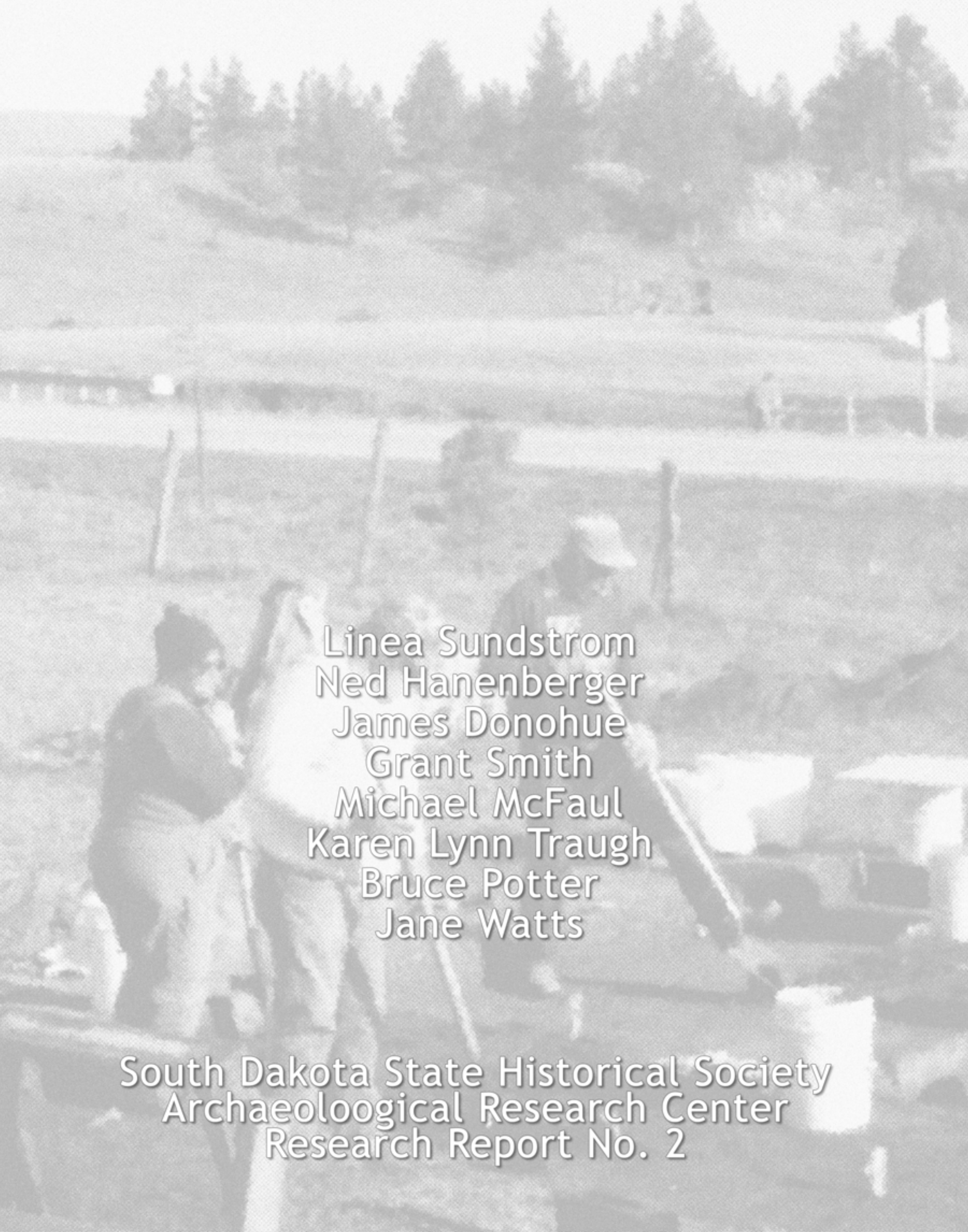
# THE BLAINE SITE

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South Dakota State Historical Society
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Research Report No. 2

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## A Multiple Component Camp in the Red Valley of the Black Hills Custer County, South Dakota

by
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# Abstract

Under contract with the South Dakota Department of Transportation, the South Dakota State Archaeological Research Center undertook mitigative excavations at the Blaine site, 39CU1144, in western Custer County, South Dakota. The site is in the Red Valley physiographic zone of the Black Hills. The site contained three components. Component A comprised four stone circle features (tipi rings) and two cairns exposed on the surface, as well as a small assemblage of lithic tools, ceramics, and lithic debitage on or near the surface. This component dates to the Late Prehistoric and late Late Archaic periods, based on diagnostic artifacts. It represents a few short-term transient camps at which hide working, tool repair, and general group maintenance activities took place. Component B dates to the Middle and Late Archaic periods, based on diagnostic artifacts and a series of radiocarbon dates. This component represents a residential camp at which biface reduction, tool repair, and group maintenance were primary activities. Component C dates to the Early Archaic period, based on two radiocarbon dates (6940 and 5870 B.P.). This component represents a periodically reoccupied residential camp at which the processing of fibrous material such as roots or wood, lithic tool production and repair, and group maintenance apparently were principal activities. Lithic materials suggest weak ties to the west (Powder River country) during the Late Prehistoric. Weak ties to the east (Missouri River) are indicated for the Late Archaic, while the Middle and Early Archaic components appear to represent wholly localized cultures. The site demonstrates that Early Archaic cultural material and Altithermal age depositional features are preserved in portions of the southwestern Black Hills. Terrace formation in the project area is hypothesized to correspond in part to a regional alluvial terrace sequence developed by Leopold and Miller (1954).

# Acknowledgments

The Archaeological Research Center staff would like to extend their appreciation to the individuals who contributed their time and resources to the Blaine site project. The Center is indebted to the landowner, Rhett Davis, who allowed personnel access to his property for the testing phase of the investigations. The South Dakota Department of Transportation (SDDOT) was an invaluable liaison between SARC and the various highway contractors. The participation of SDDOT in this capacity greatly facilitated the Center's work in the field. SDDOT further assisted the excavations by providing a road grader for the initial phase of site stripping. A special note of thanks is extended to SDDOT Custer County shop and the Regional Engineer, Don Krause, the Project Engineers, Gary Rice and Curt Grudniewski, the Grade Engineer, Larry Noem, the Maintenance Coordinator, Leonard Faiman, and the Shop Foreman, Gordan Stolp. Gratitude is also due the Guernsey Stone and Construction Company of Omaha, Nebraska, and the company's Project Superintendent, Clinton Cheeney. Their cooperation and the loan of heavy equipment for the second phase of site stripping was greatly appreciated.

James Donohue served as Principal Investigator for the Archaeological Research Center. Michael Fosha initially surveyed and recorded the Blaine site. Ned Hanenberger directed the testing phase and the mitigation excavation. He was assisted by Kurt Braun in the test phase and by Jane Watts and Eduardo Vega in the mitigaion phase. Crew members were Liz Amos, Pete Churchill, Marc Cool, Cara Dale, Barrie Davis, Edward Fosha, Wade Haakenson, Dave Holst, Joe Landon, Phillis Landon, Stan Landon, Calvin Long, Vaughn Lundberg, Laura McLuckie, John Martin, Tressa Martin, Donna Michaelis, Bruce Potter, Brenda Shierts, Candy Taft, and Mike Tuma.

The geomorphology and pedology study was subcontracted to LaRamie Soil Service of Laramie, Wyoming. Mike McFaul, Grant Smith, and Karen Lynn Traugh conducted this aspect of the study. The backhoe work was subcontracted to Andy's Service of Newcastle, Wyoming, Andy Wolf, proprietor.

Ned Hanenberger directed the laboratory work. Jane Watts identified the faunal remains. Bruce Potter and Calvin Long analyzed the artifacts and lithic debris. Bruce Potter provided the lithic material descriptions, and Ned Hanenberger provided the tool and ceramics descriptions. The feature fill and soil sample processing was done by Scott Bandalos, Dave Holst, and Rick Hanson. The artifacts were illustrated by Eduardo Vega. The plan maps and profiles were drawn by Calvin Long, assisted by Dave Holst. Photographs and video footage were cataloged by Cara Dale.

Report preparation was subcontracted to Linea Sundstrom. She would like to thank Pat Hofer, Ned Hanenberger, James Donohue, and Jane Watts of the Archaeological Research Center for providing information crucial to the completion of the report. Ann Johnson of the National Park Service, Rocky Mountain Regional Office, and Marcel Kornfeld and Charles Reher, both of the University of Wyoming, provided valuable information and advice about settlement and subsistence patterns in the Black Hills.

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# Chapter 1

# INTRODUCTION TO THE PROJECT

## 1.1 Introduction

Planned improvements to U.S. Highway 16 between Jewel Cave National Monument and the South Dakota-Wyoming border necessitated archaeological work in the area. A program of archaeological investigation was initiated to prevent damage to significant archaeological sites in the new highway right-of-way. Through a process of site survey and evaluation, it was determined that two sites in the right-of-way, 39CU1142 (Jim Pitts site) and 39CU1144 (Blaine site), merited intensive archaeological investigation prior to their destruction by the planned road construction. The sites are located in the Red Valley physiographic zone in the southwestern Black Hills. They lie in extreme western Custer County, South Dakota, near the Wyoming-South Dakota line (Figure 1.1).

This report details the investigations at the smaller of these sites, 39CU1144, referred to here as the Blaine site. Initial investigations at the site indicated the possible presence of archaeological materials dating from the Early Archaic period (ca. 7500–5000 years before present) through the Late Prehistoric period (ca. 1500–200 years before present). The potential for stratified cultural deposits and the possible presence of Early Archaic materials were of particular interest to archaeologists. Both stratified sites and Early Archaic materials are rare in the Black Hills (Sundstrom 1989; Cassells 1986). Initial evaluation indicated that data from the Blaine site could address a series of research questions based on previous archaeological research in the Black Hills. These research questions are presented in Chapter 4.

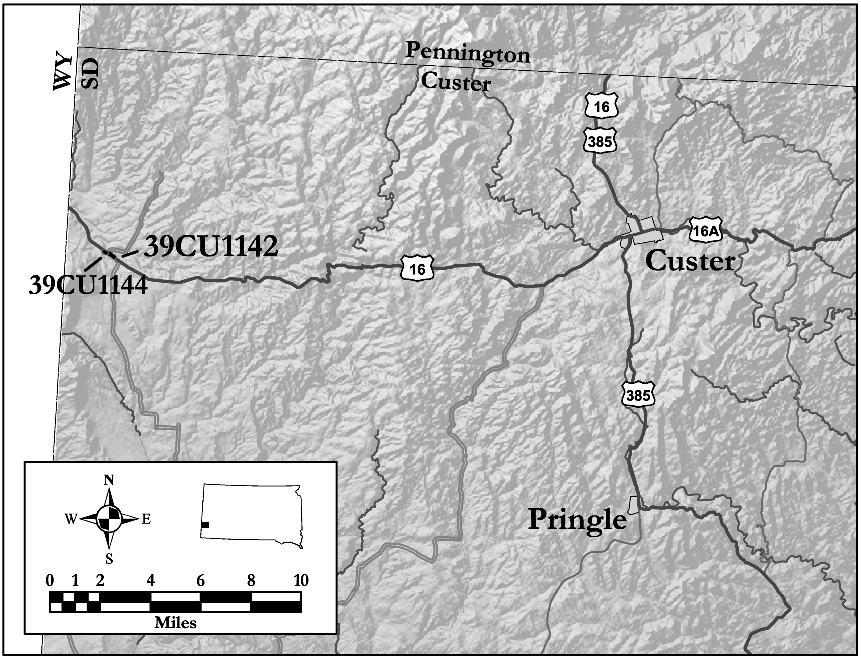



Figure 1.1. Location of 39CU1142 and 39CU1144, western Custer County, South Dakota.

## 1.2 History of Investigations at 39CU1144

The Blaine site was discovered during an initial cultural resources survey conducted by Michael Fosha under subcontract with the South Dakota State Archaeological Research Center (SARC). This survey was undertaken as part of planning for South Dakota Department of Transportation (SDDOT) Project #F0016(32)0 Custer County PCEMS K004. This project involved reconstruction of 11 miles of U.S. Highway 16 between Jewel Cave National Monument and the Wyoming state line in western Custer County, South Dakota. Activities included in the road project included road widening, regrading, resurfacing, bridge and culvert replacement, and some realignment. The initial (Phase I) archaeological investigation, completed in September 1991, led to the discovery of 30 archaeological sites and the redefinition of one previously recorded site (Williams 1993b; Fosha 1993). SARC Director of Contracts James Donohue and SDDOT Environmental Engineer James Nelson determined that 13 of these sites were potentially significant and inside the proposed construction corridor.

In summer and fall 1992, these 13 sites were evaluated for significance (Williams 1992; Hanenberger and Donohue 1992). In addition, three alternate routes were evaluated (Williams and Donohue 1992; Williams 1993b). Phase II investigation involved test excavation by crews from the Black Hills National Forest (Williams 1992) and the State Archaeological Research Center (Hanenberger and Donohue 1992). Four of the sites were found to be eligible for inclusion to the National Register of Historic Places; however, only non-contributing portions of two of the sites would be affected by the highway project. It was determined that highway construction would have no adverse effect on the latter two sites. The South Dakota Historic Preservation Officer concurred with this determination. It was recommended that mitigation of adverse effect on the other two sites, 39CU1142 and 39CU1144, could be achieved through either avoidance or archaeological excavation. SDDOT personnel chose excavation as the best means of mitigating damage to both sites. This report presents the results of this Phase III mitigative excavation of 39CU1144. Results of mitigative excavation at 39CU1142 will be presented in a separate report.

Preliminary evaluation of the Blaine site was based on the results of both surface survey and subsurface testing (Williams 1993a; Hanenberger and Donohue 1992). These revealed the presence of a large (ca. 1.5 hectare) subsurface site on a low terrace between a stream channel and present US Highway 16. Site deposits extended approximately 240 m east-to-west and 60 m north-to-south (Figure 1.2). Artifact concentrations were low in much of this area, with the main concentration of cultural material limited to a single small area of the site. Eight 1 x 1-meter test units were placed near the surface features. Fifteen shovel tests were dug at regular intervals across the site. Most of the artifacts found during the test excavation phase were from a 1 x 3-meter trench dug across Feature 1, a rock cairn. Five features were exposed on the surface of the site. These were three stone circles (tipi rings) and two rock cairns. Site deposits extended from surface to approximately 60 cm below surface.

The Phase II investigations at the Blaine site indicated the presence of three cultural components. A surface component (Component A) comprised the three partial stone circles, two cairns, and five artifacts. A few artifacts found within 10 cm of surface were assigned to this component. No diagnostic artifacts or other datable materials were found in this component. The second cultural horizon (Component B) appeared as a concentration of artifacts 10–30 cm below surface. This was the main component at the site, both in areal extent and artifact density. Flakes, a few tools, and bone fragments were found in the second component. No datable material was found in this component. The third and lowest component (Component C) appears to have been restricted to a small area of the site in the vicinity of Feature 1. Materials found 30–60 cm below surface were assigned to this third component. A hearth was uncovered at 45 cm below surface. This yielded a radiocarbon date of 5580$\pm$90 BP (Beta-55604) placing the component in the terminal Early Archaic period as it is currently defined for the Black Hills (Sundstrom 1989; Cassells 1986). Flakes and a few bone fragments were found in this component in the vicinity of Feature 1. The results of test excavations at the site are summarized in Tables 1.1 and 1.2.

Although the test excavations revealed intact and separable components at the Blaine site, the stratigraphy of the site appeared to be somewhat complex.

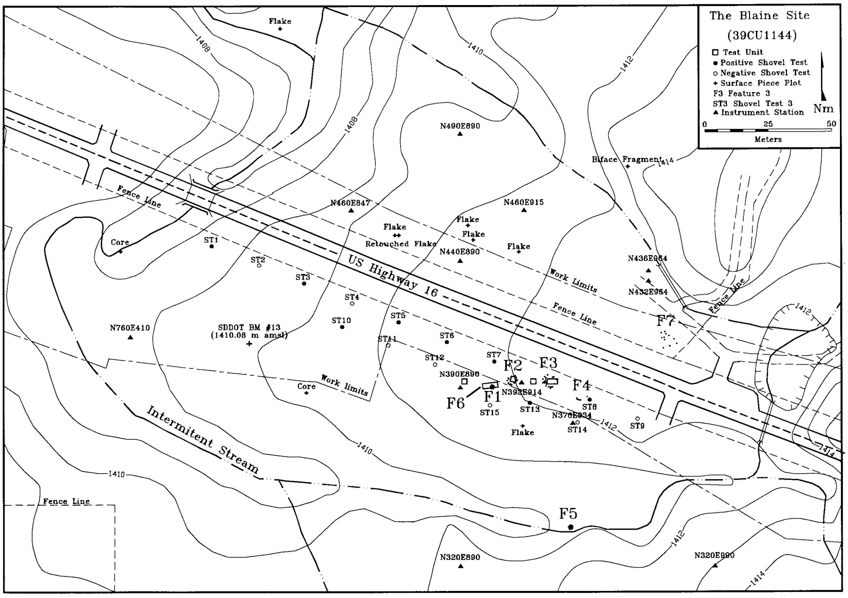



Figure 1.2. The Blaine site (39CU1144) showing surface features and test units.

Table 1.1. Results of test excavation at 39CU1144.

| Levels (depth (cm) | No. of tests | Biface frags | Flakes | Plotted | Rock & bone frags | Level totals |
|---|---|---|---|---|---|---|
| 0–10 | 5 | 0 | 8 | 4 | 18 | 30 |
| 10–20 | 5 | 1 | 31 | 12 | 8 | 52 |
| 20–30 | 3 | 0 | 17 | 0 | 0 | 17 |
| 30–40 | 2 | 0 | 0 | 0 | 0 | 0 |
| 40–50 | 2 | 0 | 2 | 0 | 0 | 2 |
| 50–60 | 2 | 0 | 0 | 0 | 0 | 0 |
| 60–70 | 1 | 0 | 0 | 0 | 0 | 0 |
| 70–80 | 1 | 0 | 0 | 0 | 0 | 0 |
| Totals | 21 | 1 | 58 | 16 | 26 | 101 |

Table 1.2. Results of test trench excavation at 39CU1144.

| Levels (cm) | Biface frags | Retouched flakes | Cores | Flakes | Plotted rock | Bone frags | Level totals |
|---|---|---|---|---|---|---|---|
| 0–10 | 2 | 1 | 0 | 14 | 1 | 3 | 21 |
| 10–20 | 0 | 0 | 0 | 29 | 8 | 8 | 45 |
| 20–30 | 1 | 1 | 0 | 79 | 11 | 1 | 93 |
| 30–40 | 1 | 0 | 1 | 66 | 13 | 0 | 82 |
| 40–50 | 0 | 0 | 0 | 23 | 85 | 0 | 109 |
| 50–60 | 0 | 1 | 0 | 21 | 2 | 2 | 26 |
| 60–70 | 0 | 0 | 0 | 9 | 0 | 1 | 10 |
| 70–80 | 0 | 0 | 0 | 3 | 0 | 0 | 3 |
| Trench totals | 4 | 3 | 1 | 244 | 120 | 15 | 389 |

The archaeological materials occurred within sediments resting directly atop gravel deposits and associated channel fill deposits. The upper component was confined to the surface and a thin, black, A2 soil horizon. The middle component was associated with buried Ab and Bkb soil horizons. The lower component was associated with a lower Bkb soil horizon. This level appeared to be discontinuous due to channel cutting and filling.

More detailed results of test excavations at the Blaine site are incorporated into the discussion of the Phase III work at the site, presented below.

Following the Phase II testing, SARC personnel developed a mitigative research proposal for the Blaine and Jim Pitts sites. This proposal was designed to conform to the South Dakota State Plan for Archaeological Resources (Winham and Hannus 1990). The State Historical Preservation Office and SDDOT approved the proposal. SARC crews conducted mitigative (Phase III) field work at the Blaine site between April and July 1993. Ned Hanenberger served as field and lab director and James Donohue as principal investigator throughout the course of the mitigation project. Laboratory analysis and draft report preparation were completed between October 1993 and November 1994. Final report revision was done in the spring of 1998.

# Chapter 2

# ENVIRONMENTAL CONTEXT

## 2.1 The Black Hills Environment

### 2.1.1 Physical Geology

The Blaine site is located in the southwestern Black Hills in western Custer County, South Dakota. The Black Hills are the easternmost extension of the Rocky Mountains. The Black Hills have been described structurally as an elongate dome or doubly plunging anticline, rising 3000–4000 feet above the surrounding high plains (DeWitt et al. 1986:9; Rich 1981). The Black Hills attain their highest elevation at Harney Peak, 7242 feet above sea level. The average elevation of the Black Hills region is about 4000 feet. The elliptical Black Hills uplift extends approximately 120 miles north to south and 50 miles east to west. It covers an area of about 6000 square miles (15,500 square km) (Froiland 1978; Rich 1981). About two-thirds of the Black Hills lie in western South Dakota, with the remaining area extending into northeastern Wyoming. The Black Hills are structurally similar to other Rocky Mountain outliers (Prucha et al. 1965; Dandavati 1981:21).

The Black Hills takes its name from the Lakota *Paha Sapa*, Black Mountains. The name refers to the dark color imparted the hills by a dense cover of ponderosa pine. Several other unique physical features break the grassy high plains surrounding the Black Hills. These include the White River Badlands to the southeast, Bear Butte on the northeastern periphery, and the Bighorn and Laramie mountains to the west.

The Black Hills uplift encompasses five physiographic zones (Darton and Paige 1925). The four main geological formations form concentric rings around an upthrust central core. The physiology follows the same pattern due to differential resistance of the various exposed rock strata (Figure 2.1). The four main physiographic zones are, from the center outward, the Central Basin or

Crystalline Core, the Limestone Plateau, the Red Valley or Racetrack, and the Hogback Ridge. Superimposed over these in the northern Black Hills, a line of igneous intrusions forms a distinctive geological and physical province (Lisenbee 1981). This line of igneous intrusives extends from Devil's Tower on the west across the Bearlodge Mountains and the Terry Peak area to Bear Butte on the east.

The Central Basin comprises massive igneous and metamorphic Precambrian rock, including granites, pegmatites, schists, slates, and quartzites. The exposed rocky peaks and pinnacles of the Harney range form the most distinctive feature of the Central Basin, along with highly eroded and dissected granite ridges overlooking large valleys. The rugged terrain of this interior basin is vegetated by closed pine forest on slopes, open pine forest or parkland in level areas, and subalpine forest in the highest areas. This rocky core includes the Mount Rushmore and Needles country and is for many visitors the most memorable part of the Black Hills.

Surrounding the Central Basin is the Limestone Plateau, a high escarpment that varies in width from 2 to 15 miles. It widens to the north and west. The Limestone Plateau attains a maximum elevation of 7100 feet. It forms the principal north-south and east-west divide of the Black Hills. The topography of this zone includes high limestone cliffs and steep ridges overlooking narrow valleys. Numerous caves and sinkholes occur in the porous rock of the limestone belt. It includes various Paleozoic limestones, sandstones, and dolomitic shales. The Limestone Plateau supports dense pine and spruce forest on the slopes, with open forests and occasional grassy meadows in level areas.

The Red Valley or Racetrack forms a narrow ring around the Limestone Plateau. The relatively unresistant sandstones and clays of the Triassic and Jurassic Sundance and Spearfish formations have heavily eroded, leaving a low, flat valley characterized by brick red to purple sediments. The Red Valley varies in width from less than a mile to several miles. It supports a sparse cover of mixed grasses and forbs; however, natural concentration of salts in local soils prevents the establishment of many plant species in this zone. The Red Valley is sacred to the Cheyenne and Lakota peoples, as the setting of the mythological great race between the two-leggeds and four-leggeds, which established the people's position in the ecological system of the area.

The last of the main physiographic zones is the Hogback Ridge. This is a ring of resistant sandstones and other Lower Cretaceous sediments including the Lakota and Fall River sandstones, shales, limestones, and conglomerates. Jurassic shales of the Morrison and Sundance formations also occur in the Hogback zone. The Hogback takes the form of a series of cuestas whose steep slopes face inward toward the central uplift and gentler slopes face outward toward the plains. The cuestas are divided by watergaps through which the streams draining the Black Hills pass before joining the north and south branches of the Cheyenne River. The Cheyenne and its northern branch, the Belle Fourche, encircle all but a small western portion of the Black Hills. The Hogback watergaps provided natural passages into the interior mountains for both people and bison (Turner 1974). In the southern Black Hills, the Hogback widens to form plateau

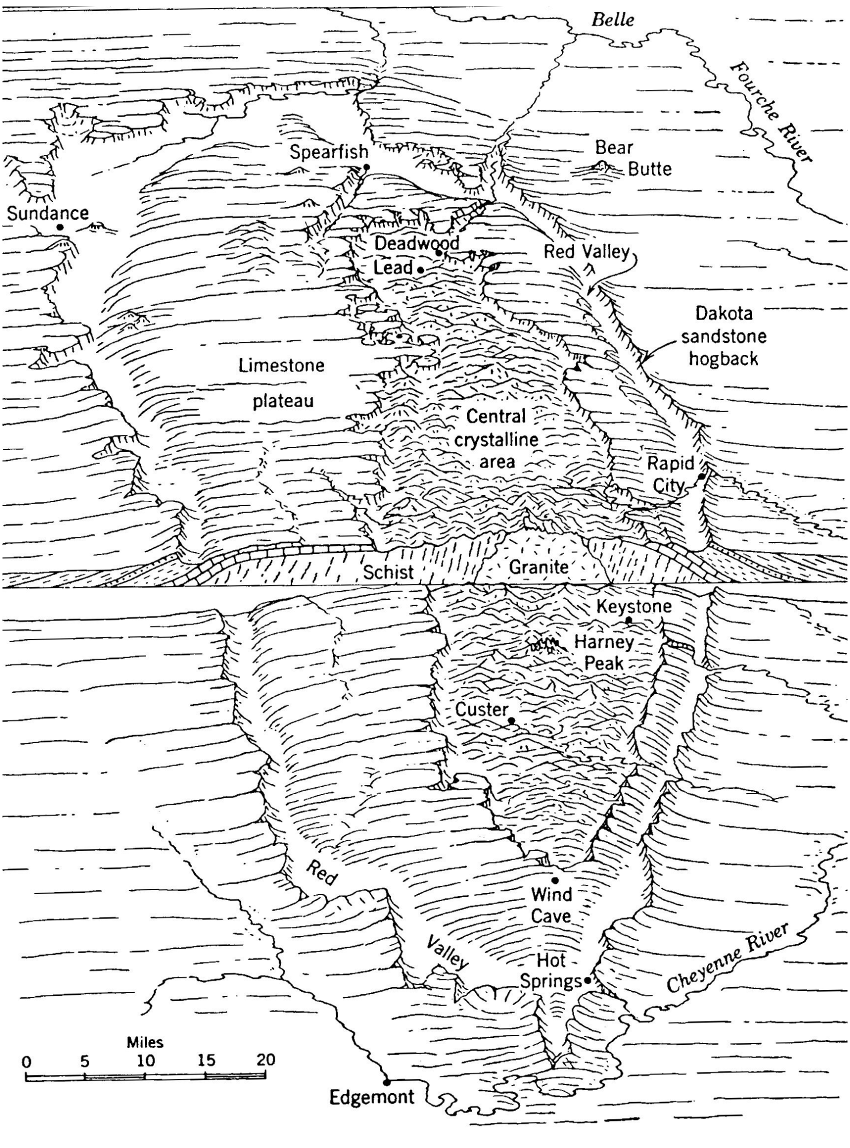



Figure 2.1. Physiographic zones and drainage of the Black Hills.

and canyon country. The Hogback Ridge is vegetated by open pine forest on the inner slopes and ridgetops and grasslands on the outer slopes.

Distinct soil types are associated with each of the main physiographic zones, as well as some smaller features such as alluvial deposits and three isolated upland prairies or "balds" occurring in the interior uplift. Black Hills soils vary widely depending on the lithology of parent material, slope angle and aspect, vegetation, and drainage. As a whole, the Black Hills form the Gray Wooded soil region of South Dakota. In general, soils within this region have developed under timber in humid to subhumid climates (Froiland 1978). Rocky, poorly developed soils characterize the more rugged areas, with rocky loams and silt loams in the more level areas and along stream channels.

### 2.1.2 Geology

The geologic history of the Black Hills is complex and well studied; thus, only a brief summary will be presented here. The following summary of Black Hills geologic history was abstracted from DeWitt et al. 1986. The Black Hills uplift comprises rock strata of various ages extending outward from the central core in concentric rings from oldest to youngest. The central granites and pegmatites are as much as 2.5 billion years old (Zartman et al. 1964; Eckleman and Kulp 1957), placing them well back into the Precambrian era and making them among the oldest rocks exposed on the continent. The outermost formations date to the mid-Tertiary period. The earliest events evident in the geologic record are deposition of silty sediments during the Precambrian era. These were metamorphosed and deformed prior to 2.5 billion years ago, when granitic rocks intruded into them. The granites were covered by sandy, silty, and conglomeritic sediments. These were intruded by mafic rocks about 2.2 billion years ago. Iron-rich sediments interbedded with sand, silt, mud, and volcanic rock were then deposited. These sediments were then metamorphosed, deformed, and intruded by a large body of granite about 1.7 billion years ago. No record exists from about 1.7 billion to 550 million years ago.

By 550 million years ago, the Precambrian rocks had been eroded and uplifted to the surface. Over the next 200 million years of the Paleozoic, sandstone and limestone were deposited across the area in a marine environment. During the Mesozoic more marine sediments were deposited. During Laramide time, 65 to 60 million years ago, deformation caused an elliptical doming of the area. This initiated erosion of Paleozoic and Mesozoic rocks in the center of the uplift, exposing the Precambrian rocks and imparting its present configuration to much of the interior Black Hills.

About 60 to 50 million years ago, igneous intrusions took place in the northern Black Hills, causing local deformation of the older rocks. These Tertiary intrusions formed many of the prominent physical features of the northern Black Hills. Renewed deposition took place from about 40 to 35 million years ago, during the Oligocene. About 30 million years ago, the Black Hills were again uplifted. Much of the more recent (Oligocene) sediment cover was removed and the area achieved its present form (DeWitt et al. 1986). The Black Hills were not glaciated during the Pleistocene (Froiland 1978) and probably served as a refuge for various plant and animal species displaced by glaciation to the west, east, and north. Gravel-capped terraces dating to the Pleistocene are found throughout the Black Hills (Plumley 1948; Martin 1991). Between three and five of these high terraces remain in various study locations at 40–310 feet above modern stream channels. Three Holocene alluvial terraces are found along the Cheyenne and Belle Fourche and some smaller streams underlain by Spearfish Formation and Inyan Kara Group rocks (Leopold and Miller 1954; Albanese 1995). Most smaller streams, however, lack Holocene terrace development (Albanese 1954).

### 2.1.3 Drainage

The Black Hills are drained by a large number of small streams extending outward from the central uplift in a radial pattern (Rahn 1970), following the general west-to-east tilt of the region. Streams draining the northern, southern, and eastern Black Hills empty into the northern (Belle Fourche) and southern branches of the Cheyenne River. The Cheyenne empties into the Missouri farther east. A few intermittent west-flowing streams drain the extreme western portion of the Limestone Plateau. Streams in the Black Hills crosscut geologic strata, forming the aforementioned watergaps at the edges of the uplift. Springs occur at some geologic contacts, most notably that between the Spearfish and Minnekahta formations at the boundary of the Red Valley and Limestone Plateau. Springs also dot the interior Limestone Plateau. Excepting a few small sinks in the northern Limestone Plateau and a small lake near Bear Butte, no natural lakes are found in the Black Hills. Stream flow varies seasonally. All but the largest streams are intermittent.

### 2.1.4 Climate

The Black Hills area has a mountain-type semi-arid continental climate (Froiland 1978). The climate is somewhat cooler and moister than elsewhere in the northern Great Plains. Summers are generally warm and dry, winters cold and dry. The weather is highly variable, with an overall annual temperature range averaging 141°F. The highest temperature on record is 112°F and the lowest recorded is -52°F (Froiland 1978). Mean annual temperature is 45.6°F. Temperatures are generally lower in the northern and central zone and higher in the southern Hogback. The growing season is about 142 days in the southern Hogback and is much shorter in the higher elevations. Annual precipitation ranges from 17 to 29 inches, generally being highest in the northern sector and at the higher elevations. Most precipitation falls between April and September, with winter snow contributing less than the frequent spring and summer thunderstorms and showers. Droughts are common and may be severe, especially in the southern sector. Blizzards occur on the order of one to several each winter. Severe blizzards occur only every three or four years (Froiland 1978).

Overall, the climate of the Black Hills is milder than that of the surrounding plains. In summer, temperatures are cooler and rainfall more frequent. During the winter months the ground is free of snow much of the time. It is not unusual to have warm, sunny days occurring mid-season. Blizzards are not as common and temperatures less severe. The Black Hills thus provide relief both winter and summer from the more extreme climatic conditions of the grasslands.

### 2.1.5 Biology

The diverse climate and topography of the Black Hills, as well as its isolation from similar environments, have resulted in a unique biological make-up (Froiland 1978; Turner 1974; McIntosh 1931). Several biomes overlap in the Black Hills, including Cordilleran, Great Plains, Northern Coniferous, and Eastern Deciduous types. Many species from these biomes reach their southern, eastern, or western limits in the Black Hills. Hybridization of some varieties contributes to the great biological diversity of the area.

Four main floral complexes are present in the Black Hills. The Rocky Mountain Coniferous Forest complex, dominated by ponderosa pine (*Pinus ponderosa*), characterizes slopes and ridge tops throughout the interior uplift and Hogback, with the Northern Coniferous Forest and Deciduous Forest complexes being largely restricted to patches in the northern and eastern portions of the uplift. The Red Valley, upland meadows, and stream valleys support a Northern Great Plains Grassland complex (McIntosh 1931). The ponderosa forest frequently has some grassy understory present. In places, pine forest is associated with a lowland shrub component of current (*Ribes* spp.), mountain mahogany (*Cercocarpus montanus*), and sumac (*Rhus* spp.). In the drier areas of the southern sector, western red cedar (*Juniperus scopulorum*) is the principal tree species, with a grassy understory and an associated shrub component of buffaloberry (*Sheperdia canadensis*), sumac, sagebrushes (*Artemisia* spp.), and rubber rabbitbrush (*Chrysanthumnus nauseosus*). Principal grass species in the southern sector are little bluestem (*Andropogon scoparius*), blue grama (*Boutelona gracilis*), buffalo grass (*Buchloe dactyloides*), and Japanese brome (*Bromus japonicus*); dominant forbs are prickly pear (*Opuntia* spp.), yucca (*Yucca glauca*), and many others. Other principal grass species in and around the Black Hills are needle-and-thread (*Stipa comata*) and green needlegrass (*S. viridula*) (Johnson and Nichols 1970).

The present fauna of the Black Hills includes large herbivores such as wapiti (*Cervus canadensis*), white tail deer (*Odocoileus virginianus dacotensis*), mule deer (*O. hemionus hemionus*), bison (*B. bison bison*), pronghorn (*Antilocapra americana americana*), mountain sheep (*Ovis canadensis auduboni*), and mountain goat (*Oreamnos americanus missoulae*). The latter is an introduced species; bison, wapiti, pronghorn, and mountain sheep are reintroduced species. Carnivores present in the area today are coyote (*Canis latrans latrans*), mountain lion (*Felis concolor hippoestes*), bobcat (*Lynx rufus pallescens*), lynx (*L. canadensis canadensis*), and red fox (*V. vulpes regalis*). Grizzly bear (*Ursus arctos horribilis*) and gray wolf (*Canis lupus irremotus*) are now locally extinct; black bear

(*U. americanus americanus*) is either extinct or extremely rare. Smaller mammals present in the Black Hills include beaver (*Castor canadensis missouriensis*), yellow-bellied marmot (*Marmota flaviventris dacota*), raccoon (*Procyon lotor hirtus*), and porcupine (*Erethizon dorsatum bruneri*), along with various rabbits, chipmunks, squirrels, prairie dogs, muskrats, gophers, voles, rats, mice, and myotises (Turner 1974).

Other fauna include about a dozen species of snakes, 17 species of toads, and a few species of frogs, turtles, lizards, and salamanders. Raptorial birds include various species of owls, hawks, falcons, and eagles; other large birds are the turkey vulture (*Cathartes aura*), ruffled grouse (*Bonasa umbellus*), sharp-tailed grouse (*Pedioecetes phasianelles*), and turkey (*Meleagris gallopavo*). Numerous smaller bird species, including songbirds and waterfowl, are also present (Froiland 1978).

### 2.1.6 Distribution of natural resources

Many of the natural resources of the Black Hills are also available in the surrounding grasslands; however, the distribution in time and space of these resources is different in the Black Hills than in the plains. Other resources, especially wood and lithic raw material, are much more abundant in the Black Hills than in the surrounding grasslands. To understand prehistoric settlement patterns in the Black Hills region, it is necessary to understand resource distribution. Each zone of the Black Hills contains a specific and unique suite of resources (see Table 4.1 on page 40).

The Hogback and adjacent foothills form an ecotone between the high plains and the interior Black Hills. The southern Hogback receives relatively little rainfall, compared to the interior uplift, but the Cheyenne and its major tributaries provide fairly reliable water sources. This area also provides shelter, wood, and browse not available in the surrounding grasslands. Outcrops of orthoquartzite and silicified siltstone, and gravel deposits including cherty silicates, were attractive to prehistoric people. Deer, mountain sheep, and other game formerly congregated in and near the watergaps dissecting the southern Hogback where water and dense browse were readily available. Rock art suggests that these areas were used for communal game hunts during the Archaic period and perhaps earlier (Sundstrom 1990, 1993a).

As was discussed above, the Red Valley operates ecologically as an extension of the high plains surrounding the Black Hills (Turner 1974). Although the Red Valley is separated from the high plains by the Hogback and foothills, bison and pronghorn were able to enter it through Buffalo Gap and other watergaps. The Red Valley served as a sheltered wintering ground for these species (Turner 1974). The high salt content of the Red Valley soils is attractive to bison. Extensive bison salt licks are visible today, particularly in cutbanks where buried "B" soil horizons are exposed. The mixed grass and forb vegetation of the Red Valley provided forage for bison and pronghorn, essentially as they did on the open plains. The abundant edible root plants endemic to the Red Valley would have provided humans a potentially important secondary food resource.

The Limestone Plateau is perhaps the richest resource area in the Black Hills. Chert, fresh water, deer, wapiti, small mammals, berries, and edible forbs are abundant in this area. Grassland/forest ecotones dot the Limestones. Marshy areas contain an additional set of resources, including beaver, muskrat, and mink, and boxelder, willow, and berry bushes. This is also the present habitat of lodgepole pine. Archaeological data indicate that bison were present in the upland prairies throughout much of prehistory. Large, multiple component prehistoric camps are found at perennial springs throughout the Limestones.

The Central Core is a relatively resource poor area. It does, however, contain habitable rock shelters. Deer, elk, cottontail rabbit, jackrabbit, and marmot are found in this zone. Wood is abundant. Chokecherry, strawberry, and limber pine are found in the central zone. This is the principal habitat of bearberry, a highly sought-after "tobacco." The Bear Lodge range in northeastern Wyoming contains essentially the same resources as the main portion of the Black Hills. In addition, mountain sheep probably were abundant there. Both the Central Core and the Bear Lodge are rather poorly known archaeologically. The Black Hills contain few resources not available in the surrounding grasslands. The major plant and animal food resources, with a few exceptions, also occur in the grasslands. Some studies indicate that edible plant densities may be higher in the Powder River Basin than in the Black Hills foothills (Latady and Dueholm 1985:83; Marlow 1979; Latady 1982). There are, however, five areas in which the Black Hills offer resource advantages over the surrounding region. These resource advantages are lithic raw material, wood, ecotone environments, seasonally successive food resources, and permanent water sources.

Black Hills lithic raw material is both abundant and of high quality. Quartzites from Flint Hill, Battle Mountain, and other large Hogback quarries were widely used for stone tool production locally and regionally. These are hard, fine-grained quartzites ranging in color from maroon to purple, brown, gold, gray, pink, and white. The majority of bifacial tools from Black Hills sites are made of this material, attesting to its knappability and durability. Morrison silicified siltstone (MSS) is a finer-grained, gray to brown, macrocrystalline material that outcrops abundantly in the foothills, Hogback, and interior Black Hills. It is nearly identical in appearance and flaking quality to Tongue River silicified sediment. MSS was widely used for a variety of chipped stone tools, especially during the Middle and Late Archaic periods. A coarser-grained quartzite outcrops in the interior Black Hills; however, its use was restricted largely to expedient chopping tools. Cryptocrystalline materials, including cherts, chalcedonies, jaspers, and petrified wood, outcrop throughout the Black Hills. These include pieces of varying quality; however, easily worked cryptocrystallines are available in most areas of the Black Hills. Silicified shale or slate outcrops in the central Black Hills; this material works well for chipped stone tools, but is not particularly abundant in local archaeological assemblages. It is similar to porcellanite in appearance and flaking quality.

The Hogback and foothills contain abundant sandstones of varying hardness. This material was used extensively for grinding stones and other groundstone tools. Elliptical grooves cut into sandstone outcrops suggest tool sharpening, although these may have functioned symbolically, as well (Sundstrom 1990). Granite from the central zone was also used for groundstone tools, especially handstones.

Ethnographic records describe the acquisition of lodgepoles from the central Black Hills (cf. DeMallie 1984:155). One of three local pine species, lodgepole pine (*Pinus contorta*), is reported to have been preferred for this use, as its common name suggests. Although lodgepole pine is now limited to a few isolated stands, botanical data suggest it had a more widespread distribution prehistorically. It is not known whether wood for shelters was acquired from the Black Hills in prehistoric times.

Archaeological data suggest that wood may have been more important as fuel than as a building material. Numerous large hearth/roasting pit complexes have been discovered in ecotone areas in and around the Black Hills. Winter habitations with large or numerous interior hearths have also been recognized. This suggests that some food processing stations and cold season habitations were sited specifically in regard to firewood sources.

The presence of specialized hafting/shafting sites in the Hogback and interior Black Hills (Tratebas 1986) indicates the exploitation of local woody species for tool shafts. Ethnographic sources suggest that green ash (*Fraxinus pennsylvanica*) may have been a preferred species for shafts (Gilmore 1977). Wood was also needed for atlatls, digging sticks, throwing sticks, thrusting spear points, and other tools. Bows recovered from archaeological sites in the northern plains are made of juniper, chokecherry, or skunkbrush (Frison 1991). The Black Hills contains a wide variety of hard and softwoods, which could have been adapted to many purposes.

The Black Hills area includes grasslands/forest ecotones in four settings: the interface between the outer Hogback and the grasslands surrounding the Black Hills; the largely unforested Red Valley; high meadows; and high-altitude prairies or "balds." With the exception of the Red Valley, these ecotone zones tend to contain large, repeatedly occupied, multicomponent sites with numerous hearths and diverse tool assemblages. The meadow sites appear to be seasonal base camps or secondary camps. The sites in the outer Hogback and at the edge of the balds are large, periodically reused hearth or fire pit complexes. These appear to have functioned primarily as plant food processing stations. The sites appear to have been deliberately placed in areas where storable plant foods and firewood were both abundant.

Ecotone zones also may have attracted game. Deer and wapiti favor the high altitude meadows and balds, while the Red Valley was a major wintering ground for bison and pronghorn. Archaeological research suggests that the large balds supported small herds of bison (Buechler 1984; Saunders et al. 1994). Such areas may have provided an optimal mix of game, edible plants, shelter, and wood.

The Black Hills also offers a resource advantage in the form of seasonally successive food resources. This resource advantage is a function of the microclimatology of mountainous areas. Simply put, plants mature later at higher elevations, due to the altitudinal temperature differential. This allows a longer gathering season for particular resources. For example, chokecherries ripen a full month earlier in the lower elevations of the Black Hills than in the central zone. This means that a group can follow the ripening plants up into the higher altitudes through spring and summer, retreating again to the lower elevations as cold weather sets in in the uplands. This gives a group more time to amass storable foods such as pemmican (dried meat and berry mush preserved in rendered fat) for winter consumption.

The numerous springs and streams occurring throughout the Black Hills provided a highly reliable source of fresh water. Annual precipitation is higher than in the surrounding areas, especially in the northern and central Black Hills. Although water levels in the Cheyenne and Belle Fourche rivers vary widely with precipitation levels in the higher Black Hills, neither of the rivers nor their principal feeder streams ever dry up completely. Even under extreme drought conditions water is easily found by traveling up the eastern edge of the Black Hills. Here the radial drainage pattern forms a ladderlike configuration with the rungs leading from the interior Black Hills across the Red Valley and foothills to the Cheyenne River. It is not clear how the high altitude springs respond to drought. The presence of a nearly complete archaeological sequence at several of the springs suggests that they produce water except during extremely dry periods. The general lack of Early Archaic components at these sites suggests the possibility that the springs failed during the Altithermal. Both archaeological and paleoenvironmental studies of these sites will be needed before this possibility can be systematically evaluated.

## 2.2 The Site Environment

The Blaine site is located at the southwestern edge of the Black Hills, about 10 miles from the high plains country of eastern Wyoming. The site is in a narrow portion of the Red Valley lying between a ridge of mountains, referred to as the Elk Mountain Range, on the southwest and limestone ridges overlooking Gillette Canyon on the north (Figures 2.2 and! 2.3). An intermittent stream following the canyon is the primary drainage of the region. The Blaine site is located on a terrace of this tributary stream. The nearest permanent water is Stockade Beaver Creek, a south flowing tributary of the Cheyenne River about six miles northwest of the site. Local landowners also report a permanent spring in the vicinity. Elk Mountain is the highest feature in the site vicinity at 5662 feet. Gillette Canyon is the lowest point at about 4600 feet. The site lies between 4640 and 4660 feet above sea level.

Within the site vicinity, outcrops of Permian gypsum and siltstones of the Spearfish formation and limestones of the Minnekahta formation form most bedrock. Well above the current drainages are remnant terraces composed of stream lag deposits of Tertiary or Pleistocene age. Gillette Canyon and its tributaries contain Holocene alluvium. Local outcrops of Spearfish formation rock include knappable chert.

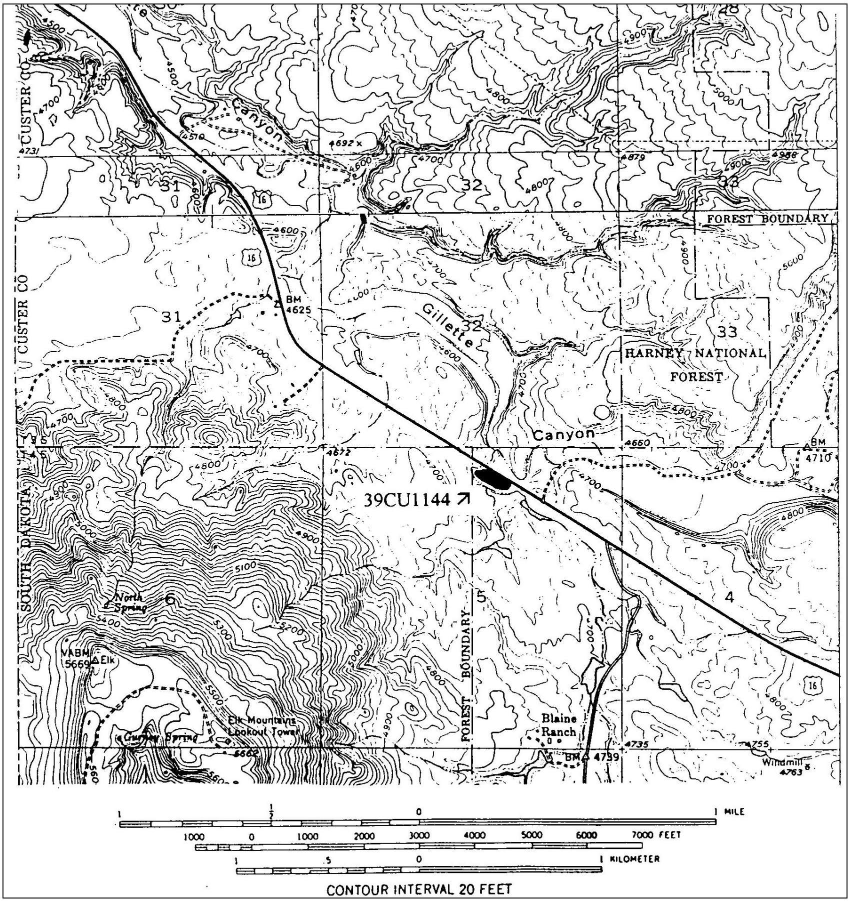



Figure 2.2. Topographic location of the Blaine Site.

Soils in the site vicinity fall into the Nevee-Gypnevee-Rekop and the Vanocker-Sawdust-Paunsaugunt associations (Ensz 1990). Typical of the Red Valley is the Nevee-Gypnevee-Rekop association. These soils are formed in material derived from siltstone, sandstone, silty shale, and gypsum. These are typically AC soils formed on recent alluvium or on steep slopes. These are reddish silty loam or loamy soils. The A horizons are yellowish red to reddish brown. The C horizons are yellowish red, light red, or red. Soils on or near limestone bedrock are typically of the Vanocker-Sawdust-Paunsaugunt association. These soils are derived from weathered limestone and calcareous sandstone. These are brown loamy soils. The A horizons are dark grayish brown to dark brown, B horizons brown to pale brown, and C horizons are pale brown. A detailed discussion of soil formation at the Blaine site is presented in Chapter 6.

The site vicinity is vegetated by mixed grasses on the upland flats and along drainages, with open ponderosa pine forest on hillslopes and ridges overlooking

Figure 2.3. View of the Blaine Site showing site environment.

the site. Dominant plant species at the Blaine site are western wheatgrass, buffalo grass, blue grama, sedges, sagewort, ball cactus, pricklypear, and segolily. Mountain mahogany occurs as an understory species within open ponderosa forest on the limestone ridge overlooking Gillette Canyon and the Blaine site vicinity.

The large number of archaeological sites in the vicinity attests to its importance to prehistoric peoples. More than 50 sites have been recorded near the Blaine site. These include a variety of tipi ring sites, small lithic scatters, and seasonal habitations. The Jim Pitts site, with Paleoindian through Late Prehistoric components, lies only 75 meters from Blaine. A major rock art complex lies a few miles west of the site in Whoopup Canyon, Wyoming (Sundstrom 1990; Tratebas 1992).

The location of the Blaine site at the juncture of the Red Valley, Limestone Plateau, and Hogback would have afforded its inhabitants access to a wide variety of natural resources. Chert outcrops in the immediate site vicinity and a variety of cherts and chalcedonies occur as secondary deposits in the gravel terraces near the site. Pricklypear, segolily, wild onion and other edible plants are abundant. Perhaps the greatest resource advantage of the site vicinity is a combination of the natural attractiveness of the Red Valley to bison and pronghorn and the local occurrence of features such as arroyos, knickpoints, and canyons that could be used for trapping game. The location also offers an easily accessible route to and from the high plains to the west. The tipi ring sites in particular may represent encampments of plains-based groups seeking shelter, game, lithic raw material, or lodgepoles in the western Black Hills. Although the role played by this locality in earlier times is not clearly understood, excavations at the Jim Pitts, Hawken, Vore, and Sanson sites indicate a long and nearly continuous tradition of bison trapping in the Red Valley. Rock art in Whoopup Canyon and other southern Black Hills localities spanning the Archaic period illustrates a deer-trapping tradition of comparable intensity and duration in the nearby Hogback canyons (Sundstrom 1990; Tratebas 1992).

# Chapter 3

# ARCHAEOLOGICAL CONTEXT OF THE PROJECT

## 3.1 The Area and Its Significance

The Black Hills make up one of the most important and least understood regions of the Great Plains culture area. Lying at the southeastern edge of the Northwestern Plains culture subarea (Wedel 1961; Frison 1991) and immediately north of the Central Plains culture subarea (Figure 3.1), the Black Hills are literally an island of forest in a sea of grasslands (Froiland 1978). Due to its unique physiographic and biologic make-up, the Black Hills area undoubtedly attracted the attention of Great Plains dwellers from their earliest ventures into the grasslands of what are now Wyoming, Montana, the Dakotas, and Nebraska, whether as a place to be enjoyed and exploited for its unique and abundant resources or avoided as an odd or hostile place.

An understanding of how prehistoric peoples perceived and used the Black Hills is crucial to some of the most basic questions of human survival in the Great Plains. Some of these questions concern the role of the Black Hills as a place of refuge when drought or extreme weather struck the open plains (Frison 1991; Wedel 1978; Buchner 1980; Bamforth 1988). Were the Black Hills perceived prehistorically as an area with few resources to offer except on a temporary or specialized basis (Lippincott 1990)? Or were they seen as a resource rich area that could support year-round occupation (Sundstrom 1989)? Were adaptive patterns in the Black Hills the same as those in the surrounding plains, or were they specifically geared toward local resources (Sundstrom 1989)? Did the Black Hills play a role in more than one adaptive pattern? What are the prehistoric precedents of adaptive patterns seen in the ethnographic record, such as warm season use of the area by Missouri River villagers, plains-based bison

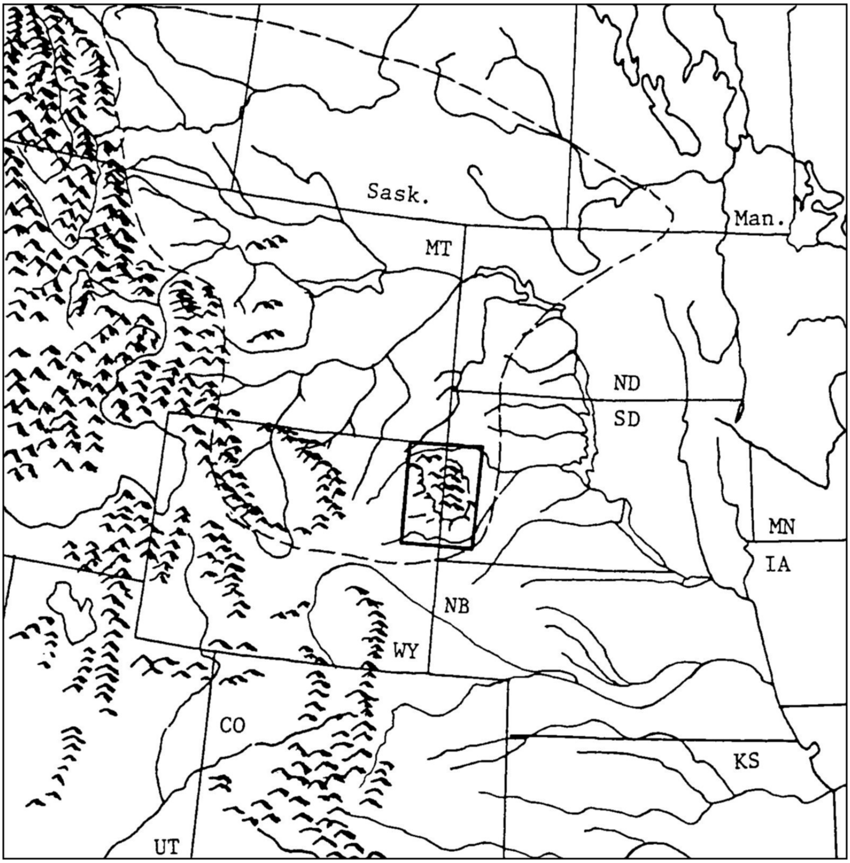



Figure 3.1. Location of the Black Hills (rectangle at center of map) within the Northwestern Plains culture area (dotted line).

hunters wintering over in the foothills, and short-term use of the area by wide ranging nomadic groups seeking game, lodgepoles, and knappable stone? An understanding of the specific role of the Black Hills and other mountain enclaves is necessary to understanding the Great Plains as a human habitat.

## 3.2 Previous Investigations

Despite its importance to understanding Great Plains prehistory, archaeological study of the Black Hills has historically been sporadic and unsystematic. The history of archaeological study of the area can be divided into four periods. The first, from about 1874 to 1942, was a period of sporadic and rather disorganized exploration and initial description of the archaeological resources of the area, mainly confined to the outlying foothills and Hogback. The second, from about 1946 to 1969, was a period of continued exploration and description under the auspices of the Smithsonian Institution, culminating in attempts to develop new classification systems for the information collected or to apply classification systems that had been developed for other regions of the Great Plains. The third period of archaeological study of the Black Hills, beginning about 1971 and continuing to the present, comprised a large number of small projects conducted to satisfy the requirements of newly enacted federal and state cultural resource management regulations. The fourth and final period began around 1978 and also continues to the present. This was a period in which more problem-oriented approaches, as opposed to description and classification, were employed in archaeology projects in the area. This final period also saw the development of several studies that attempted to draw together the large bodies of information available about Black Hills archaeology into comprehensive statements about the prehistory of the area.

The first archaeological explorations of the Black Hills were undertaken incidental to expeditions sponsored by the federal government and natural history museums to gather information about this relatively unexplored portion of the West. The Black Hills Expedition of 1874, led by George A. Custer, was purportedly undertaken to assess the natural resource potential of the Black Hills, which was Indian land at the time. In fact, the real purpose was to investigate rumors of rich gold deposits. In his report, the expedition naturalist, William Ludlow, mentions the presence of old campsites and trails in the vicinity of Red Canyon in the southern sector (Ludlow 1875). At the time, the government was mainly interested in these in reference to finding a militarily defensible trail into the interior Black Hills, and Ludlow made no attempt to establish when or by whom the remains were made.

The next published mention of archaeological sites in the Black Hills is in a report on an archaeological reconnaissance of Wyoming undertaken by Harlan I. Smith in 1907–8 for the American Museum of Natural History (H. Smith 1908). Smith discovered a few sites on the western periphery of the Black Hills and concluded that the area probably had not been settled prior to the introduction of the horse. In this conclusion, Smith was following the conventional wisdom of the day which held that the Great Plains were uninhabitable until the horse was introduced to the region—a view that was to persist well into the present century (Wedel 1961).

William H. Over, self-educated naturalist and director of the University of South Dakota (USD) Museum, conducted the first formal archaeological explorations into the interior Black Hills. Relying on the help and observations of local informants, Over identified prehistoric lithic quarries, rock art, and a possible village in the Black Hills (Over 1924, 1934, 1941, 1948). Also relying on local reports, E.B. Renaud of the University of Denver made brief mention of southern Black Hills sites in his reports on archaeological reconnaissance of the western plains (Renaud 1936). The following year, Renaud's principal Black Hills informant published a short description of archaeological remains in the southern sector (Buker 1937).

In 1938, Over and the USD Museum, with Works Project Administration funding, excavated 14 rockshelters in the southern Black Hills (Meleen and Pruitt 1941). Both ceramic-producing and nonceramic groups had occupied these shelters. Unfortunately, the field notes and most of the artifacts from this project were lost and no complete report was ever prepared. The last of the early exploratory projects in the Black Hills was the excavation of a small portion of the Agate Basin site, on the extreme southwestern periphery, by Frank Roberts of the Smithsonian Institution (Roberts 1943). The site was found to be a Paleoindian bison kill, thus erasing whatever doubts might have still lingered as to the antiquity of human occupation of the area. These early studies showed that archaeological remains were present in the area, that these included diverse site types, and that at least some of the sites were prehistoric. The studies were too limited in scope and geographic extent to allow many other conclusions. The assumption that the interior Black Hills were never occupied prehistorically persisted in spite of these early studies, and few professional archaeologists bothered to question this assumption.

The second period of archaeological research in the area would begin to change the situation. Dominated by projects conducted by the Smithsonian Institution River Basin Surveys program, the period from 1946 to 1969 was a time of continued exploration, and—more importantly—the first attempts to define and classify the various cultural complexes represented by archaeological remains in the area. Based on surveys and excavations at Angostura and Keyhole reservoirs, on the southern and northwestern perimeters of the Black Hills, respectively, Smithsonian archaeologists defined a series of complexes. These complexes could be arranged chronologically. Although radiocarbon dates were not yet available for the area, a clearer outline of area prehistory began to emerge (Bauxer 1947; Beaubien n.d.; J. Hughes 1949; J. Hughes and White n.d.; Wheeler 1950, 1957; Mulloy 1954). Hughes and Wheeler proposed a basic sequence for the area, largely extrapolated from better-known areas of the northern plains, thus providing a framework for subsequent research. While some revision has been necessary, their sequence for the Black Hills has generally stood the test of time.

Two other Smithsonian projects were influential in the development of Black Hills archaeology. The first was the excavation of the McKean site at the northwestern edge of the Black Hills (Mulloy 1954). This project resulted in the definition of the McKean complex as representative of the Middle Archaic period of area prehistory. In addition, the McKean project inspired the partial excavation of two other Middle Archaic sites on the northern and western edges of the Black Hills by the University of South Dakota and the Wyoming Archaeological Society, respectively (Gant and Hurt 1965; Steege and Paulley 1964). A second River Basin Surveys project surveyed the vicinity of Cottonwood Reservoir in the southern Black Hills; however, no significant cultural remains were found (Mallory 1967). (For a summary of this project see Weston 1983.) Limited investigations were also conducted at Deerfield Reservoir in the central Black Hills (Cooper 1947). The River Basin Surveys program was terminated in 1969.

The next period of archaeological study of the Black Hills, beginning about 1971 and continuing to the present, has been dominated by cultural resource management (CRM) projects. A large number of surveys were conducted to assess the archaeological potential of areas slated for mining exploration, logging, highway and pipeline construction, and construction of public facilities and small dams. CRM archaeology arose in response to several new federal and state antiquities-protection regulations. These projects were specifically designed to identify and evaluate sites that might be eligible for inclusion in the National Register of Historic Places and thus for special protection as important historic resources. Survey projects in the Black Hills were conducted by the US Forest Service, the South Dakota State Archaeological Research Center, the Office of the Wyoming State Archaeologist, the Tennessee Valley Authority, the National Park Service, and private consultants under contract to the forenamed agencies. Reports of these projects number in the hundreds, and no attempt will be made to list them here. (Interested readers are referred to Buechler 1984, Cassells et al. 1984, and Sundstrom 1989 for more detailed listings.)

These surveys resulted in the discovery of about 5000 previously unrecorded sites and, more importantly, gave the first realistic picture of the distribution and diversity of archaeological remains in the area. CRM archaeologists discovered a wide variety of sites. Most were lithic scatters, representing either special activity areas or larger camp sites; many historic sites were found as well. These surveys established that prehistoric sites were present throughout the Black Hills and that the entire Northwestern Plains culture sequence, from Paleoindian to Historic, was represented.

Most of the CRM survey reports were descriptive rather than analytical, but all contained detailed information on site morphology, artifact types, and environmental variables. This information would prove invaluable both to future CRM efforts and to the more analytical studies to follow. A few survey projects went beyond the basic site descriptions to include analyses of settlement patterns in regard to distance to water, proximity of natural resources, topographic position, and ecological zonation (Haug 1977, 1978a, 1978b; Chevance 1978, 1979; Tratebas 1978a, 1978b; Reher and Lahren 1977). Other studies examined tool to debitage ratios as a potential indicator of site function (Sigstad and Jolley 1975; Tratebas 1978a, 1978b; Sundstrom 1981). These were important forays into more analytical studies of area prehistory.

Test-excavation projects followed some of the CRM surveys. Most of these were done by South Dakota State Archaeological Research Center personnel (Haug 1979, 1981; Haug et al. 1980; Tratebas 1978b, 1979; Tratebas and Vagstad 1979; Hovde 1981; Sundstrom 1981). Two other CRM projects were an attempt to mitigate damage to a large central Black Hills occupation site (Buechler 1984) and a series of test excavations at a federally administered reservoir in the southern Black Hills (Weston 1983). While many of the sites were disappointing, others contained intact buried deposits. These testing projects served to reiterate the diversity and complexity of Black Hills archaeology, as well as to protect the important sites from unmitigated destruction.

The large of amount of data collected during the CRM period of archaeological research in the Black Hills spurred an interest in more analytical, problem-oriented studies. This body of data was largely undigested, but it was sufficiently complete and systematic to allow the formulation of research questions. As in all human inquiry, the more the Black Hills archaeologists knew, the less they knew. With the most intense period of CRM projects behind them, they could adopt a somewhat more studied approach to the archaeology of the area. This period of problem-oriented research, from about 1977 to the present, has included five kinds of studies: intensive excavation of potentially important sites; what can be termed"thematic" surveys, aimed at discovering particular kinds of sites; reinvestigation of previously studied sites; syntheses of previously collected data; and multidisciplinary research initiatives.

Major excavation projects have included investigations at the Hawken site, an Early Archaic bison kill on the northwestern periphery (Frison et al. 1976; Frison 1991); excavation of the Vore Site, a large Late Prehistoric bison trap at the northern edge of the Black Hills (Reher and Frison 1980); archaeological field school projects held at the multicomponent Boulder Canyon site (Tratebas 1977) and the Plains Village pattern Smiley-Evans site (L. Alex 1979; Chevance 1984), both on the northern periphery; excavations at the Agate Basin site, a multicomponent Paleoindian site on the southwestern periphery (Frison and Stanford 1982); excavations at the multicomponent Beaver Creek site in the southern Black Hills (L. Alex 1991); and mitigative excavations at 39LA117 (Sundstrom et al. 1994). Although not an excavation project, a recent intensive study of rock art in Whoopup Canyon in the southern Black Hills Hogback by Alice Tratebas of the Wyoming Bureau of Land Management can also be included in this category. Each of these sites was chosen specifically to answer questions about area prehistory, and these projects have contributed much toward piecing together past cultural patterns.

The second kind of problem-oriented study in the area, thematic surveys, includes five studies. The first was a 1980 search for Paleoindian sites along the Cheyenne River outside the southern edge of the Black Hills (Hannus 1983). The same year, a survey and inventory of rock art sites was conducted in the southern Black Hills (Sundstrom 1984). Data from the rock art survey, along with other information on area prehistory, formed the basis for a doctoral dissertation (Sundstrom 1990). A third thematic survey sought to identify lithic quarries in the Black Hills and to systematically describe the various lithic types derived from them; this was developed into a master's thesis (Church 1990b). The Black Hills area was also included in a master's thesis on lithic sources of northeastern Wyoming and southeastern Montana (Craig 1983). Another doctoral dissertation reconstructed human subsistence ecology based on studies of about a hundred sites in the vicinity of Keyhole Reservoir in the northwestern Black Hills area (Kornfeld 1989). Finally, a study of data collected during CRM surveys and test-excavations explored the nature of tipi ring sites in and near the eastern and southern Black Hills (Hovde 1981).

The third kind of problem-oriented research involves the re-excavation of previously studied sites. Two Black Hills sites important in the establishment of the basic cultural chronology of the area were re-excavated. The first is the late Paleoindian Angostura site on the southern periphery (Hannus 1986). The other is the McKean site in the northwestern Black Hills, the type site for the Northwestern Plains Middle Archaic period (Kornfeld and Todd 1985; Kornfeld and Larson 1986; Kornfeld et al. 1990). Both re-excavation of the site itself and survey of the surrounding area were undertaken as part of the latter project.

Other recently initiated problem-oriented research in the area has involved the reanalysis and synthesis of previously collected data. Recent works based on data from CRM projects on Black Hills National Forest lands include an overview of area prehistory, targeted for use by CRM personnel (Cassells et al. 1984) and a doctoral dissertation using surface collections to reconstruct prehistoric settlement patterns (Tratebas 1986). Other overviews of Black Hills prehistory have been written for the general public and for professionals (Cassells 1986; Sundstrom 1989).

The final category of problem-oriented research in the Black Hills can be described as multidisciplinary research initiatives. These include a survey, testing, and National Register nomination project at Inyan Kara mountain in the northwestern Black Hills. This project combined archaeological and ethnographic research in evaluating the past and current cultural significance of the mountain (Buechler and Malone 1987). In 1993, the Black Hills National Forest and the Illinois State Museum initiated a multi-year paleoenvironmental research program, including archaeological, palynological, sedimentological, and other lines of research (e.g. Saunders et al. 1994).

While Black Hills archaeology got off to a slow start, the era of CRM exploration of the area and the more recent problem-oriented studies have resulted in the accumulation of a substantial body of data as well as a number of published interpretations of area prehistory. Because these raise as many questions as they answer, interest in Black Hills archaeology continues to grow.

## 3.3 Prehistory of the Black Hills

Summaries of Black Hills and Northwestern Plains prehistory are widely available (see Frison 1991; Sundstrom 1989; Tratebas 1986; Cassells et al. 1984; Cassells 1986, and numerous CRM reports on file at the South Dakota State Archaeological Research Center, the Wyoming State Archaeologist's Office, and the Black Hills National Forest). This discussion, therefore, will give only a brief sketch of the culture history of the area, focusing on those periods, places, and issues of particular relevance to the present study.

Archaeological remains in the Black Hills have usually been referred to general cultural sequences developed for the Northwestern Plains, especially that initiated by William Mulloy (1958) and revised and expanded by George Frison (1991). The Black Hills data do not conform perfectly to this sequence (Sundstrom 1989); nevertheless, the Northwestern Plains sequence provides the best current framework in which to place the Black Hills materials. The Northwestern Plains cultural sequence comprises four main divisions (Table 3.1): Pa-

Table 3.1. Cultural sequence of the Northwestern Plains and Black Hills.

| Period | Years BP | Dates B.C./A.D. |
|---|---|---|
| Historic | 50–140 | A.D. 1850–1940 |
| Protohistoric | 140–240 | A.D. 1750–1850 |
| Late Prehistoric & Plains Village | 240–1500 | A.D. 500–1750 |
| Late Archaic | 1500–2500 | 500 B.C.– A.D.500 |
| Middle Archaic | 2500–5000 | 500–3000 B.C. |
| Early Archaic | 5000–7500 | 3000–5500 B.C. |
| Plano | 7500–10,000 | 5500–8000 B.C. |
| Folsom | 10,000–10,900 | 8000–9000 B.C. |
| Clovis | 10,600–12,000 | 9000–10,000 B.C. |

leoindian, Archaic, Late Prehistoric, and Historic (postcontact). While this terminology is followed here, it should be emphasized at the outset that these divisions are artificial and may tend to obscure real differences and similarities in the cultural sequence. For example, cultural differences within the Archaic period are more pronounced than those between the late Paleoindian period and the initial Archaic (Tratebas 1986; Sundstrom 1989). The terms thus are used more as convenient reference points than as indicators of watersheds of culture history. Radiocarbon dates from the Black Hills are listed in Table A.1 in the appendix.

### 3.3.1 Paleoindian

No evidence of pre-Clovis occupation (cf. Haynes 1969, Stanford 1982, Reeves 1985) has been reported from the Black Hills vicinity.

The Agate Basin site in the southwestern foothills contained a small Clovis component, probably a remnant of a much larger site (Frison and Stanford 1982). This along with other Clovis sites to the south, east, and west of the Black Hills indicates that the general vicinity was occupied by Clovis mammoth hunters between 12,000 and 10,500 years before present; however, Clovis diagnostics have not been found in the Black Hills proper.

A cultural complex intermediate between, or partially contemporaneous with, Clovis and Folsom, is recognized for some areas of the Northwestern Plains. The Goshen complex is characterized by unfluted lanceolate projectile points variously associated with mammoth and bison. Known primarily from the Mill Iron site in southeast Montana and a sparse assemblage from the Hell Gap site in eastern Wyoming (Frison 1991, 1993), this complex is poorly understood at present. Preliminary results from the Jim Pitts site, virtually adjacent to the Blaine site, indicate an extensive Goshen bison-processing locality. This firmly establishes the presence of Goshen in the Black Hills and will no doubt contribute to a more complete definition of the complex.

Following the transition to modern climatic conditions and the extinction of the mammoth, the Folsom complex replaced Clovis and Goshen on the Northwestern Plains and elsewhere in North America. Folsom period occupation of the Black Hills is evidenced by extensive deposits at the Agate Basin site (Frison and Stanford 1982), by an overlook used in bison hunting in the western foothills (Hofman and Ingbar 1988), and by a redeposited Folsom tool assemblage from the northwestern periphery (Kornfeld 1988). Folsom sites elsewhere date to between 10,850 and 10,375 BP (Frison 1991). Little is known of Folsom life outside of bison-hunting activities. Since Folsom tool assemblages are more diverse than those of the Clovis complex, Folsom peoples may have been exploiting a wider variety of resources and may have been more ethnically diverse and socially complex than their Clovis predecessors (Beckes and Keyser 1983).

Folsom may mark the beginning of what might by called a true Northwestern Plains cultural pattern—one that would persist in various forms until the late protohistoric period when horses were widely adopted by native populations. This is essentially a pattern of small, highly mobile, independent groups, probably based on family ties, pursuing a seasonal round of subsistence activities that included joining together once or twice a year for communal hunts and otherwise dispersing into smaller camps. No evidence exists for such seasonal aggregation in Clovis times; thus, Clovis social organization probably was essentially different from that of the post-Clovis period.

The trend toward more diverse use of both game and nongame resources is even more marked in the Plano period, the last Paleoindian cultural tradition. The Plano rubric encompasses several distinct complexes, defined primarily on the basis of projectile point types. From early to late Plano, these include Agate Basin, Hell Gap, Alberta, Cody/Scottsbluff-Eden, Frederick, Lusk, Angostura, and James Allen. Radiocarbon dates from Plano sites range from about 10,000 to 7500 BP; the various complexes seem to overlap both temporally and spatially.

Three Plano sites have been excavated in the general vicinity of the Black Hills: the Hudson-Meng bison kill, about 50 miles south of the southern Hogback (Agenbroad 1978); the Long (or Angostura) site, just outside the southern Hogback (Wheeler 1957; Hannus 1986); and upper components of the Agate Basin site, in the southwestern foothills (Frison and Stanford 1982).

In the Black Hills proper, what appear to be Late Paleoindian projectile points have been found throughout the uplift during survey and testing projects; however, most of these finds have not been independently dated. These are most common at large, multicomponent sites in high-altitude meadows, with fewer finds occurring in the southern Hogback. These sites may represent the warm season habitations of small groups of hunters from the plains surrounding the Black Hills (Tratebas 1986). It is not known whether mountain-oriented groups occupied the Black Hills on a year-round basis. Such groups could have been based in rockshelters, which are not well-represented in the sample of identified Plano sites in the Black Hills and thus would not show up in the archaeological record as it currently stands (Tratebas 1986).

Both lanceolate and round-based stemmed projectile points have been assigned to the Plano period in the Black Hills (Tratebas 1986). The chronological placement of these various projectile point types has relied entirely on comparisons with point sequences from other areas of the Northwestern Plains and thus demands further study before such artifacts can be considered reliable time diagnostics.

Elsewhere on the Northwestern Plains, Plano complexes indicate a continued emphasis on bison hunting. Ample evidence exists to confirm the use of natural features as bison traps and jump-offs. At the same time, the trend toward more a more diverse subsistence base continued, especially in mountainous areas. Other types of communal hunts were focused on the taking of mountain sheep or pronghorn (Frison et al. 1986), and remains of deer, wapiti, pronghorn, and smaller animals occur along with bison in Plano assemblages. No doubt, nongame resources were used as well, as the highly mobile Plano groups passed through their seasonal cycles of hunting and gathering; however, plants and other nongame resources are generally not preserved in archaeological deposits in the area. Features at some Plano sites indicate the use of portable structures, perhaps similar to the hide tipi.

Cultural diversity probably continued to increase during this period, as did group size and overall population density (Beckes and Keyser 1983). Beginning with the late Plano, a division between a mountain-oriented subsistence pattern and a plains-oriented pattern is discernible. The Plains pattern stressed large-scale communal bison hunting, while the montane pattern was based on exploitation of diverse plant and animal resources, with seasonal movements regulated by snow cover and other altitude-dependent variables. Both patterns are hypothesized to have been present in the Black Hills, with the mountain-oriented groups seasonally alternating between the Hogback and interior zones and the plains-oriented groups occupying the foothills and Hogback zones during seasons or episodes of extreme conditions on the open plains (Sundstrom 1989). An alternative hypothesis holds that during this period the Black Hills interior was used only for occasional hunting forays by small groups otherwise based in the surrounding plains, although use of the area may have increased late in the period (Tratebas 1986). These hypotheses cannot be developed further until more Plano sites are excavated in the Black Hills and the geomorphic history of the area is better known.

### 3.3.2 Early Plains Archaic

At the end of the Plano period, around 7500 BP, human groups occupying the Northwestern Plains were becoming more populous and were increasing their ability to exploit a diverse range of resources. At the same time, the climate was changing from relatively moist, cool conditions to drier and warmer conditions. This climate change probably made the open plains environment less hospitable to both bison and humans, and conversely made high-altitude environments more habitable due to reduced snowpack and amelioration of winter temperatures (Benedict and Olson 1978; Benedict 1981).

Relatively few Early Archaic sites are found in the Northwestern Plains; however, whether this is due to partial abandonment of the area, depopulation, or geomorphic processes resulting in the destruction or deep burial of sites is a matter of conjecture at this time. Early Archaic sites are relatively rare in the Black Hills, as well (Sundstrom 1989; Cassells et al. 1984; Tratebas 1986). The Hawken site in the northwestern Black Hills, dated at about 6200 BP, indicates that at least the periphery was used for communal bison hunting (of the extinct variety *Bòccidentalis*) during this period (Frison 1991; Frison et al. 1976). Early Archaic levels at the Beaver Creek site, in the southern Limestone Plateau, contained projectile points similar to those from the Hawken site; however, a diverse subsistence base, probably focused on individual small game hunting and plant food gathering, is indicated. A possible Hawken point was also found during test excavations at the multicomponent Victoria Creek site (39PN1124) in the interior uplift. Like the Beaver Creek site, Victoria Creek indicates a diverse subsistence base, including large and small animals and plants such as hackberry and wild plum (Vallejo 1993). The few Early Archaic surface collections from the interior uplift usually co-occur with Plano assemblages and, like the Plano assemblages, include a variety of hunting and butchering tools, wood and lithic tool manufacturing implements, and grinding stones (Tratebas 1986). These interior sites suggest limited occupation by hunting parties, probably based in the surrounding plains, as do the few sites Plano and Early Archaic sites present in the Hogback.

Projectile points similar to Early Archaic types from elsewhere on the Northwestern Plains have been found at several sites in the central Black Hills. These include large side-notched and basally notched types similar to those from Mummy Cave; side-notched Hawken types; and large, thin, broad-bladed corner-notched points. Types similar to Bitterroot and Simonsen points have also been found (Tratebas 1986). These points were used to tip atlatl darts. The atlatl and dart remained the main weapon system throughout the Archaic. As with the late Plano points, many of the Black Hills types have not yet been defined and independently dated.

Little is known of the Black Hills Early Archaic at present. It has been hypothesized that a diversified, mountain-oriented subsistence pattern held sway in the Black Hills proper, with a residual pattern of large game hunting-based subsistence in the foothills (Sundstrom 1989). Surface collections from throughout the Black Hills suggest a continuation of the Plano pattern of plains-based communal bison hunters making occasional seasonal use of the interior uplift (Tratebas 1986), while subsurface remains from the Beaver Creek site suggest a diversified hunting and foraging pattern (L. Alex 1991). The two basic subsistence patterns seen in the terminal Plano thus may both be represented in the Black Hills area, either as separate adaptations or as different parts of a seasonal round. Some researchers have suggested that the Black Hills served as a "refuge" for human populations during the more severe climatic conditions of the Altithermal (Frison 1991; Wedel 1978; Bamforth 1988; Buchner 1980); however, this hypothesis is not well-supported by current Black Hills data (Sundstrom 1992). There are fewer sites dating to the Early Archaic in the Black Hills than any other period. This is the opposite of the pattern predicted by the refuge hypothesis. Geomorphology studies increasingly suggest that many archaeological deposits dating to this period were removed by erosion. Thus, the apparent lack of sites may be a result of natural processes instead of reduced population levels.

### 3.3.3 Middle Plains Archaic

The beginning of the Middle Plains Archaic is marked by a dramatic increase in the number of archaeological sites in the Northwestern Plains (Frison 1991; Vickers 1986). This is true for the Black Hills, as well; most prehistoric sites thus far dated have been assigned to the Middle Archaic period (5000–2500 BP).

Three interrelated factors can be hypothesized to have produced the distinctive cultural expression of the Middle Archaic. First, during this period, the Northwestern Plains climate returned to somewhat moister and cooler conditions. This led to improved forage for bison in grassland areas. Second, the human groups occupying the Northwestern Plains had learned during the leaner times of the Early Archaic to use a large variety of resources. This trend toward diverse economic activities continued throughout the Middle Archaic in mountain and basin areas. Third, human population density appears to have increased rapidly during the Middle Archaic. Very probably, this population increase was facilitated by a combination of the first two factors—that is, more food resources were available due to both technological advances and increases in forage supporting larger populations of bison. Some evidence also exists that a depositional environment more conducive to site preservation developed at this time. If so, the hypothesized population increase may be more apparent than real.

Bison hunting activities seem to have intensified—especially in the open plains areas during this period—as compared to the preceding Early Archaic. Some of this trend may be more apparent than real, since geomorphic processes may have destroyed or obscured some Early Archaic sites in open areas; however, bison populations no doubt increased significantly at this time. In mountainous areas the tradition of wide-spectrum foraging and hunting—with its roots in the Plano period—continued, with even more resources apparently being added to the pool.

In the Black Hills, aspects of both patterns are expressed in the archaeological record. Middle Archaic sites in the Black Hills include large, repeatedly occupied camps with numerous specialized hearths and other features; smaller winter camps; and sites used for special activities such as tool-preparation, processing of plant foods, butchering/meat processing and post-hunt tool repair, and hide working (Sundstrom 1989; Tratebas 1986). Some of the Black Hills sites contain moderate amounts of bison bone; sites north and west of the Black Hills suggest communal hunting of bison and deer. In addition, probable Middle Archaic rock art found throughout the southern Black Hills illustrates the use of artificial impoundments for the communal hunting of deer, pronghorn, and, rarely, bison (Sundstrom 1990). Sites in the general vicinity indicate communal hunting, individual hunting of bison and smaller game, and plant-food foraging. Use of tipis or similar habitations is indicated at a few sites in the area by circles of stones possibly used as tent weights.

It appears that ethnically distinct groups were occupying the Black Hills seasonally as part of a yearly round of subsistence activities (Keyser and Davis 1984). Perhaps multiple groups were present in the area, each following a different seasonal round (Sundstrom 1989). At least two such seasonal rounds have been hypothesized: a pattern of warm season use of higher elevations, with winter use of the Hogback zone; and a pattern of seasonal forays into the Black Hills by groups based in the surrounding grasslands (Tratebas 1986; Sundstrom 1989).

The presence of strikingly diverse lithic assemblages in Middle Archaic sites lends support to the hypothesized increased cultural diversity in the area. In fact, distinct patterns of lithic technology, burial practices, habitation types, and seasonal subsistence in Northwestern Plains Middle Archaic materials may indicate that increased cultural diversity had by this time led to the formation of ethnically distinct macrobands occupying overlapping territories (Keyser and Davis 1984; Sundstrom 1989). This pattern may have characterized the region throughout the remainder of its prehistory.

### 3.3.4 Late Archaic and Plains Woodland

From about 2500 to 1500 years BP, the Northwestern Plains witnessed the development of several distinct cultural complexes. The first, initially defined in the northern portions of the subarea, is termed the Pelican Lake complex. This was followed in some areas by the Besant complex. Both had a bison-hunting subsistence base in the northern Northwestern Plains and mixed bison-hunting and foraging subsistence base in the southern sector. Complex communal bison hunts were an important Besant adaptation throughout the Northwestern Plains.

Several localized Plains Woodland complexes were contemporaneous with the Pelican Lake and Besant complexes. Although the Late Woodland is primarily identified with the eastern plains and woodlands, similar developments, such as the production of pottery, were widely scattered throughout the western plains, as well. In the Northwestern Plains, all of these Late Archaic/Plains Woodland period complexes are similar in terms of lithic technology, subsistence, settlement pattern, and site morphology. The burial mounds and incipient horticulture that characterize Woodland sites to the east are not present. In general, sites containing pottery are given Plains Woodland designations, while those without pottery are considered Late Archaic. The interrelationships of the two have not yet been defined.

Projectile points similar to Besant and Pelican Lake types have been found throughout the Black Hills; however, only a few small Late Archaic components have been excavated. A Late Archaic bison kill was excavated in the western Black Hills, but the results of the project remain unreported (Frison 1991). Several rockshelter sites in the interior Black Hills and Hogback contain small Besant assemblages including stone tools and ceramics. These appear to represent short-term hunting camps.

Very little is currently known of either Plains Woodland or Late Archaic developments in the area. A few very general observations can be made. First, the intense use of various Black Hills niches that typified the Middle Archaic seems to have been abandoned at this time in favor of a much more restricted use of the area. While almost as many Late Archaic as Middle Archaic sites exist, the Late Archaic sites are smaller and less diverse. Secondly, population density seems to have decreased slightly in the Black Hills, perhaps because the residence base had shifted away from mountainous areas and onto the open plains and western periphery. In the latter areas, large, complex communal bison hunts appear to have been the lynchpin of the subsistence round. Third, at least weak Woodland influences were being felt around the northern, southern, and eastern peripheries of the Black Hills, although neither villages nor incipient horticulture appeared.

It is hypothesized that the interior Black Hills were used for seasonal base camps, smaller hunting camps, and small, sheltered winter camps, while use of the southern Black Hills Hogback was restricted to hunting and butchering stations (Tratebas 1986). Sites in the western and southern foothills probably represent the camps of plains-based communal bison hunters. These site types reflect the reemphasis on hunting and continuation of the pattern of multiple subsistence bases co-occurring in the area.

### 3.3.5 Late Prehistoric and Plains Village

The introduction of the bow and arrow marks the beginning of the Late Prehistoric period, sometime around 1500 years ago. Smaller, lighter projectile points evince this change. The general subsistence pattern was essentially unchanged from that of the Late Archaic, with a heavy reliance on communal bison hunting, especially in open plains areas. The mixed communal hunting and foraging pattern persisted in the mountains and foothills. Ceramics have been found at a few early Late Prehistoric sites in the Black Hills and vicinity, as have stone circles (tipi rings) (Frison 1991; Reeves 1983).

The latter half of the Late Prehistoric of the Northwestern Plains comprises a large number of defined complexes and phases, which are basically alike in their material expressions and inferred subsistence and settlement patterns. These represent nomadic bison hunters who followed the bison herds and lived in hide tipis. Depending on the local environments in which they were based, these hunters also relied to some extent on nongame resources. The different complexes are recognized primarily on the basis of projectile point styles.

Along the Missouri River and its immediate tributaries, Plains Village pattern cultures developed at this time. The Plains Village pattern developed directly out of the earlier Plains Woodland pattern and was characterized by large, semisedentary earthlodge settlements clustered along the major waterways. Maize horticulture and seasonal bison hunting provided subsistence, with surpluses being stored in underground pits. Actual villages are rare in the Northwestern Plains proper; however, probable villages are reported from the Black Hills, White River Badlands, and southeastern Montana plains. Other sites seem to represent temporary camps used on seasonal bison hunts.

Several types of Late Prehistoric/Plains Village period sites have been excavated in the Black Hills. These include tipi rings (Haug et al. 1980; Tratebas 1979a); a large bison pit trap (Reher and Frison 1980); temporary camps used by Middle Missouri village dwellers on hunting or lithic procurement expeditions (L. Alex 1979; R. Alex 1981); a possible Crow encampment (Wheeler 1957); and two settlements possibly linked to Middle Missouri cultures (R. Alex 1981). Surface collections suggest use of the interior Black Hills for residence sites and use of the Hogback for various kinds of tool making and resource gathering (Tratebas 1986).

At present, little is known of the cultural dynamics of the Black Hills Late Prehistoric. The diversity of site types and artifact assemblages suggests that at least three cultural patterns were current in the area: the communal bison hunting pattern typical of the open plains; the mixed hunting and foraging pattern of the Wyoming Basins; and the semihorticultural, semisedentary village pattern of the Missouri River and Central Plains.

### 3.3.6 Protohistoric

Between 1700 and 1800, Euroamerican influences and material objects began to reach the Northwestern Plains in force. The introduction of the horse and gun, and the influence of the fur trade on the Upper Mississippi and Hudson Bay, led to several changes in the cultures of the Northwestern Plains. Among these were greater mobility, increased social stratification based on access to trade goods, a shift away from the use of bison jumps and traps to hunting by riding directly into the herd, and the military dominance of mounted warriors over pedestrian fighters (Secoy 1953). The Plains Indian warrior complex, with its highly structured system of recognizing individual accomplishments in battle, came to pervade nearly all aspects of Plains life by the end of this period (M. Smith 1937). At the same time, population shifts farther to the east caused a rebound effect in the Northwestern Plains, as new groups entered the area and territories shifted.

Archaeological remains dating to this period are rare in the Black Hills. This is probably because the sites are not recognized as such, rather than that occupation was not taking place. The Vore site is a periodically reused bison trap in the northern Red Valley containing Late Prehistoric and Protohistoric components. Kiowa-Apaches and Middle Missouri villagers may have used the site. Preliminary investigations at the Kenzy site, a bison butchering station in the Limestones, established that the site was used during the protohistoric period; however, few artifacts were found in association with the butchered bison bone (Saunders et al. 1994). Rock art from the southern Black Hills has been identified as having Shoshone, Siouan (unspecified), and Lakota or Cheyenne cultural affiliation (Sundstrom 1990). Some of this rock art depicts trade items of non-native origin, such as guns and horses. Ethnographic sources establish that the Black Hills area was occupied by the Crow, Ponca, Comanche, Kiowa, and Kiowa Apache (Gatacka) prior to the introduction of the horse between A.D. 1700 and 1750 (Reher 1977; Reher and Frison 1980). Shoshone territory lay just west of the Black Hills during the latter portion of the Late Prehistoric period. During the early part of the Protohistoric period, the Crow, Kiowa, and Kiowa-Apache controlled the Black Hills (Hodge 1907; Mooney 1898). Cheyenne, Arapaho, and Lakota groups moving in from the east and north replaced them later in the Protohistoric. The latter alliance dominated the area from about 1770 on, having displaced the Crow to the northwest and the Kiowa and Kiowa-Apache to the south.

In 1805, Lewis and Clark's informants placed the Cheyenne in the Black Hills (Mooney 1898:167). The Kiowa were then centered on the north fork of the Platte, while their Kiowa-Apache allies were on the headwaters of the Cheyenne River, just west of the Black Hills. Lakota oral histories indicate that Lakota bands entered the Black Hills as early as 1775 and soon claimed the area as their own.

### 3.3.7 Historic

The first non-natives began to enter the Black Hills country in the first quarter of the nineteenth century. These were explorers and fur traders, with whom the Lakota and their allies willingly coexisted. Over the next quarter century, the trickle of whites passing through Lakota territory turned into a steady and ever-increasing stream, as the settlement of Utah and the Oregon country, the California gold rush, and the race to build a transcontinental railroad all drew European Americans westward. In 1868, all of western South Dakota was set aside as a reservation for the Lakota; they were also guaranteed free access to the Powder River country for hunting (Kingsbury 1915). By 1875, reports of gold had been confirmed by the Black Hills Expedition, and entire towns had sprung up near the gold strikes. The Powder River war of 1876 was fought over the question of these treaty violations. In spite of Lakota victories over Crook and Custer that year, the Indians were forced by 1877 to cede the Black Hills and Powder River country to the US government, which opened the country to Euroamerican settlement.

Prospecting soon gave way to a more stable economy based on mining, logging, and ranching. Some of the old gold-rush towns survived this transition, while others grew up around the new industries. Today, the largest part of the Black Hills is federal and state owned parks and forests. Logging, mining, cattle ranching, and tourism are the main industries.

# Chapter 4

# RESEARCH ORIENTATION

## 4.1 Research Objectives

Mitigative research at the Blaine site was based on a formal research design. This addressed four main objectives:

- Establish a site-specific cultural chronology.
- Generate data on aspects of prehistoric settlement and subsistence systems for the various periods represented in site deposits.
- Determine patterns of lithic procurement and use.
- Establish the ecological, geomorphic, and geoarchaeological context of the site deposits.

The research objectives address a series of questions about prehistoric use of the Black Hills summarized by Sundstrom et al. (1994:5):

> An understanding of how prehistoric peoples perceived and used the Black Hills may well be a key to understanding the most basic questions of human survival in the Great Plains. Were the Black Hills a place of refuge when drought or extreme weather struck the open plains (cf. Frison 1991, Wedel 1978, Bamforth 1988)? Was the area occupied only during such times of climatic stress or during certain seasons of the year, or was occupation of the area continuous? Were the Black Hills shared by disparate groups based in the surrounding plains, or was there a single mountain-adapted culture surrounded by plains-oriented peoples?

## 4.2 The Blaine Site Data

Phase II investigations indicated probable Early Archaic, Middle or Late Archaic, and Late Prehistoric components at the Blaine site. A date of 5870±80 BP [Beta-55604] was obtained from near the top of the lower component (Component C), placing the component in the terminal Early Archaic period. No diagnostic artifacts were found in association with the dated feature or elsewhere in Component C. The upper two components did not contain cultural diagnostics or datable organic remains. These were tentatively assigned a general Middle or Late Archaic to Late Prehistoric age, based on their stratigraphic position.

The potential Early Archaic component was considered especially important to the development of local cultural chronologies. The span from the end of the Paleoindian to the beginning of the Middle Archaic period is poorly known for the Black Hills, as for much of the Northwestern Plains culture subarea. The age distribution of Black Hills radiocarbon dates (Figure 4.1) exhibits a marked low between 10,000 and 5000 years ago. A similar, but less pronounced pattern characterizes radiocarbon dates from Wyoming (Frison 1991:37). The reasons for the scarcity of sites dating to this interval are not well understood. Archaeologists have proposed various theories about human responses to hypothesized climatic deterioration during the Altithermal climatic episode (cf. Benedict and Olson 1973; Hurt 1966; Frison 1991; Dyck 1983; Reeves 1973; Black 1991). These variously predict increased or decreased population levels in the Black Hills. Many of these theories recognize separate adaptations for mountainous versus plains areas. Since the Black Hills are different from both the Rockies and the open plains, it is not clear which, if any, of the various adaptive models are applicable. Dated components and subsistence and settlement data are crucial to understanding larger issues of human adaptation during various periods of prehistory.

Various researchers have hypothesized that the relative lack of Altithermal-age sites in some regions is due partly or entirely to pronounced erosion or lack of soil formation during this period. In other words, people did inhabit these areas during the Altithermal, but conditions did not permit preservation of their material remains. With one of the few dated Altithermal-age soil deposits in the region, the Blaine site provides data relevant to this question. Research into the geomorphology of the Blaine site, presented in Chapter 6, addresses the question of whether the radiocarbon-dated horizon is an anomaly—an odd pocket of preserved sediment—or whether it indicates conditions conducive to wide-spread preservation of Altithermal deposits in the region. This research also attempts to tie the terrace sequence at the Blaine site to a regional terrace sequence first defined by Leopold and Miller (1954). The archaeological potential of the various terrace surfaces and fills is then evaluated.

It was anticipated that Phase III investigations at the Blaine site would result in a series of dates derived from stratified cultural deposits. This would provide a means of examining various models of settlement and subsistence diachronically. It would be possible to compare the various levels to see whether use of the

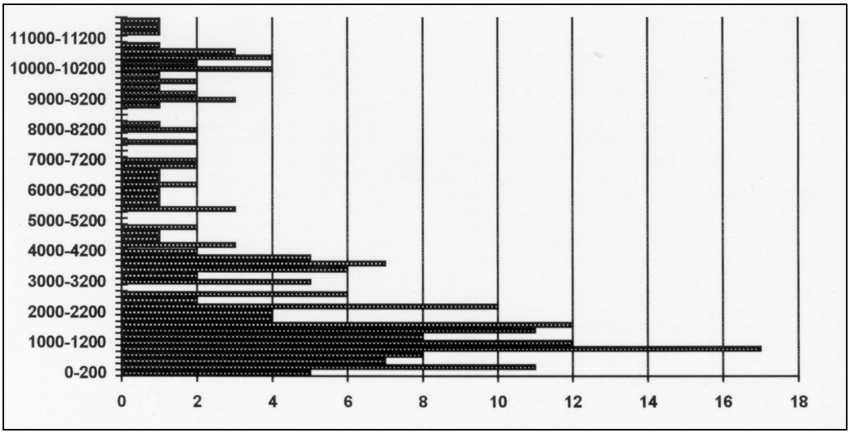



Figure 4.1. Distribution of radiocarbon dates from the Black Hills (number $x$ years before present). Dates are uncalibrated.

site had changed over time. Material from the site could also be compared with that from other dated archaeological components from the Black Hills and Northwestern Plains.

Another principal objective in our study of the Blaine site was to provide data relevant to questions about prehistoric settlement and subsistence in the Black Hills. In doing this, the material culture of the site was examined in terms of functional site types. Functional classification of the Blaine site components relied on a consideration of artifact density, tool type assemblages, tool to debitage ratios, and feature type, density, and configuration.

## 4.3 Functional Site Types

The correct identification of functional site types is an important prerequisite to tests of the various settlement pattern models proposed for the Black Hills. This applies especially to the distinction between base camps, temporary camps associated with resource exploitation, and special activity stations. In many cases, the various sites described as bases, residential camps, or special purpose camps (such as hunting camps) are largely undefined, except as associations of tool types and, in some cases, feature types.

Generalized models of hunter-gatherer subsistence and settlement systems can provide a basis for more exact definition of functional site types in the Black Hills. Several such models were considered in formulating definitions of functional site types applicable to the Black Hills situation. An assumption is made here that hunter-gatherer models are appropriate for Black Hills data. This assumption is based on the lack of evidence for other kinds of subsistence systems in the Black Hills and the Northwestern Plains in general. In other areas of the northern Great Plains such as the central Missouri River, where semihorticultural economies were developed prehistorically, hunting and gathering remained an important component of the subsistence system. The question in the Black Hills is not whether subsistence was based on hunting and gathering, but the more exact nature of the hunting and gathering subsistence systems which were developed there.

Of the numerous studies of hunter-gatherer site type classification, those of Binford and Binford (1966), Greiser (1985), Roper (1981), and Tratebas (1986) formed the basis for the research design on which this study is based (Donohue and Hanenberger 1993). Functional types used by Bender and Wright (1988) and Black (1991) in their models of high-altitude adaptations will also be considered here.

The first and most basic classification defines two main site types: maintenance and extraction (Binford and Binford 1966). Maintenance sites contain evidence of activities related to the technological requirements of the group and to food procurement and consumption. These are base camps. Extractive sites reflect a restricted range of activities conducted by task groups in extracting a limited number of specific resources. A third site type, the transient camp, comprises the remains from overnight camps used by traveling bands.

Greiser (1985) follows the Binford classification system in recognizing two basic site types, but further defines and subdivides these to reflect central Plains adaptive patterns. According to her classification system, maintenance sites are expressed as camp sites at which a variety of activities occurred, including tool manufacturing, hide preparation, food preparation, and various kinds of social interaction. Criteria for recognizing maintenance sites include settings with sufficient water and fuel to maintain a small group for a period of at least several days; features associated with preparation, processing, and storage of food; diverse subsistence remains; and structural features.

Greiser (1985) defines three classes of extractive sites: kill sites, processing sites, and quarry sites. Kill sites are defined as locations at which at least one mammoth or two ungulates were killed. Criteria for recognizing kill sites include: settings that can be utilized for natural traps or placement of constructed traps, such as arroyos, box canyons, cliffs, and bogs; features such as drive lines, corrals, and hearths; tool kits dominated by butchering tools and projectile points; faunal remains dominated by a single species; and faunal assemblages containing the least desirable elements of the carcass.

Table 4.1: Resource potential of Black Hills physiographic zones. Resource list does not include animal species not found in archaeology sites or in rock art (e.g. squirrel, black bear, grizzly bear, mountain lion, raccoon), non-food plants, non-storable plant foods such as shoots, or plant species used only as starvation foods or for medication. Animal resources are biased toward mammalian species.

| Zone | Resources |
|---|---|
| Foothill | bison, pronghorn, mule deer, whitetail deer, jackrabbit, desert cottontail, prairie dog, porcupine<br>wood<br>ponderosa pine seeds and bark |

Table 4.1: continued

| Zone | | Resources |
|---|---|---|
| | | western: Morrison silicified siltstone |
| | | eastern: cherts and chalcedonies |
| | | eastern: acorns and hazelnuts |
| | | prairie turnip, pricklypear, onion, sego lily, wild licorice, scarlet globemallow, sunflower, bush morning glory, yucca, “weedy“ species (goosefoot and other chenopods, ragweed, dock, smartweed) |
| | | chokecherry, plums, sumac, sandcherry, rose, buffaloberry, snowberry, skunkbrush. hackberry |
| | | fish and shellfish in Belle Fourche and Cheyenne rivers |
| | | grasslands/forest ecotone |
| Hogback | | Morrison silicified siltstone; high quality quartzites; cherts and chalcedonies |
| | | sandstone for groundstone tools |
| | | watergaps and arroyos for trapping game |
| | | numerous rock shelters |
| | | mule deer, jackrabbit, mountain sheep |
| | | wood |
| | | ponderosa pine seeds and bark |
| | | chokecherry, plum, skunkbrush, hackberry |
| | | prairie turnip, bush morning glory, onion, sego lily, wild licorice, scarlet globemallow |
| Red Valley | | primary habitat for bison, pronghorn, elk, prairie dog |
| | | mule deer, whitetail deer, desert cottontail |
| | | grass forage for bison |
| | | winter shelter for bison and humans |
| | | “salt” licks for bison |
| | | sego lily, onion, goosefoot |
| Limestone | | good quality cherts and chalcedonies, quartzites |
| | | perennial springs |
| | | rockshelters |
| | | semimarsh areas with beaver, muskrat, and mink |
| | | wood |
| | | ponderosa pine seeds and bark; white spruce bark |
| | | grasslands/forest ecotone |
| | | primary habitat for mule deer, whitetail deer, and elk |
| | | cottontail, jackrabbit, marmot, bison, porcupine |
| | | lodgepoles |
| | | chokecherry, buffaloberry, huckleberry, rose, Oregon grape, serviceberry, currant, nannyberry, grouseberry, raspberry, gooseberry, swamp currant, hawthorn |
| | | sunflower, onion, mountain wafer parsnip, “weedy“ species |
| | Riparian: | boxelder, willow, serviceberry, hawthorn |
| | | beaver |
| | Mountain prairie: | pricklypear, sego lily |
| | | jackrabbit |
| | | bison, elk, and deer |
| | | forest/grasslands ecotone |
| Central Core | | granite for groundstone tools |
| | | rock shelters |

Table 4.1: continued

| Zone | Resources |
|---|---|
| | wood |
| | ponderosa pine seeds and bark; white pine bark |
| | chokecherry, limber pine, strawberry, bearberry/kinnikinnic, Oregon grape |
| | primary habitat for cottontail and marmot |
| | deer, elk, rabbit, jackrabbit, porcupine |
| Bear Lodge | cottontail, marmot, mountain sheep, elk |
| | high quality cherts and quartzites, MSS |
| | ponderosa pine seeds and bark |
| | raspberries, gooseberries, strawberries, serviceberries |
| | pricklypear, yucca, "weedy" species |

Processing sites are defined as locations to which selected cuts of meat were transported for further butchering and mass processing of meat products. Tasks included secondary butchering and processing of meat, bone, sinew, and hides. Tools were repaired or manufactured at the site as needed. Kill and processing sites may co-occur in some cases. Criteria for recognizing processing sites include: settings outside natural traps such as talus slopes, arroyos, or bogs; hearths and/or drying rack features; tool kits with many butchering and cutting implements, with fewer projectile points and more scrapers than at kill sites; hammerstones and large cobbles for bone grease processing; and faunal assemblages with high proportions of the most desirable elements in terms of weight versus food value. Although extractive sites related to plant food procurement and processing can also be expected in the archaeological record, these are less easily identified and are not included in Greiser's classification.

The final class of extractive sites in Greiser's model, quarries, are defined as sites at which lithic raw material was selected, extracted, and initially processed. Criteria for recognizing quarry sites include settings at outcrops or concentrations of knappable stone; tool kits including hammerstones and excavation tools of bone, wood, and antler; and large amounts of lithic debitage including broken blanks or preforms and primary decortication flakes.

Roper (1981) recognizes a site type intermediate between the base camp and the extractive site. She terms this the "residential camp." A residential camp is defined as a site occupied for the purpose of exploiting nearby resources. The camp was likely to be moved when the resources were exhausted. Residential camps are by definition occupied for shorter periods than were base camps and tend to lack associated extractive (special activity) sites. Roper characterizes base camps, residential camps, and extractive sites as follows. base camps typically are found near the most "secure" immobile resources; contain large, dense artifact distributions and exhibit midden development; they contain storage and structural features; and contain large, diverse tool kits. Residential camps are found near immobile resources, are smaller and contain fewer artifacts than do base camps, have no midden development, contain few or no storage and structural features, and have a diverse tool kit including multipurpose and unspecialized tools. Extractive sites are found in places where one or a few high-yield resources occur, are small and contain few artifacts, lack storage and habitation features, and contain specialized tool kits geared toward procurement and initial processing of particular resources.

A more fine-grained site type classification was based on a principal components analysis of 212 surface collections from the Black Hills (Tratebas 1986). This analysis delineated 12 tool class associations representing functional site types for each of two areas: the southern Hogback/foothills zone and the interior Black Hills. These site types include a variety of extractive sites and residential or base camps. Another set of site types, termed expediency/distance camps are interpreted as transient camps (cf. Binford and Binford 1966). Because chronological data were included in the analysis, some of these site types are tied to particular periods or cultures (Tratebas 1986).

Bender and Wright (1988) recognize the following site function types in mountain-based settlement systems: base camp, secondary base, special use hunting, special use quarrying, and special use gathering. The high-elevation base camp is the basic site type. Base camps can be recognized by high artifact frequencies, high artifact diversity, and comparatively large size. They are found near resources needed for the physical comfort of the group, such as water, shelter from prevailing winds, early snowmelt, level areas, and ground cover suitable for camping. Accessibility (in terms of distance and elevational change) is also a factor in siting base camps. Base camps are located without particular regard for food sources. Since the most desirable combinations of accessibility and physical comfort factors will be found in only a few areas of a mountainous environment, base camps tend to be occupied repeatedly. Base camps should contain artifacts and features representing some of the activities of all resident individuals, i.e. the entire social unit (cf. Binford 1979).

According to this model, once a base camp was established, a series of foraging activities emanated from the camp. This would create a series of satellite special activity sites. These sites are recognizable by their small size, specialized tool kits, and distribution without regard to habitability and accessibility. Gathering sites tend to be located close to the base camps. Gathering per se is not likely to generate visible archaeological remains; however, activities associated with gathering will be expressed at the associated base camps. Grinding stones and roasting pits in particular are interpreted as evidence for plant gathering near base camps. Sites associated with hunting activities, in contrast, tend to be sparse and widely dispersed. Mountain-based hunters cover large, overlapping territories in pursuit of game. Primary processing of larger game animals tends to occur at the kill site. Hunting sites associated with this pattern take the form of small lithic concentrations and overlooks on promontories. The third kind of special activity site, the quarry, is recognized by the presence of large, dense clusters of lithic debris at and near outcrops.

The broad spectrum settlement pattern model implies the presence of one other site type: the secondary base. This site type is necessitated by resource procurement activities that take task-specific groups far from the base camp. When returning to the base camp requires great effort, a secondary base will be established nearer the particular resource being exploited. The critical distance depends on the relative accessibility of the local terrain. Secondary bases can be quite close to base camps if the terrain is especially difficult to traverse. As a focus of diverse activity, but not of band-level domestic life, these sites are characterized by high functional diversity and moderate size. They are located in areas remote from base camps, but not necessarily in highly habitable areas. They are, however, located in the most habitable areas within the range of a specific resource.

Bender and Wright's secondary base may be equivalent to sites in the Black Hills described as intermediate between Binford's residential base and field camp (Tratebas 1986). Although Tratebas concluded that no true base camps were present in the Black Hills, it is possible that primary and secondary bases cannot be easily distinguished on the basis of surface artifact scatters alone. The habitation sites Tratebas selected for test excavation appear to have been limited to secondary bases (or residential camps) and specialized hunting stations/camps; more likely candidates for base camp status, such as McKean and Deerfield, were not included in the study. Bender and Wright's special use sites are of course equivalent to the resource extraction sites described in the other models. There seems to be no equivalent for Tratebas's Distance/Expediency site type in Bender and Wright's classification; however, this type may be considered equivalent to Binford's transient camp (Binford and Binford 1966). This may be a site type specific to a plains-based subsistence system, in which trips through the Black Hills were irregular and unscheduled in regard to nonmobile resource availability.

The concept of "site" is both necessary and limiting to exploration of the various models outlined above. Many of the activities proposed for the various models would not leave material remains in the form of recognizable sites. Lodgepole cutting, plant food gathering, and netting or snaring of small animals would not have created readily visible sites. Subsistence patterns with a heavy reliance on large game will be more easily identified as "sites" in the archaeological record than those emphasizing plant foods, because bone is larger and more durable than most plant remains. On the other hand, subsistence systems based on large game hunting will be difficult to detect in areas away from kill and butchering sites. Supplementary subsistence activities included in such systems will have a low level of visibility in the archaeological record. Jumps and arroyo traps frequently were used several or many times, creating highly visible sites. The effort expended in discovering, constructing, and/or maintaining these procurement facilities tended to anchor a group or groups to a specific territory. Within these territories, however, group movements depended primarily on the availability of bison and pronghorn (i.e. herd migrations and population fluctuations). In other words, the highly mobile and flexible nature of group movements reflected the mobility of the bison and pronghorn herds that formed the subsistence base.

In subsistence patterns based on plants and nonmigratory game, group movements tend to be anchored to a series of stable or predictable resources. Rather than following the herds, people schedule their movements around the seasonal availability of various resources. In mountainous areas, this includes following the ripening plant foods up into higher elevations in the summer and returning to the lower elevations in the fall. Base camps are located with respect to availability of water, fuel, and shelter necessary for maintenance of the group and ideally within less than a half day's walk of resource patches. Sites meeting these conditions tend to be frequently reused, sometimes over periods of thousands of years. As a seasonal round becomes increasingly regularized and scheduled, more permanent features such as storage pits, tool caches, and pit houses appear. The effort expended in constructing such features implies an intention to return to a site on a regular basis. Tool or preform caches and reused hearth or roasting pit complexes demonstrate that sites were being used for the same purpose, e.g. plant food processing, throughout long spans of prehistory.

## 4.4 The Resource Base

Before describing and evaluating the various settlement pattern models proposed for the Black Hills, it is necessary to consider what resources were offered by the area, especially in contrast to the surrounding grasslands. Each physiographic zone of the Black Hills contains a unique set of resources (Table 4.1).

The information presented in Table 4.1 is a compilation of data from botanical and ethnobotanical studies, as well as field observations (Turner 1974; Froiland 1978; Latady and Dueholm 1985; Van Bruggen 1971; Gilmore 1977; Johnson and Nichols 1970; Rogers 1980; Kindscher 1987; Greiser 1985; Swetnam 1984; Haberman 1986; Keyser 1986). Plant resources listed in Table 4.1 are limited to those items for which ethnobotanical or regional archaeological data (Table 4.2) suggest regular use as food. Plants used primarily for medicine, fibers, or dyes are not included. "Survival" or starvation foods are also omitted, as are introduced species such as lambsquarters. Plants used only in the form of springtime shoots or potherbs are not included, as these are assumed to had have little effect on settlement patterning. Ubiquitous food plants, such as western wheatgrass, prairie junegrass, and sage, are similarly excluded from the resource list for two reasons. First, there is little ethnographic or archaeological evidence that these were used as food sources in the region. Second, these species are found in much greater abundance in grasslands environments than in the Black Hills.

Animal species are limited to those found in regional archaeological contexts (including rock art) suggesting their use as food. The sparse nature of faunal data from Black Hills sites, as well as their uneven geographic distributions make it difficult to draw generalizations about this aspect of prehistoric subsistence systems (Table 4.3). It now appears that communal bison kills and other large scale bison procurement were limited to the Red Valley. The Deerfield site, high in the central Limestones contained elements of at least four bison; however, most bone at the site was unidentifiable. Large scale bison procurement is not indicated for Deerfield. A long series of periodic, seasonal occupations of the site produced the four bison. Bison was also found at the nearby Kenzy site; however, it was not clear from preliminary investigations whether isolated kills

Table 4.2: Edible plant remains from area sites.

| Site | Reference | Location | Edible Plants Represented |
|---|---|---|---|
| McKean | Latady and Dueholm 85 | BH: Foothills | Pricklypear, goosefoot, ponderosa pine, serviceberry, mustard |
| 48WE320 | McKibbin 88 | BH: Foothills | Pricklypear, goosefoot, dock, shadscale |
| 39BU2 | L.Alex 89 | BH: Foothills | Chokecherry, plum |
| 39FA426 | Haug et al 80 | BH: Hogback | Saltbush |
| George Hey | Tratebas and Vagstad 79 | BH: Hogback | Goosefoot, grass |
| 39FA23 | Haberman 86 | BH: Hogback | Chenopodium (goosefoot) |
| Deerfield | Buechler 84 | BH: Interior | Chokecherry, goosefoot, dock, cocklebur |
| Beaver Creek | Abbott 94 | BH: Interior | Hackberry, other unspecified seeds |
| Victoria Creek | Vallejo 93 | BH: Interior | Hackberry, wild plum |
| Lower Grand, Helb, Walth Bay, Bagnell, Mitchell | Nickel 77 | Missouri River in North and South Dakota | Wild plum, chokecherry, rose, hackberry, marshelder, chenopods, sunflower, dock, smartweed, ragweed |
| Leigh Cave | Frison and Huseas 68 | Bighorns | Onion, buffaloberry, prickly pear, chokecherry, juniper, limber pine, thistle, rose, rye, yucca |
| Schiffer Cave | Frison 91 | Bighorns | Sunflower, pricklypear, amaranth, plum, pine, juniper |
| Lightning Spr. | Keyser 86 | Cave Hills | Goosefoot, smartweed, wild sunflower, wild bean |
| Barton Gulch | Aaberg 92 | SWern Montana | Pricklypear, goosefoot |
| 39PN972 | Larson and Penny 93 | White River Badlands | Wild mint, bergamot, pricklypear, rose, gooseberry or current, buckbrush, goosefoot, pigweed, sage, Sandberg's bluegrass, saltbush |
| 39PN975 | Larson and Penny 93 | White River Badlands | Goosefoot, pigweed, ragweed, bergamot, Sandberg's bluegrass, wild mint, mannagrass, pricklypear, plum, rose, |
| 39PN607 | Rood et al 84 | White River Badlands | Goosefoot, pricklypear, dock, wild bean, cocklebur |
| 39PN102 | Haberman et al 84 | White River Badlands | Grass, smartweed, plantago |
| 39SH36 | Haberman 90 | White River Badlands | Cocklebur, pricklypear, grass, sedge, rose |
| 39SH57 | Haberman 90 | White River Badlands | Buffaloberry?, pricklypear |

or a large scale communal drive is indicated for the site (Saunders et al. 1994). The faunal assemblage from the Beaver Creek site in the southern Limestones has received only preliminary analysis; however, deer dominates the faunal assemblages from most levels at the site. Limited testing of the Victoria Creek site in the interior Black Hills revealed a mix of large and small game. Diagnostics artifacts and a radiocarbon date suggest primary use of the site during the Middle and Early Archaic and late Paleoindian periods, with less evidence for an early Late Archaic occupation. (A second radiocarbon date is anomalously recent.) The remaining sites are located in the Hogback or western foothills. These contain varying mixes of deer, bison, pronghorn, and smaller animals. None of these contain evidence for large scale bison procurement. About 100 panels of Paleoindian and/or Archaic rock art from the southern Hogback depicts a variety of hunting methods, including communal hunts using nets and pursual of individual animals using atlatls and snares (Sundstrom 1990). The vast majority of the animals depicted are deer, with lesser numbers of pronghorn and mountain sheep. Bison are depicted on only two panels.

Plant food resources in the foothills and Hogback are generally similar to those found in the surrounding grasslands, with the exception of ponderosa pine. Some ethnographic evidence exists for use of ponderosa pine bark for food (Swetnam 1984); however, it does not appear to have been a primary food source. Archaeological evidence for intensive use of ponderosa bark or seeds is also lacking; thus, this potential food source is not viewed as a major "draw." In the foothills, shelter from inclement weather, wood for fuel and tools, lithic raw material, and habitable rock shelters are the most important potential resources. Rock art dating from Paleoindian through Middle Archaic times from about 18 sites in the southern Hogback depicts communal animal trapping using nets or other enclosures (Sundstrom 1990). This suggests use of Hogback watergaps for trapping herd animals, especially deer and mountain sheep.

Given this stable suite of resource advantages in the Black Hills, were prehistoric settlement patterns specifically geared to take advantage of them? Several settlement pattern models have been proposed for the Black Hills. Each of these predicts a specific set of archaeological data types, including functional site types, lithic raw material resource patterning, and subsistence remains.

## 4.5 Settlement and Subsistence Models

Settlement pattern models provide a means of exploring the range and intensity of prehistoric use of specific habitats. Such models are built on data from ethnographic, ethnoarchaeological, and ecological studies. These models can then be used to formulate research questions for archaeological investigations. The material expressions of conditions predicted by the models are thus directly tested against archaeological data. Increasingly specific models have been developed for various levels of technology, geographic areas, and habitat types.

Table 4.3: Faunal assemblages from excavated or tested sites in the Black Hills. Species are listed in order of their abundance. P=Plano, EA=Early Archaic, MA=Middle Archaic, LA=Late Archaic, LP=Late Prehistoric, PH=Protohistoric.

| Site | Location | Reference | Age | Faunal Assemblage |
|---|---|---|---|---|
| McKean | Foothills | Mulloy 54 | MA | Deer, bird, canid, rodent, frog, rabbit, pronghorn, mussel |
| McKean | Foothills | Mulloy 54 | LA | Bison, deer, cottontail, frog, canid, bird |
| McKean | Foothills | Kornfeld et al 91 | undifferentiated | Bison, deer, pronghorn, jackrabbit, cottontail, ground squirrel, canid, red fox, frog, shellfish |
| Mule Creek | Foothills | Wheeler 57 | MA | Bison, deer/pronghorn, canid, beaver, grouse, mussel |
| Mule Creek | Foothills | Wheeler 57 | LA | Bison, deer, pronghorn, jackrabbit, mussel |
| 48WE320 | Foothills | McKibbin 88 | LA, LP | Deer, pronghorn, bison, jackrabbit, fox |
| 48CK46 | Foothills | Wheeler 57 | LA, LP | Bison, deer, pronghorn |
| Sheaman | Foothills | Frison and Stanford 82 | Clovis | Mammoth, long-horned bison |
| Brewster | Foothills | Frison and Stanford 82 | Folsom | Bison |
| Agate Basin | Foothills | Frison and Stanford 82 | Folsom | Bison, rabbit, pronghorn, canid (wolf and dog) |
| Agate Basin | Foothills | Frison and Stanford 82 | Plano | Bison |
| 39FA23 | Foothills | Hughes 49 | Plains Village? | Pronghorn, shellfish |
| Smiley Evans | Foothills | L. Alex 89 | LP | Bison, canid, bird, deer, elk, fox, prairie dog, fish |
| Belle Shelter | Foothills | Wheeler 57 | MA, LP | Bison, deer, pronghorn |
| 39CU570 | Foothills | SARC files | unknown | Bison |
| 48WE320 | Foothills | McKibbin 88 | LA, LP | Deer, pronghorn, bison, jackrabbit, fox |
| George Hey | Hogback | Tratebas and Vagstad 79 | MA | Deer |
| Lissolo Cave | Hogback | Steege and Paully 64 | MA | Bison, elk, mule deer |
| Lissolo Cave | Hogback | Steege and Paully 64 | LA | Bison |
| 39FA392 | Hogback | Tratebas 79b | LP | Pronghorn, mountain sheep |
| 39FA426 | Hogback | Haug et al 80 | EA or MA | Bison, cottontail, other large and small mammal? |
| Deerfield | Interior | Buechler 84 | P, MA, LA, LP | Bison, fish |
| Kenzy | Interior | Saunders et al. 94 | LP, PH | Bison |
| Beaver Ck | Interior | L.Alex 91 | EA, MA | Deer, bison, pronghorn, fish, frog, rabbits, rodents, canids (including dog), birds, |
| Victoria Ck | Interior | Vallejo 93 | P,EA,MA,LA | Deer, bison, bison or elk, rabbit, rodent |
| Hawken | Red Valley | Frison 91 | EA | Bison, wolf, mule deer |
| Vore | Red Valley | Reher and Frison 80 | LP | Bison, wolf/dog hybrids |
| Sanson Jump | Red Valley | Agenbroad 78 | LP | Bison, unspecified non-bison |
| 39FA472 | Red Valley | SARC files | unknown | Bison |

In the northern Great Plains, settlement pattern models have been developed for various areas and culture types. Along the upper Missouri, a semisedentary, semihorticultural settlement pattern is recognized. Plains Village pattern cultures followed a highly structured seasonal round, spending early summer through fall in aggregated earthlodge settlements along the river, leaving the villages in summer to travel north or west to the bison hunting grounds, and dispersing to isolated camps in the wooded lowlands during the winter months. This pattern was followed by the historic Mandans, Hidatsas, and Arikaras, except that they wintered in aggregated settlements in the lowlands.

In the open plains, a fully nomadic bison-hunting culture developed. Small family groups or bands dispersed to hunt bison throughout most of the year, congregating at midsummer into larger camps for trade, socialization, and offensive raids. Limited gathering of berries and prairie turnips supplemented the diet. The pre-equestrian Blackfoot and Arapaho exemplify this pattern. Writing in 1805, Larocque described this pattern for the Crow:

> They wander about in leather tents and remain where there are buffaloes and elks. After having remained a few days in one place so that game is no more so plentiful as it was they flit to another place where there are buffaloes or deers and so on all year round (Larocque 1805 cited in Wood and Thiessen 1985:206).

In the Bighorns and Rocky Mountains, seasonally scheduled movements between local resource areas facilitated a diverse economy based on exploitation of a wide variety of plants, large and small vertebrates, shellfish, and insects. This pattern is similar to that followed by nonequestrian Great Basin cultures such as the Ute and Paiute.

Unlike other areas of the West, no ethnographic descriptions of human adaptation to the Black Hills in pre-horse days are available. By the time the first private and government expeditions penetrated the area, the Lakota and Cheyenne bands then in control of the Black Hills had completed their shift to a fully equestrian way of life. The Warren Expedition of 1857 was turned away from the Black Hills by a large band of Minneconjou and Hunkpapa Lakotas.

> They were encamped near large herds of buffalo, whose hair not being sufficiently grown to make robes, the Indians were, it may be said, actually herding the animals....The intention of the Indians was to retain the buffalo in their neighborhood till their skins would answer for robes, then to kill the animals by surrounding one band at a time and completely destroying each number of it...(Warren 1857 cited in McLaird and Turchen 1973).

This quasi-pastoralist pattern, based on acquisition of large herds of horses and centered on the hide trade, was a response to contact with non-natives. Precontact use of the Black Hills was presumably much different; however, the ethnographic record is silent in this regard.

During the protohistoric period, mounted hunters ranged the open country around the Black Hills in a wide ranging and flexible annual round. The vast Lakota and Cheyenne territory covered an area including what is now western South Dakota, southwestern North Dakota, eastern Montana, eastern Wyoming, and northwestern Nebraska. These plains-based groups ventured into the Black Hills to hunt and to get lodgepoles and lithic raw material, but were not permanent residents of the uplift. They may have occasionally sought winter refuge and hunted bison in the foothills, Hogback, and Red Valley as well. During this period, the Black Hills were viewed as a prime hunting ground, as Standing Bear related:

> At this time [1875] I was about fifteen years old and I heard Sitting Bull say that the Black Hills was just like a food pack and therefore the Indians should stick to it. At that time I just wondered about what he had said and I knew what he meant after thinking it over because I knew that the Black Hills were full of fish, animals, and lots of water, and I just felt that we Indians should stick to it. Indians would rove all around, but when they were in need of something, they could just go in there and get it (Standing Bear n.d. cited in DeMallie 1984:163–164).

It is not known whether this pattern was followed prehistorically. Horse travel is not easy in heavily wooded portions of the Black Hills and pasturage is limited. A significant reduction in use of the Black Hills may have accompanied adoption of horse culture. Group territories were probably much smaller prior to horse travel. Acquisition of the horse was a key element in taking and defending the large territories claimed by protohistoric plains tribes. Clearly, ethnographic descriptions of the Lakotas, Cheyennes, and other groups occupying the Black Hills in protohistoric and historic times cannot be expected to provide an accurate model of prehistoric use of the area.

Because reliable ethnographic models are not available, settlement pattern models for the Black Hills have largely been based on archaeological data. Five alternatives have been proposed. The first two of these view the Black Hills as peripheral to the main, open plains, habitat. According to these two models, the Black Hills area was used only occasionally, as a refuge from dry conditions or as an occasional source of special resources, by full-time bison hunters based on the open plains. The third model views the Black Hills as part of a regular seasonal round which included both the surrounding plains and the mountain uplift. The fourth model proposes year-round occupation of the Black Hills by hunter-gatherers using scheduling to exploit a broad range of local resources. The fifth model proposes a combination of the other patterns, with simultaneous or sequential use of the Black Hills by both full-time hunter-gatherers and seasonal or sporadic visits by plains-based bison hunters.

These are summarized in Table 4.4. Each model is discussed and evaluated in more detail below.

Table 4.4. Summary of expected archaeological data for various settlement pattern models hypothesized for the Black Hills.

| Model | Expected Archaeological Data |
|---|---|
| Refuge | Increased or stable site densities during Altithermal; sites concentrated near water sources; bison-based subsistence; nonlocal lithics and tool types; few sites during periods of greater precipitation |
| Plains-Based Sporadic Use | Small, ephemeral sites with highly specialized tool kits and/or discards of hunting and butchering tools; few or no base camps; sites concentrated in single-resource areas, such as stands of lodgepole pine or quartzite outcrops; much nonlocal lithic material; no caches, storage facilities or permanent shelters; little evidence of reuse of sites |
| Plains-Based Seasonal Use | Some seasonal base camps; much nonlocal lithic material; bison-based subsistence; tool kit geared toward hunting and butchering; part of seasonal round should be missing; little or no divergence in tool types and reduction sequences from general northwestern plains types |
| Mountain Archaic | Divergent, localized tool and reduction types; base camps at high and low elevations with diverse tool kits; both warm and cold season base camps; little or no nonlocal lithic material; evidence for multiple episodes of use of base camps and resource processing sites; diverse subsistence remains, emphasizing stable resources; evidence for permanent/reusable structures, tool or lithic raw material caching, and storage facilities. |
| Both Plains and Mountain-Based Systems | All sites, or all sites of a given period, do not meet any of the above sets of expected attributes. Instead, the data support two or more patterns |

### 4.5.1 Refuge Model

According to this model, the Black Hills and other upland areas are viewed as marginal environments, used only during times of periodic or seasonal climatic stress. This model has most often been tied to human responses to climatic change during the Altithermal climatic episode. As the drier climate of the Altithermal reduced forage available to bison, their human predators moved into mountain and foothills environments where water and game were more abundant (Hurt 1966; Frison 1991). In the Rockies, this process was promoted by the reduction of snowpack in the higher mountains, which opened new areas to human habitation (Benedict and Olson 1973, 1978). In intermediate areas like the Black Hills, either a continuation of a bison-based subsistence or a shift to a more diverse subsistence can be hypothesized for the refuge model, depending on local resource availability.

The refuge model has received wide acceptance in reference to the Black Hills (cf. Wedel 1978; Bamforth 1988; Buchner 1980; Frison 1991). This is largely due to work at the Hawken site in the northern Red Valley (Frison et al. 1976; Frison 1991). The site was an arroyo trap used for communal bison kills and a nearby butchering area. These portions of the site were radiocarbon dated to 6270 and 6470 BP, respectively. This falls about in the middle of the Altithermal as it is usually defined for the Great Plains. According to this interpretation, Hawken indicates that the large-scale communal bison hunting pattern established on the high plains during the Paleoindian period shifted to the Black Hills and other upland areas as people and bison sought refuge from the drier high plains (Frison et al. 1976; Frison 1991).

The refuge model has more recently come under attack (Bender and Wright 1988; Black 1991; Sundstrom 1992). Black (1991) and Bender and Wright (1988) suggest the upland refuge concept largely is a product of cultural bias on the part of archaeologists working in the Great Plains and Rocky Mountains. While this may be an oversimplification, Black Hills data provide little support for the refuge model. The model predicts an increase in population density, or at least maintenance of stable population levels, in the Black Hills during the period from 8000–5000 BP, when dry conditions were at a maximum; however, this actually represents the period of lowest population density. Both radiocarbon data (Figure fig4.1) and counts of archaeological components suggest a sharp drop in human use of the Black Hills during this interval. Moreover, there is no corresponding reduction in population density with the return of moister climatic conditions during the Middle Archaic period, as would be expected of a temporary refuge area occupied only out of desperation. Instead, population levels appear to increase significantly during the Middle Archaic period. About 145 sites with Middle Archaic components are found in the Black Hills area, compared to fewer than 30 Early Archaic sites. (An intermediate number of sites date to the Paleoindian period). If the perceived drop in population density in the Black Hills during the Altithermal is an artifact of preservation, the refuge hypothesis is still unsupported, because such widespread erosion would be a clear indicator that climate was as unstable in the Black Hills as it was elsewhere in the Great Plains. This does not argue for improved availability of water and game in the Black Hills. The refuge model also predicts that sites will be concentrated near permanent water sources. Again, the data do not meet the prediction. The numerous large, multicomponent spring-side sites in the interior Black Hills almost always lack Early Archaic components (Sundstrom 1992).

Perhaps the most fundamental problem with this model is that it necessarily assumes that refuge areas were unoccupied except during times of stress. Otherwise these areas would be unavailable, since they would already be in use by local groups. Since regional climatic episodes would likely reduce the carrying capacity of both the plains and all but the highest upland areas, localized groups could not just “move over“ to accommodate refugees from the drier open plains. Although not intensively explored, Paleoindian components are found throughout the Black Hills, including peripheral zones and the interior. Large, multicomponent spring or stream-side base camps are common in the higher Black Hills. Many contain Paleoindian or Paleo/Early Archaic transition diagnostics (West Camp Spring, Ditch Creek, Trail Draw, Deerfield, 39CU1048, 39PN795). While there is clearly a shift toward more intensive and inclusive use of the Black Hills during the Middle Archaic period (Tratebas 1986; Sundstrom 1989), it is clear that both the interior uplift and the exterior zones were being exploited prior to the onset of the Altithermal. Nor do the few Early Archaic sites thus far identified in the Black Hills show any pronounced tendency to occur near water. Overall, the refuge model is not well supported by data from the Black Hills.

Although the Hawken site in the northern Red Valley appeared to confirm the refuge model for the Black Hills (Frison et al. 1976; Frison 1991), a closer look at the data suggest otherwise. Ecologically, the Red Valley is an extension of the High Plains. The saline Red Valley soils support only grasses and forbs. Faunal species are essentially the same as those found in the high plains to the west of the Black Hills (Turner 1974). It is reasonable to assume that this zone was unforested throughout Black Hills prehistory, although data have not yet been collected to test this assumption. Bison moved freely between the Red Valley and the open plains via watergaps in the Hogback (Turner 1974). An adaptive pattern based on exploitation of local bison herds would be expected for at least some sites in the Red Valley. The Hawken site provides just one example of this pattern; others include the Sanson Buffalo Jump (Agenbroad 1988), the Vore site (Reher and Frison 1980), and possibly 39FA472 and 39CU570 (SARC records). With the possible exception of 39CU570 and 39FA472, these sites contain evidence of large-scale bison procurement. Preliminary data from the Jim Pitts site, immediately north of the Blaine site, suggest use of the locality for bison hunting and processing during the Clovis/Folsom transition (Donohue pers. comm. 1994). These sites suggest a continuity of plains-like subsistence activities concentrated in the Red Valley throughout most of Black Hills prehistory. The Middle and Late Archaic periods are not represented in the bison-bone bearing components of these sites. This may be a result of sampling error or may reflect a trend away from bison hunting in the Red Valley during these periods. In any case, it is clear that Hawken does not represent a special pattern limited to the Altithermal and/or Early Archaic.

The two best known Early Archaic sites in the Black Hills, Hawken and Beaver Creek, contain only local lithics, although some porcellanite was present in a mixed Paleoindian/Early Archaic component at 39LA117 and very small amounts of Badlands plate chalcedony and Knife River Flint were found in the combined Paleoindian through Late Archaic deposit at 39PN1124. The predicted emphasis on nonlocal lithics thus is not indicated. While Hawken seems to reflect a continued emphasis on large scale bison procurement in the Red Valley, Beaver Creek indicates a much more diverse economic base including deer, small mammals, frogs, and plant foods. The similarities in projectile point forms between Hawken and Beaver Creek suggest the possibility that the sites represent different portions of a seasonal round, or at least different subsistence activities occurring within a single culture.

### 4.5.2 Plains-Based Sporadic Use

The second variant of the Black Hills as marginal environment model can be termed the Plains-based Sporadic Use model. This model was developed in response to investigations at the Vore site in the northern Red Valley between the Black Hills proper and the Bearlodge mountains (Reher and Frison 1980). The Vore Site is a Late Prehistoric sinkhole bison jump. Using a combination of radiocarbon, stratigraphic, sediment, and lithic raw material source analyses, a detailed model of use of this bison jump was proposed. Between 1500 and the early 1600s A.D. during the first half of the Little Ice Age or Neoboreal climatic episode, a drought cycle caused cyclical fluctuations in bison populations. Bison were "harvested" only when bison populations peaked. These peaks generally occurred 3–4 years after precipitation peaks, at the maturation of large calf crops. The distribution of bone middens within varved sediments at Vore indicates that kills took place from 11 to 34 years apart, when bison populations had attained a critical density. The bison jump was not being used in the intervening periods of lower bison density. In the later 1600s and the 1700s, as precipitation continued to increase, area bison populations may have supported more frequent, or even continual, harvesting. Even then, individual bison jumps probably were used only every 5–10 years (Reher and Frison 1980:59).

Lithic data suggest that the Vore buffalo jump was operated by aggregates of several groups from west, southwest, and north of the Black Hills. The main territory of groups using the Vore site shifted north over time from southeastern Wyoming to the Powder River Basin. The relatively small number of local lithics at Vore strongly supports the hypothesized wide-ranging territories of those groups using the site and the view that the Black Hills was peripheral to the main territories. Overall, the assemblage comprised 66% Hartville Uplift materials, 10.5% Powder River basin porcellanite, 6.4% Knife River Flint, 3.9% dendritic chalcedony (of unknown derivation), and only 6.6% local Hogback quartzites (Reher and Frison 1980). The Vore site model predicts more frequent social aggregation, leading to more complex social organization, during periods of increased effective moisture when herds would have increased and cooperative kills would have taken place more frequently. Lithic raw material diversity and distance-to-lithic-source were used as indices of group mobility and dispersion versus aggregation. In general, the users of the Vore site had a relatively low degree of dispersion and fairly high mobility. This suggests the aggregation of centralized bands (Reher and Frison 1980:133). The Vore site data suggest that as group dispersion increased, mobility decreased.

Although the authors do not attempt to reconstruct the other portions of the subsistence round followed by the Vore site users, a locus outside the Black Hills is clearly implied. They suggest that the jump was operated first by a group (possibly the Kiowa) centered in southeast Wyoming and later by groups centered in the Powder River basin immediately west of the Black Hills. Groups from the upper Missouri may also have used the site during its later years. One of the explicit assumptions guiding the research at Vore was that "enclave" areas including uplands and riverine environments were occupied only seasonally, because "these resources cannot by themselves provide a secure basis for extensive occupation of grasslands areas" (Reher and Frison 1980:43). Such areas were used primarily when buffalo availability was low; thus, the availability of bison is seen as the principal controlling factor in settlement and subsistence patterning. In summary, Reher and Frison's model proposes use of the Black Hills only during times of environmental stress in the surrounding plains or during peaks in bison population density in the Red Valley. The specifics of bison procurement in the Red Valley, and associated social structure, depended on local environmental conditions, particularly precipitation.

The results of the Vore site investigations seem to contradict the authors' assertion that the Black Hills would have been especially attractive during times of low moisture (Reher and Frison 1980:6, 30), at least as far as the Red Valley is concerned. In fact, bison availability at Vore seems to have depended mainly on the regional moisture regime, just as on the open plains. Bison were continually available in "harvestable" numbers at Vore only during the latter portion of the Little Ice Age. During other periods, bison levels were too low to support sustained exploitation in the Red Valley. Again, evidence suggests that the Red Valley was an extension of the high plains environment, rather than a refuge from drought.

The Sporadic Use subsistence and settlement model is supported for some periods by functional analysis of a non-random sample of surface collections from sites throughout the Black Hills (Tratebas 1986). In this study, principal components analysis was used to define a set of site types related to various functions, local environments, and archaeological periods. Tratebas recognized 11 functional/temporal site types for the southern Black Hills periphery and 12 for the interior uplift. Site types defined for the peripheral zone are: Middle Archaic residential camp; Late Prehistoric and Middle Archaic winter camp; Late Archaic residential camp; Paleoindian activity location or residence; and special activity sites related to initial wood or bone working, shaft or haft notching, hafting or rehafting, bone breaking, primary knapping, biface manufacture, armament and hunt staging, and armament or wood tool manufacturing. Site types defined for the interior include Late and Middle Archaic residential camp; Middle Archaic residential camp; Late Prehistoric and Late Archaic residential camp; Paleoindian residential camp; Middle Archaic "distance and expediency"; and special activity sites for initial butchering, secondary butchering (two types), hide working, bone tool manufacturing, shaft manufacturing/repair and hafting, and tool manufacturing and hafting. This information was then use to define settlement patterns for various periods of Black Hills prehistory.

According to Tratebas's model, use of the interior Black Hills during the Paleoindian and Early Archaic periods was largely limited to summer or fall hunting forays concentrated in the western Limestone Plateau. Weapons preparation and repair and faunal processing took place at these sites. Little use was made of the Hogback zone except for occasional lithic procurement or tool production. This suggested that most of the seasonal round took place on the open plains outside the Black Hills, although Tratebas noted that additional data from unsampled areas might change this view. Middle and Late Archaic groups continued the pattern of using the interior Black Hills for fall and summer hunts; however, both large residential camps and smaller hunting camps occur. In contrast to the earlier periods, most production of nonlithic tools shifted to the Hogback zone during the Middle and Late Archaic. Winter habitation also took place in the Hogback zone. A wide ranging seasonal round including the plains outside the Black Hills is hypothesized for these periods. During the Late Archaic, use of the Hogback for winter habitation decreased and use of the interior for winter camps increased. The presence of bison processing camps in foothills areas suggests a renewed emphasis on a plains-oriented bison-based subsistence during the Late Archaic. This pattern continued for the Late Prehistoric. By then use of the Black Hills was largely restricted to short-term cold season hunting forays in the interior and peripheral zones. Some lithic procurement and tool production also took place in the Hogback. Most of the seasonal round took place in the open plains outside the Black Hills and was focused on communal bison hunting.

Tratebas's study is essentially in agreement with the Sporadic Use model for the Paleoindian, Early Archaic, and Late Prehistoric periods. A different pattern is indicated for the Middle and Late Archaic periods. The Vore site dates to the Late Prehistoric period. Thus, the Late Prehistoric settlement proposed by Reher and Frison (1980) is supported by Tratebas's research. The suggested avoidance of upland areas except during times of environmental stress, however, is not supported. Archaeological components dating to the Altithermal follow essentially the same patterns of distribution and site function as pre-Altithermal Paleoindian components. A shift toward more intensive and regularized use of the Black Hills does not occur until the Middle Archaic period, when site densities increase significantly in both uplands and plains areas (cf. Frison 1991). By this time, the Altithermal was over.

Other data are equivocal in regard to the Plains-based Sporadic Use model. Very small camps with specialized tool kits geared toward hunting, butchering, and projectile production and repair occur throughout the Black Hills; however, with the exception of four small hunting camps in the Bearlodge mountains, these sites do not contain significant amounts of nonlocal lithic material (Table 4.5). Some Late Archaic and Late Prehistoric components at the large, multi-component spring-side base camps may represent occasional use of these sites by hunting parties from the plains; however, this is not clear from the limited investigations thus far undertaken at these sites.

The presence of base camps, storage caches, and possible pit house features also contradicts the model. Such site types and features are widely distributed both areally and temporally. Although quarry sites exist throughout the Black Hills, site patterning otherwise suggests selection based on proximity to water, wood, and other resources needed for group maintenance, rather than special resources. A few sites in the Bearlodge Mountains and the southwestern foothills do suggest that the western edge of the Black Hills functioned within a Powder River Basin based settlement system to a limited extent, especially during the early Late Archaic period.

Table 4.5: Lithic raw material sourcing patterns for Black Hills sites. L=All local lithics, NM=minor amounts (<1% flakes or tools) of nonlocal lithics, NS=significant amounts (>3% flakes or tools) of nonlocal lithics. "Hunting camps" include pre and post-hunt camps and/or game processing stations.

| Site Type | L | NM | NS | Sites Include |
|---|---|---|---|---|
| Multiple component seasonal base camp w/ plant food processing and/or butchering, Hogback/foothills | 11 | 8 | 0 | McKean, Hermosa, Miner Rattlesnake, Gant, Hurt's Other, Dead Sage (MA component), Mule Creek, 48CK46, 39CU271, Lissolo Cave, 39FA416, 39FA426, 48WE320, 39CU331?, 39FA422?, 39CU557, 48CK13, 48CK4?, 48CK47 |
| Bison procurement or processing, Red Valley | 2 | 0 | 1 | Hawken, Vore, Sanson |
| Multicomponent spring-side base camps, Interior zones | 6 | 3 | 3 | Ditch Creek, 39LA117, 39CU1048, 39PN795, 39PN239, 39PN150, 39CU626, 39CU628, 39PN77, 39PN100, 39PN150, 39CU773, 39PN47 |
| Multiple component base camp in rock-shelter, Interior | 1 | 0 | 0 | Beaver Creek |
| Other multiple component base camps, Interior zones | 9 | 0 | 1 | Deerfield, 39CU251, 39CU253, 39CU566, 39CU728, 39CU811, 39CU989, 39CU1145, 39CU1172, 39PN690 |
| Multiple component base camp, Red Valley | 1 | 1 | 0 | 39CU1182, 39FA292 |
| Single component multifunction camps, MA & LA | 9 | 2 | 0 | 39FA437, 39FA457/458, 39FA530, 39CU144, 39FA406, 39CU690?, 39FA452, 39FA307, 39FA506, 39CU1214, 48CK837 |
| Single component multifunction sites, LP | 4 | 4 | 3 | 39CU539?, 39FA398, 48CK47, 39FA496, 39CU249, 39CU691, 39CU806, 39FA1153, 39PN86, 39PN1101, 39PN1170 |
| Plains Village pattern camps, LP | 2 | 0 | 2 | 39BU2, 39BU217, Phelps, 39FA48 |
| Small hunting camps, Paleo and Paleo/EA | 6 | 2 | 0 | 39PN97, 39LA319, 39CU32, 39CU249, 39CU1199?, 39FA1180?, 39LA117, 48CK840 |
| Small hunting camps, EA & MA | 6 | 0 | 0 | 39CU32, 39CU241, 39CU634, 39FA406, 39LA663, 39PN183? |
| Small hunting camps, LA | 3 | 0 | 4 | 48CK289, 48CK527, 48CK682, 48CK793, 39CU832, 39CU651, 39PN1109 |
| Small hunting camps, Besant | 7 | 0 | 0 | 39CU113, 39CU154, 39FA1010, 39PN219, 39FA993?, 48CK209, 39PN286 |
| Small hunting camps, LP | 2 | 4 | 0 | 39FA393, Dead Sage, 39CU449, 39CU1074, 39CU477, 39CU625 |

### 4.5.3 Plains-Based Seasonal Use

Taken as a whole, Tratebas's research suggests a third settlement and subsistence model for the Black Hills. This can be termed the Plains-Based Seasonal Use model. According to this model, none of the groups occupying the Black Hills was based solely in the mountains or plains. Instead, seasonal use of both areas is indicated for all of Black Hills prehistory, although the interior Black Hills were used more intensively during the Middle Archaic. Middle Archaic sites suggest a highly structured, scheduled (cf. Binford 1982) seasonal round. At other times, settlement patterns emphasized more use of the open plains and a more irregular and flexible seasonal round. A complete definition of the seasonal round of each period would require data from outside the Black Hills and was beyond the scope of Tratebas's study.

The basic patterns of site types and distributions defined by Tratebas (1986) have generally been confirmed by later archaeological investigations in the Black Hills (SARC files). Later work has led to the recognition of rockshelter habitations in the interior and Hogback zones as a typical Late Archaic site type (Noisat 1990); however, these sites do not contradict the pattern of small, short-term winter hunting camps defined in Tratebas's model. The Early Archaic period is better known now, due to limited excavation of the Beaver Creek rockshelter (L. Alex 1991; Martin et al. 1993) and the discovery of several other Early Archaic sites in the interior Black Hills. Data from the Early Archaic still are not adequate to more accurately define settlement patterns for the period using this model.

Tratebas asserts that the Black Hills area lacks base camps, as defined by Binford (1980). Instead, Black Hills residences fall somewhere between residential base camps and field camps as defined by Binford (Tratebas 1986). Residences in the Black Hills may be of comparable duration to Binford's field camps, but may have housed the entire social group, rather than special activity task forces. Other residence sites in the Black Hills were occupied by task groups, especially for hunting and meat processing. According to Tratebas, the lack of true base camps in the Black Hills may extend to the Northwestern Plains in general.

Tratebas's interpretation of Black Hills residential sites as primarily short-term occupations is the basis for her assertion that no mountain-based settlement patterns existed in the area. This fits well both with task-specific models, like Tratebas', and with the refuge model. These models view mountainous areas as resource poor, marginal environments. According to this view, the Black Hills environment does not have the potential to support human populations on a long-term basis. Instead, human occupation would have been based in grasslands areas where resource potential was most concentrated. This view has recently been reiterated specifically in reference to the Black Hills by Lippincott (1990):

> The Black Hills are often viewed as a cool, elevated and forested refugium or sanctuary from the hot dry grasslands. In reality they

> are more like other forested areas where biotic diversity, energy capture and net production are much less than in grassland communities. Coniferous forest soils decay very slowly and are able to support relatively few, large herbivorous vertebrates. Contrastingly, grassland soils contain large amounts of humus and can be amazingly productive. Also of importance is the characteristic of large grassland herbivores to be prolific and gregarious. Therefore current considerations on the overall importance of the Black Hills should be from a perspective of a temporary or specialized nature.

Archaeological data do not consistently fit the predictions of the Plains-Based Seasonal Use model. The model predicts the presence of seasonal base camps with significant amounts of nonlocal lithic material. Tools should be similar to types found in the surrounding areas. The complete seasonal round should not be present in the Black Hills, as the uplift would have been used only part of the year. Fall-winter-spring occupation of the foothills, Hogback, and Red Valley is one reasonable scenario. Plains-based groups seeking food and shelter could have followed bison herds into the Red Valley during the fall and returned to the high plains with warmer weather.

Fewer than half (18/45) of the reused base camps in the Hogback, foothills and interior Black Hills contain any nonlocal lithics, and only 6 (5 Interior and 1 Red Valley) contain significant proportions of nonlocal lithic material (Table 4.5). While typical northwestern plains projectile point types are found in components representing all periods of Black Hills prehistory, more divergent local types also occur in the Plano, Early Archaic, and Late Archaic periods. Evidence for plant food processing at the peripheral base camps suggests a late summer to fall occupation; however, with the exception of Mule Creek Rockshelter, these have strongly local lithic raw material assemblages. It is difficult to account for the near total lack of tools made from nonlocal materials, if these sites were indeed used on a regular basis by plains-based groups. The two probable Archaic winter camps thus far identified (George Hey and 39FA426) also contain only local lithics. These sites contained living floors that may indicate pit house structures, although neither postmolds nor distinct pit profiles were detected in the limited investigations at the two sites.

The discovery of postmold features at two Late Paleoindian and/or Early Archaic sites (Victoria Creek and Trail Draw) may also indicate construction of winter shelters in the interior Black Hills (Vallejo 1993; Tratebas and Vagstad 1979). A pit house feature at the Middle Archaic McKean site, a circular living floor at the Early or Middle Archaic 39FA426, and a postmold feature in a Besant component at 48CK209 suggest possible construction of winter shelters in the western foothills and southern Hogback during these periods. Unfortunately, excavation techniques at these sites were not adequate to clarify the function and seasonality of these structures. In general, archaeological field methods used in the Black Hills have not been adequate to detect pit house features. Only local lithics are reported from the sites with possible pit house features.

By contrast, a hypothesized Late Prehistoric winter camp, 39CU806, contained local debitage, but had a projectile point made of Knife River Flint (Rom 1987; author's analysis of lithics at SARC). The latter site contained stone circle features, rather than more substantial structural remains. Site 39FA392, an early Late Prehistoric winter camp, may provide a pattern intermediate between the Late Prehistoric tipis and the Archaic pit houses. This site contained the remains of an intensively used circular structure (tipi or wickiup) which had been placed over a dish-shaped depression dug into the sandstone bedrock (Tratebas 1979b). The latter site contained some hearth burials and artifacts similar to two other early Late Prehistoric sites in the Black Hills, 39FA71 and 39FA30 (SARC files reported in Tratebas 1979b; Wheeler 1957). No nonlocal lithics were reported for 39FA392; however, it is possible that nonlocal materials, such as Knife River Flint, were included in the chalcedony which comprised 10% of the surface collection and 2% of the subsurface material. The inclusion of bone awls (at 39FA392 and 39FA71) and pottery (at 39FA30) with burials is strikingly similar to Plains Village burial customs.

To summarize, both the reused seasonal base camps and the probable winter camps have a strongly local "look" until Late Prehistoric times. It is possible that some of the single component multifunction camps and some of the small pre- and post-hunt camps represent winter occupations of dispersed family groups. With few exceptions, however, these also have strongly local lithic raw material assemblages. The exceptions are the undated short-term base camp 39CU539 and the four Pelican Lake hunting camps in the Bearlodge. Another possibility is that selection of sites for testing and excavation is biased toward the more intensive occupation remains of locally based groups. The more ephemeral remains of temporary use by plains-based groups may have not attracted more intensive archaeological work. The greater prevalence of nonlocal lithic materials in surface collections than in excavated components lends considerable support to this possibility. On the other hand, the surface collections are more likely to date to the Late Prehistoric and Protohistoric and thus may accurately reflect a pattern of use of nonlocal lithics that was largely confined to those periods. In any case, an exclusively plains-based settlement system is not indicated for any period, including the Late Prehistoric.

### 4.5.4 Combined Mountain Archaic and Plains-Based Seasonal Use

Other researchers have questioned Tratebas's interpretation of these patterns as indicating only plains-oriented settlement systems. The fourth settlement pattern model proposed for the Black Hills recognizes both mountain- and plains-based settlement patterns (Sundstrom 1989, 1993). This recognizes a Mountain Archaic pattern in addition to the previously recognized Plains-Based Seasonal Use pattern. These may have coexisted during some or all of area prehistory. Another version of this combined settlement pattern model recognizes a shift from plains- to mountain-based settlement patterns in the Black Hills during the Middle Archaic period (Noisat et al. 1991). In other words, the two patterns occur sequentially, but not contemporaneously. The main difference between Tratebas's model and the later two models is that Noisat (et al. 1991) and Sundstrom (1989, 1993) recognize localized upland settlement patterns, as opposed to only plains-based settlement patterns.

Sundstrom (1989, 1993) proposes that settlement distributions in the Black Hills resulted from the operation of two distinct economic patterns. One is the plains-oriented bison hunting pattern recognized by Tratebas and other researchers following Frison' s (1991) model for the Northwestern Plains. (It should be noted, however, that Frison [1991] recognizes the existence of as yet undefined mountain-foothills adaptive patterns in uplands areas throughout the Northwestern Plains.) According this combined pattern model, groups adhering to the Plains-Based Sporadic Use settlement pattern spent most of their time in open plains areas in a largely unscheduled, nomadic seasonal round, following the bison herds and entering the outer Black Hills only for occasional winter habitation and gathering of wood and lithic raw material. Use of the interior uplift was even more restricted and sporadic.

Groups adhering to the Mountain Archaic or Mountain Tradition settlement pattern are hypothesized to have spent the entire seasonal round in the Black Hills, moving from the peripheral zones into the interior as spring snow melt and availability of plant and game resources permitted. These groups essentially followed the ripening berries and other edible plants up into the higher elevations, returning to the more sheltered Hogback, Red Valley, and foothills in the late fall. Deer, pronghorn, mountain sheep, rabbit, and other small animals, along with plant foods such as chokecherry, pricklypear, and possibly sego lily and other roots, formed the subsistence base. This was a regularized or scheduled (cf. Binford 1982) subsistence pattern, with groups returning to sites on a periodic, seasonal basis to exploit particular resources. Ecotone areas such as the exterior Hogback and high elevation meadows and prairies or "balds" were favored for periodically reoccupied, warm season base camps with nearby special activity sites.

This broad-spectrum mountain-based settlement pattern blossomed during the Middle and Late Archaic; however, it was not restricted to these periods. The term Mountain Archaic is intended to connote an "archaic" pattern of adaptation (i.e. scheduled, broad-spectrum foraging), not "Archaic" in the temporal sense. Sundstrom (1989, 1993a) recognizes late Paleoindian and Early Archaic precedents for the Mountain Archaic pattern at sites such as Ray Long and Beaver Creek. This suggests coexistence of mountain- and plains-based settlement patterns for most, if not all, of Black Hills prehistory. The hypothesized dual settlement patterns would place some of the winter habitations of both groups in the Hogback and foothills zone; these sites may be distinguishable by their greater or lesser amounts of nonlocal lithic material. The model further predicts that special activity sites, such as lithic quarries and shaft production stations, with significant amounts of nonlocal lithic materials or nonlocal lithic reduction technologies should occur at resource rich areas throughout the Black Hills. The mountain-oriented pattern should be expressed archaeologically as a series of large, reoccupied residential base camps in resource rich areas, with smaller special activity sites associated. These should contain local lithics and reduction sequences (cf. Keyser and Fagan 1987). Subsistence remains at the mountain-oriented sites should reflect a broad array of resources, with little or no bison.

No systematic attempt has been made to test Sundstrom's model. Studies of site patterning in the central Rockies support Sundstrom's proposed broad-spectrum mountain-based settlement pattern model (Bender and Wright 1988; Black 1991). In these areas, as well as the Bighorns and Montana Rockies, a mountain-based settlement pattern is now recognized. This has variously been termed the Mountain Tradition by (Black 1991), the Mountain Branch (Husted 1969), Mountain Complex (Grady 1971), and Montane Tradition (Wheeler and Martin 1984). Bender and Wright (1988) note that occupation of mountainous environments in Colorado, Wyoming, and Montana was continuous from late Paleoindian through Late Prehistoric times. The stable levels of occupation in uplands even during the Altithermal climatic period suggest to Bender and Wright a highly resilient and successful form of adaptation. This adaptation was based on scheduled seasonal exploitation of a wide variety of resources. These authors argue that a broad spectrum strategy is the most resilient form of adaptation in the face of environmental perturbations such as the drought cycles of the Northwestern Plains.

Site patterning in the interior Black Hills matches that predicted for the Mountain Tradition, derived from studies in the central Rockies (Bender and Wright 1988; Black 1991). Bender and Wright (1988) interpret the pattern of large, periodically reoccupied base camps, surrounded by smaller satellite activity areas and camps, as indicative of a scheduled, broad-spectrum subsistence pattern based on seasonal movements between higher and lower elevations. They specifically reject the refuge model and task-specific models like that proposed by Tratebas (1986) for this pattern of site distribution. Black (1991) essentially agrees with Bender and Wright, but notes the spatial overlap of mountain- and plains-based settlement patterns in foothills areas in the central Rockies.

Although these two studies tend to support Sundstrom's model, the Black Hills are different from the central Rockies. The studies cannot be applied to the Black Hills uncritically. Elevational differences are less pronounced in the Black Hills than in the Rocky Mountains proper. Snowpack is more limited in extent in the Black Hills, with many interior areas remaining open to travel year-round. Plains-based groups could easily penetrate to the core of the Black Hills, while a similar trek in the Rockies would involve much greater distances and difficulty. More research is needed before Sundstrom's model can be either confirmed or revised to more accurately reflect the Black Hills situation.

This model predicts the development of divergent, localized tool types and localized raw material assemblages. Multiple function base camps should occur at both high and low elevations. Both warm and cold season base camps or residential camps should be present in the Black Hills, reflecting seasonal movement. Base camps should be located to maximize access to water, wood, terrain suitable for camping, and access to resource patches. These sites are expected to exhibit evidence of multiple episodes of use, with site function remaining stable through time. Diverse subsistence remains, emphasizing storable resources and resources whose availability was predictable both spatially and seasonally, are expected. The scheduled reuse of seasonal camps should be reflected by the presence of tool caches, semipermanent shelters, and storage facilities.

All of these expected patterns are present to some extent in the Black Hills. Many warm season and a few cold season camps have been identified. Most of the latter contain evidence of constructed shelters, in the form of postmolds, stone circles, and/or circular living floors. Periodic reuse of sites in ecotone zones is clearly indicated by 15 sites in the Hogback and foothills and by the high elevation Deerfield site. All contain evidence of plant food processing in the form of extensive hearth or fire pit complexes, groundstone tools, and/or actual plant remains. Tool and/or lithic raw material caches were found at Miner Rattlesnake, Harbison, Lissolo Cave, McKean, and in the general vicinity of the George Hey site. With the exception of the Deerfield site, these ecotone sites contain few or no nonlocal lithics. With the exception of four bison procurement or processing sites in the Red Valley, Black Hills sites with preserved bone contain diverse faunal assemblages, typically containing some combination of deer, pronghorn, bison, jackrabbit, mountain sheep, small rodents, frogs, shellfish and fish.

In addition to these factors, two more specific attributes of the archaeological record of the Black Hills provide support for the Mountain Archaic model. The first is the presence of localized lithic tool traditions; the second is rock art. The Black Hills projectile point assemblage includes several types that appear to represent local variants of types known from montane environments elsewhere in the northern plains. One type vaguely reminiscent of Hell Gap has been tentatively assigned to the Plano period. Other types exhibit similarities to Pryor Stemmed, Jimmy Allen, Lovell Constricted, Lookingbill, and other terminal Paleoindian types found in the Bighorns and Pryors. A distinctive rounded-stem point type found at 8 sites in the Black Hills is similar to point types from the Bighorns and southern Rockies associated with a Mountain Archaic tradition in those areas (Black 1991:17). This type has not been securely dated in the Black Hills, but is most often referred to the terminal Paleoindian, Early Archaic, or Middle Archaic.

Other aspects of lithic technology considered diagnostic of Mountain Archaic traditions by Black (1991) are also present at some Black Hills sites. These include blade technologies, microtool traditions, split-cobble lithic reduction technologies, and split-cobble core tools. Black (1991:8) considers the latter particularly diagnostic of montane traditions, as such tools rarely occur in plains sites. It should be noted these aspects of lithic technology in the Black Hills occur alongside more typical northwestern plains lithic traditions. Split-cobble blade cores, including examples utilized as push-planes, have been reported from three localities in the Black Hills (Harbison, Keyhole Reservoir, and Gant; Sundstrom 1981; Kornfeld et al. 1991; SARC collections). It is difficult to gauge their importance in the Black Hills, as such cores have not been recognized as a specific artifact class in treatments of lithic assemblages from the area.

Another defining characteristic of the Mountain Archaic tradition is the presence of rock art with stylistic links to Great Basin styles. Pecked Realistic rock art in the Black Hills shows clear associations with the general western or Great Basin rock art tradition. This style of rock art in the Black Hills can be securely dated to the Archaic era on the basis of subject matter (atlatls) and its stratigraphic, geomorphic, and physical contexts (Sundstrom 1990). It may extend back into the Paleoindian period, as well, if AMS radiocarbon dates on microscopic organic matter sealed under patinas covering rock art can be considered reliable (Tratebas 1992). The rock art depicts capture of deer, mountain sheep, and pronghorn using nets or other artificial enclosures. Just such a hunting net was recovered from a Mountain Tradition site in the Absorokas and dated 8860 BP (Frison et al. 1986). The latter site was considered typical of Mountain Tradition sites in its apparent links to Desert Archaic materials occurring farther west (Black 1991:17).

While these factors present a strong argument for including the Black Hills in Black's Mountain Tradition, not all Black Hills sites seem to fit the pattern. Many Late Prehistoric and some Paleoindian sites in the Black Hills contain nonlocal lithic material and look more like high plains sites than Mountain Archaic sites. During the long span of the Archaic and the latter portion of the Plano period, however, a Mountain Archaic tradition seems to have been firmly entrenched in the Black Hills.

The final settlement pattern model proposed for the Black Hills refers specifically to the Middle Archaic period (Noisat et al. 1991) and is a variant of the Combined Plains-Based Seasonal Use and Mountain Archaic model. This model hypothesizes a shift in settlement pattern during this period. During the early Middle Archaic, a "pulsatory" settlement pattern (cf. Butzer 1982) held sway. This is essentially the same as Tratebas's plains-based settlement pattern. Territories were very large, with seasonal base camps concentrated in open plains areas. Human use of the interior was largely limited to short-term hunting forays. During the late Middle Archaic period, this shifted to an "oscillatory" settlement pattern. This would have resulted in a less uniform site distribution, with large base camps and associated satellite resource extraction camps concentrated at stable resource bases in both the uplands and lowlands. Intervening areas were only minimally exploited and should contain few or no sites. This is essentially the pattern recognized in Sundstrom's mountain-oriented settlement pattern model.

Whether the mountain-based settlement pattern in the Black Hills reflects a Mountain Archaic Tradition continuing from Paleoindian through Archaic times (Sundstrom 1989, 1993a), or was a short-term development restricted to the late Middle Archaic period (Noisat et al. 1991), or did not exist at all (Tratebas 1986) is a question that demands further study. All three of these models follow the earlier refuge model in attributing shifts in settlement patterns to climatic factors. The near total lack of paleoenvironmental data from the Black Hills makes this aspect of the three models difficult to assess. All that can be said at this point is that the intensification of use of upland territories in the Middle Archaic period apparently corresponds not with dry conditions, as the refuge model predictes, but with a return to less extreme climatic conditions.

## 4.6 Lithic Raw Material Studies

Few clear patterns emerge from a consideration of the use of local versus nonlocal lithic raw materials in the Black Hills. A recent study (Andrefsky 1994) suggests that lithic sourcing studies may yield different results in areas in which a wide variety of lithic types is available locally. In such areas, both expedient and patterned tools may be made of local materials. Few sites in the Black Hills contain more than a handful of exotic lithics. Amounts of nonlocal materials in excess of 3% in either debitage or tool assemblages are considered significant here.

The vast majority of sites thus far investigated in the Black Hills contain only local materials (Table 4.5). In addition to this strong local bias, two problems inherent in the available data make any conclusions tentative. First, lithic types were not well defined at the time most of the data were compiled. Researchers noted the difficulty of separating Knife River Flint from similar chalcedonies from the Flattop quarries in Colorado and from outcrops in the White River Badlands. The distribution of purple to brown chalcedonies is now known to be quite wide-spread (Hoard et al. 1993); outcrops of such material are now reported from Wind Cave National Park in the southern Black Hills (SARC files). The term Spanish Diggings has most often been used to describe quartzites and cherts from the Hartville Uplift in southeastern Wyoming (cf. Reher and Frison 1980), but at least one researcher also included local Black Hills materials in this category (Tratebas and Vagstad 1978). Identical dendritic and mottled cherts occur in the Black Hills proper. Many comparative collections of Black Hills materials are incomplete and thus do not recognize the variability of local types. For example, quartzite quarries can be found in several areas of the southern Hogback, with types ranging from coarse, poorly cemented types to fine-grained, highly siliceous materials. Hogback quartzites range from whites, tans, pinks, grays, and lavenders to dark brown, maroon, purple, and gold. Mottled and banded types occur locally as well. Lithic procurement sites in the Bearlodge Mountains have only recently been discovered and described (Church 1990; Buechler and Malone 1987).

In this study, types defined as nonlocal include obsidian, porcellanite (Porcellanite 1 and 2), Badlands plate chalcedony (Silicate 3 subset), and Knife River Flint (Silicate 9). No obsidian was found at the Blaine site; however, the other three types do occur. Figure 4.2 shows the nearest source locations for these materials. The nearest source for obsidian is the Yellowstone area of northwestern Wyoming and eastern Idaho. Porcellanite occurs in the Powder River Basin, just west of the Black Hills. Plate chalcedony outcrops throughout the White River Badlands just east of the Black Hills. Tan to brown chalcedonies, variously referred to as Flattop or Scenic chalcedony, outcrop widely in White River Group formations and can be found in eastern Colorado, northwestern Nebraska, and southwestern South Dakota (Hoard et al 1993). These are not


Figure 4.2. Location of lithic raw material sources.

readily distinguishable from chalcedonies outcropping locally in the Black Hills. Knife River Flint was obtained from quarries on the upper Missouri in North Dakota. Spanish Diggings cherts are also noted, but cannot confidently be classified as nonlocal due to the presence of nearly identical materials in the Paha Sapa formation in the Black Hills proper (Church 1987:10; Church 1988:5). The main Spanish Diggings (Silicate 10) quarry sites are located in the Hartville uplift immediately southeast of the Black Hills proper. Given the relatively poor quality of the data, a detailed statistical treatment of lithic source patterning in the Black Hills is not justified. Instead, general patterns will be discussed within the context of the hypotheses presented in Table 4.4.

No clear lithic source patterning marks the bison procurement sites in the Red Valley. The Late Prehistoric Vore buffalo trap in the northern Red Valley has by far the greatest amount of nonlocal lithics of any Black Hills site. It contained 66.5% Spanish Diggings materials, 10.5% porcellanite, 6.4% Knife River

Flint, 3.9% dendritic chalcedony (of unknown source), and only 6.6% Hogback quartzite (Reher and Frison 1980). Even allowing for some misidentification of local materials as Spanish Diggings, the high percentages of nonlocal material are striking. By contrast, the nearby Hawken site, an Early Archaic bison trap and butchering site contained only local lithics (Frison et al. 1976; Frison 1991). A small sample of lithics from the Late Prehistoric Sanson Buffalo Jump in the southern Red Valley also contained only local materials (Agenbroad 1988).

Periodically reused seasonal base camps in the Hogback and foothills zones have strongly local lithic components. These are the large fire pit or hearth complexes that dot the peripheries of the Black Hills, as well as two small tipi ring camps in the eastern foothills. Each contains two or more components dating between Plano and Late Prehistoric times. Of 18 sites, 12 contained only local lithics, while the remaining 6 contained very minor amounts of nonlocal materials. The 146 tools at 39FA422 in the southern Hogback included three of nonlocal material: a small, shallowly side-notched projectile point and a scraper of Knife River Flint and a knife of Badlands plate chalcedony. The remaining tools and debitage were local (Haug et al. 1980). Site 39CU331, a Middle Archaic base camp in the eastern Black Hills, contained a single obsidian flake (Noisat 1992). This site may contain additional components not discovered in the limited testing. The Middle Archaic Gant site in the northeastern foothills contained one drill fragment of Knife River Flint (Gant and Hurt 1965). The mixed Plano through Late Prehistoric assemblage from 39FA416 in the southern Hogback contained three tools of nonlocal material out of an assemblage of 234 tools. These were pointed bifaces of a possibly nonlocal black chert and Knife River Flint, and a Badlands knife. Less than 1% of the debitage was porcellanite; the remainder was local (Haug et al. 1980). Of 128 tools at 48WE320 in the western foothills, only a porcellanite Late Prehistoric projectile point and a KRF scraper can be counted as nonlocal. The 2516 pieces of debitage included 2 porcellanite and 3 KRF flakes (McKibbin 1988). The small amount of porcellanite is striking, given the location of the site at the eastern edge of the Powder River Basin. A stronger western component was evident at the Mule Creek site, in the western foothills. There small amounts of porcellanite and obsidian were present throughout the Middle Archaic through Late Prehistoric components (Wheeler 1957).

Interestingly, multicomponent base camps in the interior Black Hills have a somewhat stronger nonlocal signal than those in the peripheral zones. Of 23 such sites, 16 contained only local lithics. Three other sites contained insignificant amounts of nonlocal material.

Four of the interior base camps contained significant amounts of nonlocal material. The debitage assemblage at 39LA117 contained 4% porcellanite, while the tools included 8% porcellanite and 2% plate chalcedony. In addition, 41% of the debitage and 8% of the tools from 39LA117 were of chalcedony (Sundstrom et al. 1994). While this was considered a local material, it is possible that some KRF or Scenic/Flattop chalcedony was included in the category. The debitage assemblage from Deerfield contained 1% porcellanite and smaller amounts of obsidian, NVN glass, and KRF; however, 7.9% of the utilized flakes and 9.2%

of shaped tools were made of nonlocal materials (Buechler 1984). The tool assemblage from 39PN77 contained a single KRF scraper, comprising 3.8% of the tools at the site (Tratebas and Vagstad 1979). No figures are available for debitage lithic raw material types at Ditch Creek; however, KRF and porcellanite were present. About 5% of the shaped tools and retouched flakes were made of KRF; no porcellanite tools were reported (Tratebas and Vagstad 1979).

Six spring-side sites and the Beaver Creek rockshelter contained only local lithics. The remaining three spring-side base camps contained very minor amounts of nonlocal lithics. A multiple component base camp in the Red Valley, 39FA292, contained only local material (Weston 1983). A second possible Red Valley base camp, 39CU1182, had a single tool of Badlands plate chalcedony in its artifact assemblage (Wolf and Miller 1992a).

Single component multiple use camps (base camps or more temporary residential camps) dating to the Middle and Late Archaic contain localized lithic assemblages. Nine of 11 sites in the Black Hills sites fitting this description contain only local lithic material. Site 48CK837 contained several blade cores of NVN glass (Kornfeld et al. 1991). Site 39CU1214 contained small amounts of obsidian and porcellanite debitage (Wolf and Miller 1992b).

By contrast, nearly two-thirds of the 11 single component multiple use camps dating to the Late Prehistoric contain nonlocal lithics. Four sites contained only minor amounts of nonlocal materials; three had significant amounts; and four contained only local lithics. Plains Village pattern sites dating to the Late Prehistoric also contained fairly high amounts of nonlocal lithics. Two of four sites in this category contained significant amounts of nonlocal lithics, including porcellanite, KRF, Badlands plate chalcedony, and obsidian.

The small Late Prehistoric pre- and post-hunt camps and game processing stations contain slightly more localized lithic assemblages. Two sites, 39CU449 and 39CU1074, contained only local materials. Four other sites contained very small amounts of nonlocal lithics. Small hunting camps of probable Besant affiliation suggest even greater localization. None of the seven sites in this category contained any nonlocal lithic material. The three Pelican Lake-era small hunting camps identified in the Black Hills proper had only local material; however, four Pelican Lake hunting camps in the western Bearlodge mountains contained significant amounts of porcellanite and obsidian. Of eight Paleoindian or Early Archaic hunting camps in the Black Hills, two contained minor amounts of nonlocal lithics.

The overall trend in the Black Hills data is toward highly localized raw material assemblages. This is not surprising given the wide availability and variety of local stone. These same factors also make the nonlocal lithics of particular interest. Since it was not necessary to import lithic raw material into the Black Hills, such materials can be taken as reliable indicators of movements of people, despite the low amounts of nonlocal materials involved. Several sites appear to confirm the hypothesized occasional use of the Black Hills by groups centered in the Powder River basin to the west. These include the four early Late Archaic hunting camps in the Bearlodge mountains, 39LA117, and 39FA496. More regular use of the Black Hills by groups from the west is suggested by the lithic assemblages from the Mule Creek, Deerfield, and Vore sites. Vore in particular seems to represent the wholesale import of both lithic materials and bison hunting and butchering techniques from the high plains west and southwest of the Black Hills. Deerfield and Mule Creek, by contrast, appear to represent seasonal base camps at which a variety of activities, including plant food processing and storage, took place.

A different pattern is seen in the distribution of KRF and Badlands plate chalcedony. Site 39FA422 in the southern Hogback contained a small, shallowly side-notched projectile point of KRF, as well as a KRF scraper and a Badlands knife. Such shallowly side-notched points have not been securely dated. Their stratigraphic context at the Ditch Creek site suggests that they date to the Middle Archaic or Middle/Late Archaic transition. At Ditch Creek as at 39FA422 these points were associated with KRF debitage. Another of these points, made of KRF-like material, was found at 48CK46 in the western foothills (Wheeler 1957). Another KRF side-notched point was recovered from the Deerfield site; however, the exact morphology of this point is not clear from the report. Site 39FA416 in the southern Hogback contained another of the shallowly side-notched KRF points and a Badlands knife. An undated single component camp in the eastern Red Valley, 39CU539, contained a projectile point midsection of a dark chalcedony, which was identified as KRF or Scenic chalcedony. Half of all debitage at the site was comprised of the brown to black chalcedony; a single obsidian decortication flake was also found.

If these data are representative, occasional or seasonal use of the Black Hills by groups from the Middle Missouri area may have started as early as the Middle/Late Archaic transition. Badlands plate chalcedony is occasionally included in Plano, Middle Archaic, and Late Prehistoric components; however, the clearest age association for the Badlands and KRF material is initial Late Archaic. Both types tend to occur as finished tools, rather than debitage, strongly suggesting seasonal movement into the Black Hills from the Middle Missouri area. As these seasonal huntng groups reached the Black Hills they discarded their expended tools and presumably replaced them using locally available raw material.

A more complete exploration of this possible early Middle Missouri use of the Black Hills awaits more secure dating of the shallowly side-notched point style. The apparent correlations between early Late Archaic short-term camps, shallowly side-notched points, and Badlands plate chalcedony and KRF beg additional research.

These observations generally agree with patterns suggested by Tratebas's principal components analysis of surface assemblages from the Black Hills. In the latter study, Late Archaic sites were correlated with use of Badlands chalcedonies (Tratebas 1986), an association also seen in the assemblages currently being studied. An association between Late Prehistoric occupation and use of porcellanite and obsidian is also indicated by both studies.

The major point of disagreement between this and Tratebas's study is in Middle Archaic lithic source patterning. Tratebas suggested that Middle Archaic sites were characterized by use of porcellanite, KRF, and Badlands chalcedony. The present study, by contrast, generally associated porcellanite with Late Prehistoric components and KRF and Badlands with Late Archaic components. While about half of the multicomponent spring-side sites contained some nonlocal material, none of the single component Middle Archaic sites contained nonlocal lithics. There are two possible explanations for this discrepancy. The first is that the inclusion of mixed component surface assemblages in the principal components analysis influenced its results (Tratebas 1986). The second is that some periods of prehistory are characterized by more than one lithic raw material use pattern. Both studies provide some evidence for the latter explanation. For example, KRF consistently occurs in components containing probable initial Late Archaic projectile points, but single component Late Archaic base camps and hunting camps lack KRF. The strong pattern of localized lithic sources suggested by Besant and Pelican Lake hunting camps is broken by the presence of porcellanite projectile points at four hunting camps in the Bearlodge and at a high-altitude base camp in the interior Black Hills (39LA117). This suggests that lithic use patterns vary with both site function and cultural affiliation. The gross temporal divisions may no longer be adequate for studies of lithic source patterning. At the same time, it is clear that different types of contemporaneous sites exhibit differences in lithic source patterning.

## 4.7 Summary

In all probability, no single mountain-based or plains-based settlement pattern can adequately account for the totality of archaeological evidence in the Black Hills. Evidence for both patterns occurs in the Black Hills in various places and at various times. It should be remembered that Tratebas' work was based on a nonrandom sample of surface collections. Her position that base camps are not present in the area might have been altered if sites such as Gant, McKean, Deerfield, 39CU330, and 48WE320 were included in the sample. These all provide evidence of large, periodically reoccupied multiple activity camps in ecotone zones. They generally fit the definition of a base camp as a place where entire social units gathered on a regular basis.

On the other hand, movement between the high plains of the Powder River country and the western Black Hills is clearly indicated by lithic raw material assemblages from both areas. Ethnographic data also support the view of the Black Hills as an area used principally for extraction of special resources, rather than as a home base for groups occupying the high plains at the time of initial contact with non-natives. This information is difficult to evaluate, however, since the wide-spread adoption of horse culture had arguably already transformed protohistoric plains people from hunters and gatherers to a quasi-pastoralists. Horses are not well suited to either mountainous habitats or to broad-spectrum subsistence systems. The acquisition of horses by some groups appears to have ultimately permitted to the conquest of nonequestrian groups and their removal from the Black Hills. The area was then used only as an occasional resource extraction area by groups following a plains-based economy based on horse pastoralism and highly specialized bison hunting.

Prehistoric populations based on the plains probably have always used areas such as foothills, mountain slopes, and wooded stream valleys for winter shelter and acquisition of resources such as wood and lithic raw material. In addition, plains communal big-game hunting adaptations have probably always included exploitation of a wide variety of plant and animal species as secondary or seasonal resources. By the same token, mountain-based groups may have made occasional use of bison as local conditions permitted. For example, the high elevations or "balds" in the interior Black Hills probably supported local populations of bison, which may have been a major food resource for groups following a basic Mountain Tradition subsistence pattern. The Deerfield site (Buechler 1984) can be argued to represent just such a mixed pattern.

These factors make it difficult to draw a strict dichotomy between the two basic settlement patterns. A comprehensive view of settlement and subsistence in the Black Hills will require a consideration of a variety of site attributes, including patterns of lithic raw material distribution, defined tool associations (tool kits), patterns of lithic debitage discard, feature-artifact associations, patterns of site reoccupation, direct subsistence data (seeds, bone scrap, etc.), and site setting in regard to natural resources and other sites. Are sites distributed randomly across the environment, as is typical of unscheduled, hunting-based subsistence systems, or do sites tend to be tied to high-yield resource areas, as is typical of broad-spectrum subsistence strategies based on resource predictability and scheduling? Do sites exhibit evidence of periodic reoccupation or do they represent single-use habitations? What kinds of resource extraction are associated with residential sites? Do the features and tools indicate use of resources not directly preserved in site deposits? Is there evidence of middens, storage facilities, constructed housing, or other indicators of stable, periodic, or long-term occupation of a site? Were excavations at sites used for comparative analysis adequate to detect such features? (Historically, this has not been the case in the Black Hills.) These and other issues need to be factored in to our approaches to questions about prehistoric use and perceptions of the Black Hills and other uplands environments.

# Chapter 5

# RESULTS

## 5.1 The Blaine Site Excavations

Table A.2 in the appendix lists the Blaine site excavations, including the 1992 testing phase. Two types of excavation were employed: hand excavation and machine excavation. The hand excavations include Block A, Block B, Block C, the features, the test units, and the shovel tests. The excavation technique was shovel skimming. All of the soil from the hand excavations was either dry screened through 1/4-inch mesh or kept for later flotation and water screening through a 405-micron mesh. A total of 108.6 square meters were hand excavated at the Blaine site. An additional 3955 square meters were exposed through grader operations. Backhoe trenches conducted for the geomorphology study provided additional subsurface exposure (Figure 5.1). The shovel tests preceded the test units and discovered the presence of buried materials on the site. These tests were roughly 40 cm diameter, postlike holes taken to a depth of about 50 cm. The 15 shovel tests were dug during the 1992 testing phase. Except for a 1x2-meter excavation that cross-sectioned a cairn (Feature 1) the test units were 1x1-meter units excavated independently. The tests were generally noncontiguous units spread across the site area, but some of the units were adjoining. These adjoining units were test expansions, usually following what appeared to be potential features. Except for a few shallow tests located within the surface features (the stone alignments), the test units were taken down to the first gravel horizon. Some of the units on the north side of the highway were taken down to a second, or even third, gravel horizon. Most of the 44 test units were excavated in 1993. The block excavations were composed of contiguous 1x1-meter units in which the unit levels were dug simultaneously. A randomized 1.5% soil sample was taken from blocks A and B. The soil samples were 25x25-centimeter blocks of soil located within selected units. These samples were later water screened. Block A (5x5 m) was the mitigative excavation of stone alignment surface feature, Feature 2. Block B (5x5 m) was situated over an area that showed the best potential for unearthing substantial Late Archaic remains (Figure 5.2). The placement of Block B was based on materials recovered from Test Unit N412E874 and subsequent surrounding tests units. Block C (2x2 m) was a small excavation within the center of the surface stone alignment, Feature 4. The subsurface features consisted of hearths or fire pits. These features were treated as units in and of themselves. They were excavated in halves, typically a north half and a south half. This technique provided a feature profile in which to expose multiple lenses or layers and feature morphology. All of the feature fill was saved for later flotation. Individual features are described below. Backhoe Block A was partially excavated by machinery. This approximately 55-meter block was an expedient excavation. The purpose of this block was to expose a large area over what was thought to be the oldest cultural layer present at the Blaine site. A few test units north of the highway had uncovered cultural remains just below the first gravel horizon. If this horizon was the stratigraphic equivalent of the first gravel horizon located south of the highway, cultural materials there would predate Feature 6, radiocarbon dated at 5580 BP. A backhoe was used to remove the overburden above the gravel. The gravel horizon was then removed by hand and the block was leveled off. The hand excavation started at 52 to 54 cm b.s. (elevation 1410.60 to 1410.72) with shovel skimming (Figure 5.3). The excavation was terminated at 56 to 64 cm b.s. (elevation 1410.54 to 1410.62). Unlike the other blocks, this block was excavated as a single unit and level. All soil was screened, and a single soil sample was taken.

Machine excavations included the geomorph trenches and windows, the stripping, and a telephone-trench. Nine trenches and ten windows were excavated for the geomorphology and soils studies (Figure 5.4). Features 8 and 9 were exposed during the trenching. The geomorph trenches were 24 in. wide and extended to a depth of at least the first gravel horizon. The geomorph windows were deep backhoe probes into terrace deposits. A small, T-shaped trench was dug by US West Communications for replacement of a telephone line pedestal. The trench was located approximately at the center of the site area on the north side of the highway. The digging was monitored, and a single tool was piece-plotted during the trenching. The telephone trench was not included in the site grid system.

The site was stripped in order to expose areas not covered by the hand excavations. The main purpose of this was to ensure that features had not been missed. When encountered, tools, cores, flake concentrations, and bone were piece-plotted and collected. There were two stripped areas, designated I and II. Stripped Area I was on the north side of the highway and Stripped Area II was on the south side. The stripping was conducted in two phases. In the first phase a roadgrader, furnished by the Custer County SDDOT shop, stripped off the O, A, and the Ab soil horizons. This was essentially removing the black topsoil and exposing the top of the lighter B horizon soils, a depth of roughly 7 to 10 cm. The grader made two passes. The first pass was very shallow, about 5 cm. This effectively removed the sod in order to expose any features associated with the stone alignments and what was thought to be the depth of the Late Prehistoric component (Componont A). The second pass removed the remaining Ab horizon in hopes of exposing features associated with the Middle

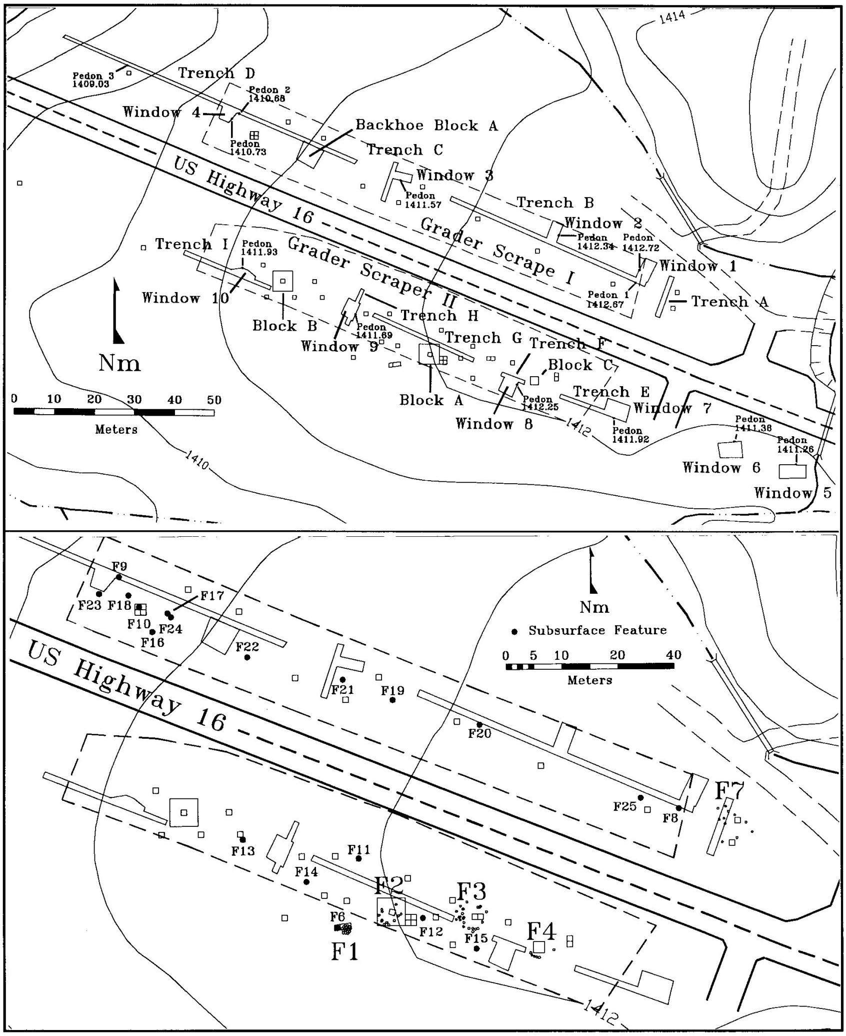



Figure 5.1. Excavation units, grader scrapes, and backhoe trenches at the Blaine site.

Figure 5.2. Excavation of Block B, 39CU1144.

Figure 5.3. Excavation of Block A, 39CU1144.

Figure 5.4. Excavation of geomorph trenches at the Blaine site.

to Late Archaic component (Componont B). Features 11 through 20 and Piece Plots 165 through 221 were found during this first phase of stripping.

Some weeks later stripping continued with the second phase (Figure 5.5). This time the stripping was done with a bellyscraper, which was provided by the principal highway contractor, the Guernsey Stone and Construction Company of Omaha, Nebraska. Several passes were made, taking off approximately 6 in. of soil each time. The stripping was terminated at the first or second gravel horizon. Features 21–25 and Piece Plots 222–226 were exposed by this second phase of stripping.

## 5.2 Radiocarbon Dates

Eight radiocarbon dates were derived from cultural material from the Blaine site. All of these dates were on charcoal from hearth features. Dates range from 2500 to 6940 BP. This interval spans the Early and Middle Archaic periods as they are currently defined for the Black Hills. The two most recent dates fall at the Middle and Late Archaic boundary. Four dates fall within the Middle Archaic period. The remaining two dates fall within the Early Archaic period. The radiocarbon analysis is summarized in Table 5.1. Additional radiocarbon dates on noncultural material are presented in Chapter 6.

Radiocarbon dates from the upper levels of the Blaine site are inconsistent with feature depth. Dates ranging from 2500 to 3600 BP are somewhat ran-

Figure 5.5. Belly-scraper operations at the Blaine site.

Table 5.1. Summary of radiocarbon analysis from the Blaine site, 39CU1144.

| Sample No. | Feature | Elevation | Depth | Measured Age | $^{13}C/^{12}C$ Ratio | Corrected Age |
|---|---|---|---|---|---|---|
| Beta-74815 | 14 | 1411.92 | 13–30 cm | 2490±60 | -24.5 o/oo | 2500±60 BP |
| Beta-74817 | 17 | 1410.74 | 26–43 cm | 2560±60 | -25.6 o/oo | 2550±60 BP |
| Beta-74818 | 19 | 1411.55 | 8–25 cm | 3120±60 | -26.9 o/oo | 3090±60 BP |
| Beta-74816 | 16 | 1410.72 | 22–40 cm | 3160±60 | -26.2 o/oo | 3140±60 BP |
| TX-8153 | 8 | 1412.54 | 15–34 cm | 3190±60 | -24.3 o/oo | 3200±60 BP |
| TX-8154 | 9 | 1410.49 | 17–40 cm | 3580±80 | -24.1 o/oo | 3600±80 BP |
| Beta-55604 | 6 | 1411.43 | 45–57 cm | 5580±90 | – | – |
| Beta-74819 | 23 | 1409.88 | 72–87 cm | 6950±80 | -25.9 o/oo | 6940±80 BP |

domly distributed within the B Component level from 8 to 26 cm below surface. This indicates either a very slow rate of deposition or alternating episodes of deposition and erosion during this period. Diagnostic artifacts from this component tend to indicate a somewhat later age for the component, again indicating slow or interrupted deposition. Much of this material apparently was deposited on the surface of the T2 terrace after its abandonment around 3100 BP (see Chapter 6), while the pre-3100 BP hearth features date to the terminal period of terrace building. The lack of stratigraphic separation of features of different ages in this component is due to much of the material having been deposited during a prolonged period of surface stability. These materials overlay a shallow subsurface cultural deposit. Mixing of these surface and subsurface deposits apparently took place as hearths were dug into the subsurface component.

The dates and projectile points indicate that the upper 30 cm of the site represents some 3600 years of deposition, indicating an average rate of net deposition of less than 0.1 cm per century. The remaining two dates, from 45 and 72 cm below surface, are stratigraphically consistent, suggesting more rapid or continuous deposition during the period from 7000 to 5600 years ago. This yields an average rate of deposition of about 0.3 cm per century. The latter two dates and the upper dates taken as a set form a stratigraphically consistent sequence (although the upper dates are stratigraphically mixed). A gap of 2000 years (3600 to 5600 BP) occurs between the Componont B and Componont C dates. This corresponds with a gap in the vertical distribution of the tops of features between 26 and 47 cm below surface. Some Componont B features extend as far as 43 cm below surface, but none overlaps the upper elevation of the Componont C features (ca. 45 cm below surface). In other words, there is a break in feature distribution by depth at about 43–45 cm below surface. The 2000 year gap in radiocarbon dates may indicate a period during which the site was not in use, corresponding to the end of the Early Archaic period and the first half of the Middle Archaic period. Alternatively, a period of erosion may have removed any cultural deposits left during the apparent gap in use of the site. The disconformable contact between the upper two formations making up the terrace fill (pre-Kaycee and Kaycee) supports the latter alternative (Chapter 6). The break in feature elevation distribution also suggests a stratigraphic disconformity separating the two cultural components.

## 5.3 Features

A total of 25 features were excavated at the Blaine site. These included 4 stone circles, 2 rock cairns, 18 hearths, and one ash lens (Table 5.2). A large amount of rough (nonchipped) rock occurred within the Blaine site cultural layers. Some of this rock was found within hearth features and as stone circles (tipi rings), indicating its use for heat conduction and for tipi cover weights. The rough rock is limestone and sandstone obtained from local stream beds and talus slopes.

Table 5.2: Summary of features at 39CU1144. Stone circle dimensions are from exterior to exterior edge. Elevations recorded for hearths are from the top of the feature; elevations for cairns and stone circles are from the bottom of the feature.

| Feature | Location | Depth | Type/size | Contents |
|---|---|---|---|---|
| 1 | N390.27E901.52 | 0–80cm, 1411.13 | Rock cairn, 220 x 150 cm, 85 cm deep | Large limestone boulder with associated flake, tool, and bone scatter (130 flakes, 1 shatter, 1 core, biface fragment, retouched flake, graver, 17 bone fragments) |
| 2 | N392–N395, E909–E935 | 0–7 cm, 1411.98 | Stone circle, 4.5 x 4.4 m | 40 flakes, 1 shatter, 17 bone fragments, stemmed projectile point, point blade fragment, retouched flake |
| 3 | N389–N396, E921-928 | 0–7 cm | Stone circle, 5.42 x 5.07 m | 5 flakes, 1 bone fragment, knife fragment |
| 4 | N387-388, E937-938 | 0–7 cm | Stone circle, 4.62 x 2.78 m | 2 flakes, 1 retouched flake |
| 5 | N390E890 | Surface, 1410.33 | Rock cairn, 2.4 x 2.0 m | None (not excavated) |
| 6 | N391.25E901.32 | 45–57 cm, 1411.43 | Rock-filled basin hearth, 90 x 95 x 12 cm | Fire-cracked rock, 591 flakes, 3 bone fragments, charcoal; $_{13}C$ 5580 BP |
| 7 | N410E973 | 0–7 cm | Stone circle, 6.44 x 5.26 m | 5 flakes, 2 pieces of wood |
| 8 | N440E890 | 15–34 cm, 1412.54 | Rock-lined basin hearth, 74 x 55 x 19 cm | Fire-cracked rock, 117 flakes, charcoal; $_{13}C$ 3200 BP |
| 9 | N453E862 | 17–40 cm, 1410.49 | Rock-lined pit hearth, 32 x ? x 23 cm | Fire-cracked rock, 4 flakes, 5 bone fragments, charcoal; $_{13}C$ 3600 BP |
| 10 | N449E866 | 52–70 cm, 1410.28 | Possible hearth, 59 x 46 x 18 cm | Flecks of charcoal, 4 flakes, 1 shatter, 1 bone fragment |
| 11 | Grader Scrape II | 14–27 cm, 1411.69 | Basin hearth, 34 x 31 x 13 cm | 11 flakes, 6 bone fragments, few fire-cracked rocks on surface |
| 12 | Grader Scrape II | 10–16cmb, 1411.95 | Rock-filled basin hearth, 80 x 77 x 6 cm | Fire-cracked rock, 68 flakes, charcoal |
| 13 | Grader Scrape II | 22–36 cm, 1411.38 | Rock-lined basin hearth, 60 x 46 x 14 cm | Fire-cracked rock, 52 flakes, 3 bone fragments, charcoal |

Table 5.2: continued

| Feature | Location | Depth | Type/size | Contents |
|---|---|---|---|---|
| 14 | Grader Scrape II | 13–30 cm, 1411.61 | Rock-filled basin hearth, 59 x 43 x 17 cm | Fire-cracked rock, 38 flakes, 1 bone fragment, charcoal; $_{13}$C 2500 BP |
| 15 | Grader Scrape II | 24 cm, 1411.92[1] | Hearth of indeterminate shape | 18 flakes, charcoal |
| 16 | Grader Scrape I | 22–40 cm, 1410.72 | Basin hearth, 50 x 58 x 18 cm | 121 flakes, 220 bone fragments, charcoal; $_{13}$C 3140 BP |
| 17 | Grader Scrape I | 26–43 cm, 1410.74 | Rock-lined basin hearth, 68 x 60 x 17 cm | Two layers of fire-fractured rock, 135 flakes, charcoal; $_{13}$C 2550 BP |
| 18 | Grader Scrape I | 14-31 cm, 1410.56 | Rock-filled basin hearth, 57 x 57 x 14 cm | Fire-cracked rock, 130 flakes, 44 shatter, 112 bone fragments, charcoal |
| 19 | Grader Scrape I | 8–25 cm, 4111.55 | Rock-filled basin hearth, 57 x 56 x 17 cm | Fire-cracked rock, 28 flakes, 36 bone fragments, charcoal; $_{13}$C 3090 BP |
| 20 | Grader Scrape I | 17–26 cm, 1411.87 | Basin hearth, 56 x 40 x 9 cm | Fire-cracked rock, 2 bone fragments, charcoal |
| 21 | Grader Scrape I | 47–60 cm, 1411.05 | Basin hearth, 59 x 54 x 13 cm | Fire-cracked rock, 51 flakes, 173 bone fragments, charcoal |
| 22 | Grader Scrape I | 65–75 cm, 1410.65 | Basin hearth, 41 x 38 x 10 cm | Fire-cracked rock, 37 flakes, 115 bone fragments, charcoal |
| 23 | Grader Scrape I | 72–87 cm, 1409.88 | Rock-lined basin hearth, 81 x 62 x 15 cm | Fire-cracked rock, 322 flakes, charcoal; $_{13}$C 6940 BP |
| 24 | Grader Scrape I | 89–98 cm, 1410.16 | Basin hearth, 53 x 51 x 9 cm | Fire-cracked rock, 104 flakes, charcoal |
| 25 | Grader Scrape I | 88 cm, 1411.74 | Ash and rock scatter | Fire-cracked rock, 18 flakes, charcoal |

[1] Elevation of bottom of hearth; top of feature destroyed

Table 5.3. Distribution of cultural material associated with Feature 1, 39CU1144.

| Level | Debitage | Tools | Bone | Other |
|---|---|---|---|---|
| 0–5 cm | 1 | 2 | 0 | 0 |
| 5–10 | 6 | 1 | 2 | 0 |
| 10–15 | 7 | 0 | 6 | 0 |
| 15–20 | 7 | 0 | 5 | charcoal |
| 20–30 | 25 | 0 | 1 | 0 |
| 30–40 | 37 | | 0 | 0 |
| 40–50 | 19 | 0 | 0 | charcoal |
| 50–60 | 20 | | 2 | 0 |
| 60–70 | 8 | | 1 | 0 |
| 70–80 | 2 | 0 | 0 | 0 |

### 5.3.1 Feature 1

This feature consisted of a very large limestone boulder with smaller rocks around it (Figure 5.6, 5.7). The boulder extended above the surface 10–15 cm and extended more than 80 cm below the surface. Cultural material was found throughout, but tapered off below 60 cm (Table 5.3). The cultural material was unimodally distributed with the highest concentration 30–40 cm below surface. The roughly corresponds to Component C, suggesting that the most intensive use of this portion of the site took place during the Early Archaic/Middle Archaic transition.

### 5.3.2 Features 2, 3, 4, and 7

These features are complete or partial stone circles, made up of circular to semicircular courses of limestone slabs (Figures 5.8, 5.9, 5.10). They were visible on the surface of the site and appeared to be tipi rings. Features 2–4 were located south of the highway in the southeastern portion of the site, while Feature 7 was located north of the highway near the northeastern edge of the site (Figure 1.2). Outside diameters range from 4.5 to 6.44 meters; associated cultural remains occurred to a depth of 7 cm below surface. Only Feature 2 contained significance amounts of cultural material in association with the stone circle. This material included a small, stemmed projectile point diagnostic of a Late Prehistoric age for the feature. Descriptive data on these features are summarized in Tables 5.2 and 5.4.


Figure 5.6. Feature 1 cairn.

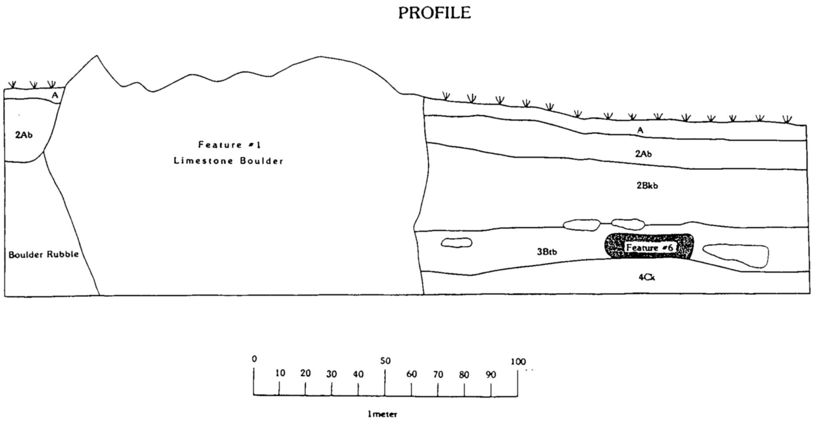



Figure 5.7. Feature 1 cairn, profile view, 39CU1144.

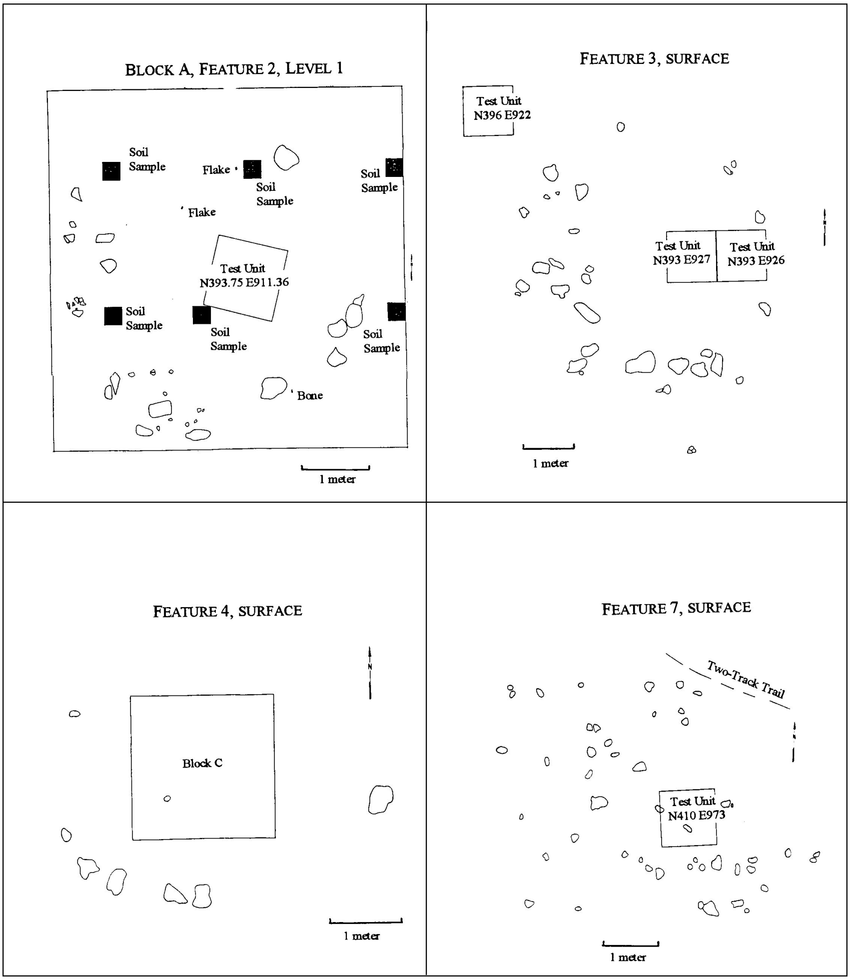



Figure 5.8. Tipi ring features 2, 3, 4, and 7, plan view, 39CU1144.

Table 5.4. Stone circle features at 39CU1144.

| Feature No. | Shape | Diameter | Lithics | Bone |
|---|---|---|---|---|
| 2 | Circular | 4.50 m | 60 | 17 |
| 3 | Circular | 5.42 m | 6 | 1 |
| 4 | Circular | 4.62 m | 3 | 0 |
| 7 | Quasi-circular | 6.44 m | 5 | 0 |


Figure 5.9. Feature 2 tipi ring.


Figure 5.10. Feature 4 tipi ring.

Figure 5.11. Feature 5 cairn.

### 5.3.3 Feature 5

This feature was a rock cairn located near the intermittent stream drainage at the southern boundary of the site (Figure 5.11). The feature was not excavated and no artifacts were found near it on the surface.

### 5.3.4 Hearth features

Features 8 and 9 are rock-lined hearths found in the geomorph trenches D and B north of the highway (Figures 5.12–5.13). They appear to relate to Componont B. Feature 6 relates to Componont C (Figure 5.14). This is the hearth radiocarbon dated to 5580 BP. Feature 10 is a possible basin hearth found below a gravel stratum in Unit N449E866 in the 60–70-centimeter level (Figure 5.15). This feature contained a possible flake and a few flecks of charcoal, but neither its age nor origin could be accurately determined. Features 11–20 were found during the intial grader stripping. These include various types of shallow basin hearths associated with component B (Figures 5.16–5.17). Features 21–24 were found in the second phase of grader stripping and are associated with Component C. These also comprise various types of basin hearths (Figure 5.19).

Attributes of the upper (Componont B) and lower (Componont C) hearths were compared (Table 5.5). The Componont C hearths tend to be bigger than the Componont B hearths. Hearth sizes range from 6160 $cm^2$ to 1054 $cm^2$ with an average size of 3955.5 $cm^2$ in Componont B and from 8550 $cm^2$ to 1558 $cm^2$ in Componont C with an average size of 3224.2 $cm^2$. The lower hearths tend

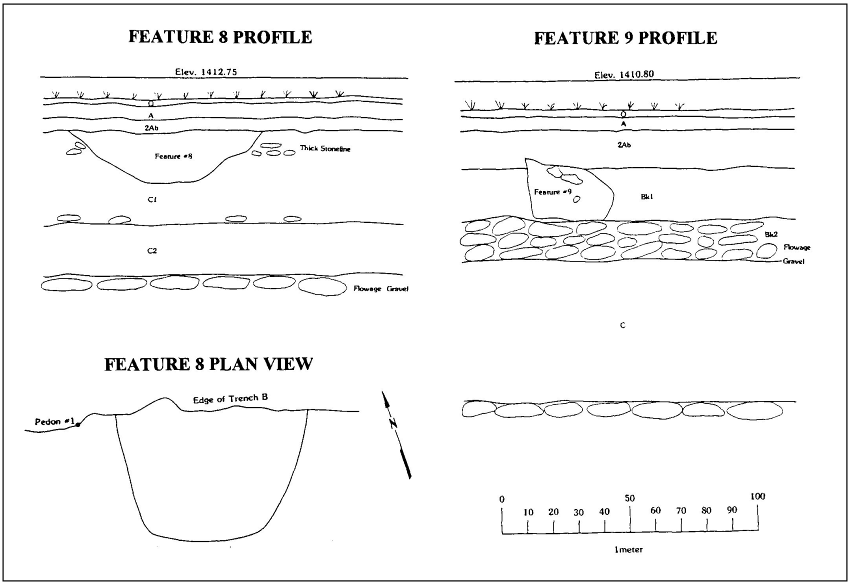



Figure 5.12. Feature 8 hearth, profile and plan views, and Feature 9, profile view, 39CU1144.


Figure 5.13. Feature 9 hearth.

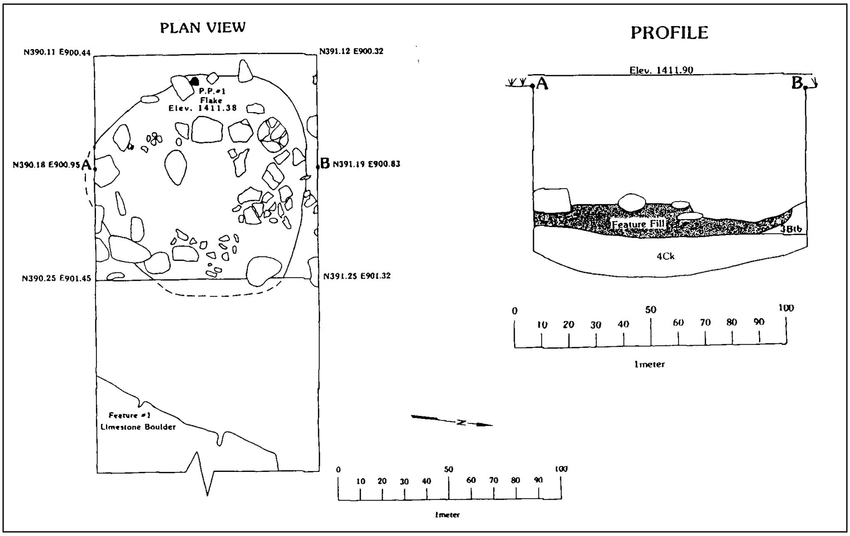



Figure 5.14. Feature 6, hearth, profile and plan views, 39CU1144.

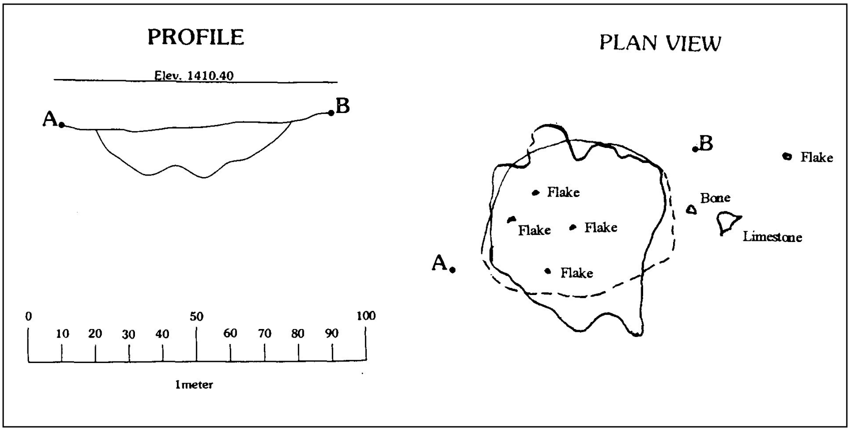



Figure 5.15. Feature 10, hearth, profile and plan views, 39CU1144.

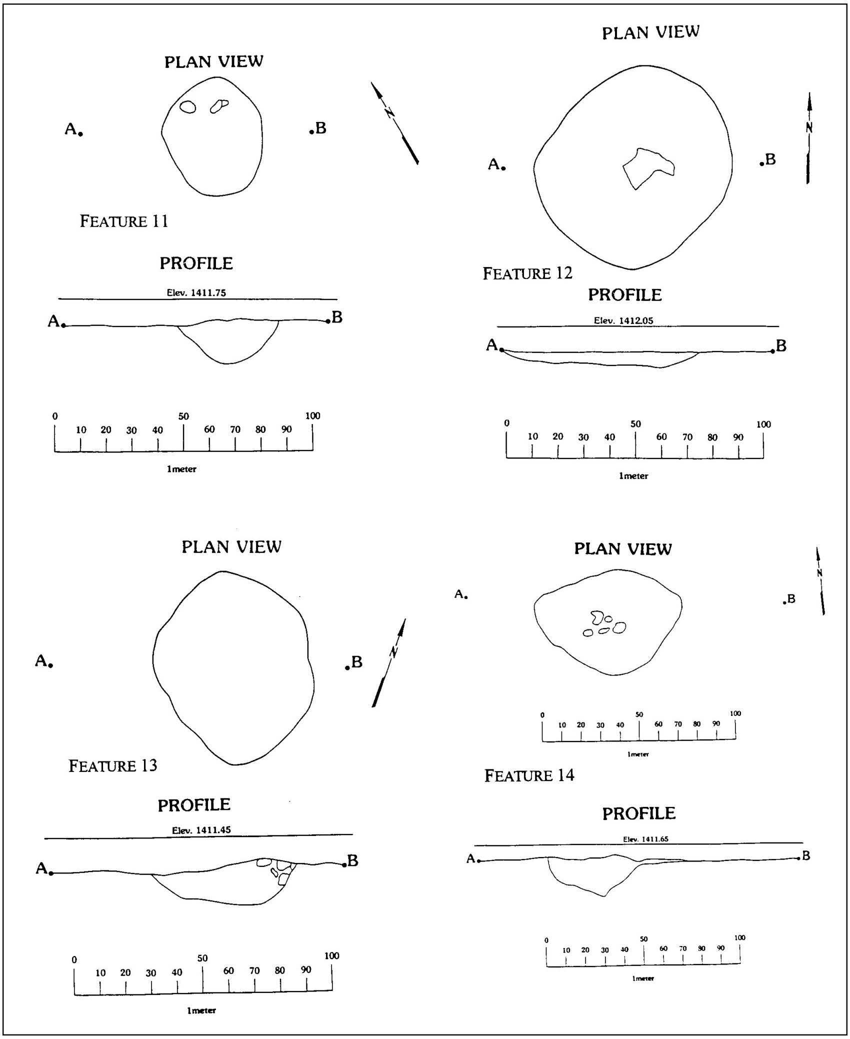



Figure 5.16. Features 11, 12, 13, and 14, hearths, profile and plan views, 39CU1144.

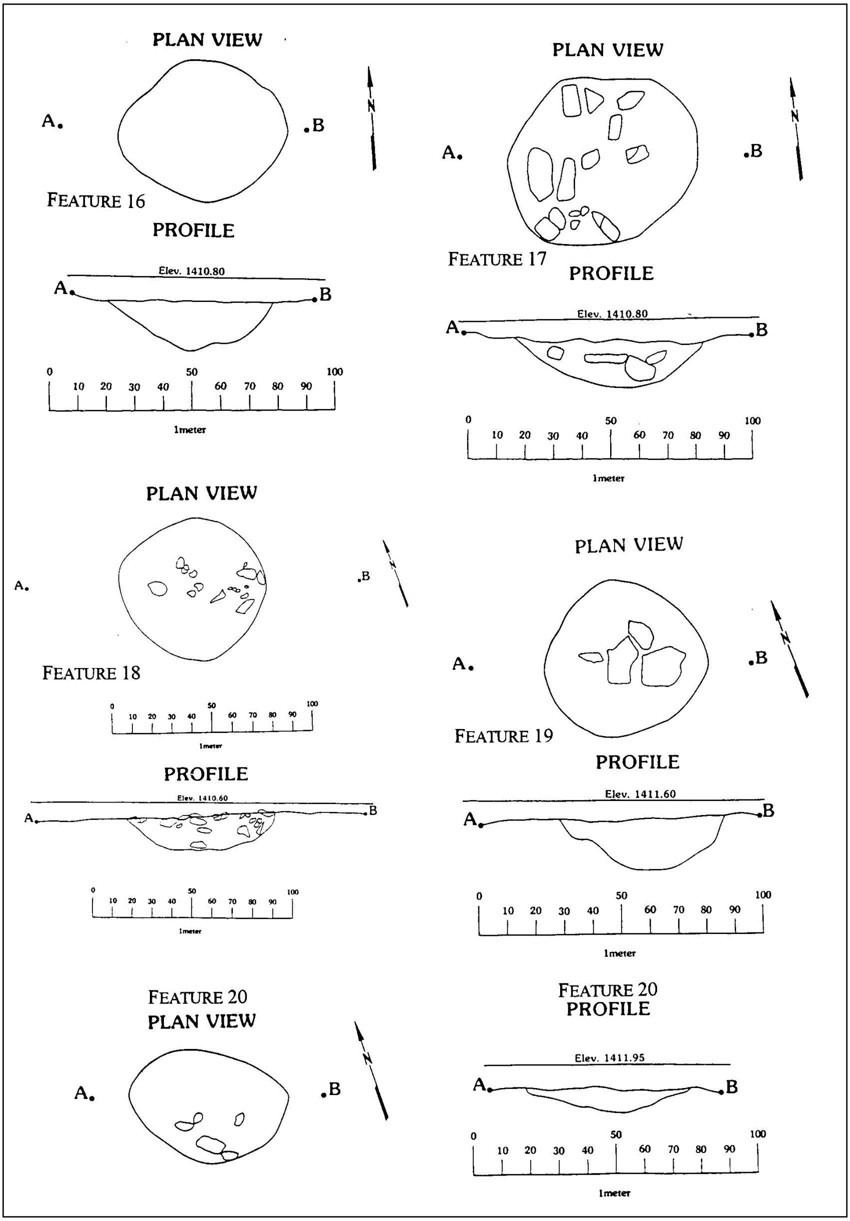



Figure 5.17. Features 16, 17, 18, 19, and 20, hearths, profile and plan views, 39CU1144.


Figure 5.18. Feature 17 hearth.

to be shallower than the upper (average depth 12.8 cm in Compononent C versus 15.2 cm in Compononent B) and to contain less rock; however, both of these attributes may have resulted from depositional and taphonomic effects. Erosion may have removed the top portions of the lower component hearths. Similarly, the limestone and sandstone rocks used for lining and filling hearths may simply have been more subject to deterioration in the lower hearths.

Hearth content also differed significantly. Bone occurred slightly more often in the upper hearth group (67%) than in the lower hearth group (57%). The upper hearths with bone also tended to contain more bone fragments than the lower hearths. Artifacts show the opposite trend. The average number of flakes in Compononent C hearths was 118.1, while the average in Compononent B hearths was 60.2. Features 6 and 23 in Component C contained 591 and 322 flakes, respectively. This compares with a maximum of 135 flakes in Compononent B, Feature 17. These observations do not clearly indicate a shift in hearth function over time. Instead, they may reflect more intensive use of the site during its earlier period of occupation and poorer preservation of bone in the lower deposits. Both groups of hearths comprise types appropriate for generalized cooking or limited food processing, such as meat or seed roasting. The moderate size and density of the hearths does not indicate large scale food processing, such as production of winter stores, or winter heating. Meat and marrow seem to have been the primary resources processed in these hearths, judging by the presence of crushed bone; however, it is possible that plant foods were also processed in the hearths, but left no preserved residue. Bone was highly fragmented throughout

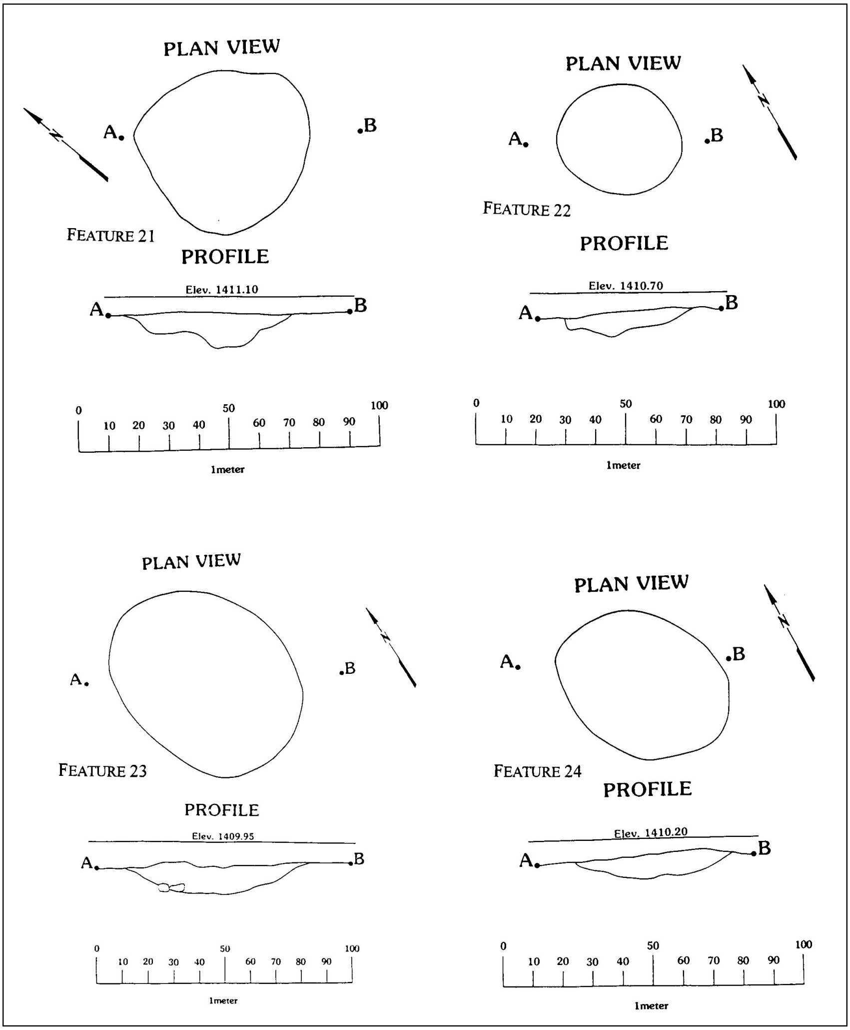



Figure 5.19. Features 21, 22, 23, and 24, hearths, profile and plan views, 39CU1144.

Table 5.5. Comparison of various attributes of hearths associated with Components A and B and Compont C, 39CU1144.

| Attribute | Component A&B Count | Component A&B Percentage | Component C Count | Component C Percentage |
|---|---|---|---|---|
| Shallow basin | 6 | 50 | 5 | 71 |
| Basin | 0 | 42 | 0 | 0 |
| Rock-filled | 4 | 33 | 1 | 14 |
| Rock-lined | 4 | 33 | 1 | 14 |
| Bone present | 8 | 67 | 4 | 57 |
| Flakes present | 11 | 92 | 7 | 100 |

the feature assemblages. A few pieces were recognizable as artiodactyl remains, while the remainder were identifiable only as mammal bone.

The most obvious difference between the two groups of hearths is in the larger number of flakes associated with the lower hearths. This may reflect a more intense use of the site area during the Early Archaic than during the Middle and Late Archaic. This greater intensity could mean either more frequent or more prolonged occupations of the site. Because Componont C occurs in pockets, rather than as a continuous deposition, the degree of site use intensity is otherwise difficult to assess. More intensive use of the site during its earlier period of use was also indicated by distribution of artifacts associated with Feature 1.

## 5.4 Ceramics

In total, 137 pottery sherds were recovered. Although most of these were extremely fragmented, they appear to represent two types of pottery (Figure 5.20). The first type is represented by a single rim sherd, with the remaining sherds all representing the second type. All were found near the surface of the site. It is possible that only two or three vessels are represented by the sherds recovered at the Blaine site.

The single sherd (#212) representing Type 1 pottery was found in Block B excavations in the western portion of the site. It is a very small fragment of what appears to be a section of the rim. The rim appears to have been very thin (0.28 cm). Two narrow (0.20 cm) parallel trailed lines are present on the sherd exterior. The temper is either a find sand or grit (crushed rock). The paste appears hard and resistive. The interior is smoothed and is reddish brown (5YR4/3). The exterior appears oxidized and is buff or reddish yellow (5YR6/6). Vessel shape and rim angle are indeterminate. Although the presence of a single tiny sherd does not permit many conclusions, this pottery is generally similar to Middle Missouri types in its thinness, hardness, and trailed decoration. Such pottery is occasionally found in very small amounts in peripheral zones of the

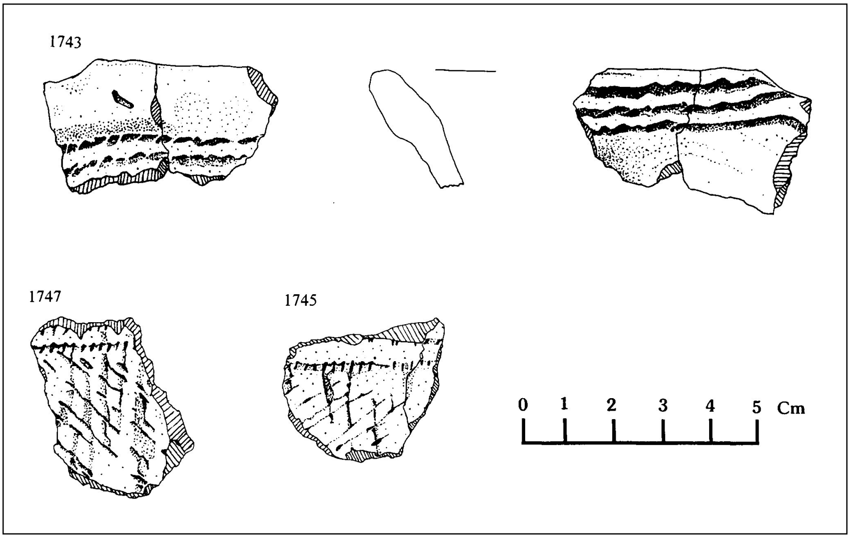



Figure 5.20. Selected pottery from the Blaine site, 39CU1144.

Black Hills (cf Wheeler 1957). It may also relate to the Powder River Basin ceramic tradition defined by Keyser and Davis (1982). Some Powder River wares are also thin, hard, and decorated with trailed designs. Powder River tradition ceramics are found in southeastern Montana, western Wyoming and peripheral areas, including the Black Hills.

The other set of sherds includes rim, shoulder, and body sherds. These were found together near the surface in Grader Scrape I, at the northeastern edge of the site. Two sets of rim sherds were found. The first (#1741) comprises three small fragments of what appears to be the lip of a rim. One of the segments has oblique, parallel cordmarked impressions on the rim lip juncture. It cannot be determined whether this is an interior or exterior treatment. The pieces are otherwise too small and fragmented to provide usable information.

The other set (#1743) comprises two conjoinable pieces that form a single rim sherd. The rim is flared and castellated. The rim appears to have been initially formed by a folding of the vessel wall. The lip and rimfield have been smoothed, but there are horizontal, parallel cord impressions running along the rim shoulder juncture. The rim interior also has horizontal, parallel cord impressions. These are heavily smoothed over. The exterior and interior are smudged black (1YR2.5/1). Temper is a medium-grained angular (possibly crushed) grit. The paste is moderately soft and crumbly. The thickest portion of the rim is at mid-rim, 0.85 cm. The rim is 0.53 cm thick at the juncture with the shoulders. Rim height cannot be accurately measured, but it was at least 2.6 cm.

Two shoulder sherds were found (#1745 and 1747). Both have a smoothed-over cordmarked exterior in a cross-hatched pattern over the shoulder area.

The rimfield area is smooth and has horizontal, parallel cord impressions. The interiors are smooth. The temper is a coarse to medium angular grit. The paste is moderately soft and crumbly. The exterior and interior are both brown (10YR5/3). The sherds are 0.61 and 0.63 cm thick.

Six of the 129 body sherds have smooth surfaces. These are small (< 2.5 cm) fragments. Most show a curvature that would suggest they are portions of the rim. One or two also exhibit polish. The temper is a medium angular grit. The sherds are smudged black (10YR2.5/1). They range in thickness from 0.47 to 0.52 cm, with a mean thickness of 0.50 cm. The remaining 126 body sherds exhibit smoothed-over cordmarking. The amount of smoothing is variable, from near obliteration of the cordmarks to simple smoothing of intracordmark ridges. The temper is a coarse to medium angular grit. The paste is moderately soft and crumbly. The exteriors are largely smudged black (10YR2.5/1). The interiors are smoothed and brown (10YR5/3). Among the larger fragments, thickness ranges from 0.42 to 0.92 cm with a mean of 0.61 cm. The shape of this vessel could not be reconstructed.

George Frison described a somewhat different ceramic type from the Blaine site vicinity (Frison 1976:37). Known from a single vessel, referred to as the Newcastle vessel, this type was described as having designs made with cord impressions around the vessel rim. Body sherds had sharp, vertical grooved paddle marks. Frison compared this vessel with ceramics from the Hagan site (Mulloy 1942) and a site near Ludlow Cave (Wood 1971). All three were identified as Mandan tradition pottery produced by Crow groups or more simply as "Crow" pottery (Frison 1976). A somewhat pointed globular pot with a high, slightly flaring rim is indicated for this ceramic type. In contrast to Frison, Ann Johnson (1979:24) considered the Newcastle vessel to belong to a formally defined Extended Middle Missouri pottery type known as Fort Yates ware, rather than belonging to the Crow ceramic tradition. This would mean that the vessel was carried in by Middle Missouri villagers on a visit to the Black Hills, rather than representing a separate, localized ceramic type.

The Blaine site ceramics bear little resemblance to the Newcastle vessel, except in the cord-impressed rim decoration. The vertical grooved paddle impressions that cover the other Newcastle body sherds are absent from the Blaine site collection and the smoothed-over cordmarked surface of the Blaine site vessel is more typical of Woodland/Besant or Initial Middle Missouri than Frison's Crow pottery or the Newcastle vessel. The shape of the Blaine site vessel is not known.

With vessel and neck shape unknown, it is impossible to determine whether the vessel represents a Late Woodland or an early Plains Village type (Johnson 1993). Since the pottery sherds were found near the surface, they can be assigned to Componont A. This component also contained a Plains Side-Notched projectile point. Plains Side-Notched points were also found at the Phelps site, an Initial Middle Missouri site in the eastern foothills, and at other Late Prehistoric sites in the Black Hills (L. Alex 1979a). Phelps may date between A.D.900 and 1050 (Johnson 1993), with later (Extended Middle Missouri) materials perhaps also present (L. Alex 1979a). Plains Side-Notched points are generally dated to the period between A.D. 1300–1700 (Kehoe 1966). These data, and the lack of Late Woodland-era radiocarbon dates from the Blaine site, suggest that the ceramics belong to a Plains Village or Late Prehistoric cultural tradition, rather than a Woodland tradition.

While the Blaine site vessel can clearly be classified as belonging to the "Mandan" ceramic tradition, as opposed to the Intermountain ceramic tradition, its more specific cultural affiliation is not clearly indicated. The term "Crow pottery" is misleading, because no evidence exists that the historic or protohistoric Crow were the actual or sole producers of these ceramics (Johnson 1979; Wood and Downer 1977; Keyser and Davis 1982). Splinter groups were leaving the Middle Missouri area to resettle in areas farther west throughout much if not all Middle Missouri prehistory. The exact number and timing of these resettlements are not known. In addition, the historic practice of Middle Missouri villagers traveling west to hunt bison on a seasonal basis may have been a long-standing tradition in the area, as the Late Archaic Besant and Sonota complex remains imply. Northern plains groups historically raided and traded for both ceramics and the women who produced them. Thus, the presence of a single Mandan tradition pot at the Blaine site does not necessarily indicate occupation of the site by either Crow or Middle Missouri tradition groups. The possibility that the ceramic tradition represented at the Blaine site developed in situ out of a preexisting Besant ceramic tradition also must be considered. The Mandan ceramic tradition as defined by Mulloy (1942) and Frison (1976) recognizes the general eastern (Middle Missouri) affiliation of the tradition, as opposed to the Intermontane ceramic tradition, but is not otherwise useful in defining interassemblage relationships (Johnson 1979; Alex 1979b; Keyser and Davis 1982).

Recognizing these problems, Keyser and Davis (1982) proposed the term "Powder River Basin tradition" for the Middle Missouri-related ceramics found in that vicinity in eastern Wyoming and Montana. This terminology permits the possibility that the tradition developed early in this area from a general Middle Missouri base, without tying it to any particular group. Powder River Basin tradition ceramics are described as thin-walled, gobular jars with vague shoulders and moderately high S-shaped, straight, or flaring rims. Lips are flattened or slightly rounded and sometimes decorated with notches or oval punctates. Other decoration may take the form of incised (trailed) lines on shoulders or vertical paddle marks on rims. Cord-impressed designs do not occur. Surfaces were wiped, scraped, rubbed, and/or polished smooth prior to firing. Keyser and Davis include the western Black Hills in the range of this ceramic type.

While Keyser and Davis (1982:296) recognize some similarities between Powder River Basin tradition ceramics and Riggs and Fort Yates wares of the Extended and Terminal variants of the Middle Missouri Tradition, they specify that such attributes as castellated and filleted rims characteristic of Riggs and Fort Yates wares do not occur in the Powder River Basin ceramics. This would place the Blaine site vessel outside the Powder River Basin tradition. Several other attributes of the Blaine site vessel are typical of various Initial Middle

Missouri and early Coalescent Tradition wares. These include cord-roughening, flared lip, cord-impressed and incised decorations, and a distinct rim shoulder juncture. Other IMM and Coalescent attributes, including braced rims and vertically brushed necks, are not seen on the Blaine site vessel.

In short, the Blaine site ceramics shed little light on the identity of the Compomont A occupants of the site. Both ceramic types suggest general connections to the east in the Middle Missouri subarea, but only the first type closely resembles Middle Missouri pottery. Many of the attributes of the more complete Blaine pot are intermediate between Woodland and Powder River or Middle Missouri Coalescent tradition types. This would tend to support the possibility of a localized ceramic tradition; however, the additional specimens that could confirm its existence have yet to be found. Lithic raw material types suggested a localized occupation of the site during the Late Prehistoric period, with some eastern (probably Middle Missouri) elements in the Late Archaic materials. Unfortunately, the Blaine site ceramics were found in the grader scrape and were not associated with datable material. The stylistics of the ceramics do not exactly match any formally described types. Until northwestern plains ceramic traditions are more accurately defined, the sherds from the Blaine site will have little diagnostic value. The pottery is of more significance as an indicator of the diversity of activities taking place at the site. It suggests use of the site by an entire social unit, rather than a specialized task group.

## 5.5 Lithic Tools

In total 68 specimens representing 61 lithic tools were found at the Blaine site. In addition 13 cores are included in the tool descriptions in the appendix. All are chipped stone. No ground stone tools or hammerstones were found. Tools were identified by formal type where possible, i.e. projectile point, scraper, biface, graver. Nonformal retouched flakes are also included in the tool inventory. These were identified on the basis of edge modification. No formal use-wear analysis was done; however, obvious use-wear is noted in the descriptions and discussion below. Description of cores and bifaces follows Callahan's (1979) biface reduction model for Clovis materials from eastern North America. Although this reduction trajectory was developed for an area and time period different from that represented at the Blaine site, the model has been widely used for biface descriptions referring to a wide range of regions and time periods. Callahan's model has been applied to northern plains materials (e.g. Keyser and Davis 1984; Metcalf and Black 1985; Keyser and Fagan 1987).

Materials found on or within 7–10 cm of the surface were grouped together as the Componont A assemblage. Componont A tools include six bifaces and biface fragments, fragments of five projectile points, three retouched flakes, and one graver. Two cores were found in this upper component (Table 5.6).

The projectile points found at this level included one Plains Side-Notched arrowpoint (#157), a stemmed or corner-notched arrowpoint (#1579), a fragment from a notched arrowpoint (#1575) and two notched dart points (#1479

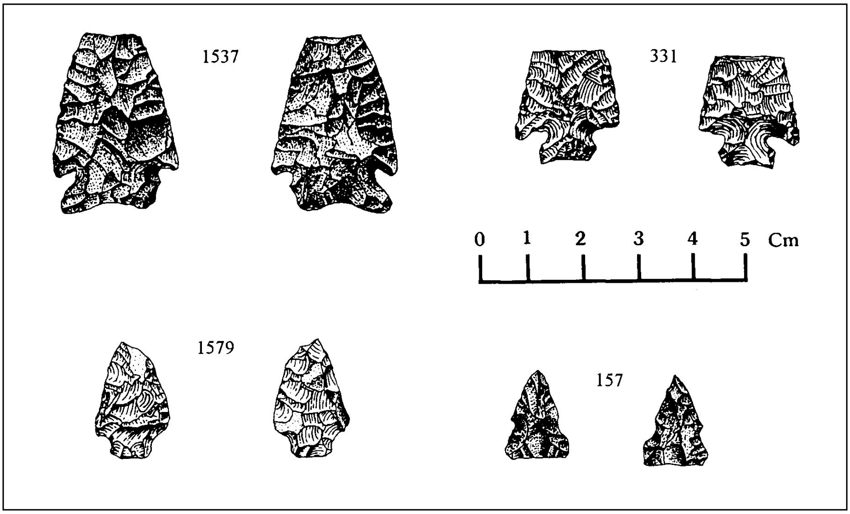



Figure 5.21. Projectile points from the Blaine site, 39CU1144.

and 1537), the latter classifiable as a Pelican Lake type (Figure 5.21). Notched arrowpoints appeared in the area about 1500 BP Pelican Lake dart points date to the initial half of the Late Archaic, or about 3000 to 2000 BP. Other notched dart points date from about 3500 to 1500 BP. This mix of Late Prehistoric and Late Archaic projectile points suggests that the upper levels of the site are mixed to some extent. It also indicates that three periods are represented in the upper 10 cm of site deposits: early Late Prehistoric, middle Late Archaic, and early Late Archaic. Mixing is also indicated by the occurrence of two tool fragments in Componont A that fit with fragments from the upper portion of Componont B. This apparent mixing is due to the extremely slow deposition of the upper portion of the site and the difficulty of accurately separating the shallow A and B strata. Nevertheless, most material from this upper level is assumed to relate to the Late Prehistoric component recognized in the tipi ring featues, the arrowpoints, and the ceramics.

The Componont A lithic tool assemblage suggests a rather diverse site function. (Selected tools are illustrated in Figures 5.22–5.26.) Indicated activities include tool repair and maintenance, biface manufacture, chopping or heavy cutting, and woodworking. Three of the five projectile points (#1479, 1537, 1575) appear to have broken during use. Another point (#1579) was discarded during manufacture or resharpening. The remaining point was finished and unbroken (#157). All but one of the six bifaces show some use-wear, as knives, choppers, or digging implements (#769/771/773, 777/779, 1670, 1727, 1827). One (#775/781/783) appears to have broken during manufacture and was never used. A second manufacturing failure (#1670) was subsequently utilized as a chopping or cutting tool. All but one of the bifaces are made of local quartzites. Such large bifacial knives are suitable for heavy cutting tasks, such as butcher-

Table 5.6. Tool and core distribution by component. "A/B" designates materials from the grader scrape that could not be securely separated by component. "A and B" designates broken artifacts with fragments in both levels.

| | Component | | | | | | |
|---|---|---|---|---|---|---|---|
| Tool | A | A/B | B | C | A and B | Unknown | Total |
| Point | 5 | 1 | 3 | 0 | 0 | 0 | 9 |
| Biface | 4 | 4 | 11 | 1 | 2 | 0 | 22 |
| Retouched Flake | 3 | 5 | 7 | 5 | 0 | 1 | 21 |
| Graver | 1 | 0 | 2 | 0 | 0 | 1 | 4 |
| Scraper | 0 | 1 | 2 | 0 | 0 | 0 | 3 |
| Denticulate | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| Badlands knife | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| Core | 2 | 8 | 0 | 1 | 0 | 2 | 13 |
| Total | 15 | 20 | 26 | 7 | 2 | 4 | 74 |

ing, as well for nonspecialized light cutting taks. A graver (#1813) and three retouched flakes (#1614, 1731, 1815) are the remaining tools from this component. One of the retouched flakes is a possible graver made on a biface thinning flake (#1731). The remaining two retouched flakes have unifacially retouched acute working edges which would have been suitable for a variety of light cutting or scraping tasks.

This diverse lithic tool assemblage suggests general group maintenance activites rather than a specialized site function. This is consistent with the ceramics and stone circle features. The broken projectile points and the gravers suggest routine repair of hunting tools. Tratebas (1986) recognizes a hafting or rehafting tool kit comprising projectile points, preforms, gravers, and notches. This tool kit is most frequently associated with Late Prehistoric occupations. The bifaces suggest that other activities also took place since they are not used for making other lithic tools. Even if these represent manufacturing failures, their subsequent use-wear suggests other activities. One biface suggests rather heavy digging; however, whether this involved food acquisition, preparation of post-holes, or cache excavation is not clear. Neither postmolds nor cache pits were found at the site. The other tools indicate a diversity of activities, such as chopping and light scraping, that probably took place in the context of a transient camp. Debitage densities are low throughout the component and only two cores were found, confirming that stone tool manufacture was not a primary focus of the site during the Late Prehistoric period.

That portion of the lithic assemblage recovered during grader stripping could not be separated into A and B components, due to the shallowness of the deposits and the inexactness of the grading operations. This is the material listed in the Table 5.6 as "A/B." The A/B assemblage contained only one projectile

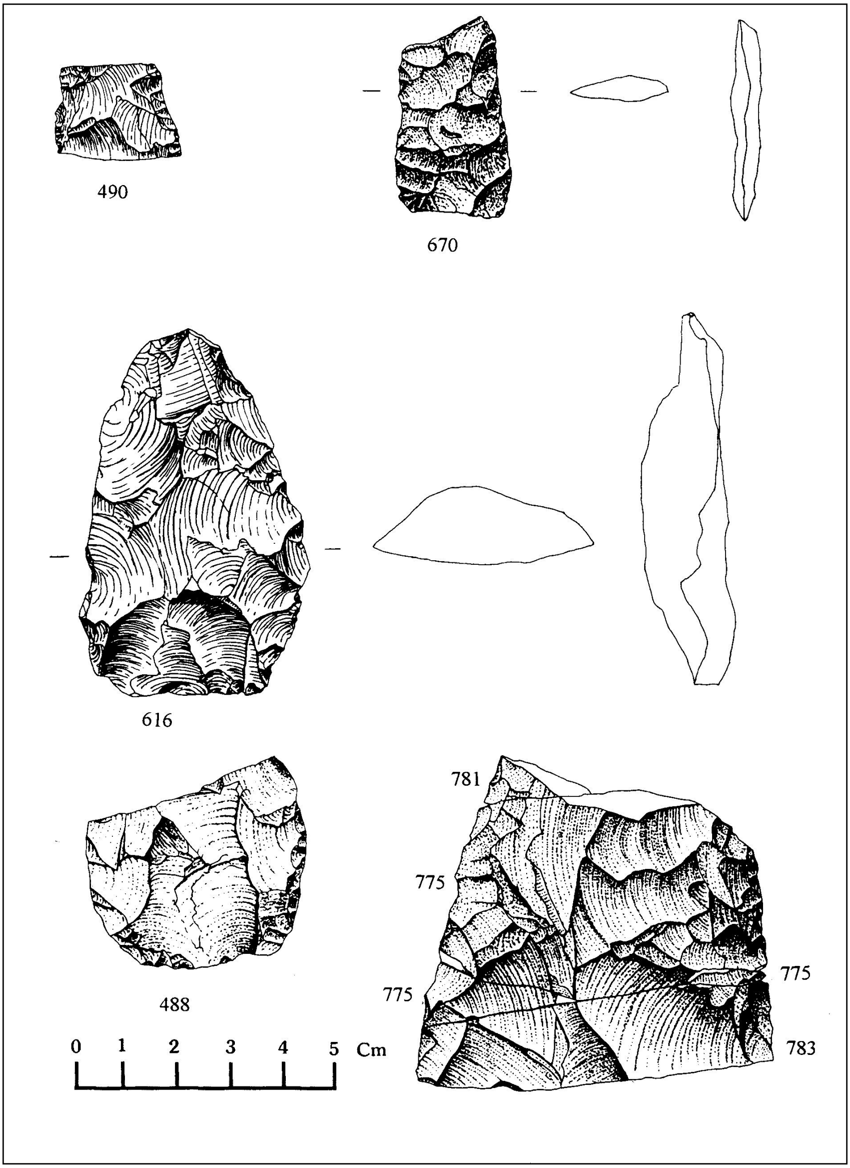



Figure 5.22. Selected bifaces from the Blaine site, 39CU1144.

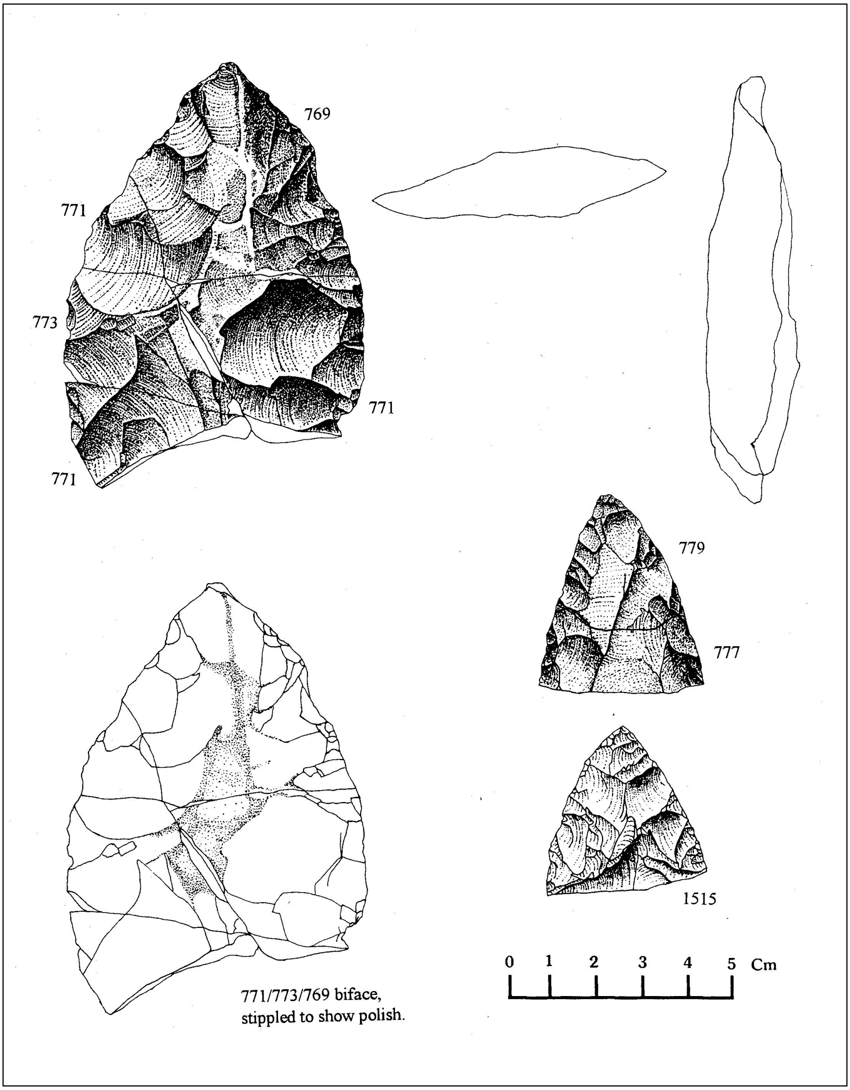



Figure 5.23. Selected bifaces from the Blaine site, 39CU1144.

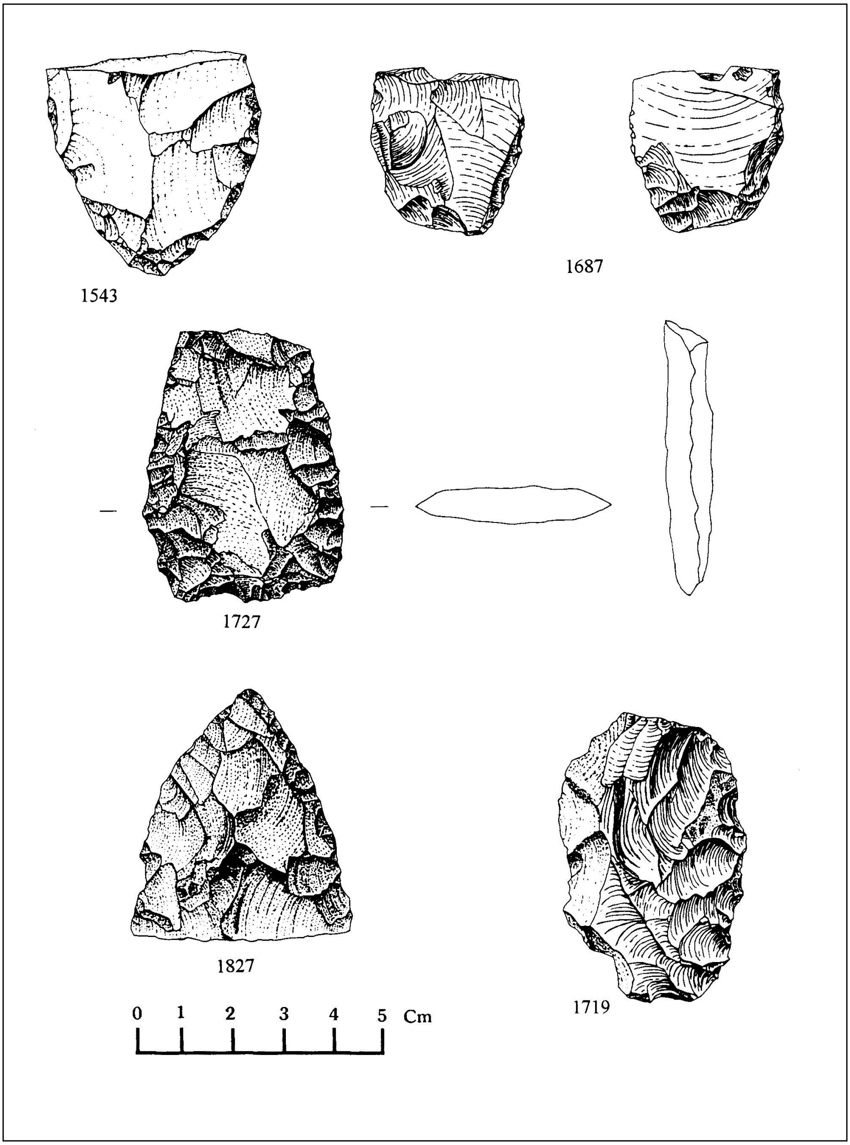



Figure 5.24. Selected bifaces from the Blaine site, 39CU1144.

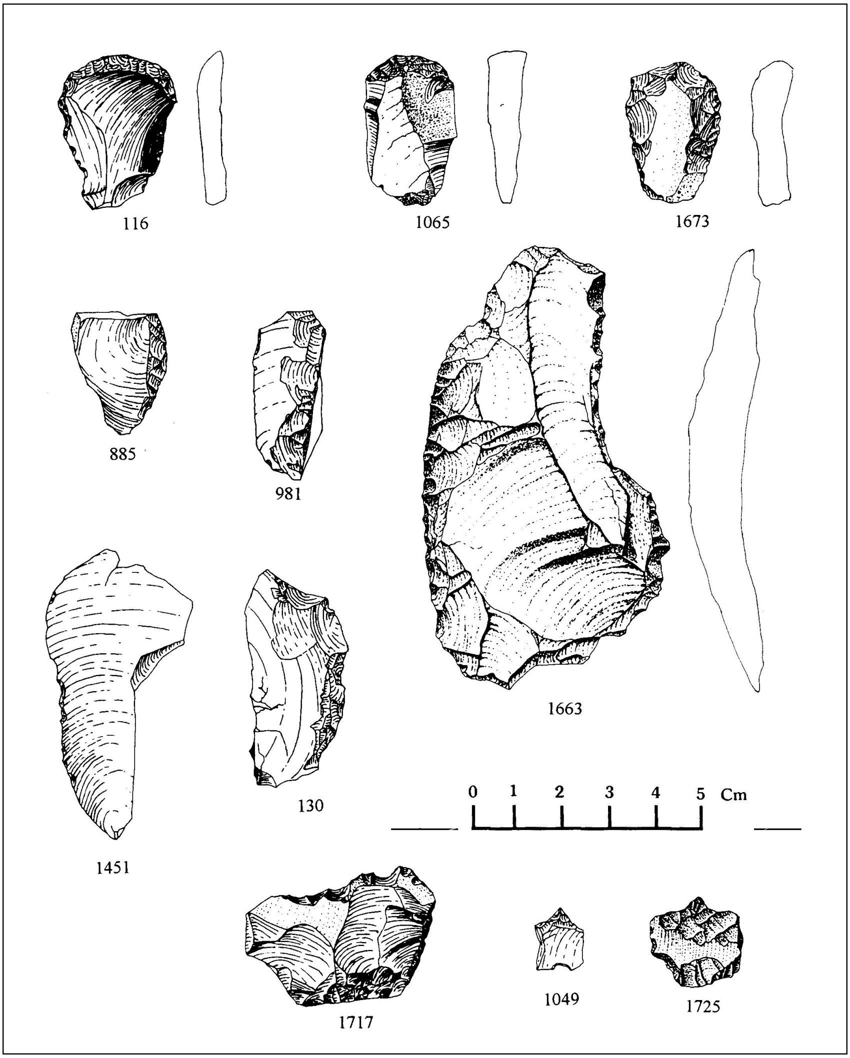



Figure 5.25. Selected lithic tools from the Blaine site, 39CU1144.

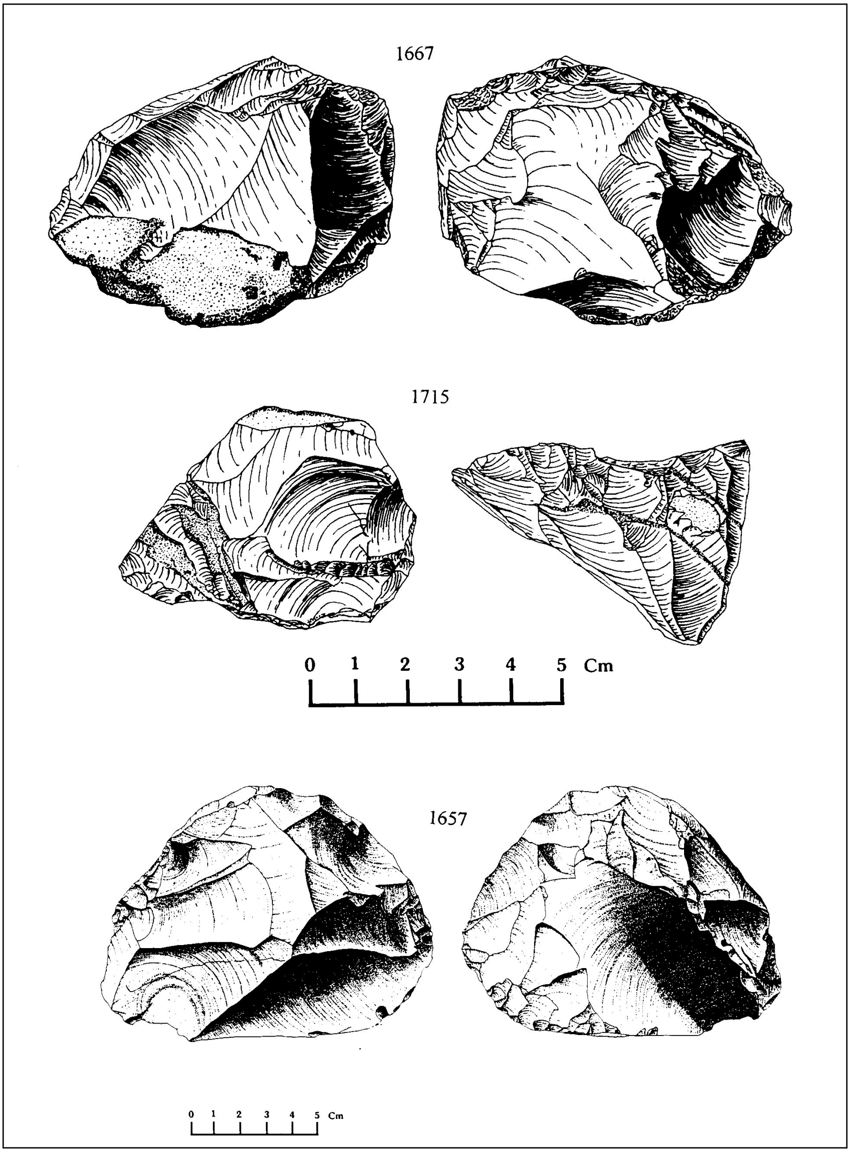



Figure 5.26. Selected cores from the Blaine site, 39CU1144.

point (#1637), a nondiagnostic tip fragment. Other tools found in the upper levels of the grader scrape include five retouched flakes, four bifaces, a scraper, and a denticulate. This assemblage also contained eight cores, ranging from spheriod and discoid types to tested nodules with one or two flakes removed. These cores include a wide variety of local lithic materials, including cherts that outcrop in the immediate site vicinity.

The retouched flakes from this assemblage included two decortication flakes with bifacial retouch on one or both lateral edges forming an acute cutting edge (#1653,1687). On two other retouched flakes continuous steep unifacial retouch forms steep, convex edges suitable for hide processing or other heavy scraping tasks (#1652, 1709). These are made of a variety of local cherts and chalcedonies. A similar function is indicated by the single formal scraper included in this assemblage (#1673). This is a keeled endscraper with use-wear evident along a lateral edge. This is made from Silicate 4, a local milky chalcedony. The remaining retouched flake (#1663) is a very large, bladelike, bifacial thinning flake or local quartzite. Continous unifacial edge retouch along the lateral edges of its dorsal side form a concave working edge like that of a spokeshave. This artifact is similar to large flake knives from Paleoindian levels of the adjacent Jim Pitts site. These were produced on very large bladelike bifacial thinning flakes of local quartzites.

Two of the 4 bifaces from the A/B assemblage were tip portions of Stage 3 or 4 bifaces (#1677, 1713). These appear to have been utilized. A thick Stage 2 biface fragment (#1697) appears to have broken during manufacture. A complete Stage 2 biface (#1719) is unbroken, but has no apparent use-wear. These large bifaces appear to have been suitable for heavy cutting tasks or may have been preforms for lighter tools. A different function is indicated for the last artifact in the A/B assemblage. This denticulated core-reduction flake probably was used for shredding fibrous material, such as roots or bark (#1717). These artifacts are made of a variety of local materials.

Materials found 7-10 and 27-30 cm below surface were included in Componont B. This component had the highest number of tools of the four assemblages. This level contained three projectile point fragments, 11 bifaces, seven retouched flakes, two gravers, two scrapers, and a Badlands knife. In contrast to the mixed A/B grader scrape assemblage, the B assemblage contained no cores. Projectile point fragments from levels correlated with Componont B included a corner notched dart point conforming to the Pelican Lake type (#331). This artifact is nearly complete; however, the corners of the base and one shoulder barb have broken off. The remaining two fragments (#672, 970) are nondiagnostic tip portions. One of these is from a dart-sized point or point preform. The Pelican Lake point and one tip are made of chert that outcrops in the immediate site vicinity. The remaining tip is made of local (southern Black Hills) quartzite.

Three other biface fragments (#490, 670, 675) appear to be portions of projectile point preforms. These show no use-wear and appear to be discarded manufacturing failures. One (#670) is a small lanceolate preform with a broken tip. Another set of bifaces (#265, 536, 616, 1539) are thick, complete or fragmentary Stage 2 (initial edging) bifaces discarded unused. Four of the preforms and Stage 2 bifaces were made of chert outcropping in the immediate site vicinity. Two others were of unidentifiable chert, and one was of local quartzite. Another thick, Stage 2 biface fragment (216) had minute step-fractures along an acute retouched edge probably indicating use of the tool fragment. This tool was made of a chert that outcrops both locally and in the Hartville uplift southeast of the Black Hills proper. One Componont B artifact is a tiny fragment of a biface made from site-vicinity chert (#14). Other bifaces include a utilized Stage 3 tip portion (#1543), a utilized Stage 4 biface base fragment (#488), and a nonutilized midsection of a very large Stage 3 or 4 biface (#775/781/783), and a tip portion from a Stage 3 or 4 biface (#777/779) all made of local quartzite. The latter two artifacts had fragments in levels correlated with Componont A, as well as in Componont B.

Retouched flakes from Componont B include a variety of forms. Four have steep, unifacially retouched edges suitable for scraping (#130, 294, 533). The latter specimen (#533) also has a more acute unifacially retouched edge. A broken lamellar flake with minute retouch or use-wear along the lateral and distal edges (#203) may have been used for light cutting or shaft shaving. Other specimens have knifelike edges formed by bifacial or unifacial retouch along a lateral edge (#21, 885, 915). These are expedient tools suited to a variety of light cutting tasks. Other Componont B tools include two gravers (#725, 1049) and two endscrapers (#116, 1065) made of local materials. The final tool from this assemblage is a bifacial knife (#1003), made on a thin tablet of Badlands chalcedony. Such Badlands knives are most commonly found in Late Archaic assemblages in the Black Hills.

Componont B tools suggest a variety of functions, including hide-processing, shaft repair or production, and lithic tool production. The latter appears to have been a principal focus of the Componont B occupation. Cherts outcropping in the immediate site vicinity were being shaped into bifacial tools and blanks. The recovery of a Pelican Lake projectile point made of such chert indicates that hunting weapons were one focus of this knapping activity.

For purposes of this discussion, all materials found lower than 27-30 cm below surface were grouped together as Componont C. This assemblage included one biface fragment, five retouched flakes, and one core. The biface fragment (#1515) is the tip of a very thin Stage 3 or 4 biface of local silicified siltstone. The biface broke and was discarded during manufacture.

The remaining tools assigned to Componont C are a diverse set of retouched flakes. One is a flake fragment with unifacial retouch or heavy use-wear along one edge of a fracture (#981). This forms a steep, straight working edge probably used as a push-plane. Another retouched flake (#1087) is a tabular chert pebble with sporadic bifacial retouch. The working edges are steep and straight with heavy use-wear in the form of step-fractures and crushing. This tool would have been suitable for heavy scraping or planing. Another tool (#1161) is a tertiary flake with continuous unifacial edge retouch along one lateral edge forming a steep, slightly concave working edge. Use-wear is apparent along this and other edges of the tool. A heavy scraping or planing function is proposed for this tool.

The remaining two retouched flakes are lighter tools suitable for cutting or light scraping tasks. One (#1371) is a bifacial thinning flake with minute unifacial edge retouch along a small portion of the distal edge, forming a straight, acute working edge. The other (#1451) is a large lamellar flake with minute edge retouch or use-wear along the lateral edges. The working edges are straight to slightly convex and acute.

These tools suggest a different focus from either of the other two components. The push-planes indicate that processing of wood or roots may have been a primary function of the site. Since other woodworking tools, such as adzes, are not present, the latter possibility is most plausible. This would suggest a somewhat specialized function for the site during the period represented by Componont C. The site may have been used as a root-processing site during this period as indicated both by the planing tools and by the presence of basin hearths. The remaining tools indicate light cutting or scraping, but do not point to any particular activity.

Two additional tools and two cores from the grader excavation could not be confidently assigned to components. One tool (#1683) is a heavily used retouched flake resembling a keeled endscraper. The other (#1725) is a fragment of a projectile point or point preform retouched to produce a graver. One core (#1667) is spheroid, made of a Black Hills or Hartville Uplift chert, and appears to have been utilized as a chopping implement. The other (#1679) is an irregular block core of site-vicinity chert.

## 5.6 Lithic Debitage

Size grade analysis was done for all debitage from the site. A summary of this analysis is presented in Tables 5.7 and 5.8.

Components A and B have similar size grade profiles, with most debitage falling in the 1.5-centimeter size grade and tapering off on either side of that point. Componont A contained about as many flakes less than 0.5 cm as flakes in the 1.0-centimeter size grade, while Componont B had very little debitage in the lowest size grade. This difference may reflect a focus in Component A on tool finishing and resharpening, while lithic reduction in Component B was more focused on primary and secondary reduction. When water screen samples are eliminated, Componont C displays a size grade profile similar to Component A; however, the waterscreen samples tip the Componont C profile heavily toward the lowest size grade. This reflects the very high percentage of tiny debitage associated with Feature 6. Of 591 pieces of debitage associated with this feature, 568 were less than 0.5 cm. The bimodal distribution of debitage sizes in Componont C further confirms that Feature 6 had a debitage discard pattern distinct from that of the rest of site. The reason for this specialized distribution is not clear.

Table 5.7. Lithic debitage size grade summary, including water screen samples. Top number in each cell is the count; bottom number is the percent of total.

| Set | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | 5.5 | 6.0 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Comp. A | 65 | 92 | 158 | 68 | 37 | 17 | 17 | 9 | 2 | 0 | 0 | 1 | 466 |
| | 13.9 | 19.7 | 33.9 | 14.6 | 7.9 | 3.6 | 3.6 | 1.9 | 0.4 | 0.0 | 0.0 | 0.2 | |
| Comp. B | 186 | 584 | 962 | 323 | 113 | 31 | 20 | 10 | 5 | 4 | 0 | 2 | 2240 |
| | 8.3 | 26.1 | 42.9 | 14.4 | 5.0 | 1.4 | 0.9 | 0.4 | 0.2 | 0.2 | 0.0 | 0.1 | |
| Comp. C | 758 | 68 | 127 | 67 | 24 | 12 | 9 | 4 | 0 | 4 | 1 | 0 | 1074 |
| | 70.6 | 6.3 | 11.8 | 6.2 | 2.2 | 1.1 | 0.8 | 0.3 | 0.0 | 0.3 | 0.1 | 0.0 | |
| Whole site | 2224 | 791 | 1249 | 459 | 178 | 54 | 44 | 20 | 7 | 8 | 1 | 6 | 5041 |
| | 44.1 | 15.7 | 24.8 | 9.1 | 3.5 | 1.1 | 0.9 | 0.4 | 0.1 | 0.2 | 0.0 | 0.1 | |

Table 5.8. Lithic debitage size grade summary, excluding water screen samples. Top number in each cell is the count; bottom number is the percent of total.

| Set | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | 5.5 | 6.0 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Set | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | 5.5 | 6.0 | Total |
| Comp. A | 64 | 67 | 109 | 41 | 22 | 8 | 10 | 4 | 0 | 0 | 0 | 1 | 326 |
| | 19.7 | 20.6 | 33.2 | 12.6 | 6.8 | 2.5 | 3.1 | 1.2 | 0.0 | 0.0 | 0.0 | 0.3 | |
| Comp. B | 2 | 536 | 939 | 321 | 113 | 33 | 22 | 11 | 6 | 4 | 1 | 2 | 1990 |
| | 0.1 | 26.9 | 47.2 | 16.1 | 5.7 | 1.7 | 1.1 | 0.6 | 0.3 | 0.2 | 0.0 | 0.1 | |
| Comp. C | 0 | 43 | 125 | 66 | 25 | 12 | 9 | 4 | 0 | 5 | 1 | 0 | 290 |
| | 0.0 | 14.9 | 43.3 | 22.8 | 8.7 | 4.2 | 3.1 | 1.4 | 0.0 | 1.4 | 0.3 | 0.0 | |
| Whole site | 359 | 711 | 1222 | 447 | 176 | 53 | 44 | 20 | 7 | 8 | 1 | 6 | 3054 |
| | 11.7 | 23.3 | 40.0 | 14.6 | 5.6 | 1.7 | 1.4 | 0.7 | 0.2 | 0.3 | 0.0 | 0.2 | |

## 5.7 Tool: and Core:Debitage Ratio Analysis

Tool to debitage ratios were calculated by dividing the number of pieces of debitage (flakes and shatter) in an assemblage by the number of tools. Cores were omitted from this analysis. Separate core to debitage ratios were calculated for each assemblage. Table 5.9 presents the results of this analysis. Ratios were calculated for both total debitage and debitage over 0.5 cm in size. This facilitates comparisons with assemblages from other sites at which smaller debitage was not collected or tabulated. Ratios for combined components A and B are also presented. This was done to accomodate data from the grader scrape which could not be separated by component. As expected, the combined AB assemblage ratios are intermediate between the separate A and B ratios. It should be kept in mind that the component designations are somewhat arbitrary divisions of the cultural deposits. While broad patterns of change through time can resonably be derived from these figures, the ratios should not be considered exact for any given component or period.

The 1:71 tool to debitage ratio (excluding waterscreen samples) derived from Componont B approaches ratios from lithic tool manufacturing sites in the Black Hills. It is difficult to make direct comparisons, because different recovery methods were used at the various sites for which data are available. Unless otherwise specified, ratios cited in this discussion are on debitage larger than 0.5 cm. Site 39FA307 in the southern Hogback yielded a 1:80 tool:debitage ratio on comparable data. This site was interpreted as a temporary camp focused on primary and secondary lithic tool manufacturing, with some plant food processing also taking place (Haug 1979). Site 39LA117 in the central Black Hills had a 1:74 tool to debitage ratio. This site was interpreted as a lithic knapping station, at which primary and secondary lithic tool production took place (Sundstrom et al. 1994).

The remaining tool to debitage ratios from the Blaine site are higher; however, none exceeds 1:20. Excavated sites in the Black Hills have tool to debitage ratios as high as 1:4. Ratios from campsites range from 1:4 to 1:35. Winter camps in the southern Hogback yielded tool:debitage ratios of 1:4 and 1:7

Table 5.9. Tool:debitage and core:debitage ratios for assemblages from the Blaine site, 39CU1144.

| | Tool:Debitage | | Core:Debitage | |
|---|---|---|---|---|
| Assemblage | (total) | (>0.5 cm) | (total) | (>0.5 cm) |
| Component A | 1:29 | 1:20 | 1:223 | 1:163 |
| Component B | 1:80 | 1:71 | no cores | no cores |
| A and B | 1:49 | 1:42 | 1:338 | 1:289 |
| Component C | 1:57 | 1:41 | 1:402 | 1:290 |
| Whole Site | 1:82 | 1:46 | 1:389 | 1:217 |

(Tratebas 1978b, 1979b). Warm season camps yield somewhat lower ratios, from 1:12 at the Beaver Creek rockshelter (L. Alex 1991) to 1:27 at 39LA117 (Sundstrom et al. 1994). Ratios for other hypothesized camping sites include 1:29 for the lower component of 39FA396 (Tratebas 1979b) and 1:35 for 39PN90 (Tratebas and Vagstad 1979).

The ratios in Components B and C at the Blaine site (1:71 and 1:41, respectively) suggest a site function more geared toward stone tool production during the periods represented by the lower components. No comparable assemblages are available from lithic tool production sites. Three knapping stations yielded an average tool:debitage ratio of 1:39; however, this was calculated from surface collections, rather than excavated material (Tratebas 1978a). Since tools are on average larger and thus more visible than debitage and less susceptible to removal by run-off, a lower ratio would be expected for excavated collections. The B and C component ratios probably indicate multiple-function occupations of the site, with lithic tool production an important activity.

The combined A and B assemblage had a tool to debitage ratio of 1:42. This is approximately equal to the average of the separate A and B assemblages, and suggests that the separate A and B samples are representative of the components as a whole. It further confirms that the grader scrape assemblage is indeed a mix of these two components.

The core to debitage analysis is not particularly instructive, except to note that the Componont A assemblage had proportionately more cores than the other assemblages. The combined A and B assemblage from the grader scrape had a much greater number of cores, 8 as compared to 2 in component A and 0 in component B. This probably reflects a concentration of knapping activities away from the habitation features (tipis). The separate A and B component assemblages were largely derived from excavation of the stone-circle features. While this explanation makes intuitive sense, it is difficult to establish with certainty. The relatively low core to tool ratio probably reflects an emphasis on secondary lithic processing and tool resharpening, as opposed to primary lithic tool production.

## 5.8 Tool Kit Analysis

The data were examined to determine whether tool clusters were present at the site. Componont A included a varied tool assemblage including a graver, two retouched flakes, two arrowpoints, two dart points, and four Stage 3 or 4 bifaces. The two arrowpoints were found in the Feature 2 tipi ring. The Feature 4 tipi ring contained a single retouched flake. A graver, a retouched flake, and a used Stage 3 or 4 biface were associated with the Feature 1 cairn. The remaining Componont A tools were not associated with features. This distribution suggests that repointing of arrows took place both inside and outside the living space, while manufacture of new tools took place mainly outside the living space. The Feature 1 boulder may have provided a convenient seat for persons engaged shaping stone tools and wood handles or shafts, as both debitage and tool distributions suggest. Componont A materials from Block B included a large bifacial digging tool, a Stage 3 biface midsection, a used Stage 3 or 4 biface tip, and a dartpoint. This distribution again suggests that bifacial tool production took place primarily outside the living areas during this period of use of the site. The exact function of the large bifacial tool is not known; however, it is similar to tools found along the Missouri River and used for digging cache pits. Perhaps it was used to prepare holes for tipi poles, as neither subsurface hearths nor cache pits were associated with the tipi rings. Alternatively, this may have been a root-digging tool that broke during repair and was discarded.

Componont B tools included a dart point or preform near the Feature 1 cairn, again suggesting production of bifacial tools in this area of the site. Two broken retouched flakes with lateral retouch were associated with the Feature 2 tipi ring, suggesting some specialized activity there, perhaps related to hideworking or food preparation. Two unused Stage 2 bifaces were found in a mixed AB assemblage near the Feature 3 tipi ring. A fragment of a Badlands knife was found inside the tipi ring. This again suggests discard of broken bifaces within the living space, while production of new bifacial tools took place outside the tipis. A retouched flake was found near the Feature 4 tipi ring.

The Componont B level of Block B contained the largest concentration of tools at the site. These included a cobble scraper, several retouched flakes, one used and four unused Stage 2 bifaces, used and unused fragments of Stage 3 and 4 bifaces, broken projectile points, a graver, and a retouched pebble. These suggest an activity area devoted to biface production and repair or rehafting of bifacial tools. The discard pattern indicates that worn-out tools and manufacturing failures were discarded together.

Block B contained five tools that could not clearly be assigned to either of the upper components. These AB tools included a tested chert nodule, two blocky chert cores, a denticulated flake or shredder, and a used Stage 2 or 3 biface tip. With the exception of the shredder, these artifacts conform well to the Componont B emphasis on biface production from local chert nodules. The shredder may belong to the more diverse Componont A tool kit.

Two keeled scrapers were found in the AB assemblage northwest of the tipi rings. This clearly indicates a hide-working area, probably associated with the Componont A occupation of the site. Their location near, but not in, the tipi rings suggests that the tipis were present when these tools were in use.

An area northwest of the Feature 7 tipi ring contained several artifacts apparently related to stone tool production or repair. These included a split-cobble core, a spheroid core, two used biface tips, and a retouched flake. Other cores and bifacial manufacturing failures were found near the Feature 3 and Feature 4 tipi rings. At the northwestern limit of the site, a utilized core (chopper), a spokeshave, and a bifacially retouched flake (flake knife) were found in the AB assemblage. The Component B assemblage in the same area included a graver and a scraper. This suggests that some specialized tasks, including woodworking, were taking place at the periphery of the site.

While some of these tool distributions from Components A and B appear to represent tool kits and/or special activity areas, the associations may be spurious. The radiocarbon dates and distribution of diagnostic artifacts clearly indicate that the upper 30 cm of the site incorporates some 3000 years of archaeological materials, with considerable stratigraphic mixing of deposits. Thus, the members of an apparent set of tools may in fact have been deposited at widely different times.

Componont C comprised five retouched flakes and a biface fragment. A core was also found at this level. No potential tool concentrations or tool kits were noted in the Componont C assemblage.

## 5.9 Lithic Source Analysis

Lithic material from the Blaine site was identified as to source area through comparison with type collections at SARC. Selected samples were analyzed through macroscopic, microscopic (10x–40x), and shortwave ultraviolet light observation in order to determine accurate lithic source locations. The results of this analysis were then applied to the various research hypotheses outlined above.

### 5.9.1 Lithic Raw Materials

This section provides a detailed analysis of the different lithic materials found at the Blaine site. The chipped stone assemblage is classified into material types based on observations utilizing macroscopic, microscopic (10x–40x), and short wave ultraviolet light methods. Various lithic types and the reasons for the major separations are described below.

The analysis focused on isolating lithic characteristics that can be observed with relatively simple methods. These characteristics include the following: *color* (matched to a *Rock-Color Chart*, Geological Society of America, 1984), *color texture* (banded, mottled, or streaked), *translucency* (translucent or opaque), *luster* (dull, waxy, glassy, or sparkling), *patina* (presence or absence), *fracture* (conchoidal, subconchoidal, or blocky), *attributes* (dendrites, fucoids, vesicles, veins, vugs, ooliths, or crystal casts), *grain size* (silt to coarse sand), *grain shape* (rounded, subangular, or angular), *sorting among grains* (very well sorted to very poorly sorted), and *fluorescence* (none, a weak lemon yellow, weak lime green, strong lime green, and orange).

Using these methods, comparisons were made between the assemblage itself and type collections housed at SARC. The type collections derive mainly from Church's work in the Bearlodge region of the Black Hills but also include diverse collections from western South Dakota. Based on studies of regional lithic resources (Miller 1991; Church 1990) and regional mineralogy (Roberts and Rapp 1965), the chipped stone assemblage is divided into three groups: *tektosilicates*, *porcellanites*, and *orthoquartzites*.

There was a large amount of rough (nonchipped) rock associated with the Blaine site cultural layers. Some of this rock was found within hearth features and as stone alignments (tipi rings), suggesting use for heating and tent weights.

The rough rock is mostly limestone and sandstone, obtainable from local stream beds and talus slopes.

*Tektosilicate* refers to a mineral class that incorporates the vast majority of the cryptocrystalline rocks. The grains of these rocks are so fine that they cannot be viewed under low power (40) magnification. Tektosilicates are quartz, or pure to nearly pure silica. The tektosilicates include agate, chert, chalcedony, flint, quartz, obsidian, opal, and silicified wood. When irradiated with ultraviolet light of an appropriate wavelength, certain tektosilicates will luminesce predictable colors due to the presence of certain mineral properties. Under shortwave ultraviolet light, cherts will not luminesce, chalcedony will luminesce lime green, Knife River Flint will luminesce orange, and silicified wood will luminesce lemon yellow (Roberts and Rapp 1965; Fahrenbach 1991). Identification of quartz was based on lack of color and its easily recognized glassy appearance. An abbreviated term, *silicate*, is used for the purpose of presentation.

*Silicate 1.* This is one of the more abundant types of lithic material found at the Blaine site. The common colors are grayish red purple (5RP4/2) to pale purple (5P6/2) and pale red (5R6/2). The cortex is very rough with colors ranging from pale reddish brown (10R5/4) to pale red (10R6/2). The material ranges from a dull to waxy luster and is opaque.

The dominant characteristics of this material are color mottling and the presence of light colored milky inclusions. These inclusions luminesce lime green and range in size from 1 to 2 mm. These inclusions may be some form of chalcedony.

Silicate 1 has many traits that distinguish it from other silicates. It contains vugs, crystal casts, and veins. No patination was found on this lithic type. The majority of the specimens exhibit good to excellent conchoidal fracture characteristics.

Silicate 1 corresponds with Williams's Type 1 Spearfish formation chert from a recorded procurement site, 39CU1145, adjacent to 39CU1144. Williams noted two types of cherts found at 39CU1145. The first type conforms to Silicate 1. The second is believed to conform to Silicate 2. Type 1 Spearfish formation cherts are described as mottled purple, gray, and white cherts that display angular to blocky fracture characteristics (Williams 1992:5). Williams's Type 1 cherts were noticed in nodule form in outcrops from the gypsum beds of the Spearfish formation. Type 2 Spearfish formation cherts are described as being inferior quality with colors predominately reds, browns, and yellows (Williams 1992:6). Williams's Type 2 cherts were noticed in outcrops from the siltstone beds of the Spearfish formation. *Silicate 2.* This is the most abundant silicate found at the Blaine site. This silicate is believed to conform to the aforementioned Type 2 chert identified by Williams in the Spearfish formation. The common colors of the Blaine site materials are pink (5RP8/2), grayish pink (5R8/2), grayish orange pink (10R8/2), pale red (10R6/2), grayish red (5R4/2), yellowish gray (5Y7/2), dark yellowish orange (10YR6/6), and very light gray (N8). The cortex of Silicate 2 is rough and unpolished with moderate orange pink (5YR8/4, and 10R7/4) to moderate reddish orange (10R6/6) coloration. The material has a very dull luster and is opaque.

A very noticeable trait of this material is the amount of color mottling with a wide variety of colors. Concentric banding of this material was noticeable only within nodules. Crystal casts and veins occur near the cortex, but not in the middle of the nodules. The specimens display no patination. This type does not fluoresce. The fracturing characteristics of this silicate vary tremendously, from excellent to poor.

*Silicate 3.* This group probably corresponds to what is commonly referred to as clear chalcedony. This type fluoresces weak to bright lime green over the majority of its surface. Common colors are pale yellowish brown (10YR6/2), dark yellowish brown (10YR4/2), moderate brown (5YR4/4), and pale brown (5YR5/2). Many in this group are colorless, while the other examples have uniform light brown coloration. The cortex is rough and unpolished. The common cortex colors are very pale orange (10YR8/2) and very light gray (N8). The material has a waxy luster. It is ususally transparent with a few specimens being translucent.

Many of the specimens exhibit milky inclusions. This appears to be a common trait of this silicate. These inclusions do not luminesce. Ooliths are present, but these spherical inclusions are found only a few millimeters from the outer cortex. Patination is common. The material has excellent conchoidal fracture.

Silicates of this type, clear chalcedonies, are reportedly abundant in the Pahasapa and Minnelusa formations of the Black Hills (Tratebas 1979:65). None of the specimens are a good match with the SARC samples. This category also included a single piece of Badlands plate chalecdony from the White River Badlands.

*Silicate 4.* This group probably corresponds to what is commonly referred to as milky chalcedony. This type fluoresces weak to bright lime green over most of the surface, as does Silicate 3. The difference is that Silicate 4, being milky, is much less transparent than Silicate 3, which is clear. There is also more variation in color. Silicate 4 ranges anywhere from light brown (5YR6/4) to white (N9) or very light gray (N8). The cortex varies from rough to polished (waterworn). Cortex colors are the same as the Silicate 3, very pale orange (10YR8/3) to very light gray (N8). The material has a waxy luster and is fairly translucent.

There are some milky inclusions, or possible ooliths, suspended within the matrix, similar to the Silicate 3 group. Veins occur in some of the specimens, but not most. The material has excellent conchoidal fracture characteristics.

Silicates of this kind, milky chalcedonies, are abundant in the Pahasapa and Minnelusa formations of the Black Hills (Tratebas 1979:65). The actual locations of procurement sites are unknown.

*Silicate 5.* This type is poorly represented in the Blaine site assemblage. This group likely conforms to chert commonly referred to as jasper or ferruginous chert. Material of this type was grouped together due to its distinctive, homogeneous red color. Color is homogeneous in all of the specimens, ranging from very dark red (5R2/6) to dusky red (5R3/4). The cortex is comprised of a rough matrix with colors from moderate reddish orange (10R6/6) to pale reddish brown (10R5/4). This material type has a waxy luster and is opaque.

This type does not luminesce under ultraviolet light.

There are some inclusions within this material, both milky ooliths and black specks. The ooliths are very noticeable without magnification, but they are uncommon. The black specks can only be seen with the aid of magnification. These black specks are either discolorations or possibly dark cherty inclusions. Some of the larger pieces contain large veins. These veins appear to affect the fracture characteristics, but all samples exhibit excellent conchoidal fracture.

The origin of this material is unknown, but it is believed that ferruginous chert replaces thin dolomite beds in the Cambrian and Ordovician Deadwood formation in the Black Hills (Lovering 1972:131).

*Silicate 6.* This form of silicate is quartz or rock crystal. In this report, quartz is subdivided into clear and milky forms.

Silicate 6 is the clear colorless variety. Cortex is not present. It does not luminesce, the luster is glassy, and it is transparent. There is no patination.

Fracture lines run throughout this type, a quality that is a normal trait for many types of quartz. This material displays a wide variety of fracturing characteristics, ranging anywhere from blocky to good conchoidal capabilities. The regional source of quartz is from veins within the Precambrian schist or as crystals in pegmatites found in the central Black Hills (Tratebas 1979:66).

*Silicate 7.* This silicate is the milky variety of quartz. It varies widely in colors anywhere from light brown (5YR6/4) to white. Some specimens with a pinkish tint (5R7/4) may be more appropriately called rose quartz. Cortex is present on one specimen. Cortex color ranges from very pale orange (10YR8/2) to moderate orange pink (5YR8/4). Cortex is very rough and unpolished. This material ranges from transparent to translucent. The luster is glassy. It does not luminesce and there is no patination.

One specimen has vugs, crystal casts, and some bright red to white inclusions. The most noticeable of these traits are the inclusions. The vugs and crystal casts are only present near the cortex. This material displays a wide variety of fracturing characteristics, ranging anywhere from blocky to good conchoidal capabilities.

*Silicate 8.* This silicate is believed to be silicified wood. In some cases it is extremely difficult to distinguish between silicified wood, Knife River Flint, and some milky forms of chalcedony. It was anticipated that the silicified wood would fluoresce a consistent lemon yellow to a dull lemonish orange, but some silicified wood did not fluoresce at all. In other instances, silicified wood fluoresced nearly the same bright orange as the Knife River Flint. The determining factor was the presence of parallel layers or growth rings indicative of silicified wood; however, in smaller specimens this may not be apparent.

Common colors at the Blaine site are predominantly browns, varying in shades from a grayish brown (5YR3/2), some moderate browns (5YR3/4, and 5YR4/4), to a pale brown (5YR5/2). Cortex is not present. The material ranges from nearly translucent to opaque, depending on the size and color of the specimen. The luster is waxy. Most specimens are patinated, which compounded the identification problems.

The most noticeable trait of Silicate 8 is the presence of parallel layers thought to be wood grain and growth rings. These traits are often visible without the aid of low power magnification (40). Another noticeable trait are white to off-white ooliths.

Silicified wood is the result of replacement of the organic material in woody plants by silica. The quality of material is dependent upon how well silica replacement has progressed. The fracture quality of the material can vary a great deal. Specimens from the Blaine site display a wide range of fracture characteristics, varying from blocky to excellent conchoidal fracture.

Silicified wood is very common in the northwestern areas of South Dakota, but the closest source is the Lakota formation in the Black Hills system, specifically the Fuson Member (Chevance 1979:20).

*Silicate 9.* This group is believed to be Knife River Flint, a high quality and widely traded silicate. The specimens from the Blaine site are fairly uniform in color, primarily dark brown. Color ranges from dusky brown (5YR2/2), dusky yellowish brown (10YR2/2), grayish brown (5YR3/2), to moderate brown (5YR3/4). Cortex can vary in color from white (N9) to yellowish gray (5R7/2). Occasional staining of the cortex results in a bright yellowish orange color (10YR8/6). Cortex is polished from water action. The material ranges from being nearly translucent in smaller, thinner pieces to opaque in large cobbles. The luster is waxy. The majority of the specimens fluoresce a bright orange. A small number did not fluoresce. The patina on Knife River Flint is often referred to as a rind, or an "orange rind," which emphasizes the orange color under ultraviolet light (Clayton, Bickley, and Stone 1970:287).

Color mottling was noticeable in specimens from the Blaine site in the form of darker colored bedding planes or lenses. All the Blaine site specimens display excellent conchoidal fracture.

Knife River Flint is primarily a secondarily deposited material, as the polished cortex indicates. This silicate type also occurs as primary deposits along the Knife River valley in North Dakota (Clayton, Bickley, and Stone 1970:282).

*Silicate 10.* The Silicate 10 type includes a variety of materials commonly grouped as "Spanish Diggings" cherts. This material is known as a high quality chert. Many colors exist within the Blaine site assemblage, including the more typical caramel coloring of dark yellowish orange (10YR6/6) and moderate yellowish brown (10YR5/4). The other color variations include pale yellowish orange (10YR8/6), yellowish browns (10YR4/2, and 10YR2/2), brownish black (5YR2/1), olive gray (5Y4/1), and reds (5R6/6, 5R5/4, and 5R4/6). The cortex is a rough matrix, usually white (N9), very light gray (N8), or very pale orange (10YR8/2). The material is opaque. Luster can range from very dull to waxy. There is no patina on any of the specimens.

A distinctive trait of some of the Silicate 10 group is the presence of dark dendrites that run throughout the matrix. These dendrites consist of mineral crystals, probably an oxide of manganese. Most specimens also have notable color mottling. The mottling seems to be exclusive to the darker colored samples, such as the dark browns and the grays. Vugs are present in a few specimens. All of the specimens exhibit excellent conchoidal fracture. The material does not fluoresce, and there is no discernable patination.

The Spanish Diggings Quarries are located in southeastern Wyoming. The chert is obtained from the Guernsey formation in the Hartville Uplift in southeastern Wyoming (Saul 1964:186). Virtually identical chert, particularly the dendritic, caramel colored chert, occurs in the Black Hills. Two types were collected by Church, one in Pennington County (39PN88), and one in Lawrence County (39LA138). These two lithic types derive from the Pahasapa formation (Church 1987:10 and 1988:5)

*Silicate 11.* This material was segregated because it was found throughout the site area. Its frequency, however, was relatively low. It does not match any of the samples within the SARC lithic collection. The colors consist of differing hues of gray: yellowish gray (5Y7/2), pale olive (10Y6/2), light olive gray (5Y5/2), grayish olive (10Y4/2), and olive gray (5Y3/2). No cortex is present on the specimens. The material is opaque with a waxy luster.

The most noticeable trait is the presence of veins composed of a white, silty material. Dendrites are also present within the matrix. Milky inclusions were visible under magnification (10x–40x). These inclusions range from 0.5 mm to less than 0.1 mm. Some streaking is apparent in this type but only in a minority of specimens. The material possesses excellent conchoidal fracture. This type fluoresces bright lime green. The origin of this silicate is unknown.

*Silicate 12.* This silicate was also segregated because it occurred throughout the site area. It does not match any of the samples in the SARC lithic collection. The colors are light bluish gray (5B7/1), medium bluish gray (5B5/1), very pale blue (5B8/2). These colors co-occur in the form of mottling in a majority of the specimens. No specimens had cortex. The material is opaque with a waxy luster.

Mottling is apparent in most specimens. The material possesses good to excellent conchoidal fracture. This type does not fluoresce. No patination was observed on this type of material. The origin of this material is unknown.

*Other Silicates.* A sizable group of silicates lacked commonalities that would warrant their separation into types. These are referred to as simply "other silicates."

*Porcellanite* is a metamorphic shale produced by subsurface coal burns. The unique origin of these rocks begins with the burning of underground coal seams that are thick enough to generate enough heat to metamorphose the overlying shale and clay. The burning apparently starts by spontaneous combustion on a coal seam's surface exposure and works back underground along the vein. As the overlying strata lose their support they collapse onto the coal bed, thereby creating a network of cracks or fissures leading to the surface. These fissures, in turn, act as vents allowing fresh oxygen to reach the fire below (Rogers 1917:4). It is along these fissures that different types of porcellanites are produced due to the extreme amount of heat created by the burning coal. These types of lithic materials can be found wherever there exist large deposits of subsurface coal. These areas include Montana, Wyoming, North Dakota, and South Dakota. Four types of metamorphosed rock are produced from these burning coal seams: baked shales, nonvitreous and vitreous porcellanite, fused glass, and fused shale and clinker (Fredlund 1976:208). Of the four types listed above, two were particularly used by prehistoric populations in the region. These are the abundant red or gray vitreous and nonvitreous porcellanites, and to a lesser extent, the natural or fused glass.

During the analysis of the lithic assemblage of the Blaine site it became apparent that porcellanite was represented by two different forms: a semivitreous porcellanite and a vitreous porcellanite. These two different forms are very easy to recognize due to the presence of vesicles. Vesicles result from small bubbles of air forming within the stone by the expansion of gas or steam during solidification. The heat produced from these coal burns affects the manner in which the porcellanite fuses together, generating a streaked appearance from flowage lines and some abrupt color changes. Both types are comprised of such fine grained materials that the grains are not visible under low power magnification (40x). However, with low power magnification (40x), the vesicles of the material are quite apparent. These vesicles are a distinctive trait of porcellanites, and they form the basis for the separation of the two types below.

*Porcellanite 1.* This is a semivitreous form of porcellanite. The color at the Blaine site is homogeneous dark reddish brown (10R3/4). No cortex is present. The material is opaque with a waxy to semiglassy luster. This type possesses very small, infrequent vesicles visible at low magnification (10–40x). Many fewer vesicles are present in the semivitreous form than in the vitreous form. There are some color variations due to the flowage of the molten shale. As the molten shale begins to cool and solidify, these flowage lines become more pronounced in the form of color variations. These color variations are present in all of the forms of semivitreous porcellanite found. No patination is present on any of the specimens. The material does not fluoresce. This material displays excellent conchoidal fracture.

*Porcellanite 2.* This is a vitreous form of porcellanite. The vitreous porcellanite has more color varieties than the semi-vitreous porcellanite. The common colors are reds, grays, and black. The reds range from blackish red (5R2/2) to very dusky red (10R2/2). The grays range from medium light gray (N6) to medium dark gray (N4). The only black noticed is pure black (N1). No cortex is present. The material displays a glassy luster and is opaque to semitranslucent in thin flakes. It does not luminesce.

The most noticeable trait of vitreous porcellanite is the high frequency of vesicles and their variations in size. Many of these vesicles can be seen without the aid of low power magnification. There is no patination of the material. This material displays excellent to poor conchoidal fracture.

*Orthoquartzites* are extremely resistant sedimentary sandstones in which the clastic material is particularly well cemented by silica. Quartz grains are a major constituent of the orthoquartzites presented below, although some of the rock has a significant amount of matrix composed of finer silts and clays. The orthoquartzites have been subdivided largely on the basis of grain size, grain sorting, and the character of the matrix. An abbreviated term for orthoquartzites, quartzite, is used here.

*Quartzite 1.* This type of quartzite is fairly distinct. It incorporates orthoquartzites commonly referred to as Hogback or Black Hills quartzites. It comes in many colors, most commonly reds, browns, and olive grays. Reds range from pale red (5R6/2), moderate reds (5R5/4, 5R4/6), grayish reds (5R4/2, 10R4/2), to very dark red (5R2/6). Browns range in color from light browns (5YR6/4, 5YR5/6), pale brown (5YR5/2), moderate browns (5YR4/4, 5YR3/4, and 10YR5/4), to dusky browns (5YR2/2, and 10YR2/2). Olive grays range from light olive gray (5Y5/2) to dark olive gray (5Y3/2). Matrix is transparent. Cortex was not present. The material displays a sparkling luster and is generally opaque, but thin flakes can be translucent. This type does not luminesce.

Dark particles and veins occur in some specimens. Dark particles are present in nearly all material of this type. These dark particles may be mineral inclusions. Rock fragments and/or cherts are also visible within the matrix. The veins occur in a minority of the specimens. Individual grain sizes are often difficult to distinguish, perhaps due to transparent matrix or outgrowths of the quartz grains. Grain size appears uniform, with a majority being medium to fine. These grains range from subrounded to rounded and are well sorted. This type of quartzite has excellent conchoidal fracture.

Hogback, or Black Hills, quartzites are known from many recorded quartzite quarries in the Hogback that encircles the Black Hills. One of the better known quarry areas is the Fall River formation Flint Hill quarry (39FA95) in Fall River County (Witzel and Hartley 1976:13). This quarry lies approximately fifty kilometers southeast of the Blaine site and could have been an important lithic procurement site for the its occupants. Most of the Blaine site orthoquartzites are classified as Quartzite 1.

*Quartzite 2.* This type of quartzite has been segregated due to its finer grain size and an opaque white to yellowish white matrix. Colors include light reds (5R7/4, and 5R8/2), tans (10YR8/6, and 10YR8/2), shades of white (N9, and N8), and grays (N7,N6,N5,N4, and N3). Cortex is not present. This material is opaque and displays a dull to sparkling luster. Quartzite 2 does not luminesce.

Some color mottling and streaking is visible within the darker specimens of Quartzite 2. A few inclusions result in minute discolorations of the matrix. Grain size ranges from fine to very fine. Individual grains are rounded and bonded together with a white and/or yellowish white matrix. Within this matrix are inclusions that vary in color from white to black. The grains are well sorted. This material displays excellent conchoidal fracture. This type is probably Hogback or Black Hills quartzite, as well.

*Quartzite 3.* This material was grouped together due to its very fine grain size and heavy color streaking. The colors are predominantly oranges (10YR8/2 and 10Y6/6), browns and tans (5YR6/4 to a 5YR3/4), olives (5Y6/4 and 5Y3/2), and reds (5R4/2 and 10R4/2). Cortex is not present on the samples. The luster is typically dull, but the quartz grains will, at times, refract light to give a sparkling effect.

This type of quartzite does not luminesce and patina is not present. The material is opaque. Color streaking is apparent on all specimens and is a hallmark of the Quartzite 3 type. The grains of this material are very fine to silty, and are predominantly well sorted. The grains are suspended within a matrix derived from fine silts and clays. This type has good to excellent conchoidal fracture.

Quartzite 3 is identical to samples of upper Jurassic Morrison formation orthoquartzites collected by Church in the Bearlodge range of the Black Hills, Crook County, Wyoming. The samples come from two nonused source locales, 4MR48CK and 3MR48CK (Church 1990:45–47 and Figure 31). Church's samples are limited but provide sufficient evidence of a match with Quartzite 3. This material is often referred to as silicified sediment or silicified siltstone. Morrison silicified sediment has been reported in the southwestern Black Hills along the Pilger and Elk Mountain escarpments (Tratebas 1979:64).

*Other Quartzites.* A small group of quartzites lacked commonalities that would warrant their separation into types. These are simply referred to as "other quartzites."

### 5.9.2 Blaine Site Lithic Raw Materials

Investigations at the Blaine site yielded 2838 pieces of debitage identifiable as to lithic raw material. Another 2221 pieces, consisting primarily of tiny debris from the waterscreen samples, were not identifiable to lithic source. The lithic assemblage includes 68 tools or tool fragments.

The Blaine site chipped stone assemblages are strongly localized. Two cherts outcropping in the site vicinity, Silicates 1 and 2, account for 46.3% of the identifiable lithic raw material in the debitage assemblage (Table 5.10). Local orthoquartzites make up another 21.2% of the identifiable debitage. The only non-local materials identified in the debitage assemblage are Porcellanite 1, Porcellanite 2, and Silicate 9 (Knife River Flint). Combined, these make up only 1.3% of the debitage assemblage. Silicate 10, Spanish Diggings Chert, is found both within the Black Hills and in the nearby Hartville uplift. This accounts for another 1.6% of the debitage. The four potential exotics combined make up only 2.9% of the debitage assemblage.

Within the tool assemblage, the only definitely imported material was a single bifacial knife made of Badlands plate chalcedony (Table 5.11). This amounts to 1.5% of the lithic tool assemblage. Three additional tools were made of Silicate 10, Spanish Diggings chert, which may or may not be exotic. These include a biface fragment, a projectile point blade fragment, and a retouched flake. A core with possible use-wear was also made of Silicate 10. Counting Silicate 10 as nonlocal and counting the S10 core as a tool, 7.2% of the tool assemblage is made of nonlocal material. Silicate 10 occurs in significantly higher proportions in the tool assemblage (5.8%) than in the debitage assemblage (1.6%). This provides some support for a nonlocal origin for this material, since tools are more likely than debitage to be imported long distances (Binford 1979; Andrefsky 1994). The presence of the Silicate 10 core suggests than some of this material may have been carried to the site in nodule form; however, this would seem to argue against long distance transport of the material. All in all, the tool assemblage provides little support for the existence of differential curation and/or import

Table 5.10: Debitage lithic raw material from 39CU1144.

| Unit | NA | P1 | P2 | Q1 | Q2 | Q3 | Q4 | S1 | S2 | S3 | S4 | S5 | S6 | S7 | S8 | S9 | S10 | S11 | S12 | S13 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Surface | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 1 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 7 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 4 |
| 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| A | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 9 |
| B | 101 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 117 |
| D | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| I | 1021 | 0 | 0 | 4 | 5 | 1 | 1 | 16 | 18 | 0 | 7 | 0 | 42 | 0 | 0 | 0 | 1 | 0 | 23 | 27 | 1166 |
| II | 174 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 9 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 9 | 198 |
| N387E937 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| N388E922 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 6 | 16 |
| N388E938 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| N388E943 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 4 | 15 |
| N389E943 | 7 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| N391.25 E901.32 | 568 | 0 | 0 | 1 | 3 | 0 | 0 | 84 | 17 | 0 | 2 | 0 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 22 | 701 |
| N391.50 E903.30 | 0 | 0 | 0 | 6 | 5 | 0 | 0 | 79 | 10 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 24 | 132 |
| N392E909 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 4 |
| N392E910 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| N392E914 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 18 |
| N392E915 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 7 |
| N392E932 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 6 |
| N393.75 E911.36 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 6 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 4 | 17 |
| N393E892 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 13 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 22 |
| N393E909 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| N393E913 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| N393E914 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 5 |
| N393E915 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 8 |
| N393E919 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 1 | 13 |
| N393E926 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 1 | 5 |
| N393E927 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 4 |
| N394E910 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| N394E913 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 |

Table 5.10: continued

| Unit | NA | P1 | P2 | Q1 | Q2 | Q3 | Q4 | S1 | S2 | S3 | S4 | S5 | S6 | S7 | S8 | S9 | S10 | S11 | S12 | S13 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N395E909 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 |
| N395E910 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| N395E911 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 |
| N395E913 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 4 |
| N396E903 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 2 | 11 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 15 | 33 |
| N396E909 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| N396E910 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 2 |
| N396E912 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| N396E922 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 4 | 25 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 18 | 49 |
| N397E899 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 7 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 13 | 26 |
| N400E914 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 9 |
| N404E895 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 |
| N404E901 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 5 |
| N406E972 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 |
| N408E870 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 6 | 11 |
| N408E877 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 3 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 19 |
| N408E884 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 4 |
| N410E872 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 6 | 5 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 17 |
| N410E873 | 0 | 0 | 0 | 4 | 1 | 0 | 0 | 8 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 18 |
| N410E874 | 0 | 0 | 0 | 11 | 6 | 0 | 0 | 12 | 11 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 44 |
| N410E875 | 0 | 0 | 0 | 16 | 7 | 0 | 0 | 12 | 39 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 79 |
| N410E876 | 0 | 0 | 0 | 8 | 1 | 0 | 0 | 11 | 33 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 58 |
| N410E973 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 5 |
| N411E872 | 46 | 2 | 0 | 5 | 2 | 0 | 0 | 8 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 71 |
| N411E873 | 0 | 0 | 0 | 9 | 3 | 0 | 0 | 12 | 9 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 36 |
| N411E874 | 99 | 0 | 0 | 28 | 40 | 0 | 0 | 23 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 219 |
| N411E875 | 0 | 0 | 0 | 29 | 30 | 0 | 0 | 27 | 39 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | 130 |
| N411E876 | 49 | 0 | 0 | 19 | 10 | 0 | 1 | 4 | 43 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 145 |
| N412E872 | 0 | 4 | 1 | 5 | 1 | 0 | 0 | 7 | 8 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | 32 |
| N412E873 | 0 | 3 | 3 | 5 | 6 | 0 | 1 | 2 | 22 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 5 | 51 |
| N412E874 | 0 | 0 | 0 | 33 | 42 | 0 | 0 | 9 | 30 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 68 | 117 | 303 |
| N412E875 | 0 | 0 | 0 | 32 | 14 | 1 | 0 | 73 | 52 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 26 | 210 |
| N412E876 | 0 | 1 | 0 | 10 | 8 | 0 | 0 | 10 | 23 | 0 | 2 | 0 | 0 | 0 | 3 | 0 | 2 | 0 | 0 | 15 | 74 |
| N412E882 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 4 |
| N412E957 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 6 |
| N413E872 | 35 | 6 | 1 | 5 | 11 | 1 | 0 | 16 | 29 | 0 | 7 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 6 | 120 |
| N413E873 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 |
| N413E874 | 19 | 0 | 0 | 4 | 16 | 1 | 0 | 14 | 25 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 10 | 92 |
| N413E875 | 32 | 1 | 1 | 5 | 32 | 1 | 0 | 16 | 18 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 6 | 0 | 0 | 4 | 119 |

Table 5.10: continued

| Unit | NA | P1 | P2 | Q1 | Q2 | Q3 | Q4 | S1 | S2 | S3 | S4 | S5 | S6 | S7 | S8 | S9 | S10 | S11 | S12 | S13 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N413E876 | 55 | 1 | 0 | 13 | 7 | 0 | 0 | 7 | 12 | 2 | 5 | 0 | 0 | 0 | 2 | 1 | 4 | 0 | 0 | 5 | 114 |
| N414E872 | 0 | 3 | 0 | 5 | 0 | 0 | 0 | 13 | 5 | 0 | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 35 |
| N414E873 | 0 | 0 | 0 | 7 | 2 | 0 | 1 | 7 | 25 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 46 |
| N414E874 | 0 | 0 | 0 | 9 | 1 | 0 | 0 | 2 | 9 | 0 | 1 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 27 |
| N414E875 | 0 | 0 | 0 | 8 | 4 | 0 | 0 | 6 | 7 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 29 |
| N414E876 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 10 | 7 | 1 | 3 | 0 | 0 | 1 | 0 | 0 | 5 | 0 | 0 | 1 | 32 |
| N416E869 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 16 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 30 |
| N420E938 | 0 | 0 | 0 | 5 | 1 | 1 | 0 | 7 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 19 |
| N428E923 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 11 |
| N432E903 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 |
| N436E808 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| N436E894 | 0 | 0 | 0 | 2 | 3 | 0 | 0 | 15 | 15 | 0 | 1 | 0 | 6 | 0 | 3 | 0 | 1 | 1 | 0 | 2 | 49 |
| N436E909 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 10 | 12 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 28 |
| N448E866 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 5 | 3 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 16 |
| N448E867 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 2 | 8 |
| N448E884 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| N449E866 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 4 | 0 | 0 | 7 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 19 |
| N449E867 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 2 | 0 | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 11 |
| N452E875 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 13 | 8 | 0 | 1 | 1 | 0 | 0 | 4 | 0 | 2 | 0 | 0 | 5 | 35 |
| N464E835 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Total | 2221 | 21 | 11 | 320 | 274 | 6 | 9 | 625 | 689 | 13 | 89 | 4 | 69 | 2 | 32 | 6 | 45 | 9 | 94 | 520 | 5059 |
| Percent of identifiable raw material | — | 0.7 | 0.4 | 11.3 | 9.7 | 0.2 | 0.3 | 22.0 | 24.3 | 0.5 | 3.1 | 0.1 | 2.4 | 0.1 | 1.1 | 0.2 | 1.6 | 0.3 | 3.3 | 18.3 | 99.9 |

Table 5.11: Tool lithic raw material from 39CU1144.

| Unit | Level | Q1 | Q2 | Q3 | S1 | S2 | S3 | S4 | S5 | S6 | S10 | S11 | S13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surface | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Surface | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 2 |
| II | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| N387E938 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| N391.25 E901.32 | 20-30 cm | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N391.25 E901.32 | 30-40 cm | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N391.50 E903.30 | 0-05 cm | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N391.50 E903.30 | 5-10 cm | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N393.75 E911.36 | 10-20 cm | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| N393E909 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| N393E912 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| N393E919 | 20-30 cm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| N393E926 | 10-15 cm | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| N410E873 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| N410E874 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| N410E875 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N410E876 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| N411E872 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N411E875 | 3 | 1 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N411E876 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N412E873 | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N412E874 | 0–10 cm | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N412E874 | 10–20 cm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| N412E874 | 20–30 cm | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N412E875 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N412E957 | 70–80 cm | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Table 5.11: continued

| Unit | Level | Q1 | Q2 | Q3 | S1 | S2 | S3 | S4 | S5 | S6 | S10 | S11 | S13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N413E873 | 1 | 8 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N413E873 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N413E874 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N413E875 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| N413E876 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N414E873 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N414E875 | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N414E876 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N420E839 | 0–10 cm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| N420E938 | 30–40 cm | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N436E909 | 30–40 cm | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N449E867 | 50–60 cm | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N452E875 | 20–30 cm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| N464E835 | 90–100 cm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Total | 0 | 21 | 7 | 2 | 9 | 7 | 1 | 4 | 1 | 1 | 3 | 1 | 11 |
| Percent | 0 | 30.9 | 10.3 | 2.9 | 13.2 | 10.3 | 1.5 | 5.9 | 1.5 | 1.5 | 4.4 | 1.5 | 16.2 |

of exotic lithic materials.

Knife River Flint debitage (Silicate 9) was confined to Components A and B. The 6 pieces of KRF debitage occurred between 5 and 20 cm below surface. No tools of this material were found at the Blaine site. As was noted in Chapter 4, use of this material in the Black Hills generally correlates with early Late Archaic occupations. This agrees with the horizontal distribution of this raw material type, which is largely confined to the Middle to Late Archaic component of the site. The single Badlands knife fragment was also found in the Middle to Late Archaic component of this site. Badlands knives, Knife River Flint, and Late Archaic diagnostics commonly co-occur in the Black Hills.

The two kinds of porcellanite were confined to the upper 20 centimeters of the site in Components A and B. No porcellanite tools were found. Porcellanite is generally correlated with Late Prehistoric occupations in the Black Hills (see Chapter 4).

Silicate 10 debitage, Spanish Diggings chert, is more widely distributed. It occurs primarily 0–20 cm below surface, but a few pieces were found at 20–30 and 40–50 cm below surface. The three tools and possible core-tool made of Silicate 10 were found at or within 7 cm of the surface, placing them in Compononent A (Late Prehistoric). Together with ceramics from the site and the limited distribution of porcellanite, this provides a weak indicator of a shift toward a western or southwestern, rather than eastern, orientation corresponding to the Late Prehistoric component. Rather than migration or trade from the Middle Missouri subarea, as suggested by the Knife River Flint and Badlands knife in the Late Archaic component, links to the eastern Powder River Basin and/or the Platte River Valley are suggested by the Silicate 10 tools, the porcellanite debitage, and possibly the ceramics in the Late Prehistoric component. It should be stressed, however, that all of these materials occur as minor constituents of strongly localized artifact assemblages.

In summary, lithic assemblages from the Blaine site indicate a strong and persistent trend toward use of local materials. This overall local lithic procurement pattern is interrupted by a weak trend toward greater use of nonlocal materials during the Late Archaic and Late Prehistoric periods. Use of Knife River Flint and Badlands plate chalcedony is associated with Late Archaic use of the site, while porcellanite and Spanish Diggings chert are associated with the Late Prehistoric occupation. All of these trends conform with previous observations of Black Hills lithic material sourcing patterns.

## 5.10 Unmodified Rock

Rough, or non-chipped, rock was found in abundance at the Blaine site. This rock appears to have been largely used as heating stones and tent weights. The rock was evaluated according to three criteria: material type, form of material, and size. Material types included limestone, sandstone, siltstone, and chert (Table 5.12). Both tabular and rounded (waterworn) forms occurred. The unmodified rock included three size categories: pebble (less than 6.4 cm), cobble

Table 5.12. Summary of unmodified rock from the Blaine site, 39CU1144.

| Material | Count | Weight (g) | Percent by Wt. |
|---|---|---|---|
| Limestone | 2241 | 289558.64 | 74.29 |
| Sandstone | 412 | 62386.60 | 16.01 |
| Chert | 4 | 1674.40 | 00.43 |
| Misc. Silicate | 5 | 1062.10 | 00.27 |
| Unidentified | N/A | 35080.00 | 09.00 |
| Shale | 6 | 0.10 | <0.00 |
| Total | 2668 | 389761.84 | 100.00 |

(6.4 to 25.6 cm), and boulder (more than 25.6 cm). Rough rock less than 3.0 cm in size from the soil samples and features was not analyzed. Rough rock too small to piece-plot (less than 3.0 cm) also was not analyzed.

The limestone is believed to derive from the surrounding Minnekahta formation in the form of either stream or talus slope deposits. The Minnekahta limestone is described as a dolomitic gray to purplish-gray slabby limestone. Rough limestone in the cultural deposits was tabular and variable in size.

Most of the sandstone and probably all of the siltstone originated from the adjacent Spearfish formation. These rocks are readily available as stream and talus slope deposits. Most of the sandstone and siltstone in the site deposits was rounded or waterworn. The sizes of these rocks varied. Most specimens were red, reflecting their origin in the Spearfish formation.

The rough rock classified as chert appears to be the local Spearfish formation chert (Silicate 1 and Silicate 2). The cherts vary in form and size.

Unmodified rock was abundant throughout the site deposits; however, the highest concentrations were in the levels corresponding to components A and B (Table 5.13). This reflects the presence of stone circles (tipi features) in Component A and the general concentration of cultural materials in Component B. The distribution suggests a different site use for Component C, since the tipis suggested by the unmodified stone apparently were not a part of the Component C use of the site.

## 5.11 Faunal Material

In total, 1,870 bone fragments, weighing 679 g, were found at the Blaine site (see Table A.3 in the appendix). The bone assemblage at 39CU1144 consists of the fragmentary, scattered, and sometimes burned remains of artiodactyls and the intrusive remains of rodents. Systematic descriptions of the faunal material are presented in the appendix. Bone was found in all levels at the site but was most prevalent near the surface and associated with features (Table 5.14). The area of the site within 10 cm of surface (Component A) contained about 41.2%

Table 5.13. Distribution of unmodified rock by component from excavation units at the Blaine site, 39CU1144.

| Component | Wt. (g) | Percent | Count | Percent |
|---|---|---|---|---|
| A | 137027.04 | 52.84 | 166 | 7.55 |
| B | 88614.80 | 34.17 | 1982 | 90.13 |
| C | 33671.20 | 12.98 | 51 | 2.32 |
| Total | 259313.04 | 99.99 | 2199 | 100.00 |

of the recovered bone by number of fragments and 61.5% by weight. Features contained 32.7% of the bone by number and 63.8% by weight. Of 250 burned fragments, 206 occurred within features, strongly suggesting meat or marrow cooking as a feature function.

Table 5.14. Distribution of bone from 39CU1144 by number and weight. "B" indicates burned bone, "Other" refers to N499 E866 not divided by levels, and "% Burned" is by unit.

| Unit | Number | % Total | % Burned | Wt. (g) | % Total |
|---|---|---|---|---|---|
| Level 1 | 121 (20B) | 6.5 | 16.5 | 47.7 | 7.0 |
| Level 2 | 171 (5B) | 9.1 | 2.9 | 66.7 | 9.8 |
| Level 3 | 69 | 3.7 | 0.0 | 4.6 | 0.7 |
| Level 4 | 68 | 3.6 | 0.0 | 10.8 | 1.6 |
| Level 5 | 4 | 0.2 | 0.0 | 1.9 | 0.3 |
| Level 6 | 1 | <.1 | 0.0 | 0.2 | <.1 |
| Level 7 | 132 (1B) | 7.1 | 0.8 | 60.6 | 8.9 |
| Level 8 | 3 | 0.2 | 0.0 | 0.8 | 0.1 |
| Level 9 | 2 | 0.1 | 0.0 | 0.3 | <.1 |
| Level 10 | 7 | 0.4 | 0.0 | 12.9 | 1.9 |
| Level 11 | 6 | 0.4 | 0.0 | 29.5 | 4.4 |
| Level 12 | 1 | <.1 | 0.0 | 0.5 | 0.1 |
| Level 13 | 1 | <.1 | 0.0 | 7.4 | 1.1 |
| Shovel Test | 6 | 0.4 | 0.0 | 0.9 | 0.1 |
| Grader | 649 (5B) | 34.7 | 0.8 | 370.2 | 54.5 |
| Features | 612 (206B) | 32.7 | 34 | 63.8 | 9.4 |
| Other | 17 (13B) | 0.9 | 76.5 | 0.7 | 0.1 |
| Total | 1870 (250B) | 100.0 | | 679.5 | 100.0 |

Bone at the site included both intrusive rodent remains and artiodactyl remains in cultural contexts. The rodent remains were found as associations of disarticulated skeletal elements. Most of the limbs were unbroken or fractured midshaft, including such delicate elements as fibulae. Elements show abrasion, some rounding, and lack of some of the more delicate processes. The incomplete nature of the skeletons, along with the mechanically damaged nature of the bones suggests predepositional erosion, mixing, and/or transport. The rodent remains are in better condition and less soil-stained then the artiodactyl remains, suggesting that they are of more recent origin than the larger mammals. The presence of the rodent bones also is evidence of postdepositional bioturbation at the site.

The nonrodent remains consist of soil-stained, small bone pieces or cracked limb fragments. The extreme fragmentation of bone at the site probably is the result of intential breakage for bone grease extraction or other food processing activity. Many of the limb fragment edges are roughened or splintered in appearence, possibly caused by alternate drying and wetting of the bone on and below the surface. Two fragments (#1306, #1620) have rodent gnaw marks which suggests the remains were exposed for some time before burial. Larger fragments also display the pitting and fine grooving caused by the acid action on the bone of plant root growth in the humic A horizon.

Some bone is more clearly culturally modified. Burned bone made up 13.4% of the bone assemblage. Burned bone was limited to unidentifiable large animal remains. Of this, 82.4% was found in or near features. Burned bone was also found in Level 1 (8.0%), Level 2 (2.0%), Level 7 (0.4%), the grader scrape (2.0%), and Unit N499E866, level unknown (5.2%). Apart from this burned bone, there is little other evidence of human modification of bone at the site. One rib fragment (#1085) has a triangular cut mark along a worn, broken end and another rib fragment (#1620) has several small cut marks along one edge. Limb fragment #1691 from the Grader Scrape displays cutmarks and green (fresh bone) flaking along one edge, however, the bone is unstained and is in much better condition that the other large mammal remains. It is assumed to be of modern origin.

Much of the bone from 39CU1144 is fragmentary. The small sample size suggests that little bone was processed or discarded at the site. Much of the bone could have been destroyed due to surface weathering and removal by scavengers; however, older, more fragile, and appreciably more bone was preserved at nearby 39CU1142. This confirms the contention that meat processing was not a major activity at the Blaine site. At the same time, the limited amounts of bone at the sight appear to have been heavily processed. Large animal bone appears to have been deliberately smashed in order to extract the bone marrow.

The identification of faunal elements was made with reference to comparative collections at the State Archaeological Research Center and the South Dakota School of Mines and Technology, Museum of Geology. Reference was also made to several published works (Gilbert 1980; Olsen 1985; Schmid 1972) and a master's thesis (Abbott 1989). None of the bone was in poor enough condition to require the use of preservatives. Glues were also not used in any bone reconstruction. The bone was dry brushed and left unwashed.

Identification of specimens beyond the ordinal level was difficult due to the fragmentary nature of the material. Only 3.8% of the bone assemblage was identifiable to the species level, with 0.1% identifiable to the genus level and 2.8% to the ordinal level. The remaining 93.3% was identifiable only as mammal bone.

The minimum number of individuals was defined as the least number of individuals represented by a particular left or right body part (Klein 1980). Using this method 7 individuals were recognized from 39CU1144: 3 *Eutamius minimus*, 1 *Marmota flaviventris*, 1 *Bison bison*, 1 *Microtus* sp., and 1 *Odocoileus* sp. The biases in this method are that it will overemphasize species with more body parts, species with more diagnostic elements, and species that are less prone to fragmentation.

In summary, the Blaine site contains very limited amounts of bone scrap. The vast majority of bone from the site is in the form of small, unidentifiable fragments. The data indicate limited use of bison and deer. Other ungulates may be represented in the mass of unidentifiable bone fragments; however, this is impossible to ascertain given the fragmented nature of the bone. Although marmot has been identified in archaeological contexts elsewhere in the northwestern plains (Frison 1991:265), the marmot remains from the Blaine site appear to be naturally rather than culturally deposited.

In its faunal assemblage, Blaine contrasts with other Red Valley sites. These typically contain only bison, or bison and wolf or dog, remains. The Vore site contained small amounts of deer bone among a prodominantly bison assemblage (Reher and Frison 1980). Blaine also contains less bone overall than the other investigated Red Valley sites. This no doubt reflects a functional difference, as the other Red Valley sites represent bison kill sites. The small amount of bone present at Blaine precludes a kill or meat processing function for the site. The data are more consistent with limited meat and marrow consumption in the context of short-term habitation.

## 5.12 Floral Material

The few seeds found within the Blaine site deposits were uncharred and are assumed to be non-cultural. Charcoal was not identified. No other floral remains were found at the site.

## 5.13 Seasonality Data

Very little information is available concerning the seasonality of site use at the Blaine site. The site is somewhat sheltered and outside the zone of heavy snowpack; thus, it could reasonably have been used at any time of the year. The bone assemblage did not contain any usable seasonality indicators, such as identifiable fetal or juvenile bison remains. The small size of the fire hearths suggests a cooking function, rather than heating facilities. This indirectly suggests warm-season use of the site. The lack of ground stone tools may also indicate a warm-season occupation. In the Black Hills, such artifacts are most commonly associated with winter or late fall occupations (Tratebas 1986). Overall, seasonality signals are weak, but somewhat suggestive of summer use of the site. The limited seasonality data are consistent throughout the site assemblage. In other words, no change in seasonality through time could be detected from the available data.

# Chapter 6

# GEOARCHAEOLOGICAL INVESTIGATIONS

## 6.1 Introduction

Geoarchaeological evaluation of the soil/sediment relationships at the Blaine site (39FA1144) had two goals. The primary goal was to assess the potential of sediments within the study area to contain intact archaeological deposits and to assess the stratigraphic integrity of the archaeological materials encountered during excavation. An additional goal was to document the terrace sequence at the Blaine site and determine its relationship to regional alluvial chronologies and paleoenvironmental models. These goals were considered important not only to the archaeological investigations at 39CU1144, but to predictive models of human-terrain relationships within the region.

Cultural materials at 39CU1144 are associated with the higher of two alluvial terraces within Gillette Canyon, a relatively small valley on the southwestern margin of the Black Hills physiographic section (Fenneman 1931:8). Based on their elevations, soil/sediment records, and the position of radiocarbon-dated cultural features and soil horizons, these two terraces are tentatively correlated to the middle to late Holocene Kaycee and Moorcroft terraces recognized in the adjacent Powder River Basin (Leopold and Miller 1954; Figure 6.1). The Kaycee equivalent terrace is of primary concern to archaeological investigations at 39CU1144 because Early Archaic and younger cultural components are associated with sediments in the top meter of this terrace fill. Component A (Late Prehistoric) is found on and near the surface of the Kaycee equivalent terrace. Component B (Middle and Late Archaic) extends from about 10 to 45 cm below the surface of this terrace, and Component C (Early Archaic) extends from about 45 to 90 cm below surface. No archaeological materials were found in the lower, Moorcroft terrace.

## 6.2 Physiography and Geology

The Gillette Canyon study area is located at the southwestern margin of the Black Hills, an isolated mountain range within the Great Plains physiographic province (Fenneman 1931:8). Gillette Canyon is a small valley occupied by an ephemeral tributary of the Cheyenne River. Two alluvial terraces are present within Gillette Canyon at the Blaine site. They are bounded by small ephemeral drainages on their northern, southern, and western margins and by limestone outcrops to the east. The bedrock outcropping immediately adjacent to the 39CU1144 study area is Minnekahta Formation limestone of Lower Permian age. Opeche Formation shale of the same age underlies the site (Love et al. 1977).

## 6.3 Background and Methods

Geoarchaeological investigations at the Blaine Site were guided by two working hypotheses. The first was that the terrace sequence at Blaine could be correlated to regional alluvial terrace sequences. If correlations were found, the sequence of terrace building and down-cutting could then be related to regional paleoenvironmental models. The second, alternative, hypothesis was that the alluvial chronology at the site was unique and not comparable to the regional model.

The prevailing alluvial terrace sequence for the Wyoming-Montana-South Dakota tri-state area is the classic model developed by Leopold and Miller (1954). This model identifies three Holocene terraces in the region. These terraces resulted from changing climatic conditions as evidenced by differences in geomorphic processes, stratigraphic sequences, and pedogenic development. The oldest is the Kaycee terrace. It is a fill terrace consisting of coarse alluvial gravels of either the late Pleistocene (Arvada Formation), the early Holocene (Ucross Formation), or both, overlain by finer grained alluvium of the middle to late Holocene (Kaycee Formation, ca. 4000–2500 BP, Leopold and Miller 1954). This terrace chronology is an idealized composite sequence. Even within Leopold and Miller's study area it is uncommon to see all three terraces at a given locale. In addition, the dates suggested by Leopold and Miller were largely inferential, because absolute dating techniques were still in their infancy at the time of their study. Subsequent studies within the region have refined Leopold and Miller's (1954) original chronology (e.g. Haynes and Gray 1965; Reider 1980, 1982, 1983, 1990).

To address the two hypotheses and their paleoenvironmental implications, soils, sediments, and terrace morphologies were examined using standard geological and pedological procedures. Within eight representative backhoe trenches (Trenches A–I), ten backhoe pits (Geomorphology Windows 1–10) and 27 archaeological test units, soil/sediment relationships were described to document their pedogenic and geologic characteristics (Birkeland 1984; Guthrie and Wittry 1982; Krumbein and Sloss 1963; USDA Soil Survey Staff 1975). Where possible, samples were collected and profiles were described in association with chronological, archaeological, and environmental indicators. Soil/sediment samples were collected for laboratory analysis to quantify geological and pedological interpretations and to provide data for future identification of specific soil horizons and sediment units. Laboratory analyses included particle size (Bouyoucos 1962), calcium carbonate equivalency (Piper 1950), organic matter (Walkley and Black 1934), sand-fraction composition (Folk 1980), and pH (Richards 1964).

## 6.4 Results

Two terraces are present in the Blaine site study area. The older and higher terrace (T2) is approximately 4–6 meters (13–20 feet) above the ephemeral channel on the western margin of the site. More than 2.7 meters of interbedded sands and gravels near the base of the T2 terrace yielded soil humates deposited during the late Pleistocene and early Holocene, based on two radiocarbon dates: 10,500 BP (TX-8149) and 9080 BP (TX-8148). A thin, ca. 45-centimeter, stratum of sandy sediments with gravel stringers overlies these coarse sands and gravels. This mid Holocene deposit is bracketed by dates of 6940 BP (Beta-74819) and 5580 BP (Beta-55604). A discontinuous deposit of Early Archaic archaeological material was found within this stratum. A thin, ca. 40-centimeter deposit of overbank sediments disconformably overlies this sandy level. Radiocarbon dated cultural features and humates from paleosols within this overbank cap suggest a period of floodplain stability from ca. 3600 to 3100 BP, occasionally interrupted by overbank flooding. Poorly separated Middle and Late Archaic cultural components were found within the overbank sediments of the T2 terrace.

Based on a radiocarbon date from a paleosol near the base of the lower, inset T1 terrace, the T2 floodplain was abandoned no later than ca. 2700 BP. The tread of the lower (T1) terrace is 1–3 meters (30–10 feet) above the ephemeral channel. Soil humates from two paleosols within the T1 terrace were radiocarbon dated at 2760±40 BP (TX-8151) and 510±40 BP (TX-8150). Both terraces have a thin veneer of overbank deposits that postdate terrace formation.

The following section models Holocene environmental conditions, suggests how these conditions may have influenced the occupation and preservation of the Blaine site, and assesses the relationship of these terraces to the Leopold and Miller (1954) model.

### 6.4.1 Ridge Top and Ucross Formation Sediments

The oldest sediments observed at 39CU1144 are colluvial and alluvial deposits that date to the late Pleistocene and early Holocene. Sediments of a similar age but different composition were present at 39CU1142, a site approximately 100 meters (330 feet) to the east and approximately 20 meters (65 feet) above the modern ephemeral channel at 39CU1144. The buried A horizon of a paleosol within fine-grained sediments at 39CU1142 is bracketed by charcoal samples radiocarbon dated at 10,170±60 BP (Beta-65398, CAMS-8995) and 9660±60 BP (Beta-63501, CAMS-7640). In comparison, radiocarbon ages obtained from soil humates of buried A horizons within the colluvial/alluvial sands and gravels at the nearby Blaine site yielded radiocarbon ages of 10,500±90 (TX-8149) and 9080±80 BP (TX-8148) (Figures 6.1, 6.2, and 6.3).

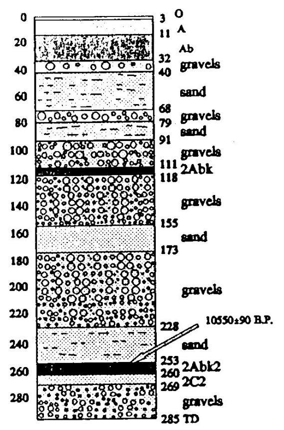
The similar ages of soils at these two sites indicate contemporaneous soil development, but the different parent materials indicate dissimilar depositional regimes. The sediments at the higher elevation 39CU1142 tend to be sand-sized and smaller, whereas those at the Blaine site are gravel-sized and include some boulders (≤40 cm in diameter). The relatively fine-grained nature of the late Pleistocene/early Holocene sediments at 39CU1142 suggests eolian and colluvial deposition. The coarse-grained gravels that form the bulk of the T2 terrace at 39CU1144 vary between being either matrix or clast supported. For this reason, they are considered to be the result of a mixture of colluvium and alluvial channel deposits. Base on their age, sediment properties, and position within the T2 terrace, the intercalated colluvial/alluvial sands and gravels at the Blaine site are correlated to the Ucross Formation (Leopold and Miller 1954).

The possibility was considered that the gravels were part of the Arvada Formation, the only other gravel-rich terrace sediments described for the Powder River Basin. However, Arvada Formation sediments are typically more highly weathered and iron stained (Leopold and Miller 1954). Evidence of weathering and iron staining was not observed in the gravels at 39CU1144, even where exposures extended to bedrock. The gravel exposures at 39CU1144 also lack the extremely calcareous and gypsum-rich Altithermal paleosol typically associated with the Ucross Formation (Leopold and Miller 1954:10). However, Leopold and Miller encountered some locales where this paleosol was absent and "fresh gravels" were disconformably overlain by Kaycee Formation sediments.

At 39CU1144, the Ucross is overlain by a thin layer of pre-Kaycee sediments dating ca. 7000 to 5600 BP. Radiocarbon dates suggest that a portion of the initial Holocene depositional record (ca. 9000 to 7000 BP) is missing at this locale; however, this may simply reflect a lack of deposition of organic material and/or soil formation during this period. In the western portion of the site (that nearest the drainage), a continuous gravel stratum marks the contact between pre-Kaycee and Ucross Formation sediments. In the eastern (upslope) portion of the site, gravel lenses are scattered throughout the pre-Kaycee sediments, but do not form a continuous contact between the pre-Kaycee and Ucross sediments.

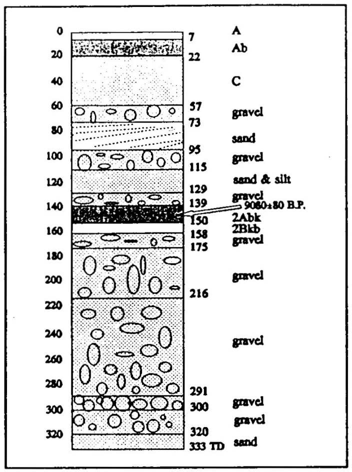
The coarse-grained (≤40 cm) texture of the alluvial/colluvial sediments of the Ucross Formation sediments at 39CU1144 indicates a high energy depositional environment and suggests that, if present at 39CU1144, cultural materials of Paleoindian age will not be in situ. However, higher elevation locales such as 39CU1142 that were not subjected to such high energy depositional processes would have been suitable for human occupation and site preservation.

The time frame indicated by the radiocarbon ages for Ucross soil formation and gravel deposition roughly correlates to the period associated with the incision and formation of the Kuner strath terrace of the South Platte River in northeastern Colorado (McFaul et al. 1994; Malde 1984, 1988). This correlation




| DEPTH (CM) | PARENT MATERIAL | HORIZON | CHARACTERISTICS/COMMENTS |
|---|---|---|---|
| 0-3 | | O | Dark reddish brown (5YR3/2m); loose |
| 3-11 | overbank | A | Reddish brown (5YR4/4m); moderate, medium, platy structure; slightly effervescent with disseminated carbonate |
| 11-32 | overbank | Ab | Dark reddish brown (5YR3/4m); violently effervescent with disseminated carbonate |
| | disconformity | | |
| 32-40 | alluvium | gravel lens | Violently effervescent with disseminated carbonate; consistence <0.25 cm kg/cm$^2$ |
| 40-68 | alluvium | | Yellowish red (5YR5/6d); silty sand; violently effervescent with disseminated carbonate; consistence <0.25 kg/cm$^2$ |
| 68-79 | alluvium | gravel lens | Violently effervescent with disseminated carbonate; consistence <0.25 kg/cm$^2$ |
| 79-91 | alluvium | | Reddish brown (5YR4/4m); silty sand; violently effervescent with disseminated carbonate; consistence < 0.25 kg/cm$^2$ |
| 91-111 | alluvium | gravel lens | Violently effervescent with disseminated carbonate; consistence <0.25 kg/cm$^2$ |
| 111-118 | alluvium | 2Abk1 | Reddish brown (5YR4/4d); moderate, medium, subangular blocky structure; slightly effervescent with common (8%), fine, irregular, segregated carbonate filaments; consistence=1.75 kg/cm$^2$ |
| 118-155 | alluvium | | Light reddish brown (5YR6/4d); violently effervescent with disseminated carbonate; consistence <0.5 kg/cm$^2$ |
| 155-173 | alluvium | sand lens | Yellowish red (5YR5/6d); sand; platy structure; strongly effervescent; 25% of upper 10 cm is carbonate whitened; consistence <0.25 kg/cm$^2$ |
| 173-228 | alluvium | gravel lens | Violently effervescent with disseminated carbonate; consistence <0.25 kg/cm$^2$ |
| 228-253 | alluvium | | Reddish brown (5YR4/4d); silty sand; massive; violently effervescent with common (12%), fine, irregular, segregated carbonate filaments; consistence=1.0 kg/cm$^2$ |
| 253-260 | alluvium | 2Abk2 | Reddish brown (5YR4/3m); discontinuous meadow soil; paleosol dates 10,500±90 BP (TX-8149) |
| 260-269 | alluvium | 2C | Yellowish red (5YR5/6m); violently effervescent with disseminated carbonate; consistence=1.0 kg/cm$^2$ |
| 269-285 (TD) | alluvium | gravels | |

Figure 6.1. Geomorphology of Window 1 profile. The Kaycee/pre-Kaycee contact is 32 cm below surface. The pre-Kaycee/Ucross contact was not determined, but probably falls at about 111 cm below surface.




| DEPTH (CM) | PARENT MATERIAL | HORIZON | CHARACTERISTICS/COMMENTS |
|---|---|---|---|
| 0-7 | overbank | A | Reddish brown (5YR4/3d) sand loam; weak, fine, granular structure; noneffervescent; consistence=0.5 kg/cm$^2$; boundary is abrupt, smooth |
| 7-22 | overbank | Ab | Reddish brown (5YR4/4d) sandy loam; weak, fine, subangular blocky structure; strongly effervescent with disseminated carbonate; consistence=1.5 kg/cm$^2$; boundary is abrupt, wavy |
| 22-57 | overbank | C | Reddish brown (5YR4/4m) sandy loam; strongly effervescent with disseminated carbonate; consistence=1.25 kg/cm$^2$ |
| | disconformity | | |
| 57-73 | colluvium | gravels | Reddish brown (5YR5/4m) flowage deposit; clasts up to 45 cm; very poorly sorted; consistence <0.25 kg/cm$^2$ |
| 73-95 | alluvium | sand | Reddish brown (5YR5/3m) medium to coarse sand; noneffervescent; consistence=1.0 kg/cm$^2$ |
| 95-115 | colluvium | gravels | Light reddish brown (5YR6/4m) flowage deposit; clasts up to 10 cm; very poorly sorted; consistence <0.25 kg/cm$^2$ |
| 115-129 | alluvium | overbank | Reddish brown (5YR5/3m) sandy loam; discontinuous Abk horizons only 3-5 cm thick; violently effervescent; consistence=1.75 kg/cm$^2$ |
| 129-139 | colluvium | gravels | Light reddish brown (5YR6/4m) flowage deposit; clasts up to 10 cm; very poorly sorted; consistence <0.25 kg/cm$^2$ |
| 139-150 | alluvium | 2Abk/ overbank | Reddish brown (5YR5/4m) sandy loam; discontinuous Abk horizons up to 10 cm thick; violently effervescent; consistence=1.75 kg/cm$^2$; radiocarbon dated to 9080±80 BP (TX-8148) |
| 150-158 | alluvium | 2Bkb/ overbank | Light reddish brown (5YR6/4m) sandy loam; weak, medium, subangular blocky structure; violently effervescent with common (8%), fine, irregular, segregated carbonate filaments; consistence=1.25 kg/cm$^2$ |
| 158-175 | colluvium | gravels | Pink (5YR7/4) flowage deposit; clasts up to 3 cm; poorly sorted; violently effervescent; consistence <0.25 kg/cm$^2$ |
| 175-216 | colluvium | gravels | Light reddish brown (5YR6/4m) flowage deposit; clasts up to 30 cm; very poorly sorted; matrix supported; violently effervescent; consistence <0.25 kg/cm$^2$ |
| 216-291 | colluvium | gravels | Red (2.5YR5/6m) flowage deposit; clasts up to 10 cm; very poorly sorted; violently effervescent; consistence <0.25 kg/cm$^2$ |
| 291-300 | alluvium | channel gravels | Light reddish brown (5YR6/4m) coarse sand; moderately well sorted; 5% pebbles up to 3 cm; violently effervescent; consistence <0.25 kg/cm$^2$ |
| 300-320 | colluvium | gravels | Reddish brown (5YR4/4m) flowage deposit; clasts up to 25 cm; very poorly sorted; violently effervescent; consistence <0.25 kg/cm$^2$ |
| 320-333 (TD) | alluvium | channel sands and gravels | Pink (5YR7/4m) channel sands; 3% pebbles up to 2 cm; sands are clean and well sorted; strongly effervescent; consistence <0.25 kg/cm$^2$ |

Figure 6.2. Geomorphology of Window 2 profile. The Kaycee/pre-Kaycee contact is at 57 cm below surface. The pre-Kaycee/Ucross contact was not determined, but probably lies at 95 cm below surface.

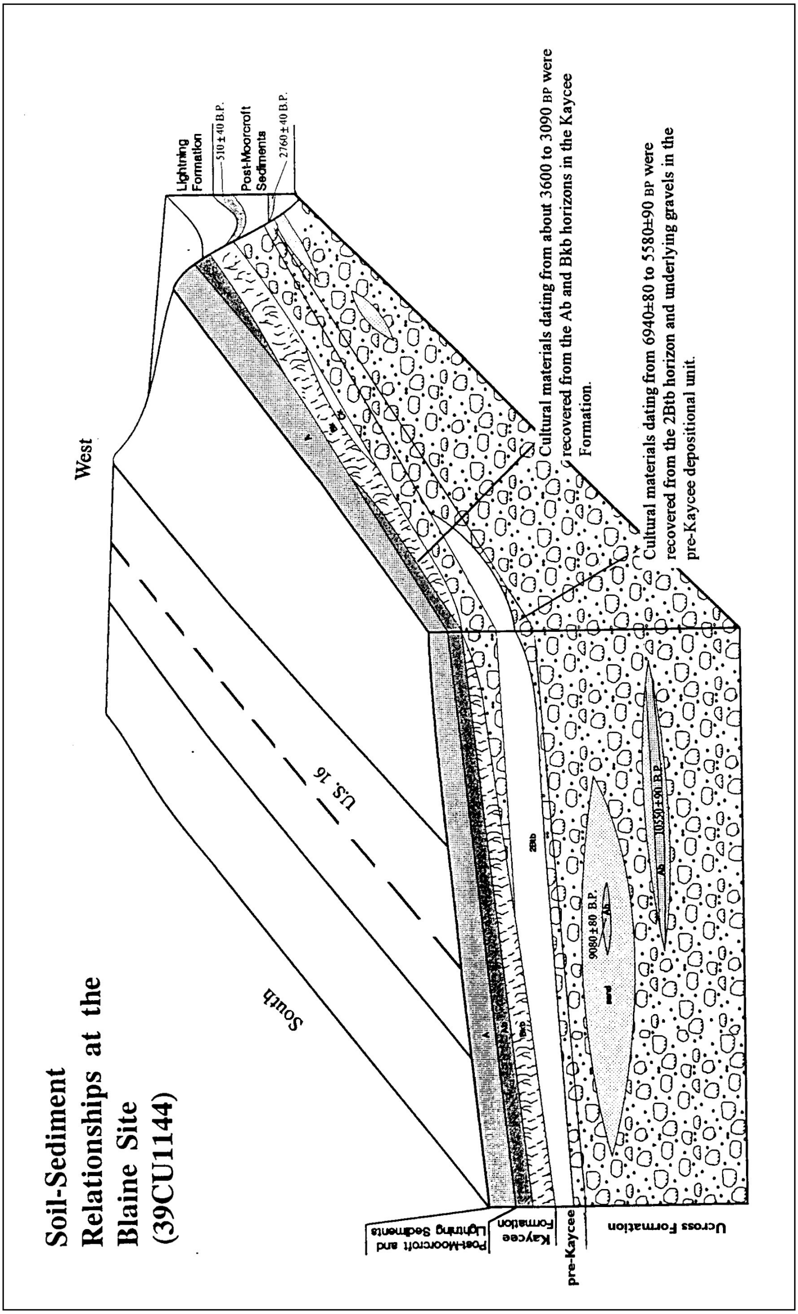



Figure 6.3. Composite summary of sediment relationships at the Blaine Site, 39CU1144.

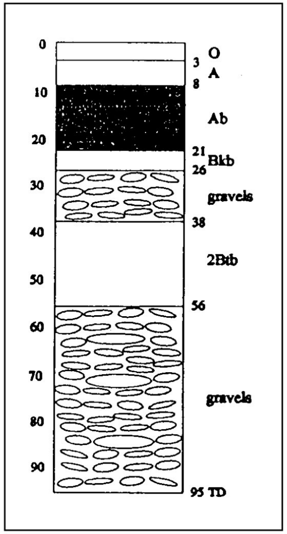
suggests that the period of coarse-grained alluvial deposition at 39CU1144 corresponds to a region-wide climatic event. The proposal that the South Platte River on the plains of northeastern Colorado experienced incision during the late Pleistocene and early Holocene while the drainage in Gillette Canyon experienced deposition probably is explained by their position within their respective drainage basins. That is, their different positions resulted in different volumes of discharge (stream order, see Strahler 1952) and thus different alluvial process during the early Holocene.

### 6.4.2 Pre-Kaycee Sediments

Between the coarse-grained Ucross Formation sediments and the overbank sediments correlated to the Kaycee Formation lies a thin layer of sandy sediment with gravel stringers. These sands and gravels suggest low-energy channel and overbank deposition, perhaps in and near a braided stream bed. Such a depositional regime would have permitted burial of archaeological materials, but these might have experienced subsequent disturbance. Although the contact between the pre-Kaycee and Kaycee sediments is irregular, the presence of a truncated soil horizon and the distribution of archaeological materials, including radiocarbon dates, indicates that the top of this stratum was erosionally stripped before the Kaycee sediments began aggrading. Radiocarbon dates suggest that this apparent gap in the depositional recorded extends from about 5580 to 3600 BP.

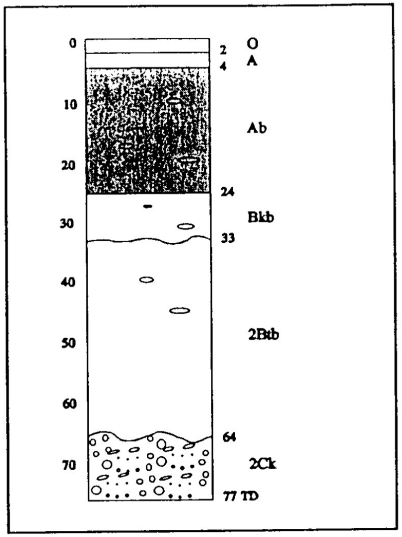
This unit at 39CU1144 is considered a separate unit rather than as a terminal Ucross deposit. Leopold and Miller (1954) attribute a remnant paleosol developed in Ucross sediments in the Powder River Basin to Altithermal climatic conditions. The top portions of this soil were removed by erosion, leaving only a crust of concentrated carbonates and gypsum. This suggests that Ucross deposition was complete prior to the onset of the Altithermal, variously estimated at 7000 to 8000 BP. The upper sands and gravels at 39CU1144 date to the Altithermal period and thus postdate the end of Ucross Formation deposition.

The pre-Kaycee deposits at the southeastern margin of 39CU1144 are near-channel overbank sediments that contain an argillic paleosol horizon (Horizon 2Btb in Figures 6.3, 6.4, and 6.5). This horizon has a sandy loam texture; a weak, coarse, subangular blocky structure; and few (15%) thin clay films on ped faces. Though very isolated in occurrence within the 39CU1144 boundaries, the clay cutans in this paleosol suggest soil development in a relatively moist but well-drained environment. Whether such conditions were widespread or only occurred adjacent to channels is unclear. The lack of an accompanying 2Ab soil horizon with the 2Btb horizon indicates that this paleosol was erosionally stripped. The discontinuous distribution of archaeological materials in this stratum probably is the result of this erosional stripping. If other portions of the drainage avoided erosional stripping (e.g. areas with broad, low-angle slopes), then it is possible that an intact 2Ab/2Btb paleosol will be present. In turn, the intact paleosol would have a higher potential of containing a horizontally continuous buried cultural deposit.




| Depth (cm) | Parent Material | Horizon | Characteristics/Comments |
|---|---|---|---|
| 0-3 | overbank | O | Brown (10YR4/3d); loose; slightly effervescent with disseminated carbonate; consistence=0 kg/cm$^2$; boundary is abrupt, smooth |
| 3-8 | overbank | A | Brown (10YR5/3d); weak, fine, granular structure; noneffervescent; consistence=1.25 kg/cm$^2$; boundary is abrupt, smooth |
| 8-21 | overbank | Ab | Very dark grayish brown (10YR3/2d); weak, medium, subangular blocky structure; slightly effervescent with disseminated carbonate; consistence=1.0 kg/cm$^2$; boundary is gradual, wavy |
| 21-26 | overbank | Bkb | Very pale brown (10YR7/3d); weak, medium, subangular blocky structure; violently effervescent with many (22%), fine, irregular, segregated carbonate filaments; 40% of the surface is carbonate whitened; consistence=1.5 kg/cm$^2$; boundary is abrupt, wavy |
| | disconformity | | |
| 26-38 | flowage | gravels | Light yellowish brown (10YR6/4d) massive; violently effervescent with common (4%), fine, irregular, segregated carbonate filaments; flowage gravels are matrix supported with clasts <15 cm; boundary is abrupt, wavy |
| 38-56 | flowage | 2Btb | Yellowish brown (10YR5/4d); weak, coarse, subangular blocky structure; violently effervescent with disseminated carbonate; clay films are few (15%), thin, and occur on the ped faces; consistence=0.75 kg/cm$^2$; laminated sands; boundary is abrupt, wavy |
| 56-95 (TD) | gravels | gravels | Light yellowish brown (10YR6/4d); massive; gravels are matrix supported with clasts < 11 cm; consistence=1.25 kg/cm$^2$ |

Figure 6.4. Unit N396 E921 profile. The Kaycee/pre-Kaycee contact is at 26 cm below surface.




| Depth (cm) | Parent Material | Horizon | Characteristics/Comments |
|---|---|---|---|
| 0-2 | | O | Reddish brown (5YR5/3d); loose; slightly effervescent with disseminated carbonate; consistence= 0 kg/cm$^2$; boundary is abrupt, smooth |
| 2-4 | overbank | A | Reddish brown (5YR4/3d); weak, fine, granular structure; noneffervescent; consistence=0.75 kg/cm$^2$; boundary is abrupt, smooth |
| 4-24 | overbank | Ab | Dark reddish brown (5YR3/3d); weak, medium, subangular blocky structure; noneffervescent; consistence=1.25 kg/cm$^2$; boundary is abrupt, wavy |
| 24-33 | overbank | Bkb | Reddish brown (5YR5/4d); weak, coarse, subangular blocky structure; violently effervescent with common (18%), fine, irregular, segregated carbonate filaments; consistence= 1.75kg/cm$^2$; boundary is clear, wavy |
| | disconformity | | |
| 33-64 | alluvium | 2Btb | Reddish brown (5YR5/4m); weak, coarse, subangular blocky structure; violently effervescent with disseminated carbonate; clay films are few (14%), thin, and occur on the ped faces; consistence= 2.25kg/cm$^2$; boundary is abrupt, wavy |
| 66-77 (TD) | flowage | 2Ck | Yellowish red (5YR5/6d); massive, violently effervescent with disseminated carbonate; gravels are a pebbly flowage with clasts from 1-2 cm and up to 8 cm; consistence=0.75 kg/cm$^2$ |

Figure 6.5. Unit N396 E902 profile The Kaycee/pre-Kaycee contact is at 33 cm below surface.

Comparable pre-Kaycee sediments are lacking from the Power River Basin. There the Kaycee Formation typically lies directly atop an Altithermal paleosol (caliche) developed in Ucross or Arvada Formation gravels. Because relatively few archaeological sites in the northern plains date to this period (ca. 7000 to 5500 BP), the pre-Kaycee sediments at 39CU1144 are important in three ways. First, they suggest that deposition did take place in some areas during the Altithermal, but that some of these deposits were subsequently eroded. Secondly, they show that people did not abandon the region during this period. Taken as a whole, the geomorphology of these sites as compared to that of the region indicates that the scarcity of sites dating to the Early Archaic period may be a consequence of preservation, not human behavior. Third, the pre-Kaycee deposition and erosion represented by these sediments and the disconformity between them and the Kaycee sediments suggests that the area experienced shifts in climate within the Altithermal climatic episode.

Sedimentary units dating to the Altithermal period have been found at other places in and near the Black Hills. Only one other stream terrace of Altithermal age is known from the area. A terrace fill along Box Elder Creek in Pennington County included alluvium with a mollic paleosol dating about 6700 BP (Donohue personal communication 1998). The Agate Basin Site about 45 km south of 39FA1144 contained an Altithermal-age arroyo fill disconformably overlying a late Pleistocene fill. The disconformity probably marks the Pleistocene-Holocene boundary ca. 8000 BP, but the exact age of the arroyo fill was not determined except as Altithermal (Frison and Stanford 1982). The Hawken Site in the northwestern Black Hills yielded radiocarbon dates of 6270 BP (RL-437) and 6470 BP (RL-185) from archaeological material within an arroyo fill (Frison 1991). Early Archaic artifacts have also been found near perennial springs in the interior Black Hills, but no archaeological or sediment studies have been done at these sites. The presence of an Altithermal age terrace fill at 39CU1144 should alert archaeologists to the possibility of similar deposits near other low gradient reaches of streams in the region.

### 6.4.3 Kaycee Formation Sediments

Examination of backhoe trenches excavated into the 4–6 meter (13–20 feet) high T2 terrace at 39CU1144 revealed that the coarse-grained Ucross Formation and pre-Kaycee sediments are more than three meters thick and are capped by 13–48 cm of fine-grained overbank sediments (Figures 6.3–6.20). This overbank cap has a sandy loam texture and contains a minor amount (ca. 3%) of pebble-sized clasts (Figure 6.21; Table 6.1). All Middle Archaic and younger archaeological materials at the Blaine site are within this thin cap of overbank sediments. The fine-grained nature of the sediments containing the archaeological materials and their proposed overbank deposition suggest a low energy depositional regime capable of burying cultural materials in situ.

Soil development in the overbank cap typically consists of an O/A/Ab/Bkb horizon sequence. The Ab paleosol horizon is overthickened (or cumulic, Birkeland 1984) in some exposures (Figure 6.19), indicating multiple episodes of

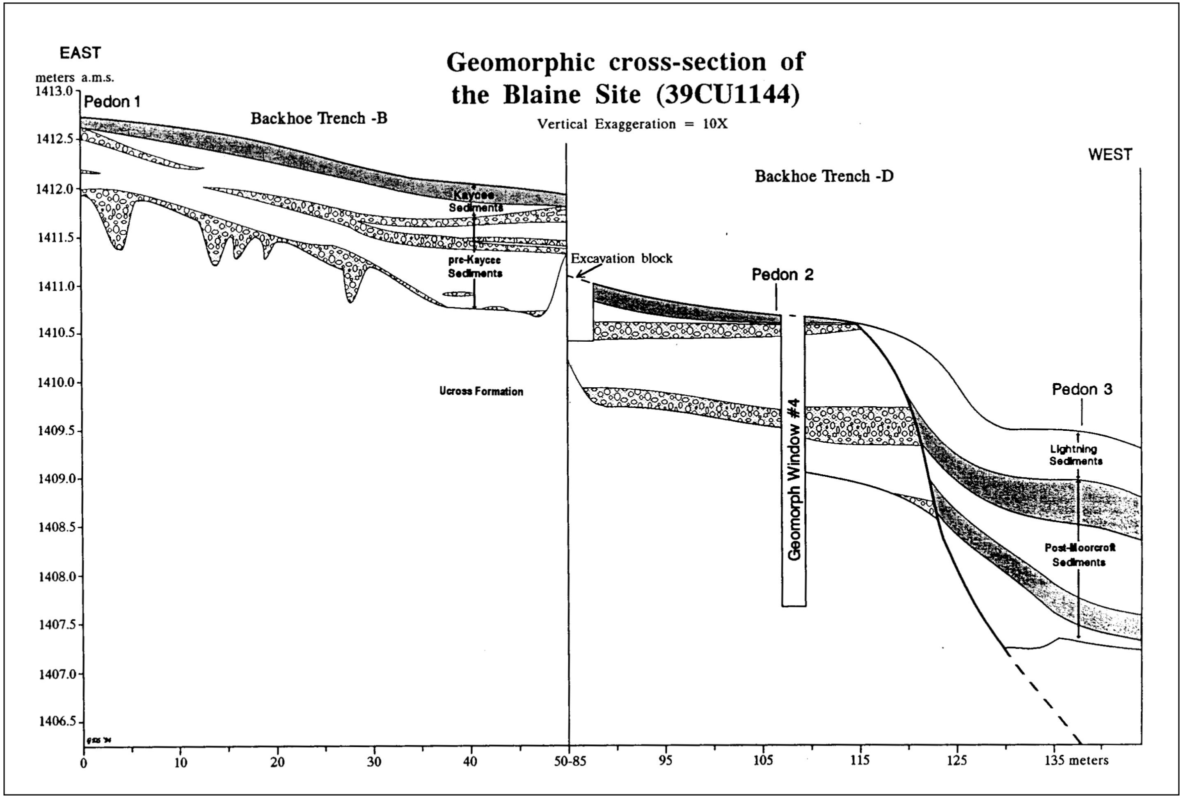
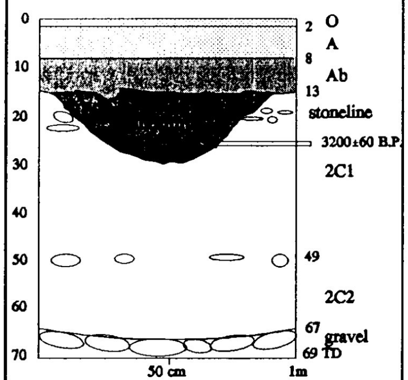
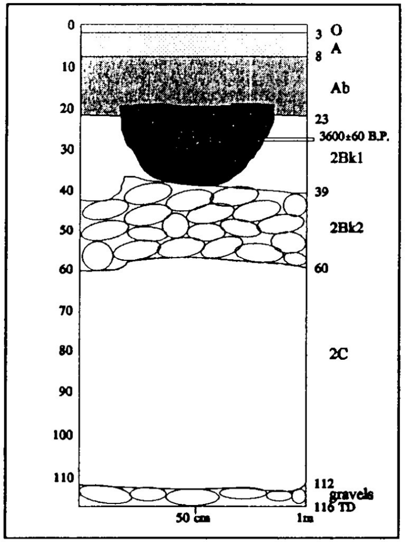



Figure 6.6. A cross-section of Kaycee terrace and Post-Moorcroft/Lightning sediments observed in Backhoe Trenches B and D at 39CU1144.



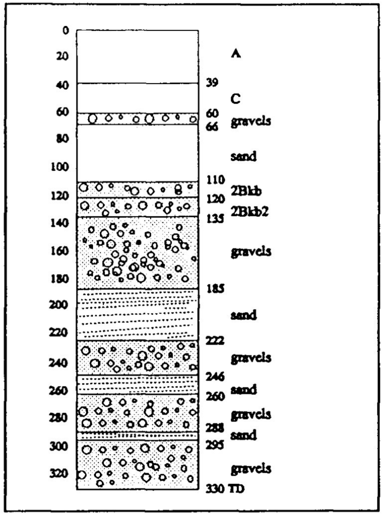

| DEPTH (CM) | PARENT MATERIAL | HORIZON | CHARACTERISTICS/COMMENTS |
|---|---|---|---|
| 0-2 | overbank | O | Dark reddish brown (5YR3/2m); loose |
| 2-8 | overbank | A | Reddish brown (5YR4/4m); moderate, medium, platy structure; slightly effervescent with disseminated carbonate |
| 8-13 | overbank | Ab | Dark reddish brown (5YR3/4m); violently effervescent with disseminated carbonate. Feature 8 hearth near base dates 3200±60 BP (TX-8153) |
| 13-49 | sand | 2C1 | Reddish brown (5YR5/4m); sandy clay; massive; violently effervescent with disseminated carbonate |
| 49-67 | sand | 2C2 | Yellowish red (5YR5/6m); clayey sand; massive; violently effervescent with disseminated carbonate |
| 67-69 (TD) | gravels | 2C3 | Yellowish red (5YR5/6m); violently effervescent with disseminated carbonate; flowage gravels 9-11 cm in diameter |

Figure 6.7. Pedon 1 profile, including Feature 8.



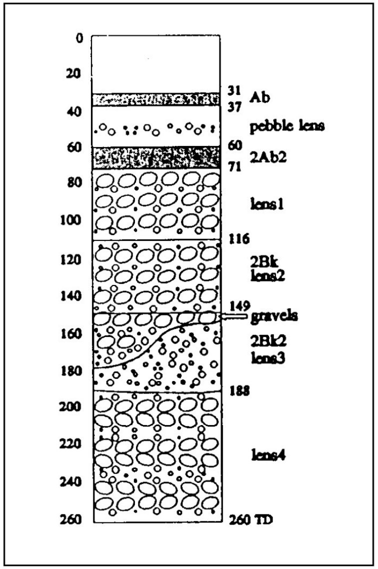

| Depth (cm) | Parent Material | Horizon | Characteristics/Comments |
|---|---|---|---|
| 0-3 | overbank | O | Reddish brown (5YR4/3d); loose |
| 3-8 | overbank | A | Reddish brown (5YR5/3d); granular |
| 8-23 | overbank | Ab | Dark reddish brown (5YR3/2m); weak, coarse, subangular blocky structure; Feature 9 hearth near base dates 3600±60 BP (TX-8154) |
| | disconformity | | |
| 23-39 | gravels | 2Bk1 | Reddish brown (5YR5/3m); weak, medium, subangular blocky structure; violently effervescent with many (25%) fine, irregular, segregated carbonate filaments; 40% of the surface is whitened |
| 39-60 | gravels | 2Bk2 | Light reddish brown (5YR6/4d); gravel, flowage, matrix-supported, with clasts up to 25 cm in diameter |
| 60-112 | sands | 2C | Light reddish brown (5YR6/4d); massive |
| 112-116 (TD) | gravels | | |

Figure 6.8. Pedon 2 profile, 39CU1144. Kaycee/pre-Kaycee contact is at 23 cm below surface. Pre-Kaycee/Ucross contact is at 39 cm below surface.



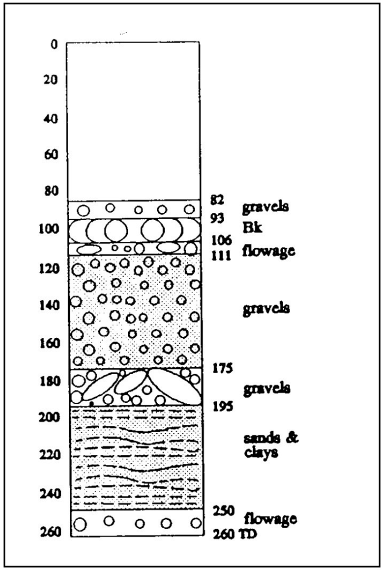

| DEPTH (CM) | PARENT MATERIAL | HORIZON | CHARACTERISTICS/COMMENTS |
|---|---|---|---|
| 0-39 | overbank | A | Dark reddish brown (5YR3/3m); violently effervescent with disseminated carbonate; consistence=0.75 kg/cm$^2$ |
| 39-60 | overbank | C | Reddish brown (5YR4/4m); consistence=1.25 kg/cm$^2$ |
| | disconformity | | |
| 60-66 | alluvium | gravels | Light reddish brown (5YR6/4m); violently effervescent with disseminated carbonate; consistence=0 kg/cm$^2$; flowage gravels are <6 cm in diameter |
| 66-110 | alluvium | sand | Yellowish red (5YR5/6m); massive; violently effervescent with disseminated carbonate; consistence=0.5 kg/cm$^2$; fine-grained sands |
| 110-120 | alluvium | 2Bkb1 | Reddish brown (5YR5/4m); violently effervescent with many (22%) fine, irregular, segregated carbonate filaments; consistence=1.0 kg/cm$^2$ |
| 120-135 | alluvium | 2Bkb2 | Pink (5YR7/3m); violently effervescent with disseminated carbonate; consistence=1.25 kg/cm$^2$; flowage gravels with 50% of the surface whitened |
| 135-185 | alluvium | gravels | Reddish brown (5YR4/4m); lensed channel gravels; clasts are 7-9 cm in diameter |
| 185-222 | alluvium | sand | Reddish brown (5YR4/4 and 5YR4/3m) to dark reddish brown (5YR3/2); sand; strongly effervescent with disseminated carbonate; consistence=1.0 kg/cm$^2$; clays and silts are horizontally bedded (2-4 cm) |
| 222-246 | alluvium | gravels | Reddish brown (5YR5/4m); violently effervescent with disseminated carbonate; clasts are <12 cm; channel gravels |
| 246-260 | alluvium | sands | Light reddish brown (5YR6/4m); strongly effervescent with disseminated carbonate; consistence=1.0 kg/cm$^2$; laminated channel sands (laminae <1 mm) |
| 260-288 | alluvium | gravels | Reddish brown (5YR5/4m); violently effervescent with disseminated carbonate; matrix supported gravels |
| 288-295 | alluvium | sands | Light reddish brown (5YR6/4m); slightly effervescent with disseminated carbonate; laminated channel sands (<1 mm); consistence=0 kg/cm$^2$ |
| 295-330 (TD) | alluvium | gravels | Light reddish brown (5YR6/4m); slightly effervescent with disseminated carbonate; channel gravels with clasts <16 cm in diameter; consistence=0 kg/cm$^2$ |

Figure 6.9. Geomorphology Window 4 profile. The Kaycee/pre-Kaycee contact is at 60 cm below surface. The pre-Kaycee/Ucross contact is at 110 cm below surface. Feature 23 occurred adjacent to this profile at 72–87 cm below surface. It dated to 6940±80 BP (Beta-74819).



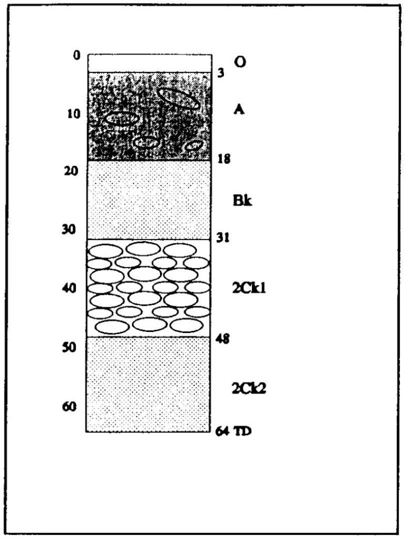

| DEPTH (CM) | PARENT MATERIAL | HORIZON | CHARACTERISTICS/COMMENTS |
|---|---|---|---|
| 0-31 | overbank | | Reddish brown (5YR4/4m); massive; consistence=0.25 kg/cm$^2$ |
| 31-37 | overbank | Ab | Reddish brown (5YR4/3m); massive; strongly effervescent with disseminated carbonate; consistence=0.25 kg/cm$^2$ |
| | disconformity | | |
| 37-60 | alluvium | | Pebble lens; clasts are <3.5 cm; consistence=0.75 kg/cm$^2$ |
| 60-71 | alluvium | 2Ab2 | Dark reddish brown (5YR3/2m); massive; consistence=0.5 kg/cm$^2$ |
| 71-116 | alluvium | lens 1 | Reddish brown (5YR4/4m); violently effervescent with disseminated carbonate; clasts are up to 37 cm; consistence=0.25 kg/cm$^2$ |
| 116-149 | alluvium | 2Bk/ lens 2 | Light reddish brown (5YR6/3m); violently effervescent with disseminated carbonate; clasts are up to 10 cm; consistence=0.25 kg/cm$^2$ |
| 149 | alluvium | | Red (2.5YR5/6m); gravel lens at 149 cm bs; clasts are up to 3 cm |
| 149-188 | alluvium | 2Bk2/ lens 3 | Pink (2.5YR7/3d); sand; weak, medium, subangular blocky structure; violently effervescent with many (27%) fine, segregated carbonate filaments; discontinuous sand lens pinches out to the west into the gravels; consistence=1.0 kg/cm$^2$ |
| 188-260 (TD) | alluvium | lens 4 | Reddish brown (5YR5/4m); violently effervescent with disseminated carbonate; consistence=0.5 kg/cm$^2$; limestone/gray micrite with vugs is below this lens |

Figure 6.10. Geomorphology Window 7 profile, 39CU1144. Feature 14 is near this profile at 13–30 cm below surface. The pre-Kaycee/Ucross contact is at 116 cm below surface.



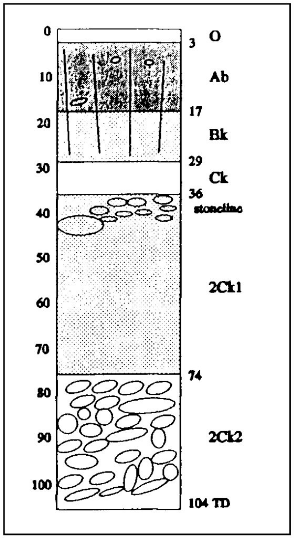

| DEPTH (CM) | PARENT MATERIAL | HORIZON | CHARACTERISTICS/COMMENTS |
|---|---|---|---|
| 0-82 | overbank disconformity | | See profile of N449/E867 (Figure 6.16) |
| 82-93 | overbank | gravels | Pink (5YR7/4d); consistence <0.25 kg/cm$^2$ |
| 93-106 | overbank | 2Bkb | Light reddish brown (5YR6/3d); weak, moderate, subangular blocky structure; violently effervescent with disseminated carbonate |
| 106-111 | overbank | flowage | Flowage deposit; clasts up to 45 cm; very poorly sorted; consistence <0.25 kg/cm$^2$ |
| 111-175 | overbank | gravels | Channel gravels; matrix supported with clasts averaging 10 cm; violently effervescent with disseminated carbonate; consistence <0.25 kg/cm$^2$ |
| 175-195 | alluvium | gravels | Gravels; clasts average 2-8 cm in diameter; violently effervescent with disseminated carbonate; consistence <0.25 kg/cm$^2$ |
| 195-250 | alluvium | sands and clays | Red (2.5YR4/6d) sands with dark reddish brown (5YR3/2d) organic lenses; laminated sands and clays; violently effervescent with medium, irregular, soft carbonate masses in the organic lenses; consistence <0.25 kg/cm$^2$ |
| 250-260 (TD) | alluvium | flowage | Red (2.5YR4/6d); violently effervescent with disseminated carbonate; consistence <0.25 kg/cm$^2$; poorly sorted flowage deposit with clasts <6 cm, predominately 2-3 cm in diameter |

Figure 6.11. Geomorphology Window 10 profile.



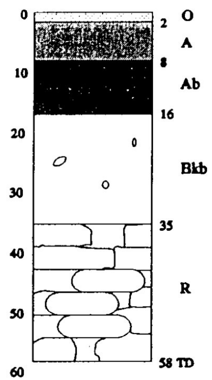

| DEPTH (CM) | PARENT MATERIAL | HORIZON | CHARACTERISTICS/COMMENTS |
|---|---|---|---|
| 0-3 | overbank | O | Reddish brown (5YR5/3d); slightly effervescent with disseminated carbonate; consistence=0 kg/cm$^2$; boundary is abrupt, smooth |
| 3-18 | overbank | A | Dark reddish brown (5YR3/3m); slightly effervescent with disseminated carbonate; consistence=0.75 kg/cm$^2$; clasts are <13 cm in diameter; boundary is clear, smooth; manuports |
| 18-31 | overbank | Bk | Reddish brown (5YR4/3m); violently effervescent with many (22-24%), medium, irregular, segregated carbonate filaments and seams; consistence=1.0 kg/cm$^2$; boundary is abrupt, wavy |
| | disconformity | | |
| 31-48 | gravels | 2Ck | Yellowish brown (5YR5/6m); violently effervescent with disseminated carbonate; gravel flowage; boundary is abrupt, smooth |
| 48-64 (TD) | alluvium | 2Ck | Yellowish red (5YR5/8m); sand; violently effervescent with disseminated carbonate; consistence=0 kg/cm$^2$ |

Figure 6.12. Unit N406 E972 profile.



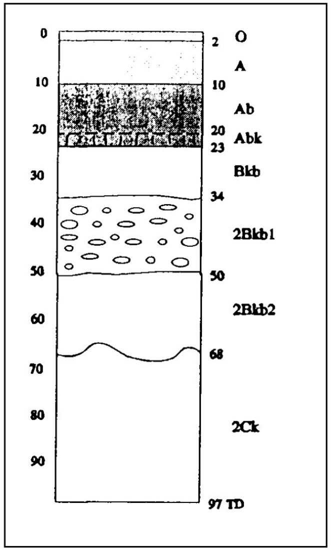

| DEPTH (CM) | PARENT MATERIAL | HORIZON | CHARACTERISTICS/COMMENTS |
|---|---|---|---|
| 0-3 | overbank | O | Reddish brown (5YR5/3d); loose, single grain; slightly effervescent with disseminated carbonate; consistence=0 kg/cm$^2$; boundary is abrupt, smooth |
| 3-17 | overbank | Ab | Reddish brown (5YR4/3m); weak, moderate, subangular blocky structure; slightly effervescent with disseminated carbonate; consistence=1.5 kg/cm$^2$; overbank sands; boundary is abrupt, smooth |
| 17-29 | overbank | Bk | Light reddish brown (5YR6/4d); weak, moderate, subangular blocky structure; violently effervescent with common (14%), fine, irregular, segregated carbonate filaments; overbank sands; consistence=2.0 kg/cm$^2$; boundary is abrupt, smooth |
| 29-36 | overbank | Ck | Light reddish brown (5YR6/4d); massive; violently effervescent with disseminated carbonate; consistence=1.0 kg/cm$^2$; boundary is abrupt, smooth |
| | disconformity | | |
| 36-74 | alluvium | 2Ck1 | Light reddish brown (5YR6/4d); massive; violently effervescent with disseminated carbonate; consistence=1.0 kg/cm$^2$; sand and 12% gravels <22 cm in diameter; flowage; stoneline |
| 74-104 (TD) | gravels | 2Ck2 | Light reddish brown (5YR6/4d); massive; violently effervescent with disseminated carbonate; consistence=0 kg/cm$^2$; flowage gravels |

Figure 6.13. Unit N412 E957 profile. The Kaycee/pre-Kaycee contact is at 36 cm below surface.



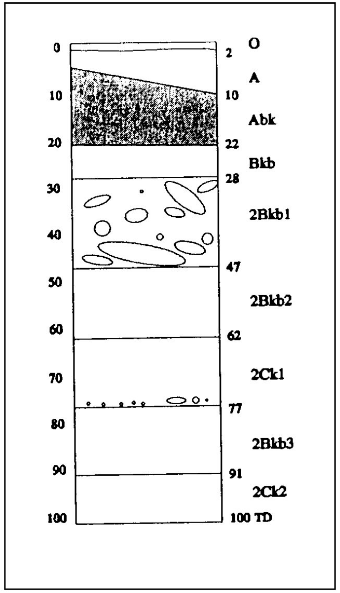

| DEPTH (CM) | PARENT MATERIAL | HORIZON | CHARACTERISTICS/COMMENTS |
|---|---|---|---|
| 0-2 | | O | Light reddish brown (5YR6/4d); single grain; slightly effervescent with disseminated carbonate; consistence=0 kg/cm$^2$; boundary is abrupt, wavy |
| 2-8 | overbank/ colluvium | A | Reddish brown (5YR5/4d); very fine, medium, granular structure; slightly effervescent with disseminated carbonate; consistence=0.5 kg/cm$^2$; boundary is abrupt, wavy |
| 8-16 | overbank/ colluvium | Ab | Reddish brown (5YR4/3d); fine, medium, subangular blocky structure; slightly effervescent with disseminated carbonate; pebbles are up to 3 cm; consistence=0.5 kg/cm$^2$; boundary is clear, wavy |
| 16-35 | overbank/ colluvium | Bkb | Light reddish brown (5YR6/3d); fine, medium, subangular blocky structure; violently effervescent with disseminated carbonate; pebbles >4 cm; consistence=0.75 kg/cm$^2$; boundary is gradual, irregular |
| 35-58 (TD) | bedrock | R | Pinkish white (5YR8/2d); limestone; Minnekahta Formation |

Figure 6.14. Unit N436 E909 profile. Sediments above limestone bedrock are Kaycee alluvium.



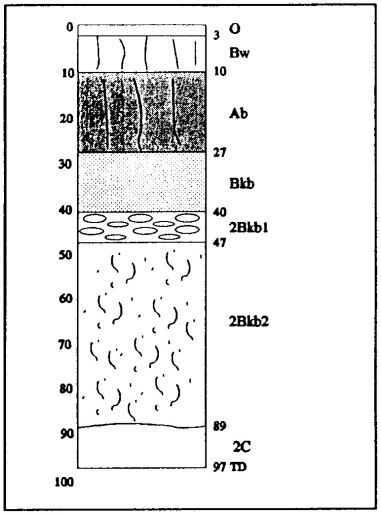

| Depth (cm) | Parent Material | Horizon | Characteristics/Comments |
|---|---|---|---|
| 0-2 | overbank | O | Light reddish brown (5YR5/4d); single grain; slightly effervescent with disseminated carbonate; consistence=0 kg/cm$^2$; boundary is abrupt, wavy |
| 2-10 | overbank | A | Reddish brown (5YR5/4d); very fine, medium, granular structure; slightly effervescent with disseminated carbonate; consistence=0.5 kg/cm$^2$; boundary is abrupt, wavy |
| 10-20 | overbank | Ab | Reddish brown (5YR4/3d); very fine, medium, subangular blocky structure; slightly effervescent with disseminated carbonate; pebbles are up to 3 cm ; consistence=0.5 kg/cm$^2$; boundary is gradual, wavy |
| 20-23 | overbank | Abk | Reddish brown (5YR4/3d), fine, medium, subangular blocky structure; violently effervescent with common (4%), fine, irregular segregated carbonate filaments; consistence=1.25 kg/cm$^2$; boundary is clear, smooth |
| 23-34 | alluvium | Bkb | Light reddish brown (5YR6/3d); fine, medium, subangular blocky structure; violently effervescent with disseminated carbonate; pebbles > 4 cm; consistence=0.75 kg/cm$^2$; boundary is gradual, irregular |
| | disconformity | | |
| 34-50 | alluvium | 2Bkb1 | Light reddish brown (5YR6/3d); massive; gravels are matrix supported light whitening up ≥13 cm; consistence=0 kg/cm$^2$; boundary is abrupt, wavy |
| 50-68 | alluvium | 2Bkb2 | Yellowish red (5YR5/6m); massive, violently effervescent with common (8%), fine, irregular, segregated carbonate filaments; consistence=1.25 kg/cm$^2$; boundary is clear, wavy |
| 68-97 (TD) | alluvium | 2Ck | Light reddish brown (5YR6/4d); massive; violently effervescent with disseminated carbonate; consistence=1.0 kg/cm$^2$ |

Figure 6.15. Unit N436 E894 profile. The Kaycee/pre-Kaycee contact is at 34 cm below surface.



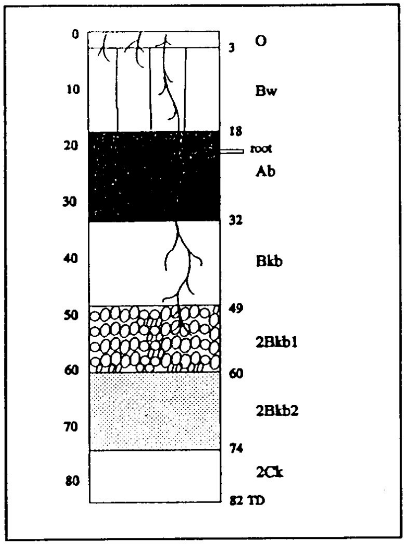

| Depth (cm) | Parent Material | Horizon | Characteristics/Comments |
|---|---|---|---|
| 0-2 | overbank | O | Reddish brown (5YR5/4d); loose, single grain; slightly effervescent with disseminated carbonate; consistence=0 kg/cm$^2$ |
| 2-10 | overbank | Ab | Yellowish red (5YR5/6d); very weak, medium, subangular structure; consistence=0.5 kg/cm$^2$; boundary is clear, smooth |
| 10-22 | overbank | Abk | Reddish brown (5YR4/3d); weak, medium, subangular blocky structure; slightly effervescent with common (7%), fine, irregular, soft carbonate masses; consistence=1.0 kg/cm$^2$; boundary is abrupt, wavy |
| 22-28 | overbank | Bkb | Reddish brown (5YR4/3d); violently effervescent with common (8%) fine, irregular, soft carbonate masses; whitened; weak, medium, subangular blocky structure; consistence=0.5 kg/cm$^2$; boundary is abrupt, wavy |
| | disconformity | | |
| 28-47 | gravel | 2Bkb1 | Light reddish brown (5YR6/3d); violently effervescent with disseminated carbonate on base of gravels; consistence=1.25 kg/cm$^2$; boundary is abrupt, wavy |
| 47-62 | alluvium | 2Bkb2 | Yellowish red (5YR5/6m); massive; violently effervescent with common (17%), fine, irregular, segregated carbonate filaments; consistence=1.0 kg/cm$^2$; boundary is abrupt, smooth |
| 62-77 | alluvium | 2Ck1 | Light reddish brown (5YR6/4d); massive; violently effervescent with disseminated carbonate and few, fine, irregular, segregated carbonate filaments; gravels are ≤6 cm; consistence=1.0 kg/cm$^2$ |
| 77-91 | alluvium | 2Bkb3 | Light reddish brown (5YR6/4d); massive; violently effervescent with common (4%), fine, irregular, segregated carbonate filaments; consistence=1.25 kg/cm$^2$; boundary is clear, wavy |
| 91-100 (TD) | alluvium | 2Ck2 | Light reddish brown (5YR6/4d); massive, violently effervescent with disseminated carbonate; consistence=1.0 kg/cm$^2$ |

Figure 6.16. Unit N432 E903 profile.



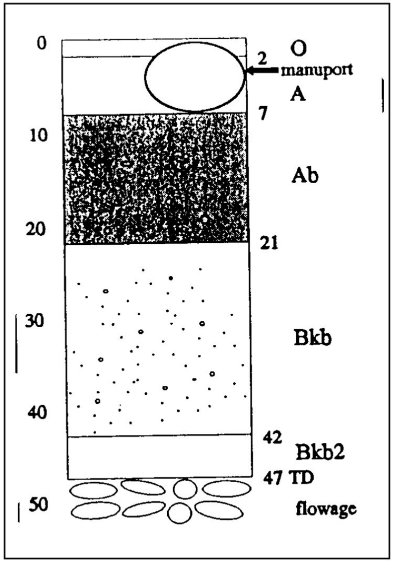

| DEPTH (CM) | PARENT MATERIAL | HORIZON | CHARACTERISTICS/COMMENTS |
|---|---|---|---|
| 0-3 | | O | Light reddish brown (5YR6/4d); weak, medium, granular structure; strongly effervescent with disseminated carbonate; consistence=0 $kg/cm^2$; boundary is clear, wavy |
| 3-10 | overbank | Bw | Reddish brown (5YR5/4); very weak, medium, subangular blocky structure; strongly effervescent with disseminated carbonate; consistence=0 $kg/cm^2$; boundary is clear, wavy |
| 10-27 | alluvium | Ab | Yellowish red (5YR5/6d); very weak, medium, subangular blocky structure; slightly effervescent with disseminated carbonate; consistence=0.5 $kg/cm^2$; boundary is clear, wavy |
| 27-40 | alluvium | Bkb | Light reddish brown (5YR6/4d); very weak, medium, subangular blocky structure; violently effervescent with few, fine, irregular, segregated carbonate filaments; consistence=1.0 $kg/cm^2$; boundary is abrupt, wavy |
| | disconformity | | |
| 40-47 | flowage | 2Bkb1 | Light reddish brown (5YR6/4m); very weak, medium, subangular blocky structure; violently effervescent with disseminated carbonate; matrix is gravel size (≤8 cm); consistence=0.75 $kg/cm^2$; boundary is abrupt, wavy |
| 47-89 | alluvium | 2Bkb2 | Reddish yellow (5YR6/6d); weak, medium, subangular blocky structure; violently effervescent with common (7%), fine, irregular, segregated carbonate filaments; consistence=0.75 $kg/cm^2$; boundary is clear, wavy |
| 89-97 (TD) | overbank sand | 2C | Yellowish red (5YR5/6d); loose, single-grained; violently effervescent with disseminated carbonate; consistence=0 $kg/cm^2$ |

Figure 6.17. Unit N452 E875 profile. Deposits above 40 cm are Kaycee Formation. Deposits below 40 cm are pre-Kaycee alluvium.




| Depth (cm) | Parent Material | Horizon | Characteristics/Comments |
|---|---|---|---|
| 0-3 | overbank | O | Reddish brown (5YR4/3d); weak, medium, granular structure; slightly effervescent with disseminated carbonate; consistence=0.75 kg/cm$^2$; boundary is abrupt, smooth |
| 3-18 | overbank | Bw | Reddish brown (5YR5/4d); very weak, medium, subangular blocky structure; slightly effervescent with disseminated carbonate; consistence=0.75 kg/cm$^2$; boundary is abrupt, smooth |
| 18-32 | overbank | Ab | Reddish brown (5YR5/3d); weak, coarse, subangular blocky structure; slightly effervescent with disseminated carbonate; consistence=1.0 kg/cm$^2$;; boundary is clear, wavy |
| 32-49 | overbank | Bkb | Light reddish brown (5YR6/4d); weak, very coarse, subangular blocky structure; violently effervescent with common (7%), fine, irregular, segregated carbonate filaments; consistence=1.0 kg/cm$^2$; boundary is clear, smooth |
| | disconformity | | |
| 49-60 | colluvial gravel | 2Bkb1 | Pink (5YR7/4d); matrix supported; violently effervescent with disseminated carbonate; consistence=3.5 kg/cm$^2$; limestone coatings up to 1 mm thick; clasts are predominantly 2-3 cm in diameter with other clasts up to 30 cm; boundary is abrupt, smooth |
| 60-74 | sands | 2Bkb2 | Light red (2.5YR6/6d); weak, coarse, subangular blocky structure; violently effervescent with common (15%), fine, irregular, segregated carbonate filaments; consistence=2.25 kg/cm$^2$; no clay skins; boundary is abrupt, irregular |
| 74-82 (TD) | sands | 2Ck | Light red (2.5YR6/6d); massive; violently effervescent with disseminated carbonates; consistence=1.0 kg/cm$^2$ |

Figure 6.18. Unit N449 E867 profile. The Kaycee/pre-Kaycee contact is at 49 cm below surface.




| Depth (cm) | Parent Material | Horizon | Characteristics/Comments |
|---|---|---|---|
| 0-2 | overbank | O | Reddish brown (5YR5/3d); loose; noneffervescent; consistence= 0 kg/cm$^2$; boundary is abrupt, smooth |
| 2-7 | overbank | A | Reddish brown (5YR4/3d); weak, fine, granular structure; noneffervescent; consistence=0.5 kg/cm$^2$; boundary is abrupt, smooth |
| 7-21 | overbank | Ab | Reddish brown (5YR4/4d); weak, fine, subangular blocky structure; noneffervescent; consistence=1.5 kg/cm$^2$; boundary is abrupt, wavy |
| 21-42 | overbank | Bkb1 | Reddish yellow (5YR6/6d); weak, fine, subangular blocky structure; violently effervescent with common (11%), fine, irregular, segregated carbonate filaments; consistence=1.25 kg/cm$^2$; boundary is clear, smooth. |
| 42-47 (TD) | overbank | Bkb2 | Reddish yellow (5YR6/6d); weak, medium, subangular blocky structure; violently effervescent with few, fine, irregular, segregated carbonate filaments; consistence=1.0 kg/cm$^2$; flowage at depth |

Figure 6.19. Unit N408 E883 profile.

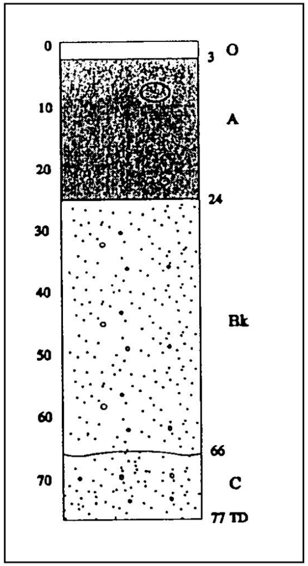
overbank flooding. Hearths at 39CU1144 are associated with the Ab horizon and intrude into the Bkb horizon (Figures 6.7 and 6.8). The upper portions of the hearths are within the cumulic Ab horizon, indicating that the occupations at 39CU1144 took place during a period when overbank flooding was common. The fact that the hearths intrude into the Bk horizon may imply that the hearth builders preferred the durability of this calcareous horizon for the construction of such features. An association of intrusive cultural features with calcareous soil horizons has also been noted for Late Prehistoric sites in the Southwest (McFaul et al. 1993). None of the hearths extend into the lower 2Btb horizon, perhaps because this is capped by a gravel in many places that would make digging difficult.

Radiocarbon ages of soil humates and charcoal obtained from hearths within the overbank sediments indicate that this upper cap was deposited from ca. 3600 to 3100 BP (Beta-74819 and 74818). Two hearths on the T2 terrace (Features 4 and 17) date to ca. 2500 BP (Beta-74815 and 74817). Since these postdate the 2760±40 BP (TX-8151) Ab2 soil in the inset T1 terrace (Figures 6.3 and 6.22), they represent occupations of the T2 surface after stream incision to the T1 level. For this reason, the ca. 3100 BP time frame indicated by Features 8 (3198±60 BP, TX-8153) and 19 (3090±60 BP, Beta-74817) is considered to approximate the abandonment of the T2 floodplain and incision to the T1 level. The ca. 3600–3100 BP time frame, the position of the terrace, soil development, and sediment characteristics suggest that the upper T2 overbank sediments correlate to the Kaycee Formation in the Powder River Basin and that the T2 terrace of 39CU1144 correlates to the Kaycee terrace (Leopold and Miller 1954). In the Powder River Basin, the Kaycee is estimated to have formed between 4000 and 2500 BP (Leopold and Miller 1954). In addition, the ca. 3100 BP time frame for abandonment of the Kaycee or T2 terrace corresponds to the end of the Late Triple Lakes glacial advance in the Colorado Front Range (Benedict 1981, 1985). Thus, the overbank sediments, soil development, and abandonment of the T2 or Kaycee terrace at 39CU1144 probably relate to climatic events. The ca. 6940–3090 BP age of the overbank cap and pre-Kaycee sediments also suggests that the upper 10–90 cm of the Kaycee terrace have the potential to yield Early Archaic and later cultural materials.

The uppermost sediments on the T2 terrace, those containing the modern A horizon, were not radiocarbon dated due to the likelihood of modern humate contamination. However, a radiocarbon age of 510±40 BP (TX-8150) was determined for humates in a buried paleosol at Geomorphology Window 5 (Figure 6.23). This date suggests that, after channel incision to the T1 level, both the T1 and T2 terraces were occasionally inundated. Late Prehistoric archaeological materials were associated with the surface and upper 10 cm of the T2 terrace.

### 6.4.4 The T1 Terrace

The tread of the lower or T1 terrace at 39CU1144 is 1–3 meters (3–10 feet) above the ephemeral stream channel. Sediments of this terrace consist entirely




| DEPTH (CM) | PARENT MATERIAL | HORIZON | CHARACTERISTICS/COMMENTS |
|---|---|---|---|
| 0-3- | | O | Reddish brown (5YR5/3d); loose; noneffervescent; consistence= 0 $kg/cm^2$; boundary is abrupt, smooth |
| 3-24 | overbank | A | Reddish brown (5YR5/4d); weak, fine, granular structure; slightly effervescent with disseminated carbonate; consistence=1.75 $kg/cm^2$; boundary is abrupt, wavy |
| 24-66 | overbank | Bk | Reddish yellow (5YR6/6d); weak, medium, subangular blocky structure; violently effervescent with common (24%), fine, irregular, segregated carbonate filaments; consistence=2.0 $kg/cm^2$; boundary is clear, wavy |
| 66-77 (TD) | overbank | C | Reddish yellow (5YR6/6d); massive, violently effervescent with disseminated carbonate; consistence=1.0 $kg/cm^2$ |

Figure 6.20. Unit N408 E870 profile.

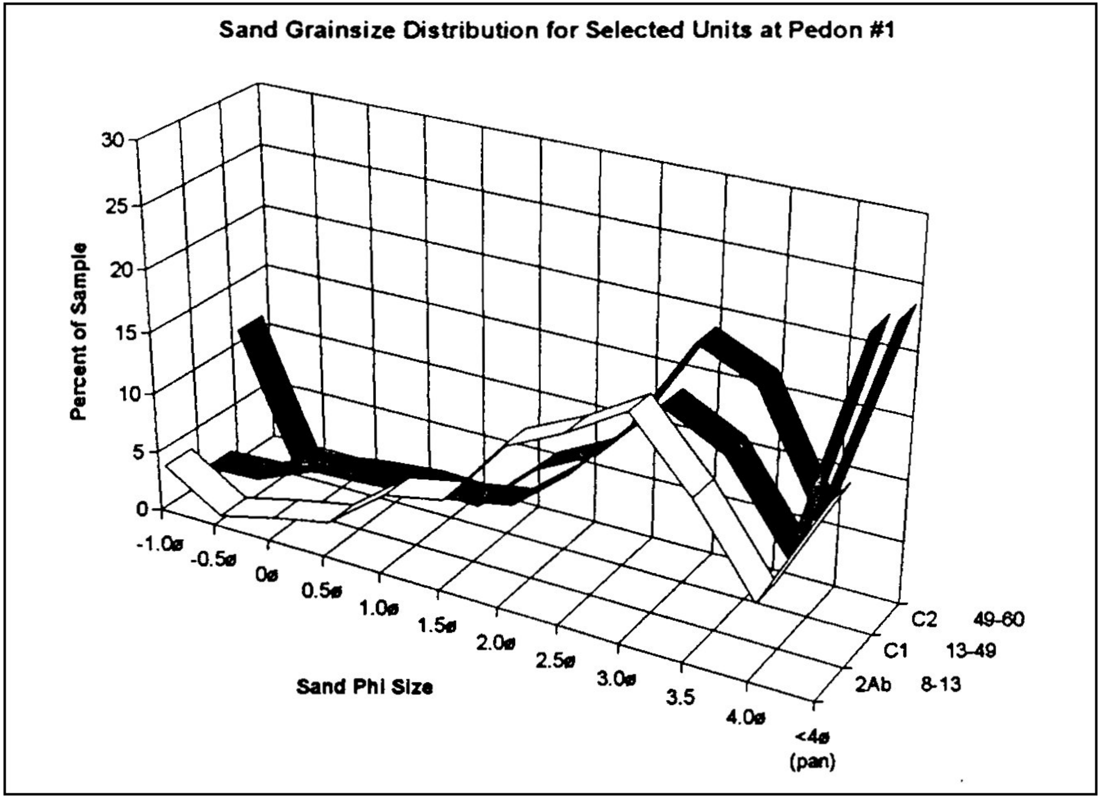
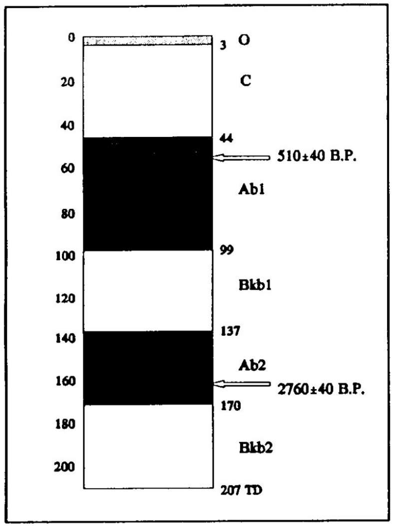



Figure 6.21. Grainsize distribution of selected overbank deposits on the T2 (Kaycee) terrace. Note the coarse "tail" from 1.0 to -1.0 phi. This is considered to be a result of colluvial pebbles within the overbank sediments.

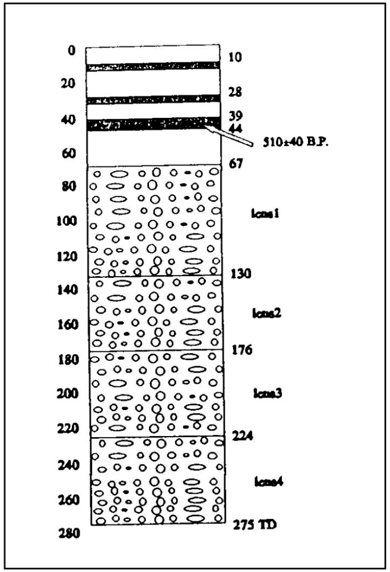
Table 6.1. Sediment textures and chemical properties of selected units at 39CU1144.

| Sample | Depth | pH | % CaCO3 | % O.M. | % Sand | % Silt | % Clay | Texture |
|---|---|---|---|---|---|---|---|---|
| N449 E867 | | | | | | | | |
| O | 0–3 | 7.8 | | 3.70 | 62.78 | 29.64 | 7.59 | SL |
| Bw | 3–18 | | 6.00 | | 66.80 | 24.29 | 8.91 | SL |
| 2ab | 18–32 | 8.1 | 7.50 | 1.90 | | | | |
| 2Bk1 | 32–49 | 8.3 | 21.00 | | | | | |
| 2Bk2 | 49–60 | 8.5 | 27.50 | | | | | |
| 4Bk | 60–74 | | 24.50 | | 56.10 | 28.26 | 15.64 | SL |
| 4Ck | 74–82 | | 24.00 | | | | | |
| Window 1 | | | | | | | | |
| Upper Abk | 111–118 | 9.3 | 18.50 | 0.60 | | | | |
| Lower Abk | 253–260 | 9.2 | 20.00 | 0.60 | | | | |
| C | 260–269 | 9.4 | | | | | | |
| Pedon 1 | | | | | | | | |
| A | 2–8 | 8.1 | | 3.40 | 60.04 | 28.50 | 11.46 | SL |
| 2Ab | 8–13 | 8.4 | | 2.60 | | | | |
| Pedon 3 | | | | | | | | |
| O | 0–3 | 8.4 | | 1.70 | 74.42 | 16.21 | 9.37 | SL |
| 2Ab | 44–99 | 8.6 | | 1.30 | | | | |
| 2Bk | 99–137 | 8.8 | 21.00 | | | | | |
| 3Ab | 137–170 | 8.5 | | 2.70 | 27.11 | 49.10 | 23.79 | L |
| 3Bk | 170–207 | | 22.00 | | 25.25 | 44.46 | 30.29 | CL |




| DEPTH (CM) | PARENT MATERIAL | HORIZON | CHARACTERISTICS/COMMENTS |
|---|---|---|---|
| 0-3 | overbank | O | Reddish brown (5YR4/4m); slightly effervescent with disseminated carbonate; consistence=0.5 kg/cm$^2$; boundary is clear, smooth |
| 3-44 | overbank | C | Reddish brown (5YR4/3m); weak, very coarse, subangular blocky structure; violently effervescent with disseminated carbonate; consistence=0.75 kg/cm$^2$; boundary is gradual, smooth |
| 44-99 | overbank | Ab1 | Dark reddish brown (5YR3/2m); moderate, coarse, subangular blocky structure; slightly effervescent with disseminated carbonate; consistence=1.25 kg/cm$^2$; boundary is clear, smooth. Paleosol correlated with paleosol dating 510±40 BP (TX-8150) in Geomorphology Window 5 |
| 99-137 | overbank | Bkb1 | Yellowish red (5YR4/6m); moderate, very coarse, subangular blocky structure; violently effervescent with common (6%), fine, irregular, soft carbonate masses; consistence=1.25 kg/cm$^2$; boundary is clear, smooth |
| 137-170 | overbank | Ab2 | Dark reddish brown (5YR3/3m); weak, coarse, subangular blocky structure; violently effervescent with common (4%), fine, irregular, soft carbonate masses; boundary is clear, smooth. Dates 2760±40 BP (TX-8151) |
| 170-207 (TD) | overbank | 2Bkb2 | Reddish brown (5YR4/4m); moderate, coarse, subangular blocky structure; violently effervescent with common (10%), fine, irregular, soft carbonate masses and segregated carbonate filaments in the upper 10 cm and common (6%), fine, irregular, soft carbonate masses; consistence=2.0 kg/cm$^2$ |

Figure 6.22. Pedon 3 profile. The upper 44 cm comprises the Lightning Formation overbank deposits. Below 44 cm are post-Moorcroft overbank deposits.



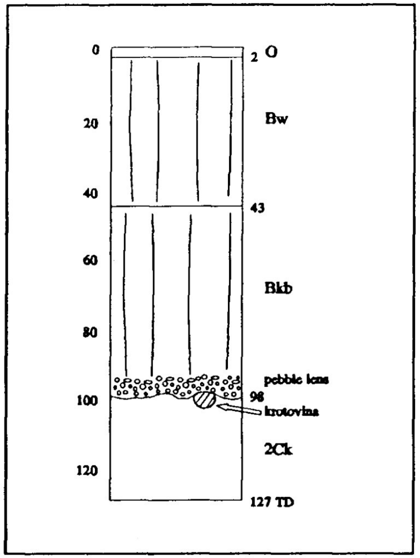

| DEPTH (CM) | PARENT MATERIAL | HORIZON | CHARACTERISTICS/COMMENTS |
|---|---|---|---|
| 0-67 | overbank | A/C complex | Red (2.5YR4/6d) overbank sands with reddish brown (5YR4/4d) laminar beds; dark reddish brown lens (5YR3/2d) from 39-44 cm bs; strongly effervescent with disseminated carbonate and common (14%), fine, segregated carbonate filaments within the lens; laminae are 3 cm thick; consistence=0.05 kg/cm$^2$; lowest A/C complex dated 510±40 BP (TX-8150). |
| | disconformity | | |
| 67-130 | episodic flow | lens 1 | Light reddish brown (5YR6/4d) |
| 130-176 | episodic flow | lens 2 | Flowage deposit with a sandstone matrix; extremely poor sorting; clast size is 2 cm in diameter |
| 176-224 | episodic flow | lens 3 | Predominately micritic limestone and some siltstone; grains have a sphericity of 0.1 →0.7 and a roundness of 0.1→0.7; imbrication oriented to the southwest |
| 224-275 (TD) | episodic flow | lens 4 | Strongly to violently effervescent with disseminated carbonate; consistence <2.5 kg/cm$^2$ |

Figure 6.23. Window 5, south wall profile. Upper 67 cm are post-Moorcroft and Lightning overbank deposits. Sediments below 67 cm are attributed to Ucross Formation episodic flow.

of fine-grained overbank alluvium that range in texture from silty loam to clay loam (Figures 6.22, 6.23, 6.24; Table 6.2). The T1 terrace sediments do not contain a colluvial pebble component like the T2 terrace sediments (Figure 6.25). This suggests that hillslopes during the deposition of the T1 fill have been comparatively more stable than during T2 formation (after Knox 1972, 1984). That is, the hillslope conditions may have been less subject to erosion during the past ca. 3100 years than during earlier portions of the Holocene. This may be due to climate influenced increases in vegetation densities and/or the fact that incision to the T1 involved less elevation change than previous incision events. The small amount of incision may be a key factor because slope angles would be less and, therefore, less subject to erosion. Decreased erosion also suggests that the finer textured younger sediments also have an increased potential to yield in situ buried cultural materials.

The overbank sediments of the T1 terrace contain two buried paleosols that both exhibit cumulic A horizons overlying Bk horizons with Stage 1 carbonate accumulations (Gile et al. 1966; Figure 6.22). Stage 1 carbonate accumulations suggest a soil forming interval of at least 1000 years (Karlstrom 1988). Radiocarbon ages for humates in the buried A horizons indicate that the Ab2 was buried after 2760±40 BP (TX-8151) and the Ab1 was buried after ca. 510±40 BP (TX-8150; Figure 6.22). The age of humates in the Ab1 horizon is based on correlation of this paleosol to a similar paleosol on the T2 terrace (Figures 6.22 and 6.23). The ages of these paleosols, combined with the proposed ca. 3100 BP incision of the T1 terrace, suggest the archaeological potential of the lower terrace at 39CU1144 is limited to Late Archaic and younger cultural components. The fine-grained nature of the overbank deposits also suggests that, if present, cultural materials recovered from the T1 terrace are probably buried in situ.

The height and position of the T1 sediments together with ages of humates within these sediments suggest that the T1 floodplain abandonment resulted from Moorcroft incision followed by post-Moorcroft (our term) and Lightning deposition (Leopold and Miller 1954). In their studies of the terraces in the Powder River Basin, Leopold and Miller (1954) described a period of terrace formation at 4450–550 BP (Moorcroft cut terrace), characterized by neither deposition nor soil formation. The Lightning terrace, on the other hand, was described as a fill terrace devoid of soil formation that dated 500–100 BP. Though Leopold and Miller did not encounter sediments and soils dating 4450–550 BP, subsequent investigations in northeastern Wyoming have frequently encountered alluvial sediments containing buried Fluvents (Entisols) that date from ca. 5000–200 BP (Reider 1990). The T1 terrace observed at 39CU1144 has paleosols and sediments dating within the period Leopold and Miller propose for Moorcroft incision. These paleosols were dated at 2760±40 BP and 510±40 BP (Figure 6.22). Since 39CU1144 does contain evidence of an incision event that roughly correlates to the Moorcroft incision proposed by Leopold and Miller (1954), we propose the term "post-Moorcroft" for sediments at 39CU1144 that date ca. 3000–500 BP. In addition to the post-Moorcroft sediments, there are 44 cm of overbank sediments capping the 510±40 BP paleosol that are correlated to the Lightning Formation.




| Depth (cm) | Parent Material | Horizon | Characteristics/Comments |
|---|---|---|---|
| 0-2 | overbank | O | Reddish brown (5YR5/3d); moderate, fine, granular structure; slightly effervescent with disseminated carbonate; consistence=0.5 kg/cm$^2$; boundary is abrupt, smooth |
| 2-43 | overbank | Bw | Reddish brown (5YR5/4d); weak, coarse, subangular blocky structure; slightly effervescent with disseminated carbonate; consistence=0.75 kg/cm$^2$; boundary is gradual, smooth |
| 43-98 | overbank | 2Bkb | Reddish brown (5YR5/3 to 4/3m); very weak, moderate, subangular blocky structure; slightly effervescent with disseminated carbonate; cumulic; consistence=0.5 kg/cm$^2$; boundary is gradual, wavy; pebble lens |
| 98-127 (TD) | overbank | 2Ck | Reddish brown (5YR5/3d); very weak, medium, subangular blocky structure; violently effervescent with disseminated carbonate; consistence=1.0 kg/cm$^2$ |

Figure 6.24. Unit N464 E835 profile. The upper 43 cm are Lightning Formation overbank deposits. Sediments below 43 cm are post-Moorcroft overbank deposits.

Table 6.2. Grainsize distributions for selected units at 39CU1144.

| | | Percent of sample | | | | | | | | | | | | | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | -1.0$\phi$ | -0.5$\phi$ | 0$\phi$ | 0.5$\phi$ | 1.0$\phi$ | 1.5$\phi$ | 2.0$\phi$ | 2.5$\phi$ | 3.0$\phi$ | 3.5$\phi$ | 4.0$\phi$ | <4.0$\phi$ (pan) | % Total | $\phi$ size |
| N449 E867 | | | | | | | | | | | | | | | |
| 2Ab | 18-32 | 0.46 | 0.04 | 0.13 | 0.51 | 1.43 | 4.77 | 14.21 | 18.78 | 20.35 | 13.70 | 6.78 | 18.53 | 99.70 | 2.93 |
| 2Bk1 | 32-49 | 1.27 | 0.36 | 0.82 | 2.05 | 3.58 | 6.32 | 13.84 | 16.70 | 17.05 | 11.82 | 5.59 | 20.12 | 99.53 | 2.79 |
| 2Bk2 | 49-60 | 56.22 | 1.13 | 0.82 | 0.80 | 1.06 | 1.92 | 5.33 | 7.34 | 7.65 | 5.53 | 2.40 | 9.78 | 99.97 | 0.41 |
| 4Ck | 74-82 | 0.15 | 0.09 | 0.25 | 0.66 | 1.79 | 3.59 | 11.23 | 17.31 | 19.50 | 15.42 | 7.00 | 22.62 | 99.62 | 3.09 |
| Window 1 | | | | | | | | | | | | | | | |
| Upper Abk | 111-118 | 18.67 | 0.87 | 2.42 | 3.26 | 3.73 | 4.20 | 7.57 | 9.11 | 11.53 | 9.87 | 5.51 | 22.22 | 98.96 | 2.11 |
| Lower Abk | 253-260 | 0.08 | 0.42 | 2.52 | 4.37 | 5.71 | 6.20 | 9.32 | 11.05 | 16.04 | 11.77 | 8.16 | 22.85 | 98.49 | 2.85 |
| C | 260-269 | 0.32 | 0.15 | 0.21 | 0.40 | 1.50 | 4.38 | 13.25 | 21.55 | 26.20 | 13.26 | 5.46 | 13.09 | 99.78 | 2.79 |
| Pedon 1 | | | | | | | | | | | | | | | |
| Ab | 8-13 | 3.51 | 0.44 | 1.56 | 2.47 | 6.13 | 7.03 | 12.63 | 14.93 | 17.81 | 12.44 | 5.68 | 14.72 | 99.36 | 2.50 |
| 2C1 | 13-49 | 1.10 | 1.33 | 3.24 | 3.97 | 4.40 | 4.21 | 8.60 | 11.04 | 16.11 | 13.55 | 6.79 | 25.02 | 99.36 | 2.87 |
| 2C2 | 49-60 | 11.03 | 0.17 | 0.32 | 0.63 | 1.15 | 1.97 | 5.96 | 11.22 | 18.92 | 16.75 | 7.49 | 23.87 | 99.46 | 2.78 |
| Pedon 3 | | | | | | | | | | | | | | | |
| C | 3-44 | 0.05 | 0.07 | 0.38 | 0.96 | 2.49 | 4.13 | 11.83 | 19.25 | 25.50 | 16.47 | 5.64 | 12.36 | 99.15 | 2.80 |
| Ab | 44-99 | 1.06 | 0.67 | 0.97 | 1.56 | 3.28 | 8.12 | 23.96 | 22.75 | 16.06 | 8.19 | 2.48 | 10.60 | 99.70 | 2.38 |
| Bk | 99-137 | 0.27 | 0.46 | 1.03 | 2.02 | 3.20 | 4.79 | 10.60 | 15.15 | 18.44 | 15.46 | 6.58 | 21.70 | 99.71 | 2.96 |

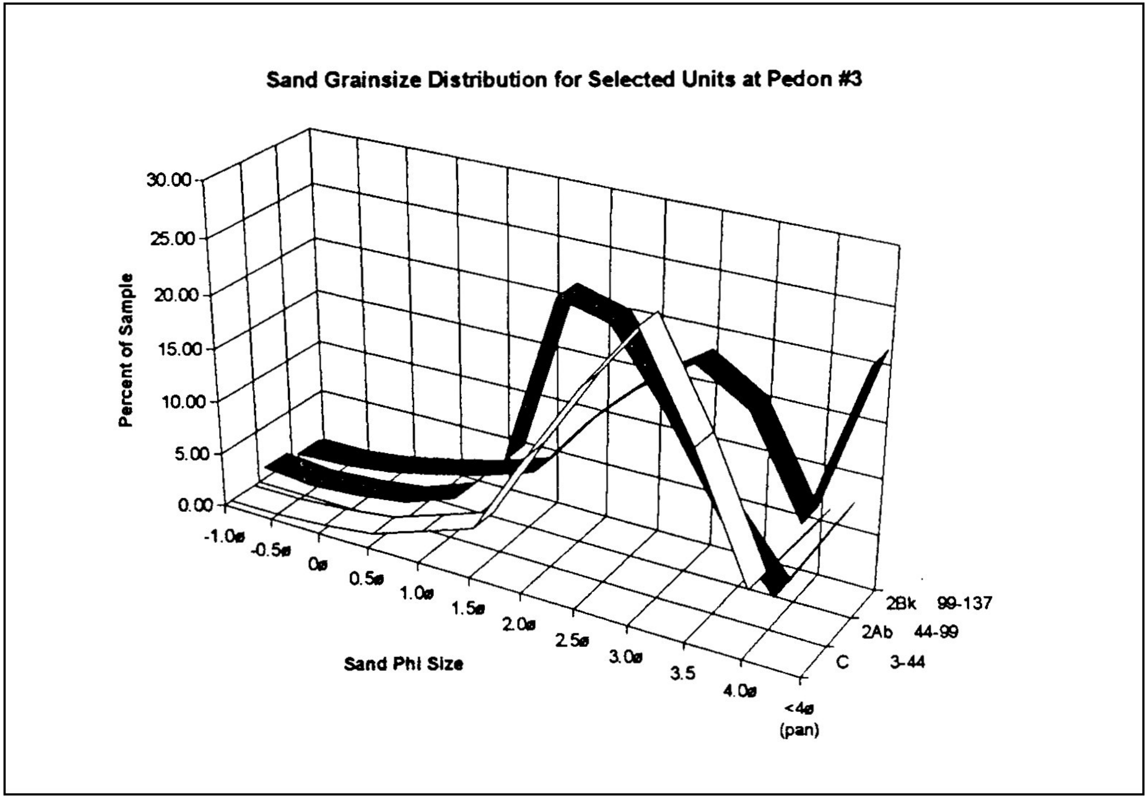



Figure 6.25. Grainsize distribution of selected overbank sediments on the T1 (Moorcroft/Lightning) terrace. Note the even distribution and lack of a coarse "tail" like that caused by colluvium in the T2 terrace (Figure 6.21).

This apparent discrepancy between the terrace sequence observed by Leopold and Miller (1954) and that observed in the 39CU1144 study area can be explained by the position of 39CU1144 within its drainage basin. Whereas Leopold and Miller's observations were conducted primarily on higher order perennial streams, the 39CU1144 terraces are associated with a low order, ephemeral stream near the head of a drainage basin. The proposed climatic events that led to the formation of three terraces in the lower portions of the Powder River Basin may have been expressed differently at basin margin locales and resulted in the formation of only two terraces in Gillette Canyon. This proposal is supported by the fact that alluvial incision works its way headward in a drainage. It is possible that either the ca. 510 BP Lightning incision event did not reach this portion of the basin or that the relatively close proximity of bedrock to the surface in Gillette Canyon severely limited incision.

Also unlike the Powder River Basin locales, after the Moorcroft incision, sporadic overbank deposition occurred from ca. 3000 to 500 BP on both the T1 and T2 terraces in Gillette Canyon. Occasional overbank deposition alternating with periods of stability resulted in the development of two paleosols on the T1 terrace. In addition, the position and/or bedrock controls of Gillette Canyon also appear to have limited Lightning terrace formation to strictly a depositional event. This is based on the observation that Lightning-age sediments cap the post-Moorcroft sediments and do not occur as a separate terrace. Thus, the late Holocene terrace sequence observed at 39CU1144 is considered a variation on the Powder River Basin terrace sequence (Leopold and Miller 1954) that reflects the study area's position within its drainage. There is a sediment record from ca. 4450–550 BP in the 39CU1144 study area and another from 7000–5600 BP that were absent in terraces described in the largely perennial portions of the Powder River Basin. This suggests that the headward segments of drainage basins in the region have a higher potential to contain in situ, buried Early Archaic and younger cultural components than do downstream locales.

## 6.5 Conclusions

Geoarchaeological observations of the two terraces in the 39CU1144 study area suggest that they are a variation of the Kaycee, Moorcroft, and Lightning terrace sequence proposed by Leopold and Miller (1954; Figure 6.1). The higher elevation fill terrace is considered a Kaycee equivalent with more than 2.5 meters of Ucross Formation overlain by about 45 cm of pre-Kaycee sands and gravels. Comparable pre-Kaycee deposits were not present at Leopold and Miller's study sites. Above these is a 13–48 cm cap of Kaycee Formation sediments. These are, in turn, capped by up to 10 cm of post-Moorcroft/Lightning Formation sediments. At 39CU1144 humates from paleosols dating 10,500±90 (TX-8149) and 9080±80 (TX-8148) BP were observed in sandy lenses intercalated with gravels in Ucross Formation sediments. The coarse-grained nature of the Ucross Formation sediments at 39CU1144 suggests that the formation is unlikely to contain in situ buried Paleoindian materials. Cultural features within the proposed pre-Kaycee Formation sediments at 39CU1144 yielded ages between 7000 and 5600 BP. This range of radiocarbon ages brackets an episode of periodic overbank deposition, channel cutting and filling, and soil formation. Although the top of this soil was removed by erosion, buried Early Archaic archaeological materials still remain at this level.

Deposition of coarse alluvial sediments at 39CU1144 (Ucross Formation and pre-Kaycee deposits) was followed by deposition of finer-grained overbank sediments on the T2 floodplain. TheSE sediments are considered equivalent to the Kaycee Formation (Figures 6.6 and 6.3). Dates on hearths in this formation range from about 3600 to 2300 BP. These provide a minimum age for this deposit of 3600 BP. Hearth dates later than 2700 BP must represent use OF the terrace surface after its floodplain was abandoned and the lower terrace was formed. Buried Middle and Late Archaic archaeological components of the Blaine site are associated with the Kaycee Formation sediments.

The Kaycee terrace (T2) was abandoned after 3090 BP. This is based on the age of the youngest hearth on the T2 terrace that predates the oldest paleosol on the inset T1 terrace (2760 BP). Multiple episodes of fine-grained "post-Moorcroft" overbank deposition and soil formation followed abandonment and resulted in the development of two paleosols that dated 2760±40 and 510±40 BP. A final period of sediment accumulation after 510 BP correlates to the development of the Lightning fill terrace in the Powder River Basin (Leopold and Miller 1954). The sediments preserved in the 39CU1144 vicinity that date 2260-510 BP represent a period of non-deposition in other portions of the Powder River Basin. This suggests that the potential of ephemeral alluvial locales on basin margins to yield Late Archaic and younger cultural materials is greater than locales in perennial portions of drainage basins.

# Chapter 7

# SUMMARY AND CONCLUSIONS

## 7.1 Summary of Interpretations

The Blaine site comprises a series of cultural deposits on a stream terrace in the southwestern Red Valley of the Black Hills. The extensive excavations undertaken to mitigate anticipated damage to the site produced only a modest amount of cultural material. Deposits representing some 7000 years of human use of the site yielded only about 5200 artifacts, about half of which were tiny flakes from waterscreen samples. Faunal and floral remains were also scant, although the 25 features do attest to both camping and food processing at the site. This stands in contrast to the richer Jim Pitts site lying just east of the Blaine site. While the Blaine site is far from spectacular, it nevertheless has a story to tell. It may in fact provide a more representative picture of prehistoric life in the Black Hills than the more impressive bison kills and densely occupied foothills sites.

The exact timespan of the earliest occupation of the Blaine site is not clear. Component C hearths were radiocarbon dated at 5580 and 6940 BP. Cultural material found both above and below these hearths was assigned to Component C. This lowest cultural stratum is not continuous, but appears as pockets of sediment within an alluvial matrix. The spotty nature of this stratum makes it somewhat difficult to interpret. The divergent radiocarbon dates suggest the component represents a series of short-term uses rather than a single occupation of the site. The large proportion of planing or heavy scraping tools and relative abundance of hearths suggest a somewhat specialized function for the site, perhaps related to processing roots or other fibrous plant foods. The relatively large amount of debitage associated with the Component C features indicates a fairly intensive use of the site. This can translate as either a few long-term camps or many short-term camps. In either case the number of people involved was probably minimal, perhaps comprising a special task group rather than an entire band or extended family. The tool kit is not recognizably gender-linked; however, the lack of projectile points, butchering tools, and hide-working tools suggests that an entire social unit was not present at the site.

The site may represent a remnant activity area associated with a larger site or may have been a special resource extraction or processing site. The presence of some bison and other large mammal bone in Component C suggests the former. A core and 402 pieces of debitage were also found in the Component C excavations, suggesting that lithic tool manufacture was at least a secondary focus of the site. Much of this material was associated with Feature 1, the large limestone boulder. This, like the bone, suggests that the site served as a camp as well as a root or wood processing station. Several large fire-pit or hearth complexes in ecotone areas of the Black Hills are hypothesized to have served in part as plant food processing sites. These include 48WE302, 39CU214, McKean, Gant, and an unnamed site near the Gant site (McKibbin 1988; Reher 1981; Kornfeld et al. 1991; Gant and Hurt 1965). A combination root-processing and pre-hunt gearing function was suggested for the smaller Harbison site in the eastern Red Valley (Sundstrom 1981). All of these contained some artifacts and/or features not directly associated with root processing, suggesting that the task was carried out in or near a camp. All date to the Middle and/or Late Archaic period.

The relatively intensive use of the site suggested by the concentrated distribution of artifacts and features may well reflect scheduled, seasonal reuse of the site. As was noted above (Chapter 4), stable, immobile resources such as vegetation communities tend to be reoccupied more frequently than the less predictable sites of game kills and butchering stations. This possibility is difficult to assess given the discontinuous distribution of the Component C materials.

Although lithic concentrations are highest at this level, bone concentrations were lowest in this component. This suggests that faunal resources were unimportant during Component C times relative to the later components. While it is possible that the Component C bone was for some reason more subject to weathering processes, this explanation is at odds with the apparent steady or rapid rate of deposition during this period of occupation of the site. While a relative paucity of bone and lack of a hunting-related tool kit in Component C fit neatly with a hypothesized reduction in bison and other game during the Altithermal, the cultural deposit is too incomplete to allow conclusions in this regard.

The middle levels of the Blaine site, assigned to Component B, suggest a shift in the focus of the site. The tool assemblage of Component B indicates a Late Archaic date, while the radiocarbon dates indicate that the component includes Middle Archaic materials, as well. An age of roughly 3600 to 2000 BP is indicated for this component. This mixing is due to a lack of deposition on the terrace surface between ca. 3100 and 500 BP. Tools in Component B are most appropriate for secondary butchering and general purpose tasks, rather than forming a specialized tool kit. Tratebas (1986) lists projectile points, choppers, sidescrapers, and gravers, along with endscrapers, light retouched flakes, and perforators, as the artifacts types most commonly associated with Late Archaic residence sites. Except for a lack of perforators and the rather large number of bifaces, this fits the Component B assemblage fairly well. The unfinished bifaces and the relatively abundant debitage suggest that bifacial tool production overlay the more general residence function as a principal site function. It may be that the habitation site was chosen at least in part for its proximity to high quality cherts and chalcedonies and that the Middle and Late Archaic residents of the site took advantage of this handy resource by gearing up on bifacial tools. The tendency to "gear up" on specialized tools suggests a somewhat regularized, scheduled seasonal round of subsistence activities. The mass production and/or caching of bifacial tool blanks shows that the site's occupants were anticipating and planning for hunting. Scheduling is often indicated for Middle and Late Archaic sites in the Black Hills and elsewhere in the northwestern plains (Chapter 4).

Bifaces included three projectile point preforms and four Stage 2 bifaces, most of which are of cherts outcropping in the immediate site vicinity. A finished Pelican Lake point is also made of this local chert. The ratio of tools to debitage in this component, 1:71, also reflects an emphasis on stone tool production. The broken Stage 3 and 4 quartzite biface fragments indicate that these artifacts were carried to the site and used there until broken beyond repair. The chert bifaces being produced at the Blaine site may have been made in part to replace tools made elsewhere in the Black Hills and expended at the site.

The hearth features, diverse tools, and abundance of unmodified rock indicate that the site was not used exclusively as a lithic knapping station. Half of the 12 hearths assigned to Component B were radiocarbon dated. These dates fell between 2500 and 3600 years BP, indicating a late Middle Archaic age for the hearth features. This suggests that activities represented by the hearths, such as food processing and camping, may have been limited to the Middle Archaic occupation of the site; however, it is possible that some of the undated hearths belong to the Late Archaic occupation. The lack of Middle Archaic projectile point blanks or fragments in Component B further suggests that hunting tool production, repair, and replacement were not emphasized during the Middle Archaic occupation of the site to the extent that they were during the Late Archaic occupation.

A few pieces of Knife River Flint debitage and a Badlands knife in Component B suggest weak ties to the Missouri River area to the east. In the Black Hills, these materials are most commonly found in early Late Archaic components. The amounts of exotic lithic raw material in this assemblage are not high enough to suggest regular interaction with areas to the east, but may indicate sporadic use of the site by eastern-oriented groups perhaps on an irregular seasonal basis.

Component A is perhaps the most easily interpreted of the three components. This component includes both Late Archaic and Late Prehistoric diagnostics; however, no radiocarbon dates were available to confirm this hypothesized age. The stone circle features clearly indicate a camp site. The sparse artifact scatter and the lack of hearths or permanent habitation or storage facilities indicates short-term use of the site. This component contained 41% of the bone found at the site, suggesting that the trend toward increased reliance on faunal resources indicated for Component B continued into the Late Prehistoric period as well. The amount of bone is still small. Meat consumption in the context of an ephemeral camp, rather than a kill or butchering station is indicated. The diverse projectile point assemblage from this component indicates that it was produced through a series of brief occupations through the latter portion of the Late Archaic and the early portion of the Late Prehistoric period.

The small assemblage of tools also reflects the diverse activities associated with basic group maintenance. Unlike Component B, the bifacial tools in Component A are mostly used tools carried to the site and discarded there after use. The bifacial blanks or preforms characteristic of Component B are largely lacking in Component A. The tool to debitage ratio is also much higher, 1:20, as compared with 1:71 in Component B. While some lithic tool production did take place during this period of use of the Blaine site, it was not a main focus of activity. The small amount of pottery found at the site also suggests a brief camp. This component fits well the pattern expected for a sporadically reused short-term transient camp site.

## 7.2 Settlement Pattern Research Hypotheses

The settlement pattern models discussed above (Chapter 4) provide a theoretical basis for a series of research questions around which the Blaine site investigations were organized (Donohue and Hanenberger 1993). The questions recognize the existence of four main functional site types: base camp, residential camp, transient camp, and special activity or resource extraction station.

*Hypothesis 1: One or more of the components of 39CU1144 are base camps associated with a mountain-based, broad spectrum settlement system. Base camps are typified by:*

- *location near significant or high-yield resources,*
- *comparatively large areal extent, high debris density, and tool kit diversity,*
- *and structural and/or storage features.*

*Features should include hearths, domestic structures, and in particular storage facilities. Midden formation or secondary deposition of refuse should be evident. base camps are a central focus of locally based and relatively close-ranging resource exploitation. They should contain mixed frequencies of lithic raw material types representing the range and availability of lithic resources in the catchment area for the base camp for some patterned and most non-patterned tools. If the base camp represents a particularly localized settlement pattern, such as the proposed mountain pattern, patterned tools should also reflect local (i.e. Black Hills) lithic resources.*

This question was addressed through several lines of evidence. Because site function may have changed over time, each component of the Blaine site was considered separately. Identification of site type is based on the various factors listed above. Features such as middens, multiple occupation levels, structures, and storage facilities are especially relevant to determinations of site function. Tool-to-debitage ratios and degree of tool diversity are also keys to site function. Given the location of 39CU1144 near known quarry sites in the Black Hills and the restricted catchment area postulated for mountain-based hunter-gatherers, both patterned and non-patterned tools were expected to be made of local lithics if the localized, mountain-based settlement pattern is represented at the site. Alternatively, if the site functioned within a plains-based settlement pattern, nonlocal lithics would be expected for at least some of the patterned tools. Expedient (non-patterned) tools should still reflect local lithic types.

None of the three components appears to represent a base camp. Artifact densities are consistently low, except around some features. While structural remains are present in the form of the Component A stone circles, these do not indicate permanent or semi-permanent structures, as they contained few artifacts and no features. No storage pits, caches, or middens were found. The site is near significant resources areas; however, its specific location offers few advantages over other locations in the general area.

*Hypothesis 2. Components at the Blaine site represent residential camps. Residential camps should exhibit artifact varieties and distributions similar to those found in base camps. The locational attributes for residential camps are also the same as for base camps. Tool kit varieties, though similar to those from base camps, should exhibit lower densities and frequencies. The size, intensity, and duration of the occupation are more limited than those for base camps. Consequently, storage features and incidents of midden development or secondary deposition are limited or non-existent. Lithic material type frequencies should reflect local sources if the site was utilized by mountain-based groups and exhibit more mixed source assemblages if both mountain and plains environments were exploited as part of the seasonal round.*

The archaeological delineation of residential camps is problematical, since the differences between base camps and residential camps are more of degree than kind. Important features in differentiating between the two site types are the number and variety of feature types, variety of tool types, and incidence of secondary deposition or midden development. All of these should be less pronounced and exhibit more restricted distributions in residential camps. The full complement of groups activities should not be represented at residential camps, because they were not occupied by the complete social unit. Residential camps should be less extensive due to their shorter duration.

Following the Bender and Wright model, this hypothesis can be rephrased to examine whether components of the Blaine site represent secondary bases. While the secondary base is similar to the residential camp, Bender and Wright's classification permits a more exact set of criteria for differentiation. Furthermore, the model is specifically designed to describe adaptations in mountainous regions. Criteria specifically related to site locations and expected feature configuration are listed for secondary bases, in addition to the attributes listed above for residential camps. According to Bender and Wright's model, secondary bases are, by definition, remote in terms of distance or accessibility from base camps. While base camps are located at sites offering maximum comfort and accessibility, secondary bases are located in less favorable settings near seasonally available high-yield resource areas. Secondary camps are less likely to have been periodically reoccupied. Features at secondary bases are less diverse, because these sites tend to be focused on procurement and processing of a single main resource. Evidence for gathering can be found at either a base camp or a secondary base; however, the secondary bases will exhibit a more restricted range of species and/or processing activities than do base camps.

Plains tradition base camps will by definition be located in open plains areas. These can be expected to contain a higher percentage of specialized hunting tools, such as projectile points, knives, and scrapers, and fewer tools associated with nonhunting activities than would mountain tradition base camps. Plains tradition secondary bases or residential camps in mountain or foothills areas are more difficult to distinguish from mountain tradition sites. These secondary sites are less likely to contain a strong hunting component. They presumably resulted from seasonal or occasional deviation from the large scale communal hunting pattern in order to exploit secondary resources such as smaller game, food plants, or trees, or to take shelter from harsh weather. In general, plains tradition sites should contain a less diverse tool kit, because these groups are less likely to have developed or adopted a complete set of tool technologies adapted to plant and small animal exploitation. In particular, microtools, microblades, and multipurpose tools should be rare in plains tradition sites.

Roasting pits, caches, and storage pits would be more commonly found in the secondary bases or residential camps of mountain tradition groups, as would other evidence for periodic reuse of a site. Roasting pits are associated with mass processing of plant foods. Caches, storage facilities, and multiple occupation floors reflect the periodic return to sites near stable and abundant resources, such as plant foods or migrating animals, permitted by a scheduled, broad spectrum subsistence pattern. Faunal assemblages from mountain tradition sites will be more diverse than those from plains tradition sites and may include species such as jackrabbit and prairie dog eschewed by the plains oriented bison hunters. Mountain tradition secondary bases are also expected to contain more ground stone tools and other artifacts associated with plant food processing, such as unifacial scrapers with heavy stepped use-wear.

Component B of the Blaine site can be interpreted as a residential site. It contained a moderately dense artifact distribution reflecting a variety of activities. Group maintenance (food preparation and consumption, tool repair) and primary biface production are the main activities indicated by the Component B assemblage. As was noted above, the Blaine site is located near significant faunal, floral, and lithic resources, as well as near water and sheltered terrain. These locational attributes are associated with both base camps and residential camps. The size, intensity, and duration of the Component B occupations are intermediate between those expected for base camps and extractive sites. Features are also consistent with a residential camp interpretation. No structural or storage features were found. Lithic materials are strongly local, with a weak eastern signal in the form of small amounts of Knife River Flint and Badlands plate chalcedony.

Component B does not fit the definition of the secondary base developed for high altitude regions (Bender and Wright 1988). It lacks attributes of regularly reoccupied sites, such as caches, storage pits, and well defined multiple occupation living floors. The site location is not remote from ideal habitation areas, as would be expected of a secondary base. Specialized resource procurement and processing is not indicated for this component, except for the use of local cherts for biface production. This lithic resource is not seasonally restricted and thus does not fit the expected pattern of seasonal use of high-yield resource areas.

Component A does not fit either the residential camp or the secondary base. This component lacks evidence for specialized resource extraction or processing, as would be expected as one attribute of secondary bases and residential camps. This component seems to represent a very short-term camp occupied by an entire social unit.

Component C may have been a residential camp; however, the discontinuous nature of the deposits makes any conclusions tenuous. This component does include a variety of features and tool types, suggesting a camp at which processing of roots or other fibrous material took place, along with limited tool production and general group maintenance. This also fits Bender and Wright's description of a secondary base; however, the locational attribute of remoteness is not met by the Blaine site. The apparent emphasis on plant use and the relative paucity of faunal remains is consistent with the mountain tradition subsistence model; however, other expected mountain tradition attributes, such as caches and roasting pits, are not present.

In summary, this hypothesis is confirmed. Component B and, to a lesser extent, Component C conform to the residential base site type. Component C also fits the description of a secondary base except that its location is not remote from areas suitable for base camps. Component B more closely resembles the residential camp defined by Roper (1981), while Component C displays more attributes of the mountain tradition secondary base as defined by Bender and Wright (1988).

*Hypothesis 3. Components at the Blaine site represent extractive site activities. If this is an extractive site, the excavations should document specific activities loci covering small areas and exhibiting limited, task-specific tool kit inventories. Features expected at extractive sites are limited to hearths and task-specific facilities. Extractive sites associated with lithic and faunal procurement and processing activities are more readily discernible than those associated with plant procurement and processing.*

Three kinds of extractive sites are defined for plains-based settlement systems: kill sites, processing (secondary butchering) sites, and quarries (Greiser 1985). For mountain-based settlement systems, four kinds of extractive sites are defined: hunting, quarrying, and gathering (Bender and Wright 1988). Each of these site types was considered separately in regard to the Blaine site.

Quarrying can be ruled out as a function of the Blaine site. No significant outcrops of knappable stone occur at the site. Knappable cherts outcrop at nearby site 39FA1145 and within the gravel terraces at the Blaine site. The former was used for biface production at the site, but the local gravels appear to have been used mainly for expedient tools. No significant lithic raw material procurement activities took place at the Blaine site.

The low density of bone, the presence of habitation features (tipi rings), and the lack of a primary butchering tool kit (cf. Tratebas 1986) at the Blaine site do not fit the pattern expected for a kill site. Neither the current nor the prehistoric topography of the site was conducive to game trapping. A high percentage of broken projectile points is also expected for kill sites. The small number of projectile points found at the Blaine site are mainly distal portions apparently discarded during reshafting of arrows and darts.

A faunal processing/secondary butchering function was considered for this site. Numerous locations in the immediate site vicinity could have served as natural game traps. Archaic rock art in Whoopup Canyon just a few miles west of the Blaine site suggests that canyons in the immediate vicinity were used for communal hunts of deer, pronghorn, and mountain sheep, apparently using nets or corrals rather than natural traps. The Blaine site locale, on a flat bench overlooking a stream, would have provided a comfortable and easily reached location for meat processing. Such sites can be expected to contain large amounts of bone scrap (but not complete carcasses), numerous cutting tools, and possibly hearths. Midden development, secondary deposition of artifacts, and extensive, diversified tool kits are not expected.

Although tertiary processing activities such as hide working, meat drying, and pemmican production may have taken place at extractive sites (cf. Donohue and Hanenberger 1993:33), a more likely pattern is removal to base camps, secondary bases or residential camps for this work. These activities take several days to accomplish and thus would require that a camp be established nearby or that the meat and hides be transported to an existing camp. In addition, a relatively large labor force (including both sexes) is needed for these processing activities, so they are likely to have been done at or near a camp occupied by an entire social group. For these reasons, scraping tools, groundstone tools, and drying rack features and fire pits or hearths are expected at secondary bases and base camps, but may not be present at faunal processing/ or secondary butchering sites. Anvils and hammerstones for smashing bone may or may not be present at base camps and secondary bases, depending on the meat storage techniques being used. Smashed bone is associated with the production of pemmican for long term storage.

Secondary butchering is proposed as one function of Component B, due to the presence of a tool kit appropriate for such activity. The limited amount of bone present at the site and the diverse tool and feature assemblage, however, indicate that this faunal processing took place in the context of on-site consumption rather than large scale processing of meat for storage.

A site function limited to plant or microfaunal gathering is less likely for the Blaine site, simply because such sites are usually "invisible" in the archaeological record (Greiser 1985; Bender and Wright 1988). Gathering activities tend to be expressed as processing features at secondary bases, rather than at the actual extraction site (Bender and Wright 1988). Large-scale plant food processing generally takes place at a secondary base or residential camp established for that purpose, or at a base camp if the desired resource happens to be available nearby. The processing of roots, wood, or other fibrous plant materials was suggested for Component C. This appears to have taken place in the context of a secondary base or residential camp. The actual extraction site or sites would have been in the immediate site vicinity or in nearby stands of trees.

In summary, none of the components at the Blaine site represents an extractive site. Processing activities (biface reduction and meat preparation and consumption in Component B and plant processing in Component C) apparently took place at campsites away from resource extraction areas.

Lithic raw material type distributions at the Blaine site were expected to reflect the catchment area of the group using the site. If these were mountain-oriented groups, few or no exotic lithics should be present. If they were plains-based groups, nonlocal lithics were expected at least among the patterned tools. Expedient tools would, however, reflect local procurement. Lithic raw material distributions were expected to reflect direction of movement, and the likely home base of the group or groups utilizing the site if consistent patterns of lithic source distributions were found in the various components. In addition, the presence of a diverse set of nonlocal lithic resources was expected to reflect a high degree of group mobility, while a homogenous and/or localized lithic raw material assemblage would reflect a low degree of mobility.

The Blaine site lithic raw material assemblages are strongly localized. Although there is a high degree of diversity, this reflects the local availability of lithic types, rather than large catchments or territories. Very small amounts of Knife River Flint and Badlands plate chalcedony in Component B and porcellanite in Component A provide a weak indication of connections to the east (Missouri River) and west (Powder River Basin), respectively. Many of the utilized bifacial tools were being replaced with bifaces made of cherts outcropping in the immediate site vicinity. This suggests a quite restricted territory and a low degree of mobility throughout the time span represented at the site. This appears to have been most pronounced in Component C, which contained only local lithics.

*Hypothesis 4. Components at the Blaine site represent transient or bivouac sites. If the site was a bivouac, extensive low frequencies of expedient tool types are expected. Disproportionate frequencies of specific source lithic types or exotic lithic types, possibly indicating directionality, are expected to occur. Features, if any, are expected to consist of small, low intensity burn hearths. Documented transient/bivouac sites are rare in the Northwestern Plains. The occurrence of such sites, however, is undisputed. The seasonal usage of particular locations along trails as overnight camps, while in transit to and from resource areas, would eventually result in the accumulation of extensive lithic debris scatters.*

Although somewhat difficult to quantify, this potential function for the Blaine site demands consideration. Location of the site alongside a major highway certainly raises the possibility that a trail into the interior Black Hills passed by the site in prehistoric times, as well. Tool kit diversity for bivouac sites should be low, relatively redundant and weighted toward expedient tool types (Tratebas 1986). If the camp is situated along traditional routes to and from areas containing primary lithic resources, disproportionately high frequencies of lithic types derived from those areas are expected to occur. In the case of the Blaine site, these lithic types could include porcellanite from the Powder River country (Porcellanites 1 and 2), Morrison silicified siltstone from the western foothills of the Black Hills (Quartzite 3), quartzite from the southern Hogback (Quartzites 1 and 2), and various cherts and chalcedonies from the interior uplift (Silicates 1-8, 11-13).

Component A conforms fairly well to the pattern expected for transient sites. The few stone circle features, the cairns (which may have served as trail markers), and low artifact density in the upper component at the Blaine site fit well with a hypothesized transient camp or bivouac function for the later occupations. The Component A assemblage contained few exotic lithics; however, the small amount of porcellanite is consistent with a hypothesized seasonal or sporadic use of the foothills area by groups centered in the Powder River Basin. Hearths and storage features are absent from this component. The only structural features are the stone circles. These suggest temporary, short-term occupation, rather than investment in permanent shelter.

*Hypothesis 5. Components of the Blaine site are multifunctional at the synchronic or diachronic levels. All of the above site types can and do occur as associated, overlapping, and mixed component assemblages in a synchronic sense. Various components, during different periods, may reflect changes in the function of a site over time.*

This hypothesis addresses the possibility that the Blaine site may have served a variety of functions over time or may have served more than one function at once. If multiple functions occurred simultaneously, separate activity areas should be recognizable based on distinctive distributions of tool kits, features, and lithic debris classes.

As has been noted above, the Blaine site did serve different functions at different times. The lowest stratum appears to represent a residential camp or secondary base at which the processing of fibrous plant material was a primary function. The middle component also represents a campsite and can be classified as a residential camp. Biface reduction and group maintenance activities were the primary focus of the series of short-term camps represented by Component B. Possible activity areas recognized within this component were devoted to lithic tool manufacturing, tool repair, and food preparation. This component encompasses both Middle and Late Archaic materials, which seem to reflect slightly different functions. It appears that biface reduction was a primary emphasis during the Late Archaic, while group maintenance was the main focus during the Middle Archaic. In the upper component, hide working and stone tool production took place away from the living spaces (tipi rings), while stone tool repair apparently took place both inside and away from living areas.

## 7.3 Subsistence Economy Research Hypotheses

These first five hypotheses address two questions: What was the function of the Blaine site? Did the site function within a broad-spectrum mountain-based settlement system or within a plains-based settlement system focused on large-scale bison procurement? Both of these questions present methodological challenges to the archaeologist. Problems in differentiating various kinds of site functions were reviewed above.

The distinction between mountain and plains oriented settlement patterns may also be difficult to determine archaeologically, especially in a peripheral area like the Red Valley. It has been argued elsewhere (Sundstrom 1992) that the Red Valley functions ecologically more as an extension of the open high plains than as part of the Black Hills as a mountain environment. In his study of the mammalian fauna of the Black Hills, Turner (1974) recognizes a "transition" life-zone comprising the arid prairie uplands and stream valleys, the semiarid Red Valley, and the basal slopes of the foothills. Steppe-associated mammals including desert cottontail, black-tailed prairie dog, black-footed ferret, pronghorn, and bison are largely limited to this zone. Both bison and pronghorn migrated between the Red Valley and the grasslands surrounding the Black Hills via watergaps in the Hogback, such as the Buffalo Gap (Turner 1974:20-22). Since their human predators in all likelihood migrated in concert with the herds, a grasslands-type adaptation might be expected in the Red Valley. The Hawken, Vore, and Sanson sites, communal bison kills located in the Red Valley, lend support to this hypothesis. Other communal bison kill or processing sites had not been identified in the Black Hills prior to investigations at the Blaine and Jim Pitts sites. In terms of the Black Hills as a whole, bison procurement and processing sites in the Red Valley appear to be anomalous.

In their model of high-altitude, broad spectrum settlement pattern, Bender and Wright place hunt-related sites into the special activity (resource extraction) site category. Residential sites are not directly associated with hunting. This is because hunting in the high country is aimed at individual animals or small herds. The animals and the kills are small, relative to large-scale communal bison hunting on the high plains, and hunters can easily complete the initial butchering at the kill site or transport the entire carcass back to the base camp or secondary base for processing. Under these conditions, there would be little incentive to move the camp to the animal; instead, the animal could be moved to the base camp (or secondary base). Greiser (1985) recognized two kinds of sites associated with hunting in plains-based settlement patterns: kill sites and secondary processing sites. Like Bender and Wright (1988), Greiser (1985) defines these as extractive sites; however, Greiser's model is geared toward communal procurement of bison and mammoth, since an assumption is made that initial butchering took place at the kill site. Both the actual faunal remains and the configuration of hunt-related sites thus can differentiate between the plains and mountain hunting patterns.

Current models of plains-based and mountain-based settlement patterns propose a specialized economy based on communal bison procurement for the plains pattern and a diverse, broad-spectrum economy for the mountain model (Frison 1991; Husted 1969; Bender and Wright 1988; Sundstrom 1992; Black 1991). In areas like the Bighorns and central Rockies, the mountain-based subsistence pattern is easily recognized. Species such as deer, mountain sheep, jackrabbit, pronghorn, and canids clearly dominate the archaeological record. Bison bone is rare or absent. The camps, kills, and processing sites of the plains-based subsistence pattern may contain a few non-bison elements; however, bison is the dominant species at the vast majority of sites related to this pattern. The Black Hills situation is not so clear cut. Faunal remains are quite rare in Black Hills sites. Many sites contain a mixture of very small amounts of bone from bison and smaller animals. Often bone is broken and crushed to the extent that it cannot be identified. At what point should a faunal assemblage be identified as "diverse"? Should the number of species present be the criterion for diversity, or should estimated meat-weight of various species represented in an assemblage be the deciding factor? Does the presence of any bison bone indicate a plains-based subsistence? One goal of the Blaine site excavations was to provide data relevant to a more exact definition of these characteristics as applied to the Black Hills situation.

Ideally, these questions should be addressed either by examining faunal data from a large number of contemporaneous sites and particularly material from base camps and residential camps or secondary bases. Unless a large sample of sites is available, extractive sites will tend to yield a skewed view of subsistence patterns, because they are focused on the procurement and processing of just one or two food resources. Data from sites from each of the major environmental zones included in a hypothesized group territory are needed to form a complete picture of seasonal subsistence activities. Researchers need to develop a statistical description of the hypothesized broad spectrum versus specialized subsistence assemblages.

Such data sets have not yet been generated. Apart from the communal bison kills at the Vore and Hawken sites, few faunal assemblages have been described from the Black Hills. These sites, together with the Sanson buffalo jump and Hawken II site, confirm the presence of large-scale communal bison kills in the Red Valley during the Early Archaic, Middle Archaic, Late Prehistoric, and Protohistoric periods. These sites contain very few non-bison faunal elements. Sites from elsewhere in the Black Hills tend to contain more mixed faunal assemblages (Table 4.3). The Agate Basin site, a bison kill located southwest of the Black Hills contained few non-bison elements. The Smiley-Evans site is a Plains Village seasonal hunting base camp on the northern periphery of the Black Hills. Bison dominated its faunal assemblage.

Faunal material from the Blaine site adds to this data base. It provides a much needed sample of bone from non-kill contexts in the Red Valley.

*Hypothesis 1. The Early Archaic period in the Black Hills is typified by specialized, communal bison hunting based economies.*

Clearly, a single site cannot confirm or refute this hypothesis. Instead, this study will address the evidence that the Blaine site provides in regard to questions of Early Archaic subsistence in the Black Hills. The hypothesis is also examined from a diachronic perspective. Each component of the site is considered separately in order to detect changes in subsistence orientation over time. The alternative to the stated hypothesis is that the Blaine site operated within a settlement and subsistence pattern that was not based on communal bison hunting. If non-bison faunal remains or plant food remains equal or outnumber bison elements at the Blaine site, the site can be interpreted as representing a diverse rather than specialized subsistence base. If bison comprises more than 60 percent of the faunal assemblage, a specialized, bison-based subsistence base can be inferred.

Too little identifiable bone was present at the Blaine site to provide convincing evidence for a specialized bison economy. Any reasonable test of this hypothesis would require that the majority of bone from the site be identifiable as to species. Only 3.8% of the Blaine site faunal assemblage could be identified to species, including noncultural (intrusive) marmot and other rodents. This translated to a minimum of one bison and one deer. The tool kit found in Component C suggests that plant foods were more important at this site during the Early Archaic than were animal foods. This does not mean that bison and other game were not important resources during this period. Instead, it appears that other gathering, as well as hunting, was important to the Early Archaic subsistence economy. The kind of large-scale, specialized bison hunting seen at the Hawken site is not in evidence at the Blaine site.

## 7.4 Conclusions

The limited archaeological material recovered during mitigative excavation at the Blaine site provides a glimpse of human activities in the southwestern Red Valley during the span of the Archaic and early Late Prehistoric periods. The shallow uppermost component suggests use of the site as a transient camp during the Late Prehistoric period. The site area was evidently used for one or more tipi camps by groups traversing the Red Valley on their way into or out of the Black Hills. The presence of southern Black Hills quartzites and porcellanites from the Powder River country suggest a basic east to west, or plains to foothills, route of migration. Tool repair and hide working took place at this camp or camps, but occupation was too brief to leave substantial artifact deposits. The cultural affiliation of the Late Prehistoric occupants of the Blaine site is unknown. Pottery associated with the Late Prehistoric component does not match any regional pottery styles. This suggests a localized ceramic tradition perhaps reflecting use of the site by some group centered in or near the western foothills. The lack of non-native trade items indicates a prehistoric age for the deposit, as does the mixing of Late Prehistoric and Late Archaic materials in the component.

The middle component of the Blaine site contains Late Archaic and Middle Archaic materials. Although no accurate separation could be made of these materials due to the shallowness of the deposits, it appears that most or all of the numerous hearths found in the middle component date to the last millennium of the Middle Archaic period, while most of the biface reduction features date to the early Late Archaic period. This component is interpreted as representing a residential camp at which biface reduction, tool repair, and group maintenance activities took place. A few pieces of Knife River Flint and Badlands plate chalcedony suggest a weak connection to the Missouri River area, probably corresponding to the Late Archaic occupation of the site. Otherwise, use of the site by a strongly localized group appears to be indicated for this component.

The lower component is estimated to date between about 7000 and 5800 BP. This corresponds to both the Early Archaic cultural period and the Altithermal climatic episode in the Black Hills. A series of short-term camps are represented by this component. Artifact density is fairly high, suggesting either frequent or intensive occupations. It is possible that groups were returning to this location on a periodic basis, perhaps to gather and process root foods such as sego lily, wild onion, or prairie turnip. The tool assemblage lacked projectile points, but contained several tools suitable for processing fibrous materials. Little bone was found in the component, relative to the middle and upper components. This suggests an emphasis on plant resources, rather than animal resources, during this period of site use.

Conclusions about the Blaine site are limited by the small amount of data recovered, the lack of horizontal separation of the upper components, and the apparent loss by erosion of some of the lower component. By itself, the information from this site is of limited value; however, when considered together with the rapidly growing body of archaeological data from the Black Hills, the Blaine site helps clarify several questions about prehistoric use of the area.

Three observations are of particular significance. First, the highly localized lithic raw material assemblage strongly suggests the presence of locally based groups, especially during the Early and Middle Archaic periods, whose seasonal range may have been limited to the Black Hills. Second, the presence of Missouri River materials in association with the Late Archaic occupation of the site and the presence of porcellanites in association with the Late Prehistoric occupations amplify patterns observed in other archaeological data from the Black Hills. These suggest that the Black Hills-Missouri River interaction sphere observed at the time of initial contact with non-native people may have been established as early as the Late Archaic period. A Powder River country-Black Hills interaction sphere appears to have been a later development and may have been limited to use of the western foothills during winter by bison hunters from the Wyoming basins. Third, subsistence appears to have changed over time from a broad spectrum gathering and hunting pattern in the Early and Middle Archaic to a greater emphasis on large game hunting in the Late Archaic and Late Prehistoric.

Perhaps the greatest contribution of the Blaine site study is establishing that this area of the Black Hills was in use during the Early Archaic period. The archaeological data establish a human presence in the southwestern Red Valley at this time. The geomorphological study confirms that sedimentary deposition did take place in some areas of the Black Hills during the hypothesized Altithermal climatic episode. Such deposits can be expected to have been partially preserved in areas like the Red Valley. The Red Valley may have been a natural sediment trap during periods of low precipitation. As vegetation cover diminished in the higher elevations due to decreased or sporadic precipitation, more sediment was washed into streams draining into the Red Valley. The reduced volume of water was insufficient to carry this load of sediment across the gentler gradient of the Red Valley and through the Hogback watergaps. This meant that sediment built up in some portions of the lowlands as erosion was taking place in upland areas. The subsequent preservation of these deposits depended on the paths taken by rejuvenated streams during subsequent periods of greater precipitation. No doubt many of the Altithermal deposits were scoured away, especially in and near the narrow watergaps; however, data from the Blaine site clearly indicate that the rapidly down-cutting streams left some pockets of sediment preserved as stream terraces. Such terraces can be correlated with regional terrace sequences and, by inference, with regional climatic shifts. Armed with this knowledge, archaeologists can now begin to more systematically examine the human occupation of the Black Hills during the Altithermal and its larger implications for human response to climate change.

# Chapter 8

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# Appendix A

# Supplemental Data

Table A.1: Radiocarbon dates from the Black Hills. List does not include dates on non-cultural charcoal lenses (forest fire deposits) or rejected dates from Belle Rockshelter (Frison 1991), McKean (Kornfeld et al. 1993), Clayton Draw (Cowan, Pers. comm. 1994), and Kenzy (Saunders et al. 1994).

| Period | Site | Date | Sigma | Range | Material | Lab no. | Reference |
|---|---|---|---|---|---|---|---|
| Mod | 48CK1396 | 60 | 60 | | soil | Beta-80137 | Schneider 1996 |
| Mod | 39CU624 | | | | charcoal | Beta-60497 | BHNF files |
| Mod | 39LA305 | | | | charcoal | Beta-28446 | BHNF files |
| Mod | 39FA205 | | | | charcoal | Beta-5414 | Fredlund et al. 1985 |
| Mod | 39LA783 | 100.2 | 0.8% | | charcoal | Beta-83704 | Fosha pers comm 1995 |
| LP | 48CK1388 | 120 | 70 | 50–190 | soil | Beta-80134 | Schneider 1996 |
| PH | Kenzy | 170 | 60 | 110–230 | charcoal | CAMS-16622 | Styles pers comm 1994 |
| PH | Kenzy | 180 | 70 | 110–250 | wood | Beta-67167 | SARC files |
| H | 39LA305 | 200 | | | charcoal | Beta-28446 | Noisat et al. 1991 |
| PHH | Vore | 200 | 90 | 110–290 | charcoal | RL-173 | Reher and Frison 1980 |
| PH | 39FA205 | 200 | 110 | 90–310 | charcoal | Beta-5415 | Fredlund et al. 1985 |
| PHH | Vore | 230 | | | charcoal | RL-172 | Reher and Frison 1980 |
| PH | 39FA205 | 230 | 160 | 70–390 | charcoal | Beta-5413 | Fredlund et al. 1985 |
| PHH | 39LA319 | 270 | 70 | 200–340 | charcoal | WIS-1674 | Noisat et al. 1991 |
| PHH | 39PN47 | 270 | 70 | 200–340 | charcoal | Beta-24297 | Noisat et al. 1991 |
| LP PH | 39PN1170 | 290 | 60 | 230–350 | wood posts | Beta, not reported | Sheveland and Flemmer 1993 |
| PHH | Deerfield | 300 | 70 | 230–370 | charcoal | WIS-1571 | Buechler 1984 |
| LP | Kenzy | 320 | 60 | 260–380 | wood | Beta-67169 | SARC files |
| LP | 48CK34 | 330 | 50 | 280–380 | charcoal | Beta-41985 | Kornfeld et al. 1991 |
| LP | Vore | 370 | 140 | 230–510 | charcoal | RL-349 | Reher and Frison 1980 |
| LP | Kenzy | 380 | 60 | 320–440 | wood | Beta-67166 | SARC files |
| LP | Deerfield | 390 | 70 | 320–460 | charcoal | WIS-1572 | Buechler 1984 |
| LP | 39PN1124 | 420* | 60 | 360–480 | charcoal | Beta-68611 | BHNF files |
| LP | Deerfield | 460 | 70 | 390–530 | charcoal | WIS-1587 | Buechler 1984 |
| | Blaine | 513 | 44 | 469-557 | soil | | Donohue pers comm 1994 |
| LP | 49CK1395 | 570 | 90 | 480–660 | soil | Beta-79983 | Schneider 1996 |
| LP | Deerfield | 580 | 70 | 510–650 | charcoal | WIS-1589 | Buechler 1984 |
| LP | Deerfield | 600 | 70 | 530–670 | charcoal | WIS-1565 | Buechler 1984 |
| LP | 39FA23 | 600 | 50 | 550–650 | charcoal | Beta-43004 | Noisat et al. 1991 |

Table A.1: continued

| Period | Site | Date | Sigma | Range | Material | Lab no. | Reference |
|---|---|---|---|---|---|---|---|
| LP | Smiley-Evans | 600 | 60 | 540–660 | charcoal | Beta-29536 | Alex 1989 |
| LP | Deerfield | 620 | 70 | 550–690 | charcoal | WIS-1593 | Buechler 1984 |
| LP | Deerfield | 630 | 70 | 560–700 | charcoal | WIS-1574 | Buechler 1984 |
| LP | 39FA23 | 710 | 60 | 650–770 | charcoal | Beta-43004 | Noisat et al. 1991 |
| LP | 39FA23 | 720 | 70 | 650–290 | charcoal | WIS-1815 | Noisat et al. 1991 |
| LP | 39CU691 | 740 | 80 | 660–820 | charcoal | Beta-24296 | Noisat et al. 1991 |
| LP | Deerfield | 760 | 70 | 690–830 | charcoal | WIS-1563 | Buechler 1984 |
| LP | 39CU449 | 780 | 120 | 660–900 | charcoal | Beta-33674 | Noisat et al. 1991 |
| LP | Deerfield | 790 | 70 | 720–860 | charcoal | WIS-1576 | Buechler 1984 |
| LP | Smiley-Evans | 810 | 70 | 740–880 | charcoal | | Chevance 1984 |
| LP | 39PN1011 | 820 | 80 | 740–900 | charcoal | Beta-55768 | BHNF files |
| LP | 39FA23 | 860 | 90 | 770–950 | charcoal | Beta-43003 | Noisat et al. 1991 |
| LP | 39CU1074 | 900 | 60 | 840–960 | charcoal | | SARC files |
| LP | Smiley-Evans | 900 | 70 | 830–970 | charcoal | WIS-1347 | Alex 1989 |
| LP | Smiley-Evans | 900 | 90 | 810–990 | charcoal | Beta-29439 | Alex 1989 |
| LP | 48CK141 | 900 | 110 | 790–1010 | charcoal | RL-1539 | Scott et al. 1981 |
| LP | Sanson | 920 | 70 | 850–990 | charcoal | NWU-63 | Agenbroad 1988 |
| LP | 39FA1178 | 920 | 80 | 840–1000 | charcoal | Beta-54184 | BHNF files |
| LP | Smiley-Evans | 930 | 70 | 860–1000 | charcoal | WIS-1352 | Alex 1989 |
| LP | Deerfield | 940 | 70 | 870–1010 | charcoal | WIS-1564 | Buechler 1984 |
| LP | Smiley-Evans | 950 | 90 | 860–1040 | charcoal | Beta-29441 | Alex 1989 |
| IMM? | 48CK1396 | 950 | 60 | 890–1010 | charcoal AMS | Beta-80138 | Schneider 1996 |
| LP | Smiley-Evans | 960 | 70 | 890–1030 | charcoal | WIS-1350 | Alex 1989 |
| LP | 39FA1153 | 970 | 80 | 890–1050 | charcoal | Beta-50144 | Wolf and Miller 1992 |
| LP | Smiley-Evans | 980 | 70 | 910–1050 | charcoal | WIS-1349 | Alex 1989 |
| LP | Deerfield | 990 | 70 | 920–1060 | charcoal | WIS-1566 | Buechler 1984 |
| LP | McKean | 1000 | 50 | 950–1050 | charcoal | Beta-41988 | Kornfeld et al. 1991 |
| LP | 39FA392 | 1030 | 60 | 970–1090 | charcoal | WIS-1084 | Tratebas 1979a |
| LP | 48CK1393 | 1040 | 70 | 970–1110 | soil | Beta-80135 | Schneider 1996 |
| LP | Deerfield | 1060 | 70 | 990–1130 | charcoal | WIS-1573 | Buechler 1984 |
| LP | Smiley-Evans | 1070 | 70 | 1000–1140 | charcoal | WIS-1346 | Alex 1989 |
| LP | 39PN690 | 1070 | 70 | 1000–1140 | charcoal | Beta-17377 | Noisat et al. 1991 |

Table A.1: continued

| Period | Site | Date | Sigma | Range | Material | Lab no. | Reference |
|---|---|---|---|---|---|---|---|
| LP | 39FA1153 | 1080 | 60 | 1020–1140 | charcoal | Beta-50142 | Wolf and Miller 1992 |
| | 39FA1145 | 1080* | 70 | 1010–1150 | soil | Beta-54721 | Donohue pers comm 1994 |
| LP | Smiley-Evans | 1110 | 90 | 1020–1200 | charcoal | Beta-29440 | Alex 1989 |
| LP | Deerfield | 1150 | 70 | 1080–1220 | charcoal | WIS-1570 | Buechler 1984 |
| LP | 39FA1153 | 1160 | 60 | 1100–1220 | charcoal | Beta-50145 | Wolf and Miller 1992 |
| LP | 39CU271 | 1175 | 60 | 1115-1235 | charcoal | UGA-4081 | Noisat et al. 1991 |
| LP | 39CU651 | 1180 | 90 | 1090–1270 | charcoal | | Noisat et al. 1991 |
| LP | Smiley-Evans | 1190 | 70 | 1120–1260 | charcoal | | Chevance 1984 |
| LP | McKean | 1210 | 80 | 1130–1290 | charcoal | Beta-15871 | Kornfeld et al. 1991 |
| | 39CU1210 | 1220 | 60 | 1160–1280 | soil | | Donohue pers. comm. 1994 |
| LP | 48CK806 | 1260 | 90 | 1170–1350 | charcoal | Beta-14915 | Kornfeld pers. comm. |
| LP | 48CK1392 | 1260 | 50 | 1210–1310 | charcoal | Beta-58876 | Schneider 1996 |
| LP | 39CU1074 | 1270 | 60 | 1210–1330 | charcoal | | SARC files |
| LP | 48CK1395 | 1310 | 60 | 1250–1370 | charcoal AMS | Beta-79974 | Schneider 1996 |
| | 39PN1083 | 1320 | 60 | 1260–1380 | soil | | Donohue pers. comm. 1994 |
| LP | 39CU154 | 1340 | 60 | 1280–1400 | charcoal | Beta-33673 | Noisat et al. 1991 |
| LP | Deerfield | 1390 | 70 | 1320–1460 | charcoal | WIS-1595 | Buechler 1984 |
| LP | Clayton Draw | 1400 | 60 | 1340–1460 | charcoal | | Cowan pers comm 1994 |
| | 39FA1236 | 1420 | 80 | 1340–1500 | soil | | Donohue pers. comm. 1994 |
| LP | 39CU1048 | 1440 | 50 | 1390–1490 | charcoal | Beta-40683 | Noisat et al. 1991 |
| LP | 48CK1403 | 1480 | 60 | 1420–1540 | soil | Beta-80139 | Schneider 1996 |
| LP | McKean | 1490 | 60 | 1430–1550 | charcoal | Beta-5575 | Kornfeld et al. 1991 |
| LPA | Agate Basin | 1520 | 140 | 1380–1660 | charcoal | RL-1419 | Frison and Stanford 1982 |
| LPA | 48CK1395 | 1530 | 60 | 1470–1590 | charcoal | Beta-73782 | Schneider 1996 |
| LPA | 48WE320 | 1531 | 55 | 1476-1586 | charcoal | Beta-23794 | Noisat et al. 1991 |
| LPA | 48WE320 | 1541 | 57 | 1597-1598 | charcoal | Beta-23792 | Noisat et al. 1991 |
| LPA | 39CU895 | 1545 | 70 | 1461-1601 | charcoal | Beta-33499 | Noisat et al. 1991 |
| LPA | 48CK1124 | 1550 | 60 | 1490–1610 | charcoal | Beta-17383 | Kornfeld et al. 1991 |
| | 39FA1145 | 1550* | 70 | 1480–1620 | soil | Beta-54722 | Donohue pers comm 1994 |
| LP | 48CK43 | 1580 | 90 | 1490–1670 | charcoal | Beta-13076 | Kornfeld et al. 1991 |
| LPA | 39FA1010 | 1580 | 50 | 1530–1610 | charcoal | Beta-34178 | Noisat et al. 1991 |
| LPA | 39CU895 | 1645 | 70 | 1575-1715 | charcoal | Beta-33500 | Noisat et al. 1991 |

Table A.1: continued

| Period | Site | Date | Sigma | Range | Material | Lab no. | Reference |
|---|---|---|---|---|---|---|---|
| LPA | 48WE320 | 1647 | 57 | 1590–1704 | charcoal | Beta-23792 | Noisat et al. 1991 |
| LPA | 39CU271 | 1650 | 65 | 1585-1715 | charcoal | UGA-4079 | Noisat et al. 1991 |
| LPA | 48WE320 | 1668 | 66 | 1602-1734 | charcoal | Beta-19881 | Noisat et al. 1991 |
| LPA | 39FA351 | 1690 | 50 | 1640–1740 | bulk soil | | Hanenberger 1994 |
| LPA | McKean | 1700 | 60 | 1640–1760 | charcoal | Beta-41987 | Kornfeld et al. 1991 |
| LPA | 39CU271 | 1715 | 80 | 1635-1795 | charcoal | UGA-4075 | Noisat et al. 1991 |
| LPA | 48CK864 | 1720 | 70 | 1650–1790 | charcoal | Beta-15872 | Kornfeld et al. 1991 |
| LPA | 39CU691 | 1740 | 80 | 1660–1820 | charcoal | Beta-24296 | SARC files |
| LPA | Beaver Creek | 1750 | 60 | 1690–1810 | charcoal | Beta-13825 | Alex 1991 |
| LPA | 48CK1124 | 1750 | 90 | 1760–1840 | charcoal | Beta-17382 | Kornfeld et al. 1991 |
| LPA | 48CK1124 | 1770 | 130 | 1640–1900 | charcoal | Beta-17384 | Kornfeld et al. 1991 |
| LPA | 48CK1395 | 1770 | 60 | 1710–1830 | soil | Beta-79980 | Schneider 1996 |
| LPA | McKean | 1780 | 60 | 1720–1840 | charcoal | Beta-41986 | Kornfeld et al. 1991 |
| LPA | 39FA993 | 1880 | 60 | 1740–1940 | charcoal | Beta-34177 | Noisat et al. 1991 |
| LPA | 39CU271 | 1890 | 80 | 1810–1870 | charcoal | UGA-4077 | Noisat et al. 1991 |
| LPA | McKean | 1920 | 120 | 1800–2040 | charcoal | RL-1859 | Kornfeld et al. 1991 |
| LPA | 48CK1395 | 1980 | 90 | 1890–2070 | charcoal AMS | Beta-79981 | Schneider 1996 |
| LPA | 48CK1395 | 1990 | 60 | 1930–2050 | soil | Beta-79975 | Schneider 1996 |
| LPA | 48WE320 | 1998 | 70 | 1928-2068 | charcoal | Beta-10741 | Noisat et al. 1991 |
| LPA | 48CK1393 | 2000 | 70 | 1930–2070 | bone collagen | Beta-80136 | Schneider 1996 |
| LPA | 39CU728 | 2070 | 70 | 2000–2140 | charcoal | Beta-16933 | Noisat et al. 1991 |
| LPA | 49CK1395 | 2110 | 80 | 2030–2190 | soil | Beta-79979 | Schneider 1996 |
| LPA | 39PN795 | 2150 | 80 | 2070–2230 | charcoal | Beta-24293 | Noisat et al. 1991 |
| LPA | 48WE302 | 2150 | 150 | 2000–2300 | charcoal | RL-350 | Frison 1978 |
| LPA | 39CU113 | 2170 | 80 | 2090–2250 | charcoal | Beta-33672 | Noisat et al. 1991 |
| LPA | Agate Basin | 2215 | 60 | 2155-2275 | charcoal | SI-4432 | Frison and Stanford 1982 |
| LPA | Beaver Creek | 2220 | 70 | 2150–2290 | charcoal | Beta-13826 | Alex 1991 |
| LPA | 39CU651 | 2280 | 90 | 2190–2370 | charcoal | Beta-17986 | Noisat et al. 1991 |
| LPA | 39FA68 | 2281 | 350 | 1931-2631 | charcoal | | Noisat et al. 1991 |
| LPA | 48WE320 | 2323 | 108 | 2215-2431 | charcoal | Beta-23793 | Noisat et al. 1991 |
| LPA | 39CU271 | 2330 | 65 | 2265-2395 | charcoal | UGA-4078 | Noisat et al. 1991 |
| LPA | Deerfield | 2340 | 70 | 2270–2410 | charcoal | WIS-1588 | Buechler 1984 |

Table A.1: continued

| Period | Site | Date | Sigma | Range | Material | Lab no. | Reference |
|---|---|---|---|---|---|---|---|
| LPA | Miner Rattler | 2370 | 70 | 2300–2440 | charcoal | WIS-1369 | Hovde 1981 |
| LPA | 39CU271 | 2400 | 100 | 2300–2500 | charcoal | UGA-4076 | Noisat et al. 1991 |
| LPA | 39FA1178 | 2400 | 60 | 2340–2460 | charcoal | Beta-12345 | BHNF files |
| LPA | 48CK1395 | 2470 | 50 | 2420–2330 | soil | Beta-79982 | Schneider 1996 |
| LPA | Blaine | 2500 | 60 | 2490–2560 | charcoal | Beta-74815 | Sundstrom et al. ms 1994 |
| MPA | Blaine | 2550 | 60 | 2490–2610 | charcoal | Beta-74817 | Sundstrom et al. ms 1994 |
| LPA | 48CK1403 | 2570 | 60 | 2510–2630 | charcoal AMS | Beta-85410 | Schneider 1996 |
| MPA | 39CU253 | 2650 | 70 | 2580–2720 | charcoal | Beta-16533 | Noisat et al. 1991 |
| LPA | Deerfield | 2670 | 80 | 2590–2750 | charcoal | WIS-1590 | Buechler 1984 |
| MPA | 39PN795 | 2680 | 70 | 2610–2750 | charcoal | Beta-24294 | Noisat et al. 1991 |
| | Buster Hill | 2750 | 120 | 2630–2870 | charcoal | I-17835 | Hannus pers comm 1994 |
| | Blaine | 2758 | 44 | 2714-2802 | soil | | Donohue pers comm 1994 |
| MPA | Mule Creek | 2790 | 350 | 2440–3140 | charcoal | C-668 | Wheeler 1957 |
| MPA | Blaine | 3090 | 60 | 3030–3150 | charcoal | Beta-74818 | Sundstrom et al. ms 1994 |
| MPA | 48CK143 | 3030 | 130 | 2900–3160 | charcoal | RL-1540 | Scott et al. 1981 |
| MPA | Blaine | 3140 | 60 | 3080–3200 | charcoal | Beta-74816 | Sundstrom et al. ms 1994 |
| MPA | 39CU271 | 3150 | 100 | 3050–3250 | charcoal | UGA-4080 | Noisat et al. 1991 |
| LPA | Blaine | 3200 | 60 | 3140–3260 | charcoal | Beta- | Sundstrom et al ms 1994 |
| MPA | 48CK1395 | 3260 | 80 | 3180–3340 | charcoal | Beta-73783 | Schneider 1996 |
| LPA | McKean | 3287 | 600 | 2687-3887 | charcoal | C-715 | Mulloy 1954 |
| MPA | Deerfield | 3330 | 80 | 3250–3410 | charcoal | WIS-1592 | Buechler 1984 |
| MPA | Deerfield | 3410 | 70 | 3340–3480 | charcoal | WIS-1578 | Buechler 1984 |
| MPA | Deerfield | 3480 | 80 | 3400–3560 | charcoal | WIS-1594 | Buechler 1984 |
| MPA | 39FA31 | 3500* | 110 | 3390–3610 | charcoal | Beta-25358 | Haug et al. 1992 |
| MPA | 39PN690 | 3520 | 80 | 3440–3600 | charcoal | Beta-17378 | Noisat et al. 1991 |
| MPA | George Hey | 3520 | 70 | 3450–3590 | charcoal | WIS-1086 | Tratebas and Vagstad 1979 |
| MPA | Deerfield | 3590 | 80 | 3510–3670 | charcoal | WIS-1591 | Buechler 1984 |
| MPA | Blaine | 3600 | 80 | 3520–3680 | charcoal | Beta- | Sundstrom et al. ms 1994 |
| MPA | Gant | 3620 | 300 | 3320–3920 | charcoal | | Gant and Hurt 1965? |
| MPA? | 48CK148 | 3620 | 150 | 3470–3770 | charcoal | RL-1541 | Scott et al. 1981 |
| MPA | 39PN795 | 3630 | 110 | 3520–3740 | charcoal | Beta-24295 | Noisat et al. 1991 |
| MPA | Kolterman | 3640 | 350 | 3290–3990 | charcoal | | Wheeler 1958 |

Table A.1: continued

| Period | Site | Date | Sigma | Range | Material | Lab no. | Reference |
|---|---|---|---|---|---|---|---|
| MPA | Gant | 3650 | 150 | 3500–3800 | charcoal | | Gant and Hurt 1965 |
| MPA | Deerfield | 3690 | 70 | 3620–3760 | charcoal | WIS-1577 | Buechler 1984 |
| MPA | McKean | 3790 | 140 | 3650–3930 | charcoal | RL-1860 | Kornfeld et al. 1991 |
| MPA | 38CK1395 | 3850 | 60 | 3790–3910 | charcoal | Beta-81536 | Schneider 1996 |
| MPA | Beaver Creek | 3870 | 70 | 3800–3940 | charcoal | Beta-13827 | Alex 1991 |
| | 39CU1145 | 3890* | 80 | 3810–3970 | soil | Beta-54723 | Donohue pers comm 1994 |
| MPA | George Hey | 3925 | 65 | 3860–3990 | charcoal | WIS-1085 | Tratebas and Vagstad 1979 |
| MPA | Beaver Creek | 3940 | 170 | 3770–4110 | charcoal | Beta-19059 | Alex 1991 |
| | 39CU1145 | 3990* | 80 | 3910–4070 | soil | Beta-54724 | Donohue pers comm 1994 |
| MPA | Beaver Creek | 4010 | 100 | 3910–4110 | charcoal | Beta-19060 | Alex 1991 |
| MPA | Gant | 4130 | 130 | 4000–4260 | charcoal | | Gant and Hurt 1965 |
| MPA | Kolterman | 4230 | 350 | 3880–4580 | charcoal | | Wheeler 1958 |
| MPA | Hawken II | 4250 | 140 | 4110–4390 | charcoal | RL-470 | Frison 1991 |
| MPA | 39CU93 | 4370 | 70 | 4300–4440 | charcoal | | Williams 1993 |
| MPA | 48CK1395 | 4440 | 60 | 4380–4500 | charcoal | Beta-81537 | Schneider 1996 |
| MPA | 49CK1395 | 4550 | 130 | 4420–4680 | charcoal | Beta-73784 | Schneider 1996 |
| MPA | McKean | 4590 | 160 | 4430–4750 | charcoal | RL-1861 | Kornfeld et al. 1991 |
| MPA | Beaver Creek | 4710 | 110 | 4600–4820 | charcoal | Beta-19061 | Alex 1991 |
| MPA | 48CK1162 | 4850 | 180 | 4670–5030 | charcoal | Beta-57550 | BHNF records |
| MPA | Deerfield | 4950 | 70 | 4880–5020 | charcoal | WIS-1586 | Buechler 1984 |
| EPA | 48CK1395 | 5180 | 60 | 5120–5240 | soil | Beta-79978 | Schneider 1996 |
| MPA | Landers | 5410* | 80 | 5330–5490 | soil | Beta-25359 | Haug et al. 1992 |
| EPA | Beaver Creek | 5500 | 80 | 5420–5580 | charcoal | Beta-23712 | Alex 1991 |
| EPA | Beaver Creek | 5500 | 150 | 5350–5850 | charcoal | Beta-19066 | Alex 1991 |
| EPA | Blaine | 5580 | 90 | 5490–5670 | charcoal | Beta-55604 | Donohue and Hanenberger 1993 |
| EPA | 48CK1395 | 5600 | 160 | 5440–5760 | charcoal AMS | Beta-79976 | Schneider 1996 |
| EPA | Beaver Creek | 5740 | 110 | 5630–5850 | charcoal | Beta-24068 | Alex 1991 |
| | Jim Pitts | 5870 | 80 | 5790–5950 | soil | | Donohue and Hanenberger 1993 |
| EPA | 48CK1395 | 5960 | 70 | 5890–6030 | charcoal AMS | Beta-79977 | Schneider 1996 |
| EPA | Hawken II | 6010 | 170 | 5840–6180 | charcoal | RL-484 | Frison 1978 |

Table A.1: continued

| Period | Site | Date | Sigma | Range | Material | Lab no. | Reference |
|---|---|---|---|---|---|---|---|
| EPA | Beaver Creek | 6220 | 100 | 6120–6320 | charcoal | Beta-23715 | Alex 1991 |
| EPA | Hawken | 6270 | 170 | 6100–6440 | charcoal | RL-437 | Frison 1991 |
| EPA | Hawken | 6470 | 140 | 6330–6610 | charcoal | RL-185 | Frison 1991 |
| EPA | Beaver Creek | 6720 | 100 | 6620–6820 | charcoal | Beta-24067 | Alex 1991 |
| | 39PN1083 | 6890 | 70 | 6820–6960 | soil | | Donohue pers. comm. 1994 |
| EPA | Blaine | 6940 | 80 | 6860–7020 | charcoal | Beta-74819 | Sundstrom et al. ms 1994 |
| EPA | Clayton Draw | 7010 | 50 | 6960–7060 | charcoal | Beta-76116 | Cowan pers comm 1994 |
| P | Ray Long | 7073 | 300 | 6773-7373 | charcoal | | Wheeler 1958 |
| EPA | 48CK1387 | 7430 | 80 | 7350–7510 | soil | Beta-80133 | Schneider 1996 |
| | Buster Hill | 7690 | 210 | 7480–7900 | charcoal | I-17835 | Hannus pers comm 1994 |
| P | Ray Long | 7710 | 740 | 6970–8450 | charcoal | | Wheeler 1958 |
| | 39PN1124 | 8140* | 70 | 8070–8210 | charcoal? | Beta-68609 | BHNF files |
| | Ray Long | 8130 | 400 | 7730–8530 | charcoal | | Hannus 1986 |
| | WCNP | 8230* | 100 | 8130–8330 | soil | TX-8232 | Fredlund pers comm 1994 |
| P | Ray Long | 8950 | 140 | 8810–9090 | charcoal | I-14239 | Hannus 1986 |
| | Blaine | 9077 | 77 | 9000–9154 | soil | | Donohue pers comm 1994 |
| P | Ray Long | 9150 | 230 | 8920–9380 | charcoal | I-17779 | Hannus pers comm 1994 |
| | WCNP | 9160* | 80 | 9080–9240 | soil | TX-8230 | Fredlund pers comm 1994 |
| P | Agate Basin | 9350 | 450 | 8900–9800 | charcoal | O-1252 | Frison and Stanford 1982 |
| P | Ray Long | 9380 | 500 | 8880–9880 | charcoal | | Wheeler 1958 |
| P | Ray Long | 9540 | 540 | 9000–10080 | charcoal | I-14240 | Hannus 1986 |
| P | Jim Pitts | 9660 | 60 | 9600–9720 | | | Donohue and Hanenberger 1993 |
| P | Agate Basin | 9750 | 130 | 9620–9880 | charcoal | SI-4431 | Frison and Stanford 1982 |
| P | Agate Basin | 9990 | 225 | 9765-10215 | charcoal | M-1131 | Frison and Stanford 1982 |
| C | Agate Basin | 10030 | 280 | 9750–10310 | charcoal | RL-1263 | Frison and Stanford 1982 |
| | Agate Basin | 10100 | 2800 | 7300–12900 | charcoal | RL-1000 | Frison and Stanford 1982 |
| | Agate Basin | 10140 | 500 | 9640–10640 | charcoal | RL-1241 | Frison and Stanford 1982 |
| | Agate Basin | 10200 | 2000 | 8200–12200 | charcoal | RL-738 | Frison and Stanford 1982 |
| F | Agate Basin | 10375 | 700 | 9675-11075 | charcoal | I-472 | Frison and Stanford 1982 |
| | Ray Long | 10400 | 360 | 10040–10760 | charcoal | I-14245 | Hannus 1986 |
| P | Agate Basin | 10430 | 570 | 9860–11000 | charcoal | RL-557 | Frison and Stanford 1982 |

Table A.1: continued

| Period | Site | Date | Sigma | Range | Material | Lab no. | Reference |
|---|---|---|---|---|---|---|---|
| P | Agate Basin | 10445 | 110 | 10335-10555 | charcoal | SI-4430 | Frison and Stanford 1982 |
| | Blaine | 10550 | 91 | 10459-10641 | soil | | Donohue pers comm |
| FP | Agate Basin | 10575 | 90 | 10485-10665 | charcoal | SI-3730 | Frison and Stanford 1982 |
| F | Agate Basin | 10665 | 85 | 10580–10750 | charcoal | SI-3732 | Frison and Stanford 1982 |
| C | Sheaman | 10690 | 150 | 10540–10840 | charcoal | Beta-25836 | Frison 1991 |
| F | Agate Basin | 10780 | 120 | 10660–10900 | charcoal | SI-3733 | Frison and Stanford 1982 |
| ? | Ray Long | 11000 | 310 | 10690–11310 | charcoal | I-14241 | Hannus 1986 |
| | WCNP | 11217* | 114 | 11331-11559 | soil | TX-8229 | Fredlund pers comm 1994 |
| | Agate Basin | 11450 | 110 | 11340–11560 | charcoal | SI-3734 | Frison and Stanford 1982 |
| | Agate Basin | 11700 | 95 | 11605-11795 | charcoal | SI-3731 | Frison and Stanford 1982 |
| | WCNP | 14118* | 123 | 13995-13749 | soil | TX-8228 | Fredlund pers comm 1994 |

* C-13 adjusted age. Dates are uncalibrated.

Table A.2: Summary of Excavations at the Blaine Site, 39CU1144.

| Excavation | Unit | Level | Level increment | # Tools | # Debitage | Comments |
|---|---|---|---|---|---|---|
| Block A | N392E909 | 1 | 0–7 cm b.s. | 0 | 4 | Feature 2 mitigation |
| Block A | N392E910 | 1 | 0–7 cm b.s. | 1 | 1 | Feature 2 mitigation |
| Block A | N392E911 | 1 | 0–7 cm b.s. | 0 | 0 | Feature 2 mitigation |
| Block A | N392E912 | 1 | 0–7 cm b.s. | 0 | 0 | Feature 2 mitigation |
| Block A | N392E913 | 1 | 0–7 cm b.s. | 0 | 0 | Feature 2 mitigation |
| Block A | N393E909 | 1 | 0–7 cm b.s. | 0 | 2 | Feature 2 mitigation, soil sample taken |
| Block A | N393E910 | 1 | 0–7 cm b.s. | 0 | 0 | Feature 2 mitigation |
| Block A | N393E911 | 1 | 0–7 cm b.s. | 0 | 0 | Feature 2 mitigation, soil sample taken |
| Block A | N393E912 | 1 | 0–7 cm b.s. | 0 | 0 | Feature 2 mitigation |
| Block A | N393E913 | 1 | 0–7 cm b.s. | 0 | 1 | Feature 2 mitigation, soil sample taken |
| Block A | N394E909 | 1 | 0–7 cm b.s. | 0 | 0 | Feature 2 mitigation |
| Block A | N394E910 | 1 | 0–7 cm b.s. | 0 | 1 | Feature 2 mitigation |
| Block A | N394E911 | 1 | 0–7 cm b.s. | 0 | 0 | Feature 2 mitigation |
| Block A | N394E912 | 1 | 0–7 cm b.s. | 0 | 0 | Feature 2 mitigation |
| Block A | N394E913 | 1 | 0–7 cm b.s. | 0 | 2 | Feature 2 mitigation |
| Block A | N395E909 | 1 | 0–7 cm b.s. | 0 | 1 | Feature 2 mitigation, soil sample taken |
| Block A | N395E910 | 1 | 0–7 cm b.s. | 0 | 2 | Feature 2 mitigation |
| Block A | N395E911 | 1 | 0–7 cm b.s. | 0 | 2 | Feature 2 mitigation, soil sample taken |
| Block A | N395E912 | 1 | 0–7 cm b.s. | 0 | 0 | Feature 2 mitigation |
| Block A | N395E913 | 1 | 0–7 cm b.s. | 0 | 3 | Feature 2 mitigation, soil sample taken |
| Block A | N396E909 | 1 | 0–7 cm b.s. | 0 | 2 | Feature 2 mitigation |
| Block A | N396E910 | 1 | 0–7 cm b.s. | 0 | 2 | Feature 2 mitigation |
| Block A | N396E911 | 1 | 0–7 cm b.s. | 0 | 0 | Feature 2 mitigation |
| Block A | N396E912 | 1 | 0–7 cm b.s. | 0 | 1 | Feature 2 mitigation |
| Block A | N396E913 |  | 0–7 cm b.s. | 0 | 0 | Feature 2 mitigation |
| Block B | N410E872 | 1 | 0–7 cm b.s. | 0 | 0 |  |
|  |  | 2 | 7–17 cm b.s. | 0 | 8 |  |
|  |  | 3 | 17–27 cm b.s. | 0 | 7 |  |
|  |  | 4 | 27–37 cm b.s. | 0 | 0 |  |
| Block B | N410E873 | 1 | 0–7 cm b.s. | 0 | 2 |  |
|  |  | 2 | 7–17 cm b.s. | 1 | 5 |  |
|  |  | 3 | 17–27 cm b.s. | 0 | 7 |  |

Table A.2: continued

| Excavation | Unit | Level | Level increment | # Tools | # Debitage | Comments |
|---|---|---|---|---|---|---|
| | | 4 | 27–37 cm b.s. | 0 | 0 | |
| Block B | N410E874 | 1 | 0–7 cm b.s. | 0 | 4 | |
| | | 2 | 7–17 cm b.s. | 0 | 13 | |
| | | 3 | 17–27 cm b.s. | 0 | 10 | |
| | | 4 | 27–37 cm b.s. | 0 | 1 | |
| Block B | N410E875 | 1 | 0–7 cm b.s. | 0 | 8 | |
| | | 2 | 7–17 cm b.s. | 0 | 7 | |
| | | 3 | 17–27 cm b.s. | 2 | 13 | |
| | | 4 | 27–37 cm b.s. | 0 | 1 | |
| Block B | N410E876 | 1 | 0–7 cm b.s. | 0 | 4 | |
| | | 2 | 7–17 cm b.s. | 0 | 10 | |
| | | 3 | 17–27 cm b.s. | 0 | 10 | |
| | | 4 | 27–37 cm b.s. | 0 | 3 | |
| Block B | N411E872 | 1 | 0–7 cm b.s. | 0 | 9 | soil sample |
| | | 2 | 7–17 cm b.s. | 0 | 11 | soil sample |
| | | 3 | 17–27 cm b.s. | 0 | 2 | soil sample |
| | | 4 | 27–37 cm b.s. | 0 | 2 | soil sample |
| Block B | N411E873 | 1 | 0–7 cm b.s. | 0 | 5 | |
| | | 2 | 7–17 cm b.s. | 0 | 12 | |
| | | 3 | 17–27 cm b.s. | 0 | 7 | |
| | | 4 | 27–37 cm b.s. | 0 | 1 | |
| Block B | N411E874 | 1 | 0–7 cm b.s. | 0 | 1 | soil sample |
| | | 2 | 7–17 cm b.s. | 0 | 17 | soil sample |
| | | 3 | 17–27 cm b.s. | 0 | 28 | soil sample |
| | | 4 | 27–37 cm b.s. | 0 | 1 | soil sample |
| Block B | N411E875 | 1 | 0–7 cm b.s. | 0 | | |
| | | 2 | 7–17 cm b.s. | 0 | 16 | |
| | | 3 | 17–27 cm b.s. | 0 | 21 | |
| | | 4 | 27–37 cm b.s. | 0 | 3 | |
| Block B | N411E876 | 1 | 0–7 cm b.s. | 0 | 3 | soil sample |
| | | 2 | 7–17 cm b.s. | 0 | 10 | soil sample |
| | | 3 | 17–27 cm b.s. | 0 | 30 | soil sample |

Table A.2: continued

| Excavation | Unit | Level | Level increment | # Tools | # Debitage | Comments |
|---|---|---|---|---|---|---|
| | | 4 | 27–37 cm b.s. | 0 | 4 | soil sample |
| Block B | N412E872 | 1 | 0–7 cm b.s. | 2 | 8 | |
| | | 2 | 7–17 cm b.s. | 0 | 9 | |
| | | 3 | 17–27 cm b.s. | 0 | 5 | |
| | | 4 | 27–37 cm b.s. | 0 | 1 | |
| Block B | N412E873 | 1 | 0–7 cm b.s. | 1 | 10 | |
| | | 2 | 7–17 cm b.s. | 0 | 11 | |
| | | 3 | 17–27 cm b.s. | 0 | 8 | |
| | | 4 | 27–37 cm b.s. | 0 | | |
| Block B | N412E875 | 1 | 0–7cm b.s. | 0 | 3 | |
| | | 2 | 7–17 cm b.s. | 0 | 14 | |
| | | 3 | 17–27 cm b.s. | 0 | 34 | |
| | | 4 | 27–37 cm b.s. | 0 | 6 | |
| Block B | N412E876 | 1 | 0–7 cm b.s. | 0 | 2 | |
| | | 2 | 7–17 cm b.s. | 0 | 16 | |
| | | 3 | 17–27 cm b.s. | 0 | 21 | |
| | | 4 | 27–37 cm b.s. | 0 | 2 | |
| Block B | N413E872 | 1 | 0–7 cm b.s. | 0 | 9 | soil sample |
| | | 2 | 7–17 cm b.s. | 1 | 25 | soil sample |
| | | 3 | 17–27 cm b.s. | 0 | 12 | soil sample |
| | | 4 | 27–37 cm b.s. | 0 | 2 | soil sample |
| Block B | N413E873 | 1 | 0–7 cm b.s. | 0 | 5 | |
| | | 2 | 7–17 cm b.s. | 0 | 3 | |
| | | 3 | 17–27 cm b.s. | 0 | | |
| | | 4 | 27–37 cm b.s. | 0 | | |
| Block B | N413E874 | 1 | 0–7 cm b.s. | 0 | 3 | soil sample |
| | | 2 | 7–17 cm b.s. | 0 | 19 | soil sample |
| | | 3 | 17–27 cm b.s. | 0 | 15 | soil sample |
| | | 4 | 27–37 cm b.s. | 0 | 2 | missed sample |
| Block B | N413E875 | 1 | 0–7 cm b.s. | 0 | 1 | |
| | | 2 | 7–17 cm b.s. | 0 | 19 | |
| | | 3 | 17–27 cm b.s. | 0 | 15 | |

Table A.2: continued

| Excavation | Unit | Level | Level increment | # Tools | # Debitage | Comments |
|---|---|---|---|---|---|---|
| | | 4 | 27–37 cm b.s. | 0 | 5 | soil sample |
| Block B | N413E876 | 1 | 0–7 cm b.s. | 0 | 4 | soil sample |
| | | 2 | 7–17 cm b.s. | 0 | 14 | soil sample |
| | | 3 | 17–27 cm b.s. | 0 | 22 | soil sample |
| | | 4 | 27–37 cm b.s. | 0 | 3 | soil sample |
| Block B | N414E872 | 1 | 0–7 cm b.s. | 1 | 14 | |
| | | 2 | 7–17 cm b.s. | 0 | 1 | |
| | | 3 | 17–27 cm b.s. | 0 | 28 | soil sample |
| | | 4 | 27–37 cm b.s. | 0 | | |
| Block B | N414E873 | 1 | 0–7 cm b.s. | 0 | | |
| | | 2 | 7–17 cm b.s. | 0 | 15 | |
| | | 3 | 17–27 cm b.s. | 0 | 9 | |
| | | 4 | 27–37 cm b.s. | 0 | | |
| Block B | N414E874 | 1 | 0–7 cm b.s. | 0 | 2 | |
| | | 2 | 7–17 cm b.s. | 0 | 11 | |
| | | 3 | 17–27 cm b.s. | 0 | 4 | |
| | | 4 | 27–37 cm b.s. | 0 | 1 | |
| Block B | N414E875 | 1 | 0–7 cm b.s. | 0 | | |
| | | 2 | 7–17 cm b.s. | 0 | 9 | |
| | | 3 | 17–27 cm b.s. | 0 | 11 | |
| | | 4 | 27–37 cm b.s. | 0 | | |
| Block B | N414E876 | 1 | 0–7 cm b.s. | 0 | | |
| | | 2 | 7–17 cm b.s. | 0 | 10 | |
| | | 3 | 17–27 cm b.s. | 0 | 9 | |
| | | 4 | 27–37 cm b.s. | 0 | 1 | |
| Block C | N387E937 | 1 | 0–7cm b.s. | 0 | 1 | Feature 4 test |
| Block C | N387E938 | 1 | 0–7cm b.s. | 0 | 0 | Feature 4 test |
| Block C | N388E937 | 1 | 0–7cm b.s. | 0 | 0 | Feature 4 test |
| Block C | N388E938 | 1 | 0–7cm b.s. | 0 | 1 | Feature 4 test |
| Test Unit | N388E922 | 1 | 0–10 cm b.s. | 0 | 6 | |
| | | 2 | 10–20 cm b.s. | 0 | 2 | |
| | | 3 | 20–30 cm b.s. | 0 | 2 | |

Table A.2: continued

| Excavation | Unit | Level | Level increment | # Tools | # Debitage | Comments |
|---|---|---|---|---|---|---|
| | | 4 | 30–40 cm b.s. | 0 | 1 | |
| | | 5 | 40–50 cm b.s. | 0 | 1 | |
| | | 6 | 50–60 cm b.s. | 0 | 2 | |
| Test Unit | N388E943 | 1 | 0–10 cm b.s. | 0 | 4 | |
| | | 2 | 10–20 cm b.s. | 0 | 5 | |
| | | 3 | 20–30 cm b.s. | 0 | 2 | |
| | | 4 | 30–40 cm b.s. | 0 | 0 | |
| | | 5 | 40–50 cm b.s. | 0 | 0 | |
| | | 6 | 50–60 cm b.s. | 0 | 0 | |
| | | 7 | 60–70 cm b.s. | 0 | 0 | |
| Test Unit | N389E943 | 1 | 0–10 cm b.s. | 0 | 2 | |
| | | 2 | 10–20 cm b.s. | 0 | 2 | |
| Test Unit | N391.25 | | Surface | 0 | 9 | Adjoining Feature 1 trench and associated with Feature 6, 1992 |
| | E901.32 | 1 | 0–10 cm b.s. | 0 | 5 | |
| | | 2 | 10–20 cm b.s. | 0 | 8 | |
| | | 3 | 20–30 cm b.s. | 0 | 15 | |
| | | 4 | 30–40 cm b.s. | 0 | 9 | |
| | | 5 | 40–50 cm b.s. | 0 | 5 | |
| | | 6 | 50–60 cm b.s. | 0 | 3 | |
| | | 7 | 60–70 cm b.s. | 0 | 1 | |
| | | 8 | 70–80 cm b.s. | 0 | 1 | |
| Test Unit | N391.50 | 1 | 0–5 cm b.s. | 0 | 1 | 1x2-meter trench cross sectioning Feature 1, 1992 |
| | E903.30 | 2 | 5–10 cm b.s. | 0 | 5 | |
| | | 3 | 10–15 cm b.s. | 0 | 7 | |
| | | 4 | 15–20 cm b.s. | 0 | 6 | |
| | | 5 | 20–30 cm b.s. | 0 | 9 | |
| | | 6 | 30–40 cm b.s. | 0 | 9 | |
| | | 7 | 40–50 cm b.s. | 0 | 11 | |
| | | 8 | 50–60 cm b.s. | 0 | 15 | |
| | | 9 | 60–70 cm b.s. | 0 | 5 | |

Table A.2: continued

| Excavation | Unit | Level | Level increment | # Tools | # Debitage | Comments |
|---|---|---|---|---|---|---|
| | | 10 | 70–80 cm b.s. | 0 | 2 | |
| Test Unit | N392E914 | 1 | 0–10 cm b.s. | 0 | 2 | |
| | | 2 | 10–20 cm b.s. | 0 | 6 | |
| | | 3 | 20–30 cm b.s. | 0 | 1 | |
| Test Unit | N392E915 | 1 | 0–10 cm b.s. | 0 | 5 | |
| | | 2 | 10–20 cm b.s. | 0 | 2 | |
| | | 3 | 20–30 cm b.s. | 0 | 0 | |
| Test Unit | N392E932 | 1 | 0–10 cm b.s. | 0 | 2 | |
| | | 2 | 10–20 cm b.s. | 0 | 2 | |
| | | 3 | 20–30 cm b.s. | 0 | 1 | |
| | | 4 | 30–40 cm b.s. | 0 | 0 | |
| | | 5 | 40–50 cm b.s. | 0 | 0 | |
| | | 6 | 50–60 cm b.s. | 0 | 0 | |
| Test Unit | N393E892 | 1 | 0–10 cm b.s. | 0 | 2 | 1992 |
| | | 2 | 10–20 cm b.s. | 0 | 8 | |
| | | 3 | 20–30 cm b.s. | 0 | 4 | |
| | | 4 | 30–40 cm b.s. | 0 | 0 | |
| | | 5 | 40–50 cm b.s. | 0 | 0 | |
| | | 6 | 50–60 cm b.s. | 0 | 0 | |
| Test Unit | N393E914 | 1 | 0–10 cm b.s. | 0 | 4 | |
| | | 2 | 10–20 cm b.s. | 0 | 0 | |
| | | 3 | 20–30 cm b.s. | 0 | 1 | |
| Test Unit | N393E915 | 1 | 0–10 cm b.s. | 0 | 3 | |
| | | 2 | 10–20 cm b.s. | 0 | 1 | |
| | | 3 | 20–30 cm b.s. | 0 | 2 | |
| Test unit | N393E919 | 1 | 0–5 cm b.s. | 0 | 0 | 1992 |
| | | 2 | 5–10 cm b.s. | 0 | 1 | |
| | | 3 | 10–15 cm b.s. | 0 | 1 | |
| | | 4 | 15–20 cm b.s. | 0 | 1 | |
| | | 5 | 20–30 cm b.s. | 0 | 4 | |
| | | 6 | 30–40 cm b.s. | 0 | 0 | |
| | | 7 | 40–60 cm b.s. | 0 | 2 | |

Table A.2: continued

| Excavation | Unit | Level | Level increment | # Tools | # Debitage | Comments |
|---|---|---|---|---|---|---|
| | | 8 | 60–75 cm b.s. | 0 | 0 | |
| Test Unit | N393E926 | 1 | 0–5 cm b.s. | 0 | 0 | Within Feature 3, 1992 |
| | | 2 | 5–10 cm b.s. | 0 | 2 | |
| | | 3 | 10–15 cm b.s. | 0 | 1 | |
| | | 4 | 15–20 cm b.s. | 0 | 2 | |
| | | 5 | 20–30 cm b.s. | 0 | 0 | |
| Test Unit | N393E927 | 1 | 0–5 cm b.s. | 0 | 0 | Within Feature 3, 1992 |
| | | 2 | 5–10 cm b.s. | 0 | 3 | |
| | | 3 | 10–15 cm b.s. | 0 | 1 | |
| | | 4 | 15–20 cm b.s. | 0 | 1 | |
| Test unit | N393.75E911.36 | 1 | 0–10 cm b.s. | 0 | 1 | Test Unit within Feature 2 and Block A, 1992 |
| | | 2 | 10–20 cm b.s. | 0 | 8 | |
| | | 3 | 20–30 cm b.s. | 0 | 5 | |
| Test unit | N396E903 | 1 | 0–10 cm b.s. | 0 | 3 | |
| | | 2 | 10–20 cm b.s. | 0 | 10 | |
| | | 3 | 20–30 cm b.s. | 0 | 5 | |
| | | 4 | 30–40 cm b.s. | 0 | 3 | |
| | | 5 | 40–50 cm b.s. | 0 | 1 | |
| | | 6 | 50–60 cm b.s. | 0 | 3 | |
| | | 7 | 60–70 cm b.s. | 0 | 0 | |
| | | 8 | 70–80 cm b.s. | 0 | 0 | |
| Test Unit | N396E922 | 1 | 0–10 cm b.s. | 0 | 3 | |
| | | 2 | 10–20 cm b.s. | 0 | 9 | |
| | | 3 | 20–30 cm b.s. | 0 | 0 | |
| | | 4 | 30–40 cm b.s. | 0 | 0 | |
| | | 5 | 40–50 cm b.s. | 0 | 0 | |
| | | 6 | 50–60 cm b.s. | 0 | 2 | |
| | | 7 | 60–70 cm b.s. | 0 | 0 | |
| | | 8 | 70–80 cm b.s. | 0 | 0 | |
| | | 9 | 80–90 cm b.s. | 0 | 3 | |
| | | 10 | 90–100 cm b.s. | 0 | 3 | |

Table A.2: continued

| Excavation | Unit | Level | Level increment | # Tools | # Debitage | Comments |
|---|---|---|---|---|---|---|
| Test Unit | N397E899 | 1 | 0–10 cm b.s. | 0 | 11 | |
| | | 2 | 10–20 cm b.s. | 0 | 0 | |
| | | 3 | 20–30 cm b.s. | 0 | 4 | |
| | | 4 | 30–40 cm b.s. | 0 | 0 | |
| | | 5 | 40–50 cm b.s. | 0 | 0 | |
| | | 6 | 50–60 cm b.s. | 0 | 0 | |
| Test unit | N400E914 | 1 | 0–10cm b.s. | 0 | 2 | |
| | | 2 | 10–20 cm b.s. | 0 | 5 | |
| | | 3 | 20–30 cm b.s. | 0 | 1 | |
| | | 4 | 30–40 cm b.s. | 0 | 0 | |
| | | 5 | 40–50 cm b.s. | 0 | 0 | |
| | | 6 | 50–60 cm b.s. | 0 | 0 | |
| Test unit | N404E895 | 1 | 0–10cm b.s. | 0 | 1 | |
| | | 2 | 10–20 cm b.s. | 0 | 1 | |
| | | 3 | 20–30 cm b.s. | 0 | 3 | |
| | | 4 | 30–40 cm b.s. | 0 | 0 | |
| | | 5 | 40–50 cm b.s. | 0 | 0 | |
| | | 6 | 50–60 cm b.s. | 0 | 0 | |
| | | 7 | 60–70 cm b.s. | 0 | 0 | |
| | | 8 | 70–80 cm b.s. | 0 | 0 | |
| | | 9 | 80–90 cm b.s. | 0 | 0 | |
| | | 10 | 90–100 cm b.s. | 0 | 0 | |
| Test Unit | N404E901 | 1 | 0–10 cm b.s. | 0 | 2 | |
| | | 2 | 10–20 cm b.s. | 0 | 1 | |
| | | 3 | 20–30 cm b.s. | 0 | 1 | |
| | | 4 | 30–40 cm b.s. | 0 | 1 | |
| | | 5 | 40–50 cm b.s. | 0 | 0 | |
| Test unit | N406E972 | 1 | 0–10 cm b.s. | 0 | | |
| | | 2 | 10–20 cm b.s. | 0 | 0 | |
| | | 3 | 20–30 cm b.s. | 0 | 0 | |
| | | 4 | 30–40 cm b.s. | 0 | 0 | |
| | | 5 | 40–50 cm b.s. | 0 | 0 | |

Table A.2: continued

| Excavation | Unit | Level | Level increment | # Tools | # Debitage | Comments |
|---|---|---|---|---|---|---|
| | | 6 | 50–60 cm b.s. | 0 | 4 | |
| | | 7 | 60–70 cm b.s. | 0 | 0 | |
| Test Unit | N408E870 | 1 | 0–10cm b.s. | 0 | 0 | |
| | | 2 | 10–20cm b.s. | 0 | 5 | |
| | | 3 | 20–30cm b.s. | 0 | 0 | |
| | | 4 | 30–40cm b.s. | 0 | 3 | |
| | | 5 | 40–50cm b.s. | 0 | 1 | |
| | | 6 | 50–60cm b.s. | 0 | 0 | |
| | | 7 | 60–70cm b.s. | 0 | 0 | |
| | | 8 | 70–80cm b.s. | 0 | 1 | |
| Test Unit | N408E877 | 1 | 0–10cm b.s. | 0 | 6 | |
| | | 2 | 10–20cm b.s. | 0 | 5 | |
| | | 3 | 20–30cm b.s. | 0 | 3 | |
| | | 4 | 30–40cm b.s. | 0 | 0 | |
| | | 5 | 40–50cm b.s. | 0 | 0 | |
| | | 6 | 50–60cm b.s. | 0 | 1 | |
| | | 7 | 60–70cm b.s. | 0 | 0 | |
| | | 8 | 70–80cm b.s. | 0 | 0 | |
| Test Unit | N408E884 | 1 | 0–10cm b.s. | 0 | 3 | |
| | | 2 | 10–20cm b.s. | 0 | 1 | |
| | | 3 | 20–30cm b.s. | 0 | 0 | |
| | | 4 | 30–40cm b.s. | 0 | 0 | |
| | | 5 | 40–50cm b.s. | 0 | 0 | |
| | | 6 | 50–60cm b.s. | 0 | 0 | |
| Test Unit | N410E973 | 1 | 0–7cm b.s. | 0 | 4 | Associated with Feature 7 |
| Test Unit | N412E874 | 1 | 0–10cm b.s. | 0 | 10 | Test Unit within Block B |
| | | 2 | 10–20cm b.s. | 0 | 28 | |
| | | 3 | 20–30cm b.s. | 0 | 23 | |
| | | 3 or 4? | | 0 | 3 | |
| | | 4 | 30–40cm b.s. | 0 | 5 | |
| | | 5 | 40–50cm b.s. | 0 | 1 | |
| | | 6 | 50–60cm b.s. | 0 | 3 | |

Table A.2: continued

| Excavation | Unit | Level | Level increment | # Tools | # Debitage | Comments |
|---|---|---|---|---|---|---|
| | | 7 | 60–70cm b.s. | 0 | 1 | |
| | | 8 | 70–80cm b.s. | 0 | 0 | |
| Test Unit | N412E882 | 1 | 0–10cm b.s. | 0 | 2 | |
| | | 2 | 10–20cm b.s. | 0 | 2 | |
| | | 3 | 20–30cm b.s. | 0 | 0 | |
| | | 4 | 30–40cm b.s. | 0 | 0 | |
| | | 5 | 40–50cm b.s. | 0 | 0 | |
| | | 6 | 50–60cm b.s. | 0 | 0 | |
| Test Unit | N412E957 | 1 | 0–10cm b.s. | 0 | 2 | |
| | | 2 | 10–20cm b.s. | 0 | 2 | |
| | | 3 | 20–30cm b.s. | 0 | 0 | |
| | | 4 | 30–40cm b.s. | 0 | 0 | |
| | | 5 | 40–50cm b.s. | 0 | 0 | |
| | | 6 | 50–60cm b.s. | 0 | 1 | |
| | | 7 | 60–70cm b.s. | 0 | 1 | |
| | | 8 | 70–80cm b.s. | 0 | 0 | |
| | | 9 | 80–90cm b.s. | 0 | 0 | |
| | | 10 | 90–105cm b.s. | 0 | 0 | |
| Test Unit | N416E869 | 1 | 0–10cm b.s. | 0 | 0 | |
| | | 2 | 10–20cm b.s. | 0 | 2 | |
| | | 3 | 20–30cm b.s. | 0 | 0 | |
| | | 4 | 30–40cm b.s. | 0 | 0 | |
| | | 5 | 40–50cm b.s. | 0 | 0 | |
| | | 6 | 50–60cm b.s. | 0 | 0 | |
| | | 7 | 60–70cm b.s. | 0 | 0 | |
| | | 8 | 70–80cm b.s. | 0 | 0 | |
| | | 9 | 80–90cm b.s. | 0 | 0 | |
| | | 10 | 90–105cm b.s. | 0 | 0 | |
| Test Unit | N420E839 | 1 | 0–10cm b.s. | 0 | 0 | |
| | | 2 | 10–20cm b.s. | 0 | 0 | |
| Test Unit | N420E938 | 1 | 0–10cm b.s. | 0 | 4 | |
| | | 2 | 10–20cm b.s. | 0 | 8 | |

Table A.2: continued

| Excavation | Unit | Level | Level increment | # Tools | # Debitage | Comments |
|---|---|---|---|---|---|---|
| | | 3 | 20–30cm b.s. | 0 | 2 | |
| | | 4 | 30–40cm b.s. | 0 | 0 | |
| | | 5 | 40–50cm b.s. | 0 | 0 | |
| | | 6 | 50–60cm b.s. | 0 | 0 | |
| | | 7 | 60–70cm b.s. | 0 | 2 | |
| | | 8 | 70–80cm b.s. | 0 | 1 | |
| | | 9 | 80–90cm b.s. | 0 | 0 | |
| | | 10 | 90–105cm b.s. | 0 | 1 | |
| Test Unit | N428E923 | 1 | 0–10cm b.s. | 0 | 2 | |
| | | 2 | 10–20cm b.s. | 0 | 1 | |
| | | 3 | 20–30cm b.s. | 0 | 1 | |
| | | 4 | 30–40cm b.s. | 0 | 0 | |
| | | 5 | 40–50cm b.s. | 0 | 3 | |
| | | 6 | 50–60cm b.s. | 0 | 1 | |
| | | 7 | 60–70cm b.s. | 0 | 2 | |
| | | 8 | 70–80cm b.s. | 0 | 0 | |
| | | 9 | 80–90cm b.s. | 0 | 0 | |
| | | 10 | 90–105cm b.s. | 0 | 0 | |
| Test Unit | N432E903 | 1 | 0–10cm b.s. | 0 | 5 | |
| | | 2 | 10–20cm b.s. | 0 | 0 | |
| | | 3 | 20–30cm b.s. | 0 | 0 | |
| | | 4 | 30–40cm b.s. | 0 | 0 | |
| | | 5 | 40–50cm b.s. | 0 | 0 | |
| | | 6 | 50–60cm b.s. | 0 | 0 | |
| | | 7 | 60–70cm b.s. | 0 | 0 | |
| | | 8 | 70–80cm b.s. | 0 | 0 | |
| | | 9 | 80–90cm b.s. | 0 | 0 | |
| | | 10 | 90–105cm b.s. | 0 | 0 | |
| Test Unit | N436E808 | 1 | 0–10cm b.s. | 0 | 0 | |
| | | 2 | 10–20cm b.s. | 0 | 1 | |
| | | 3 | 20–30cm b.s. | 0 | 0 | |
| | | 4 | 30–40cm b.s. | 0 | 0 | |

Table A.2: continued

| Excavation | Unit | Level | Level increment | # Tools | # Debitage | Comments |
|---|---|---|---|---|---|---|
| | | 5 | 40–50cm b.s. | 0 | 0 | |
| Test Unit | N43E894 | 1 | 0–10cm b.s. | 0 | 2 | |
| | | 2 | 10–20cm b.s. | 0 | 5 | |
| | | 3 | 20–30cm b.s. | 0 | 11 | |
| | | 4 | 30–40cm b.s. | 0 | 12 | |
| | | 5 | 40–50cm b.s. | 0 | 0 | |
| | | 6 | 50–60cm b.s. | 0 | 0 | |
| | | 7 | 60–70cm b.s. | 0 | 0 | |
| | | 8 | 70–80cm b.s. | 0 | 0 | |
| | | 9 | 80–90cm b.s. | 0 | 0 | |
| | | 10 | 90–105cm b.s. | 0 | 0 | |
| Test Unit | N436F909 | 1 | 0–10cm b.s. | 0 | 5 | |
| | | 2 | 10–20cm b.s. | 0 | 7 | |
| | | 3 | 20–30cm b.s. | 0 | 3 | |
| | | 4 | 30–40cm b.s. | 0 | 2 | |
| | | 5 | 40–50cm b.s. | 0 | 3 | |
| Test Unit | N448E866 | 1 | 0–10cm b.s. | 0 | 1 | Associated with Feature 10 |
| | | 2 | 10–20cm b.s. | 0 | 5 | |
| | | 3 | 20–30cm b.s. | 0 | 3 | |
| | | 4 | 30–40cm b.s. | 0 | 0 | |
| | | 5 | 40–50cm b.s. | 0 | 0 | |
| | | 6 | 50–60cm b.s. | 0 | 2 | |
| | | 7 | 60–70cm b.s. | 0 | 2 | |
| | | 8 | 70–80cm b.s. | 0 | 1 | |
| Test Unit | N448E867 | 1 | 0–10cm b.s. | 0 | 0 | Associated with Feature 10 |
| | | 2 | 10–20cm b.s. | 0 | 0 | |
| | | 3 | 20–30cm b.s. | 0 | 3 | |
| | | 4 | 30–40cm b.s. | 0 | 0 | |
| | | 5 | 40–50cm b.s. | 0 | 2 | |
| | | 6 | 50–60cm b.s. | 0 | 2 | |
| | | 7 | 60–70cm b.s. | 0 | 0 | |
| | | 8 | 70–80cm b.s. | 0 | 1 | |

Table A.2: continued

| Excavation | Unit | Level | Level increment | # Tools | # Debitage | Comments |
|---|---|---|---|---|---|---|
| Test Unit | N448E884 | 1 | 0–10cm b.s. | 0 | 0 | |
| | | 2 | 10–20cm b.s. | 0 | 2 | |
| | | 3 | 20–30cm b.s. | 0 | 1 | |
| | | 4 | 30–40cm b.s. | 0 | 0 | |
| | | 5 | 40–50cm b.s. | 0 | 3 | |
| | | 6 | 50–60cm b.s. | 0 | 0 | |
| Test Unit | N449E866 | 1 | 0–10cm b.s. | 0 | 1 | Associated with Feature 10 |
| | | 2 | 10–20cm b.s. | 0 | 2 | |
| | | 3 | 20–30cm b.s. | 0 | 1 | |
| | | 4 | 30–40cm b.s. | 0 | 1 | |
| | | 5 | 40–50cm b.s. | 0 | 1 | |
| | | 6 | 50–60cm b.s. | 0 | 2 | |
| | | 7 | 60–70cm b.s. | 0 | 7 | |
| | | 8 | 70–80cm b.s. | 0 | 2 | |
| Test Unit | N44E867 | 1 | 0–10cm b.s. | 0 | 1 | Associated with Feature 10 |
| | | 2 | 10–20cm b.s. | 0 | 2 | |
| | | 3 | 20–30cm b.s. | 0 | 2 | |
| | | 4 | 30–40cm b.s. | 0 | 0 | |
| | | 5 | 40–50cm b.s. | 0 | 1 | |
| | | 6 | 50–60cm b.s. | 0 | 2 | |
| | | 7 | 60–70cm b.s. | 0 | 1 | |
| | | 8 | 70–80cm b.s. | 0 | 0 | |
| Test Unit | N452E875 | 1 | 0–10cm b.s. | 0 | 2 | |
| | | 2 | 10–20cm b.s. | 0 | 9 | |
| | | 3 | 20–30cm b.s. | 0 | 14 | |
| | | 4 | 30–40cm b.s. | 0 | 0 | |
| | | 5 | 40–50cm b.s. | 0 | 2 | |
| | | 6 | 50–60cm b.s. | 0 | 0 | |
| | | 7 | 60–70cm b.s. | 0 | 0 | |
| | | 8 | 70–80cm b.s. | 0 | 0 | |
| | | 9 | 80–90cm b.s. | 0 | 0 | |
| | | 10 | 90–105cm b.s. | 0 | 0 | |

Table A.2: continued

| Excavation | Unit | Level | Level increment | # Tools | # Debitage | Comments |
|---|---|---|---|---|---|---|
| Test Unit | N464E835 | 1 | 0–10cm b.s. | 0 | 0 | |
| | | 2 | 10–20cm b.s. | 0 | 1 | |
| | | 3 | 20–30cm b.s. | 0 | 0 | |
| | | 4 | 30–40cm b.s. | 0 | 0 | |
| | | 5 | 40–50cm b.s. | 0 | 0 | |
| | | 6 | 50–60cm b.s. | 0 | 0 | |
| | | 7 | 60–70cm b.s. | 0 | 0 | |
| | | 8 | 70–80cm b.s. | 0 | 0 | |
| | | 9 | 80–90cm b.s. | 0 | 0 | |
| | | 10 | 90–105cm b.s. | 0 | 0 | |
| | | 11 | 100–110cm b.s. | 0 | 0 | |
| | | 12 | 110–120cm b.s. | 0 | 0 | |
| | | 13 | 120–130cm b.s. | 0 | 0 | |
| Backhoe Block A | | 1 | 0–56 to 64 cm b.s. | 0 | 0 | Excavated as a single unit and level |
| Surface | | | Surface | 0 | 6 | |
| Shovel Test | 1 | 1 | 0–60cm b.s. | 0 | 2 | 1992 |
| Shovel Test | 2 | 1 | 0–58cm b.s. | 0 | 0 | 1992 |
| Shovel Test | 3 | 1 | 0–56cm b.s. | 0 | 2 | 1992 |
| Shovel Test | 4 | 1 | 0–54cm b.s. | 0 | 0 | 1992 |
| Shovel Test | 5 | 1 | 0–51cm b.s. | 0 | 2 | 1992 |
| Shovel Test | 6 | 1 | 0–50cm b.s. | 0 | 0 | 1992 |
| Shovel Test | 7 | 1 | 0–50cm b.s. | 0 | 4 | 1992 |
| Shovel Test | 8 | 1 | 0–50cm b.s. | 0 | 2 | 1992 |
| Shovel Test | 9 | 1 | 0–50cm b.s. | 0 | 0 | 1992 |
| Shovel Test | 10 | 1 | 0–47cm b.s. | 0 | 1 | 1992 |
| Shovel Test | 11 | 1 | 0–50cm b.s. | 0 | 0 | 1992 |
| Shovel Test | 12 | 1 | 0–50cm b.s. | 0 | 0 | 1992 |
| Shovel Test | 13 | 1 | 0–50cm b.s. | 0 | 0 | 1992 |
| Shovel Test | 14 | | 0–50cm b.s. | 0 | 0 | 1992 |
| Shovel Test | 15 | | 0–60cm b.s. | 0 | 0 | 1992 |
| Feature 1 | | | | 0 | 0 | Cairn, cross sectioned, T.U. N391.50-E901.30 and T.U. N391.25E901.32 |

Table A.2: continued

| Excavation | Unit | Level | Level increment | # Tools | # Debitage | Comments |
|---|---|---|---|---|---|---|
| Feature 2 | | | | 0 | 0 | Stone alignment, mitigated, Block A excavation |
| Feature 3 | | | | 0 | 0 | Stone alignment tested. T.U. N393-E926 and T.U. N393E927 |
| Feature 4 | | | | 0 | 0 | Stone alignment, tested, Block C |
| Feature 5 | | | | 0 | 0 | Cairn, not tested |
| Feature 6 | | | | 0 | 0 | Hearth, T.U. N391.25E901 top elev. 1411.43 |
| Feature 7 | | | | 0 | 0 | Stone alignment?, tested, T.U. |
| Feature 8 | | | | 0 | 0 | Hearth, Geomorph. Trench B, Top elev. 1412.54 |
| Feature 9 | | | | 0 | 0 | Hearth Geomorph. Trench D, Top elev. 1410.49 |
| Feature 10 | | | | 0 | 0 | Hearth?, T.U. N449E866 Top elev. 1410.28 |
| Feature 11 | | | | 0 | 0 | Hearth, Stripped Area II, Top elev. 1411.69 |
| Feature 12 | | | | 0 | 0 | Hearth, Stripped Area II, Top elev. 1411.95 |
| Feature 13 | | | | 0 | 0 | Hearth, Stripped Area II, Top elev. 1411.38 |
| Feature 14 | | | | 0 | 0 | Hearth, Stripped Area II, Top elev. 1411.61 |
| Feature 15 | | | | 0 | 0 | Hearth, Stripped Area II, Top elev. 1411.92, No plan or profile |
| Feature 16 | | | | 0 | 0 | Hearth, Stripped Area I, Top elev. 1410.72 |
| Feature 17 | | | | 0 | 0 | Hearth, Stripped Area I, top elev. 1410.74 |
| Feature 18 | | | | 0 | 0 | Hearth, Stripped Area I, Top elev. 1410.56 |

Table A.2: continued

| Excavation | Unit | Level | Level increment | # Tools | # Debitage | Comments |
|---|---|---|---|---|---|---|
| Feature 19 | | | | 0 | 0 | Hearth, Stripped Area I, top elev. 1411.55 |
| Feature 20 | | | | 0 | 0 | Hearth, Stripped Area I, top elev. 14.1187 |
| Feature 21 | | | | 0 | 0 | Hearth, Stripped Area I, top elev. 1411.05 |
| Feature 22 | | | | 0 | 0 | Hearth, Stripped Area I, top elev. 1410.65 |
| Feature 23 | | | | 0 | 0 | Hearth, Stripped Area I, top elev. 1409.88 |
| Feature 24 | | | | | | Hearth, Stripped Area I, top elev. 1410.16 |
| Feature 25 | | | | | | Hearth, Stripped Area I, top elev. 1411.74. No plan or profile |
| Geomorph Trench | A | | | 0 | 5 | |
| Geomorph Trench | B | | | 0 | 7 | Exposed Feature 8 |
| Geomorph Trench | C | | | 0 | 0 | |
| Geomorph Trench | D | | | 0 | 3 | Exposed Feature 9 |
| Geomorph Trench | E | | | 0 | 0 | |
| Geomorph Trench | F | | | 0 | 0 | |
| Geomorph Trench | G | | | 0 | 0 | |
| Geomorph Trench | H | | | 0 | 0 | |
| Geomorph Trench | I | | | 0 | 0 | |
| Geomorph Window | 1 | | | 0 | 0 | |
| Geomorph Window | 1 | | | 0 | 0 | |
| Geomorph Window | 2 | | | 0 | 0 | |
| Geomorph Window | 3 | | | 0 | 0 | |
| Geomorph Window | 4 | | | 0 | 0 | |
| Geomorph Window | 5 | | | 0 | 0 | |
| Geomorph Window | 6 | | | 0 | 0 | |
| Geomorph Window | 7 | | | 0 | 0 | |
| Geomorph Window | 8 | | | 0 | 0 | |

Table A.2: continued

| Excavation | Unit | Level | Level increment | # Tools | # Debitage | Comments |
|---|---|---|---|---|---|---|
| Geomorph Window | 9 | | | 0 | 0 | |
| Geomorph Window | 10 | | | 0 | 0 | |
| Telephone Trench | | | | 0 | 0 | PP 164 not shot in |
| Stripped Area | 1 | | | 0 | 91 | North of Highway 16 |
| Stripped Area | II | | | 0 | 27 | South of Highway 16 |

## A.1 Tool Descriptions from 39CU1144

*Cat. No.:* 14
*Class:* Biface Fragment
*Unit/Block:* N411E975 (B)
*Component:* B (17–27 cm b.s.)
*Length:* 1.15
*Width:* 0.95
*Thickness:* 0.44
*Material:* S2
*Description:* The fragment is a very small piece of a biface, perhaps a portion of a lateral edge. Three of the four edges are sharp, 90° fractures. The fragment exhibits bifacial thinning on both sides.

*Cat. No.:* 21
*Class:* Retouched Flake
*Unit/Block:* N411E875 (B)
*Component:* B (17–27 cm b.s.)
*Length:* 3.49
*Width:* 2.88
*Thickness:* 0.48
*Material:* Q1
*Description:* The artifact is a large bifacial thinning flake with minute, continuous, unifacial edge retouch along one lateral edge of the dorsal side. The outline of the working edge is straight, and the cross section is very acute (knife-like). Edge angle is 21°.

*Cat. No.:* 116
*Class:* Scraper
*Unit/Block:* N410E873 (B)
*Component:* B (17–27 cm b.s.)
*Length:* 3.16
*Width:* 2.45
*Thickness:* 0.40
*Material:* S13
*Description:* This artifact is a formal endscraper. It is made from a primary decortication flake from a water-worn pebble or cobble. The outline (plan) of the artifact is basically teardrop-shaped. The transverse cross section is plano-convex (a slightly flattened convex). Retouch is confined to the distal edge of the dorsal side, giving a relatively steep (59°), convex working edge. One lateral edge appears heavily damaged by use-wear. There is no evidence that the artifact was hafted.

*Cat. No.:* 130
*Class:* Retouched Flake
*Unit/Block:* N410E874 (B)
*Component:* B (7–17 cm b.s.)

*Length:* 4.55
*Width:* 2.12
*Thickness:* 0.85
*Material:* S4
*Description:* This tool appears to be fashioned of a pebble or cobble piece that has been severed by an overshot flake. There is continuous unifacial edge retouch along one edge of the piece. The retouched edge is convex and steep (scraper-like, 53 to 64°).

*Cat. No.:* 157
*Class:* Side-Notched Point
*Unit/Block:* N410E875 (B)
*Component:* A (0–7 cm b.s.)
*Length:* 1.58
*Width:* 1.16
*Thickness:* 0.29
*Material:* Q1
*Description:* The artifact is a very small, well-fashioned, arrow-sized projectile. It is complete. The point conforms to the Plains Side-Notched type. The outline is an isosceles triangle widest at the base. The base is straight and is not ground. The maximum thickness although not very pronounced is at the juncture of the blade and the haft element. The notches are very shallow broad semicircles, which are placed high on the projectile. The haft is 0.69 cm in length, or 44% of the total projectile length. The notches are 0.32 cm wide and 0.11 cm deep. The transverse cross-section is a relatively thick lenticular shape. The width/thickness ratio is 4.00. The flaking pattern is somewhat widely spaced and irregular, but the entirety of both sides possesses bifacial thinning. The base has been thinned by retouch on both sides.

*Cat. No.:* 203
*Class:* Retouched Flake
*Unit/Block:* N414E876 (B)
*Component:* B (7–17 cm b.s.)
*Length:* 5.78
*Width:* 2.39
*Thickness:* 1.02
*Material:* Q2
*Description:* The specimen is a large, broken, tertiary blade-flake with very minute, sporadic bifacial edge retouch along both lateral and the distal sides. The retouch appears to be more likely a function of utilization rather than intentional edge modification, and the artifact may be categorized more appropriately as a utilized flake. Working edges are both straight and concave, but all are relatively acute (40 to 45°). The bulb of percussion is missing. It is possible that the flake originated from a large biface or bifacial core.

*Cat. No.:* 216
*Class:* Biface Fragment

*Unit/Block:* N410E876 (B)
*Component:* B (7–17 cm b.s.)
*Length:* 2.80
*Width:* 4.70
*Thickness:* 1.50
*Material:* S10
*Description:* This is a fragment of a Stage 2 (initial edging) biface. The blank (Stage 1 biface) appears to have been a large, tertiary (little or no cortex) core reduction flake. The plan cannot be ascertained, and the length-width orientation is also uncertain. The cross section is thick and irregular. The width/thickness ratio was probably less than 3.13. The offset of the lineal edges is moderate (somewhat wavy). Very thick edges are also present. The edge angles (from the "spine plan", or centered edge angles) vary from 40 to 64°. Most of the flake scars occur along one edge of one side. A few deeply gouged scars penetrate the center of the biface. Very deep step- and hinge-fracture scars are present. The broken edge is a slight hinge-fracture. Minute step-fractures along an acute retouched edge probably indicate utilization.

*Cat. No.:* 265
*Class:* Biface
*Unit/Block:* N414E875 (B)
*Component:* B (17–27 cm b.s.)
*Length:* 5.57
*Width:* 5.44
*Thickness:* 1.97
*Material:* S2
*Description:* This artifact is a complete Stage 2 biface. The outline is a rough subtriangular shape. The transverse cross-section is a rough lenticular shape. The width/thickness ratio is 2.76. The offset of the lineal edges is wide (very wavy), and the edges are thick. The edge angles range from 50 to 80°. The flake scars are often deeply gouged and deep step-fractures are present. The flake scars are largely confined to the biface edges, but a few scars reach the center. Most of the thinning occurs on one face; flaking on the other side is minimal. There is no readily observed evidence that the biface was utilized.

*Cat. No.:* 294
*Class:* Retouched Flake
*Unit/Block:* N411E872 (B)
*Component:* B (7–17 cm b.s.)
*Length:* 3.40
*Width:* 2.20
*Thickness:* 0.90
*Material:* S1
*Description:* This tool is fashioned from a tertiary flake (core reduction flake). A small area of the distal edge of the dorsal side possesses edge retouch, creating a small, straight and relatively steep (45°) working edge.

*Cat. No.:* 331
*Class:* Corner-Notched Point
*Unit/Block:* N414R873 (B)
*Component:* B (7–17 cm b.s.)
*Length:* 1.95
*Width:* 1.88
*Thickness:* 0.44
*Material:* S2
*Class:* This is a well-fashioned, dart-sized corner-notched point of Pelican Lake type. In relationship to the point size, it has deep (0.52 cm) and relatively broad (0.25 cm) U-shaped corner notches. The base is not complete, but it appears to have been slightly constricted (not as wide as the blade), giving the shoulders distinctive barbs. The base is concave with "eared" corners. There is no indication of basal grinding. The base, 0.58 cm in length, comprises less than one-fourth of the projectile length. The blade outline has straight sides. The transverse cross-section is a very symmetrical, thin, lenticular shape. The width/thickness ratio would have exceeded 4.27. The point of maximum thickness is at the juncture of the blade and the haft element. Both sides are covered by bifacial thinning. The blade exhibits close, very uniform flake scars. The lineal edges of the blade are sharp and straight. Edge angles range from 29 to 34°. The base has been thinned by retouch on either side. There is a sharp, 90° fracture truncating the blade tip. One of the shoulder barbs and the corners of the base are also broken.

*Cat. No.:* 488
*Component:* Biface Fragment
*Unit/Block:* N411E874 (B)
*Component:* B (17–27 cm b.s.)
*Length:* 3.69
*Width:* 4.10
*Thickness:* 0.76
*Material:* Q2
*Description:* The fragment probably represents a Stage 4 (secondary thinning) biface. The artifact is one end (probably the base) of a biface. The width/thickness ratio is 5.39. The transverse cross section is a flattened lenticular shape. The edge angles fall between 25 to 34°. The outline appears to have been regular (uniform and symmetrical), and the offset of the lineal edges is relatively moderate (somewhat wavy). The flake scars are widely spaced. Flake scars are shallow with minimal gouging, but several prominent step-fracture scars are present. Opposing flake scars contact to at least the center of the biface. A sharp, slightly hinged fracture runs parallel to the biface width (end shock fracture?). One lateral edge possesses minute step-fracture scars and has been either ground or dulled by use-wear.

*Cat. No.:* 490
*Class:* Biface Fragment

*Unit/Block:* N411E875
*Component:* B (17–27 cm b.s.)
*Length:* 1.80
*Width:* 2.29
*Thickness:* 0.43
*Material:* S2
*Description:* This artifact fragment is either a midsection of a point blade or a midsection of a preform (Stage 5 biface). The artifact has a thin, lenticular cross section. The edge angles are 24°. The offset of the lineal edges is minimal with essentially straight and very sharp edges. The lateral flake scars extend well beyond the center of the piece. One side of the artifact displays a large end-thinning or impact fracture scar. Both broken ends are relatively straight 90° fractures.

*Cat. No.:* 533
*Class:* Retouched Flake
*Unit/Block:* N413E876 (B)
*Component:* B (17–27 cm b.s.)
*Length:* 4.58
*Width:* 3.07
*Thickness:* 1.47
*Material:* S1
*Description:* The item is a secondary decortication flake (core reduction flake) with continuous bifacial edge retouch along one lateral edge and the distal edge. The retouched edges are convex but vary from steep (67°) to acute (38°).

*Cat. No.:* 536
*Class:* Biface
*Unit/Block:* N411E876 (B)
*Component:* B (7–17 cm b.s.)
*Length:* 5.96
*Width:* 4.70
*Thickness:* 1.84
*Material:* S1
*Description:* This is a complete Stage 2 biface. The outline is roughly oval. The transverse cross-section is thick and very irregular. The width/thickness ratio is 2.55. Lineal edges are widely offset (very wavy). The edges are thick, with angles between 54 and 69°. Flake scars are deeply gouged and deep step- and hinge-fractures are common. The flake scars are widely spaced and largely confined to the biface edges. There is no readily observed use-wear on the artifact.

*Cat. No.:* 616
*Class:* Biface
*Unit/Block:* N412E873 (B)
*Component:* B (17–27 cm b.s.)
*Length:* 6.81

*Width:* 4.16
*Thickness:* 1.35
*Material:* S2
*Description:* This is a complete Stage 2 biface with a roughly ovate outline. The transverse cross-section is thick and plano-convex. The width/thickness ratio is 3.08. The edges are relatively thick, with edge angles of 40–60°. The offset of the lineal edges is wide. Flake scars are widely spaced and often gouged. Deep step-fracture scars are present. One face has almost no flake scarring; the other side has minimal flake scar contact at the biface center. The biface does not appear to have been utilized.

*Cat. No.:* 670
*Class:* Biface Fragment
*Unit/Block:* N412E8785 (B)
*Component:* B (7–17 cm b.s.)
*Length:* 3.76
*Width:* 2.15
*Thickness:* 0.48
*Material:* Q1
*Class:* This specimen is a Stage 5 biface (projectile point preform). It appears to have had a uniform lanceolate shape. The tip is missing. The transverse cross-section is a thin lenticular shape. The edge angles are 24°. The width/thickness ratio is 4.48. The offset of the lineal edges is very close, essentially straight. Flake scars are closely spaced and morphologically similar. Deeply gouged flake scars and step-fractures are absent. Opposing flake scars undercut the biface center and, often, almost the entire width. The straight base has been thinned by bifacial retouch. Ground edges are not present. The broken edge is a sharp 90° fracture that runs obliquely to the biface width. The artifact shows no obvious signs of being utilized.

*Cat. No.:* 672
*Class:* Point Tip
*Unit/Block:* N412E875 (B)
*Component:* B (7–17 cm b.s.)
*Length:* 0.91
*Width:* 0.94
*Thickness:* 0.30
*Material:* Q1
*Description:* The item is the very tip of a projectile point. This small fragment exhibits overall bifacial retouch.

*Cat. No.:* 675
*Class:* Biface Fragment
*Unit/Block:* N413E875 (B)
*Component:* B (17–27 cm b.s.)
*Length:* 2.78
*Width:* 0.85

*Thickness:* 0.35
*Material:* S13
*Description:* The fragment is a long sliver of a biface edge. It possesses a hinge fracture running parallel with to the edge (overshot fracture?). The flake scars are very close and morphologically similar, perhaps indicative of a fragment originating from a projectile or preform.

*Cat. No.:* 725
*Class:* Graver
*Unit/Block:* N413E874 (B)
*Component:* B (7–17 cm b.s.)
*Length:* 2.88
*Width:* 2.05
*Thickness:* 0.53
*Material:* Q1
*Description:* The tool appears to be a bifacial thinning flake with a point or spur produced on a lateral edge of the dorsal side. The point projects 0.44 cm from the edge.

*Cat. No.:* 769
*Class:* Biface Fragment
*Unit/Block:* N413E873 (B)
*Component:* A (0–7 cm b.s.)
*Length:* 4.74 (9.26)
*Width:* 4.16 (6.65)
*Thickness:* 1.47 (1.67)
*Material:* Q1
*Description:* This fragment fits with Catalog #771 and 773. The fragments combine to form most of what is a very large Stage 3 biface. The outline appears to have been a uniform ovate shape. The transverse cross-section is a relatively thin, lenticular shape. The edge angles are 36–45°. The width/thickness ratio is 3.98. The lineal edges are moderately widely offset (wavy). Flake scars exhibit some gouging (deep scars) and relatively deep step-fractures are present. Opposing flake scars are widely spaced and contact at some portions of the center of both faces, but undercutting of the center is absent. The artifact is shattered into five pieces. Some of this fracturing occurred during excavation (hit by a shovel), but the biface tip and base were broken previously. The base is missing. It has been truncated by a hinge-fracture. The biface exhibits polish over some of the flake scar ridges, covering an area of about 3 by 6 cm down the center of one face. This suggests use as a digging implement. Some of this polishing has been removed by succeeding flake scars, perhaps indicating tool rejuvenation. The combined fragments produce a length of 9.26 cm, a width of 6.65 cm, and a thickness of 1.67 cm.

*Cat. No.:* 771
*Class:* Biface Fragment
*Unit/Block:* N413E873 (B)

*Component:* A (0–7 cm b.s.)
*Length:* 4.39
*Width:* 3.62
*Thickness:* 1.46
*Material:* Q1
*Description:* The fragment fits with Catalog #769 and 773. See Catalog #769 for a description.

*Cat. No.:* 773
*Class:* Biface Fragment
*Unit/Block:* N413E873 (B)
*Component:* A (0–7 cm b.s.)
*Length:* 4.05
*Width:* 2.83
*Thickness:* 1.47
*Material:* Q1
*Description:* The fragment fits with Catalog #769 and 771. See Catalog #769 for a description.

*Cat. No.:* 775
*Class:* Biface Fragment
*Unit/Block:* N413E873 (B)
*Component:* A (0–7 cm b.s.)
*Length:* 6.21 (6.22)
*Width:* 4.01 (6.74)
*Thickness:* 1.35 (1.47)
*Material:* Q1
*Description:* This fits with Catalog #781 and 783. The joined fragments form part of a midsection of what appears to have been a very large Stage 3 or Stage 4 biface. The outline of the artifact appears to have been uniform. The existing transverse cross-section is a thin, lenticular shape. Edge angles range from 31 to 40°. The width/thickness ratio cannot be ascertained. The offset of the lineal edges is moderately close (somewhat wavy). Flake scarring, for the most part, is relatively shallow and not deeply gouged; however, some shallow step- and hinge-fractures are present. The lateral thinning scars contact and undercut much of the biface center. The biface exhibits multiple fractures running parallel to the width. At least three fractures are apparent. For the most part, the fractures are steep, 90° snaps with slight hinging. These may be end shock fractures. The lateral edges of the biface are sharp and lack any conspicuous evidence of wear. With the fragments joined, the length is 6.22 cm, the width is 6.74 cm, and the thickness is 1.47 cm.

*Cat. No.:* 777
*Class:* Biface Fragment
*Unit/Block:* N413E873 (B)
*Component:* A (0–7 cm b.s.)
*Length:* 1.78 (4.30)

*Width:* 4.29 (4.29)
*Thickness:* 0.93 (0.93)
*Material:* Q2
*Description:* This is a Stage 3 (primary thinning) or Stage 4 biface. The fragment fits with Catalog #779. Fragments 777 and 779 fit to make the tip of a biface; they are described here as one item. The artifact is too incomplete for a width/ thickness ratio. The transverse cross-section is lenticular. Edge angles are 35–40°. The offset of the lineal edge is close (not extremely wavy). The outline appears to have been very regular. For the most part, the flake scars are close and morphologically similar with minimal gouging; however, there are several deep step-fracture scars. The artifact has two hinge fractures (end shock fractures?) parallel to the biface width. Combined, the fragments have a length of 4.30 cm, a width of 4.29 cm, and a thickness of 0.93 cm. Minute step-fractures are noticeable along the edges of the artifact, probably indicating utilization.

*Cat. No.:* 779
*Class:* Biface Fragment
*Unit/Block:* N413E873 (B)
*Component:* B (7–17 cm b.s.)
*Length:* 2.94
*Width:* 2.76
*Thickness:* 0.80
*Material:* Q2
*Description:* The fragment fits with Catalog #777. See #777 for a description.

*Cat. No.:* 781
*Class:* Biface Fragment
*Unit/Block:* N413E873 (B)
*Component:* B (7–17 cm b.s.)
*Length:* 1.86
*Width:* 1.02
*Thickness:* 0.95
*Material:* Q1
*Description:* This fragment fits with Catalog # 775 and 783. See #775 for a description.

*Cat. No.:* 783
*Class:* Biface Fragment
*Unit/Block:* N413E873 (B)
*Component:* B (7–17 cm b.s.)
*Length:* 6.71
*Width:* 1.98
*Thickness:* 1.38
*Material:* Q1
*Description:* This fragment fits with Catalog #775 and 781. See #775 for a description.

*Cat. No.:* 885
*Class:* Retouched Flake
*Unit/Block:* N393.75 E911.36 (TU)
*Component:* B (10–20 cm b.s.)
*Length:* 2.62
*Width:* 2.01
*Thickness:* 0.71
*Material:* S4
*Description:* This appears to be a broken secondary decortication flake (core reduction flake) with continuous unifacial edge retouch along one lateral edge of the ventral side. The retouched edge is convex and acute (25°).

*Cat. No.:* 915
*Class:* Retouched Flake
*Unit/Block:* N393E919 (TU)
*Component:* B (20–30 cm b.s.)
*Length:* 1.90
*Width:* 1.61
*Thickness:* 0.33
*Material:* S11
*Description:* The artifact is a broken (tertiary?) flake with continuous bifacial retouch along one edge (flake edge cannot be determined). The working edge is irregular and acute (28°).

*Cat. No.:* 970
*Class:* Point Tip
*Unit/Block:* N391.25 E901.32 (TU)
*Component:* B (20–30 cm b.s.)
*Length:* 2.16
*Width:* 1.75
*Thickness:* 0.41
*Material:* S1
*Description:* The specimen is the tip portion of a preform or relatively large (dart-sized) projectile point. The piece exhibits bifacial thinning dressing the entirety of both sides. The broken edge is a sharp 90° fracture that runs parallel to the artifact width.

*Cat. No.:* 981
*Class:* Retouched Flake
*Unit/Block:* N391.25 E901.32 (TU)
*Component:* C (30–40 cm b.s.)
*Length:* 3.58
*Width:* 1.30
*Thickness:* 0.69
*Material:* S1
*Description:* This tool is a flake piece (the distal end of a tertiary core reduction flake?) with unifacial retouch and/or heavy use wear along one edge of a

fracture. The fracture is a sharp, slightly hinged break. The working edge is straight and very steep (82°). The wear would indicate a heavy planing action.

*Cat. No.:* 1003
*Class:* Knife Fragment
*Unit/Block:* N393E926 (TU)
*Component:* B (10–15 cm b.s.)
*Length:* 1.80
*Width:* 1.73
*Thickness:* 0.45
*Material:* S3
*Description:* This artifact is a small fragment of a "Badlands Knife" (plate chalcedony knife). The fragment exhibits regular, continuous bifacial retouch that is confined to about 0.5 cm of the edge margin. The faces of the artifact appear to be cortex and unmodified. The working edge is very acute (21). The plate was quite thin, less than 0.5 cm in thickness.

*Cat. No.:* 1049
*Class:* Graver
*Unit/Block:* N452E875 (TU)
*Component:* B (20–30 cm b.s.)
*Length:* 1.26
*Width:* 1.00
*Thickness:* 0.33
*Material:* S13
*Description:* The tool is a small flake or shatter fragment with one edge unifacially retouched into a sharp point or spur. The spur protrudes from the flake edge about 0.4 cm.

*Cat. No.:* 1065
*Class:* Scraper
*Unit/Block:* N452E875 (TU)
*Component:* B (20–30 cm b.s.)
*Length:* 3.12
*Width:* 1.92
*Thickness:* 0.79
*Material:* S13
*Description:* This artifact fits the definition of the classic keeled endscraper. It is fashioned of a tertiary flake (core reduction flake) with a pronounced central ridge running the length of the dorsal side. The flake thickens toward the distal end. The outline is essentially oval. The transverse cross-section is plano-convex. There is no unifacial thinning of the flake; all retouch is confined to the distal edge of the dorsal side. The retouch forms a very steep (73°) convex working edge. There is no indication that the scraper was hafted.

*Cat. No.:* 1087
*Class:* Retouched Flake

*Unit/Block:* N464E835 (TU)
*Component:* C (90–100 cm b.s.)
*Length:* 3.70
*Width:* 2.48
*Thickness:* 0.69
*Material:* S13
*Description:* This artifact appears to be a fragment of a tabular, water-worn chert pebble that exhibits sporadic bifacial retouch. The flake scars are generally confined to the edges, but some continue well into the center of the piece. A sharp hinge-fracture is present along an entire edge of the artifact. The working edges are essentially straight and steep (59–65°). These edges appear heavily damaged with pronounced step fractures and crushing.

*Cat. No.:* 1161
*Class:* Retouched Flake
*Unit/Block:* N449E867 (TU)
*Component:* C (50–60 cm b.s.)
*Length:* 1.95
*Width:* 3.14
*Thickness:* 0.79
*Material:* S1
*Description:* This is a tertiary flake (core reduction flake) with continuous unifacial edge retouch along one lateral edge of the dorsal side. The retouched edge is slightly concave and very steep (74°). The artifact also exhibits minute scarring along several other edges suggesting additional utilization.

*Cat. No.:* 1371
*Class:* Retouched Flake
*Unit/Block:* N436E909 (TU)
*Length:* C (30–40 cm b.s.)
*Length:* 2.84
*Width:* 2.34
*Thickness:* 0.45
*Material:* S1
*Description:* The item appears to be a bifacial thinning flake with minute, unifacial edge retouch along a small portion of the distal edge of the dorsal face. The working edge is straight and acute (24°).

*Cat. No.:* 1451
*Class:* Retouched Flake
*Unit/Block:* N412E957 (TU)
*Component:* C (70–80 cm b.s.)
*Length:* 6.09
*Width:* 3.01
*Thickness:* 1.12
*Material:* S1
*Description:* This tool is a large, irregular-shaped, tertiary blade-flake (probably

a core reduction flake) with minute, continuous to sporadic, bifacial edge retouch along the lateral edges. The working edges are convex to straight and largely acute (24–49°). Tool may be better described as a utilized flake.

*Cat. No.:* 1479
*Class:* Point Base
*Unit/Block:* N420E839 (TU)
*Component:* A (0–10 cm b.s.)
*Length:* 0.89
*Width:* 2.15
*Thickness:* 0.43
*Material:* S13
*Description:* The specimen is a basal fragment of a relatively large (dart-sized) notched point. The artifact is not complete enough to determine the notch type. The base is straight and it does not exhibit grinding. The fragment has overall bifacial retouch. The base is 2.15 cm in width.

*Cat. No.:* 1515
*Class:* Biface Fragment
*Unit/Block:* N420E938 (TU)
*Component:* C (30–40 cm b.s.)
*Length:* 3.54
*Width:* 3.48
*Thickness:* 0.65
*Material:* Q3
*Description:* This is a Stage 3 or 4 biface. The artifact is the tip of what appears to have been a very thin biface, but the width/thickness ratio cannot be ascertained. The transverse cross-section of the fragment is a flattened, lenticular-shape. The edges are thin (32–35°). The outline appears to have been very regular. The offset of the lineal edge is relatively close (not extremely wavy). Flake scarring is close with only moderate to minimal gouging, but some shallow step-fracture scars are present. The fragment exhibits a sharp, slightly hinged fracture that runs parallel to the biface width. This may be an end shock fracture and hence indicate failure and then discard of the biface during manufacture. The edges exhibit minute step-fracture scars, indicating use-wear.

*Cat. No.:* 1537
*Class:* Corner-Notched Point
*Unit/Block:* N412E874 (TU)
*Component:* A (0–10 cm b.s.)
*Length:* 3.24
*Width:* 2.26
*Thickness:* 0.45
*Material:* Q2
*Description:* This artifact is a large, well-fashioned, dart-sized corner-notched projectile. The point conforms to the generalized Pelican Lake type. Relative to the point size, the notches are narrow (0.25 cm) and shallow (0.35 cm). The

notches are U-shaped. The base is a deep concave with rounded "ears" at the corners. Basal grinding is absent. The haft element is low on the projectile; the base element, with a length of 0.73 cm, is less than one-fourth of the total projectile length. The shoulders are barbed. The blade outline is ovate. The transverse cross-section is a thin lenticular shape. The edge angles fall between 24 and 31°. The width/thickness ratio is 5.02. The point of maximum thickness is just above the juncture of the haft and the blade. Maximum width is at the shoulders; the base appears to have been only slightly narrower. Both sides of the artifact are entirely dressed by bifacial thinning. The lateral edges of the blade exhibit close, uniform retouch that creates a sharp, straight lineal edge. The base has been thinned by retouch on both sides. The tip of the blade is truncated by a slightly hinged fracture, and one of the corner ears of the base has been broken off.

*Cat. No.:* 1539
*Class:* Biface Fragment
*Unit/Block:* N412E874 (TU)
*Component:* B (10–20 cm b.s.)
*Length:* 5.86
*Width:* 4.01
*Thickness:* 1.43
*Material:* S13
*Description:* This specimen is a fragment of a Stage 2 biface. The biface blank (Stage 1) appears to have been a core reduction flake (secondary decortication?). The piece was in the very initial process of edging before failure and discard; most of both faces are void of flake scars. The edges are generally thick, with the edge angles ranging from 45 to 80°. A sharp 90° fracture truncated a sizable portion of the flake. The fragment does not appear to have been utilized.

*Cat. No.:* 1543
*Class:* Biface Fragment
*Unit/Block:* N412E874 (TU)
*Component:* B (20–30 cm b.s.)
*Length:* 4.26
*Width:* 4.08
*Thickness:* 0.88
*Material:* Q1
*Description:* This is probably a Stage 3 biface. The artifact is the end (tip?) fragment of a biface. The width/thickness ratio is 4.63. The transverse cross section is a thin, slightly irregular lenticular shape. The outline appears to have been semi-regular. The offsets of the lineal edges are moderate (somewhat wavy). Some of the biface edges are relatively thick. Edge angles are 47–61°. The flake scars are relatively widely spaced and minimally gouged. A few shallow step-fractures are present. The lateral flake scars contact at, or slightly undercut, the center. The broken edge (end shock fracture?) runs across the biface width and is sharp and slightly hinged. The edges of the artifact appear

ground or dulled by use-wear.

*Cat. No.:* 1575
*Class:* Point Blade
*Unit/Block:* N393E909 (A)
*Component:* A (0–7 cm b.s.)
*Length:* 1.13
*Width:* 0.81
*Thickness:* 0.26
*Material:* S10
*Description:* The artifact is a blade fragment of a notched projectile point. The points of fracture occur at the notching and the blade tip, leaving only the lower portion of the blade element. Notching is discernable, but the type cannot be determined. The fragment appears to come from a small, probably arrow-sized, projectile. The maximum width of the blade is 1.13 cm. The maximum thickness of the blade is 0.26 cm. The fragment exhibits overall bifacial thinning.

*Cat. No.:* 1579
*Class:* Stemmed Point
*Unit/Block:* N393E912 (A)
*Component:* A (0–7 cm b.s.)
*Length:* 2.08
*Width:* 1.35
*Thickness:* 0.51
*Material:* S13
*Description:* The projectile is a small, arrow-sized stemmed point. Notches run oblique to the point median such that the point could be construed as corner-notched. The point is complete. This point may be an aberrant type, but the outline is rather irregular and the flaking is sporadic, perhaps indicating the artifact was either unfinished or being reworked because of damage. The stem has straight sides and a straight base; the blade is roughly triangular. Edge grinding is not apparent. The haft is low on the projectile. The haft element is 0.50 cm in length, or about 25% of the overall point length. The thickest portion is at the midsection of the blade. The projectile has a thick, asymmetrical cross-section. The width/thickness ratio is 2.65. The point exhibits overall bifacial thinning.

*Cat. No.:* 1614
*Class:* Retouched Flake
*Unit/Block:* N387E938 (C)
*Component:* A (0–7 cm b.s.)
*Length:* 2.43
*Width:* 1.70
*Thickness:* 0.90
*Material:* S13
*Description:* This appears to be a broken tertiary flake (core reduction flake) with continuous unifacial edge retouch along one lateral edge of the ventral side.

The retouched edge is straight and acute (26°).

*Cat. No.:* 1637
*Class:* Point Tip
*Unit/Block:* GS I (#219)
*Component:* A or B
*Length:* 0.89
*Width:* 0.75
*Thickness:* 0.27
*Material:* S13
*Description:* This tool fragment is the very tip of a projectile point. The fragment exhibits overall bifacial retouch or thinning.

*Cat. No.:* 1652
*Class:* Retouched Flake
*Unit/Block:* GS I (#199)
*Component:* A or B
*Length:* 3.85
*Width:* 3.25
*Thickness:* 1.70
*Material:* S13
*Description:* The specimen is a large, thick, broken secondary decortication flake (core reduction flake) with continuous unifacial edge retouch along the distal edge of the dorsal side. The retouched edge is convex and steep (68°). The artifact is similar to the classic keeled endscraper. It has a dorsal ridge running the length of the flake and the distal edge of the dorsal side possesses steep retouch. Its form, however, is irregular, and the edge retouch appears less deliberate.

*Cat. No.:* 1653
*Class:* Retouched Flake
*Unit/Block:* GS I (#219)
*Component:* A or B
*Length:* 3.08
*Width:* 1.74
*Thickness:* 0.87
*Material:* S6
*Description:* The artifact is a secondary decortication flake (core reduction flake) with continuous bifacial edge retouch along a single (proximal?) edge. The retouched edge is slightly convex and acute (37°).

*Cat. No.:* 1655
*Class:* Core
*Unit/Block:* GS I (#219)
*Component:* A or B
*Length:* 5.43
*Width:* 3.43

*Thickness:* 1.87
*Material:* S4
*Description:* This is a split cobble of milky chalcedony. Flakes have not been removed from this piece. The material appears to have been tabular in form and the surfaces are water worn.

*Cat. No.:* 1657
*Class:* Core
*Unit/Block:* GS I (#215)
*Component:* A or B
*Length:* 12.97
*Width:* 9.59
*Thickness:* 5.88
*Material:* Q3
*Description:* This is a large, cobble-sized bifacial core. It has a thick, rough disc shape. The striking platform is formed by the edges of two opposite faces. Flakes have been removed around the circumference of both faces. The flake scars terminate at the center of the core. The core does not exhibit water-worn surfaces. About 5 cm of an edge possesses pronounced step-fracture scarring, suggesting that the core may have been utilized as a chopping implement.

*Cat. No.:* 1662
*Class:* Core
*Unit/Block:* Surface (#1)
*Component:* A
*Length:* 5.16
*Width:* 3.63
*Thickness:* 2.87
*Material:* S13
*Description:* This block core has a single flake driven from an unprepared platform. Alternatively, the artifact may represent one-half of a split nodule. The cortex is rough, and the shape is irregular.

*Cat. No.:* 1663
*Class:* Retouched Flake
*Unit/Block:* GS I (#215
*Component:* A or B
*Length:* 9.46
*Width:* 5.13
*Thickness:* 1.07
*Material:* Q1
*Description:* The tool is a very large bifacial thinning flake with continuous unifacial edge retouch along the lateral edges of the dorsal side. The flake is particularly long and is less than one centimeter short of being classified as a blade-flake. One entire lateral edge possesses continuous, deliberate edge retouch that creates a long, slightly convex working edge. This edge falls between steep and acute, 38–51°. Except at the juncture with the proximal end, the

other lateral edge possesses minute edge retouch (use-wear?) along a steep (50°) concave working edge. This forms a spokeshave-like working edge. The juncture with the proximal end has deliberate, steep (63°) retouch along a convex edge, similar to an endscraper. This artifact is somewhat reminiscent of the large, so called "flake knives" from Paleoindian layers at the Jim Pitts Site. These flake knives were similarly fashioned from very large, blade-like bifacial thinning flakes.

*Cat. No.:* 1664
*Class:* Core
*Unit/Block:* Surface (#2)
*Component:* A
*Length:* 9.34
*Width:* 6.93
*Thickness:* 5.20
*Material:* S4
*Description:* This tested core is an irregular, cobble-sized chunk with a single flake struck from an unprepared platform. The chunk does not appear to have been water worn.

*Cat. No.:* 1667
*Class:* Core
*Unit/Block:* GS I (#)
*Component:* Unknown
*Length:* 6.49
*Width:* 4.55
*Thickness:* 4.18
*Material:* S10
*Description:* The multifaceted core has a general globular shape. It has multiple (more than two) striking platforms and faces. The cortex is rough. One relatively sharp edge exhibits a series of deep step-fracture scars and battering, perhaps indicating use of the core as a chopper.

*Cat. No.:* 1670
*Class:* Biface Fragment
*Unit/Block:* Surface (#5)
*Component:* A
*Length:* 5.43
*Width:* 3.51
*Thickness:* 2.15
*Material:* S13
*Description:* This item is a fragment of a Stage 2 biface. It appears to have been split longitudinally by a massive overshot flake. The fracture is a very pronounced hinge-fracture. The transverse cross-section appears to have been a thick, rough lenticular shape. The width/thickness ratio cannot be ascertained. The offset of the lineal edges is wide. Very thick edges are present; the angles are from 64 to 67°. Most of the flake scars are limited to the edges. Deep step- and

hinge-fractures are present. It appears that there was an attempt to rejuvenate the biface; several flakes were removed after breakage. Two edges appear to be heavily damaged by use-wear, perhaps indicating its use as a heavy cutting or chopping tool.

*Cat. No.:* 1673
*Class:* Scraper
*Unit/Block:* GS I (#221)
*Component:* A or B
*Length:* 2.99
*Width:* 2.03
*Thickness:* 0.72
*Material:* S4
*Description:* The artifact conforms to the classic keeled endscraper. The tool was fashioned from either a primary or secondary decortication flake (core reduction flake). The outline is basically teardrop-shaped. The transverse cross-section is plano-convex. A central ridge runs the length of the dorsal side. All retouch is unifacial and limited to the edges of the dorsal side. The distal edge and one lateral edge possess continuous retouch, producing a steep (62°), convex working edge at the distal end and a slightly convex, relatively steep (49°) working edge at the lateral edge. The other lateral edge exhibits minute edge scarring, possibly use-wear, along a straight, acute (27°) working edge.

*Cat. No.:* 1675
*Class:* Core
*Unit/Block:* GS I (#214)
*Component:* A or B
*Length:* 6.33
*Width:* 3.00
*Thickness:* 2.00
*Material:* Q4
*Description:* This spheroid core possesses multiple platforms and faces. It is basically cylindrical in shape. The existing cortex appears water worn.

*Cat. No.:* 1677
*Class:* Biface Fragment
*Unit/Block:* GS I (#210)
*Component:* A or B
*Length:* 2.55
*Width:* 3.73
*Thickness:* 0.73
*Material:* S2
*Description:* This item is probably the end (tip?) of a Stage 3 biface. The transverse cross-section is a thin lenticular shape. The edge angles are 29–43°. The offset of the lineal edges is moderate (wavy). The flake scars are moderately gouged and relatively deep step-fractures are present. The broken edge is oblique to the biface width and is a sharp 90° snap. Some apparent edge

scarring may indicate that the artifact was utilized.

*Cat. No.:* 1679
*Class:* Core
*Unit/Block:* GS I (#)
*Component:* Unknown
*Length:* 3.88
*Width:* 2.78
*Thickness:* 2.36
*Material:* S2
*Description:* This is an irregular block core. It has two unprepared opposing platforms. The flakes were removed in opposite directions on two different faces. The cortex is rough.

*Cat. No.:* 1683
*Class:* Retouched Flake
*Unit/Block:* GS I (#)
*Component:* Unknown
*Length:* 2.70
*Width:* 1.52
*Thickness:* 0.66
*Material:* S5
*Description:* The tool is a tertiary flake (probably a core reduction flake) with sporadic unifacial edge retouch along the distal and a portion of one lateral edge of the dorsal side. Together, the retouched edges form a steep (61–77°) angular edge. This artifact resembles the classic keeled endscraper in several ways: it has a dorsal ridge running the length of the flake, the distal edge of the dorsal side possesses steep retouch, the flake outline is roughly teardrop-shaped, and the transverse cross-section is plano-convex. The working edge, however, appears angular rather than smoothly convex, and the retouched edge is less deliberate. The working edge also appears heavily damaged by use-wear in the form of deep step-fractures.

*Cat. No.:* 1685
*Class:* Core
*Unit/Block:* GS I (#220)
*Component:* A or B
*Length:* 4.63
*Width:* 3.42
*Thickness:* 1.75
*Material:* S2
*Description:* This is an irregularly spheroid, pebble-sized core with multiple (more than two) platforms and faces. The cortex is rough.

*Cat. No.:* 1687
*Class:* Retouched Flake
*Unit/Block:* GS I (#202)

*Component:* A or B
*Length:* 3.21
*Width:* 2.88
*Thickness:* 0.79
*Material:* S10
*Description:* This specimen appears to be fashioned of a primary decortication flake (core reduction flake). The flake has sporadic, bifacial edge retouch along both lateral sides. The working edges are essentially straight and largely acute (35–49°).

*Cat. No.:* 1695
*Class:* Core
*Unit/Block:* GS II (#165)
*Component:* A or B
*Length:* 9.51
*Width:* 9.10
*Thickness:* 3.2
*Material:* S2
*Description:* This tested core is a cobble-sized, tabular chunk with a single flake removed from an unprepared platform. The item does not appear water worn.

*Cat. No.:* 1697
*Class:* Biface Fragment
*Unit/Block:* GS II (#175)
*Component:* A or B
*Length:* 6.16
*Width:* 2.68
*Thickness:* 2.37
*Material:* S2
*Description:* The artifact is a fragment of what appears to have been a very thick Stage 2 biface. Flake scars are very deeply gouged ("hollow ground" scars) and its lineal edge is widely offset (very wavy). There is no overt indication of utilization on the fragment.

*Cat. No.:* 1703
*Class:* Core
*Unit/Block:* GS II (#186)
*Component:* A or B
*Length:* 6.55
*Width:* 5.59
*Thickness:* 4.29
*Material:* S1
*Description:* This block core has a single prepared platform with flakes driven off two faces in a single direction. The cortex is rough. The core has a basic block-like form.

*Cat. No.:* 1709
*Class:* Retouched Flake
*Unit/Block:* GS II (#167)
*Component:* A or B
*Length:* 4.75
*Width:* 4.19
*Thickness:* 1.60
*Material:* S4
*Description:* This artifact is a large secondary decortication flake (core reduction flake) with continuous unifacial edge retouch along one lateral edge of the dorsal side. The retouched edge is convex and steep (47–54°).

*Cat. No.:* 1713
*Class:* Biface Fragment
*Unit/Block:* GS II (#180)
*Component:* A or B
*Length:* 2.93
*Width:* 3.38
*Thickness:* 0.88
*Material:* Q1
*Description:* The fragment is the end (tip?) of a Stage 2 or Stage 3 biface. The transverse cross-section is basically plano-convex. The width/thickness ratio cannot be ascertained. The offset of the lineal edges is moderately close (slightly wavy). The blank (Stage 1) appears to have been a large flake. On one face (the ventral face?) the flaking is confined to the edges. On the other face (the dorsal face?) the flaking exhibits contact with the biface center. A single prominent step-fracture is present, but the rest of the flake scarring is quite shallow. The edges are relatively thin. The edge angles measure 32–46°. The broken edge is a slightly hinged fracture that cuts the biface width (end shock fracture?). Some minute edge scarring may indicate that the biface was utilized.

*Cat. No.:* 1715
*Class:* Core
*Unit/Block:* GS II (#170)
*Component:* A or B
*Length:* 5.74
*Width:* 4.59
*Thickness:* 3.99
*Material:* S5
*Description:* This is a rough conical block core with a single prepared platform. Flakes have been removed in a single direction over two faces. The cortex is rough.

*Cat. No.:* 1717
*Class:* Denticulate
*Unit/Block:* GS II (#168)

*Component:* A or B
*Length:* 4.05
*Width:* 2.65
*Thickness:* 1.00
*Material:* S13
*Description:* This tool is recognized as a denticulate or shredder. It is a tertiary flake (core reduction flake) with unifacial notching along the distal edge of the dorsal side. The notching gives the effect of a pronounced serrated edge. The notched edge is straight and alternates between steep to acute (33–60°).

*Cat. No.:* 1719
*Class:* Biface
*Unit/Block:* GS II (#176)
*Component:* A or B
*Length:* 5.88
*Width:* 3.57
*Thickness:* 1.36
*Material:* S1
*Description:* This is a complete Stage 2 biface. The width/thickness ratio is 2.62. The transverse cross section is thick and irregular. The edge angles are 44–57°. The offset of the lineal edges is moderate to wide. The flake scars are typically gouged (very pronounced) with numerous step- and hinge-fractures. The lateral flake scars are largely confined to the edge of the artifact and do not contact or undercut the center. The artifact has no overt appearance of being utilized.

*Cat. No.:* 1721
*Class:* Core
*Unit/Block:* GS II (#169)
*Component:* A or B
*Length:* 8.60
*Width:* 9.64
*Thickness:* 5.12
*Material:* S12
*Description:* This tested core is a nodule with one side heavily faceted by thermal and/or frost spalls. A single flake has been removed from an unprepared platform.

*Cat. No.:* 1725
*Class:* Graver
*Unit/Block:* II (#164)
*Component:* Unknown
*Length:* 1.95
*Width:* 1.66
*Thickness:* 0.37
*Material:* Q2
*Description:* This artifact appears to be a reworked fragment of either a pro-

jectile point blade or a point preform (Stage 5 biface). The fragment possesses bifacial thinning over the entirety of both sides. One lateral edge of the piece has been retouched to produce a short spur. This spur protrudes 0.33 cm from an otherwise straight edge.

*Cat. No.:* 1727
*Class:* Biface Fragment
*Unit/Block:* Surface (#4)
*Component:* A
*Length:* 5.21
*Width:* 3.83
*Thickness:* 0.87
*Material:* Q3
*Description:* The specimen is a nearly complete Stage 4 biface; the tip has been broken off. The outline is a regular subtriangular shape. The transverse cross-section is a flattened lenticular shape. The edge angles are 35–42°. The width/thickness ratio is 4.40. The offset of the lineal edges is close (only slightly wavy). Flake scarring is closely spaced. The scars are relatively regular in morphology and not gouged. A few shallow step-fractures are present on one side. Opposing flake scars contact or undercut the center of the biface. The broken edge is an irregular hinge-like fracture that is basically parallel to the biface width. This may be an end shock fracture or possibly a fracture made by an overshot flake. One edge of this fracture has been retouched, perhaps in an attempt to rejuvenate the biface. Minute flake scars are present along the artifact edges, suggesting that the biface was used.

*Cat. No.:* 1731
*Class:* Retouched Flake
*Unit/Block:* Surface (#6)
*Component:* A
*Length:* 2.54
*Width:* 2.15
*Thickness:* 0.46
*Material:* Q2
*Description:* This is a broken bifacial thinning flake with minute, continuous, unifacial edge retouch along both lateral edges, one on the dorsal side and one on the ventral side. Both working edges are broken. The remaining portions of the working edges are one straight and the other angular, forming a V-shape (graver?). Both edges are acute (34–41°).

*Cat. No.:* 1813
*Class:* Graver
*Unit/Block:* N391.50 E903.30 (TU)
*Component:* A (0–5 cm b.s.)
*Length:* 1.41
*Width:* 1.05
*Thickness:* 0.48

*Material:* Q1
*Description:* This item is either small a flake fragment or shatter (a bulb of percussion is not present). Material cortex is not present. One edge of the item has a spur or point that projects out 0.36 cm. This point appears to have been utilized, but its creation appears to be opportunistic breakage. The opposite edge has been retouched to form a diminutive, steep convex working edge.

*Cat. No.:* 1815
*Class:* Retouched Flake
*Unit/Block:* N391.50 E903.30 (TU)
*Component:* A (0–5 cm b.s.)
*Length:* 1.88
*Width:* 1.11
*Thickness:* 0.30
*Material:* Q1
*Description:* The specimen is a broken flake with continuous, unifacial edge retouch along one edge of the ventral side. The working edge is straight and acute (40°). Cortex is not present on the piece.

*Cat. No.:* 1827
*Class:* Biface Fragment
*Unit/Block:* N391.50 E903.30 (TU)
*Component:* A (5–10 cm b.s.)
*Length:* 4.85
*Width:* 4.23
*Thickness:* 1.07
*Material:* Q1
*Description:* This artifact is an end (probably the tip) fragment of a Stage 3 or 4 biface. The transverse cross-section is slightly plano-convex. The width/thickness ratio cannot be ascertained. The outline appears to have been rather regular. The edges are quite thin. Edge angles are 34–38°. The flake scarring is somewhat widely spaced and morphologically variable. Shallow step-fracture scars are present. The broken edge is a sharp 90° fracture that is parallel to the biface width (end shock fracture?). Minute flake scarring along the edges probably indicates the artifact was used.

*Cat. No.:* 1868
*Class:* Core
*Unit/Block:* N391.50 E903.30
*Component:* C (40–50 cm b.s.)
*Length:* 5.54
*Width:* 3.90
*Thickness:* 2.00
*Material:* S1
*Description:* A single flake has been driven from a prepared platform of this block core. The cortex is rough.

## A.2 Faunal Data from 39CU1144

Table A.3: Faunal data from the Blaine Site, 39CU1144. Count of burned elements is in parentheses.

| Cat. # | Unit | Level | I.D. | Element | No. | Wt. |
|---|---|---|---|---|---|---|
| 83 | N410 E872 | 2 | Mammalia | Fragments | 9 | 4.6 |
| 103 | N410 E873 | 1 | Mammalia | Fragments | 4 (1B) | 1.1 |
| 107 | N410 E873 | 2 | Mammalia | Fragments | 2 | 1.4 |
| 114 | N410 E873 | 3 | Mammalia | Fragment | 1 | 0.5 |
| 124 | N410 E874 | 1 | Mammalia | Fragment | 1 | 0.9 |
| 155 | N410 E875 | 1 | Mammalia | Fragment | 1 | 3.6 |
| 173 | N414 E876 | 2 | Mammalia | Fragments | 15 | 8.5 |
| 195 | N410 E275 | 3 | Mammalia | Fragment | 1 | 0.2 |
| 255 | N414 E875 | 2 | Mammalia | Limb frags. | 3 | 5.3 |
| 362 | N411 E873 | 3 | Eutamius | Various | 11 | 0.7 |
| 370 | N411 E874 | 1 | Mammalia | Fragments | 3 | 4.8 |
| 389 | N414 E872 | 2 | Artiodactyla | Enamel | 1 | 0.1 |
| 398 | N411 E874 | 2 | Mammalia | Fragments | 17 | 2.3 |
| 437 | N413 E876 | 2 | Mammalia | Fragments | 4 (1B) | 1.3 |
| 442 | N411 E874 | 3 | Mammalia | Fragments | 3 | 0.7 |
| 511 | N412 E872 | 2 | Mammalia | Fragments | 11 | 7.1 |
| 513 | N412 E872 | 2 | Mammalia | Fragment | 1 | 0.1 |
| 537 | N413 E876 | 3 | Mammalia | Fragment | 1 | 0.1 |
| 562 | N412 E873 | 1 | Marmota | Manus | 10 | 1.4 |
| 583 | N413 E875 | 1 | Mammalia | Fragment | 1 | 0.2 |
| 601 | N413 E875 | 2 | Mammalia | Fragments | 8 | 1.5 |
| 618 | N412 E873 | 3 | Mammalia | Fragment | 1 | 0.1 |
| 806 | N413 E872 | 2 | Mammalia | Fragments | 7 (3B) | 2.4 |
| 849 | ST 6 | 0–24" | Mammalia | Fragments | 5 | 0.3 |
| 850 | N388 E922 | 1 | Artiodactyla | Enamel | 2 | 0.5 |
| 858 | N388 E922 | 2 | Artiodactyla | Enamel | 3 | 0.6 |
| 865 | ST 13 | 1 | Artiodactyla | Enamel | 1 | 0.6 |
| 892 | N388 E943 | 2 | Mammalia | Fragments | 2 | 1.2 |
| 901 | N393 E919 | 3 | Mammalia | Fragments | 41 | 0.4 |
| 910 | N388 E943 | 3 | Artiodactyla | Enamel | 1 | 0.2 |
| 921 | N393 E927 | 1 | Mammalia | Fragments | 23 | 0.5 |
| 934 | N391 E901 | 1 | Artiodactyla | Enamel | 2 | 0.7 |
| 937 | N393 E892 | 2 | Artiodactyla | Enamel | 5 | 1.2 |
| 952 | N391.25 E901.32 | 2 | Artiodactyla | Enamel | 1 | 0.2 |
| 995 | N393 E926 | 1 | Artiodactyla | Enamel | 1 | 0.2 |
| 1004 | N392 E914 | 1 | Artiodactyla | Enamel | 1 | 0.1 |
| 1011 | N452 E875 | 1 | Mammalia | Limb frag. | 1 | 2.4 |
| 1044 | N393 E914 | 1 | Mammalia | Tooth frag. | 1 | 0.2 |
| 1064 | N393 E915 | 2 | Artiodactyla | Enamel | 9 | 2.5 |
| 1073 | N464 E835 | 2 | Mammalia | Fragments | 3 | 0.3 |
| 1075 | N464 E835 | 5 | Mammalia | Fragments | 2 | 1.1 |
| 1079 | N464 E835 | 9 | Microtus | rt. tibia | 1 | 0.1 |
| 1083 | N464 E835 | 10 | Mammalia | Fragments | 6 | 2.7 |
| 1085 | N464 E835 | 10 | Mammalia | Rib frag. | 1 | 10.2 |
| 1089 | N464 E835 | 11 | Mammalia | Fragment | 1 | 5.5 |
| 1091 | N464 E835 | 11 | Mammalia | Fragment | 1 | 3.7 |
| 1093 | N464 E835 | 11 | Bison | Malleolus | 1 | 12.0 |
| 1094 | N396 E903 | 1 | Mammalia | Fragments | 15 (14B) | 1.3 |
| 1095 | N464 E835 | 12 | Mammalia | Fragment | 1 | 0.5 |
| 1096 | N396 E903 | 1 | Mammalia | Fragments | 5 | 2.3 |

Table A.3: continued

| Cat. # | Unit | Level | I.D. | Element | No. | Wt. |
|---|---|---|---|---|---|---|
| 1097 | N464 E835 | 13 | Artiodactyla | Tooth frag. | 1 | 7.4 |
| 1105 | N449 E866 | 2 | Mammalia | Fragments | 7 | 3.6 |
| 1119 | N449 E866 | 7 | Mammalia | Fragments | 5 (1B) | 0.7 |
| 1122 | N396 E903 | 2 | Eutamius | Various | 47 | 1.9 |
| 1124 | N396 E903 | 1 | Mammalia | Fragments | 10 | 2.1 |
| 1143 | N449 E867 | 2 | Artiodactyla | Enamel | 1 | 0.1 |
| 1155 | N449 E867 | 5 | Mammalia | Fragment | 1 | 0.5 |
| 1165 | N449 E867 | 7 | Mammalia | Fragments | 6 | 0.8 |
| 1171 | N449 E867 | 8 | Mammalia | Fragment | 1 | 0.5 |
| 1191 | N448 E866 | 3 | Artiodactyla | Enamel | 1 | 0.1 |
| 1207 | N448 E866 | 7 | Mammalia | Fragments | 50 | 26.0 |
| 1209 | N448 E866 | 7 | Mammalia | Fragments | 23 | 5.5 |
| 1211 | N448 E866 | 7 | Mammalia | Fragments | 20 | 2.2 |
| 1213 | N448 E866 | 7 | Mammalia | Fragments | 23 | 23.1 |
| 1217 | N448 E866 | 7 | Mammalia | Fragments | 2 | 0.8 |
| 1225 | N448 E866 | 3 | Mammalia | Fragment | 1 | 0.2 |
| 1245 | N448 E867 | 6 | Mammalia | Fragment | 1 | 0.2 |
| 1246 | N397 E899 | 3 | Artiodactyla | Enamel | 1 | 0.3 |
| 1247 | N448 E867 | 7 | Mammalia | Fragments | 3 | 1.5 |
| 1255 | N448 E884 | 2 | Artiodactyla | Bone,enam | 7 | 3.1 |
| 1256 | N400 E914 | 1 | Mammalia | Fragment | 1 | 0.3 |
| 1257 | N448 E884 | 2 | Bison | Coronoid | 1 | 15.9 |
| 1306 | N404 E895 | 11 | Mammalia | Fragments | 3 | 8.3 |
| 1341 | N436 E909 | 1 | Mammalia | Fragments | 10 | 3.4 |
| 1373 | N436 E909 | 4 | Mammalia | Fragments | 63 | 7.9 |
| 1380 | N408 E877 | 2 | Artiodactyla | Enamel | 1 | 0.2 |
| 1385 | N428 E923 | 1 | Odocoileus | lf. radius | 5 pcs. of 1 | 13.3 |
| 1404 | N408 E884 | 1 | Mammalia | Fragments | 6 | 4.0 |
| 1409 | N432 E903 | 1 | Mammalia | Fragments | 2B | 0.1 |
| 1410 | N408 E884 | 2 | Artiodactyla | Fragments | 3 | 0.5 |
| 1491 | N420 E938 | 1 | Mammalia | Fragment | 1 | 0.6 |
| 1498 | N412 E874 | 2 | Mammalia | Fragment | 1 | 0.4 |
| 1509 | N420 E938 | 2 | Mammalia | Fragment | 1 | 0.1 |
| 1565 | N392 E910 | 1 | Mammalia | Fragment | 1 | 0.4 |
| 1567 | N392 E911 | 1 | Mammalia | Fragments | 2B | 0.3 |
| 1569 | N392 E912 | 1 | Mammalia | Fragments | 6 | 0.5 |
| 1570 | N396 E910 | 1 | Mammalia | Fragments | 3 | 0.9 |
| 1571 | N392 E912 | 1 | Mammalia | Fragment | 1 | 0.4 |
| 1582 | N395 E912 | 1 | Artiodactyla | Enamel | 1 | 0.3 |
| 1583 | N394 E910 | 1 | Artiodactyla | Fragments | 2 | 0.3 |
| 1585 | N394 E913 | 1 | Mammalia | Fragments | 2 | 0.5 |
| 1620 | Grader | | Mammalia | Rib frags. | 14 | 27.6 |
| 1622 | Grader | | Mammalia | Limb frags. | 2 | 16.9 |
| 1624 | Grader | | Mammalia | Limb frags. | 2 | 13.8 |
| 1626 | Grader | | Mammalia | Fragment | 1 | 2.1 |
| 1627 | Grader | | Mammalia | Fragment | 1B | 0.4 |
| 1628 | Grader | | Mammalia | Fragment | 1 | 1.9 |
| 1629 | Grader | | Mammalia | Vert. frags. | 13 | 19.2 |
| 1630 | Grader | | Mammalia | Fragments | 4 | 0.8 |
| 1632 | Grader | | Artiodactyla | Enamel | 5 | 0.8 |
| 1634 | Grader | | Mammalia | Fragments | 3 | 1.4 |
| 1636 | Grader | | Mammalia | Limb frags. | 6 | 16.8 |
| 1638 | Grader | | Mammalia | Fragments | 19 | 2.8 |
| 1640 | Grader | | Mammalia | Fragments | 9 | 4.4 |

Table A.3: continued

| Cat. # | Unit | Level | I.D. | Element | No. | Wt. |
|---|---|---|---|---|---|---|
| 1642 | Grader | | Mammalia | Fragment | 1 | 5.9 |
| 1644 | Grader | | Mammalia | Limb frag. | 1 | 22.1 |
| 1658 | Grader | | Mammalia | Fragments | 22 | 2.7 |
| 1659 | Grader | | Mammalia | Fragments | 17 | 2.5 |
| 1680 | Trench D, Fea. 9 | | Mammalia | Limb frags. | 5 | 7.4 |
| 1690 | Grader | | Mammalia | Fragments | 12 | 1.3 |
| 1691 | Grader | | Mammalia | Limb frag. | 1 | 11.9 |
| 1692 | Grader | | Mammalia | Scapula | 16 | 4.8 |
| 1693 | Grader | | Mammalia | Fragments | 3 | 0.3 |
| 1694 | Grader | | Mammalia | Fragments | 4 | 0.5 |
| 1696 | Grader | | Mammalia | Fragments | 6 | 1.3 |
| 1698 | Grader | | Mammalia | Fragments | 55 | 2.4 |
| 1700 | Grader | | Mammalia | Fragments | 33 | 0.6 |
| 1702 | Grader | | Mammalia | Fragments | 16 | 1.0 |
| 1704 | Grader | | Mammalia | Fragments | 46 | 10.6 |
| 1706 | Grader | | Mammalia | Fragments | 33 | 13.4 |
| 1708 | Grader | | Mammalia | Fragments | 3 | 5.4 |
| 1710 | Grader | | Bison | lf. tibia | 1 | 19.2 |
| 1712 | Grader | | Mammalia | Fragments | 63 | 28.5 |
| 1714 | Grader | | Mammalia | fragments | 78 | 18.9 |
| 1716 | Grader | | Mammalia | fragments | 41 | 45.2 |
| 1718 | Grader | | Mammalia | fragments | 112 | 29.5 |
| 1720 | Grader | | Bison | metacarpal | 1 | 33.2 |
| 1773 | Feature 8 | | Mammalia | fragments | 16 (8B) | 0.3 |
| 1775 | Feature 6 | | Mammalia | fragments | 3B | 0.2 |
| 1779 | N449 E866 | | Mammalia | fragments | 17 (13B) | 0.7 |
| 1781 | Feature 11 | | Mammalia | fragments | 6B | 0.1 |
| 1785 | Grader | | Mammalia | fragments | 3B | 0.1 |
| 1787 | Grader | | Mammalia | fragment | 1B | 0.1 |
| 1791 | Feature 16 | | Mammalia | fragments | 220 | 31.4 |
| 1795 | Feature 18 | | Mammalia | fragments | 112 (99B) | 13.4 |
| 1797 | Feature 19 | | Mammalia | fragments | 36 (33B) | 3.5 |
| 1799 | Feature 20 | 7 | Mammalia | fragments | 2 (1B) | 0.3 |
| 1801 | Feature 21 | | Mammalia | fragments | 95 (29B) | 2.9 |
| 1803 | Feature 22 | | Mammalia | fragments | 115 (27B) | 3.7 |
| 1829 | Feature 1 | 2 | Mammalia | fragments | 2 | 0.7 |
| 1831 | N391.50 E903.30 | 3 | Mammalia | fragments | 6 | 1.1 |
| 1840 | N391.50 E903.30 | 5 | Artiodactyla | enamel | 1 | 0.3 |
| 1847 | N391.50 E903.30 | 4 | Mammalia | fragments | 5 | 2.9 |
| 1880 | N391.50 E903.30 | 8 | Mammalia | fragments | 2 | 0.3 |
| 1897 | N391.50 E903.30 | 9 | Artiodactyla | enamel | 1 | 0.2 |
| 1921 | N413 E876 | 2 | Mammalia | fragment | 1B | 0.3 |
| 1924 | N393 E909 | 1 | Mammalia | fragment | 1B | 0.1 |
| Total | | | | | 1870 (250B) | 679.7 |

## A.2.1 Systematics

### Faunal List

Mammalia

Order: Rodentia

Family: Sciuridae

*Eutamius minimus*
*Marmota flaviventris*
Family: Cricetidae
*Microtus*, sp. indet.
Order: Artiodactyla
Family: Cervidae
*Odocoileus*, sp. indet.
Artiodactyla, family indet.
Family: Bovidae
*Bison bison*
Mammalia, order indeterminate

**Rodentia**

### *Sciuridae*

*Eutamius minimus* Bachman, 1839

Referred Specimens. 93-107-362: right maxillary fragment, P3/-M3/; right mandible fragment, 2 pieces, I/1, P/4, M/1; 1 left humerus; 1 right humerus; 1 sacral fragment; 1 right femur, 1 right tibia fragment; 1 cervical vertebra, 1 lumbar vertebra, 1 fragment; 93-107-1122: 1 right and left tibia; 1 right and left fibula; 3 cervical vertebrae; 5 thoracic vertebrae; 1 sacrum; 3 right pelvic fragments; 2 left pelvic fragments; 2 caudal vertebrae; 2 vertebral epiphyses; 5 vertebral fragments; 1 right femur; 1 left femur fragment; 1 patella; 1 right and left calcaneum; 1 left astragalus; 1 right cuboid; 1 right navicular; 1 right cuneiform; 4 metacarpals; 4 carpals/tarsals; 2 phalanges; 1 terminal phalanx.

Description. Specimen 93-107-362 is the incomplete skeleton of a single individual. The palatal fragment is broken anterior to the P4/, posterior to the M3/ and parallel to the maxillarial symphysis with the jugal broken near its contact with the squamosal. The mandible is broken into 2 fragments. The first fragment is broken just posterior to the M/2 alveolus. The second fragment contains the M/3 alveolus with a slight portion of the coronoid process and is broken parallel to the rootline. The left humerus is complete with some abrasion along the tuberosity and on the distal margin of the humeral head. The right humerus is broken anterioposteriorly through the shaft with 2 mm of the lateral supracondyloid ridge present. The proximal right femur is broken 5 mm below the third trochanter. The proximal right tibia is broken 5 mm below the termination of the crest. The sacral fragment has the second and third vertebrae; the neural processes, transverse processes and zygapophyses are missing. The cervical and lumbar vertebra is complete except for abrasion of the neural spine. The lumbar vertebral fragment is the dorsal surface with one prezygapophyses and one postzygapophyses present; the neural spine is broken away near the base. Specimen 93-107-1122 is the skeletal remains of at least two individuals. The sacrum is complete, except for abrasion on the wings of the first sacral vertebra. The left pelvis is missing the pubis. The right pelvis is a fragment of the ilium lacking the iliac crest and broken across the articular surface of the acetabulum. Also present are 2 right fragments and 1 left of the ischium. The left tibia is complete except for missing the medial malleolus. The right tibia is missing a portion of the medial condyle. The right femur is complete. The left distal femur fragment is broken approximately midshaft. The left fibula is complete and unworn. The right fibula consists of a 7 mm shaft fragment and a portion of the proxiaml end broken 1.5 cm from the head. The patella is complete and unworn. The thoracic vertebrae are abraded and lack processes and portions of the centrum. The cervical vertebrae are fairly complete; 1 with an abraded transverse process, 1 lacking a transverse process. The caudal vertebrae are complete and unabraded. The ankle elements, metacarpals, carpals/tarsals and phalanges are complete. The 4 mm terminal phalanx is triangular in cross-section and gently curved along its palmar surface.

Discussion. Specimen 93-107-362 was identified based upon tooth morphology. The upper cheek teeth of the similarly sized sciurid *Eutamius minimus* can be distinguished from *Spermophilus tridecemlineatus* by their smaller size, less developed cingulum, and lower cusp height. The lower cheek teeth of *Eutamius* can be distinguished from *Spermophilus* by the lower cusp height and better developed posteroanterior cusp. The postcranial elements are assumed to belong to *Eutamius* based upon their association with the cranial elements. Specimen 93-107-1122 was identified based on the characteristics of the complete tibia. Complete *Eutamius minimus* and *Spermophilus tridecemlineatus* tibiae are the same length; however the tibial shaft of *Eutamius* is laterally thinner, the distal end is one-half as large; the medial malleolus is thinner across its width but relatively longer; and in side view, the fibular semi-lunar notch is more pronounced.

*Marmota flaviventris* Audubon and Bachman, 1841

Referred Specimen. 93-107-562: 3 right metacarpals, 4 right carpals, 2 claws, 1 bone fragment.

Description. All of the manus elements are complete. The claws are 7 mm long, triangular in cross-section and are slightly curvate. The three metacarpals are 1.2 cm, 2.5 cm and 3 cm long and have a distinctive triangular-shaped, strongly lipped proximal articular surface. The four carpals range in size from 1.1-1.5 cm.

Discussion. The distinctive metacarpals of the specimen were compared to those of a number of comparatively sized animals. The metacarpal of *Lepus*, *Sylvilagus*, *Mephistis*, and *Castor* lack the distinctive triangular-shaped, lipped proximal articular surface. The *Procyon* metacarpal also lacks the triangular, lipped proximal articular surface and also has less pronounced articular ridges on the distal articular surface. The metacarpal of *Sciurus niger* is similar in appearance to that of *Marmota* but it is noticeably smaller.

em Cricetidae

*Microtus*, sp. indet.

Referred Specimen. 93-107-1079: right tibia.

Description. Specimen 93-107-1079 is a right fused tibia and fibula. The fibula is broken 6 mm from the proximal end of the fibula. The tibia is complete except for a missing 3 mm portion of the tibial crest and a worn and abraded distal end. The proximal end is unworn and has a triangular-shaped articular surface of the tibial tuberosity and a pronounced tibial crest. The distal end, though worn, has a well-developed medial malleolus.

DISCUSSION. *Microtus* and *Peromyscus* tibiae are similar is size but have several distinguishing characteristics: 1) proximally, the tibial crest of *Microtus* is more pronounced, and the tibial tuberosity gives the articular surface a triangular shape, whereas in *Peromyscus* the articular surface is oval; 2) from ventral view, the distal articular surface of the *Peromyscus* tibia has a smaller, less pronounced medial malleolus and a hook-shaped fibular semi-lunar notch; 3) anterior and posterior to the notch, the borders of the tibia are more heavily developed in *Microtus* than *Peromyscus*.

### Artiodactyla

#### *Cervidae*

*Odocoileus*, sp. indet.

REFERRED SPECIMEN. 93-107-1385: left proximal radius.

DESCRIPTION. Specimen 93-107-1385 is a left proximal radial fragment with a complete articular surface. The shaft is jaggedly broken approximately 3.5 mm below the radial notch on the posterior surface and approximately 1.0 mm on the anterior surface. The anterolateral and posterolateral corner of surface for articulation with the internal condyle of the humerus is broken away.

DISCUSSION. The radius was identified by 1) its size, 2) the deep, U-shaped radial notch, and 3) the lack of a prominence on the anterolateral corner of the mesial articular surface.

#### *Bovidae*

*Bison bison* Linné, 1758

REFERRED SPECIMENS. 93-107-1093: left lateral malleolus; 93-107-1097: right P2/; 93-107-1257: right coronoid process fragment; 93-107-1710: left distal tibia; 93-107-1720: left proximal metacarpal.

DESCRIPTION. Specimen 93-107-1093 is a complete, slightly abraded, left lateral malleolus. Specimen 93-107-1097 is an extremely well-worn premolar whose occlusal surface is almost completely worn away. Only an remnant amount of enamel is left on the sides of the tooth and occlusal surface. Specimen 93-107-1257 is a mandibular fragment broken parallel across the hinge from the dorsal edge of the articular process. The edge of the coronoid process is broken away and is abraded. Specimen 93-107-1710 is a fragment of the tibia surrounding the inner malleolus process. Specimen 93-107-1720 is a metacarpal fragment with a portion of the ventral articular surface and dorsal shaft intact. The element is broken along the ventral edge of the mesial articulation and along the dividing ridge between the mesial and medial articular surface. The upper portion of the vascular groove remains intact; 5 cm of jaggedly broken shaft remains along the dorsal surface.

DISCUSSION. The lateral malleous was distinguished from other large artiodactlys based on its large size and its short, broad process of articulation with the lateral malleolus groove on the tibia. The coronoid process of *Bison bison* can be separated from *Cervus canadensis* based on its larger size and the gentler curvature and more acute angle of the posterior border of the coronoid process. The upper premolar was identified by its size, its square, columnar shape, and the remnant occlusal pattern. The tibial fragment was identified by the absence of the flexor digitalis groove and the large, V-shaped inner coronoid process. The metacarpal was identified by the placement of the vascular groove and the shape of the medial articular surface.

*Artiodactyla, family indet.*

Referred Specimens. 93-107-389: tooth enamel fragment; 93-107-850: 2 tooth enamel fragments; 93-107-858: 3 tooth enamel fragments; 93-107-865: tooth enamel fragment; 93-107-910: tooth enamel fragment; 93-107-934: 2 tooth enamel fragments; 93-107-937: 5 tooth enamel fragments; 93-107-952: tooth enamel fragment; 93-107-995: tooth enamel fragment; 93-107-1004: tooth enamel fragment; 93-107-1064: 9 tooth fragments; 93-107-1097: tooth enamel fragment;93-107-1143: tooth enamel fragment; 93-107-1191: tooth enamel fragment; 93-107-1246: tooth enamel fragment; 93-107-1255: 7 tooth and bone fragments; 93-107-1380: tooth enamel fragment; 93-107-1410: tooth enamel and 2 bone fragments; 93-107-1582: tooth enamel fragment; 93-107-1583: tooth enamel and bone fragment; 93-107-1632: 5 tooth enamel fragments; 93-107-1795: 2 tooth enamel fragments; 93-107-1840: tooth enamel fragment; 93-107-1897: tooth enamel fragment.

Discussion. The specimens are enamel fragments which display the ridged, high-crowned, selenodont characteristics of artiodactyl teeth. The associated bone is fragmentary and unidentifiable.

**Mammalia, order indet.**

Referred Specimens. 93-107-83: 9 bone fragments; 93-107-103: 4 bone fragments (1 burned); 93-107-107: 2 bone fragments; 93-107-114: bone fragment; 93-107-124: bone fragment; 93-107-155: bone fragment; 93-107-173: 15 bone fragments; 93-107-195: bone fragment; 93-107-255: 3 limb fragments; 93-107-370: 3 bone fragments; 93-107-398: 17 bone fragments; 93-107-442: 3 bone fragments; 93-107-437: 4 bone fragments (1 burned); 93-107-511: 11 bone fragments; 93-107-513: bone fragment; 93-107-537: bone fragment; 93-107-583: bone fragment; 93-107-601: 8 bone fragments; 93-107-618: bone fragment; 93-107-806: 7 bone fragments (3 burned); 93-107-849: 5 bone fragments; 93-107-892: 2 bone fragments; 93-107-910: 41 bone fragments; 93-107-921: 23 bone fragments; 93-107-1011: limb fragment; 93-107-1044: tooth enamel fragment; 93-107-1073: 3 bone fragments; 93-107-1075: 2 bone fragments; 93-107-1083: 6 bone fragments; 93-107-1085: rib fragment; 93-107-1089: limb fragment; 93-107-1091: bone fragment; 93-107-1094: 14 burned bone fragments, 1 tooth enamel fragment; 93-107-1095: bone fragment; 93-107-1096: 5 bone fragments; 93-107-1105: 7 bone fragments; 93-107-1119: 5 bone fragments (1 burned); 93-107-1124: 10 bone fragments; 93-107-1155: bone fragment; 93-107-1165: 6 bone fragments; 93-107-1173: bone fragment; 93-107-1207: 50 bone fragments; 93-107-1209: 23 bone fragments; 93-107-1211: 20 bone fragments; 93-107-1213: 23 bone fragments; 93-107-1217: 2 bone fragments; 93-107-1225: bone fragment;

93-107-1245: bone fragment; 93-107-1247: 3 bone fragments; 93-107-1256: bone fragment; 93-17-1306: 3 bone fragments; 93-107-1341: 10 bone fragments; 93-107-1373: 63 bone fragments; 93-107-1404: 6 bone fragments; 93-107-1409: 2 burned bone fragments; 93-107-1491: bone fragment; 93-107-1498: bone fragment: 93-107-1509: bone fragment; 93-107-1565: bone fragment; 93-107-1567: 2 burned bone fragment; 93-107-1569: 6 bone fragments; 93-107-1570: 3 bone fragments; 93-107-1571: bone fragment; 93-107-1585: 2 bone fragments; 93-107-1620: 14 rib fragments; 93-107-1622: 2 limb fragments; 93-107-1624: 2 limb fragments; 93-107-1626: bone fragment; 93-107-1627: burned bone fragment; 93-107-1628: bone fragment; 93-107-1629: 13 vertebral fragments; 93-107-1630: 4 bone fragments; 93-107-1634: 3 bone fragments; 93-107-1636: 6 limb fragments; 93-107-1638: 19 bone fragments; 93-107-1640: 9 bone fragments; 93-107-1642: bone fragment; 93-107-1644: 1 limb fragment; 93-107-1658: 22 bone fragments; 93-107-1659: 17 bone fragments; 93-107-1680: 5 limb fragments; 93-107-1690: 12 bone fragments; 93-107-1691: limb fragment; 93-107-1692: 16 scapular reports; 93-107-1693: 3 bone fragments; 93-107-1694: 4 bone fragments; 93-107-1696: 6 bone fragments; 93-107-1698: 55 bone fragments; 93-107-1700: 33 bone fragments; 93-107-1702: 16 bone fragments; 93-107-1704: 46 bone fragments; 93-107-1706: 33 bone fragments; 93-107-1708: 3 bone fragments; 93-107-1712: 63 bone fragments; 93-107-1714: 78 bone fragments; 93-107-1716: 41 limb fragments; 93-107-1718: 112 bone fragments; 93-107-1773: 16 bone fragments (8 burned); 93-107-1775: 3 burned bone fragments; 93-107-1779: 17 bone fragments (13 burned); 93-107-1781: 6 burned bone fragments; 93-107-1785: 3 burned bone fragments; 93-107-1787: burned bone fragment; 93-107-1791: 220 burned bone fragments; 93-107-1795: 112 bone fragments (99 burned), 1 tooth enamel fragment; 93-107-1797: 36 bone fragments (33 burned); 93-107-1799: burned bone fragment, tooth enamel fragment; 93-107-1801: 95 bone fragments (29 burned): 93-107-1803: 115 bone fragments (27 burned): 93-107-1829: 2 bone fragments; 93-107-1831: 6 bone fragments; 93-107-1847: 2 bone and 3 tooth enamel fragments; 93-107-1880: 2 bone fragments; 93-107-1921: burned bone fragment; 93-107-1924: burned bone fragment.

Discussion. The material was too fragmentary to assign to any particular mammalian order with confidence. None of the material displays any cut marks or other human modification.