50 km north of the Regina. The site is situated in a ploughed field above the Qu'Appelle Valley. In the 1960s, material from EeNd-3 was collected by John Hodges. Subsequently, this material has been willed to the Department of Anthropology at the University of Regina. The site consists of a dense artifact scatter of lithics and ceramics. "A single component is suggested by the recovery of Plains Side-notched projectile points and Mortlach pottery" (Walde 1994:327). A published report of the site has not been produced.

Walde (1994:327-333) has analysed the material from EeNd-3. He indicated that only Plains Side-notched projectile points were recovered (Walde 1994327, 333). The pottery from EeNd-3 was classified as belonging to the Lake Midden Subphase of the Mortlach Phase. The other Subphase of the Mortlach Phase is the Lozinsky Subphase.

The Lozinsky and the Lake Midden Subphases are associated with the ethnographically known northern and southern subdivisions of the Saskatchewan Assiniboine groups, respectively (Walde 1994:173).

Discussion

The EeNd-3 projectile points used in this study are part of the John Hodges' collection. This collection is housed in the Department of Anthropology at the University of Regina. A total of 36 projectile points and projectile point fragments were examined.

The Bill Richards Site (FaNp-9)

Background

The Bill Richards Site (FaNp-9) is a locality with an intact component in an area with numerous archaeological sites collectively called "the Preston Avenue Site" (Linnamae et al. 1988:169). It is located in the City of Saskatoon "at the southwest corner of Preston and Circle Drive" (Linnamae et al. 1988:169). The site has been interpreted as a bison kill pound and processing area (Morlan 1993:25).

In 1986, the site was jointly excavated by the Saskatoon Archaeological Society, the University of Saskatchewan, and the Saskatchewan Research Council (Linnamae et al. 1988:170). "The occupation layer is a thick, black soil layer which is overlain by a 40 cm thick level of yellow sand" (Morlan 1993:25).

An uncorrected radiocarbon date of 820±10 B.P. (S-2884) was obtained from a bison metacarpal excavated from the occupation layer (Morlan 1993:67). Two other age estimates have been obtained by applying thermoluminescence dating to pottery sherds from the site. The dates are A.D. 1630±70 (Dur88TL 124-1BS) and A.D. 1680 ±70 (Dur88TL 124-2BS) (Walde 1994:297). Jim Finnigan indicated that the radiocarbon date was older than expected, an opinion supported by the thermoluminescence dates (Morlan 1993:25). The Bill Richards site has yet to be completely analyzed and published (Linnamae 1988:171)

Discussion

Since the initial recovery of the material from the Bill Richards Site, the pottery has been analyzed by Dale Walde (1994). Walde (1994:106-108) attributes the pottery from the Bill Richards site to the Lozinsky Subphase of the Mortlach Phase. Walde (1994) divides the latest precontact/early contact archaeological assemblages from the Saskatchewan Plains with two Subphases of the Mortlach Phase: the Lozinsky and the Lake Midden Subphases. These Subphase are associated with the northern and southern ethnographically known Saskatchewan Assiniboine (Walde 1994:173).

The following describes the projectile points from the Bill Richards Site. A sample of 37 projectile points and projectile point fragments were analysed.

The Sanderson Site (DhMs-12)

Background

The Sanderson Site (DhMs-12) is "...located on the south slope and valley bottom of a hogsback separating the Souris River from an abandoned coulee" (Morlan 1993:11). The site has been interpreted as large historic campsite (Morlan 1993:11). "The site was excavated by a Saskatchewan Research Council crew during the late 1980s to mitigate the effects of possible inundation by a reservoir caused by the construction of the Rafferty Dam" (Walde 1995:400). The Saskatchewan Research Council excavated about 200 m^2 (208 units of 1m x 1m) in which they detected seven stratigraphic levels (Morlan 1993:11, Terry Gibson 1994, pers comm). The site has not been fully analysed and a report has yet to be published.

An uncorrected radiocarbon date of 310±75 (S-2967) was retrieved from bone fragments from level 3/4, a well defined bone bed (Morlan 1993:11,61). Trade goods, in the form of European beads and metal points, were recovered in levels 1, 2, and 4 at the Sanderson site (Terry Gibson pers. comm. 1994). Lithic artifacts recovered from this site include Plains Side-notched projectile points, debitage, cores, bifaces, perforators, drills, awls, scrapers, and spokeshaves (Morlan 1993:11, Terry Gibson pers. comm. 1994). Non-lithic material recovered from the site include substantial faunal remains, bone tools (Terry Gibson pers. comm.), and an abundance of Mortlach pottery (Morlan 1993:11). The occurrence of trade goods has already been mentioned.

Discussion

Since the initial excavation, the pottery from the Sanderson site has been analysed by Dale Walde (1994). He classified the pottery from the Sanderson Site as belonging to the Lake Midden Subphase of the Mortlach Phase. The other Subphase of the Mortlach Phase is the Lozinsky Subphase. The Lozinsky and the Lake Midden Subphases are associated with the ethnographically known northern and southern subdivisions of the Saskatchewan Assiniboine groups, respectively (Walde 1994:173).

A total of 392 projectile points were recovered from the site by Western Heritage Services. A sample of 120 projectile points and projectile point fragments were analysed for this study. The random selection of projectile points excluded level 7 due to the small number of projectile points (n=2) from this level.

APPENDIX E:

DESCRIPTION OF ATTRIBUTES

DEFINITION OF ATTRIBUTES

Introduction

The following provides definitions for the attributes used in the analysis of the Late Side-notched projectile points from the Old Women's Buffalo jump, Head-Smashed-In Buffalo Jump, the Junction site, the Ross site, the Walter Felt site, the Lake Midden site, the Stony Beach site, EeNd-3, the Bill Richards site, and the Sanderson site. For convenience the attributes have been divided into three sections: (1) general reference points, (2) discrete attributes, and (3) continuous attributes.

General Reference Points

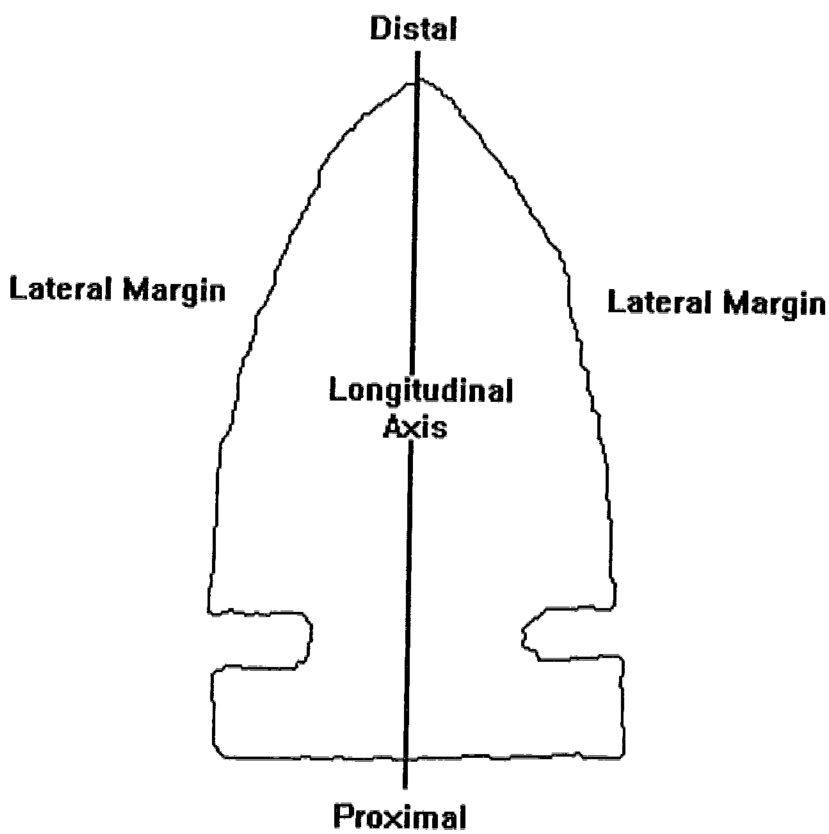
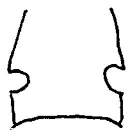


Figure E1- General reference points on a generic projectile point.

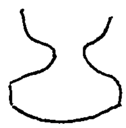
Discrete Attributes

Basal Edge Shape

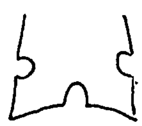
Refers to the shape of the most proximal margin of the projectile point when the point is in the study orientation. The various basal edge shapes include:



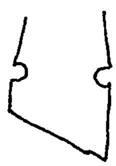
Concave- the basal edge is curved inwards toward the distal end of the projectile point and aligned symmetrically on the longitudinal axis of the projectile points.



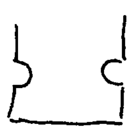
Convex -the basal edge is curved outward toward the proximal end of the projectile points.



Notched -the basal edge has a blow directed in on the base from the proximal end of the projectile point aligned symmetrically on the longitudinal axis of the projectile point.

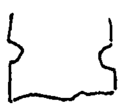


Oblique- the basal edge is straight (i.e., free from curves, bends, angles, or irregularities) but is not aligned perpendicular relative to the longitudinal axis of the projectile point.



Straight- the basal edge is straight (i.e., free from curves, bends, angles, or irregularities) and it is aligned perpendicular to the longitudinal axis of the projectile point.

Spurred- the basal edge curved inward toward the distal end of the projectile point and is not aligned perpendicular to the longitudinal axis of the projectile points.



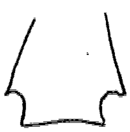
Irregular- the basal edge shape is aligned asymmetrically relative to the longitudinal axis of the projectile point owing to a lack of uniformity.

Unknown- the portion of the projectile point where the attribute is expected to occur was not present to evaluate.

Notch Type

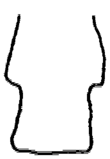
Refers to the manner in which the lateral margins, and sometimes the basal edge, of the projectile point have been modified for hafting. The various notch types recognized in this study include:

Side-notched- comparable blows have been directed in on both lateral margins (i.e., an indentation on each side at approximately the same distance from the basal edge, but never connecting with the basal edge, and never penetrate as deep or deeper than the longitudinal axis of the projectile point.



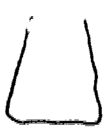
Corner-notched- blows creating two indentations of comparable size directed in from both junctures between the lateral margins and the basal edge. An indentation at both lateral margin-basal edge juncture that never cross the longitudinal axis of the projectile point.

Side and Basal notched- side-notches occur as above, as well as a single blow, comparable to the side-notches described above, creating an indentation located approximately on the longitudinal axis.

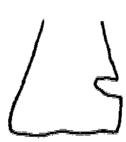


Stemmed- see Reeves (1970:ii)

Side-corner- blows creating two indentations of comparable size: one indentation is side-notched, as described above, and one indentation is corner-notched, as described above.



Unnotched- blows have not been directed in on either the lateral margins or the basal edge of a projectile point.

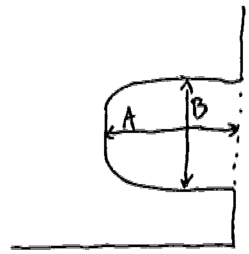


One Side Notched- a single blow is directed in a single lateral margin of a projectile point, closer to the juncture between the lateral margin and the basal edge than the juncture of the two lateral margins, creating an indentation that never crosses the longitudinal axis of the projectile point.

Unknown- the portion of the projectile point where the attribute is expected to occur was not present to evaluate.

Notch Form

Refers to the visual impression of indentations on the lateral margins, and possibly the basal edge, of the projectile point that have been modified for hafting. The various notch forms recognized in this study include:




Angular broad- in planview the outline of the notch is angular with dimension 'A' less than dimension 'B'.


Angular narrow- in planview the outline of the notch is angular with dimension 'A' greater than dimension 'B'.


Rectangular broad- in planview the outline of the notch is rectangular with dimension 'A' less than dimension 'B'.


Rectangular narrow- in planview the outline of the notch is rectangular with dimension 'A' greater than dimension 'B'.


Round shallow- in planview the outline of the notch is circular with dimension 'A' less than dimension 'B'.


Round deep- in planview the outline of the notch is circular with dimension 'A' greater than dimension 'B'.


V-shaped broad- in planview the outline form of the notch is V-shaped or triangular with dimension 'A' less than dimension 'B'.


V-shaped narrow- in planview the outline form of the notch is V-shaped or triangular with dimension 'A' greater than dimension 'B'.

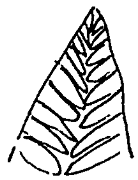

U-shaped broad- in planview the outline form of the notch is U-shaped with dimension 'A' less than dimension 'B'.


U-shaped narrow- in planview the outline form of the notch is U-shaped with dimension 'A' greater than dimension 'B'.

Unknown- the portion of the projectile point where the attribute is expected to occur was not present to evaluate.

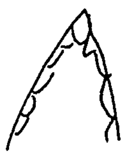
Flaking Pattern

Refers to the pattern of flake scars left on the surface of the point as a result of manufacture. The various flaking patterns recognized in this study include:

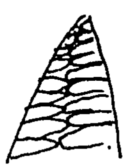


Double diagonal- flake scars converge from the lateral margins to the longitudinal axis at a point slightly towards to proximal end of the point from where the flake left the lateral margin making a V-shaped pattern (e.g., Duke 1988:267).

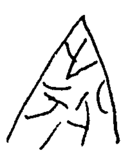
Diagonal oblique- flake scars converge from the lateral margins to the longitudinal axis with one scar originating from the distal end of the point and one scar originating from the proximal end of the point.



Edge modified- flake scars that one alter the edge of the original struck flake.



Parallel- flake scare converge from the lateral margins to the longitudinal axis originating from roughly the same height on the lateral margins (e.g., Duke 1988:267).



Irregular- flake scars do not occur in an obvious pattern

Unknown- the portion of the projectile point where the attribute is expected to occur was not present to evaluate or was not large enough to determine the nature of the attribute.

Cross-section

Refers to the impression of the cross-section looking down the longitudinal axis from either the proximal or distal end focusing on the thickness part of the point usually located just distally from the neck. The various cross-sections recognized in this study include:

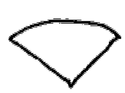
Biplano- the dorsal and ventral surfaces of the projectile point are flat and roughly parallel.

Plano-triangular- the ventral surface is flat while the dorsal surface has two flat surfaces that converge forming a ridge roughly above the longitudinal axis.

Plano-convex- the ventral surface is flat while the dorsal surface is convex with the peak of the arc roughly above the longitudinal axis.

Convex asymmetrical- both the ventral and dorsal surfaces are convex but they are not mirror images of each other.

Convex symmetrical- both the ventral and dorsal surface are convex and they exhibit mirror images of each other.



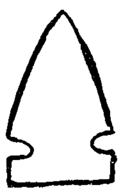
Convex triangular- one surface of the point is convex while the remaining side consists of two planes converging roughly over the longitudinal axis.

Unknown- the portion of the projectile point where the attribute is expected to occur was not present to evaluate or the specimen was not large enough to determine the nature of the attribute.

Outline Symmetry

Refers to the symmetry of the lateral margins, notch forms, and basal edge relative to the longitudinal axis of the projectile point. The various body symmetries include:

Asymmetrical- the lateral margin, notch form, and basal edge on one side of a point do not mirror the lateral margin, notch form, and basal edge on the other side of the point relative to the longitudinal axis.



Symmetrical- the lateral margin, notch form, and basal edge on one side of a point do mirror the lateral margin, notch form, and basal edge on the other side of the point relative to the longitudinal axis.

Intentional Asymmetrical- the lateral margins, notch forms, and/or basal edge shape exhibit clearly intentional asymmetry (e.g., spurs, extra notches)

Unknown- the portion of the projectile point where the attribute is expected to occur was not present to evaluate or the specimen was not large enough to determine the nature of the attribute.

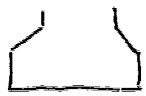
Base Form

Refers to the overall impression of the outline of the base. The various base forms recognized in this study include:

1- 

2- 

3- 

4- 

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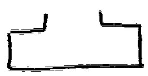
6- 

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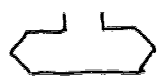
9- 

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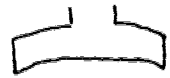
15- 

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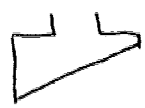
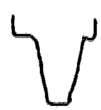
21- 

22- 

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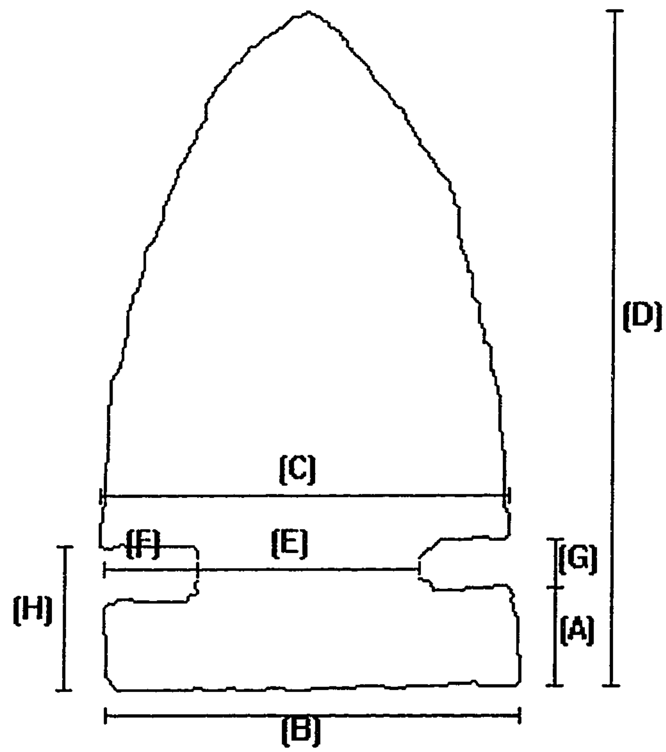
26- 

Continuous Attributes

Linear Attributes



(A) - Base Height

(B) - Base Width

(C) - Blade Width

(D) - Length

(E) - Neck Width

(F) - Notch Depth

(G) - Notch Height

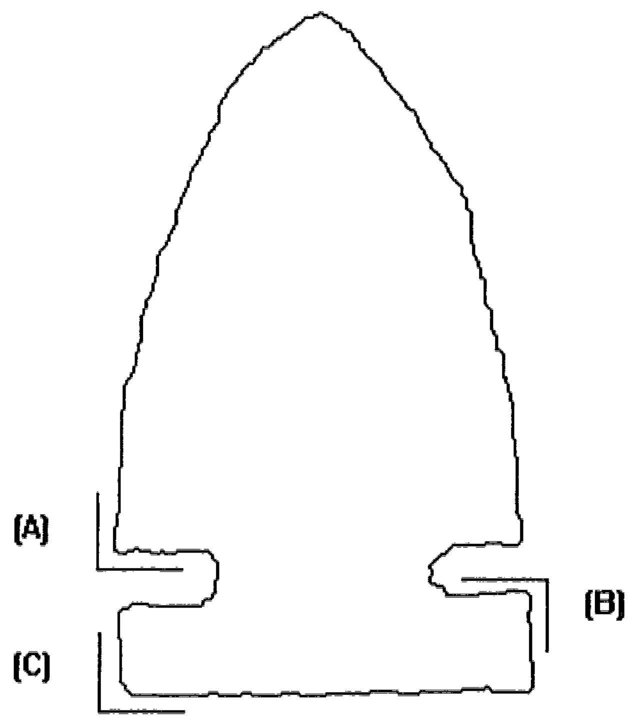
(H) - Shoulder Height

(I) - Thickness

Weight Attribute

Weight - was established using an electronic balance capable of distinguishing to 1/100 of a gram.

Angular Attributes



(A) Shoulder Angle

(B) Distal Base Angle

(C) Proximal Base Angle