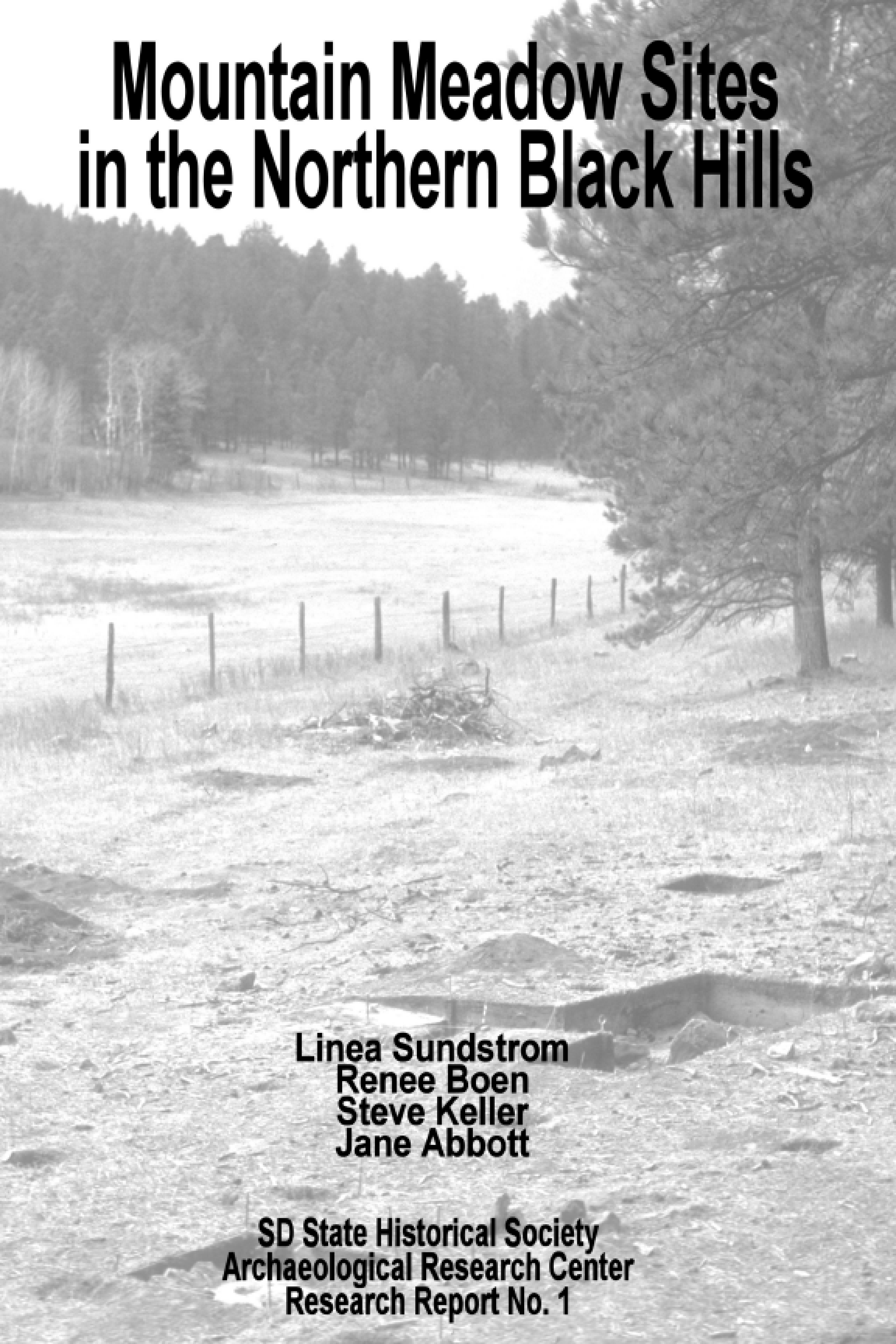
Mountain Meadow Sites in the Northern Black Hills



Linea Sundstrom
Renee Boen
Steve Keller
Jane Abbott

SD State Historical Society
Archaeological Research Center
Research Report No. 1

MOUNTAIN MEADOW SITES IN THE NORTHERN BLACK HILLS

Research Report No. 1

MOUNTAIN MEADOW SITES IN THE NORTHERN BLACK HILLS

A STUDY OF THREE SITES ALONG THE NEMO–STURGIS ROAD LAWRENCE COUNTY, SOUTH DAKOTA

by
Linea Sundstrom
Renee Boen
Steve Keller
Jane Abbott

with an appendix by
James E. Martin

Research Report No. 1
South Dakota State Archaeological Research Center
2002

©2002 by the South Dakota State Historical Society
Archaeological Research Center
All rights reserved
Printed in U.S.A.

Abstract

Mitigative data recovery efforts focused on three high-altitude meadow sites in the northern Black Hills, South Dakota. Site 39LA314 is an undated, high-density lithic knapping station. The site was devoted to the production of biface platforms and contained significant amounts of imported lithic raw material from areas to the west of the Black Hills. Site 39LA319 is a late Paleoindian (Plano) special activity site used for prehunt weapon preparation and posthunt tools manufacture and repair, secondary butchering, and hide working. Site 39LA117 contained two cultural horizons: an in situ hunt-related base camp with mixed Middle and Late Archaic components, and a redeposited late Paleoindian to Early Archaic cultural horizon representing a small, special activity site used for initial butchering. These sites are located on an older high terrace surface and within a lower, more recent terrace surface. A pre-Altithermal dry period and a mid-Altithermal wet period may be suggested by terrace formation in the project area.

Acknowledgments

The first thanks for any successful archaeology project must go to the field and lab crews. The ultimate contribution a project makes rests on their abilities to collect and compile data efficiently and accurately. Assisting in the field during various stages of the project were Renee Boen, Glen Burbidge, Nick Chevance, Dan Flemmer, Steve Keller, Bill Kurtz, Ben Rhodd, Dan Walter, Roger Wardlow, Greg Wermers, and Roger Williams. All are to be thanked and congratulated for gracefully enduring both unusually hot summer and typically cold and snowy fall conditions, the interruptions of interested passers-by, and the hazards of the Archaeology Rendezvous.

In the lab, several hundred liters of soil were waterscreened and sorted by Glen Burbidge, Greg Wermers, and Roger Williams. They also helped wash artifacts and completed size grading of some of the lithics. Burbidge was responsible for keeping the lab records accurate and up-to-date. Williams was in charge of all mapping both in the field and in the lab, and preparation of the contour map of the site. He also wrote the initial raw material descriptions used in the analysis. Jane Abbott organized and cataloged all lithic materials and identified the small amount of bone found at 39LA117. Abbott also took on the challenges of use-wear analysis and tool descriptions, and she also did much of the analysis of lithic debitage from 39LA117. Karen Tjaden cataloged the photographs and assisted with lithic analysis and tool descriptions for 39LA117. Tom Haberman identified the seeds from 39LA117.

Nicholas Chevance acted as the principal investigator on the project until the spring of 1989. He wrote the research design, assisted in negotiating the contract with the Federal Highway Administration, applied for the Forest Service permit, established an agreement with the Nemo Ranch for camping and cabin facilities, handled miscellaneous paperwork for the project, and intermittently participated in the fieldwork. In the spring of 1989, James Donohue took over as principal investigator after Chevance accepted another job.

Wini Michael handled the project book and billings. Leona Rans typed various drafts of parts of the report.

James E. Martin conducted the geomorphological study of 39LA117 and 39LA319. The trenching and some of the grader work was done by Short and Sons construction company. John Orr generously volunteered his time and equipment for a portion of the grader work.

Linea Sundstrom wrote Chapters 2–3 and 7–8 of the report, as well as portions of the remaining chapters. Portions of Chapters 1 and 4 were written by Renee Boen. Steve Keller wrote most of chapters 5 and 6. Jane Abbott prepared Appendices C and D and contributed the lithic tabulations used in writing Chapter 4. Jim Haug, Jim Donohue, Renee Boen, Jane Abbott, and Steve Keller commented on various drafts of the report.

The monumental tasks of producing the various tables and graphs, and completing the final editing and proofing fell to Robyn Sedustine. After many long hours of work, she emerged from the ordeal with her sense of humor amazingly intact.

Special thanks are extended to Tim Church of the University of Montana for providing the results of lithic source-area identification for the 39LA314 obsidian and to Richard Hughes of the University of California–Sacramento for doing the analysis.

Contents

Abstract v
Acknowledgments vii

1 Introduction to the Project **1**
1.1 Introduction 1
1.2 History of the Project 3
1.3 Research Design and Objectives 4
1.4 Organization of the Report 5

2 Archaeological Context **7**
2.1 Archaeological Significance of the Area 7
2.2 Previous Investigations 7
2.3 Culture History of the Black Hills 13
2.3.1 Paleoindian 14
2.3.2 Early Plains Archaic 18
2.3.3 Middle Plains Archaic 19
2.3.4 Late Archaic and Plains Woodland 20
2.3.5 Late Prehistoric and Plains Village 21
2.3.6 Protohistoric 22
2.3.7 Historic 23
2.4 Research Orientation 23

3 Environmental Context **27**
3.1 The Black Hills Environment 27
3.1.1 Physical Geography 27
3.1.2 Geology 30
3.1.3 Drainage 30
3.1.4 Climate 31
3.1.5 Biology 31
3.2 Natural Resources 33
3.3 The Local Environment 33

4 Investigations at 39LA117 **37**
4.1 Introduction 37
4.2 Previous Investigations 37

4.3 Objectives For 1988 . . . 42
4.4 Methods for Mitigative Data Recovery . . . 43
4.5 Laboratory Methods . . . 53
4.6 Stratigraphy . . . 58
4.6.1 Cultural zone . . . 63
4.6.2 Disturbances . . . 64
4.7 Results of Investigations . . . 66
4.7.1 Historic Artifacts . . . 66
4.7.2 Features . . . 66
4.7.3 Nonlithic Material . . . 68
4.7.4 Lithic Tools . . . 69
4.7.5 Lithic Debitage . . . 82
4.8 Discussion . . . 82
4.8.1 Features . . . 82
4.8.2 Lithics . . . 86
4.8.3 Other Remains . . . 113
4.9 Conclusions . . . 113

5 Investigations at 39LA314 117
5.1 Introduction . . . 117
5.2 Previous Investigations . . . 117
5.3 Objectives for 1988 . . . 121
5.4 Field Methods for Mitigative Data Recovery . . . 122
5.5 Laboratory Methods . . . 123
5.6 Stratigraphy . . . 126
5.7 Results of Excavations . . . 127
5.8 Discussion . . . 128
5.9 Conclusions . . . 130

6 Investigations at 39LA319 133
6.1 Introduction . . . 133
6.2 Previous Investigations . . . 133
6.3 Comments on Previous Data and Interpretations . . . 137
6.4 Objectives for 1988 . . . 138
6.5 Field Methods for Mitigative Data Recovery . . . 139
6.6 Stratigraphy . . . 145
6.7 Laboratory Methods . . . 145
6.8 Results . . . 146
6.9 Discussion . . . 146
6.10 Conclusions . . . 148

7 Research Conclusions 153
7.1 Tests of Hypotheses . . . 153
7.2 Implications for Northern Black Hills Prehistory . . . 173
7.3 Implications for Northern Great Plains Prehistory . . . 177

8 References Cited **183**

A Stratigraphy and Geomorphlogy **199**
A.1 Introduction 199
A.2 Methods 200
A.3 Physiology and Bedrock Geology 201
A.4 Terraces 203
A.5 Terrace Stratigraphy 203
A.5.1 Qt_1 203
A.5.2 Qt_2 204
A.6 Stratigraphy of Qt_2 204
A.6.1 39LA117: Trench 3 204
A.6.2 39LA117: Trench 2 206
A.6.3 5 39LA117: Trench 1 207
A.6.4 39LA319 207
A.7 Analysis 210
A.7.1 Stratigraphy 210
A.7.2 Lithic Sources 210
A.8 Conclusions 211
A.9 Sample Analysis 212
A.9.1 39LA117: Trench 1 212
A.9.2 39LA117: Trench 2 213
A.9.3 39LA117: Trench 3 214
A.9.4 39LA319 216
A.10 References 219

B Additional Lithic Data from 39LA117 **221**

C Tool and Use Wear Descriptions **227**
C.1 39LA117 228
C.2 39LA314 279
C.3 39LA319 282

List of Figures

1.1 Topographic map of project area 2

2.1 Location of the Black Hills with reference to the Great Plains culture area and the Northwestern Plains subarea 8

3.1 Major physiographic zones and drainage of the Black Hills 28

4.1 Topographic map of 39LA117 vicinity 38
4.2 Map of 39LA117 39
4.3 39LA117 Unit 13 profile 59
4.4 39LA117 Unit 9 profile 60
4.5 39LA117 Unit 22 profile 60
4.6 39LA117 Unit 15 profile 61
4.7 39LA117 Units 1–2 profile 62
4.8 39LA117 Unit 20 profile 63
4.9 Schematic map of 39LA117 67
4.10 Schematic map of 39LA117 74
4.11 Paleoindian and Early Plains Archaic points from 39LA117 . . . 76
4.12 Middle and Late Plains Archaic points from 39LA117 77
4.13 Miscellaneous tools from 39LA117 80
4.14 Dominant lithic raw material 90
4.15 Distribution of clear chalcedony by unit, 39LA117 93
4.16 Distribution of brown chalcedony by unit, 39LA117 94
4.17 Distribution of light chalcedony by unit, 39LA117 96
4.18 Distribution of light chert by unit, 39LA117 97
4.19 Distribution of dark chert by unit, 39LA117 98
4.20 Distribution of white quartzite by unit, 39LA117 99
4.21 Distribution of tan quartzite by unit, 39LA117 100
4.22 Distribution of brown quartzite by unit, 39LA117 101
4.23 Distribution of tan silicified siltstone by unit, 39LA117 102
4.24 Distribution of gray silicified siltstone by unit, 39LA117 103
4.25 Distribution of red quartzite by unit, 39LA117 104
4.26 Distribution of purple quartzite by unit, 39LA117 105
4.27 Distribution of silicified slate by unit, 39LA117 106
4.28 Distribution of quartz by unit, 39LA117 107

4.29 Distribution of gray shale by unit, 39LA117 108
4.30 Distribution of red shale by unit, 39LA117 109
4.31 Distribution of porcellanite by unit, 39LA117 110

5.1 Topographic location of 39LA314 118
5.2 39LA314 test units excavated in 1984 119
5.3 Profile of Feature 2, 39LA314 120
5.4 Map of 39LA314 124
5.5 Representative soil profile, 39LA314 126
5.6 Vertical distribution of artifacts from 39LA314 127
5.7 Tools from 39LA314 129

6.1 Topographic location of 39LA319 134
6.2 Shovel test excavations from 1984 investigations at 39LA319 . . . 135
6.3 Plan and profile of Feature 1 posthole 136
6.4 Selected tools from 39LA319 137
6.5 Map of 39LA319 140
6.6 Representative soil profile, 39LA319 141
6.7 Vertical distribution of artifacts from 39LA319 143
6.8 39LA319 artifact totals by level 147

A.1 Cross-section of Trench 1, 39LA117 201
A.2 Cross-section of Trenches 2 and 3, 39LA117 202
A.3 Cross-section of trench at 39LA319 202

List of Tables

2.1 Cultural sequence of the Black Hills 14
2.2 Radiocarbon dates from the Black Hills 15

4.1 Schedule of field and laboratory work 38
4.2 Collections from previous investigations at 39LA117 40
4.3 Results of shovel tests at 39LA117 46
4.4 Summary of field methods at 39LA117, 1988 field season 49
4.5 Nonlithic materials collected at 39LA117 68
4.6 Tools from 39LA117 69
4.7 Tool raw material preference and morphology classifications . . . 71
4.8 Debitage totals by size grade, 39LA117 83
4.9 Debitage raw material type percentages by weight, 39LA117 . . . 84
4.10 39LA117 debitage raw material type percentages by weight . . . 85
4.11 Tool to debitage (T:D) for Black Hills sites 111

5.1 Summary of debitage recovered from 39LA314 121
5.2 Summary of tools from 39LA314 122
5.3 1988 Shovel test results from 39LA314 125

6.1 Summary of tools and debitage recovered from 39LA319 149
6.2 Tools from 39LA319 150

7.1 Chi-square and Fisher test statistics comparing the distribution of broken and whole bifacial, unifacial, patterned, and nonpatterned tools 165
7.2 Chi-square and Fisher test statistics comparing the distribution of macrocrystalline and cryptocrystalline bifacial, unifacial, patterned, and nonpatterned tools 167
7.3 Chi-square statistic comparing the distributions of raw material preferences for bifacial, unifacial, patterned, and nonpatterned tool classes, 39LA117 168
7.4 Summary of tool raw material type preferences, 39LA117, 39LA-314, and 39LA319 172

B.1 Distribution of debitage lithic raw material 221

B.2 Debitage raw material percentage distributions 223

Chapter 1

Introduction to the Project

1.1 Introduction

This document presents the results of an archaeological project undertaken to gather information from three prehistoric sites falling within the right-of-way of the Nemo-Sturgis (Forest Highway 26) road improvement project. Earlier studies established that these sites were eligible for nomination to the National Register of Historic Places. As it was not deemed possible to avoid damage to the three sites during road construction, efforts were made to mitigate the loss of information from the sites. These efforts were focused on extensive excavation at each site, along with a detailed study of the stratigraphy of the site area, and subsequent analysis and interpretation of the information collected.

Archaeological excavation destroys sites, just as surely as road construction does; thus, archaeologists strive to be as complete and systematic in their work as the confines of schedules and budgets allow. The collected artifacts and field observations, along with the final report of a mitigation project, can be thought of as a surrogate for the site itself. While they are never as complete as the original, they nevertheless provide a valuable repository of information on our human past that may well hold keys for the future.

The three sites in this study lie in two high-altitude meadows in the northern Black Hills (Figure 1.1). They are located within the Black Hills Study Unit, as defined in the *South Dakota State Plan for Archaeological Resources*, a cultural resource planning document sponsored by the National Park Service and the S.D. State Historical Preservation Center (Winham and Hannus 1990). The relatively high density of sites and isolated artifacts inventoried during various archaeological survey projects in similar Black Hills environmental settings leaves no doubt that the high-altitude meadows were important prehistorically, over a period of at least several thousand years, if not throughout the prehistory of the area. The specific role these high-altitude meadows played however, is poorly understood at present. For this reason, the three sites potentially had much to contribute to an understanding of the cultural history of the area.

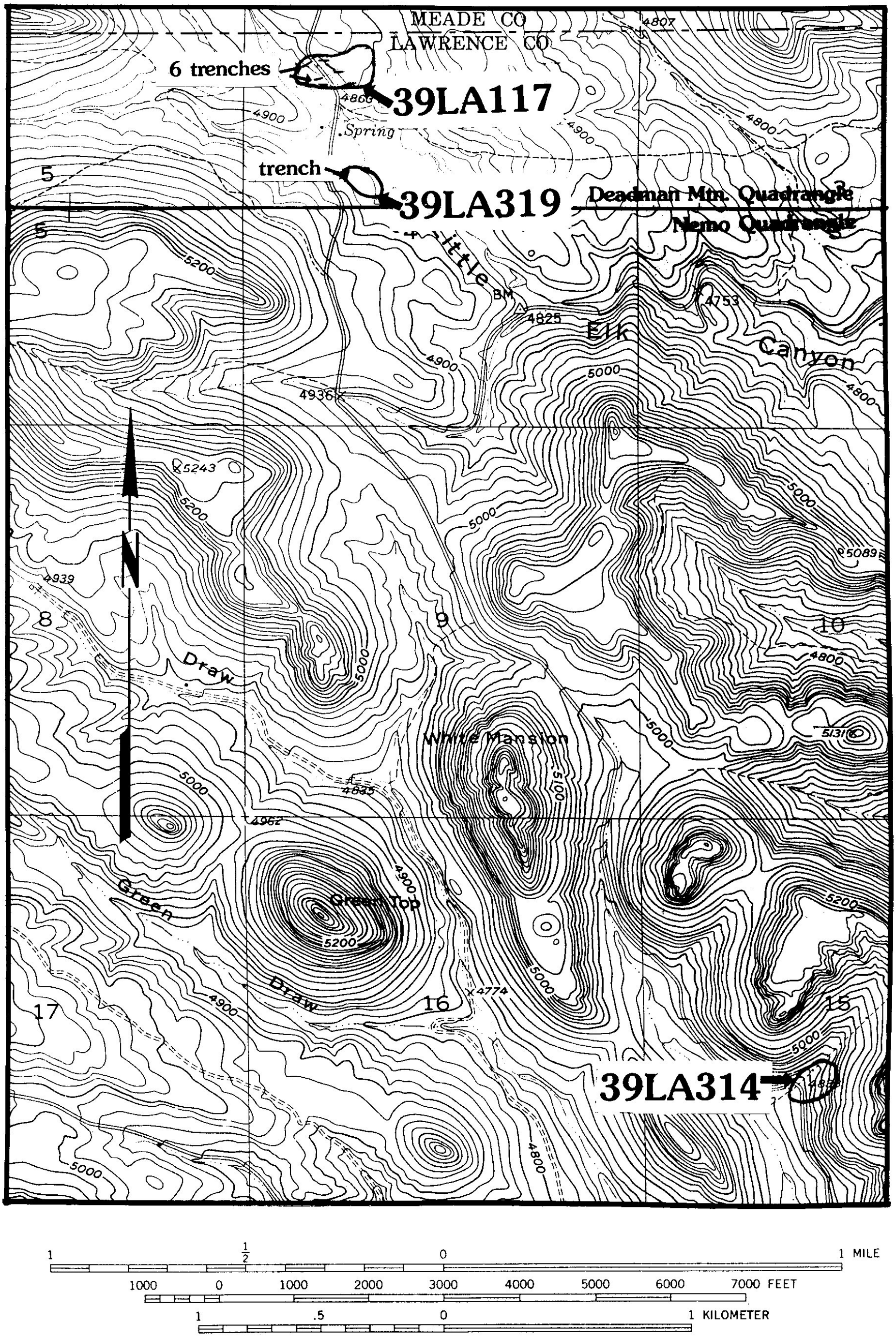


Figure 1.1: Topographic map of project area showing site locations and trenches.

1.2 History of the Project

In 1984, the U.S. Department of Transportation, Federal Highway Administration (FHWA), contracted with the State Archaeological Research Center, South Dakota State Historical Society (SARC) to carry out a cultural resources survey along the right-of-way of a proposed improvement of the Vanocker Canyon Road, Forest Highway 26 (FHR 135), between Sturgis and Nemo, South Dakota. The proposed improvements included realigning, widening, and blacktopping the present road. The cultural resources survey project combined a search of the state's archaeological site inventory, a pedestrian survey, and shovel testing (Church et al. 1985). Based on the results of the survey, a program of formal testing was then undertaken (Church et al. 1985). The survey and testing phases of the project were conducted in the summer and fall of 1984. The late State Archaeologist Robert Alex served as principal investigator, Tim Church was project director, and Therese Chevance was field director.

Twenty-seven sites were identified during the records search and survey phase of the project (Church et al. 1985). These included 8 historic and 19 prehistoric sites. This phase of the project was termed a "100% survey" (Church et al. 1985). This should be taken to mean that the entire project area was examined, not that all sites in existence in the area were found. Given the limited surface visibility due to vegetation cover, and the possibility of deeply buried cultural deposits in the creek terraces, the survey techniques employed were not adequate to guarantee that all sites lying within the project area were found. Nevertheless, it can reasonably be concluded that all significant sites likely to be severely damaged by the road improvement project were identified and evaluated.

Six of the sites found during the survey phase of the project were formally test excavated. Fourteen other sites were recommended for further evaluation, but were not chosen for formal testing as part of this project because they lay outside planned construction zones (Church et al. 1985). The testing program sought to establish 1) whether the sites were significant, 2) whether they contained buried components in the highway right-of-way, and 3) whether they were single or multiple component sites and the approximate depth of cultural material. Four of the six test-excavated sites were found to be eligible for National Register status. Of those four, only one could be avoided by the proposed road construction. The three remaining sites would require excavation to recover the data they contained before their destruction or damage by the road improvements.

In the fall of 1987, FHWA requested that SARC prepare a research design for mitigative excavation of the three sites that would be damaged by road construction. Based on recommendations and research questions specified in the survey and testing report (Church et al. 1985) and on general research concerns (Chevance 1987), SARC prepared the research design and submitted it in December 1987 (Chevance 1987).

The three sites to be excavated were potential habitation sites at the edges of high-altitude meadows and all lay directly in the right-of-way of the proposed road improvements. These sites were thought to hold great potential for answering questions of chronology, artifact typology, effects of contact with nonnative cultures, prehistoric use of various Black Hills resources, (including lithics), prehistoric settlement and use of high-altitude meadows, prehistoric attitudes toward resource use and conservation, and paleoenvironmental reconstruction.

The mitigation plan was designed to meet the requirements of both responsible scholarly research and state- and federally mandated cultural resource management procedures (Chevance 1987). As required, the research design was read and approved by the State Historical Preservation Center and the Advisory Council on Historic Preservation. The research design specified the kinds of data that would be collected at each site so that information loss would be minimal. For the three sites in this study further investigation, rather than preservation or avoidance, was the necessary means of mitigation. Mitigative investigation refers to problem-oriented data recovery, analysis, publication, and dissemination to professional and public audiences (McGimsey and Davis 1977). In other words, the data saved from unavoidable destruction must be both studied as part of the mitigation project and made available for future research by others.

In 1988, FHWA contracted with SARC to conduct mitigative excavation of the three sites, as outlined in the 1987 research design (Chevance 1987). The mitigation fieldwork on which the current study reports was conducted from July 12, 1988 to November 14, 1988. SARC archaeologist Nicholas Chevance served as principal investigator for this phase of the project throughout the research design and fieldwork stages. When Chevance accepted another position in the spring of 1989, James Donohue, SARC Director of Contracts, took over as principal investigator. SARC archaeologists Renee Boen and Steve Keller served as both field and laboratory directors for this phase of the project. Laboratory analysis and curation of materials proceeded intermittently from November 15, 1988 through the end of 1990.

In January 1991, SARC contracted with Linea Sundstrom, Ph.D., a private consultant, to prepare the final project report. Sundstrom was to compile the site analyses and summaries that had been prepared up to that time and to complete the remainder of the analysis and written report, including the introductory sections, parts of the site reports, the sections on the results of the hypothesis tests specified in the research design, and general conclusions.

1.3 Research Design and Objectives

The overall objective of this project, as noted above, was to mitigate loss of information from the three sites through a program of intensive excavation. At two of the sites (39LA117 and 39LA319), excavation was supplemented by a geomorphological study of the site areas to determine the stratigraphic sequence and formation processes of deposits containing cultural material. At each site, a primary goal was to date all cultural deposits through a combination of radiocarbon dating (if possible), comparison of time-diagnostic artifacts with others from dated contexts, and geomorphology (Chevance 1987). Actual excavation plans were different for each site, but all focused initially on 1) determining the extent of cultural deposits within the impact area and 2) establishing the number and nature of various cultural components.

All materials recovered were brought to SARC for processing, analysis, and curation. All artifacts, soil samples, maps, field notes, and photographs from the project are housed there. Separate analyses of lithics, faunal material, waterscreen residues, and sediment were conducted by various SARC personnel; these are detailed in the individual site reports to follow.

1.4 Organization of the Report

The first chapter of this report gives an introduction to the project, including a brief history and abstract of the research plan and data recovery procedures. This is followed by a discussion of the archaeological context of the project, including a review of previous archaeological research in the Black Hills, an overview of Black Hills prehistory, and a discussion of current research questions relevant to the current study. Next the general Black Hills environment and the specific environment of the project area are described, to provide additional context for the interpretations and conclusions to follow. The next three chapters detail the results of investigations at each of the three sites. This is followed by a discussion of the research conclusions, addressing both the specific questions outlined in the research design (Chevance 1987) and more general implications for the northern Black Hills and Northwestern Plains prehistory.

The geomorphologist's report on sites 39LA117 and 39LA319 appears as Appendix A. Appendix B presents detailed tabulations of lithic debitage from 39LA117. Appendix C gives detailed descriptions of tools found at the three sites.

Chapter 2

Archaeological Context

2.1 Archaeological Significance of the Area

The Black Hills make up one of the most important and least understood subregions of the Great Plains culture area. Lying at the southeastern edge of the Northwestern Plains culture subarea (Wedel 1961; Frison 1978) and immediately north of the Central Plains culture subarea (Figure 2.1), 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 Great Plains dwellers were undoubtedly attracted to the Black Hills area, whether as a place to be enjoyed and exploited for its unique and abundant resources, avoided as an odd place, feared, or revered.

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 (Frison 1978; Wedel 1978; Buchner 1980; 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 (Sundstrom 1989)? What do the numerous Middle Archaic sites in the Black Hills indicate in terms of the origin of the McKean complex? The answers to these and other questions will bring archaeologists much closer to a true understanding of the Great Plains as a human habitat, both in the past and for the future.

2.2 Previous Investigations

In spite of its importance to understanding Great Plains prehistory, archaeological study of the Black Hills has been sporadic and unsystematic. The history of archaeological study of the area can be divided into four periods. The first,

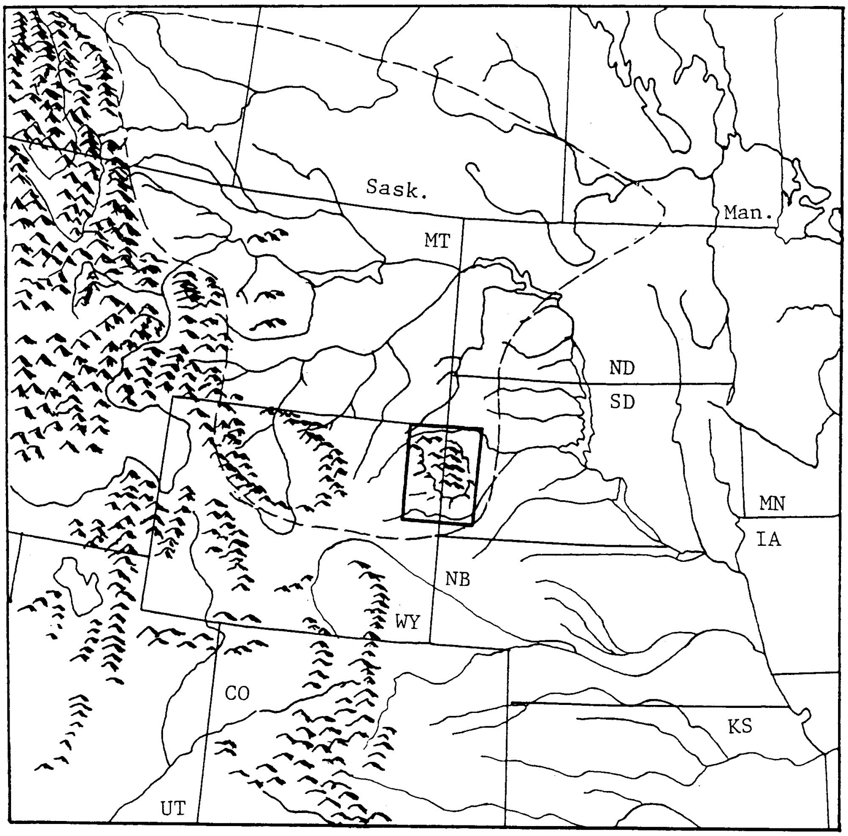


Figure 2.1: Location of the Black Hills with reference to the Great Plains culture area and the Northwestern Plains subarea.

from about 1874 to 1942, was a period of sporadic and disorganized exploration that included initial description of the archaeological resources of the area. It was 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. It culminated in attempts to develop new classification systems for the information collected or to apply classification systems developed for other regions of the Great Plains. The third period of archaeological study of the Black Hills began about 1971 and continues to the present, comprising 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. 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 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, their purpose was to gather information about this relatively unexplored portion of the West. The Custer Expedition of 1874 was purportedly undertaken to assess the natural resource potential of the Black Hills, which was Indian land at the time. The real purpose of the expedition 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). The government's main interest in the information was 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 1907–1908 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 before 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).

The first formal explorations into the interior Black Hills were conducted by William H. Over, a self-educated naturalist and director of the University of South Dakota (USD) Museum. 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). These shelters had been occupied by both ceramic-producing and nonceramic groups. 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 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 may 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 no professional archaeologists questioned 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 1954 was a time of continued exploration and, what is more important, the first attempts were made 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, and, although radiocarbon dates were not yet available for the area, a clear 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. This provided 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; see also 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 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 U.S. Forest Service, the South Dakota State Archaeological Research Center (SARC), the Office of the Wyoming State Archaeologist, the Tennessee Valley Authority, the National Park Service, and private consultants under contract to the aforementioned 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 4000 previously unrecorded sites, and, more importantly, gave the first realistic picture of the distribution and diversity of archaeological remains in the area. A wide variety of sites were discovered. Most were lithic scatters, representing either special activity areas or larger campsites; a large number of historic sites were found as well. These surveys established that prehistoric sites were present throughout the Black Hills, rather than in the peripheries alone, 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 SARC 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 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 Black Hills archaeologists knew, the less they knew. With the most intense period of CRM projects behind them, they could adopt a more studied approach to the archaeology of the area. This period of problem-oriented research, from about 1977 to the present, has included four 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; and syntheses of previously collected data.

Major excavation projects have included investigations at the Hawken site, an Early Archaic bison kill in the northern Red Valley (Frison 1978); 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) in the northern Black Hills; the Plains Village pattern Smiley-Evans site (L. Alex 1979; Chevance 1984), on the northern periphery; excavations at the late Paleoindian Hudson-Meng site, south of the Black Hills (Agenbroad 1978); excavations at the Agate Basin site, a multicomponent Paleoindian site on the southwestern periphery (Frison and Stanford 1982); and excavations at the multicomponent Beaver Creek site in the southern Black Hills (L. Alex 1991). Although not an excavation project, a recent intensive study of rock art in Whoopup Canyon located 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. The studies have contributed much toward piecing together past cultural patterns.

The present study could also be placed in this category. Although a CRM project, the mountain meadow investigations were extensive and held a great deal of potential for answering questions about area prehistory. The project research design was problem oriented, based on a series of explicit hypotheses (Chevance 1987). The study, therefore, combines cultural resource management with scholarly research.

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 thesis (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 (Church 1989); this was developed into a master's thesis (Church 1990). 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 thesis currently in progress will reconstruct human subsistence ecology based on studies of about 100 sites near 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 reexcavation of previously studied sites. Two Black Hills sites important in the establishment of the basic cultural chronology of the area were reexcavated. The first is the late Paleoindian Ray Long 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). Reexcavation of the site and survey of the surrounding area were undertaken as part of the latter project.

The final and most recently initiated kind of 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 thesis 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).

While Black Hills archaeology got off to a slow start, the era of CRM exploration 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.

2.3 Culture History of the Black Hills

Summaries of Black Hills and Northwestern Plains prehistory are widely available (see Frison 1978; Sundstrom 1989; Tratebas 1986; Cassells et al. 1984; Cassells 1986, and numerous CRM reports issued by SARC). 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 (1978). 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 2.1): Paleoindian, 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

Table 2.1: Cultural sequence of the Black Hills.

Years B.P.	Period	Subsistence and Settlement
	Historic	Mining, logging, agriculture, industry; modern rural settlement
100	Protohistoric	Bison hunting; plains equestrian pastoral pattern
200	Late Prehistoric and Plains Village	Communal bison hunting, limited foraging; dispersed with seasonal aggregation; camps and semipermanent villages
1500	Late Plains Archaic	Communal bison hunting, some foraging; dispersed with seasonal aggregation; little use of Black Hills center
2500	Middle Plains Archaic	Mixed hunting and foraging; dispersed, some aggregation for communal hunts; intensive use of entire Black Hills area
5000	Early Plains Archaic	Mixed foraging and hunting; some communal hunting; dispersed with seasonal aggregation; limited use of Black Hills
7500	Plano	Communal bison hunting around Black Hills perimeter; mixed hunting and foraging in Black Hills proper; dispersed/aggregated
10,000	Folsom	Communal bison hunting; some foraging; dispersed/aggregated; western Black Hills
11,000	Clovis	Mammoth hunting; unknown/dispersed; no use of Black Hills proper
12,000		

period are more pronounced than those between the late Paleoindian period and the initial Archaic (Tratebas 1986; Sundstrom 1989). The terms therefore, 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 2.2.

2.3.1 Paleoindian

No evidence of pre-Clovis sites (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 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 (Frison 1991; Hannus 1985); however, Clovis diagnostics have not been found in the Black Hills proper.

Post-Clovis cultural developments are of particular relevance to the present study. Following the transition to modern climatic conditions and the extinction of the mammoth, the Folsom complex replaced Clovis 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, 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 B.P. (Frison 1978). Little is known of Folsom life outside of bison-hunting activities; however, 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).

Table 2.2: Radiocarbon Dates from the Black Hills. Dates are uncalibrated. Omitted from this table are several dates from non-cultural levels at the Agate Basin site (Frison and Stanford 1982) and Capes Caves (Weston 1983) and rejected dates from Belle Rockshelter and Mule Creek Rockshelter (Frison 1978). References: 1. Agenbroad 1978; 2. L. Alex 1991; 3. Buechler 1984; 4. Chevance 1984; 5. Frison 1978; 6. Frison and Stanford 1982; 7. Gant and Hurt 1965; 8. Hannus 1986; 9. Hovde 1981; 10. Mulloy 1958; 11. Reher and Frison 1980; 12. Tratebas 1986; 13. Wheeler 1957

Ref	Period	Site	Date	Complex/Affiliation
3	LP	Deerfield	300±70	
			390±70	
			460±70	
			580±70	
			600±70	
			620±70	
			630±70	
			760±70	
			790±70	
			940±70	
			990±70	
			1060±70	
			1150±70	
			1390±70	
11	LP	Vore	<230	Late Late Prehistoric
			200±90	Late Late Prehistoric
			370±140	
4	LP	Smiley-Evans	810±70 to 1190±70	8 Dates: Plains Village
12	LP	Lost Bumper	1030±60	
2	LPA	Beaver Creek	1750±60	Unanalyzed Component
	LPA		2220±70	Unanalyzed Component
6	LPA	Agate Basin	1520±140	Archaic Fire Pit
			2215±150	Archaic Fire Pit
5	LPA	Fulton (48WE302)	2150±150	
9	LPA	Miner Rattlesnake	2370±70	Archaic Hearth
3	LPA	Deerfield	2340±70	
			2670±80	
10	LPA	McKean	3287±600	Post-McKean Level
3	MPA	Deerfield	3330±80	

Table 2.2: continued

Ref	Period	Site	Date	Complex/Affiliation
			3410±70	
			3480±80	
			3590±80	
			3690±70	
			4950±70	
2	MPA	Beaver Creek	3870±70	McKean
			3940±170	McKean
			4010±100	McKean
			4710±110	
12	MPA	George Hey	3520±70	McKean
			3925±65	McKean
7	MPA	Gant	4130±130	McKean
11	MPA	Kolterman	3630±350	McKean
			4230±350	McKean
5	MPA	Hawken II	4250±140	
2	EPA	Beaver Creek	5500±150	Early Archaic
			5500±80	Early Archaic
			5740±110	Early Archaic
			6220±100	Early Archaic
			6720±100	Early Archaic
5	EPA	Hawken III	6010±170	
5	EPA	Hawken	6270±170	
			6470±140	
13	Plano	Ray Long	7715±740	
			7073±300	
1	Plano	Hudson-Meng	8900±190	Alberta
			9380±100	Alberta
			9820±160	Alberta
13	Plano	Ray Long	9380±500	Angostura
2	Unknown	Beaver Creek	9380±300	Non-cultural
6	Plano	Agate Basin	9350±450	Agate Basin
			9990±225	Agate Basin
			10,445±110	Hell Gap
			10,430±570	Agate Basin
8	Unknown	Ray Long	8950±140	
			9540±540	
			10,400±360	
			11,000±310	
6	Folsom	Agate Baisn	10,375±700	
			10,780±120	
			10,665±85	
6	Clovis	Agate Basin	10,030±280	Clovis level bone

Folsom may mark the beginning of what might be 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 may have been 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 terminal 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 B.P.; 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 30 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, 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 more 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. This practice demands further study before such artifacts can be considered reliable time diagnostics. This problem is of special relevance to the present study and will be treated in more detail below.

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 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). 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 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.

2.3.2 Early Plains Archaic

At the end of the Plano period, around 7500 B.P., 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 semiabandonment of the area or to 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 B.P., indicates that at least the periphery was used for communal bison hunting (of the extinct variety *B. bison occidentalis*) during this period (Frison 1978). Early Archaic levels at the Beaver Creek site, inside the southern hogback, 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. Surface collections in 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 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 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 would remain the main weapon system throughout the Archaic. As with the late Plano points, 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 1978; Wedel 1978; Bamforth 1988; Buchner 1980); however this hypothesis is not well supported by current Black Hills data.

2.3.3 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 1978; Vickers 1986). This is true for the Black Hills as well; most prehistoric sites thus far dated have been assigned to the Middle Plains Archaic period (5000–2500 B.P.).

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 grasslands 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.

Bison hunting activities seem to have intensified, especially in the open plains areas during this period, as compared with 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 late Plano—continued, with even more resources apparently being added to the pool.

In the Black Hills, aspects of both patterns are evidenced by the archaeological record. The numerous Middle Archaic sites in the Black Hills include large, repeatedly occupied camps with large numbers of 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 posthunt 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, rock art estimated to date to the Paleoindian through Middle Archaic periods found throughout the southern Black Hills illustrates the use of artificial impoundments for the communal hunting of deer, pronghorn, and, rarely, bison (Sundstrom 1990). Communal hunting, individual hunting of bison and smaller game, and plant-food foraging thus are all indicated by sites in the general vicinity. Possible use of tipilike habitations is indicated at a few sites in the area.

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). Probably, 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 would characterize the region throughout the remainder of its prehistory.

2.3.4 Late Archaic and Plains Woodland

From about 2500 to 1500 years B.P., 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 of these had a bison-hunting subsistence base in the northern Northwestern Plains and a mixed bison-hunting and foraging subsistence base in the southern sector. Complex communal bison hunts were an important Besant adaptation throughout the Northwestern Plains.

Contemporaneous with the Pelican Lake and Besant complexes were several localized Plains Woodland complexes. Although the Late Woodland is primarily identified with the Eastern Plains and Woodlands, similar developments, especially 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 1978).

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 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 linchpin 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.

2.3.5 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. This change is evidenced by smaller, lighter projectile points. 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 basins. Ceramics have been found at a few early Late Prehistoric sites outside of the Black Hills. Tipi ring features have been found at some early Late Prehistoric sites (Frison 1978; Reeves 1983; Tratebas 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, following the bison and living 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-scale bison trap (Reher and Frison 1980); temporary camps used by Middle Missouri village dwellers on hunting or lithic procurement expeditions (L. Alex 1979; R. Alex 1981b); a possible Crow encampment (Wheeler 1957); and two possible Middle Missouri-related villages (R. Alex 1981a, 1981b). Surface collections suggest use of the interior uplift for residence sites and use of the hogback for various kinds of manufacturing and extraction activities (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.

2.3.6 Protohistoric

Between A.D. 1700 and 1800, Euro-American 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, more social stratification, 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 war 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. Rock art from the southern Black Hills has been identified as having Shoshone, Siouan (unspecified), and Lakota cultural affiliation (Sundstrom 1990). Ethnographic sources establish that the Black Hills was occupied by the Crow, Plains Apache, Ponca, Comanche, Kiowa, and Kiowa Apache prior to the introduction of the horse between A.D. 1700 and 1750 (Reher 1977). 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). They were replaced later in the Protohistoric by Lakota, Arapaho, and Cheyenne groups moving in from the east and north. 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.

2.3.7 Historic

The first nonnatives 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 Dakota Territory (what is now the western half of 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 in the Black Hills had been confirmed by the Custer 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 U.S. government, which opened the country to Euro-American 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, ranching, and tourism are the main industries.

2.4 Research Orientation

Previous investigations in the Black Hills and the Northwestern Plains suggest a number of research questions that can be addressed by the present study (cf. Winham and Hannus 1990). These include both broad, general questions and specific concerns.

One of the most obvious gaps in our knowledge of Black Hills prehistory is a locally established culture sequence. Local cultural manifestations need to be defined in terms of their archaeological expressions and hypothesized settlement, subsistence, and interaction patterns. While Smithsonian Institution archaeologists began such an attempt early in the history of organized archaeology in the Black Hills, few if any have followed their lead. Instead, most researchers in the area have borrowed culture sequences developed for other areas of the Great Plains (see Tratebas 1986 for an important exception). It is abundantly clear that, just as cultural developments in the northern sector of the Northwestern Plains subarea are different from those in the southern sector, Black Hills cultural developments are different from those elsewhere in the Northwestern Plains. Both the particular environmental characteristics of the Black Hills and their proximity to the Middle Missouri and Central Plains no doubt contributed to the unique cultural sequence of the area. At this point, these differences cannot be specifically explored because the Black Hills culture complexes have never been completely defined in their own terms, although recent studies have made some advances in this direction.

An essential part of a more complete and accurate Black Hills sequence is chronological control. Each defined culture complex must be dated as accurately as possible, using radiocarbon and other independent dating methods on Black Hills materials. This way, it can be determined if a complex or artifact type from the Black Hills is contemporaneous with similar developments in other areas of the Northwestern Plains. This, in turn, can lead to the recognition of time-diagnostic artifacts and features. At present, the projectile point sequence of the Black Hills is quite poorly defined. It is possible that some projectile points and associated archaeological components have been assigned to the wrong periods (Sundstrom 1989).

Few studies have been undertaken by either archaeologists or paleoenvironmentalists to reconstruct the past climates and biological regimes of the Black Hills. This kind of information is important to an understanding of sedimentation and deposition processes that largely determine what will be preserved for archaeologists to find. It also is vital for reconstructing the environments to which prehistoric peoples had to adapt. Paleoenvironmental reconstruction through studies of fossil pollen, animal fossils, and geomorphology is also a key to understanding the role of the Black Hills in prehistoric developments.

Other research questions concern subsistence and interaction. Is our view of area subsistence biased toward hunting, at the expense of a realistic view of the importance of foraging activities (Kornfeld 1989)? Was trade in lithic raw material or other resources conducted from the Black Hills? With whom and for what exchange? What special adaptations permitted people to survive in the Black Hills? Can different ethnic groups or macro-bands be recognized in the archaeological remains of the area? What is the source of the McKean complex and its distinctive technology and settlement pattern? What tools and technologies did people have at their disposal during various periods of area prehistory?

In addition to these general questions which apply to all Black Hills sites, a research orientation for the present study was provided by its research design (Chevance 1987). The research design listed twelve hypotheses to be assessed using data from the mitigation of the three Lawrence County sites. These hypotheses concern site function, lithic raw material preferences, seasonality of use of the high-altitude meadows, effects of contact with nonnative cultures, and prehistoric attitudes towards the conservation of various types of stone tools (see Chapter 7).

Chapter 3

Environmental Context

3.1 The Black Hills Environment

3.1.1 Physical Geography

The Black Hills, located in northeastern Wyoming and western South Dakota, are the easternmost extension of the Rocky Mountains. The Black Hills are an elongate dome or doubly plunging anticline, sometimes described as a "blister" on the surrounding plains, from which they rise 900 to 1200 m (Froiland 1978; DeWitt et al. 1986:9; Rich 1981). The Black Hills attain an elevation of 2203 m at Harney Peak, the highest elevation in North America east of the Rocky Mountains proper. The uplift is elliptical, extending approximately 200 km north to south and 80 kmeast to west and covering an area greater than 15,000 square kilometers (Froiland 1978; Rich 1981). The Black Hills are structurally similar to other Rocky Mountain outliers, such as the Bighorn, Laramie, and Medicine Bow mountains (Prucha et al. 1965; Dandavati 1981:21).

The Black Hills area takes its name from the Lakota *paha sapa*, black mountain. From a distance, the uplift looks like a dark blue or purple mass, due to its heavy cover of pine. The grassy plains surrounding the Black Hills are broken by several other unique physical features. These include the White River Badlands east of the Black Hills; Bear Butte, just outside the northeastern Black Hills; the Cave Hills erosional feature to the north; and the Bighorn and Laramie Mountains to the west. Closer to the project area, a line of igneous intrusions, extending from Devil's Tower on the west across the Bear Lodge Mountains and Terry Peak area to Bear Butte on the east, form a distinctive geologic province (Lisenbee 1981).

For descriptive purposes, the Black Hills uplift has been divided into four physiographic zones (Darton and Paige 1925). As is typical of domal uplifts, the geologic formations form concentric rings around the upthrust central core; the physiography follows the same pattern due to differential resistance of the various exposed rock strata. The four main physiographic zones are, from the center outward, the Central Basin (or Crystalline Core), the Limestone Plateau,

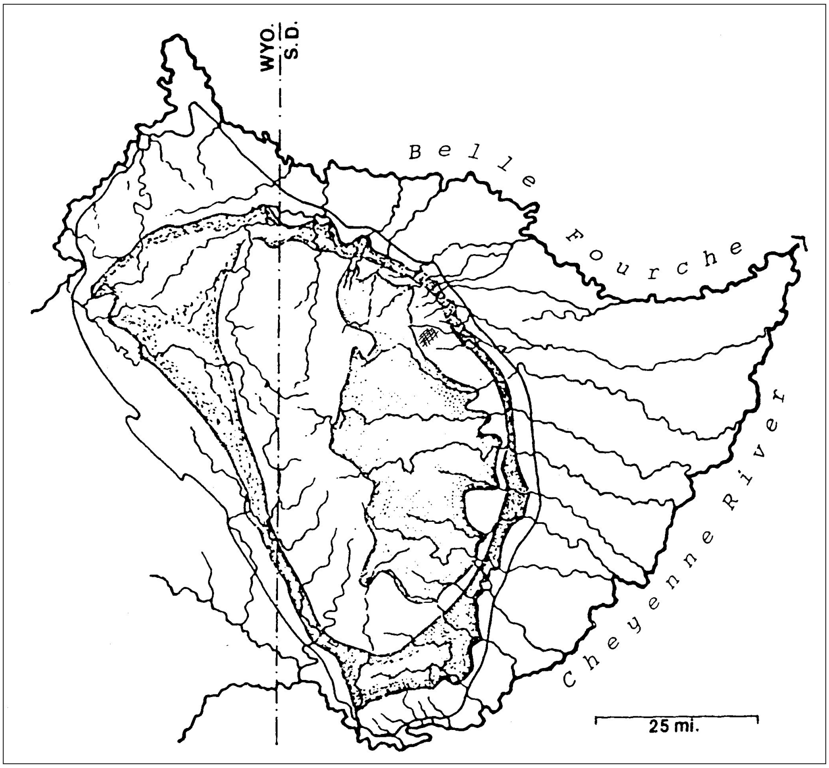


Figure 3.1: Major physiographic zones and drainage of the Black Hills. From the center out: Central Core (stippled area), Limestone Plateau (unstippled ring), Red Valley (stippled ring), and Hogback (unstippled ring). Project location is indicated by crosshatching.

the Red Valley (or Racetrack), and the Hogback Ridge (Figure 3.1).

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 which varies in width from 3 to 25 km. It widens to the west and north. The Limestone Plateau attains an elevation of 2165 m and 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, which includes various Paleozoic limestones, sandstones, and dolomitic shales. The Limestone Zone supports dense pine and spruce forest on the slopes, with open forests and occasional grassy meadows in level areas.

The Red Valley forms a narrow ring around the Limestone Plateau. The relatively unresistant sandstones and clays of the Triassic and Jurassic Sundance and Spearfish formations have been eroded away, leaving a low, flat valley characterized by brick red to purple sediments. The Red Valley varies in width from less than a kilometer to several kilometers and supports a sparse cover of mixed grasses and forbs. Its other name, the Racetrack, can be traced to the occupation of the area by Cheyenne and Lakota groups, just prior to Euro-American contact. Their legend holds that a great race was held here to determine whether the people would be permitted to eat bison or whether the bison would get to eat the people. Thanks to the help of the magpie, the people won.

The last of the main physiographic zones is the Hogback Ridge. This is an area 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 Ridge actually takes the form of a series of cuestas, with their steep slopes facing in toward the central uplift and their gentler slopes facing outward toward the plains. The cuestas are divided by watergaps through which the streams draining the Black Hills flow into the north and south branches of the east-flowing Cheyenne River, which encircles all but a small western portion of the uplift. These watergaps provide natural passages into the interior mountains and have frequently been used for roads and trails, as well as migration routes for bison and other animals (Turner 1974). In the southern Black Hills, the hogback widens to form plateau and canyon country. The Hogback Ridge is vegetated by open pine forest on the inner slopes and grasslands on the outer slopes.

Froiland (1978) recognized a secondary physiographic zone, the Foothills and Minnekahta Plains, forming the transition between the Red Valley and Limestone Plateau. This zone is narrow in the northern and eastern Black Hills, widening into the broad Minnekahta Plains in the southern Black Hills.

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” occurring in the interior uplift. Black Hills soils vary widely depending on the lithology of parent material, slope angle and aspect, vegetation, and drainage. The Black Hills as a whole 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.

3.1.2 Geology

The geologic history of the Black Hills is complex and well studied; a brief summary will suffice here. 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 known on the continent. The outermost formations date to the mid-Tertiary period. The following summary of Black Hills geologic history was abstracted from DeWitt et al. 1986. 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 conglomeratic sediments. These were intruded by mafic rocks about 2.2 billion years ago. Iron-rich sediments interbedded with sand, silt, mud, and volcanic rocks 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 500 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 prominant physical features in 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 was 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.

3.1.3 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, which in turn empties in the Missouri River to the east of the Black Hills. 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. Excepting a few small sinks in the northern Limestone Plateau and a small lake near the base of Bear Butte, no natural lakes are found in the Black Hills. Stream flow varies seasonally, and all but the largest streams are intermittent.

3.1.4 Climate

The Black Hills area has a mountain-type semiarid continental climate (Froiland 1978). The climate is similar to that elsewhere in the northern Great Plains, but somewhat cooler and moister. Summers are generally warm and dry, and winters cold and dry. The weather is highly variable, with an overall annual temperature range of 141^oF. The highest temperature on record is 112^o and the lowest recorded is -52^o (Froiland 1978). Mean annual temperature is 45.6^o; 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 430 to 735 mm, generally being highest in northern sector and at the higher elevations. Most precipitation falls between April and September, with winter snow contributing a lesser amount 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 and 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.

3.1.5 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 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 and in places is associated with a lowland shrub component of currant (*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 (Bouteloua gracilis), buffalo grass (*Buchloe dactyloides*), and Japanese brome (*Bromus japonicus*); dominant forbs are prickly pear (*Opuntia* spp.), yucca (*Yucca glauca*), and sage. The main grass species in the northern sector are western wheatgrass (*Agropyron smithii*) and prairie Junegrass (*Koleria pyramidata*). 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 aududoni*), 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 (*U. arctos horribilis*) and gray wolf (*Canis lupus irremotus*) are now extinct from the area; black bear (*Ursus 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, seventeen 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).

3.2 Natural Resources

The Black Hills are rich in natural resources. In prehistoric times, the area provided both a relatively mild climate and numerous rockshelters to people seeking refuge. Fresh water is available year round; hot mineral waters are found in the southern sector. Abundant timber and stone for building are found throughout the area, as are food plants such as wild fruits, mushrooms, prickly pear, yucca, Indian turnip, and sego lily. Historical records indicate that native groups made trips into the Black Hills to obtain lodge poles. In addition, numerous medicinal herbs and forbs are found in the varied plant communities of the area (Gilmore 1977; Kindscher 1987; Rogers 1980; Van Bruggen 1971). Both large and small game is abundant, with many bird and large mammal species wintering in the interior uplift.

Knappable rock is found throughout the Black Hills, in a variety of colors, textures, and hardnesses probably unsurpassed anywhere (cf. Church 1990; Tratebas 1986; Craig 1983). The massive sandstone cliffs surrounding the interior were used prehistorically as abrasives in the manufacture of bone and wood tools and were also used as a medium on which to carve and paint rock art (Sundstrom 1990). Finally, the physical features of the Black Hills lent themselves to both practical activities, such as scouting and game trapping, and religious activities, such as vision questing. In historic times, minerals and timber, as well as the scenery, have proved to be important resources.

3.3 The Local Environment

The three sites in this study—39LA117, 39LA314, and 39LA319—lie in two high-altitude meadows in the northern Black Hills. Each site is on a broad, well-watered meadow lying between high cliffs and ridges of the Limestone Plateau and Central Basin. The sites lie at the inside edge of the Limestone Plateau. The altitude of these meadows ranges from about 1480 to 1490 m above mean sea level, while the surrounding peaks attain elevations of around 1650 m.

The geology of the project area is discussed in Appendix A. Additional information is available in Redden 1981.

Soils in the project area include Maitland and Citadel association types. Both are alluvial types associated with mountainous side slopes and drainages; the Maitland soils are found on the flood plains and lower terraces and the Citadel soils are found on the second (upper) terraces in the project area. In most places these soils are underlain by limestone, sandstone, and soft shale (or alluvium derived from them), although igneous and metamorphic rocks also occur in the vicinity of ridges and peaks. More specific information about the soils and stratigraphy of the site areas will be found in Appendix A and in the individual site discussions.

The site areas are drained by Little Elk Creek and an unnamed intermittent stream. These small streams are tributaries of Elk Creek and Boxelder Creek, respectively. The latter are permanent streams that flow east through the outer formations of the Black Hills, joining the southern fork of the Cheyenne River well east of the hogback and foothills. Small springs, both intermittent and permanent, are fairly common in the project area. One such spring lies just south of 39LA117 and north of 39LA319.

Like the rest of the northern Black Hills, the project area enjoys a climate that is cooler, windier, snowier, and more humid than that of the southern Black Hills. The average winter temperature is approximately 27^oF. and the average summer temperature is about 64^0. Average annual precipitation in this area of the Black Hills is 735 mm, with 75 percent falling during the period from April to September. On average, 390 cm of snowfall is received. Unlike much of the Black Hills, these high-altitude meadows may remain snow covered throughout much of the winter. Snowfall may be heavy at times; a single spring blizzard in 1977 dumped over 150 cm of snow in the project area. Relative humidity is among the highest in the Black Hills, averaging 50 percent in mid-afternoon and increasing to 70 percent at dawn (Froiland 1978).

A mixed vegetation dominates the project area, with grassy valleys and forested slopes. The meadow flood plains and lower terraces are used for hay and pasturage and have a dense cover of grasses and forbs in season, including bluegrass, timothy, brome, wild rye, aster, yarrow, goldenrod, and ox-eye daisy. Stands of quaking aspen (*Populus tremuloides*) also occur in these low-lying zones. The upper terraces and higher slopes support the ponderosa pine forest typical of the Rocky Mountain Coniferous Forest complex. Ponderosa is by far the dominant species, with common juniper (*Juniperus communis*), bearberry (*Arctostaphylos uva-ursi*), and Oregon grape (*Mahonia aquifolium*) forming the understory. Shrub species found along the banks of streams and near springs include various willows (*Salix* spp.), river birch (*Betula occidentalis*), red osier dogwood (*Cornus stolonifera*), rose (*Rosa* spp.), raspberry (*Rubus* spp.), and currant (*Ribes* spp.).

The fauna of the project area is basically the same as that of the rest of the interior Black Hills. The most commonly seen mammalian species are white-tail deer, mule deer, squirrel, chipmunk, cottontail rabbit, porcupine, skunk, raccoon, coyote, fox, marmot, and elk. Unconfirmed sightings of black bear have been made in the general vicinity within the last two decades (Froiland 1978); however, this animal is certainly not present in the area in significant numbers. Mountain lion seems to be locally extinct in this area, and the reintroduced populations of bison, mountain sheep, and mountain goat do not exist here outside the confines of private ranches. Chubs, suckers, catfish, and minnows seem to be the only fish species native to the Black Hills, although area streams and lakes are now widely stocked with rainbow trout. Migratory birds, waterfowl, hawks, owls, bald and golden eagles, and turkey vultures all frequent the northern Black Hills.

The project area contains numerous resources attractive to prehistoric and historic people. In historic times, gold, silver, galena, tin, and other minerals, timber, and land suitable for cattle grazing drew settlers to the area.

Prehistorically, abundant game and food plants, springs, trees suitable for lodge poles, and knappable cherts and quartzites were important resources in the project area. The open, grassy meadows and shrub-lined creeks undoubtedly attracted deer, elk, and other game. A cornucopia of edible plants was available in season, including raspberry, currant, serviceberry, hawthorn, rose hips, chokecherry, plum, gooseberry, huckleberry, Oregon grape, strawberry, goosefoot, vetch, wild onion, mountain water-parsnip, mint, nettle, and several varieties of mushrooms and puffballs (Kindscher 1987; Rogers 1980; Gilmore 1977; Van Bruggen 1971; McIntosh 1931). Medicinal plants native to the project area include mint, willow, dogwood, yarrow, coneflower, iris, and juniper. Bearberry or kinnikinnick was smoked by the Indians who occupied the area at the time of Euro-American contact.

It is doubtful that the project area was an attractive locale for winter camps, given its typically heavy snow cover, but it had much to offer in the other seasons. With their ready access to fresh water, game, lithic sources, edible plants, and good vantage points, these meadows would have provided excellent places for camping and special activities, such as hunting and berry picking. The stream banks are lined with shrubs that provide winter forage for deer when the ground is covered with snow, in all probability making it a productive hunting area year round. If winter snows were too severe, the relatively sheltered Red Valley was only a short distance away.

Chapter 4

Investigations at 39LA117

4.1 Introduction

Site 39LA117 is the largest of the three sites studied as part of the mitigation project. It lies on the first terrace above the floodplain of Little Elk Creek (Qt_2) and the slope leading to the second (higher) terrace (Qt_1), between the creek and high sandstone and limestone ridges (Figure 4.1). Because of its size and location, the site was thought to have good potential for contributing to an understanding of how high-altitude meadows were used prehistorically and other information on prehistoric settlement and subsistence patterns of the Black Hills. Tools, flakes, and flaking debris found during earlier surface surveys and test excavations at the site suggested that it might contain important information about lithic technology, raw material procurement patterns, and subsistence activities, as well as the cultural chronology of the area.

The site is transected by the proposed right-of-way, with cultural materials showing on both sides of the current Forest Highway 26 (Figure 4.2); thus, extensive damage to the site due to road construction was expected. The site has easy access to permanent water and wood, as well as to the resource-rich meadow shrub and forb plant community. Few lithic sources are found in the immediate vicinity; however, an abundance of knappable rock is available within 25 km of the site.

The mitigation project fieldwork was begun in July 1988, and completed in November of the same year. Lab work and initial analysis immediately followed the fieldwork (Table 4.1).

4.2 Previous Investigations

Site 39LA117 was recorded on August 24, 1977, by SARC personnel as part of a cultural resource survey of the Kelly Timber Sale for the USDA Forest Service, Black Hills National Forest (Boen 1977). The original site dimensions were estimated to be 100 m northwest-southeast by 25 m northeast-southwest,

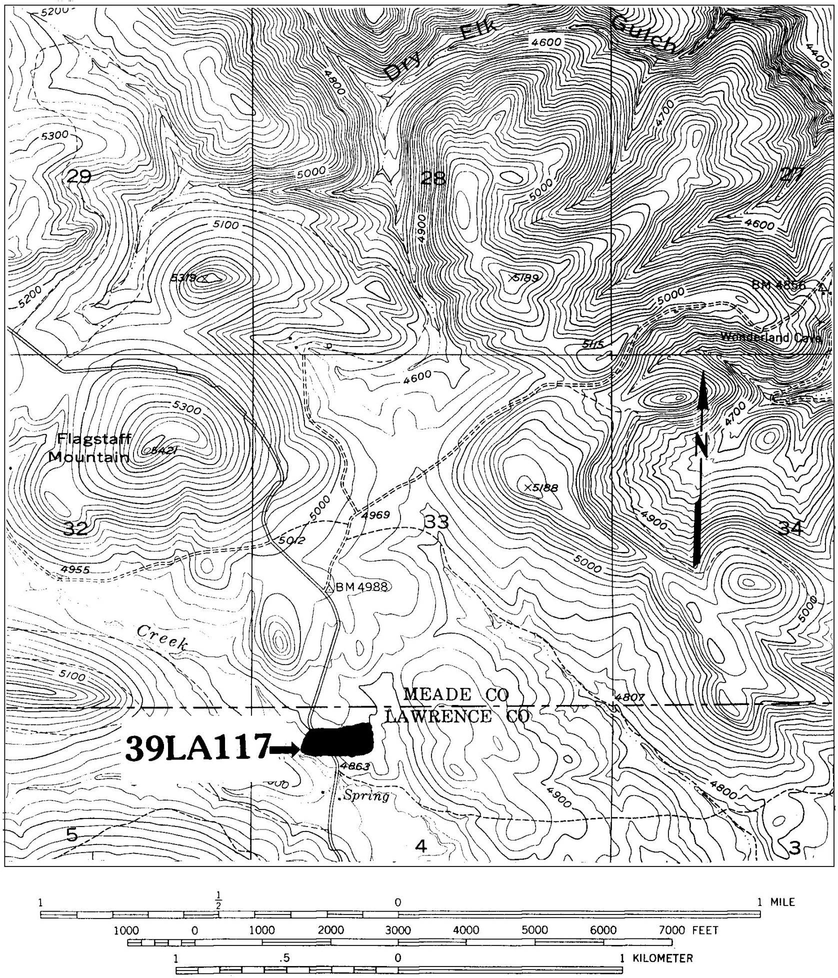


Figure 4.1: Topographic map of 39LA117 vicinity.

Table 4.1: Schedule of field and laboratory work related to mitigative data recovery at 39LA117.

Dates	Activity
7/5–7/9	Organize field camp; obtain Forest Service permit
7/12–7/14	establish grid; inspect site surface
7/15–9/3	shovel test to find N–S site boundaries
9/6–11/14	excavate units; grad portions of site
11/6–11/7	trench site for geomorphological study
winter 1988–89	artifact processing; lab work; analysis

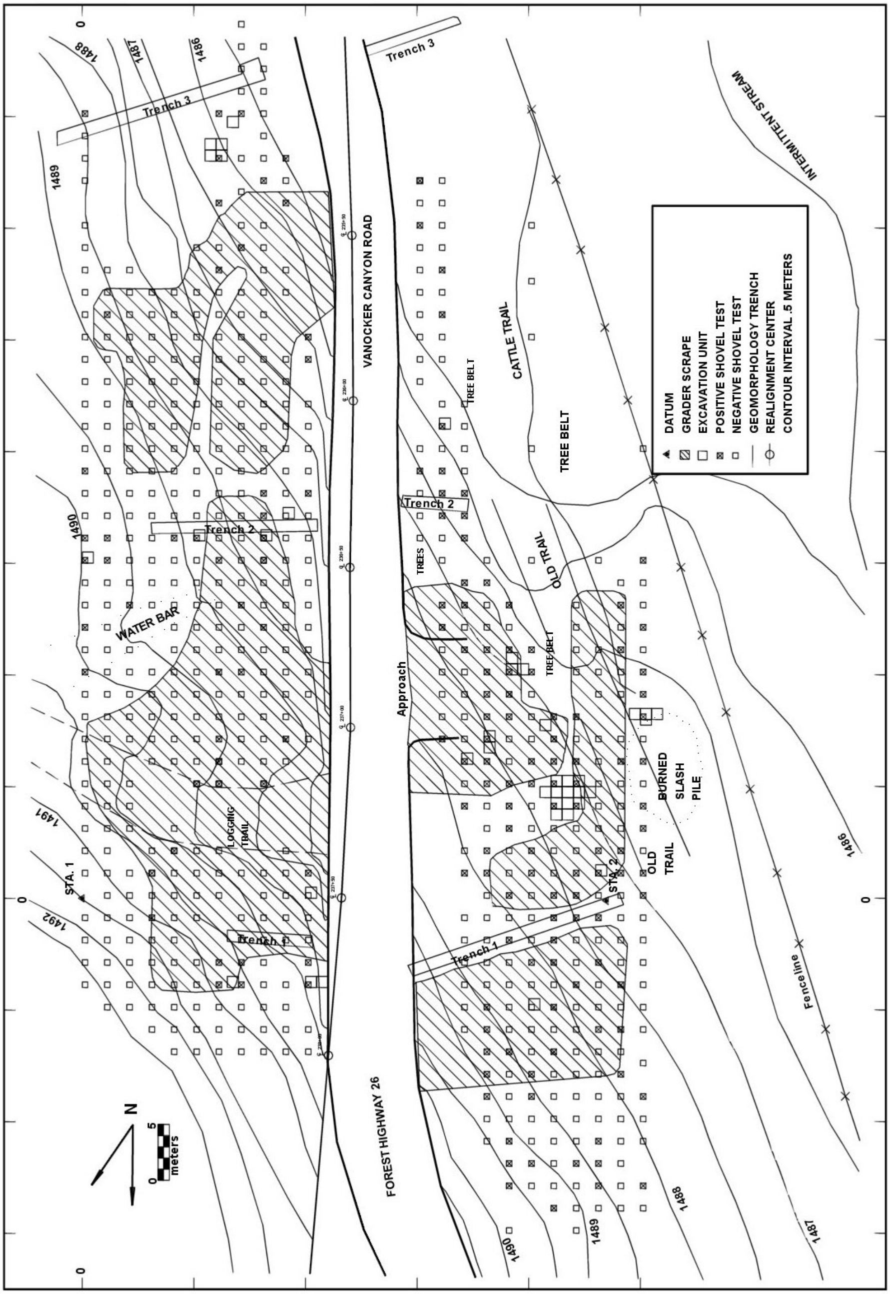


Figure 4.2: Map of 39LA117 showing centerline, excavation units, graded areas, disturbed areas, and shovel tests.

based on the distribution of surface materials recovered from an overgrown trail west of FH26. It was noted that the site might extend onto private property to the west, but this was not investigated. Eighteen artifacts, including two biface fragments, a projectile point preform, a utilized flake, and fourteen flakes, made up the 1977 collection (Table 4.2).

Table 4.2: Collections from previous investigations at 39LA117. Modified flake category includes various kinds of retouched and utilized flake tools.

Artifact Class	Material type: Qtzite	Chert	Chalcedony	Silic. sed.	Vitreous porc.	Total
1977 Surface Collection (77-325)						
Biface	2					2
Preform		1				1
Mod. Flake	1					1
Flake	8	6				14
Total	11	7	0	0	0	18
1978 Surface Collection (78-534)						
Chopper	1					1
Chopper/Adze	1					1
Total	2	0	0	0	0	2
1984 Surface Collection (84-580)						
Proj. Pt.		1				1
Biface		2				2
Mod. Flake		2	2			4
Flake	4	4		2		10
Shatter		1				1
Total	4	10	2	2	0	18
1984 Shovel Tests						
Biface	1					1
Flake	7	6	22			35
Total	8	6	22	0	0	36
1984 Testing (84-580)						
Flake	61	47	111	42	1	262
Shatter		2	4			6
Total	61	49	115	42	1	268
All Collections 1977–1984						
Proj. pt.		1				1
Biface	3	2				5
Preform		1				1
Chopper	1					1
Endscraper/Adze	1					1
Mod. flake	1	2	2			5
Flake		63	133			321
Shatter	80	3	4	44	1	7
Total	86	72	139	44	1	342

A return visit to the site on October 23, 1978, by SARC personnel resulted in the collection of two additional artifacts east of FH26 in a two-track trail. These were identified as a chopper and a combination chopper/adze. Suggested site activities, based on these two collections, were butchering and stone tool manufacturing (Tratebas 1979b:103).

Because the cultural material was observed only in areas of surface disturbance and because heavy vegetation cover hindered investigation of the surrounding area, it was recommended that test excavations be conducted at

39LA117 to determine the extent, as well as the significance, of the site (Tratebas 1979b:103).

During the same period, two other cultural resource surveys were conducted east of FH26, across the road from 39LA117. One was undertaken in 1979 by a paraprofessional from the Black Hills National Forest for the Dalton Timber Sale. The survey included portions of Sections 3, 4, 9, 10, 15, 16, 21, and 22, T3N, R5E (Lindstrom 1980). The other survey consisted of two uranium drill hole locations and access roads for the Tennessee Valley Authority in Section 4, T3N, R5E and Section 33, T4N, R5E, on July 18, 1979 (Lippincott 1980). Neither of these surveys detected cultural material on the surface.

Site 39LA117 again received the attention of SARC in 1984, in response to the U.S. FHWA's proposed realignment of FH26 from Sturgis to Nemo. During the cultural resource survey of the proposed right-of-way, the site was reexamined on July 26, 1984. Cultural materials were observed eroding out of the two-track trail east of FH26, up slope to the north and east. As a result, the site boundaries were expanded to 150 m east-west and 80 m north-south to include this additional area (Church et al. 1985).

The artifact inventory associated with this collection comprises 18 items: a projectile point, two biface fragments, four modified flakes, and eleven pieces of debitage. It was estimated that an additional 60 pieces of debitage were observed in the two-track trail but were not collected.

To help determine the vertical and horizontal extent of the site beyond the exposure created by the east and west trails, 38 shovel tests were dug at this time. A total of 23 tests were dug east of FH26, of which 9 were located in the northeastern portion of the site on or near the trail, 13 were located in the southeastern portion near a high point above the terrace, and 1 was located at the junction of the two-track trail and FH26. Seven produced cultural material and the rest were sterile.

The other 15 shovel tests were dug in and on either side of the overgrown trail west of FH26, on the lower portion of the terrace. Only four of these produced cultural material; the other eleven were sterile. There appeared to be less overburden on the lower portion of the terrace, compared to profiles of the upper level shovel tests, although fewer tests were dug on the lower terrace because the right- of-way was originally located east of FH26.

Sometime in September 1984, the eastern two-track trail was inadvertently reconstructed, along with drainage ditches, in preparation for the Dalton Timber Sale. The grading removed most or all of the cultural level through this portion of 39LA117.

Between October 4 and 24, 1984, four of the shovel tests were expanded to 1-x-1 or 1.5-x-1.5-m units and excavated in 10-cm levels for vertical control. Soil was dryscreened through 1/4- or 1/8-inch hardware cloth at the site. A general summary of the artifacts recovered from these units is also presented in Table 4.2. Quartzite, chert, chalcedony, and nonspecific silicified sediment artifacts dominate the collection, with one piece of vitreous porcellanite present. Only flakes and other lithic debitage were recovered from the excavation units.

An evaluation of all the materials collected from 39LA117 between 1977 and 1984 indicated that stone tool manufacturing, butchering, and timber preparation all may have taken place at the site (Church et al. 1985:149).

The authors of the report on the 1984 project suggested a Late Archaic to Late Prehistoric occupation date, based on the single projectile point collected from the surface of the trail (Church et al. 1985:151); however, the point has since been identified as an Early Archaic type comparable to those recovered from the Hawken site and the Beaver Creek site (Frison 1978:198–200; L. Alex 1991:10), based on morphology, size, and flaking pattern. Application of two mathematical formulas for dating out-of-context Northwestern Plains projectile points, based on their gross morphology (Knight and Keyser 1983), suggested that the point is Archaic, rather than Late Prehistoric.

Mitigative data recovery was recommended for 39LA117, to take place prior to the realignment of FH26. The State Historic Preservation Office and Advisory Council on Historic Preservation concurred. A research design for the mitigation project was submitted for their approval.

4.3 Objectives For 1988

The 1988 excavations at 39LA117 were to partially mitigate adverse effects to archaeological materials located within the FHWA's right-of-way associated with the realignment of Forest Highway 26. The final plans indicated that the new centerline would for the most part be slightly west of the current centerline. Widening and raising the road, as well as logging operations to accommodate construction activities, would all affect the integrity of 39LA117. The 1984 survey and testing on this project (Church et al. 1985) had already suggested the possibility that the current road had taken out a portion of the site, based on observations of cultural material found in shovel tests and trails on either side of the road.

One objective was to determine the linear extent of the site within the right-of-way. The right-of-way impact included 25 m on either side of the centerline, for a total of 50 m bearing roughly northeast-southwest. Because of the landforms and trees, the northwest-southeast impact area extended for a maximum distance of 100 m, with variations on either end. The exact northwest-southeast site boundaries had not been determined during earlier visits to the site or by tests, because the cultural materials were subsurface except in disturbed areas, and the shovel tests and excavations had not been adequate to determine the site boundaries.

A second objective was to recover either time-diagnostic artifacts or sufficient charcoal samples for a radiocarbon date. Only one projectile point fragment had been recovered from the previous investigations at the site, suggesting a possible Early Archaic occupation. This projectile point was found on the surface in an area subject to soil movement; thus, its relationship to the buried cultural deposits was not clear. It was hoped that either additional diagnostic artifacts or datable carbon would aid the definition of discrete cultural components vertically and horizontally across the site. If these were not available, both vertical stratigraphy and variations in the horizontal distribution of artifacts or material types and densities of such materials would be used to define discrete occupation zones.

Related to the definition of cultural components is the definition of activities associated with the occupation of 39LA117. Microscopic examination of tool edge-wear patterns to determine function was one method to be employed to identify the range of site activities. Another method was the analysis of lithic debitage to determine if tools were being manufactured at the site from cores or preforms, or if they were merely being finished or resharpened. This analysis, too, would lend itself to the identification of discrete cultural components if significant differences were recognizable.

A final objective at site 39LA117 was a study of the terrace geomorphology. This would aid in the identification of the formation processes of the Little Elk Creek valley. This information, in turn, contributes to 1) establishing the relative ages of site deposits and thereby dating various portions of the site, 2) understanding what the local environment was like when the site was occupied, and 3) suggesting methods for future archaeological research in similar terrace settings in the Black Hills.

4.4 Methods for Mitigative Data Recovery

Six steps, or field methods, were used to investigate 39LA117. These were 1) establish a grid system, 2) surface collect and examine the site, 3) shovel test at 2-m intervals, 4) excavate 1-x-1-m units, 5) grade off the topsoil to expose the cultural zone, so that it could be examined for possible features, and 6) dig trenches to facilitate a geomorphological study. The mechanics of each step are detailed below.

The first step in investigating 39LA117 was the establishment of a metric grid system in order to control horizontal provenience of artifacts, features, and stratigraphic units. The limits of the grid were in accordance with the prescribed 50-m right-of-way construction boundaries, which parallel the proposed centerline for the new road. The new centerline lay slightly northeast of the present centerline and nearly paralleled FH26 as it cut through 39LA117.

Initially, a metal stake was set into the ground as a site datum, along the eastern right-of-way boundary, 68 feet northeast of centerline stake $237+50-12$. (This stake was located 12 ft (3.67 m) north of the actual centerline.) Then the approximate boundaries of the right-of-way were flagged, either based on survey stakes located along the boundary or measured out from the centerline stakes. Because the right-of-way boundaries represent the limits of archaeological excavation as well as the construction disturbance, the site grid was laid parallel to those boundaries to accommodate testing procedures. As a result "grid north" lies 40^o west of true north. Throughout the general discussion of 39LA117, true compass directions are used except when referring to the grid, shovel tests, or excavation units.

A transit and 100-m tape were used to put in pin flags at 5-m intervals west of the site datum to a maximum distance of 50 m. At each of these 5-m intervals, the transit was set up and the north-south lines were taped in at 5-m intervals to a maximum of 70 m south and 15 m north. The 5-m interval grid was measured along the ground surface.

The east-west limits of the grid were determined by the edge of the right-of-way unless natural surface contours interfered. A steep uphill slope on the northern end east of the road and along the eastern edge of the right-of-way determined the boundaries in those areas. The natural curve of the terrace edge along the southern end determined the boundary in that area. The grid on the northern end west of the road was arbitrarily discontinued at 15 m.

As time permitted, a theodolite and metric rod were used to measure the ground surface elevation with respect to site datum at each 5-m pin flag interval. A nearby construction survey stake with a known elevation was used to tie in the actual site datum elevation. This information was later converted to metric measurements and approximate contour intervals were drawn on the site map.

After completing the 5-m interval grid system, a general surface inspection of 39LA117 was undertaken to identify the location of surface artifacts, erosional patterns, and unnatural disturbances. Information plotted on a field map marked off with the 5-m intervals included the relative locations of FH26, two trails leading off of this road, a waterbar, and clusters of young pines. The field map was continually updated throughout the fieldwork.

A surface collection of 5-m blocks in the eastern graded trail was conducted based on the results of the surface inspection. Because the artifacts collected in these areas seemed to be the subject of out wash from the cut bank or simply washed down slope in the trail, more exact horizontal provenience was not recorded.

The surface inspection helped identify areas of disturbance, exposed cultural material, and areas completely obscured by vegetation. Although this indicated a few likely areas to test, it also emphasized how little was actually known about the distribution of cultural material at 39LA117.

Following the surface inspection of 39LA117, shovel tests were dug at 2-m intervals in order to identify possible buried activity areas and the north-south site boundaries within the right-of-way. Shovel tests were limited to the 50-m right-of-way boundaries to the east and west. To the north and south along the grid, shovel tests were carried out until a number of tests were sterile, the land slope changed drastically, or some natural barrier (rocks or tree roots) made testing impossible.

Shovel testing began along the 0-west line on the eastern right-of-way boundary. A 100-m tape and mason line were temporarily strung out along the 0W line of the 5-m grid. The tape was used to measure the 2-m intervals between shovel tests. The shovel tests were dug to the southwest of the 2-m marks, using the grid coordinate of the northeast corner as the unit identification number. The 100-m tape and mason line were moved parallel along the grid to the west at 2-m intervals as shovel testing progressed across the site.

Ideally, the dimensions of a shovel test were 30-x-30-x-30 cm, but many exceptions were made. In several cases, rocks or tree roots partially or completely interfered with a shovel test. Disturbed areas were excavated in some cases, such as where soil was artificially piled next to a stump or the waterbar, if the overburden could be stripped off down to the original ground surface. This also helped identify the type and extent of disturbance. In other cases, where it was obvious that the soil associated with the cultural zone had already been stripped off, such as in the middle of the waterbar or on the eastern trail off of FH26, the shovel test was usually not dug.

The tests were dug with shovels or trowels, depending on the nature of the soil and the presence of large rocks below the surface. Soil from the tests was screened through 1/4-inch mesh. All cultural material recovered from screening was bagged, labeled, and returned to the lab for processing.

A shovel-test form was filled out for each unit dug, indicating the dimensions of the test, the nature of the soil, the number and type of artifacts found, and any comments. The number and type of artifacts recorded on these forms were transferred to the site map used in the field. This map also indicated which shovel tests were not dug or were sterile, thus providing an overview of the results of shovel testing at 39LA117.

Although necessary at a subsurface site of this nature, shovel testing was time consuming and tedious. A total of 653 shovel tests were dug. Of these, 498 (76.26 percent) were sterile and 155 (23.73 percent) produced at least one flake, tool, or bone fragment (Table 4.3). The location and result of each shovel test was plotted on a site map, which was later used to identify possible buried activity areas.

The shovel tests not only provided information concerning distribution of subsurface material, but also provided valuable information concerning site stratigraphy. Shovel testing helped identify disturbed areas not easily recognized on the surface, such as natural gullies cut and later refilled along the slope at the southern end of the site. It also became apparent that at least one, but more likely several, forest fires and/or slash pile burns had occurred over the site. In many of the shovel tests, flecks or even large chunks of charcoal and unburned wood were observed. This was useful to know when noncultural, misshapen, or even circular black stains associated with charcoal, unburned wood, and roots were uncovered during excavation of the 1-x-1-m units.

Even though it was not an enviable task, shovel testing did provide a basis for further investigations at 39LA117. It helped determine the probable depth at which cultural material would be encountered at different locations across the site, the types of soils at the site, and so on. It also helped determine where grading off layers of topsoil to expose the cultural level would be most beneficial later on.

After the shovel tests were completed, the results were plotted on a 5-m grid site map. Symbols were used to indicate which tests were sterile, not dug at all, or productive. Productive tests were further identified as to number and type of cultural material (debitage, tool, or bone). Once the shovel tests and the map were completed, clusters of subsurface cultural material became apparent at

Table 4.3: Results of shovel tests at 39LA117

			East of Forest Highway 26			
N–S Grid Line	1umber Excavated	2umber Sterile	3umber Productive	4umber Not Dug	Northern Limit	Southern Limit
0W	37	31	6	3	8N	70S
2W	34	31	2	0	10N	56S
4W	31	30	1	4	10N	56S
6W	27	25	2	7	12N	54S
8W	32	30	2	4	14N	56S
10W	32	30	2	6	14N	60S
12W	36	25	11	7	14N	70S
14W	39	33	6	7	14N	78S
16W	42	35	7	4	14N	76S
18W	33	30	3	8	14N	64S
20W	25	19	6	9	14N	52S
Total	368	319	49	59		
% Subtotal	100	86.68	13.31			
% Total	56.97	49.38	7.58			
			West Of Forest Highway 26			
30W	16	13	3	2	30S	64S
32W	24	15	9	1	14S	64S
34W	25	16	9	4	12N	44S
36W	27	12	15	0	22N	30S
38W	24	10	14	5	30N	26S
40W	30	19	11	15	26N	60S
42W	23	11	12	0	28N	16S
44W	27	18	9	2	30N	26S
46W	25	17	8	5	28N	30S
48W	28	19	9	1	28N	28S
50W	29	17	12	6	28N	40S
Total	278	167	111	41		
% Sub-Total	100	60.07	39.93			
% Total	43.03	25.85	17.18			
			Total Site			
	Excavated	Sterile	Productive			
Total	646	486	160			
% Total	100	75.23	24.77			

various points across 39LA117. The area with the highest density of subsurface cultural material was located in the western portion of the site between the 6 and 20 south lines and the 33W and 50W lines. This area included the less frequently used graded trail near the terrace edge.

North of this area, the grid was expanded out from the original 15N stake to 30N, until shovel tests seemed less productive or vegetation interfered. With few exceptions, most of the productive test units contained only one or two flakes or pieces of debitage.

South of the most productive area, between FH26 and the tree belt west of the road, scattered shovel tests contained one to three flakes or pieces of debitage. Significantly, four shovel test units in this area contained tools.

Across the road, a few areas contained more than one or two flakes, although none of the areas seemed as productive as west of the road. Unfortunately, most of these areas were adjacent to major disturbances at 39LA117. It was thought that, although some intact cultural material was probably present, large portions of the site had already been destroyed. At the southern end of this area, a projectile point base was discovered in the shovel test. Another shovel test approximately 4 m away produced four flakes. A single flake was found 2 m away. This area seemed relatively undisturbed, although subject to slope wash.

After the site area within the right-of-way was shovel tested at 2-m intervals, 1-m square excavation units were opened at various locations across the site. A total of forty units (39 1-x-1-m and one 1-x-0.5-m) were excavated between August 6 and November 14, 1988. Twenty-six units were located west of FH26, where 70 percent of all positive shovel tests were located. Within this area, the main block excavation of 13 units lies between the 44W and 46W lines and the 7S and 11S lines. Four units were opened at and near 16S/50W, another area containing a high number of artifacts. Three units were opened just south of the trail at 14S/35W. The first area opened west of FH26 was highly productive and several more units were opened there. Later, areas with lesser concentrations were opened beginning on the eastern portion of the site. Four 1-x-1-m units were opened north of the two-track trail and five south of the trail. Only one of these, Unit 21, at the extreme southern end of the site, was particularly productive. This was expanded to a 2-x-2-m unit.

The other 14 units were placed east of FH26. Aside from Units 8 and 11, which were adjacent at 8N/20W, and Units 21, 22, 32, and 36, which formed a 2-x-2-m square at the southern end of the site, units were single and scattered across the eastern side of the site. These units were laid in to help identify other possible activity areas or separate cultural components.

Although lithic debris was scattered in varying degrees of density across the site, it appeared that two main areas were still intact. One of these areas occurred at the southern end of the site east of FH26 and the other was centrally located within the right-of-way west of FH26. Other areas were productive, but either occurred in disturbed areas or did not show up in the initial shovel tests and were not discovered until exposed by grading at the site. By the time an area was graded, it was difficult to assess the extent of the concentration.

The shovel test map, indicating the amount of cultural materials recovered across the site, became the basis for deciding the location of the initial 1-x-1-m excavation units. Several areas were chosen for investigation, using quantity of cultural material as the main factor and artifact type as a secondary factor. For example, if an area had very few artifacts, but some of those were tools, it was chosen over an area containing a similar number of artifacts with no tools. Location was another factor. Several units were opened at various locations, not because a high number of artifacts had been found, but because several productive shovel tests formed clusters surrounded by a number of sterile shovel tests. This suggested the possibility of isolated activity areas or separate cultural components. The 1-x-1-m excavation units in these areas would also help determine the reliability of shovel test results as indicators of actual subsurface material.

The location of some excavation units was taped directly off of the flags on the 5-m grid system. In other instances, where flags had been knocked out of place by cattle, the theodolite was used to shoot in new reference points and excavation units were taped off these. In most cases, a 2-x-2-m unit was taped in first, so that a productive 1-x-1-m unit could easily be expanded.

Excavation techniques, although similar throughout the project, were tailored to meet changing needs as work progressed. Although test excavation at the site in 1984 and shovel tests in 1988 indicated that subsurface cultural material existed at 39LA117, it had never been determined if more than one cultural component was present at the site. This necessitated strict vertical control from the outset.

Originally, the sod layer, which was generally sterile, was removed by shovel skimming and screened through 1/4-inch hardware cloth. When cultural material was encountered, often within 5 or 10 cm of the surface, a trowel was used to remove soil and the screen was changed to 1/8-inch mesh. Cultural material found in situ was mapped in three dimensions, as to depth from unit datum and distance from two conjoining walls of the unit, using a line-level and 5-m tape.

The unit datum was established in the northeast corner of the unit whenever possible. If two or more adjacent units were opened, they usually shared the same unit datum to simplify mapping later. Excavation proceeded at 10-cm levels measured from the unit datum.

The first two excavation units dug at 39LA117 (Units 1 and 2) contained a dense concentration of lithic debris starting at 15 cm below surface and continuing to 40–45 cm below surface. Mapping every piece of cultural material found in situ was time consuming; therefore, an alternative method was adopted for maintaining vertical control. Although not as accurate, it did not require the vast amount of time to excavate a single 10-cm level as did the troweling and piece-plotting method. Instead, soil was shovel skimmed in 5-cm increments, bagged and labeled, and returned to the lab for waterscreening. Only tools or heavy concentrations of lithic debris were piece plotted as described above. If a possible feature appeared in the unit, the shovel skimming was again abandoned for the troweling method.

Although some control of vertical and horizontal provenience data was compromised for the sake of time, other benefits were realized by abandoning the time consuming piece plotting of hundreds of tiny pieces of lithic debitage. One benefit was that more excavation units could be opened across the site, in order to investigate areas of possible buried cultural material indicated by the shovel test results. Another benefit was that the waterscreening process used 1/16-inch mesh, as opposed to the 1/4- or 1/8-inch mesh used in the field. This resulted in a much more complete artifact recovery. It was observed that lithic debris had been missed by the field screening even when 1/8-inch mesh was used.

A 2-liter soil sample was collected from each 10-cm level or from both the upper and lower 5 cm of a level. These samples were returned to the lab for flotation processing. The material recovered from flotation was compared to that recovered from dryscreening through 1/4- and 1/8-inch mesh, to determine whether significant cultural material was being lost through the larger gauge screens. The large numbers of very small flakes recovered in the waterscreening process indicated that this was, in fact, the case. As field time became critical, the 2-liter sample was not collected in the field. Instead, it was collected at the lab from the soil bagged in the field.

As other units were opened outside the main excavation block, the presence of cultural material had not been established with any degree of certainty. Until it was, the original techniques of shovel skimming, screening through 1/4-inch hardware cloth, and removing 2-liter soil samples in the field were employed. If cultural material was present in an area, soil was bagged for waterscreening, as described above. Because techniques varied somewhat from unit to unit, the specific techniques used to excavate each are discussed under the description of each unit (Table 4.4).

Table 4.4: Summary of field methods at 39LA117, 1988 field season. Depth is given in cm below surface at unit datum. Quarter- and 1/8-inch (and both) dryscreening was done in the field; 1/16-inch waterscreening was done in the lab. In a few cases artifact counts are best approximates (in order to include material waterscreened from balks between units). Artifact counts include materials from soil/flotation samples; the counts do not include historic artifacts, snails, bone, seeds, or charcoal

Unit	Location	Level	Depth	Screen	Float Sample	Artifacts Present
1	8S/42W	1	0-10	1/4”	yes	0
1		2	10-20	1/4”	yes	20
1		3	20-30	1/4”	yes	99
1		4	30-40	1/8”	yes	27
1		5	40-50	both	yes	2
2	9S/42W	1	1-10	1/4”	yes	0
2		2	10-20	1/4”	yes	2
2		3	20-30	1/16”	yes	785
2		4	30-40	1/16”	yes	819
2		5	40-50	1/16”	yes	141
3	8S/43W	1	0-20	1/8”	yes	11
3		2	20-30	1/8”	yes	524
3		3	30-40	1/16”	yes	1052
3		4	40-50	1/16”	no	104
4	9S/43W	1	10-20	1/8”	yes	4
4		2	20-30	1/8”	yes	156
4		3	30-40	1/8”	yes	120
4		4	40-50	1/16”	yes	49
5	7S/42W	1	0-10	1/8”	yes	4
5		2	10-20	1/8”	yes	64
5		3	20-30	1/16”	yes	775
5		4	30-40	1/16”	yes	82
5		5	40-50	1/16”	no	25
6	7S/43W	1	10-20	1/8”	yes	7
6		2	20-30	1/16”	no	2911
6		3	30-40	1/16”	yes	297
6		4	40-50	1/16”	yes	79
7	8N/13W	1	0-10	1/4”	yes	1
7		2	10-20	1/8”	yes	2
7		3	20-30	1/8”	yes	6
8	8N/20W	1	0-10	1/8”	yes	0
8		2	10-20	1/8”	yes	30
8		3	20-30	1/8”	yes	30
9	0S/20W	1	0-10	1/4”	yes	0
9		2	10-20	1/4”	yes	3
9		3	20-30	both	yes	4
9		4	30-40	1/8”	yes	11
10	32S/16W	1	0-10	1/8”	yes	8

Table 4.4: continued

Unit	Location	Level	Depth	Screen	Float Sample	Artifacts Present
10		2	10-20	1/8”	yes	56
10		3	20-25	1/16”	yes	73
10		3	25-30	1/8”	yes	35
10		4	30-40	1/8”	yes	8
11	8N/21W	1	10-20	1/8”	yes	0
11		2	20-30	1/8”	yes	1
11		3	30-40	1/8”	yes	2
11		4	40-50	1/8”	yes	1
12	9S/44W	1	0-20	1/4”	no	1
12		2	20-25	1/8”	yes	33
12		2	25-30	1/16”	yes	175
12		3	30-40	1/16”	yes	149
12		4	40-45	1/8”	yes	0
13	30S/0W	1	0-10	1/4”	no	0
13		2	10-20	1/4”	no	1
13		3	20-30	1/4”	no	2
13		4	30-40	1/4”	no	2
14	69S/13W	1	0-10	1/8”	no	0
14		2	10-20	1/8”	no	0
14		3	20-30	1/8”	no	5
14		4		1/8”	no	0
15	42S/32W	1	0-10	1/4”	yes	0
15		2	10-20	1/4”	yes	1
15		3	20-30	1/4”	yes	1
16	12S/34W	1	0-10	1/8”	no	0
16		2	10-20	1/8”	yes	61
16		3	20-30	1/8”	yes	12
17	32S/10W	2	10-20	1/4”	no	0
17		3	20-30	both	no	11
17		4	30-40	1/8”	yes	29
17		5	40-50	1/8”	yes	9
18	10S/42W	2	10-20	1/8”	yes	2
18		3	20-25	1/8”	yes	200
18		3	25-30	1/16”	yes	219
18		4	30-40	1/16”	yes	2817
18		5	40-50	1/16”	yes	216
19	20S/38W	1	0-10	1/8”	yes	6
19		2	10-20	1/8”	yes	41
19		3	30-40	1/8”	yes	10
19		4	40-50	1/8”	yes	3
20	10N/40W	1	0-10	1/4”	no	0
20		2	10-20	1/8”	yes	21
20		3	20-30	1/8”	yes	14
21	66S/12W	1	0-10	1/4”	no	0
21		2	10-20	1/8”	no	71
21		3	20-30	1/8”	no	35
22	66S/11W	1	0-10	1/8”	no	57
22		2	10-20	1/8”	no	337
22		3	20-30	1/8”	no	111
23	20S/39W	1	0-10	1/4”	yes	1
23		2	10-20	1/4”	yes	5
23		3	20-25	1/8”	yes	13
23		3	25-30	1/16”	yes	32
23		4	30-40	1/8”	no	12

Table 4.4: continued

Unit	Location	Level	Depth	Screen	Float Sample	Artifacts Present
24	14S/36W	1	0-10	1/4”	no	16
24		2	10-15	1/4”	no	33
24		2	15-20	1/16”	yes	369
24		3	20-30	1/16”	yes	203
25	34S/18W	1	0-10	1/8”	no	0
25		2	10-20	1/8”	yes	15
25		3	20-30	1/8”	no	0
26	16S/50W	1	0-10	1/16”	yes	1002
26		2	10-15	1/16”	yes	97
26		3	15-30	1/8”	no	38
27	21S/38W	1	0-10	1/16”	yes	0
27		2	10-20	1/8”	yes	10
27		3	20-30	1/16”	yes	130
28	15.5S/50W	1	0-10	1/16”	yes	1879
28		2	10-20	1/16”	yes	24
29	15S/41W	1	0-10	1/16”	yes	59
29		2	10-20	1/16”	yes	181
30	13S/36W	1	0-10	both	no	0
30		2	10-20	1/16”	yes	195
30		3	20-30	1/16”	yes	22
31	16S/49W	1	0-10	1/16”	yes	1063
31		2	10-20	1/16”	yes	102
32	67S/11W	1	0-10	1/8”	yes	195
32		2	10-20	1/16”	yes	8
33	2S/46W	1	0-10	1/16”	no	3
33		2	10-20	1/16”	no	65
33		3	20-30	1/16”	no	53
34	9S/45W	2	0-20	1/16”	yes	0
34		3	20-30	1/16”	yes	33
34		4	30-40	1/16”	yes	86
35	16S/51W	1	0-10	1/16”	no	1625
35		2	10-20	1/16”	no	1847
35		3	20-30	1/16”	no	126
36	67S/12W	1	0-17	1/16”	no	1
36		2	17-27	1/16”	yes	115
36		3	27-37	1/16”	yes	82
37	9S/41W	1-3	0-30	1/16”	no	1592
37		4	30-40	1/16”	yes	152
38	10S/43W	3	0-30	1/16”	yes	380
38		4	30-40	1/16”	yes	402
38		5	40-50	1/16”	yes	36
39	8S/44W	3	0-30	1/16”	yes	124
39		4	30-40	1/16”	yes	160
39		5	40-50	1/16”	yes	88
40	10S/44W	1	23-40	1/16”	yes	77
40		2	40-50	1/16”	yes	69

State of South Dakota excavation level forms and unit summary forms were used to record data from each unit. Plan views and profiles were drawn of several units to identify the stratigraphy from various areas of the site. In most cases photographs using black-and-white print and color slide film were taken of the floor of the unit.

By October 19, 21 of the 40 excavation units had been finished or at least started. Nine of these were located east of FH26, still leaving large areas yet to be investigated. Most of the shovel tests on this side of the site were sterile. If they did contain cultural material, they were associated with a disturbed area such as the dirt trail or the waterbar. The only area that still showed some promise was at the extreme southern end, near the location of shovel test 70S/14W, which contained a projectile point base. It was decided that grading off the topsoil east of the road in thin layers would facilitate the effort to locate any features or concentrations of cultural material that might exist below the surface. The area near 70S/14W was left intact for further excavation.

A crew of seven looked for subsurface evidence of cultural remains as the grader stripped off thin layers of soil in the eastern portion of the site. Shovel skimming and troweling were both employed to check suspicious stains, profiles, and possible concentrations of lithic material. Thin layers were continually removed from one blade width until the soil associated with the cultural zone, as identified in shovel tests and excavation units on the east side of the road, was exposed.

What was first suggested by shovel tests became obvious during the grading activities east of the road, namely that forest fires had occurred across the site. Numerous small, round, black stains were exposed below the topsoil and forest litter. Small chunks of charcoal and unburned wood were commonly associated with these stains.

Grading east of the road also exposed some cultural material. A few flakes and a small tool preform fragment were found north of the dirt trail near Unit 7 (8N/13W) and east of Unit 9 (0S/20W). A few more flakes were exposed south of the trail near 60S/20W. Both of these areas were carefully troweled but no more cultural material was exposed. A few tools, including modified flakes and flake tools were among the artifacts exposed by the grading. Concentrations of flakes were also exposed by the grading, on both sides of the road. An isolated unifacial tool was also found south of the dirt trail, in the vicinity of 26S/15W.

The area of greatest interest was between 30 and 33 m south and 16 and 19 m west of datum. A bifacially worked tool, several flakes, and two projectile point bases were found. Another concentration of flakes was found a few meters to the east. Both areas were shovel skimmed and the soil screened through 1/8-inch mesh. After the grading, Unit 25 (34S/18W) was excavated in an intact area just south of where the uniface was found.

The site area west of FH26 was not graded at this time because the ongoing block excavation was still producing quite a large number of artifacts, and work was concentrated in this area. As November approached and weather became a factor, portions of the west side of the site were also graded. An occasional flake or tool was found, as well as two bifacial tools near Unit 33 (2S/46W). Shoveling and screening were used to salvage additional flakes associated with the bifacial tool.

A little more grading was done east of the road at this time in areas originally left intact until the location of trenches for the geomorphological study were known. A few flakes were exposed by the waterbar on the eastern edge of the right-of-way at this time.

Overall, grading portions of 39LA117 seemed inevitable considering the site size, depth of cultural material, and time and weather limitations associated with the project. Even though grading is a very destructive method of investigating an archaeological site, it was necessary to insure that any important activity areas or other types of features would not go undetected. The soil was stripped down to the cultural zone without the entire zone being destroyed.

The final method used to investigate 39LA117 involved the outside help of a geologist. In order to study formation processes of the Little Elk Creek valley, and to help determine the cultural chronology of the site, three trenches were dug in an east-west direction across 39LA117. Results of the study are presented as Appendix A.

4.5 Laboratory Methods

Lab work for 39LA117 began immediately at the close of field work in mid-November 1988 and continued intermittently until the field season closed for the winter. At that time, lab work progressed with the efforts of one to three individuals.

A large quantity of soil, 4398 liters, was collected in the field and returned to the lab for processing. Two waterscreening stations were established at the office to facilitate indoor washing throughout the winter months.

Each soil sample was measured, recorded, and washed through 1/16- inch window screen. Materials recovered this way were transferred to drying baskets, air dried, and sorted. All lithic and bone material and a small sample of snails and charred seeds were sorted out of the waterscreen residue. Because no hearth features were identified and there was direct evidence of one or more forest fires across the site, the charcoal found in the soil samples was not collected. Although some seeds and charred bone were recovered, it was later determined that these were not associated with cultural activities at the site. Bone and seed fragments were counted and, when possible, identified as to species.

All the artifacts from waterscreening and dryscreening in the field were cataloged at the same time and the means of collection recorded.

Cataloging procedures included size grading the lithics using a series of five screens. The lithics were sorted into the following size grades:

- Grade 1 (G1): 25.4 mm mesh (1 opening per inch)
- Grade 2 (G2): 12.7 mm mesh (2 openings per inch)
- Grade 3 (G3): 6.3 mm mesh (4 openings per inch)
- Grade 4 (G4): 3.2 mm mesh (8 openings per inch)
- Grade 5 (G5): 1.6 mm mesh (16 openings per inch)

After the materials were size graded, they were initially sorted by material type, as well as into tool and debitage categories. The tools were handled separately in the edge wear analysis. Tool and debitage classification and lithic raw material typology were based on the SARC Cataloging Guide. After the initial cataloging, the debitage was weighed, counted, and tabulated in preparation for analysis.

The following lithic tool categories were used in the initial cataloging of artifacts from 39LA117:

Biface A biface is any item that has bifacial modification that completely covers or nearly covers both dorsal and ventral faces.

Uniface A uniface is any item that has unifacial modification that completely or nearly covers either the dorsal or ventral faces, but not both.

Retouched/Utilized This category consiss of any item that exhibits use wear or purposeful modification along one or more sections of its margins extending onto one face only.

Bifacially Retouched/Utilized Bifacially retouched or utilized artifacts are those which exhibit use wear or purposeful modification along one or more sections of their margins which extend onto both faces at the same point of the margin.

Later, recognized formal tool classes were used to categorize lithic tools. These categories combine morphological and functional traits. They include projectile point, biface, bifacial knife, sidescraper, endscraper, other scraper, preform, graver, perforator, heavy retouched flake knife, light retouched flake knife, utilized flake knife, adze, and chopper. Tool classes approximated those defined in an earlier study of Black Hills settlement patterns (Tratebas 1986) as closely as possible.

Due to the somewhat arbitrary nature of tool classification in general and this system in particular, some inconsistencies may enter into the tool classifications presented here. Most tools, however, could readily be placed into one or another of the defined tool classes. One tool class, *biface fragment*, was added for the present study. This class comprises pieces of bifaces that lack adequate use wear or edges to allow determination of their function. These are bifacially worked artifacts which show little or no use wear. The present study also makes a distinction between preforms, whose probable final use cannot be construed from the size and shape of the artifact, and projectile point preforms, representing probable unfinished projectile points.

For purposes of description and classification, flake tools and unifaces were oriented so that the striking platforms were proximal and margins were distal or lateral. The dorsal side is that which would have been on the outside of the core when the flake was removed and the ventral side is that which would have been on the interior of the core, usually exhibiting a bulb of percussion. Medial fragments were oriented with the bulb of percussion as the proximal, if visible.

Bifaces were oriented with the haft modification as proximal and the working edge as distal, if these could be recognized. If one side of the tool was flatter, that was considered the ventral, and the more ridged side was considered the dorsal, otherwise these terms were not applied to bifaces.

Debitage was sorted into cores, flakes and flake fragments, thinning flakes, and shatter. Shatter was defined as angular or blocky chipping debris that does not exhibit any evidence of a striking platform or bulb of percussion. Thinning flakes were recognized on the basis of the acute angle of the striking platform, the dorsal face exhibiting previous flake removal, and prepared striking platform.

After identifying the artifact type, the material type and color were recorded. The Munsell rock color chart (Geological Society of America 1984) was used to determine raw material color. The following lithic raw material categories were used.

Chert, Chalcedony, and Silicified Wood This category subsumes a large number of lithic materials, many of which may have been individually described and named in the archaeological literature. These materials are composed of cryptocrystalline or microcrystalline quartz and can exhibit a wide range of appearances. Specimens may be nearly transparent to opaque and of any color or combination thereof. Luster ranges from dull or earthy to vitreous. Fracture properties vary from flat or blocky to highly conchoidal. Cherts/chalcedonies may contain a variety of crystal and fossil inclusions which affect knapping quality.

In this report, chert, chalcedony, and silicified wood were differentiated, despite their often similar appearances. Silicified wood was recognized on the basis of structure and fluorescence. Its structure retains the linear or fibrous structure of the wood, visible macroscopically or microscopically. Silicified wood exhibits lemon yellow fluorescence. Chalcedony was recognized on the basis of its light green to lime green fluorescence. Knife River flint was recognized on the basis of its orange fluorescence. Cherts do not fluoresce. Both cherts and chalcedonies are locally abundant in the central and exterior Black Hills.

Quartzite The term *quartzite*, as used here, refers to clastic sedimentary rocks cemented by silica in which detrital grains are predominantly sand size. The Udden-Wentworth grade scale classifies as sand those sediments between 0.00625 mm and 2.0 mm in diameter (Blatt et al. 1980:Table 3-3). All specimens in which the predominance of visible clasts were in this size range, when compared to a grain size chart (Sigma Gamma Epsilon n.d.), were placed in this category. Quartzites may be of any color, though shades of orange, red, purple, brown, and gray occur most frequently. The luster of quartzite is difficult to describe due to the uneven surface of fractures; overall appearance ranges from dull with ‘sparkle’ to nearly vitreous in very fine-grained specimens. Some coarser quartzites are difficult to knap because of their blocky fracture, while medium- to fine-grained varieties display good to excellent conchoidal fracture properties. Coarse-grained Deadwood formation quartzite outcrops near 39LA117; a wide variety of finer-grained quartzites can be found throughout the hogback physiographic formation surrounding the interior Black Hills.

Silicified Siltstone Silicified siltstones are microcrystalline or macrocrystalline clastic sedimentary rocks made up predominantly of silt-sized grains which have been cemented with silica. Silt ranges from 0.0039 mm to 0.00625 mm (1/160 mm) in diameter on the Udden-Wentworth grade scale (Blatt et al. 1980:Table 3-3). Those specimens in which most of the visible clasts were less than 1/160 mm, when compared to a grain size chart (Sigma Gamma Epsilon n.d.), were placed in this category. While colors may vary widely, shades of gray, bluish-gray, tan, and yellow are most common. Fracture properties range from blocky to highly conchoidal. Luster of silicified siltstones is generally dull or earthy, with fractured surfaces of individual grains giving a sparkled appearance. Silicified siltstone is abundant in the interior and exterior Black Hills, especially where the Morrison formation outcrops.

Porcellanites Porcellanites consist of microcrystalline, fine-grained sedimentary rocks which have been thermally metamorphosed by the burning of adjacent coal seams. The degree to which the rocks have been fused is dependent upon the proximity to and intensity of the heat source, as well as the mineral composition of the original sediments (Fredlund 1976). Color varies greatly. Shades of gray and red are most common, though black, yellow, buff, brown, pink, and purple occur. Some specimens may contain two or more colors bonded together. Luster ranges from the dull or earthy look of unglazed porcelain, through waxy, to vitreous. Fracture properties, too, are variable. Relict sedimentary structures in some specimens inhibit controlled knapping. Others display good to excellent conchoidal fracture. Porcellanite is softer than chalcedonies, rating between 5 and 6 on the Mohs scale of hardness (Fredlund 1976) and is described by Frison and Stanford (1982) as "somewhat inferior to chert and quartzite, particularly for working edges of tools." Porcellanites do not occur locally, but are abundant in the Powder River Basin just to the west of the Black Hills.

Siliceous Shale or Slate This category was devised to describe a concentration of rather distinctive lithic material recovered from Units 21, 22, 32, and 36 in the southern portion of 39LA117. The texture is generally similar to that of a medium- to fine-grained chert, with no definite individual grains distinguishable under a binocular microscope at 25x magnification. Colors range from medium light gray (N6) through grayish black (N2) and brownish black (5YR2/1) to blackish red (5YR2/2) and very dusky red (10R2/2). Color is fairly homogeneous in some pieces; in others banded, with indistinct layers of the lighter group, which appear as lenses, stringers, and broken lines of minute spots under magnification, interspersed with similar layers of the darker values. In some specimens, the bands contain what appear to be areas of voids or cavities partially to completely filled with crystals of a dark reddish brown (10R3/4) color, possibly stained by hematite. Whether these areas represent original constituent minerals, minerals formed during metamorphism, or the weathering products of one or both of these is uncertain. Indeed, without petrographic analyses, just what this stone is remains unknown. Generally, this material is grouped with porcellanite in the tables showing lithic material type preferences. The fissility, or slatey cleavage, characteristic of shales or slates is lacking, though the color banding may represent relict fabric which has been partially destroyed by thermal metamorphism (Whitten and Brooks 1972). The material displays good to excellent conchoidal fracture and a luster that ranges from dull to waxy. Siliceous slate or shale outcrops in the central Precambrian area of the Black Hills (Tratebas 1986:427).

Plate Chalcedony Plate chalcedony is a clear, white, gray, or pinkish gray material occurring in thin laminar veins which range in thickness from 5 to 20 mm. Internal structure appears fibrous, with fibers arranged perpendicular to the surfaces. Many specimens exhibit a medial seam. Small voids, sometimes containing detrital grains from the surrounding matrix in which the chalcedony formed, occur along these seams and affect knappability. The material is characterized by a frosted, matte surface appearance, while flaked surfaces are uneven with a waxy luster (Ahler 1975). Plate chalcedony outcrops in the White River Badlands immediately east of the Black Hills.

Quartz Quartz is a hard, glassy material that occurs in veins throughout the central Black Hills. Individual pieces range in size from sand to extremely large boulders. Quartz may appear clear or milky; the translucent varieties may be white, gray, or pink. It exhibits a glassy to vitreous luster and irregular to conchoidal fracture. Quartz frequently contains veins of other minerals, such as tourmaline, feldspar, pegmatite, gold, or mica. Quartz does not flake easily or predictably, but was nevertheless used in making tools in the Black Hills, probably due to its wide availability and hardness.

Obsidian and Pitchstone Obsidian is a hard, brittle, lustrous volcanic glass. It is usually black, but red and banded specimens occur. Obsidian fractures conchoidally, producing extremely sharp, but brittle, edges. Obsidian is reported in small quantities in the northern Black Hills (Michels 1983). Pitchstone is a less homogenous form of volcanic glass formed in vents. It exhibits irregular to conchoidal fracture. Because it is brittle and fractures unpredictably, pitchstone is not suitable for stone tools. Pitchstone outcrops in small quantities in the northern Black Hills; one outcrop is about 16 km from the project area (Church 1989).

4.6 Stratigraphy

The portion of 39LA117 located within the 55-m right-of-way corridor lies on the first terrace (Qt_2) and the slope below the second terrace (Qt_1) of Little Elk Creek. Appendix A provides descriptions of soil samples from three trenches excavated in the southern, central, and northern areas of the right-of-way. The reader can refer to this for detailed information concerning soil formation at the site. This section provides a general description of soil horizons observed during excavation, as well as representative unit profiles.

Most of the units excavated east of FH26 were on the slope between the first and second terraces above Little Elk Creek. The most centrally located and uppermost unit, Unit 13, consisted of a thin organic layer of forest litter overlying a layer of sandy or silty clay (Munsell 5YR5/3, reddish brown) averaging 10–12 cm thick (Figure 4.3). These form poorly developed A and B horizons. Below them are another A and B horizon, also developed in sandy or silty clay. A piece of cut wood was uncovered in the level 10–20 cm below surface, indicating disturbance of the natural stratigraphy. The upper A and B horizons apparently represent postdisturbance soil development, while the lower set represents the predisturbance surface. This unit (Unit 13) is located near the upper trail and the waterbar. Only a few artifacts were recovered from this unit throughout all four levels (0–40 cm below surface). It was thought that enough disturbance had occurred in this area of the site to mix the cultural zone with the sterile soil above and below, precluding any need to open more units in this area.

At the northern end of the site, east of the road, Unit 9 consisted of approximately 10 cm of loosely compacted silty loam (10YR6/1, gray) in a dense layer of roots (Figure 4.4). Under this was approximately 8 cm of slightly darker gray (10YR6/1, gray) silty or sandy clay. Below this was a 20- to 25-cm thick soil of similar composition, darkening from light yellowish brown (10YR6/4) to light brownish gray (10YR6/2). This unit is located near the base of the slope above the first terrace. Slope wash has probably been accumulating in this area.

In the southern portion of the site, east of the road, the topsoil layer was about 10 cm of loam (7.5YR3/2, dark brown). Below this was a dark mottled silty or sandy clay layer containing charcoal and numerous rocks (Figure 4.5). The soil, a very dark gray to a very dark grayish brown or brown (10YR3/1, 3/2) gravelly clay, changes to a grayish brown or brown (10YR5/3, 5/2) gravelly clay from approximately 25 to 33 cm below surface. This level was below the cultural zone. A gravelly, sandy clay (10YR8/3, 7/3, 6/3 very pale brown to pale brown) occurs at the base of the excavation unit and varies in thickness.

The soils east of FH26 on the slope generally consisted of 8 to 10 cm of a root-filled, organic silty loam. At the southern end of the site, a dark mottled layer showed up that was not present in the central and northern areas. Grading the site provided evidence of slope wash, possibly being more extensive on the southern end. Below this or directly below the upper 10 cm was silty or sandy clay, slightly darker in color and usually containing rocks of various sizes. Below this layer the soil contained more clay and had a blocky texture. Disturbance

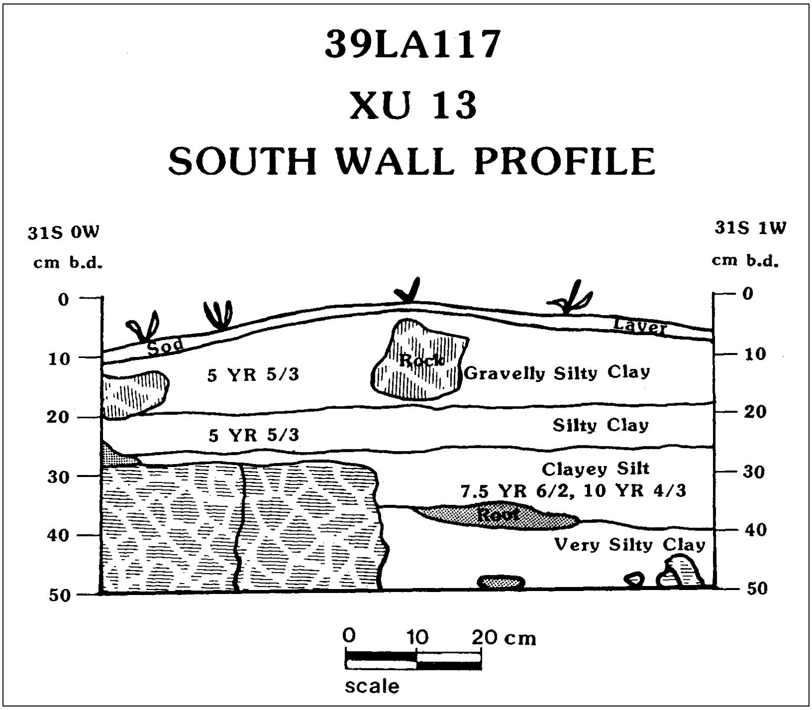


Figure 4.3: 39LA117 Unit 13 profile

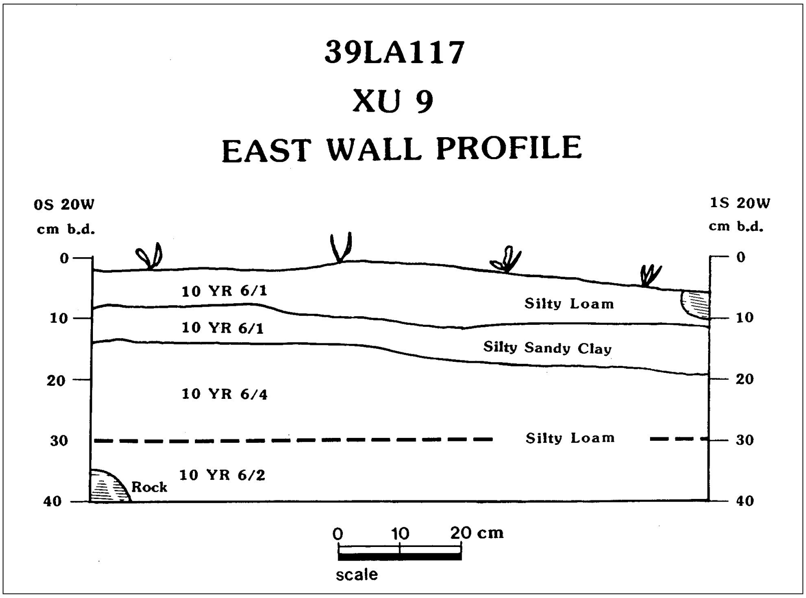


Figure 4.4: 39LA117 Unit 9 profile

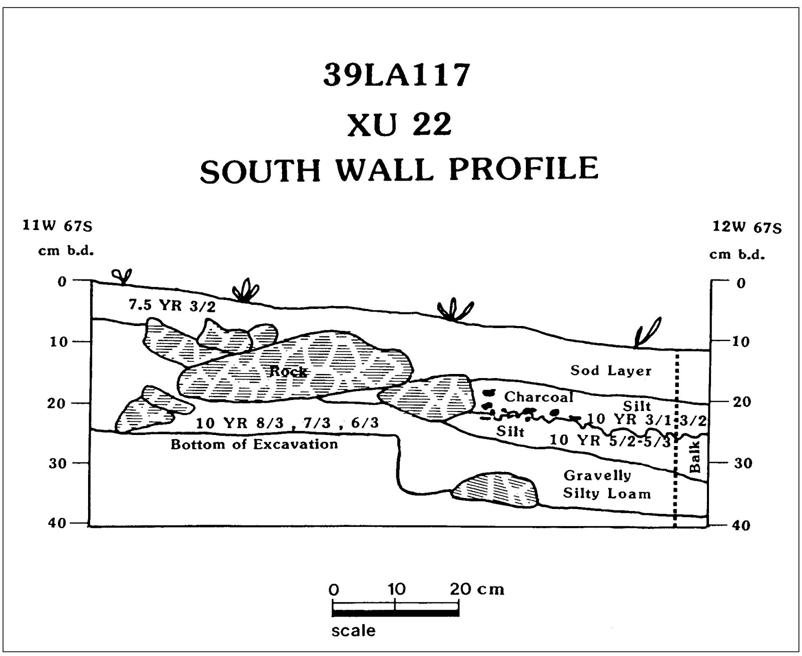


Figure 4.5: 39LA117 Unit 22 profile

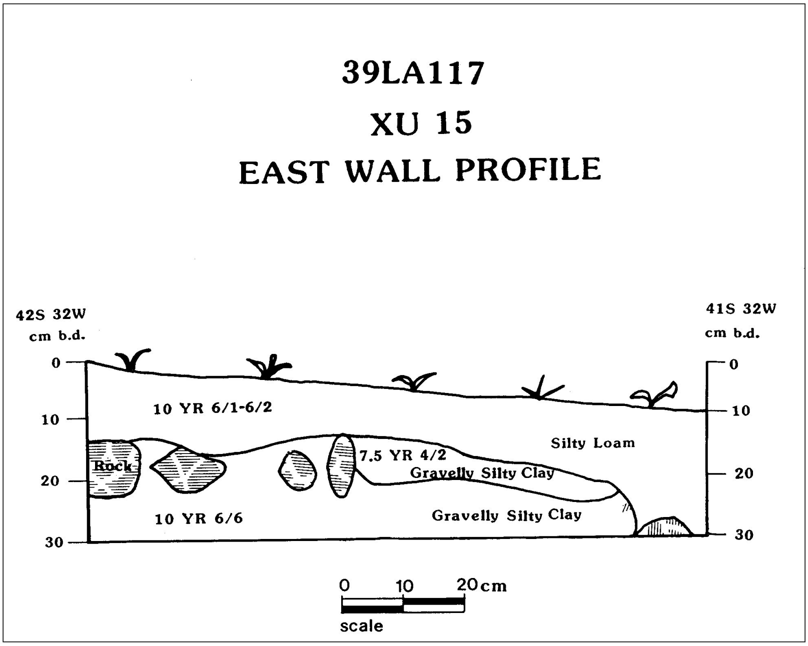


Figure 4.6: 39LA117 Unit 15 profile

from the waterbar and timbering along the right-of-way at the top of the slope from the trail showed up in Unit 13 as buried and mixed soil horizons.

The southern portion of the site, west of the road, contained a loosely compacted silty loam topsoil (10YR6/1-6/2, very dark gray), averaging about 15 cm thick. Under this was a brownish yellow silty clay (10YR6/6), containing a large amount of gravel and larger rocks, and extending to the base of the unit at 30 cm below surface. In Unit 15, a weak red lens of silty clay (7.5YR4/2) appeared at the base of the topsoil (Figure 4.6).

The central portion of the terrace, west of FH26, contained a 5 to 10-cm thick sod layer (10YR4/2, 3/3, 4/3) overlying sandy and silty clays (Figure 4.7), including a red (10YR 4/4) sandy clay stratum, widest on the east side of the area, a thin lens of black mottled silty clay on the northern portion, and a 20-cm thick stratum of yellowish brown silty clay (10YR6/3, 6/4). The silty strata are underlain by sterile blocky yellowish brown clay (10YR6/4). Large rocks occur in the basal clay and at the silt-clay contact. A small gravel lens (10YR4/3, 4/4) occurs in Units 1 and 2, between the red sandy clay and the yellowish brown silty clay.

The northern portion of the site, west of FH26 contained a root zone extending 10–12 cm below the surface (Figure 4.8). In areas disturbed by logging, the root and forest litter zone was underlain by a narrow layer of gray (10YR3/2) silt. Elsewhere the root zone contacted directly with the next layer, a dark

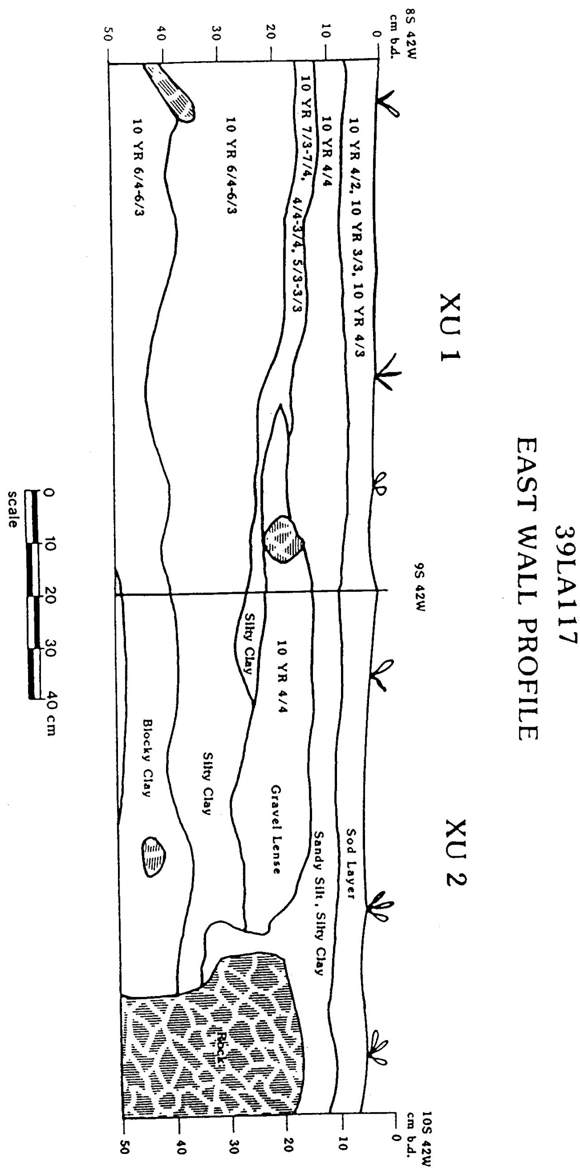


Figure 4.7: 39LA117 Units 1–2 profile

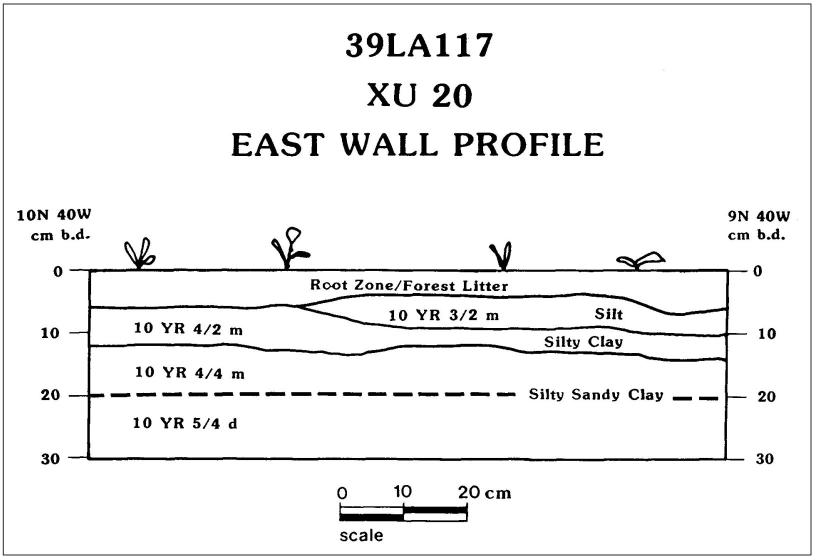


Figure 4.8: 39LA117 Unit 20 profile

brown silty clay (10YR4/2). This was underlain by a thick stratum of yellowish brown silty or sandy clay. Excavation was terminated 30 cm below surface in the yellowish brown silty or sandy clay.

The western portion of the site has an overall pattern of a dark gray silty topsoil overlying yellowish brown silty clay to a depth of about 40–45 cm, at which point the soil turns into blocky yellowish clay. Large rocks occur in the lower half of the silty clay and at the contact of the silty clay and yellowish clay. Lenses of gravel and sand occur in the excavated units and probably are scattered across the terrace. In places, a dark, charcoal-mottled layer occurs at the top of the yellowish brown silty clay, undoubtedly the result of fire.

4.6.1 Cultural zone

The cultural zone at 39LA117 occurred within the main B horizon, in brownish yellow silty or sandy clay. This stratum, sometimes referred to as the "red cultural level", lay just below the topsoil. No stratified cultural components were detected within the cultural zone, which was lithologically and stratigraphically identical across the site. If separate components exist at the site, they were not stratigraphically recognizable. Instead artifacts were consistently concentrated in the middle of the cultural horizon, between 10 and 40 cm below the surface.

A blocky clay lay below the cultural zone in the western portion of the site. In this area, excavation was stopped just below the contact between the upper sandy clay and the blocky clay. Elsewhere, the cultural zone occupied only the upper portion of the sandy clay and excavation was terminated before the blocky clay substratum was reached. Soil descriptions from the cultural zone in various portions of the site are presented in Appendix A.

4.6.2 Disturbances

A variety of activities have had adverse effects on the integrity of cultural deposits at 39LA117. Some of these activities exposed the subsurface deposits, which led to the discovery of the site. The construction of the Nemo-Sturgis road, two trails leading off of it, and waterbars associated with the maintenance of one of the trails, as well as timbering and forest fires, are among the disturbances to the site. Disturbances of natural origin include forest fires and bioturbation.

Probably the most destructive activity was the original construction of FH26. The road transects the site from southeast to northwest. The cut bank profile on the upslope side exposes as much as 1 m below the ground surface, a depth well below the cultural zone. On the downslope side, there is no vertical cut bank, but shovel tests indicate that some topsoil was removed adjacent to the roadbed.

FH26 is a gravel road, well traveled particularly throughout the summer months. Maintaining the road has required grading to remove waterbars. This often results in scraping away a little more of the upslope cut bank, as was observed by the field crew in 1988. Gravel inevitably builds up off the edge of the road onto the site as well. The road averages 7 m wide, having removed an estimated 700 m^2 of the site.

When originally recorded in 1977, a two-track trail leading off of FH26 to the northeast, then curving southeast, and finally curving to the north, cut through 39LA117. At that time, no cultural material was exposed in the trail. On a return visit, two large bifacial quartzite tools were exposed near the junction of the trail and FH26. During the original Vanocker survey in 1984, additional material was exposed in the trail to the northeast. The road was graded for timbering operations in the fall of the same year, exposing even more cultural material. It was apparent that most of the cultural zone in this area was removed by the road grading. Shovel tests later supported this observation. A number of artifacts were observed in this trail, but it is most likely that they were carried down slope with outwash or washed out of the cut bank on either side of the trail. Through the right-of-way, the trail averages 5 m across, with 1 to 2 m of slope cut along the northern edge. A locked Forest Service gate bars this trail about 35 m up slope from the main road.

Along the northern right-of-way limits, a waterbar was cut from the edge of the graded trail to 15 m south. At its widest point the waterbar and associated backdirt on either side are 5 m across, diminishing to 1 m at the southern end. Cultural material was observed washing out of the walls of the waterbar, as well as in the backdirt.

Another trail, not as prominent and used only occasionally, lies west of FH26. The trail cuts across the terrace to the west, then follows along the terrace edge above Little Elk Creek to the northwest, adjacent to private land. Although some topsoil was removed, this trail has much less disturbance than the other. Of all the disturbed areas, this seemed the most likely to contain intact cultural material.

Although it is unclear what caused the surface disturbance near the southwestern end of the site, it was obvious that topsoil had been removed. This may at one time have been part of the trail along the terrace edge. Today, this area is covered with a thick growth of young ponderosa pine. Such pine stands typically indicate some sort of disturbance, either fire or soil displacement. Exposed artifacts were observed in a cattle path that cuts through these trees and follows the terrace edge to the northwest. The amount of soil stripped off here was probably less than along the trails, but the thick growth of small trees prevented excavation.

This area is also near the edge of the terrace, an area nearly paved with large rocks. Between the edge of the tree belt and FH26 is an area that also seems stripped of topsoil, although artifacts were recovered below the surface in shovel tests.

Disturbances related to timbering operations were also noted across the surface of 39LA117. The main one, grading of the eastern trail, has already been discussed. Other disturbance included burned slash piles and soil piled up near tree stumps in various areas across the site. The burned slash piles changed the soil color and may have affected subsurface cultural deposits. The piles of soil affected the stratigraphy and may have displaced cultural materials.

Deposits appear to have been mixed to some degree by bioturbation, such as root movement, small mammal and insect burrowing, and worm activity. Combined with a rather slow rate of deposition, these factors have led to a lack of clear vertical separation of components in some areas of the site.

Finally, the natural occurrence of forest fires may have affected the 39LA117 deposits. Large numbers of lithic artifacts from the site appear to be thermally altered. Thermal alteration as a prehistoric activity related to tool manufacture is well documented in the literature, as a means of improving the knapping quality of chert. At 39LA117, however, evidence of stump burns and round black stains in the soil suggests unintentional, postabandonment thermal alteration for some of the lithic material that appears heat treated.

Forest fires also make it hard to tell if burned bones and seeds are cultural or not. Normally charred bone and seeds are assumed to be related to cultural activities, especially if they occur within features. Since no features were discovered at the site, and the entire area appears to have been subject to natural fires, the burned organic material cannot be assumed to be cultural.

In varying degrees all of these disturbances have affected the integrity of 39LA117. Although these disturbances have had negative effects on the cultural deposits, they permitted the discovery of the site by exposing cultural material. During the 1988 surface inspection, artifacts observed on the surface were only found in the disturbed areas—along the waterbar, in the cattle path, and along both trails. The waterbar was cut through the cultural zone down to sterile soil and artifacts were mainly associated with the backdirt on either side. Although all of these areas provided clues as to the location of artifacts, all but the less used trail were too disturbed to contain any cultural materials in situ.

4.7 Results of Investigations

For purposes of this discussion, the forty excavation units are arranged into six groups, corresponding to various areas of the site. These groupings and the excavations units they contain are designated as follows (Figure 4.9):

- Northeast sector: Units 7–9 and 11
- East sector: Units 10, 13, 17, and 25
- Southeast sector: Units 14, 21, 22, 32, and 36
- Northwest sector: Unit 20
- West sector: Units 1–6, 12, 16, 18, 19, 23, 24, 26–31, 33–35, and 37–40
- Southwest sector: Unit 15

In the analysis, materials from various levels of the excavation units are combined, because it appears that a single in situ cultural horizon is present at the site. Artifact distributions within units were consistently unimodal, reaching a single peak of horizontal density in each unit. As was discussed above, no separate cultural components were detected in the subsurface stratigraphic units at 39LA117. Thus, neither sedimentary nor distributional evidence of multiple occupation horizons ("living floors") existed at the site. The possibility of separate occupations existing within the recognized cultural horizon on different portions of the site is not obscured by the analytical methods employed here.

4.7.1 Historic Artifacts

Three metal artifacts were recovered from excavations at the site. Two of these, a bolt and a metal fragment, were found near the surface in Units 35 and 37. The other, a square nail, was found 15–20 cm below the surface of Unit 2. These units are in the west sector, near the two-track trail leading west from FH26. In addition, a piece of sawed deer bone, of recent origin, was found in a disturbed area in the northwest sector of the site. These materials are in disturbed areas of the site and are unrelated to the main cultural occupation of the site. They are not included further in the analysis of the site.

4.7.2 Features

No hearths or other cultural features were found at 39LA117. A number of dark stains and charcoal concentrations were investigated; however, all were found to be of natural origin. These hearthlike natural features resulted from tree roots burning during natural forest fires. The ubiquity of natural fire features and the general rockiness of the cultural horizon would have made cultural

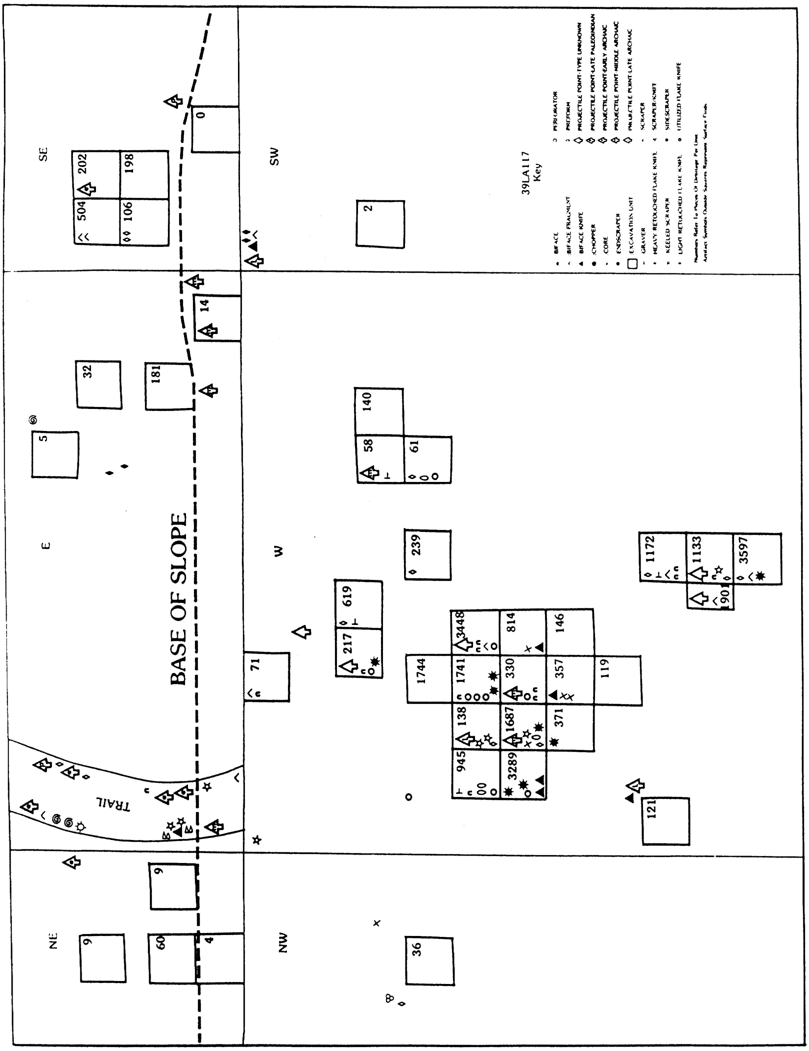


Figure 4.9: Schematic map of 39LA117, showing distribution of lithic debitage and tools

features extremely hard to distinguish, had any existed at the site. Special field methods, including block excavation, troweling, and large-area grading, were adopted to compensate for these conditions, but nothing was found to indicate that cultural features were present at the site.

4.7.3 Nonlithic Material

In the presence of noncultural fire features and the absence of cultural features, it was difficult to establish whether faunal remains, seeds, and charcoal were of natural origin or were the remains of cultural activities at the site. Table 4.5 summarizes the nonlithic materials recovered from each excavation unit. The three charcoal samples collected were not subjected to radiocarbon age determination, because no evidence exists that they were cultural.

Table 4.5: Nonlithic materials collected at 39LA117

Unit	Location	Snails	Bone	Seeds	Metal	Burned Earth	Charcoal
1	8S/42W	15					
2	9S/42W		23	15			
3	8S/43W		14			1 sample	
4	9S/43W		3		1		
5	7S/42W	26	14				
6	7S/43W	47	39			2 samples	
10	32S/16W	31	5				
12	9S/44W		22				
14	69S/13W						1 sample
16	12S/34W	1					
18	10S/42W		322				
22	66S/12W						1 sample
23	20S/39W		21				
24	14S/36W		54				
26	16S/50W	4	10				
29	15S/41W	10					
30	13S/36W		11				
31	16S/49W		1				
33	2S/46W	172	11				
34	9S/45W	1	13				
35	16S/51W		11		1		
36	67S/12W	667	1				
37	9S/41W	4	74		1		
38	10S/43W	11	46				
39	8S/44W	3	21				1 sample
40	10S/44W	7	36				

Only Unit 2 (9S/42W), in the west sector of the site, contained seeds. Fifteen seeds were found during waterscreening of soil from 25–30 cm below surface, within the cultural horizon. This unit formed part of a block excavation in the west sector of the site, in the most concentrated area of cultural material (Figure 4.10). In spite of this, the seeds were recent, uncharred, and clearly noncultural. The only identifiable seed was Ponderosa pine, a species ubiquitous in the site area and throughout the Black Hills.

Fragmentary bone, including some charred specimens, was found in 21 of the 40 excavation units. Of the 21 bone-bearing units, all but two lay in the west sector of the site, in the main concentration of cultural material. One unit in the east sector and one in the southeast sector contained much smaller amounts of bone. The three units with more than 50 bone fragments all lay in the center of the west sector of the site. This distribution argues strongly for a cultural origin for the bone deposits. The bone fragments themselves were too fragile and fragmentary (most under 3 cm in maximum dimension) for identification, with the exception of a single small bird wing bone and the aforementioned historic deer bone.

Two units in the block excavation in the west sector of the site contained small pieces of burned earth. These could have resulted from the heat of natural forest fires firing the clayey subsoil; however, a cultural origin cannot be dismissed, given that the pieces were found in a definite cultural context. Unfortunately, little can be inferred from the presence of such small quantities of burned earth. It is not possible to determine whether the burned earth is indeed cultural and, if so, what type of hearth, roasting pit, or other feature they may represent.

4.7.4 Lithic Tools

The excavation units contained 77 lithic tools. Another 43 tools were found on the surface, in shovel tests, and in the graded areas of the site. One additional tool, a projectile point, was collected from the back dirt of one of the geomorphology exploration trenches. Together with the 14 tools previously collected, an assemblage of 135 tools was available for study (Table 4.6). These included 22 projectile points and projectile point fragments, 2 projectile point preforms, 11 bifacial knives, 12 biface fragments, 2 choppers, 1 combination chopper/adze, 1 perforator, 4 heavy retouched flake knives, 13 light retouched flake knives, 10 utilized flake knives, 2 combination scraper-knives, 2 gravers, 1 combination graver/burin, 5 unclassified scrapers, 10 light scrapers, 12 sidescrapers, 10 endscrapers, 1 keeled endscraper, 1 chisel, 5 unspecified tool preforms, and 8 retouched and utilized flakes. Tools were further sorted by raw material type, and as patterned versus nonpatterned and bifacial versus unifacial (Table 4.7), to facilitate tests of hypotheses specified in the research design (see Chapter 7).

Table 4.6: Tools from 39LA117. Modified flake category includes various utilized and retouched flake tools. Fragments are counted as whole tools. Bifacial thinning flakes were not included in this tally. SC=surface collection, ST=shovel test collection, GR=grader collection. Fragments of each of the projectile points found in Unit 38 were found in other units and tabulated therewith

Unit	Location	Projectile Point	Biface	Scraper	Modified Flake	Other
SC	E of Rd	4	3	1		Perforator
ST	6N/20W					Preform

Table 4.6: continued

Unit	Location	Projectile Point	Biface	Scraper	Modified Flake	Other
ST	16N/48W			1		
ST	22N/38W				1	
ST	2S/48W		1			
ST	4S/40W				1	
ST	12S/34W					Point Preform
ST	12S/40W		1			
ST	26/48W			1	1	
ST	30S/0W					Chopper
ST	38S/30W				1	
ST	42S/32W				1	
ST	52S/32W		1			
ST	56S/32W		1		2	
ST	70S/14W	1				
GR	35mSW0/0					Point Preform
GR	4S/47W	1				
GR	15S/47W				1	
GR	26S/15W				1	
GR	28S/0W			1		
GR	28S/48W				1	
GR	30S/40W			1		
GR	30S/46W	1	1			
GR	32S/16W	1				
GR	33S/18W	1				
GR	14N/38W			1		
GR	Area A				1	
GR	Area B			1		
GR	nr. XU33		1	1		
1	8S/42W	1		2	1	
2	9S/42W			3	3	
3	8S/43W	1	1	3		Preform
4	9S/43W	1		3	2	
5	7S/42W			1	1	Two Preforms; Chisel
6	7S/43W		2	2	1	
12	9S/44W		1			
16	12S/34W		1	1		
18	32S/42W	2	1	3	1	
19	20S/38W	1				Graver
21	66S/12W				2	
22	66S/11W		2			
23	20S/39W				1	Preform
24	14S/36W		1		1	Graver
25	34S/18W	1				
26	16S/50W	1		2	1	
28	15.5S/50W	1	1			
29	15S/41W				1	
31	16S/49W		1	2	3	Graver
32	67S/11W	1				
35	16S/51W		1	1	1	
38	10S/43W	(2)	1	2	1	
39	8S/44W			1		
Previous Collections		1	3	3	4	Preform; Chopper; Chopper/Adze

Table 4.6: continued

Unit	Location	Projectile Point	Biface	Scraper	Modified Flake	Other
Total		22	25	37	35	16

Table 4.7: Tool raw material preference and morphology classifications (unifacial/bifacial and patterned/nonpatterned) for 39LA117. Catalog numbers refer, in order, to: 1988 excavation units (Accession No. 89-0088, 1988 shovel tests, 1988 grader, 1977 surface collection (77-0325), 1978 surface collection (78-0534), 1984 surface collection (84-0580), 1984 shovel tests, and 1987 surface collection. Raw material types are, from left to right, chert, chalcedony, porcellanite, and silicified slate, quartzite, silicified siltstone, and silicified wood

Unit	Cat	CHT	CAL	POR	QZT	SSI	SWD	Tool Type	P/N-P	B/U
1	302				x			Proj Point	P	B
1	303	x						Sidescraper	N	U
1	304	x						Lt Ret Fl Knife	N	U
1	343	x						Sidescraper	N	U
2	408	x						Ut Fl Knife	N	U
2	409	x						Endscraper	N	U
2	411	x						Ut Fl Knife	N	U
2	413	x						Biface Fragment	P	B
2	414	x						Lt Scraper	N	U
2	415	x						Ut Fl Knife	N	U
2	416	x						Endscraper	P	U
3	521				x			Proj Point	P	B
3	522	x						Sidescraper	N	U
3	523				x			Endscraper	P	U
3	524	x						Biface Kn Frag	N	B
3	595	x						Preform	N	U
3	603	x						Lt Scraper	N	U
4	623				x			Proj Point	P	B
4	624	x						Lt Scraper	N	U
4	625	x						Lt Ret Fl Knife	N	U
4	686	x						Lt Scraper	N	U
4	692	x						Ut Fl Knife	N	U
4	695	x						Endscraper	N	U
5	710	x						Scraper	P	U
5	711	x						Pt Preform?	P	U
5	721	x						Chisel	N	U
5	725				x			Preform Frag	P	B
5	736				x			Ut Fl Knife	N	U
6	769	x						Endscraper	N	U
6	770		x					Ut Fl Knife	N	U
6	771				x			Biface	P	B
6	775					x		Biface Knife	P	B
6	776					x		Endscraper	N	U
12	971				x			Biface Knife	P	B
16	1025		x					Biface Fragment	N	B
16	1026		x					Scraper	P	U
18	1075	x						Proj Point	P	B
18	1076		x					Proj Point	P	B
18	1077	x						Lt Scraper	N	U
18	1078	x						Biface Fragment	N	B
18	1079		x					Scraper	P	B
18	1109	x						Ut Fl Knife	N	U
18	1117	x						Endscraper	P	U

Table 4.7: continued

Unit	Cat	CHT	CAL	POR	QZT	SSI	SWD	Tool Type	P/N-P	B/U
19	1146	x						Proj Point	P	B
19	1147				x			Graver/Burin	P	U
21	1193			x				Ret Flake	N	U
21	1193			x				Ret Flake	N	U
22	1204			x				Biface/Thin	P	B
22	1220			x				Bif Fl Knife	P	B
23	1263				x			Preform	P	U
23	1264				x			Lt Ret Fl Knife	N	U
24	1285		x					Graver	P	U
24	1286	x						Lt Ret Fl Knife	N	B
25	1330						x	Proj Point	P	B
26	1337		x					Proj Point	P	B
26	1338		x					Scraper	P	U
26	1339		x					Lt Ret Fl Knife	N	B
26	1340		x					Sidescraper	N	U
28	1379						x	Biface	P	B
2 28	1380		x					Proj Point	P	B
29	1423				x			Lt Ret Fl Knife	N	U
31	1456				x			Biface Fragment	P	B
31	1457			x				Ret Flake	N	U
31	1457			x				Ret Flake	N	U
31	1458	x						Graver	N	U
31	1458	x						Lt Scraper	N	U
31	1467				x			Lt Ret Fl Knife	N	U
31	1475	x						Lt Scraper	N	U
32	1482			x				Proj Point	P	B
35	1537	x						Endscraper	P	U
35	1539				x			Biface Fragment	P	B
35	1551		x					Ut Flake	N	U
38	1655			x				Biface Kn Frag	P	B
38	1656				x			Proj Point	P	B
38	1657	x						Endscraper	P	U
38	1661	x						Lt Scraper	N	U
38	1661	x						Ut Fl Knife	N	U
39	1684	x						Endscraper	P	U
30S0W	1				x			Chopper	P	B
70S14W	2				x			Proj Point	P	B
33S18W	3	x						Proj Point	P	B
38S30W	4				x			H Ret Fl Kn	N	U
42S32W	5	x						H Ret Fl Kn	N	B
52S32W	6	x						Biface	P	B
56W32W	7	x						Biface Knife	P	B
12S34W	8		x					Pt Preform	P	B
2S48W	9	x						Biface Knife	P	B
22N38W	14					x		Lt Ret Fl Kn	N	U
4S40W	15	x						Ut Fl Knife	N	U
12S40W	16						x	Biface Fragment	P	B
6N20W	72					x		Preform?	P	B
56S32W	82						x	Lt Ret Fl Kn	N	U
26S48W	197	x						Lt Scraper	N	U
26S48W	197	x						Ret Flake	N	U
16N48W	200					x		Sidescraper	N	U
Grader	226	x						Proj Point	P	B
Grader	227					x		Proj Point	P	B
Grader	228					x		Pt Preform	P	B

Table 4.7: continued

Unit	Cat	CHT	CAL	POR	QZT	SSI	SWD	Tool Type	P/N-P	B/U
Grader	229	x						Proj Point	P	B
Grader	230	x						Sidescraper	N	U
Grader	231	x						Endscraper	P	U
Grader	232		x					H Ret Fl Kn	N	U
Grader	233	x						H Ret Fl Knife	N	U
Grader	249	x						Lt Scraper	N	U
Grader	251	x						Biface Fragment	N	B
Grader	263		x					Lt Ret Fl Kn	N	U
Grader	273	x						Ut Fl Knife	N	U
Grader	290	x						Sidescraper	N	U
Grader	295	x						Sidescraper	N	U
Grader	295	x						Bif Fl Knife	N	B
Surface	0001.1				x			Biface	P	B
Surface	0001.2				x			Biface Knife	P	B
Surface	0001.3	x						Pt Preforn	P	B
Surface	0001.4				x			Lt Ret Fl Kn	N	U
Surface	0002.1				x			Chopper	P	B
Surface	0002.2				x			Chopper/Adze	P	U
Surface	01	x						Proj Point	P	B
Surface	02	x						Scraper/Knife	P	B
Surface	03	x						Sidescraper	N	B
Surface	04	x						Lt Ret Fl Kn	N	U
Surface	05	x						Scraper Frag	N	U
Surface	06						x	Lt Ret Fl Kn	N	U
Surface	07						x	Sidescraper	N	U
Test	6				x			Biface Fragment	P	B
Surface	0001	x						Proj Point	P	B
Surface	0002						x	Perforator	P	B
Surface	0003	x						Proj Point	P	B
Surface	0004					x		Proj Point	P	B
Surface	0005	x						Proj Point Frag	P	B
Surface	0006				x			Biface Knife	P	B
Surface	0007	x						Proj Point Frag	P	B
Surface	0008			x				Sidescraper	N	U
Surface	0009	x						Biface Fragment	P	B
Surface	00010	x						Scraper/Knife	P	B
Trench	020			x				Proj Point	P	B

Projectile Points

The projectile points found at 39LA117 include types diagnostic of the late Paleoindian (Plano), Early Plains Archaic, Middle Plains Archaic, and Late Plains Archaic periods It should be noted that many of these assignments are tentative, due to lack of complete specimens and ambiguities in the projectile point typology for the Black Hills. With one exception, the Plano and Early Plains Archaic points were found on or near the surface on the slope between the first and second terrace along the eastern side of the site. Nearly all of the Middle Plains Archaic and Late Plains Archaic points were found below the surface on the lower terrace, in the western portion of the site (Figure 4.9). Two cultural horizons are indicated by the distribution of projectile points at 39LA117: a redeposited horizon comprising mixed late Paleoindian and Early

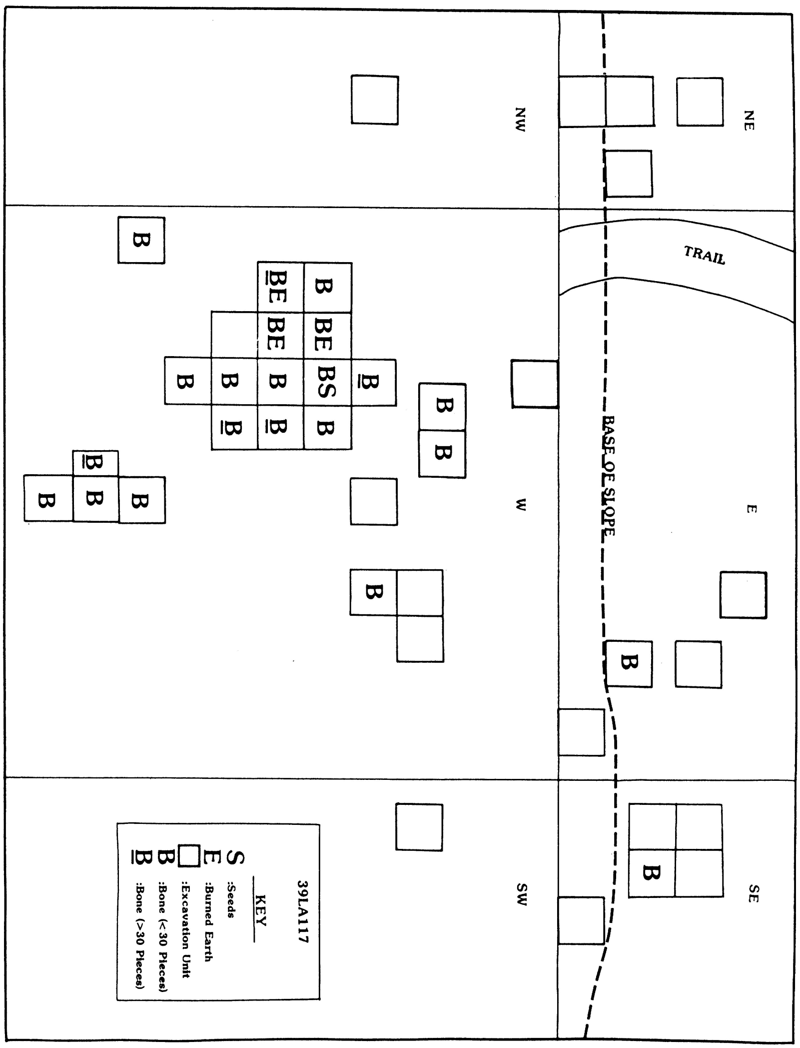


Figure 4.10: Schematic map of 39LA117 showing distribution of bone, seeds, and burned earth.

Archaic components on the interterrace slope and an in situ cultural horizon containing mixed Middle and Late Archaic components on the lower terrace (Qt_2). This is discussed in more detail below.

The two Paleoindian points are lanceolate types, tapering to straight, extensively ground bases (Figure 4.11a–b). The points are somewhat similar in shape and flaking pattern to Hell Gap points, but are smaller than typical late Paleoindian points. These two specimens may be reworked Hell Gap, Agate Basin, or Angostura points. More probably, they represent a local variant of the general late Paleoindian lanceolate projectile point type. Although the existence of an Early Archaic lanceolate form intermediate between the terminal Paleoindian types and the Middle Archaic McKean lanceolate has been hypothesized for the Black Hills (Sundstrom 1989), no lanceolate types securely dated as Early Archaic have as yet been recognized for the area. These points, intermediate in size and flaking pattern between the late Paleoindian and McKean lanceolate types, fit the expected pattern for the hypothesized Early Archaic lanceolate form (cf. Benedict and Olson 1973); however, in the absence of comparable forms from the Black Hills, a late Paleoindian date for the two points is the most reasonable conclusion at this time.

An Early Archaic side-notched point type is represented by fragments of three projectile points (Figure 4.11d, g–h). These conform most closely to the Early Archaic Hawken type (Frison 1978). Similar points were found in Early Archaic levels of the LoDaisKa, Magic Mountain, and Wilbur Thomas sites (Irwin and Irwin 1959, 1966; Breternitz 1971). Another fragment appears to be an extensively reworked Hawken point (Figure 4.11f).

Two very large, incompletely flaked, side- and basally notched bifaces may represent another Early Archaic point type (Figure 4.11i–j). These points do not match any defined styles. The more complete specimen could be described as having either long, shallow side-notches or an expanding stem. It is similar in shape to some Middle Archaic points, especially the Duncan and Hanna types, but appears to be too large to be a preform for these. The other point is more definitely side-notched. These two points bear a vague resemblance in shape, size, and flaking pattern to specimens from Early Archaic levels at Wilbur Thomas rockshelter and Paint Rock V rockshelter, except that the latter have straight or convex, rather than concave, bases (Benedict and Olson 1973; Frison 1978; Black 1991). A stemmed, concave-based point type is found in Early Archaic components in the Bighorn Basin (Frison 1978; Black 1991). Based on their size, general morphology, and stratigraphic position, these two points are tentatively accepted as Early Archaic types. A large, corner-notched projectile point appears to be most closely aligned with the Early Archaic point types in terms of size, gross morphology, and flaking pattern (Figure 4.11e); however, corner-notched Early Archaic point types are not generally recognized in the Black Hills. The Beaver Creek site contained a corner-notched projectile point in an Early Archaic level (L. Alex 1991:38). This specimen, though, shows little similarity to the 39LA117 point, the former being smaller, thicker, and narrower across the neck, and more randomly flaked than the 39LA117 specimen.

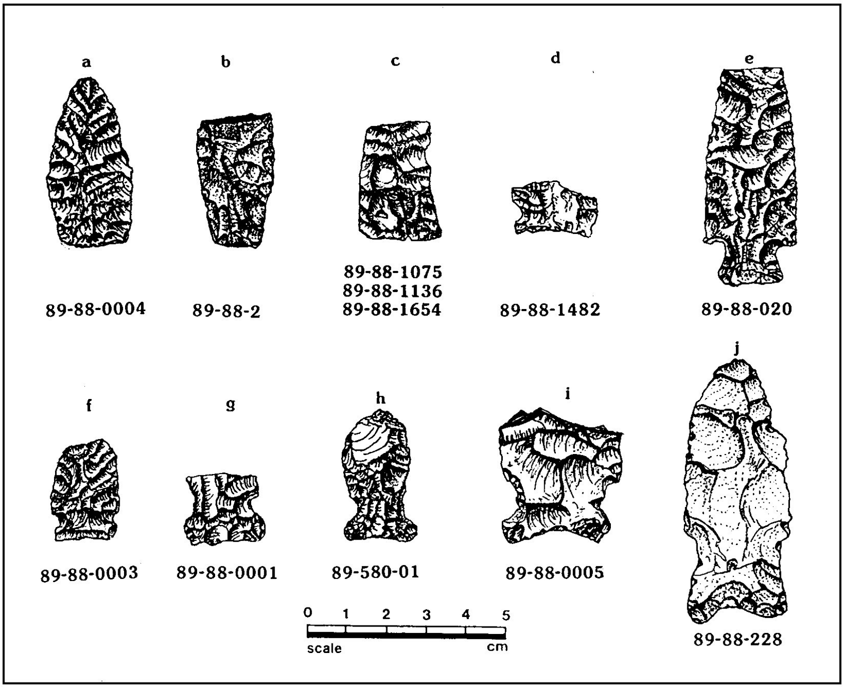


Figure 4.11: Paleoindian and Early Plains Archaic points from 39LA117: a, Late Paleoindian/unspec. Plano lanceolate; b, Late Paleoindian lanceolate; c, indeterminate; d, Early Plains Archaic/Hawken variant; e, Early Plains Archaic?; f, Early Plains Archaic; g, Early Plains Archaic/Hawken; h, Early Plains Archaic/Hawken?; i, Early Plains Archaic?; j, Early Plains Archaic?

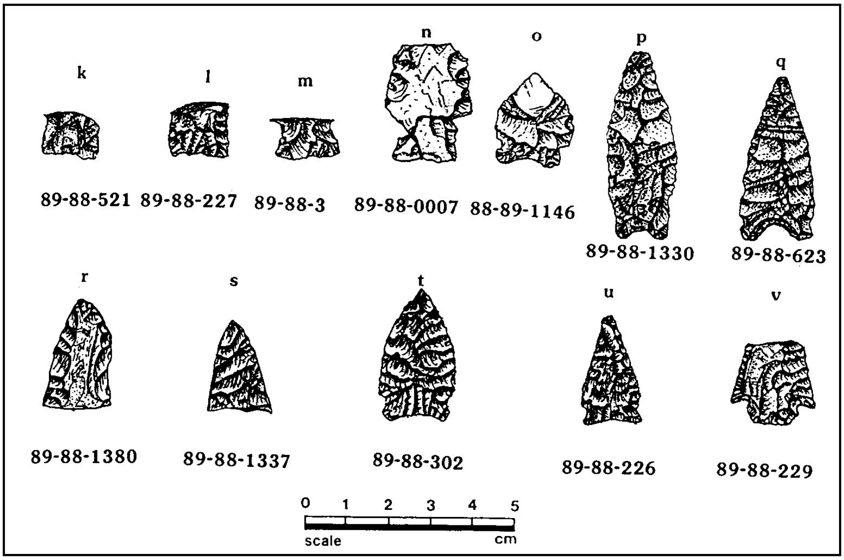


Figure 4.12: Middle and Late Plains Archaic points from 39LA117: a, Middle Plains Archaic/McKean Duncan; b, Middle Plains Archaic?/McKean Duncan?; c, Middle Plains Archaic/McKean Duncan or Hanna; d, Middle Plains Archaic/McKean Hanna; e, Middle Plains Archaic/McKean Duncan or Hanna variant; f, Middle Plains Archaic/McKean lanceolate; g, Middle Plains Archaic/McKean Hanna; h, indeterminate; i, indeterminate; j, Late Plains Archaic/Besant variant; k, Late Plains Archaic/Avonlea or Besant variant; l, Late Plains Archaic/Pelican Lake variant

Seven projectile points from the lower terrace are identified as Middle Archaic types. These include three basally notched specimens (Figure 4.12e–g). Fragments of four other projectile points are from stemmed types comparable to the Middle Archaic Duncan and Hanna types (Figure 4.12a–d). Two possible projectile point tip fragments made from plate chalcedony are tentatively included with the Middle Archaic specimens on the basis of size, shape, and flaking pattern (Cat. 89-88-1380, 89-88-1337; (Figure 4.12h–i).

Three other projectile points from the lower terrace represent two Late Archaic types. Two are triangular and shallowly side-notched, with concave bases (Figure 4.12j–k). These are similar to what have been labeled Besant types elsewhere in the northern plains. Due to the prevailing confusion over the meaning of Besant as a cultural complex, the present authors prefer to designate these simply as Late Archaic side-notched points. Nevertheless, the two points do fall within the defined flaking pattern and range of variation of Besant points (Zeier 1983; Reeves 1983). One of the points (Cat. 89-88-226) is also similar to a projectile designated an Avonlea variant (Reeves 1983:337) and unnamed points from the Late Archaic component of the McKean site (Mail 1954). At this juncture, there seems to be little sense in joining the argument over Late Archaic point typology. As more points are found in datable context in the Black Hills, the relation of these local Late Archaic points to types defined for other regions of the plains will become clearer.

A third Late Archaic point conforms to the Pelican Lake type as defined by Reeves (1973). This is a straight-sided, triangular, corner-notched point with no basal notching or grinding (Figure 4.12 l). It represents an initial Late Archaic type, probably predating the side-notched Late Archaic points discussed in the previous paragraph.

Two other projectile point fragments could not be readily assigned to any period. One is the extreme tip of a point apparently broken in manufacture (Cat. 89-88-1076). Because the fragment is small and incompletely flaked it is not possible to determine what type of point it came from. The other problematical point fragment is a thin, flat-based, rectangular basal portion of a lanceolate point (Figure 4.11 c). The fragment exhibits a parallel flaking pattern usually associated with late Paleoindian points; however, it is much thinner than would be expected for a Paleoindian point base and does not exhibit the edge grinding typical of such points. Its stratigraphic context suggests a Middle or Late Archaic age. Middle Archaic McKean lanceolate points occasionally display a parallel flaking pattern essentially similar to that used on Paleoindian points; however, they are consistently basally notched and lanceolate, rather than rectangular in outline. In addition, they usually are ground at the base and thicker than this specimen. This point thus does not conform well to any defined type and cannot be assigned to any specific period, although a pre-Late Archaic age is suggested by its morphology and flaking pattern.

It is assumed here that all of the 39LA117 projectile points functioned as parts of hunting weapons. This assumption is based on a lack of evidence for nonhunting uses, including armed conflict and ceremonial activities, and on the morphology and use-wear patterns of the artifacts themselves. Edge grinding and impact fractures are typical of points used (or intended for use) as hunting weapons. All but two of the projectile points were broken, suggesting that posthunt weapon repair was taking place at the site. Significantly, the two unbroken points are the two side-notched Late Archaic specimens, dating to the terminal Late Archaic. This suggests that use of the site may have changed during the latter part of the Late Archaic from posthunt activities to prehunt staging.

Other Lithic Tools

One hundred thirteen lithic tools were recovered in addition to the projectile points. Some of these are illustrated in Figure 4.13. Bifacial knives and biface fragments comprise twenty-three tools from the 39LA117 assemblage. Biface fragments are bifacial tools too incomplete for classification as projectile points or knives. Two bifacial knives and three biface fragments were collected from the eastern portion of the site, on the interterrace slope. With the exception of one heavily worn bifacial knife fragment, these exhibit light use-wear in the form of smoothing and, on one specimen, light battering. The lower terrace assemblage included nine bifacial knives and nine biface fragments. In contrast to the interterrace assemblage, none of these biface fragments show any use-wear. One bifacial knife was unused; the remainder exhibit smoothing, and, on two specimens, edge rounding and step flaking. The morphology and use-wear of these bifacial knives suggest cutting tasks; heavy tasks such as butchering versus lighter tasks cannot be inferred on the basis of morphology and use-wear (Tratebas 1986). One artifact classified as a biface fragment (Cat. 89-88-1456) appears to be a fragment of a perforator; it exhibits use-wear in the form of edge-rounding and step-fractures.

Three heavy-duty choppers were recovered from the eastern, interterrace, portion of the site. One of these is a combination chopper/adze. They exhibit use-wear in the form of battering (i.e. crushing and edge rounding), with the chopper/adze showing additional use-wear in the form of faceting and step-flaking. Similar large choppers are hypothesized to have been used for heavy butchering (dismembering); similar adzes are hypothesized to have been used for planing wood (Tratebas 1986).

Three tools from the western portion of the site were classified as gravers. These are flakes retouched to produce a sharp, projecting point on one end. One graver tip is broken; the others exhibit smoothing, feather-flaking, and step-fractures. Such tools are hypothesized to have been used for removing sinew or incising or grooving bone or wood (Tratebas 1986). It is possible that the broken "graver" actually functioned as a small chisel or burin; however, such tools have not been described for the Black Hills and the specimen is too incomplete to provide a convincing argument for their existence at 39LA117. Another utilized flake from the western portion of the site was classified as a chisel. This specimen is a rectangular flake, one projecting corner of which exhibits light use-wear in the form of blunting, step-fractures, and edge-rounding. A single perforator fragment was recovered from the eastern, interterrace, portion of the site. The long, parallel-sided shape of the bit fragment suggests a T-shaped or expanded-base drill. The edges are rounded and have step-fractures. The size, shape, and use-wear of this specimen suggests use on hard materials such as wood, bone, or soft stone (Tratebas 1986).

A variety of flake tools characterized the 39LA117 assemblage. These included thirteen light retouched flake knives, of which two were recovered from the eastern portion of the site. Use-wear on these varied from none on two specimens to various combinations of nicking, scaling, step-flaking, smoothing, feathering, and striations. These tools are expedient and nonpatterned. They appear to have been used for a variety of light cutting tasks (Tratebas 1986).

Four heavy retouched flake knives were recovered from 39LA117, two from the eastern, interterrace, portion of the site. Use-wear ranges from none on one specimen from the western portion of the site to various combinations of edge rounding, polish, smoothing, feathering, hinge-flaking, step-flaking, and pitting on the other three specimens. Heavy retouched flake knives are nonpatterned tools that probably functioned much the same as the patterned bifacial knives (Tratebas 1986). They would have been suited to butchering and other heavy

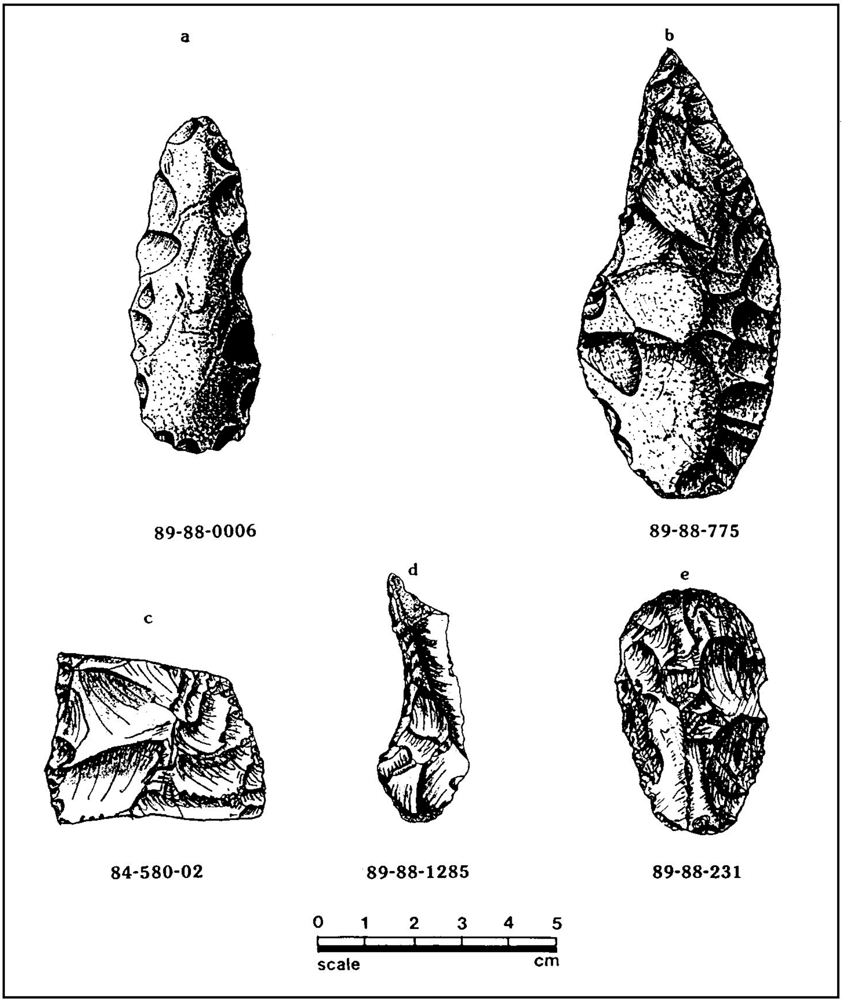


Figure 4.13: Miscellaneous tools from 39LA117: a, biface knife (Cat. 89-88-0006); b, hafted biface knife (Cat. 89-88-775); c, scraper/biface knife (Cat. 84-580-02); d, graver (Cat. 89-88-1285); e, keeled scraper (Cat. 89-88-231).

cutting tasks.

Two final flake tool categories comprise five utilized flake knives and eight unclassifiable retouched and utilized flake fragments. All of the utilized flake knives were recovered from the western portion of the site. With one exception, all are made of cryptocrystalline material (chert or porcellanite). These exhibit use-wear in the form of nicking, striations, and feathering. They were expedient, light-duty cutting tools used for a variety of tasks (Tratebas 1986). Two small retouched flake fragments of porcellanite or silicified slate were found in the eastern portion of the site; these show no use-wear. The remaining retouched and utilized flake fragments came from the western portion of the site.

The remaining forty tools in the assemblage are various scrapers or combination scraper/knives. Two tools combining scraping and cutting edges were recovered from the eastern portion of the site. Each is a large, parallel-sided, tabular flake with a bifacially worked knife edge on one side and a unifacially worked scraper edge on the opposite side. The ends of the flakes terminate in snap fractures. These appear to represent heavy-duty scraping and cutting tools, suited to tasks such as butchering or wood processing.

Eleven tools were classified as endscrapers. Seven are patterned and four are nonpatterned expedient tools. All eleven endscrapers, including the single keeled endscraper, were recovered from the western portion of the site on the lower terrace. The endscrapers exhibited light to pronounced use-wear, in the form of edge rounding, smoothing, polish, and step-fractures. The morphology and use-wear patterns indicate these tools were used for scraping hides.

Twelve side-scrapers, ten light scrapers, and five undifferentiated scraper fragments were also recovered from the western portion of the site. All exhibited use-wear, in the form of polish, smoothing, step-fractures, or feathering. Such scrapers are hypothesized to have been used for hide scraping and other light-duty scraping tasks (Tratebas 1986). The eastern, interterrac,e portion of the site contained three additional sidescrapers, with light to medium use-wear. Again, scraping of hide or other soft material is indicated. A single keeled endscraper was found in the western portion of the site. Its working edges exhibit smoothing, rounding, step-fractures, and striations. These wear patterns suggest that the tool was used on bone or wood, as well as softer material such as hides or green wood (Tratebas 1986).

In summary, distinct tool assemblages characterize the eastern and western portions of the site. The eastern portion of the site, on the slope between the upper and lower terraces, contains a hunting-based tool assemblage including broken projectile points, bifacial knives, choppers, combination scraper/knives, sidescrapers, and retouched flake tools. This assemblage is suggestive of post-hunt weapon repair and butchering. The main, western, portion of the site contains a more diverse tool assemblage suggestive of hunting tool preparation, woodworking, meat processing, and hide processing. Tools found in the western portion of the site include a wide variety of scrapers, utilized flake knives, light retouched flake knives, heavy retouched flake knives, preforms, a chisel, biface fragments, bifacial knives, and gravers.

4.7.5 Lithic Debitage

Some 25,828 flakes and lithic tool manufacturing by-products were recovered from the excavations at 39LA117 (Table 4.8). Another 1063 pieces of debitage were found on the surface, in shovel tests, and in the graded areas of the site, bringing the total to 26,891 pieces. As mentioned, the horizontal distribution of debitage is unimodal in all excavation units, suggesting a single subsurface component at 39LA117. The greatest concentration of lithic debitage was in the west sector of the site, in the main block excavation.

All size grades of lithic debitage were present, with Grade 5 (¡1/16”) predominant by number of pieces and Grade 3 predominant by weight. Sorting by number yielded consistently unimodal distributions, with Grade 5 usually predominant. In a few instances, Grade 4 or 3 debitage outnumbered Grade 5 debitage. When sorted by weight, Grade 3 was most abundant, with some units displaying a bimodal distribution.

Debitage was also sorted according to lithic raw material type (Tables 4.9 and 4.10). Various colors of chalcedony were the most common material, comprising 41 percent of the assemblage by weight. Cherts made up another 31 percent and quartzites 20 percent of the total debitage. Silicified slate (or shale) and porcellanite (4 percent), silicified siltstone (3 percent), and quartz (1 percent) were also represented in the debitage assemblage (see Appendix B for detailed tabulations of debitage size grades and raw material types).

4.8 Discussion

4.8.1 Features

The most unexpected and frustrating aspect of 39LA117 is the complete lack of cultural features at the site. Several hypotheses can be offered to explain the lack of features. The first and most obvious is that no features ever existed at the site, because no activities were undertaken there that would have left such traces. This idea is hard to accept for two reasons. First, the sheer size of the site argues for either a large number of successive occupations or few intensive or prolonged occupations of the site. Either way, it is difficult to envision such an occupation or series of occupations not involving construction of temporary dwellings, roasting pits, fire hearths, drying racks, or other items needed to supply food and shelter. Second, Middle and Late Archaic sites elsewhere in the Black Hills and Northwestern Plains typically are replete with fire hearths and roasting pits; some contain structural remains, in the form of tipi rings or house pits, as well. Thus, the lack of features is unexpected in terms of both the type of site and the age of 39LA117.

A second possibility is that features were present at the site, but the field methods employed were inadequate to detect them. The field notes mention in several places the difficulty of recognizing features among the numerous natural charcoal lenses and burned roots that occur within the cultural horizon. In response to this recognized difficulty, special field methods were used to ensure

Table 4.8: Debitage totals by size grade, 39LA117. Weight is given in grams. Amounts less than 0.1 g were not included in the totals

Unit	Grade 1		Grade 2		Grade 3		Grade 4		Grade 5		Total	
	n	wt	n	wt	n	wt	n	wt	n	wt	n	wt
1	0	0	7	12.5	60	17.9	50	2.2	20	.2	137	32.8
2	2	12.2	8	14.3	141	52.2	528	20.5	1060	6.8	1739	106.0
3	0	0	2	2.3	166	42.1	636	23.6	879	5.2	1683	73.2
4	0	0	7	14.4	49	20.2	160	7.2	111	.5	327	42.3
5	0	0	8	12.4	79	30.1	288	9.8	567	3.0	942	55.3
6	3	41.0	12	15.8	201	51.0	668	22.6	2405	13.9	3289	144.3
7	0	0	1	5.0	4	1.2	3	.2	1	¡.1	9	6.4
8	0	0	1	1.4	23	8.9	36	1.6	0	0	60	11.9
9	0	0	0	0	8	2.2	9	.4	1	¡.1	18	2.6
10	0	0	2	2.5	29	8.3	67	2.3	83	.4	181	13.5
11	0	0	0	0	2	1.0	2	.1	0	0	4	1.1
12	4	30.0	6	12.2	30	10.0	96	4.2	221	1.5	357	57.9
13	0	0	1	1.4	4	2.7	0	0	0	0	5	4.1
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	1	.3	1	¡.1	0	0	2	.3
16	0	0	3	9.5	13	3.6	45	1.8	10	.1	71	15.0
17	0	0	2	2.2	26	7.5	24	2.0	6	¡.1	58	11.7
18	0	0	13	29.6	170	54.0	635	26.6	2628	12.1	3446	122.2
19	4	94.1	5	13.2	20	9.0	20	1.0	9	¡.1	58	117.3
20	1	4.3	1	2.4	11	4.5	14	.5	9	¡.1	36	11.7
21	0	0	2	2.0	54	18.1	45	2.0	3	¡.1	104	22.1
22	0	0	4	5.0	107	29.2	275	10.3	117	.6	503	45.1
23	0	0	0	0	9	1.3	33	1.5	19	.1	61	2.9
24	1	6.4	14	25.9	89	27.2	186	7.7	329	2.4	619	69.6
25	0	0	1	.7	5	.8	6	.3	2	¡.1	14	1.8
26	0	0	4	7.5	112	39.2	374	17.7	643	4.8	1133	69.2
27	0	0	1	.7	12	2.6	46	2.1	81	.6	140	6.0
28	2	10.2	9	16.6	125	42.1	439	18.5	1326	8.3	1901	95.7
29	0	0	1	1.1	28	7.8	81	3.0	129	.9	239	12.8
30	0	0	0	0	12	5.1	69	2.2	136	.9	217	8.2
31	0	0	13	23.0	113	41.5	334	15.8	706	5.5	1166	85.8
32	0	0	0	0	37	7.9	141	4.5	24	.1	202	12.5
33	0	0	1	3.2	9	2.4	42	1.2	69	.5	121	7.3
34	0	0	4	2.5	11	2.6	39	1.4	65	.4	119	6.9
35	1	10.0	21	49.1	344	118.3	915	43.7	2314	16.3	3595	237.4
36	0	0	1	.5	15	3.7	51	2.3	131	.8	198	7.3
37	1	5.9	9	15.7	94	29.6	416	15.1	1224	7.5	1744	73.8
38	2	18.9	8	14.7	59	19.1	192	6.5	551	3.2	812	62.4
39	0	0	4	5.2	21	5.4	130	4.4	216	1.3	371	16.3
40	0	0	1	2.6	9	1.4	54	1.8	82	.4	146	6.2
Total	21	233.0	177	327.1	2,302	732.0	7,150	288.6	16,177	98.3	25,827	1679.0

that features would not be missed. These included 1) investigating each soil stain and/or burned area as if it were a cultural feature; 2) excavating blocks of units, so that larger contiguous areas of cultural horizon were exposed, thus giving the excavators a better horizontal view of the intact cultural horizon; and 3) exposing large areas of the site by removing the topsoil with a road grader, thus greatly expanding the area that could be searched for features. While a small percentage of features at a site might escape detection by even these methods, it is extremely unlikely that a significant number were overlooked, given the field methods used.

A third possible explanation for the lack of features at 39LA117 is that features once existed at the site, but were subsequently removed or disturbed by natural processes or human activity. If features were ill-defined to begin with, it is quite possible that a combination of soil movement, bioturbation, and natural fires virtually erased them. For example, a typical Middle Archaic feature is a shallow, basin-shaped hearth, with or without a lining of rock slabs. Soil movement due to flooding, slope wash from the upper terrace, or accelerated run-off following a removal of vegetation by fire could easily result in a mixing of the oxidized soil from the feature with the surrounding matrix. In addition, the slow rate of deposition on the main portion of the site would have left any features exposed to the effects of wind, run-off, root action, and animals for a relatively long time. The high degree of historic disturbance at the site may have also contributed to the removal of recognizable features.

Limited soil displacement is suggested by both stratigraphic and and archaeological evidence (see Appendix A). Various sizes of lithic debitage are

Table 4.9: Debitage raw material type percentages by weight, 39LA117 (size grades 1–4)

Material Type	Total Weight in Grams	Percent of Total Weight	Material Class Group	
			Weight	Percent
Clear Chalcedony	25.1	1.6	642.9	41
Light Chalcedony	221.6	13.3		
Brown Chalcedony	398.4	24.0		
Dark Chalcedony	10.8	.7		
Light Chert	218.1	14.0	478.3	31
Dark Chert	260.2	16.7		
Silicified Shale & Porcellanite	70.8	4.5	70.8	4
Light Quartzite	28.4	1.8	318.7	20
Tan Quartzite	67.9	4.3		
Brown Quartizite	57.0	3.7		
Red, Pink Quartzite	39.6	2.5		
Purple Quartzite	125.8	8.1		
Gray Silicified Silt	34.5	2.2	48.9	3
Tan Silicified Silt	14.4	.9		
Quartz	2.9	.1	2.9	1
Total	1562.5	100.0	1562.5	100

Table 4.10: 39LA117 debitage raw material type percentages by weight, broken down by size grades 1–4

Material Type	Grade 1	Grade 2	Grade 3	Grade 4	Total
Clear Chalcedoney	4.2	1.1	.9	1.5	1.6
Light Chalcedony	2.4	17.4	13.5	16.3	13.2
Brown Chalcedony	4.3	24.8	28.8	30.0	24.5
Dark Chalcedony		.2	.9	1.1	.7
Light Chert	15.9	9.6	15.7	21.2	15.4
Dark Chert	21.3	19.7	15.2	12.0	16.5
Silicified Shale & Porcellanite	0.0	1.9	6.9	5.7	4.6
Light Quartzite	1.8	.5	2.1	2.5	1.8
Tan Quartzite	5.4	3.6	4.2	4.0	4.2
Brown Quartzite	2.3	9.6	2.6	.4	3.6
Red, Pink Quartzite	8.0	.8	2.0	3.0	2.8
Purple Quartzite	34.4	5.9	2.7	1.2	7.8
Gray Silicified Silt		3.2	3.3	.8	2.3
Tan Silicified Silt		1.7	1.1	.2	.9
Siliceous Slate		1.9	6.6	5.5	4.4
Quartz			.1	.1	.2

distributed unevenly across the site, suggesting some postdepositional sorting. (This is discussed in more detail below.) The natural burns that are clearly evident at the site resulted in soil discoloration from charcoal inclusions and oxidation, further obscuring any hearth features that may have existed at the site. The natural abundance of burned rock in the site area confounds the identification of particular rocks as having been used in hearths or roasting pits, as opposed to occurring naturally on the site. The historic and recent disturbances to the site detailed above may have resulted in disturbance of the cultural deposits beyond their immediate and visible impacts, by changing the pattern of drainage and sedimentation in the site area.

Three possible explanations for the lack of features at 39LA117 have been presented—that no features existed, that features were missed by the field work, and that features were "erased" or obscured by later events. Of these, the latter explanation is most plausible in terms of the archaeological and depositional contexts of the site, and given the field techniques employed in its investigation. The present interpretation of 39LA117 operates on the admittedly controversial assumption that activities may have taken place at the site which normally would have resulted in feature formation, even though no such features were identified. In other words, certain site functions, such as cooking, are not ruled out on the basis of a lack of recognizable features related to those functions. This assumption accommodates the very real possibility that once visible features were obscured or destroyed by later depositional events. At the same time, no interpretations are offered in the absence of features or artifactual evidence.

Both functional and stratigraphic interpretations are greatly hampered by the lack of recognizable features at 39LA117. The vertical and horizontal placement of features can clarify whether multiple occupations are present at a site and, if so, their vertical and horizontal limits. As was stated above, the available data suggest a few intense or prolonged uses of the site; however, repeated short-term multiple occupations cannot be entirely ruled out.

4.8.2 Lithics

Several patterns emerge from the distribution of chipped stone tools at 39LA117. One of the more obvious patterns was a discrepancy in the distribution and types of tools on the surface versus those found during excavation. Surface collections suggested that the main concentration of tools was on and near the slope between the upper and lower terraces. Tools found on the surface included four bifaces, six projectile points, a preform, three retouched or utilized flakes, two scraper/knives, four scrapers, a perforator, a chopper, and a chopper/adze. Nineteen of these twenty-three tools were found in the east and southeast sectors of the site.

The surface distribution of tools was not a good predictor of subsurface deposits. The surface collection exhibited a bias in tool distribution toward the east side of the site, while the subsurface collections were biased toward the west side of the site. The main subsurface concentrations of tools were in the main block excavation and the secondary block west of it, both in the west sector, an area that contained few surface tools. The eastern portion of the site, by contrast, actually had more tools on the surface (n=19) than in the excavated areas (n=8). Although smaller areas were excavated in the eastern sectors, a comparison of these excavated areas with those west of FH26 also indicates that the eastern units were tool poor compared with those in the west sector, in spite of surface indications to the contrary.

The discrepancy between the surface and the subsurface tool distributions can be explained in terms of postdepositional displacement of artifacts. It appears that two separate cultural horizons are represented by the artifacts found at 39LA117. The main cultural horizon dates to the Middle and Late Archaic; this occupies the lower of the two terraces, including both the buried component and the surface component.

The other cultural horizon, whose existence is inferred from the artifact distributions and the geomorphic context of the site, comprises Late Paleoindian and Early Archaic components. This occupies the upper terrace, above and to the east of the investigated area of 39LA117. The artifacts found on and below the surface of the east and southeast sectors apparently are materials from these earlier occupations that have been displaced down slope through colluvial action. This second cultural horizon occupies the slope between the two terraces, and the buried component represented by Units 10, 13, and 17 in the east sector and 21, 22, 32, and 36 in the southeast sector. The subsurface materials from Unit 25 in the east sector and Unit 14 in the southeast sector belong to the later, Middle and Late Archaic components adjacent to the west. Near the base of the interterrace slope, the Paleoindian and Early Archaic material forms a surface veneer on the eastern portion of the lower terrace. This is unrelated to the main subsurface component, which dates to the Middle and Late Archaic. This creates a reverse stratigraphy situation, with earlier artifacts stratigraphically overlying more recent ones near the base of the slope. Whether the Paleoindian-Early Archaic horizon is restricted to the surface or extends below the surface of the upper terrace was not deter- mined, because the upper terrace is outside the project area.

The eastern extent of the subsurface Middle and Late Archaic occupations also could not be determined. The cultural horizon certainly extends at least to the base of the slope, as indicated by the presence of Middle Archaic projectile point fragments in and near Unit 25 and on the surface of the trail just east of FH-26. The cultural affiliation of the subsurface materials in the remaining excavation units in the eastern sectors is less certain. It is possible that the lower portions of these units contain Middle and Late Archaic deposits, and the upper portions contain Paleoindian to Early Archaic materials redeposited from the upper terrace. For purposes of this analysis, all of the northeast, east, and southeast sectors are assumed to belong to the earlier, redeposited component, with the exception of Units 11, 25, and 14, which lie at the edge of the lower terrace adjacent to the interterrace slope.

Both late Paleoindian and Early Archaic projectile points are present in the early cultural horizon of 39LA117. Similarly, Middle Archaic and early and middle Late Archaic projectile points are present in the late cultural horizon. This indicates that, rather than isolated occupations, both portions of the site represent a series of occupations. Within each cultural horizon, these occupations appear to be essentially similar, suggesting that the site was used for one basic type of occupation during the Paleoindian and Early Archaic periods and for a different type of occupation during the Middle and Late Archaic.

In the eastern portion of the site, representing the Paleoindian-Early Archaic cultural horizon, the tool assemblage included eight projectile points, all of which were broken, five bifacial knives or fragments of bifaces, two scraper-knives, three sidescrapers, six retouched flakes, two heavy retouched flake knives, two light retouched flake knives, three choppers, one perforator, and one tiny fragment of a tool or preform. The tool to debitage ratios for this portion of the site are 1:59, inclusive of debitage size grades 1–5, and 1:14, excluding debitage size grade 4–5, based on subsurface debitage and both surface and subsurface tools. (The debitage ratio probably is inflated by the possible inclusion of materials from the Middle and Late Archaic components in the debitage tabulations from the eastern sectors of the site.) Taken together, the tool types, breakage patterns, wear-patterns, and tool to debitage ratios indicate a special activity site devoted to the repair of hunting tools, initial butchering, and manufacture of wood or bone tools. Secondary butchering may also have taken place at the site, judging by the presence of both heavy- and light-duty expedient cutting tools. Stone tool manufacture was not a major focus of the series of occupations represented by this early component.

The western portion of the site contained a more diverse tool assemblage, including eleven broken and one unbroken projectile points, three projectile point preforms, eight bifacial knives, nine biface fragments, two heavy and ten light retouched flake knives, three gravers, ten utilized flake knives, a chisel, and a variety of scrapers, including ten endscrapers, eight sidescrapers, five scraper fragments, ten light scrapers, and one keeled endscraper. The people occupying this portion of the site appear to have been engaged in prehunt staging operations, stone tool manufacture, hide preparation, and secondary butchering.

Diagnostic projectile points indicate a minimum of three occupations, separated by hundreds of years, of the portion of 39LA117 lying on the lower terrace. No stratigraphic separation of these occupations could be detected, nor is any expected given the thinness of the deposit and the degree of soil disturbance in this area of the site. Given this evidence that materials from the various occupations of the lower terrace are mixed, clearly defined activity areas cannot be expected to exist in the site deposits. Nevertheless, a few distinctive patterns of tool distribution could be discerned, suggesting the existence of activity areas.

These remnant activity areas are indicated by clusters of tools belonging to a single type or tool kit. The first of these is a cluster of three broken projectile points found in the east sector near the base of the interterrace slope, in and near Unit 25. The breakage and use-wear patterns of these projectile points indicate that they were broken during use and not during manufacture. This area thus may represent either hunting weapons maintenance or butchering; however, the lack of other tools, specifically knives and choppers, mitigates against this having been a butchering station.

A second tool cluster occurs in the eastern half of the main block excavation in the west sector of the site. Units 5, 1, 2, and 18 contained three endscrapers, five utilized flake knives, two light duty scrapers, two scraper fragments, one side-scraper, and one light retouched flake knife. Another six endscrapers, four light scrapers, one side-scraper, three utilized flake knives, and one light retouched flake knife were found in adjacent units to the south. This seems to represent the remnants of a hide-working tool kit, apparently used for scraping and cutting green hides.

An overlapping cluster of bifacial tools has a slightly more western distribution. This includes five projectile point fragments, one complete projectile point, and five bifacial knives. One additional biface fragment was found in Unit 18, east of the units containing bifacial knives. The combination of broken projectile points and bifacial knives is suggestive of secondary butchering and hunting weapon maintenance. The chisel recovered from Unit 5 is probably also part of this hypothesized weapon maintenance tool kit. Although the separation between these two tool clusters is not entirely convincing, two general activity areas do seem to be indicated. These might be interpreted as a women's work area, devoted to hide preparation, and a men's work area, in which tool repair and secondary butchering or other cutting activity took place.

Two of the gravers in the 39LA117 assemblage were found in the southwestern portion of the west sector. Such tools may have been used in tool manufacturing, for incising wood or bone, or in removing sinew during butchering (Tratebas 1986). Other tools in the vicinity were a broken projectile point, a preform, and several light retouched flake knives. The point was broken during manufacture or resharpening, lending some support to the hypothesis that the gravers were being used during dart hafting or shaft preparation. Other evidence of secondary stone tool manufacturing is, however, lacking from the area of the site.

Finally, two blade portions of projectile points or bifacial knives, both made of plate chalcedony, were found in the secondary block excavation on the west edge of the west sector. A graver, four biface fragments, two utilized flake knives, four light scrapers, an endscraper, and a sidescraper were also found in this block. General cutting and scraping activities, perhaps related to hide preparation, and hunting tool preparation or repair are indicated.

Since the materials from the earlier, Paleoindian-Early Archaic cultural horizon were redeposited by slope wash, their spatial patterning is a consequence of natural, rather than cultural, forces. Most of the tools recovered from this portion of the site were found in or near the dirt trail leading east of FH-26.

The distribution of lithic debitage (flakes and other by-products of chipped stone tool manufacturing) also exhibits distinctive patterns at 39LA117. In terms of number of pieces per excavation unit, the main concentrations of debitage are in the main block excavation and the smaller block excavation west of it in the west sector. Secondary concentrations occur in Unit 24 in the west sector and the southeast sector block excavation (Figure 4.14). The uneven distribution of debitage in the main block excavation suggests the presence of stone-knapping stations, marked by localized concentrations of lithic debris. This suggestion is strengthened by the distribution of lithic raw material types, discussed below, and by the occurrence of two cores in Unit 12 of the main block excavation. Two other cores were found on the surface west of FH26, but neither was near the block excavation.

A distinct pattern also characterizes the distribution of lithic debitage size categories, according to number of pieces per unit. All but two of the thirteen units in the main block excavation were dominated by lithic debitage of size grade 5 (G5=1/6" or smaller). Unit 4 in the center of the block was dominated by G4 debitage and contained fewer pieces of debitage than its neighboring units. Unit 4 thus seems to be a "clean spot" between chipping debris piles. It could be speculated that it represents the space where the flintknapper sat, or a space covered by a hide or other ground-cover. G3 was the dominant size grade in Unit 1; however, most of this initial unit was screened using 1/4-inch mesh and thus is not readily comparable to the other units most of which were screened using 1/8- or 1/16-inch mesh. It is reasonable to assume that G5 debitage would have dominated Unit 1, had a different recovery technique been employed.

Grade 5 debitage also was prevalent in the west sector units nearest the main block excavation on the west, south, and east. The west sector units farthest to the south and east, however, are dominated by G4 and G4-G3 size debitage. Grades 3 and 4 also predominate in the northeast sector units, and most of the east and southeast sector units. Some of this observed patterning may be the result of different recovery techniques having been applied to the various units; however, the general pattern of smaller debitage towards the west and larger debitage toward the east of the site is not explainable solely as a product of field

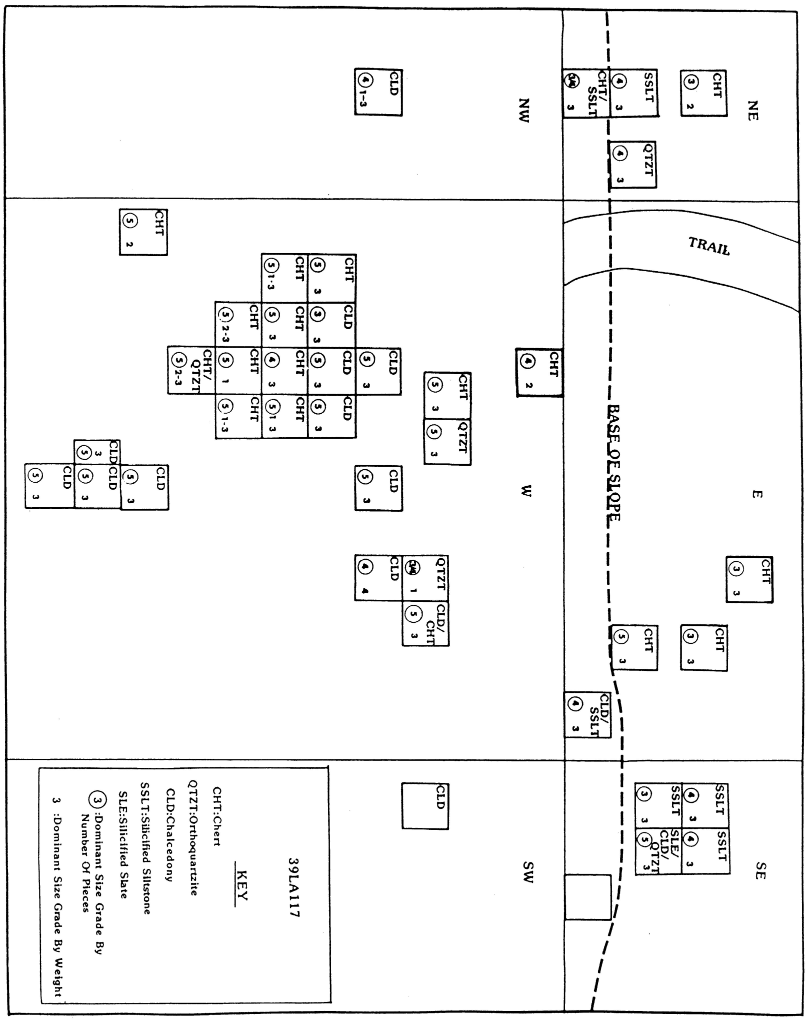


Figure 4.14: Dominant lithic raw material and size grade of lithic debitage by unit, 39LA117

methods.

Several possibilities must be considered in explaining this lithic size grade distribution. The first is that natural geomorphic processes, rather than cultural factors, resulted in the observed distribution. In fact, geomorphic factors seem to have had little impact on debitage sorting. Since lighter, smaller flakes are more readily displaced by run-off, a pattern could be expected of smaller flakes at the base of the slope and on the more level terrace surfaces, with larger pieces having been left behind on the higher portions of the terrace and on the slope. The 39LA117 debitage follows this pattern to some extent, with larger sizes predominant in areas where run-off is heavier; however, sorting does not take place north to south, following the overall trend of the landscape. Thus geomorphic processes can account for some, but not all, of the observed distribution.

Since neither field methods nor geomorphic processes can completely account for the observed lithic sorting, it is reasonable to conclude that the pattern is at least partially the result of cultural activity. As mentioned earlier, the surface and at least some of the subsurface materials from the eastern portion of the site apparently represent Paleoindian and Early Archaic materials redeposited from the upper terrace. Some of the subsurface materials from the southeast and east sectors may represent special activity areas related to the main, Middle and Late Archaic, occupation on the lower terrace. For example, primary lithic tool manufacture may have taken place slightly away from the main site, the roughed out tools then being brought into camp for finishing. Without ruling out the latter possibility altogether, it should be noted that neither raw material distributions nor the distribution of cores at the site supports the idea of peripheral primary tool manufacturing stations related to the main occupation of the lower terrace.

A somewhat different pattern emerges if weight, rather than number, is used to compare the various size grades. By weight, G3 debitage predominates throughout the site, with a few notable exceptions. In the northeast sector, Unit 7 had mostly G2 flakes; however, this may be due to sampling error, since only nine pieces of debitage were recovered from the unit. The remaining units in the northeast, east, and southeast sectors all had more G3 debitage than any other size grade.

The site area west of FH26 displayed several exceptions to the expected prevalence of G3 debitage. Unit 20, in the northwest sector, had a bimodal distribution, with G1 and G3 flakes predominant. This may indicate that both primary (decortication) and secondary stone tool production was taking place in this area of the site. Interestingly, one of the five cores found at the site was collected from the surface near Unit 20. One unit in the main block excavation also had a bimodal distribution, with G1 and G3 flakes predominant; three other units in the main block (Unit 6, 34, 39, 40, and 38) had roughly equal amounts of G1, G2, and G3 debitage, also indicating that more than one stage of lithic tool production took place in this part of the site. One of these units also contained a core. These four units surround Unit 12, which contained mostly G1 debitage, as well as two cores. Apparently, this portion of the site was used for primary, as well as secondary, stone tool manufacturing. The smaller block excavation to the west of the main block contained mostly G3 debitage by weight, as did the remaining units of the main block excavation. Unit 33, northwest of the main block, was dominated by G2 debitage, perhaps suggesting that the primary lithic manufacture activity area extended in that direction. The west sector units east and south of the main block excavation contained mostly G3 debitage, with the exception of Unit 16 (G2), Unit 19 (G1), and Unit 23 (G4). Again, a mix of primary and secondary tool manufacture is suggested for this area of the site.

The number and weight data appear to refer to different kinds of variance in debitage distribution patterns. In the 39LA117 data set, number seems mainly to be an indicator of general trends, which may be at least partially geomorphically controlled, while weight data point out the specific variances or microtrends, which appear to be wholly cultural in origin. To summarize these, a broad variance can be seen in the distribution of debitage between the eastern and western portions of the site, with secondary, localized variance appearing in the western half of the main block excavation and the units to the north, east, and south of the main block. These variances in debitage size distribution suggest, first, that the eastern and western portions of the site represent distinct cultural horizons or activity areas and, second, that both primary and secondary lithic tool production took place at the site. Similar conclusions are suggested by the distribution of cores and tools and lithic raw material types at the site.

Another means of assessing the relative importance of primary versus secondary stone tool production is comparison of the amount of large versus small debitage. The ratio of large (G1-2) to small (G3-5) debitage at 39LA117 is 1:129 (1:2 by weight). Such a high ratio of small to large debitage suggests an emphasis on secondary lithic production. Thus, it appears that, while some primary tool production was undertaken at the site as evidenced by the presence of limited numbers of cores and large flaking debris, the main stone tool production activity at the site was finishing roughed-out tools or preforms and/or reworking finished tools.

The distribution of lithic raw materials also exhibits patterning (Figures 4.15–4.31). In some cases, a rock type is distributed more or less evenly across the site, while other types are concentrated in one or two areas. The most notable of these concentrations are 1) silicified slate in the southeast sector of the site; 2) chalcedony in the southern half of the main block excavation and the smaller block west of it in the west sector; and 3) chert in the northern half of the main block excavation and in the east sector. Purple quartzite, gray silicified shale, and porcellanite were concentrated in single excavation units in the west sector (Units 19, 39, and 31, respectively).

Figure 4.14 illustrates the prevalent lithic raw material type in each of the excavation units (in some instances, more than one type was predominant in a given unit). Chert predominates in three units in the east sector, one in the northeast and twelve in the west sector. Most of the latter are in the northwestern half of the main block excavation. Chalcedony is also widely scattered across the site, dominating the assemblages from one unit each in

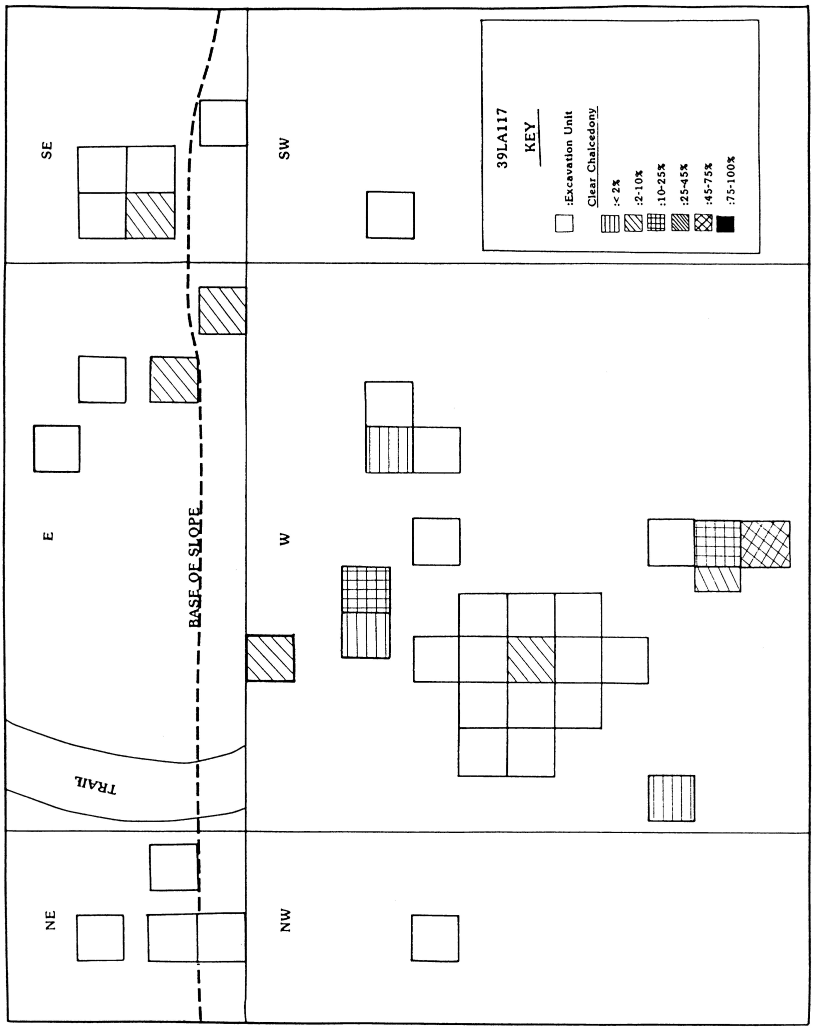


Figure 4.15: Distribution of clear chalcedony by unit, 39LA117

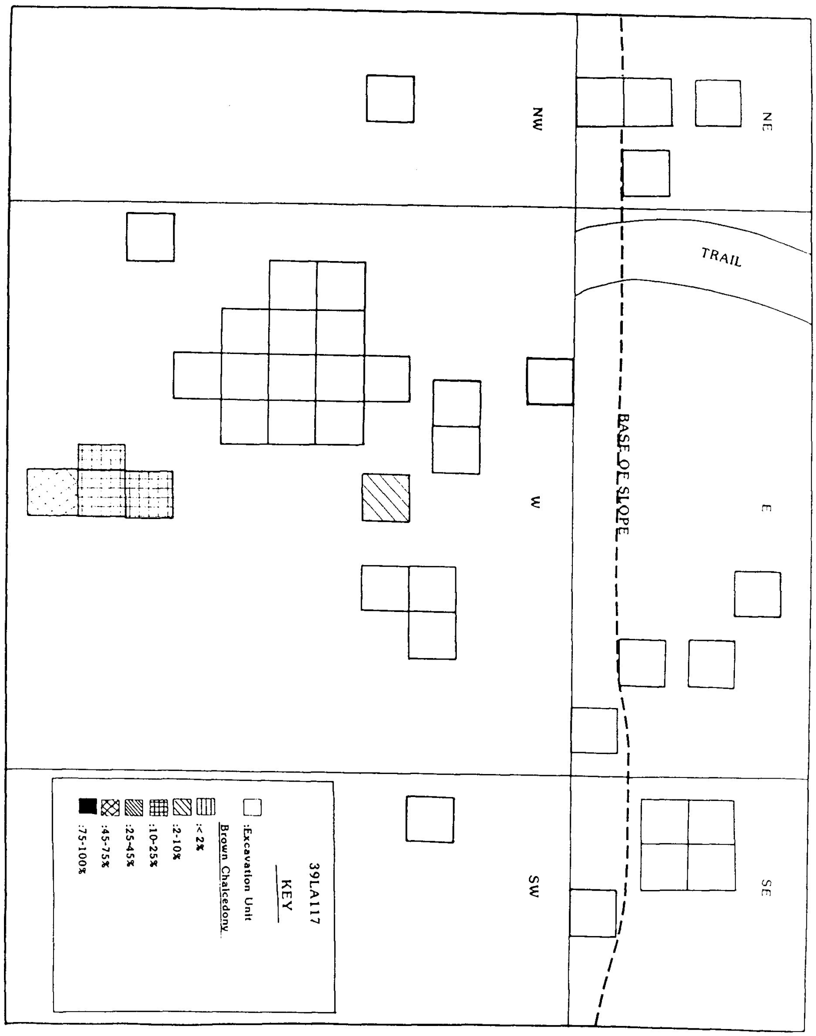


Figure 4.16: Distribution of brown chalcedony by unit, 39LA117

the east, northwest, southwest, and southeast sectors and eleven units in the west sector. Most of the west sector chalcedony is in the southeast half of the main block excavation and the units south and west of the main block. Quartzite formed the greater part of the lithic assemblage in only five units, three in the west sector and one each in the northeast and south- east sectors.

The most distinct pattern is in the distribution of silicified siltstone. This material is predominant in six units, all on the eastern side of the site. This pattern is a result of a relative scarcity of chert, chalcedony, and quartzite in the eastern portion of the site, rather than an absence of silicified siltstone on the western side of the site. Again, a distinct difference between the eastern and western portions of the site is indicated.

With the exception of a small amount of porcellanite, one tool made from Tongue River silicified sediment, and two tools made of Badlands plate chalcedony, all lithic raw materials are locally occurring types. (Here, *locally occurring* means outcropping in the northern Black Hills.) Badlands chalcedony is found in the White River Badlands just east of the Black Hills and porcellanite is abundant in the Powder River Basin just west of the Black Hills; thus, limited interactions to the west and east are suggested. Whether the interactions took the form of migrations or trade is a matter of conjecture. The single tool made from Tongue River silicified sediment, if correctly identified, would indicate travel or trade to the north of the Black Hills. It is possible that this material is actually a locally outcropping silicified sediment bearing a close resemblance to the Tongue River material. In any case, the lithics suggest a Black Hills oriented group, albeit one that whose range extended outside the Black Hills proper.

Tools were classified as patterned versus nonpatterned and bifacial versus unifacial. The unifacial tool class displayed no significant raw material preference; however, the bifacial and patterned tool classes exhibited a significant preference for macrocrystalline raw material, using tool data alone to predict distributions (.05 level of significance). The nonpatterned tool class exhibited a weak preference for cryptocrystalline material. Using debitage raw material distributions to predict distribution of raw material types among tool classes, the bifacial and patterned tool classes showed a significant preference for macrocrystalline raw material; the unifacial and nonpatterned tool classes showed no significant raw material preferences. (See Tables 7.2 and 7.3 for χ^2 values.)

Patterning is also indicated by the relative abundance of cryptocrystalline and macrocrystalline rocks in the debitage and tool assemblages. The debitage assemblage contained 77 percent cryptocrystalline rock (chert, chalcedony, porcellanite, silicified shale) and 23 percent macrocrystalline rock (quartzites and silicified siltstone). The tool assemblage contained 72 percent cryptocrystalline and 28 percent macrocrystalline rock. This difference seems to suggest a slight preference for local cherts for tool manufacture and a pattern of importing some tools to the site from elsewhere. The latter suggestion is confirmed by the presence of several tools made of Badlands plate chalcedony, porcellanite, and, possibly, Tongue River silicified sediment. This hypothesized pattern of using local cherts for expedient tools and importing some shaped tools from the

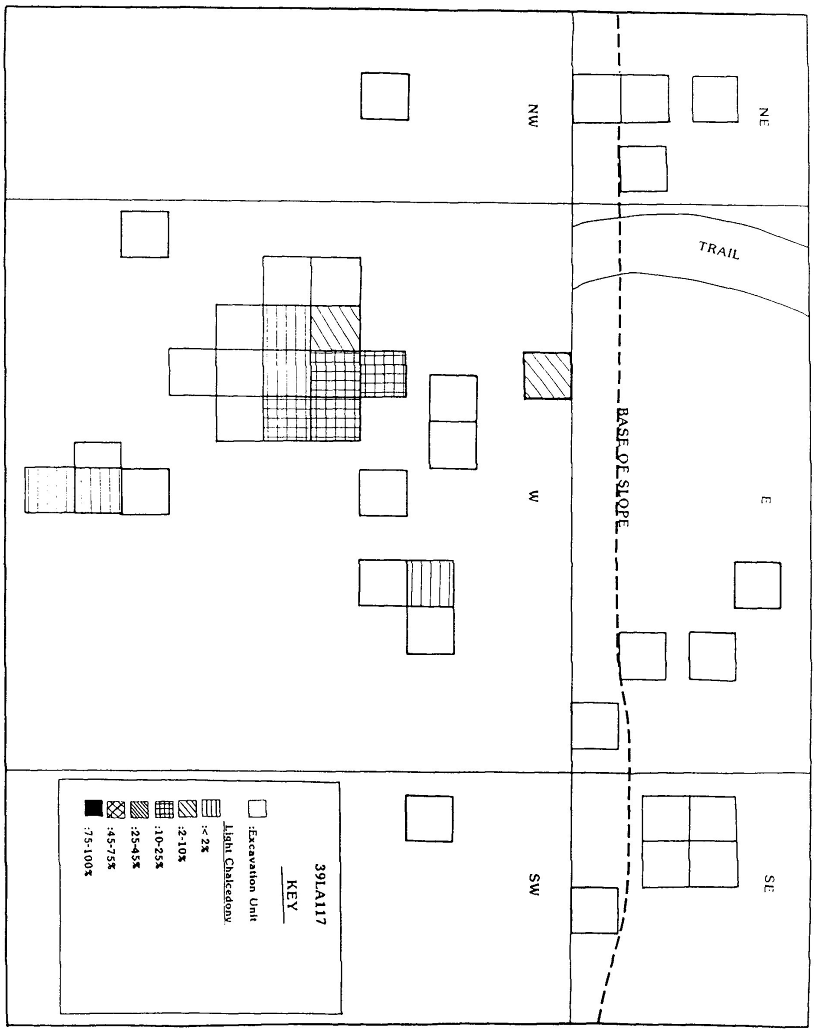


Figure 4.17: Distribution of light chalcedony by unit, 39LA117

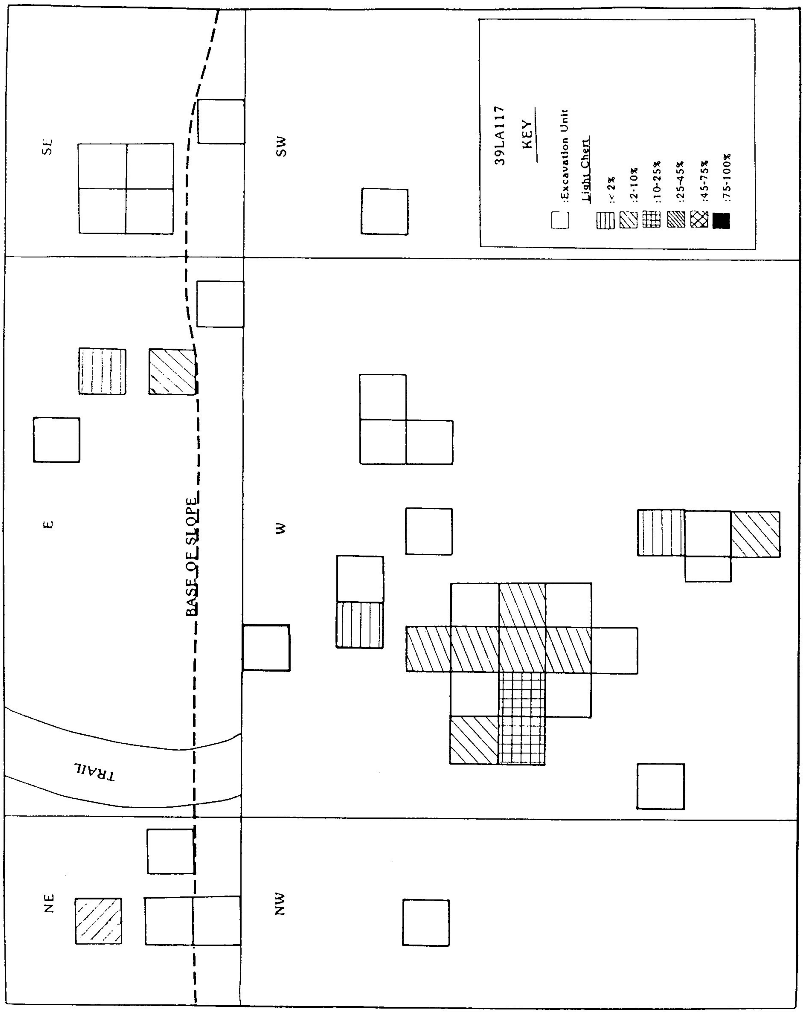


Figure 4.18: Distribution of light chert by unit, 39LA117

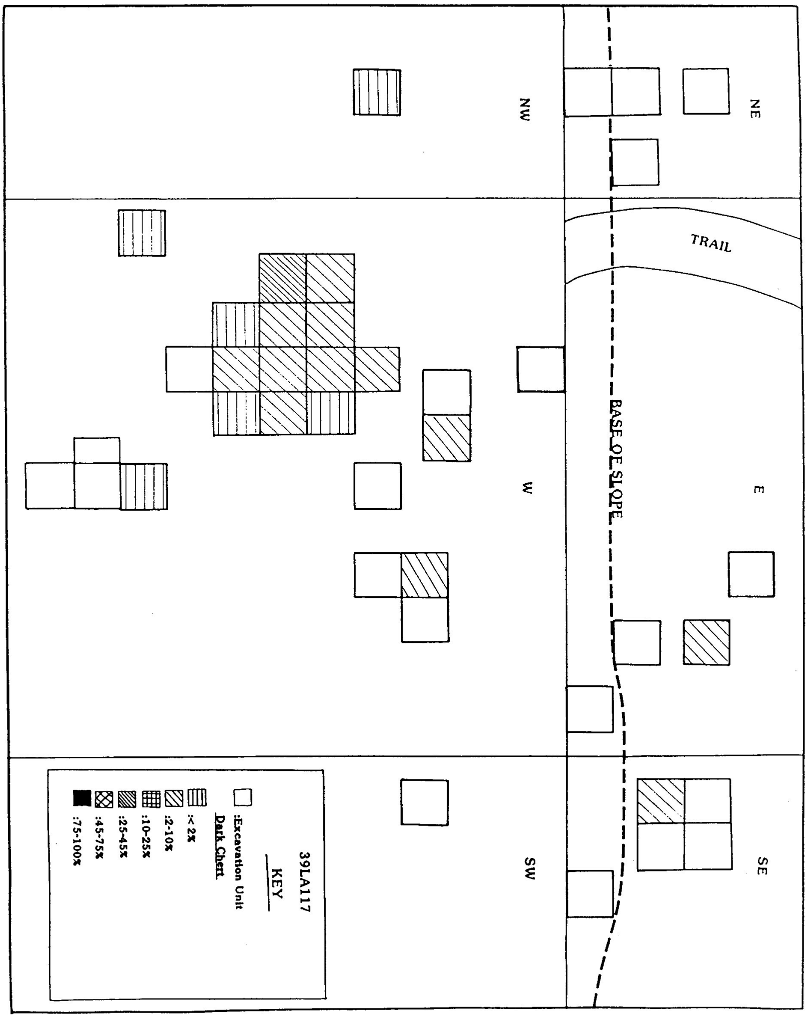


Figure 4.19: Distribution of dark chert by unit, 39LA117

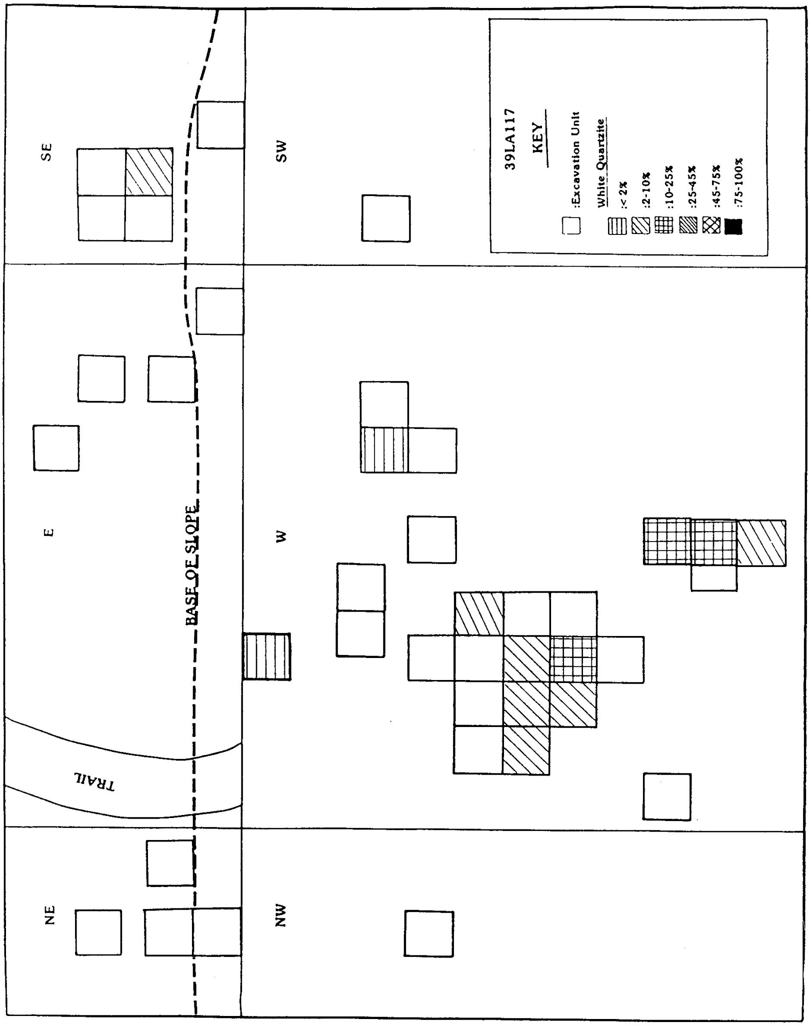


Figure 4.20: Distribution of white quartzite by unit, 39LA117

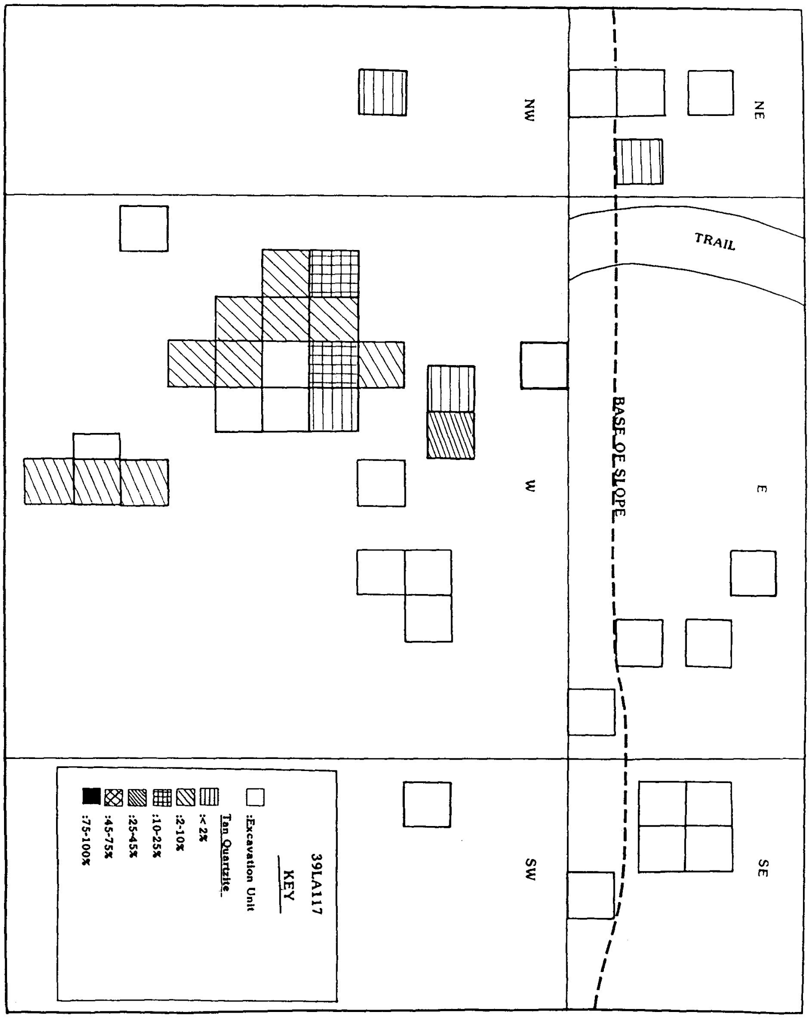


Figure 4.21: Distribution of tan quartzite by unit, 39LA117

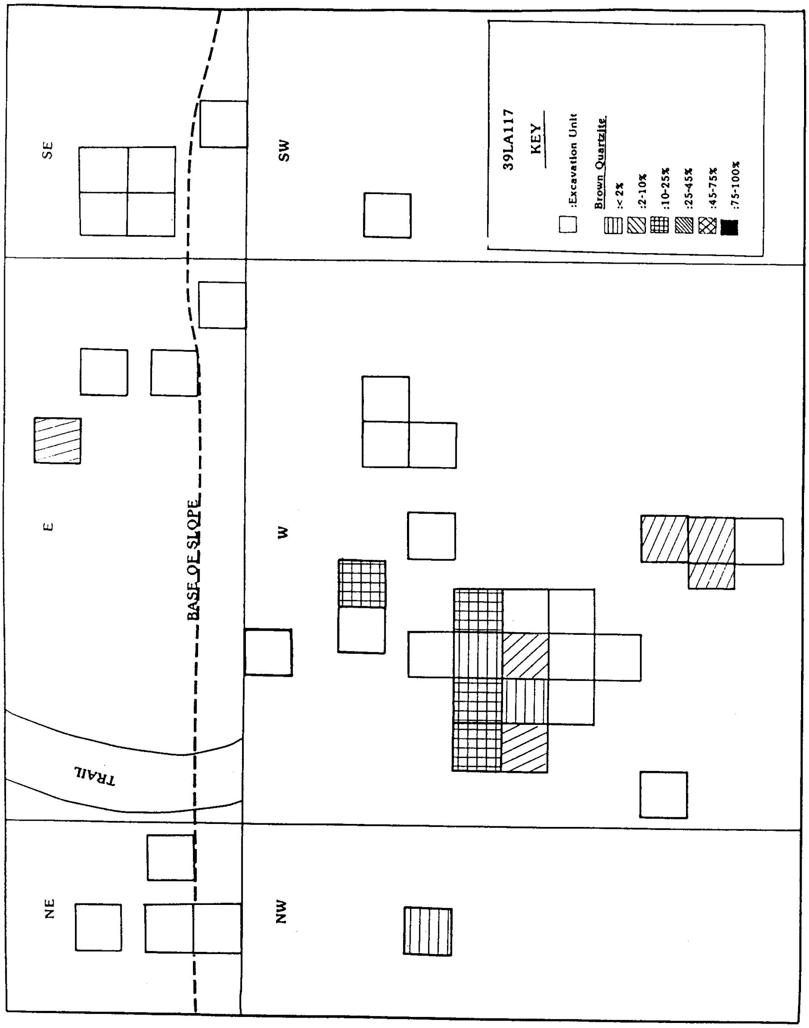


Figure 4.22: Distribution of brown quartzite by unit, 39LA117

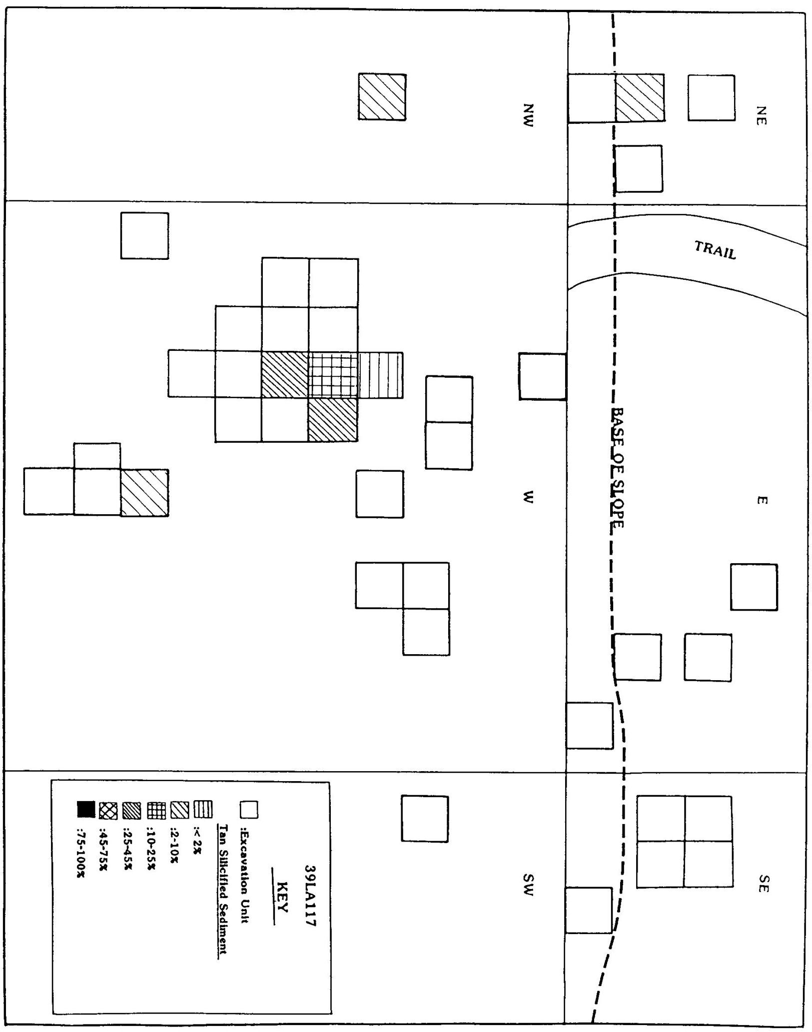


Figure 4.23: Distribution of tan silicified siltstone by unit, 39LA117

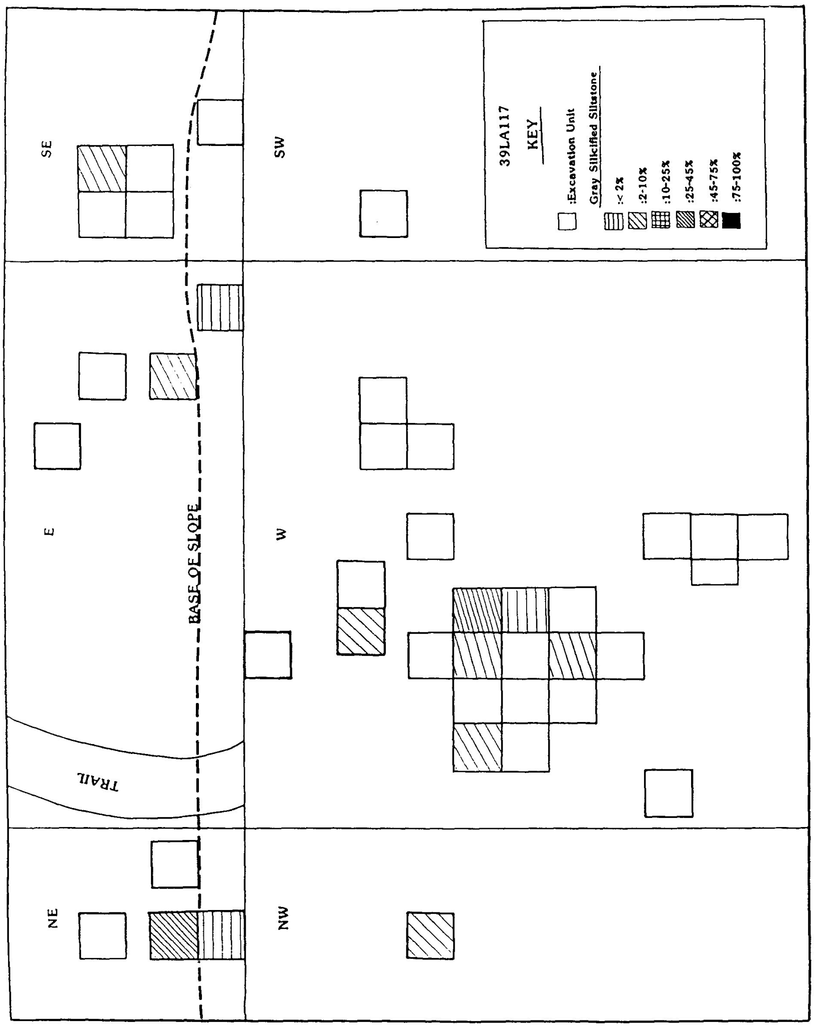


Figure 4.24: Distribution of gray silicified siltstone by unit, 39LA117

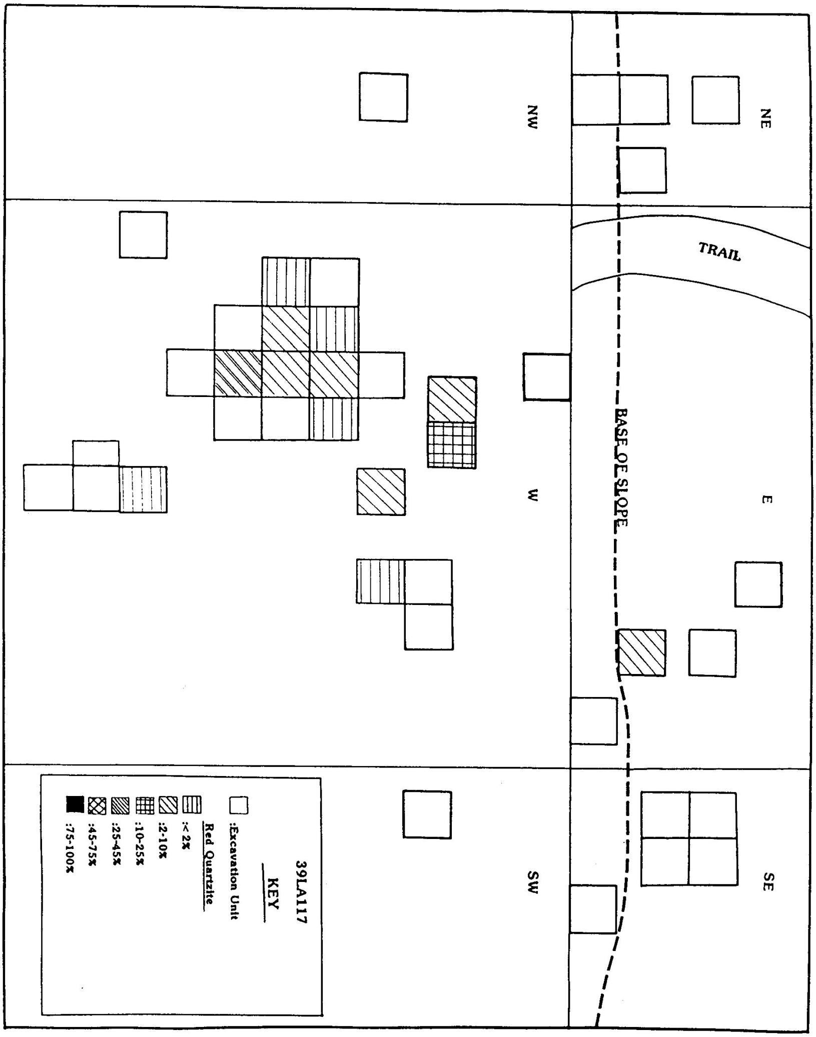


Figure 4.25: Distribution of red quartzite by unit, 39LA117

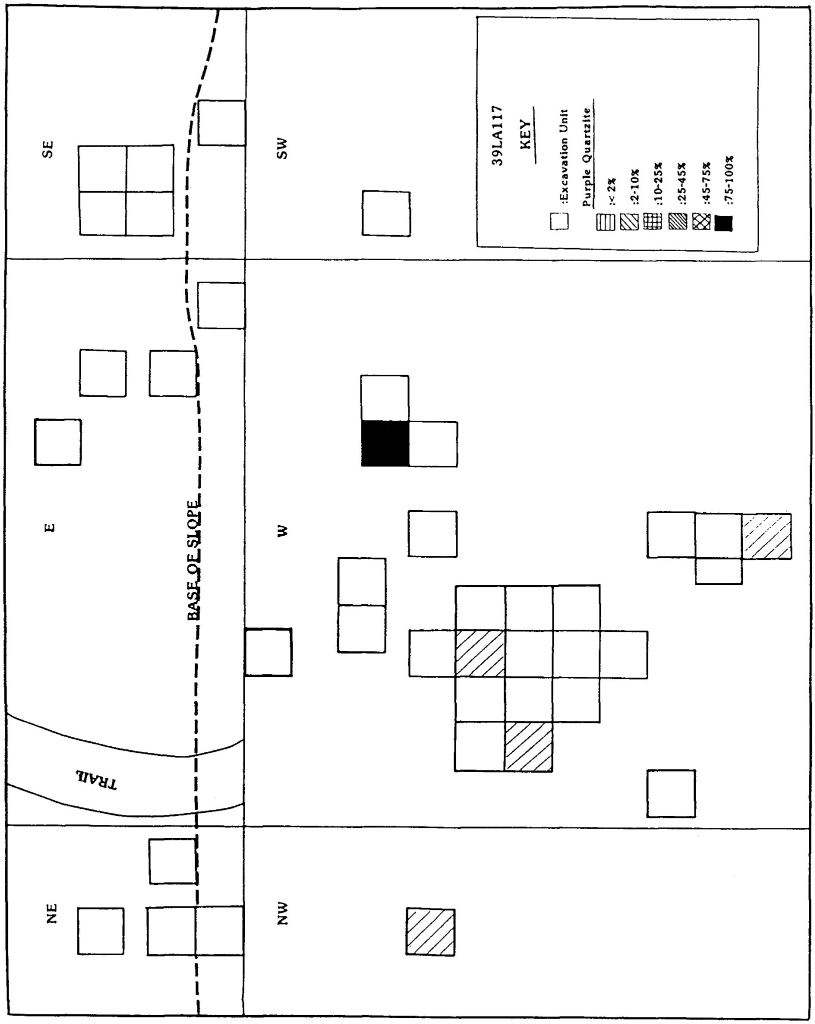


Figure 4.26: Distribution of purple quartzite by unit, 39LA117

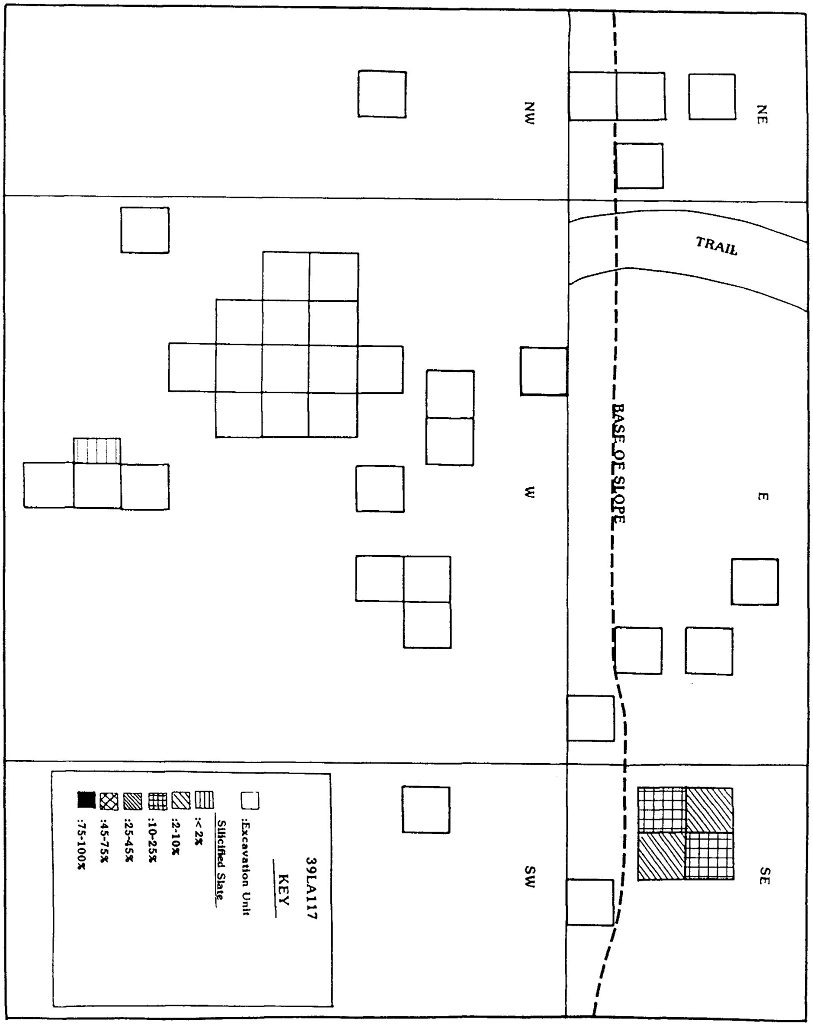


Figure 4.27: Distribution of silicified slate by unit, 39LA117

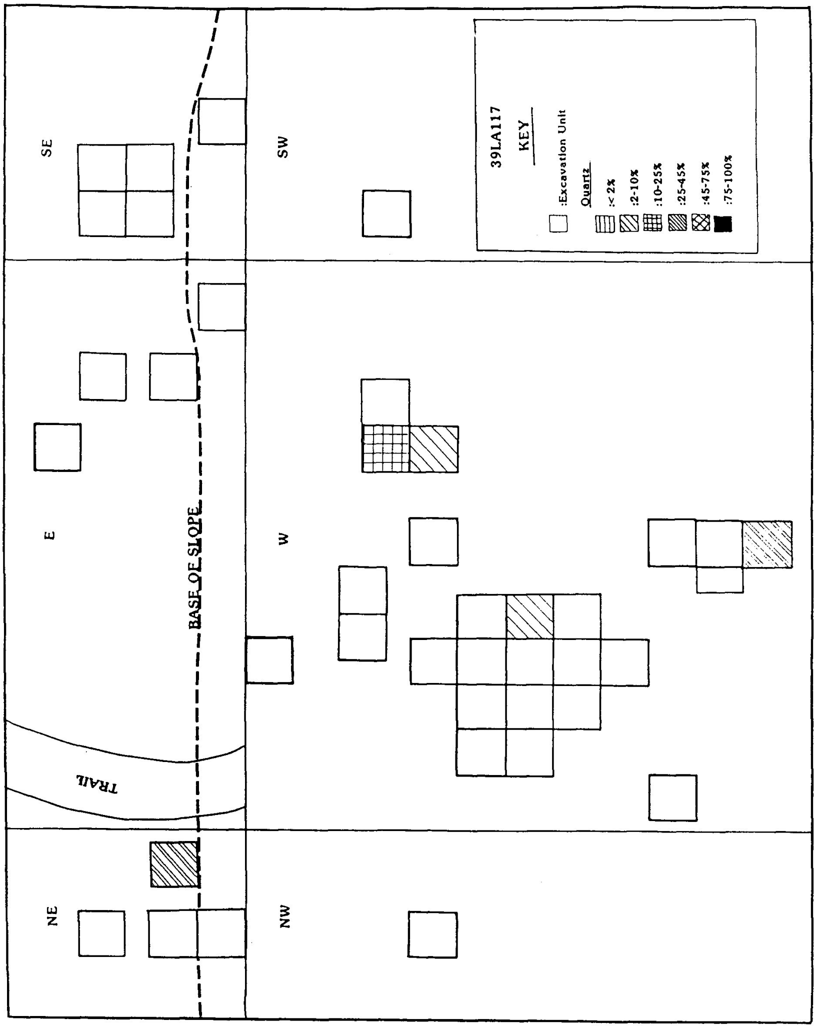


Figure 4.28: Distribution of quartz by unit, 39LA117

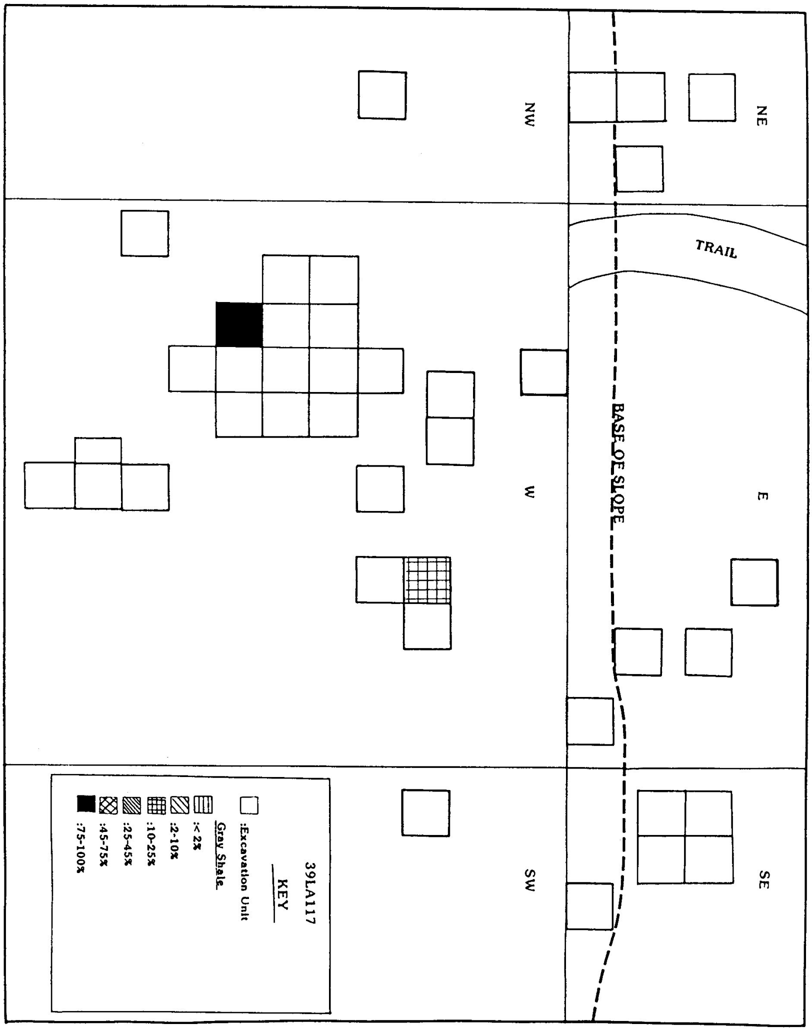


Figure 4.29: Distribution of gray shale by unit, 39LA117

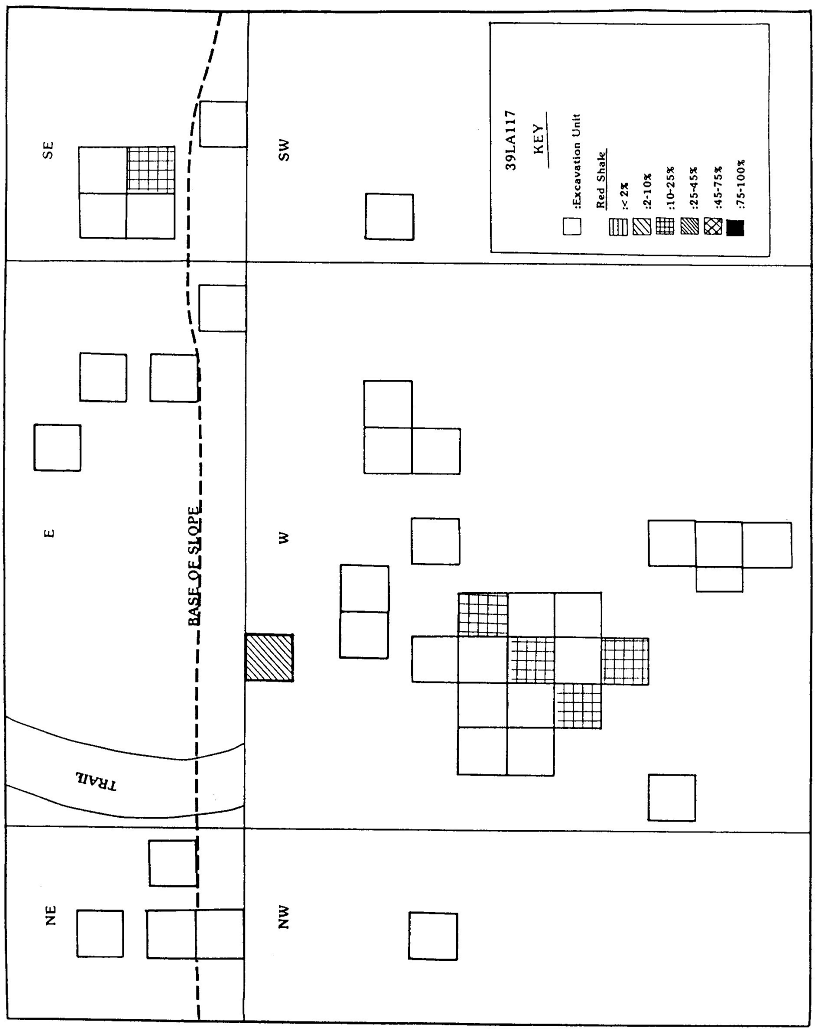


Figure 4.30: Distribution of red shale by unit, 39LA117

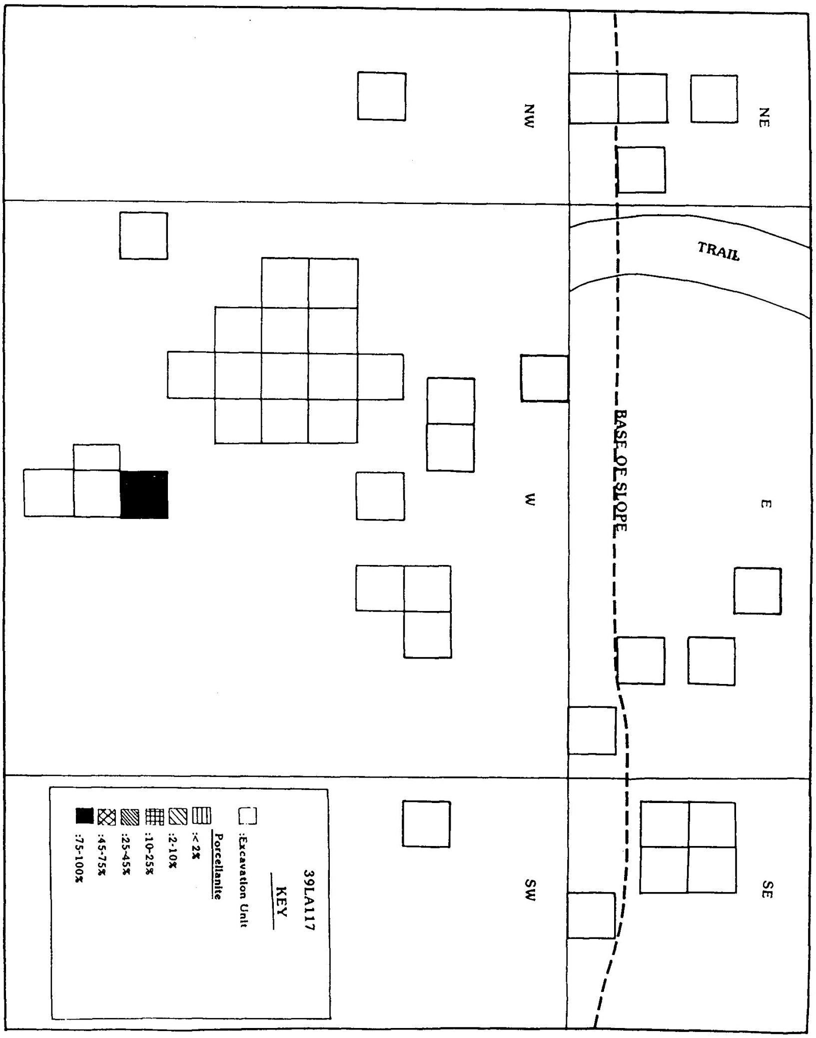


Figure 4.31: Distribution of porcellanite by unit, 39LA117

quartzite-rich hogback zone is also evident in the χ^2 test of raw material type distribution using debitage to provide the estimated distributions (Table 7.3). Both the patterned and the bifacial tool classes deviated significantly from the expected pattern of raw material type distribution, while the unifacial and non-patterned tools conformed to the distribution predicted by the debitage.

Tool to debitage ratios for 39LA117 suggest a multiple function site, including stone tool manufacturing. Tool to debitage ratios for other Black Hills sites are presented in Table 4.11. It is difficult to make direct comparisons, because different recovery methods were used at the various sites; nevertheless, 39LA117 is characterized by a low ratio of tools to debitage. Including all debitage (G1–5), the ratio is 1:201. Eliminating the smallest two classes, G4–5, the ratio is 1:27. (The latter figure is roughly comparable to material from 1/4" dryscreen field recovery.) The excavated Middle to Late Archaic cultural horizon from the western portion of the site yielded tool to debitage ratios of 1:345, including size grade 1–5, and 1:31, including only size grades 1–3.

Table 4.11: Tool to debitage (T:D) for Black Hills sites. Site function key: 1LM—preliminary lithic tool manufacturing, 2LM—secondary lithic tool manufacturing, B—butchering, H—hunting, C—camp (habitation, warm or cold season), WM—wood tool manufacturing, P—plant food processing. Reference key: 1. L. Alex 1991, 2. Buechler 1984, 3. Haug 1979, 4. Kornfeld 1988, 5. Sundstrom 1981, 6. Tratebas 1978a, 7. Tratebas 1979, 8. Tratebas and Vagstad 1978, 9. present report

Site	Period	Site Function	Ref	Collection	Recovery Method	T:D
39CU544	MPA?	2LM(H), P	5	Surface	Syst. Surface Collection	1:7
				Subsurface	1/4" Dryscreen	1:20
				Subsurface	1/4" Dryscreen w/ 1/16" Water-screen Samples	1:42
				Total		1:32
39CU799	EPA, LPA	2LM, H, B, C-ws, WM	1	Subsurface	1/16" Waterscreen	1:12
39FA302	MPA	C-cs	8	Surface	Unsyst. Surface Collection	1:2
				Subsurface	1/4" Dryscreen /w 1/16" Waterscreen	1:5
				Total		1:4
39FA307	LPA	1LM, 2LM, P	3	Total	1/4" Dryscreen	1:80
					1/4" Dryscreen w/ 1/16" Water-screen Samples	1:92
39FA392	LP	C-cs	7	Surface	Syst. Surface Collection	1:11
	Mixed?			Subsurface	1/4" Dryscreen	1:7
39FA393	LP	H, B	7	Total	1/4" Dryscreen	1:23
39FA396	LP	H, 2LM, H, B, P, LM, WM, C?	7	Total	1/4" Dryscreen	1:55
	MPA					1:29
39FA398	LP	C, H	7	Surface	Syst. Surface Collection	1:19

Table 4.11: continued

Site	Period	Site Function	Ref	Collection	Recovery Method	T:D
				Subsurface	1/4" Dryscreen	1:56
39PN77	Paleo or LPA	B, H, LM, WM, P, FM	8	Total	1/4" Dryscreen /w 1/16" Waterscreen	1:12
39PN90	MPA	C	8	Surface	Unsyst. Surface Collection	1:2
				Subsurface	1/4" Dryscreen	1:35
				Total		1:30
39PN97	Paleo, Archaic	H, B, LM	8	Total	1/4" Dryscreen	1:21
39PN214	All	C, ?	2	Total	1/4" Dryscreen /w 1/16" Waterscreen	1:14
48CK840	Folsom	?, P?	4	Surface	Syst. Surface Collection	1:0.6
3 Stone Knapping Sites	Unknown	LM	6	Surface	Syst. Surface Collection	1:19
						1:4
						1:49
				Combined		1:39
39LA117	Paleo EPA MPA LPA	C-ws, 1LM, 2LM, B, H	9	XU 1-40	1/16" Waterscreen w/ G1-5 Debitage	1:335
					w/ G1-3 Debitage	1:32
				XU 1-40 (including tools)	1/16" Waterscreen w/ G1-5 Debitage	1:193
					w/ G1-3 Debitage	1:19
				XU 1-40 (E. Half)	1/16" Waterscreen w/ G1-5 Debitage	1:226
					w/ G1-3 Debitage	1:55
				(West Half)	w/ G1-5 Debitage	1:345
					w/ G1-3 Debitage	1:31
				XU 1-40 All Tools (East Half)	1/16" Waterscreen w/ G1-5 Debitage	1:59
					w/ G1-3 Debitage	1:14
				(West Half)	w/ G1-5 Debitage	1:220
					w/ G1-3 Debitage	1:20
				Site (All Debitage & All Tools	1/16" Waterscreen w/ G1-5 Debitage	1:201
					w/ G1-3 Debitage	1:27
39LA314	Unknown	1LM, 2LM	9	Total	1/4" Dryscreen w/o Feature 1	1:74
38LA319	Paleo	LM, H, B, H	9	Total	1/4" Dryscreen	1:34

This matches the ratio of 1:32 at 39CU544, a hypothesized Middle Plains Archaic special activity site devoted to plant food processing and secondary tool production related to hunt preparation. Other special activity sites yielded tool-to-debitage ratios both higher and lower than the 39LA117 and 39CU544 estimates: 1:80–92 at 39FA302, a stone tool production and plant-food processing site; 1:23 at 39LA393, a hunting/butchering locality; 1:12 at 39PN77, a multifunction site; and 1:21 at 39PN97, a hunt-related butchering and stone tool manufacturing site. Three lithic knapping features yielded an average tool-to-debitage ratio of 1:39, closely approaching the 1:31 ratio from the western portion of 39LA117. Campsites generally produced significantly higher tool to debitage ratios. Some campsites, however, had tool to debitage ratios as low as 1:56 (39LA398) and 1:35 (39PN90). These data, while somewhat muddy, point to either a single, stone tool manufacturing function at 39LA117 or multiple functions, with an emphasis on stone tool production. Stone tool production was clearly more important during the Middle and Late Archaic occupations of the site than during the Paleoindian and Early Archaic occupations. The latter yielded tool to debitage ratios of 1:59 with size grades 1–5 and 1:14 with size grades 1–3, based on both excavated and surface materials.

4.8.3 Other Remains

Seeds, bone fragments, and burned earth at 39LA117 also exhibit patterned, rather than random distributions. The 15 seeds recovered from the site all came from a single unit (Unit 2) in the main block excavation. This distribution apparently resulted from rodent activity, as the seeds are clearly of recent, noncultural origin.

Bone fragments are scattered throughout the west sector of the site, with much smaller amounts present in the east and southeast sectors. The main concentrations of bone fragments are on the southern side of the main block excavation and in Unit 6 on the northern side of the block. The only fragment big enough to be identified was a bird ulna from Unit 6 in the main block. Bone also occurred in west sector units east, south, and west of the main block. Highly fragmented bone is typical of Middle Archaic sites in the Black Hills, and probably resulted from people breaking and boiling the bones to extract marrow.

Two excavation units on the northern side of the main block excavation contained small amounts of burned earth. Since this was found alongside concentrations of artifacts and bone, a cultural origin cannot be ruled out. The ubiquity of natural burn features at the site, however, leaves open the possibility that the burned earth resulted from forest fire, rather than cultural activity. If the burned earth is cultural, it probably represents the remains of a disintegrated hearth or roasting-pit, the exact form of which cannot be conjectured from the data available. A structural feature would be expected to contain much larger amounts of burned earth.

4.9 Conclusions

Site 39LA117 comprises two cultural horizons, each representing a series of short term occupations. The main, in situ, cultural horizon dates to the Middle and Late Plains Archaic (cf. Frison 1978). It contains recognizable activity areas related to secondary faunal processing, primary (decortication) and secondary lithic tool manufacture, wood or bone tool production, hide preparation and tool maintenance in the form of reshaping and resharpening. The size of the site, density of artifacts, and variety of activities represented strongly suggest that the site functioned as a base camp. Time-diagnostic artifacts indicate that this portion of the site was occupied at least three times: at least once during the Middle Plains Archaic and at least twice during the Late Plains Archaic. No stratigraphic separation of these various occupations could be detected, nor is it clear whether the site was occupied only three times or was reused frequently and periodically. Other Middle and Late Archaic habitation sites in and near the Black Hills show a pattern of repeated reoccupation (cf. Kornfeld and Larson 1986; Kornfeld and Todd 1985; Tratebas 1986).

Seasonality indicators are lacking, but a warm-season occupation appears likely for three reasons. First, the larger hearths typical of Middle Archaic winter camps (cf. Tratebas 1986) would be unlikely to disintegrate to the extent of being undetectable. Second, high-altitude meadows in the northern Black Hills, such as the locale of 39LA117, typically receive very heavy snowfall in winter, making them less than ideal campsites. Third, no ground-stone tools were found at 39LA117. Such tools are typical of Middle Archaic winter camps in the Black Hills (Tratebas 1986).

Tratebas (1979a; 1986) suggests that Middle Archaic winter camps were focused on intensive use and curation of previously gathered resources, rather than actual resource gathering activities. Such sites would contain a large ratio of reworked to new tools, and little if any primary knapping debris, such as cores and decortication flakes. Since 39LA117 clearly was used as a primary tool production site, and does not contain a large ratio of heavily used and reworked tools, it does not fit the expected pattern for a Middle Archaic cold-season occupation. A more fitting scenario for 39LA117 would be a late summer or early autumn camp geared toward prehunt tool manufacture and posthunt hide and meat processing. It is also possible that small game and plant food gathering and processing also took place at the site; however, these activities would be virtually invisible in the general purpose tool assemblage from the site. Such activities are better indicated by features, which unfortunately are lacking at this site, due to natural and artificial disturbances.

The second cultural horizon at 39LA117 comprises artifacts removed from the higher (Qt_1) terrace and redeposited with other colluvium on the slope and eastern portions of the site. These redeposited materials date to the late Paleoindian and Early Plains Archaic periods, based on projectile point forms. The nature of the terrace deposit from which they eroded is not known; either a surface or shallow subsurface site could be the origin of these artifacts. The combination of bifaces, broken projectile points, choppers, and utilized flakes suggest an initial butchering function for this component of the site (Tratebas 1986).

Cultural materials found below the surface in the southeastern portion of the site are problematical. It is not entirely clear whether these belong to the main, Middle and Late Archaic components, the redeposited Paleoindian and Early Archaic components, or yet another archaeological component. These materials are different from those in the main Middle and Late Archaic cultural horizon in tool types and distributions, lithic raw material preferences, and debitage size grade distributions, suggesting separation either by function or age. Three Middle Archaic projectile points were found below the surface near the slope leading up to the higher terrace, indicating the existence of some buried material east of FH-26 belonging to the Middle Archaic component. The interterrace slope in the southeastern sector contained two buried projectile points belonging to the earlier component; however, it is not clear whether these were redeposited over cultural material from the later components.

To summarize, 39LA117 is a Middle and Late Archaic campsite, at which a variety of food resource extraction and tool production activities took place. The site generally conforms to one of two residence patterns hypothesized for the interior Black Hills Middle Archaic (Tratebas 1986). This residence pattern comprises prolonged or serial occupations near perennial water sources, which apparently were large base camps for hunting operations. Unlike other sites of this type, however, lithic raw material types found at 39LA117 are of local origin, with the exception of very small amounts of porcellanite, Badlands plate chalcedony and Tongue River silicified siltstone, suggesting weak connections to areas immediately west, east, and north of the Black Hills, respectively. Although recognizable features were lacking, the limited resource extraction activities at the site seem to have centered on secondary butchering and possibly hide processing. A limited amount of primary stone tool manufacturing took place at the site, but most knapping was related to finishing and/or reworking tools. Both patterned and nonpatterned tools characterize the main site deposit, again suggesting both production and use of tools on site. The two side-notched projectile points dating to the latter half of the Late Archaic period were unbroken, unlike the projectile points dating to earlier occupations of the site. This suggests that use of the site shifted away from posthunt activities toward the end of the Archaic period. It might be conjectured that changes in hunting patterns, resulting from the addition of the bow and arrow to the hunting tool kit, are reflected in this change in projectile point discard pattern.

The main, Middle and Late Archaic, cultural horizon is overlain on the east side of the site by a colluvially redeposited late Paleoindian and Early Archaic assemblage, apparently related to hunting and primary butchering. Subsurface materials on the eastern side of the site near the interterrace slope represent material redeposited from the upper terrace late Paleoindian and Early Archaic components, or a special activity area related to the main Middle and Late Archaic occupations of the lower terrace, or another cultural component unrelated to the others.

Chapter 5

Investigations at 39LA314

5.1 Introduction

Site 39LA314, the Inyan Zi site, is located at the base of a small draw opening onto a terrace of an unnamed, intermittent tributary of Box Elder Creek (Figure 5.1). The Box Elder Creek terrace forms a broad, undulating meadow bordered on the northeast and southwest by high sandstone and limestone ridges. The slopes of the draw are sparsely forested by ponderosa pine, with grasses in the meadow and intermittent drainage beds.

The main portion of this small site lies outside the right-of-way, along a two-track trail leading northwest from Forest Highway 26. A lithic workshop feature in the main portion of the site contained large amounts of a distinctive chert, in the form of cores, debitage, and tools broken during manufacture. The site also contained small amounts of obsidian, which, like the chert, is of interest as a possible exotic lithic type (Church et al. 1985; Church 1986).

Mitigative data recovery at 39LA314 was begun October 7, 1988. Fieldwork was completed October 28, with lab work and initial analysis completed during the winter of 1988–89.

5.2 Previous Investigations

This site was recorded on July 19, 1984, during the cultural resources survey of the Nemo-Sturgis (FH26) road project (Church et al. 1985:153). The survey crew discovered a concentration of lithic debitage, several lithic tools, a blue seed bead, and a patch of oxidized soil (Figures 5.2 and 5.3) exposed in a vehicle trail near its intersection with FH26.

Eleven shovel tests were dug on the northeast side of FH26. Lithic debitage was found in three of these shovel tests. Only one flake was found in the ten shovel tests located southwest of the road.

Formal testing of 39LA314 began on October 9, 1984. A 1 x 1-m test unit was excavated on each side of FH26. Both of these test units produced scant

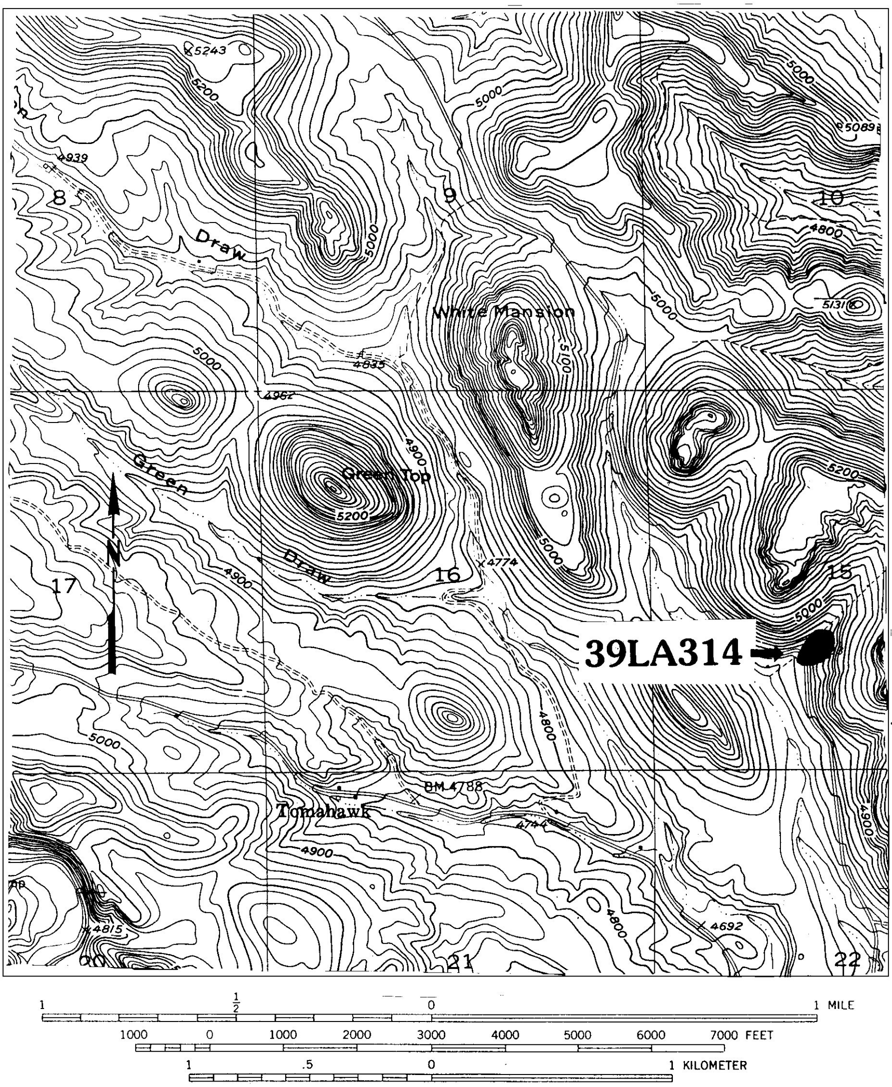


Figure 5.1: Topographic location of 39LA314

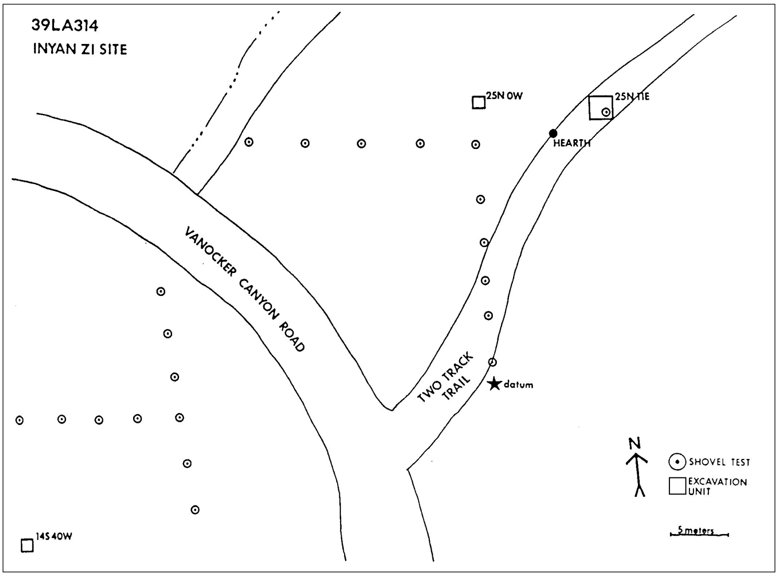


Figure 5.2: 39LA314 test units excavated in 1984

amounts of knapping debris. A 2 x 2-m test unit, datum 25N/11E, was placed in the vicinity of the lithic debitage concentration located in the vehicle trail. Over 1750 pieces of knapping debris and approximately twelve tool fragments were recovered from this unit. Nearly all of these artifacts are made of the same type of chert. Some obsidian flakes were also found in this unit. Tables 5.1 and 5.2 summarize the results of the previous investigations at 39LA314. The oxidized soil feature was hypothesized to be the remains of a small, unlined, basin-shaped hearth. The hearth feature washed away before it could be completely analyzed and is mentioned only in passing in the survey and testing report (Church et al. 1985).

Analysis and interpretation of these data led to the following evaluation of 39LA314:

> This site consists of an extensive lithic workshop and possible habitation area. A glass trade bead collected from the surface indicates the site may date from the Protohistoric period . . . Sites from this period are rare in the Black Hills, and this site can provide an excellent opportunity to study lithic reduction strategies, as well as providing insights into lithic resource preferences. The site provides an opportunity to study the breakdown of values attached to lithic materials as metal tools became available. Because of these reasons, the site appears eligible for nomination to the National Register (Church et al. 1985:195).

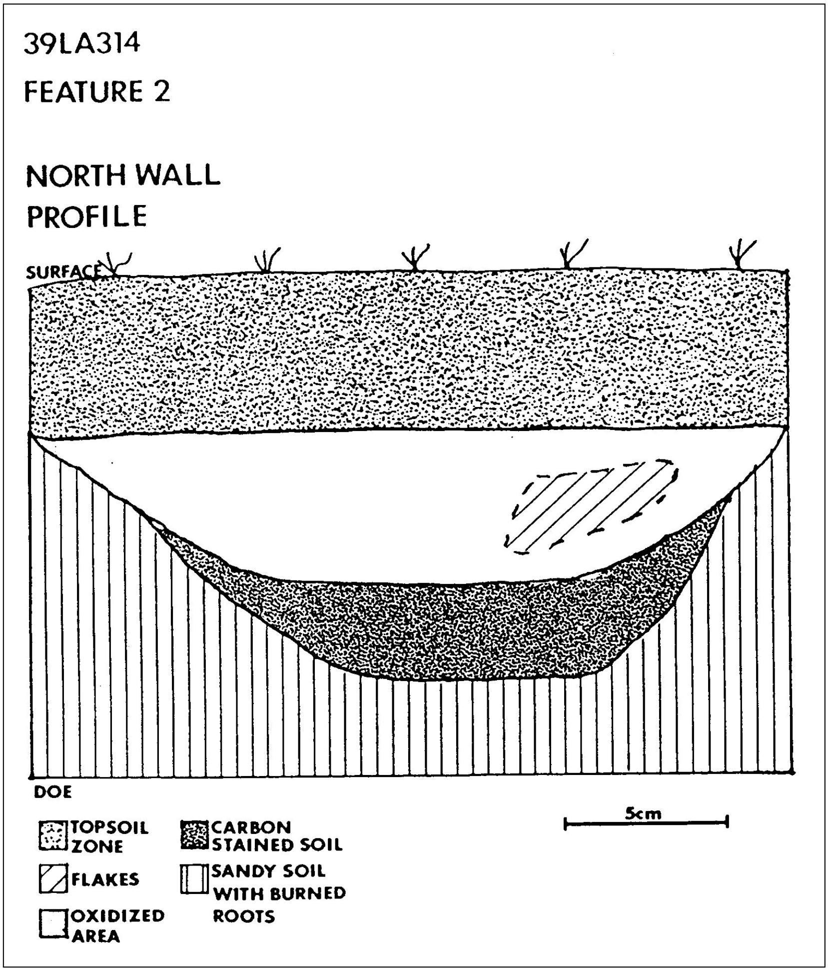


Figure 5.3: Profile of Feature 2, 39LA314

Table 5.1: Summary of debitage recovered from 39LA314. Horizontal divisions correspond to 1984, 1985, and 1988 field investigations, respectively. No comprehensive totals are given, because debitage from the 1986 investigations was not counted and debitage from the 1988 investigations was not weighed

Unit	Obsidian		Yellow Chert		Red Chert		Other Chert		Quartzite		Other	
	#	wt	#	wt	#	wt	#	wt	#	wt	#	wt
Surface		.1	61	327.5	34	92.1	5	12.8	3	12.8		
Shovel Test			1	3.4	1	.3	4	1.8	1	1.8		
25N0W					2	1.2	1	3.1	4	3.1	1	.3
14S39W					2	.7	1	.3	1	.3		
25N11E	2	12.1	1461	1698.1	275	229.5	12	27.6	7	27.6		.4
Feature 1		6.4		1833.1				21.6		33.0		
Total	2	18.6		3862.1		323.8		51.5		78.6		.7
Shovel Test			1		1				4			
30N0			2				3		20		1	
31N0			5		2		3		4			
30N1E							1		1			
31N1E					1		3		11		2	
Total			8		4		10		40		3	

After the survey and testing phase of the Nemo-Sturgis road project was completed, a volunteer crew of archaeologists conducted excavations at 39LA314 (Church 1986). This round of fieldwork was not part of the FHWA project. The purpose of the excavation was to salvage a portion of the lithic concentration in danger of being damaged by the presence and use of the vehicle trail.

Sixteen .5 x .5-m excavation units were dug along the eastern and southern edges of test unit 25N/11E (the 2 x 2-m test unit). More knapping debris and lithic tool fragments were found in these excavation units.

5.3 Objectives for 1988

The main objective of the 1988 excavation project was to establish whether the archaeological deposits investigated during the survey and feature-salvage projects extended into the proposed right-of-way. If significant concentrations of cultural material were found in the right-of-way, additional excavation would be undertaken to recover as much data as possible within the limits of the project schedule and budget.

Several questions remained to be answered about the site. Had the site been used only for stone tool production or was the lithic workshop part of a larger, multiple activity habitation? Did the site contain additional features? Were the distinctive chert and obsidian limited to the lithic workshop feature

Table 5.2: Summary of tools from 39LA314. Horizontal divisions correspond to 1984 (Acc. 84-582), 1985 (Acc. 84-582), and 1988 (Acc. 90-168) investigations, respectively

No.	Tool Type	Material Type	Axial Length	Max Width	Thickness	Weight
01	Biface Frag	Chert	N/A	29.3	9.3	8.3
02	Flake Knife	Chert	38.8	23.9	10.5	6.4
06	Lt Scraper	Chert	N/A	18.1	5.3	3.6
07	Preform	Dwd Quart	80.0	47.1	15.1	42.9
09	Biface Knife	Chert	N/A	40.2	6.7	12.1
013	Endscraper	Chert	N/A	30.6	11.2	14.0
6	Biface Knife	Chert	N/A	N/A	8.9	9.4
24	Pt Frag	Chert	N/A	N/A	?5.4	1.9
32	Biface Frag	Chert	N/A	N/A	14.6	25.9
37	Biface Frag	Chert	N/A	N/A	7.5	4.5
69	Biface Frag	Chert	N/A	N/A	9.1	7.8
70	Biface Frag	Chert	N/A	N/A	7.0	5.0
79		Chert	N/A	N/A	2.5	.4
89	Scraper Frag	Chert	N/A	N/A	4.4	1.8
90	Biface Frag	Chert	N/A	N/A	8.2	4.4
132	Biface Frag	Chert	N/A	38.2	8.0	6.5
165	Biface Frag	Chert	56.4	34.4	10.9	20.2
177	Biface Knife	Chert	N/A	N/A	?1.8	.1
7	Biface Frag	Porcellanite	N/A	14.0	3.8	.7
9	Biface Frag	Chert	N/A	20.6	6.9	3.0
23	Flake Knife	Chert	22.3	20.5	4.8	2.6

excavated in 1985, or were these materials distributed throughout the site? Could the Protohistoric age suggested by the single glass bead found during the site survey be confirmed by time-diagnostic cultural material or datable carbon in clear association with the cultural horizon? The secondary objective for the 1988 project was to collect data to answer these questions.

5.4 Field Methods for Mitigative Data Recovery

The research design for this project called for a two-part excavation strategy. First, a series of shovel tests were to be dug at a regular interval within the right-of-way. Larger units were then to be excavated, and expanded if necessary, to explore any features or concentrations of cultural material encountered in the shovel tests.

Preparations for mitigative data recovery at 39LA314 began on October 7, 1988. A Cartesian coordinate system was established to record horizontal provenience at the site. Because 39LA314 is situated at a bend in the right-of-way, the azimuth of the rectangular coordinate system is 34.55^o from magnetic north (Figure 5.4). The y-axis of the Cartesian system intersects the centerline at stake 73+50. Coordinates of this point are 20N/0. The elevation of temporary benchmark no. 74, 1469.77 m above mean sea level, was used to record vertical provenience at the site.

It was decided that a 10-m shovel test interval would be used initially. The distance between shovel tests could be reduced later if necessary. A transit and tape were used to place pin flags at the specified intervals in and around the untested portion of 39LA314.

Shovel tests were placed just to the northeast of each pin flag. They ranged in size from 30 x 25 cm to 42 x 42 cm. Depths ranged from 15 to 30 cm. All the soil from the shovel tests was passed through 1/4" screen. Any artifacts recovered were bagged and labeled with the corresponding coordinates. Information from each shovel test was recorded on a short form.

Just under one cubic meter of soil was excavated from the shovel tests at 39LA314. Two general soil profiles were revealed in the shovel probes. Soils in the broad, shallow drainage south west of FH26 consist of a dark loam interspersed with gravel lenses. Bedrock was encountered just below the surface in the vicinity of the road. The soil profiles of the shovel probes located on the terrace flanking the drainage exhibited more stratification. See Figure 5.5 for a more complete description of these soils.

Lithic artifacts were found in five of the twenty-eight shovel tests dug at 39LA314 (Table 5.3). All five positive shovel probes were located on the terrace. They occurred in a cluster east of the centerline.

Based on the results of the shovel tests, a 2 x 2-m excavation unit was placed northeast of coordinate 30N/0. For better provenience control, the 2 x 2-m unit was excavated as four 1 x 1-m squares. The subunits were dug in 10-cm arbitrary levels as measured from the elevation of coordinate 32N/2E. Each level was excavated by carefully shovel-skimming and troweling the soil into buckets. Every effort was made to piece-plot all artifacts encountered. Soil from each level was sifted through 1/4" screen. All artifacts, whether found in the excavation unit or in the screen, were bagged and labeled with the appropriate provenience. A level summary form was completed for each 10-cm level excavated. After each 1 x 1-m square was excavated, a unit summary form was completed and a profile of at least one wall of the unit was drawn. Finally, a 35 mm camera was used to take a color slide and a black-and-white photograph of the excavated unit.

5.5 Laboratory Methods

The methods used in cataloging, classifying, and analyzing material from 39LA314 are essentially the same as those used at 39LA117. Size grading of 39LA314 debitage was limited to the largest three grades, because the field

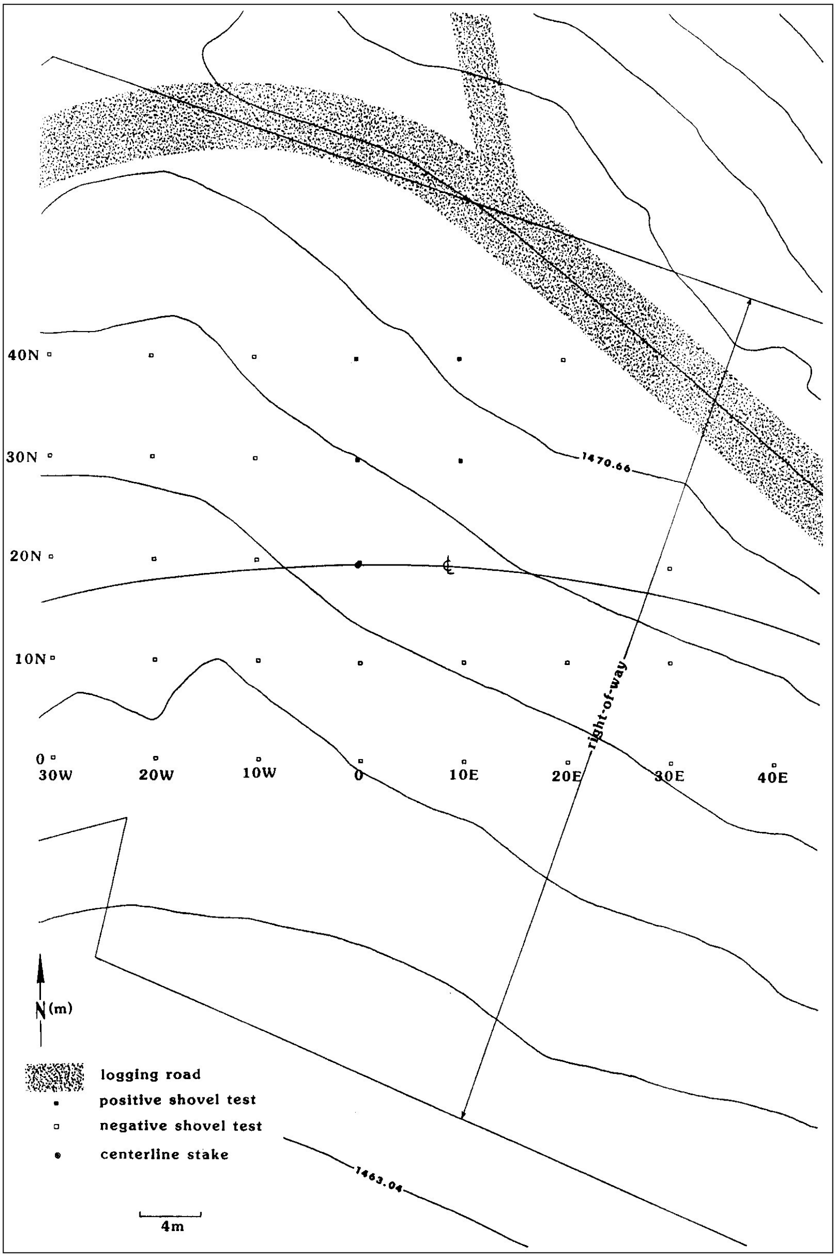


Figure 5.4: Map of 39LA314, showing locations of grid, excavation units, and shovel tests

Table 5.3: 1988 Shovel test results from 39LA314

Unit	Artifact Type	Material Type
0N40E		
10N30E		
20N30E		
30N20E	Not Dug	
0N30E		
10N20E	Not Dug	
20N20E	Not Dug	
40N10E	Flake Fragment	Quartzite
0N20E		
20N10E		
30N10E	Biface Fragment	Porcellanite
10N0E		
0N10E		
30N0E	2 Flakes/Fragment	Quartzite
30N0E	Fragment	Chert
40N0E	Flake Fragment	Quartzite
10N0E		
20N0E	Flake	
0N0E		Chalcedony/Chert
40N10W		
30N10W		
20N10W	Not Dug	
10N10W		
0N10W		
40N20W		
30N20W		
20N20W		
10N20W		
0N20W		
40N30W		
0N30W		
10N30W		
30N30W		
20N30W		

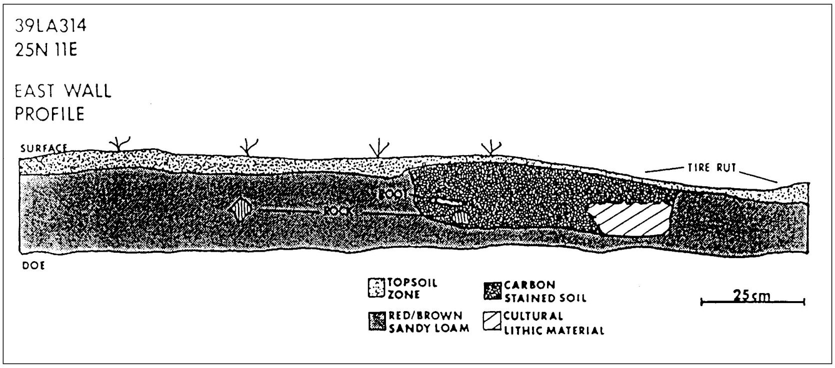


Figure 5.5: Representative soil profile, 39LA314

methods employed did not include collection of smaller debitage. One descriptive classification was added to the tool/debitage, tool type, color, and lithic raw material categories defined in Chapter 4. This was the classification of lithics as heat-altered versus unaltered. Characteristics of heat alteration, such as pot lid fractures, unusual luster, crazing or cracking, sugary texture, and hinge fractures, were noted in the artifact catalog.

The presence of cortex on lithic debitage was also noted. Decortication flakes, shatter, and chunks are defined as any pieces with cortex visible on one or more surfaces. During earlier investigations (Church et al. 1985; Church 1986), the terms *primary*, *secondary*, *tertiary*, and *micro-debitage* were used to describe debitage resulting from the various stages of core-reduction. Primary and secondary debitage contains large or small amounts of cortex, while tertiary and micro-debitage exhibit no cortex. In these earlier reports, the term *non-diagnostic* refers to what is called shatter in this report.

5.6 Stratigraphy

The soils in this area of the site are classified as part of the Citadel series. They are composed of deep, well-drained soils, formed in material weathered from calcareous sandstone, limestone, and soft shale (Meland 1979:67). Occasional flecks of charcoal were present throughout the soil profile. None of the soil horizons could be identified by their appearance as being associated with the cultural level.

As can be seen in Figure 5.6, the cultural deposit is closer to the surface in Unit 30/0 than it is in Unit 31N/1E. This increase in the depth of the cultural deposit as one moves up slope suggests that the occupational surface may have been flatter than the present 10% slope.

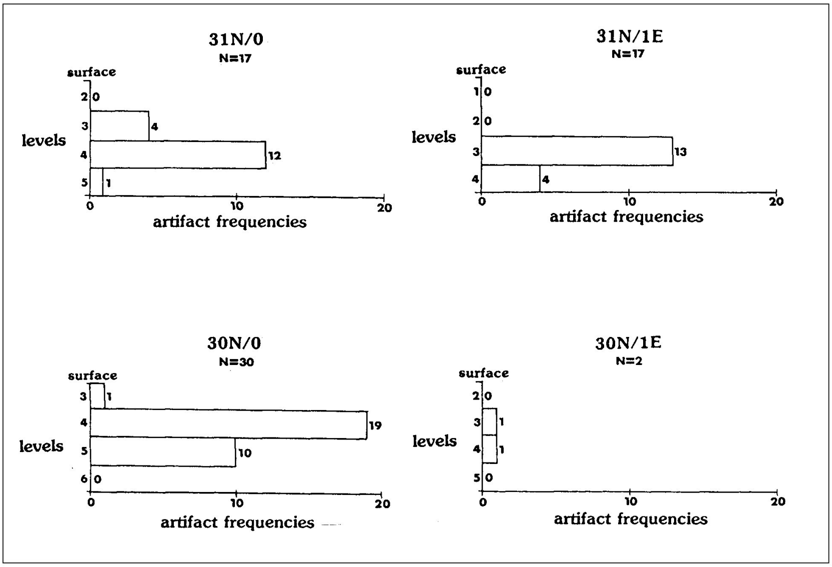


Figure 5.6: Vertical distribution of artifacts from 39LA314

5.7 Results of Excavations

The cultural material recovered from the 2 x 2-m excavation unit consists almost entirely of knapping debris. The cultural deposit in the 2 x 2-m unit varied between 20 and 30 cm in thickness. The vertical distribution of artifacts was consistently unimodal, suggesting a single cultural component. The lack of a distinct, well-defined cultural level suggests this portion of 39LA314 has experienced some disturbance. Since earthworms and root systems were pervasive in the excavation unit it is quite likely that the cultural deposit has been affected by pedoturbation (Hole 1961:375–377).

The greatest concentration of cultural material in the 2 x 2-m unit occurred in Unit 30N/0, where thirty artifacts were found. Units 31N/0 and 31N/1E each produced just over half as many artifacts as 30N/0. Only two artifacts were found in Unit 30N/1E.

After a preliminary assessment of the data recovered from the 2 x 2-m unit, and taking into consideration the results of the earlier investigations of the site (Church et al. 1985), it was decided to terminate excavation at this point. This decision was based on the redundancy of the data being recovered and the paucity of lithic tools at 39LA314. It was clear that the portion of the site in the right-of-way represented only a minor component, with the main portion of the site lying just north of the right-of-way.

5.8 Discussion

It is clear from the relatively small amount of cultural material recovered from the portion of 39LA314 within the FH26 right-of-way that the main site lies farther to the north. It was not determined whether the lithic workshop feature excavated in 1985 made up the bulk of the site, or whether additional concentrations of cultural material lay to the north of FH26 and to the east and west of the two-track trail in which the feature was exposed, as these areas lay outside the right-of-way. The cultural material within the right-of-way itself was of limited significance and did not justify further mitigation efforts.

If the investigated portions of 39LA314 are representative of the site as a whole, it was a special activity site, primarily devoted to the production of biface preforms from a distinctive yellow chert, along with other, more limited, knapping activities and secondary activities related to stone tool production. No diagnostic artifacts (other than the one bead of dubious age) or datable carbon were recovered from the site. The single possible projectile point fragment recovered from the site (Cat. 84-582-24; Figure 5.7a) is extremely fragmented and could not be assigned to any definite period. If this artifact is indeed a projectile point fragment, it appears to have been a rather large, side-notched type, suggesting an Archaic age; however, a more specific temporal classification is not possible, nor can it be stated with certainty that this artifact was a projectile point prior to breakage and reshaping. Because 39LA314 could not be dated, its importance to current research questions is extremely limited.

The knapping feature salvaged in 1985 was the most productive and interesting portion of the site investigated. The identity of the yellow chert and the obsidian as exotic material is at least partially established. Although yellow cherts are common in the Black Hills and obsidian or pitchstone outcrops in immediate vicinity of the site (R. Alex personal communication 1982; Church personal communication 1991) and in other areas of the northern Black Hills (Tratebas 1986), chemical and physical analyses confirm that the obsidian recovered from 39LA314 came from the Bear Gulch, Idaho, obsidian quarry (Church personal communication 1991). Because the obsidian is clearly not locally found, the possibility that the yellow chert also represents imported material and consequently trade or migration from areas west of the Black Hills (Church et al. 1985; Church 1986) cannot be dismissed.

Aside from its significance as indicating long distance migration or trade, the feature is significant as an intact, definable activity locus, containing detailed information on the lithic reduction sequence, an unconventional core reduction technique, and other behavior associated with stone tool production. The reader is referred to Church's 1986 report for a detailed analysis of the feature.

The preference for yellow chert and use of obsidian were confined to the feature itself. Elsewhere, cherts and quartzites of various colors were scattered throughout the cultural deposits, with no distinctive preferences showing up. No obsidian was found during mitigative data recovery. The "yellow" chert category should also include the various red and gray cherts found in the artifact assemblage. The former represent heat-altered pieces of the yellow chert, while

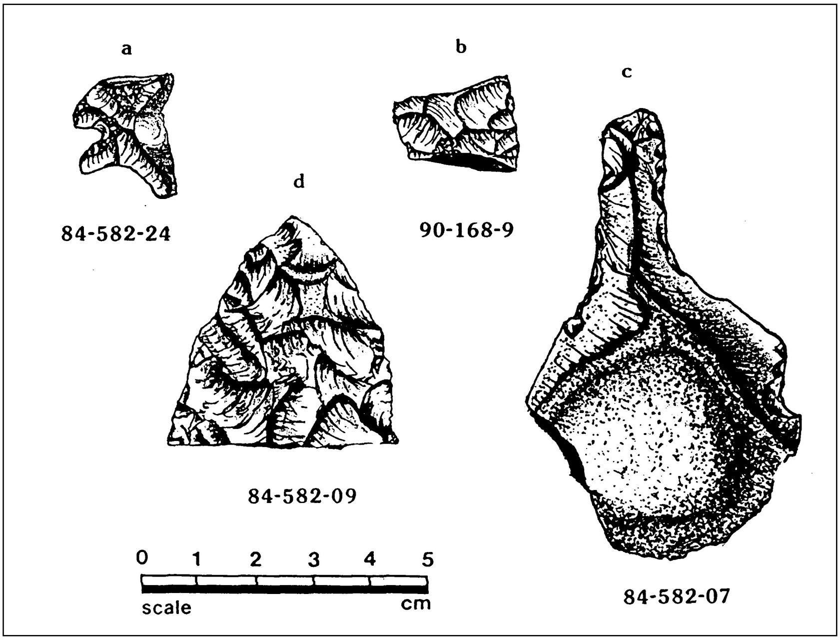


Figure 5.7: Tools from 39LA314: a, projectile point fragment?; b, biface fragment; c, perforator; d, biface knife.

most or all of the latter are a variant of the yellow chert, as indicated by the presence of pieces displaying both colors. An examination of conjoinable flake and tool fragments clearly demonstrated that the heat-alteration of the yellow chert was unintentional (Church 1986), a conclusion supported by the 1988 investigations.

No additional features were found. The present authors are reluctant to draw any inferences from the presence of a possible hearth at the site. Data regarding the feature are sketchy and it seems possible that a natural, rather than cultural feature may be indicated.

In total, twenty-one tools were recovered during the various phases of archaeological investigation of 39LA314 (Figure 5.7). All but three of these were made of the yellow chert or its red and gray varieties. Only one artifact, a large drill or perforator (Cat. 84-582-07; Figure 5.7c), was made of quartzite; an endscraper (Cat. 84-582-013) and a biface thinning flake (tabulated as a biface fragment; Cat. 90-168-7) were made of black chert and dark red porcellanite, respectively. Eleven of the twenty-one tools were biface fragments (including bifacial knife fragments), all made of the yellow chert and apparently broken during manufacture (Cat. 84-582-09; Figure 5.7d). The possible projectile point fragment was also made from the yellow chert and may have been broken during manufacture and subsequently reshaped into a notch-like tool (Cat. 84-582-24; Figure 5.7a). A small bifacial knife tip fragment made of the yellow chert exhibited possible use-wear in the form of step fractures and smoothing and polish (Cat. 84-582-177). This was the only bifacial tool, except for the perforator, that exhibited any recognizable use-wear. Four core fragments recovered from the site were of the same yellow chert, as were five of the six utilized flakes and flake tools (scrapers and flake knives).

Except for the perforator and endscraper, tools were either expedient (utilized flakes and lightly retouched flake knives and scrapers) or unused due to breakage during manufacture (bifaces). Two lightly retouched yellow chert flake knives were either used very lightly or not at all. The function of the large perforator is unknown; a function of perforating wood, bone, or soft stone was suggested for similar large perforators found in the Black Hills (Tratebas 1986); however, the use-wear, which consists of smoothing and blunting, can also result from hide piercing. None of these inferred functions is directly related to biface preform production; thus, the perforator may represent an artifact brought to the site and discarded, but not used there. The utilized flake, endscraper, and lightly retouched flake scrapers were presumably used on-site, as all but the endscraper are expedient tools made from the ubiquitous yellow chert. The endscraper may have been brought to the site from elsewhere; it is made of a distinctive black chert and exhibits more deliberate shaping than the other unifacial flake tools. These tools exhibit use-wear in the form of step fractures and smoothing on the working edges. The triangular utilized flake (Cat. 84-582-79) exhibited breakage, which may have resulted from use, in the form of two notches opposite one another near the tip, as well as some rounding and smoothing above the notch on one side. All of the wear patterns found on the flake tools are compatible with a hypothesized function of scraping either soft material such as hides or harder materials such as wood, bone, or antler; thus, the use-wear analysis is not especially useful in establishing the function of the flake tools.

5.9 Conclusions

The portion of 39LA314 lying within the FH26 right-of-way represents a special activity site, devoted to stone tool production, and more specifically to the production of bifaces or biface preforms from a distinctive yellow chert. A secondary activity indicated by the unifacial tool assemblage is woodworking, perhaps shaft or haft preparation or antler-tool production related to stone tool manufacture.

No features or concentrations of cultural material were discovered during the mitigative data recovery at this site. The hypothesized Protohistoric age of the site was not supported by any subsurface data; thus, the age and cultural affiliation of the cultural deposit are undetermined. The single, badly fragmented possible projectile point base tentatively suggests an unspecified Archaic age, but this is not conclusive.

The presence of imported obsidian clearly indicates connections, probably through trade, to areas west of the Black Hills. The yellow chert also comes from the basins west of the Black Hills. Migrations to and from the Powder River Basin and the Black Hills are strongly suggested by the archaeological record for the Middle Plains Archaic (cf. Kornfeld and Todd 1985); thus, a combination of trade and migration may be suggested by the nonlocal lithics from 39LA314. The rather meager cultural deposit explored during the mitigative data recovery does not permit further interpretation of the site.

Chapter 6

Investigations at 39LA319

6.1 Introduction

The Singing Hawk site, 39LA319, lies at the base of a hill adjacent to the first terrace (Qt_2) of Little Elk Creek (Figure 6.1). The hill slope is vegetated with open ponderosa pine forest, which gives way to mixed grasses and forbs in the terrace meadow. High limestone and sandstone ridges overlook the terraces. Two perennial springs occur in the general vicinity of the site.

Earlier investigations suggested that this was a small but potentially significant site, dating to the late Paleoindian period. A possible Late Prehistoric component was suggested by a single radiocarbon date from a posthole feature. Since both Paleoindian and stratified sites are rare in the Black Hills, mitigative data recovery was recommended for 39LA319.

Fieldwork for the mitigative data recovery project at 39LA319 was started July 29, 1988, and completed October 6, 1988. Laboratory work and initial analysis were completed during the winter of 1988–89.

6.2 Previous Investigations

Site 39LA319 was discovered on August 17, 1984, during the cultural resources survey of the Nemo-Sturgis Road project (Church et al. 1985:177). The investigator found two pieces of lithic debitage and what was identified as a Hell Gap projectile point base, diagnostic of a late Paleoindian occupation (Cat. 84-581-02; Figure E.3e), on the surface of a logging road on the edge of the meadow (Figure 6.2). Ten shovel tests placed in areas adjacent to the vehicle trail failed to yield any artifactual materials; however, a layer of oxidized soil, possibly indicative of cultural activity, was present in one of the shovel tests.

Formal testing of 39LA319 began on September 19, 1984. A total of six test units were excavated, three of which were sterile. Only one Unit, 20N/60E, produced significant amounts of lithic tools and debitage. The cultural material ranged in depth from 10 to 50 cm below the ground surface, with a concentration

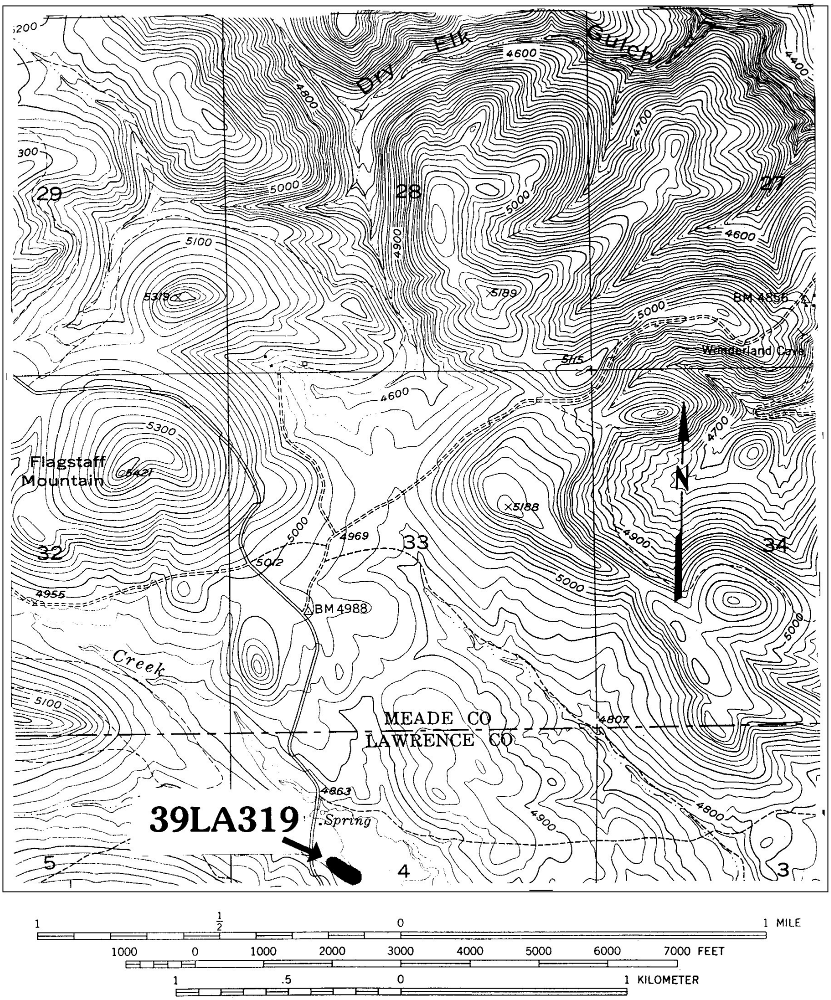


Figure 6.1: Topographic location of 39LA319

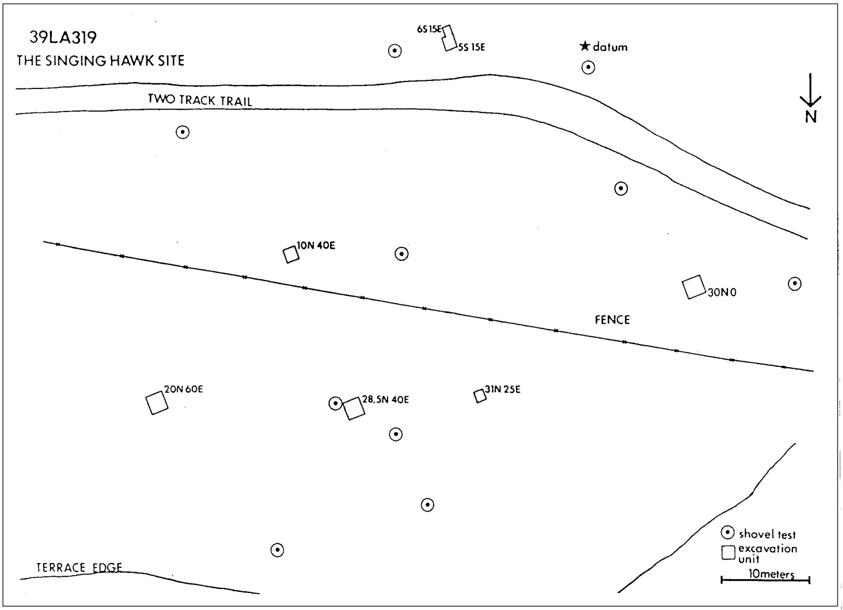


Figure 6.2: Shovel test excavations from 1984 investigations at 39LA319

occurring between 20 and 30 cm below surface. A posthole and a possible metate were also encountered in this test unit at a depth consistent with the lithic concentration (Figure 6.3). Charcoal from the posthole produced a radiocarbon age of 270±70 years (A.D. 1680) (Church et al. 1985:183, 186; Steventon and Kutzbach 1986:1206).

Analysis and interpretation of the information gathered at 39LA319 led to the following evaluation of the site:

> Site 39LA319 is considered eligible for nomination to the National Register of Historic Places for the following reasons. First, the presence of the Hell Gap projectile point base suggests an early occupation of the site, and one that has been missing from the Black Hills cultural chronology ... Second, a radiocarbon date from charcoal recovered from Feature 1, a posthole, yielded a date of 270±70 (WIS-1674). This date suggests at least two components at the site, separated by several thousand millennia [sic], may be present. Thus, the site has the potential of comparing the similarities and differences between two temporally separated cultural components using the same environment (Church et al. 1985).

Officials from the South Dakota State Historic Preservation Office, the Black Hills National Forest, and the FHWA concurred with the SARC determination that site 39LA319 is eligible for nomination to the National Register of Historic

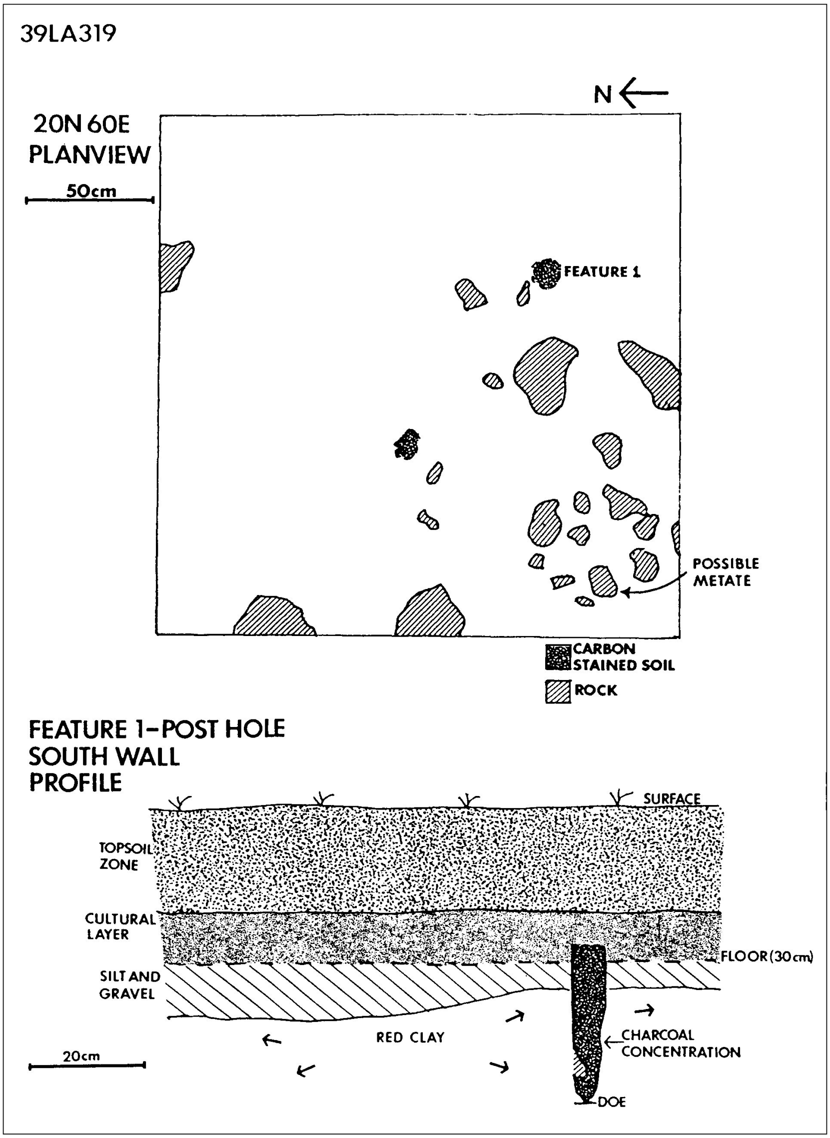


Figure 6.3: Plan and profile of Feature 1 posthole

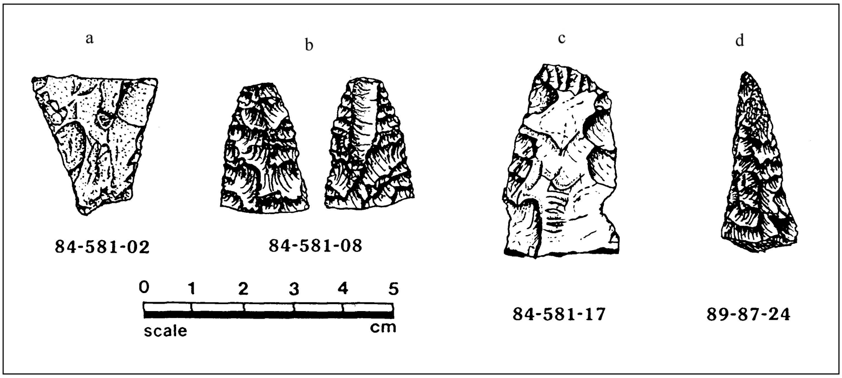


Figure 6.4: Selected tools from 39LA319

Places. The concurring parties then agreed to seek a no-adverse-effect for the FWHA road improvement project through mitigative data recovery at the site.

6.3 Comments on Previous Data and Interpretations

The data and materials from the initial investigations of 39LA319 were examined before further excavations were conducted at the site. Several observations made during this reexamination are worthy of mention.

First of all, Specimen 84-581-02, identified as a Hell Gap projectile point base (Figure 6.4a), was compared morphologically and metrically to other Hell Gap points. Neither the stem angle, 30^o, nor the minimum stem width, 10.8 mm, fall within the ranges of variation of the Hell Gap points from the Casper and Agate Basin sites (Frison 1974:81; Frison and Stanford 1982:202). Furthermore, in his description of the distal portions of the Hell Gap projectile points from the Casper site, Frison states that "grinding of the edges always extends from the base to the end of the shoulder" (Frison 1974:83). Grinding on the 39LA319 point extends just beyond the juncture of the basal and lateral margins. The distal margin is incomplete but appears to have been heavily ground. The basal damage exhibited on this point may well have occurred while the artifact was hafted. Both collateral and transverse parallel flaking are present on the faces of the tool fragment.

A review of the materials from the test excavations revealed that a brown chalcedony biface fragment (Cat. 84-581-08; Figure 6.4 b), was present in the artifact concentration discovered in Unit 20N/60E. The tip of the biface fragment is missing and a 12.8-mm long impact fracture extends from the break along the longitudinal axis of one face. The damage present suggests the artifact is the distal portion of a projectile point. Both faces of the projectile point fragment exhibit collateral and transverse parallel flaking.

The possible metate found in the artifact concentration in Unit 20N/60E was also examined. There are discontinuous smoothed and striated areas on one side of the rock, but they appear to be a geological phenomenon known as slikensides. Slickensides are smoothed and striated surfaces produced on rock by movement along a fault or subsidiary fracture.

The review of data and materials from the previous investigation of 39LA319 leads to the following conclusions. The projectile point base found on the surface and the projectile point base from the test excavation can be assigned to the late Paleoindian period, based on size, morphology, and flaking pattern. Although the point fragments could not be assigned to defined projectile point types, they clearly represent a late Paleoindian occupation at the site.

It is difficult to explain the observation that the brown chalcedony projectile point base was encountered in the same unit and level as a posthole with a radiocarbon age of 270±70 years, or A.D. 1680. It appears that a relatively recent event, unrelated to the prehistoric occupation of 39LA319, was dated. Based on the location, morphology, and radiocarbon age of the post mold, the present authors interpret it as a historic fence-post hole. An old fenceline is still visible in the vicinity of the feature. It appears that the fence-post hole was covered by recent colluvium. The profile is somewhat misleading in that the top of the feature is depicted within the cultural horizon—a configuration that is impossible given the late Paleoindian age of the cultural horizon and the recent age of the feature. Apparently the top of the posthole was obscured by later deposition, or the sparse cultural deposit was mixed with the sediments covering the feature, or both. The radiocarbon date can be interpreted as indicating a modern age for the dated feature.

While it appears that 39LA319 dates to the Paleoindian period, the cultural affiliation of the site is less clear. The projectile point bases (Cat. 84-581-02 and 84-581-08), do not fit morphologically or metrically with the Hell Gap points from the Casper and Agate Basin sites. In terms of flaking pattern and gross morphology, the points show resemblances to some projectile points classified as Angostura, Agate Basin, and Lovell Constricted, without fitting any of the types exactly. The collateral and parallel transverse flaking found on both projectile point fragments is characteristic of a number of Paleoindian projectile point types. Therefore, the cultural affiliation of the site is considered to be indeterminate, as far as the pre-1988 data indicate.

6.4 Objectives for 1988

A primary objective for the 1988 mitigative data recovery was to determine whether two cultural components were indeed present at the site, and, if not, which of the proposed dates (Paleoindian or Late Prehistoric) was correct. Intact cultural deposits with either time-diagnostic artifacts or datable carbon were sought to answer these questions. If multiple cultural components were present at the site, were they separable and recognizable? Other multiple component sites in the Black Hills have typically contained compressed and mixed deposits lacking horizontal separation. This has greatly hindered the development of a locally derived cultural sequence for the area. For these reasons, the possibility of cultural stratification at 39LA314 deserved careful investigation. In addition, the extent of the site within the right-of-way needed to be estimated accurately.

The function of the site also needed to be determined. Was primary or secondary stone tool production—or yet another activity—the purpose of the site? Does the site represent a special activity locus or part of a larger residence site? Could this function or functions be related to a definable settlement pattern? It was anticipated that artifacts, features, and/or environmental remains would be recovered, from which site function could be inferred.

A final objective for the 1988 project was to determine whether additional features were present that would support the original interpretation of the post mold as indicative of a prehistoric structure.

6.5 Field Methods for Mitigative Data Recovery

The research design for this project called for a two-part excavation strategy. First, a series of shovel tests were to be dug at regular intervals within the right-of-way. Larger units would then be excavated, and expanded if necessary, to explore any features or concentrations of cultural materials encountered in the shovel tests.

Preparations for mitigative data recovery at 39LA319 began on July 26, 1988. Site datum for this phase of investigation was established at centerline stake 221+50 (Figure 6.5). This point is also the origin of the Cartesian coordinate system used in recording horizontal provenience at 39LA319. Vertical provenience was recorded with mean sea level as datum.

It was decided that a 5-m shovel test interval would be used initially. The distance between shovel tests could be reduced later, if necessary. A transit and tape were used to place pin flags at the specified 5-m intervals throughout most of the right-of-way to a point 60 m north of site datum. The elevation at each pin flag was recorded and referenced to temporary benchmark no. 224, which has an elevation of 1484.39 meters a.m.s.l. Coordinates in the southwest portion of the right-of-way were not pin flagged due to the steepness of the slope.

The shovel tests were placed just to the northeast of each pin flag. They ranged in size from 30 x 25 cm to 40 x 38 cm. Depths ranged from 12 to 55 cm. All soil from the shovel tests was passed through 1/4" screen. Any artifacts recovered were bagged and labeled with the corresponding coordinates. Information from each shovel test was recorded on a short form.

A total of 3.7 m^2 of soil was excavated from the shovel tests at 39LA319. The soil profiles revealed in the shovel probes were fairly consistent throughout this portion of the right-of-way. See Figure 6.6 for a description of the soils at 39LA319.

Lithic artifacts were found in 16 of the 114 shovel tests dug at 39LA319. All but one of the positive shovel probes were located east of the centerline.

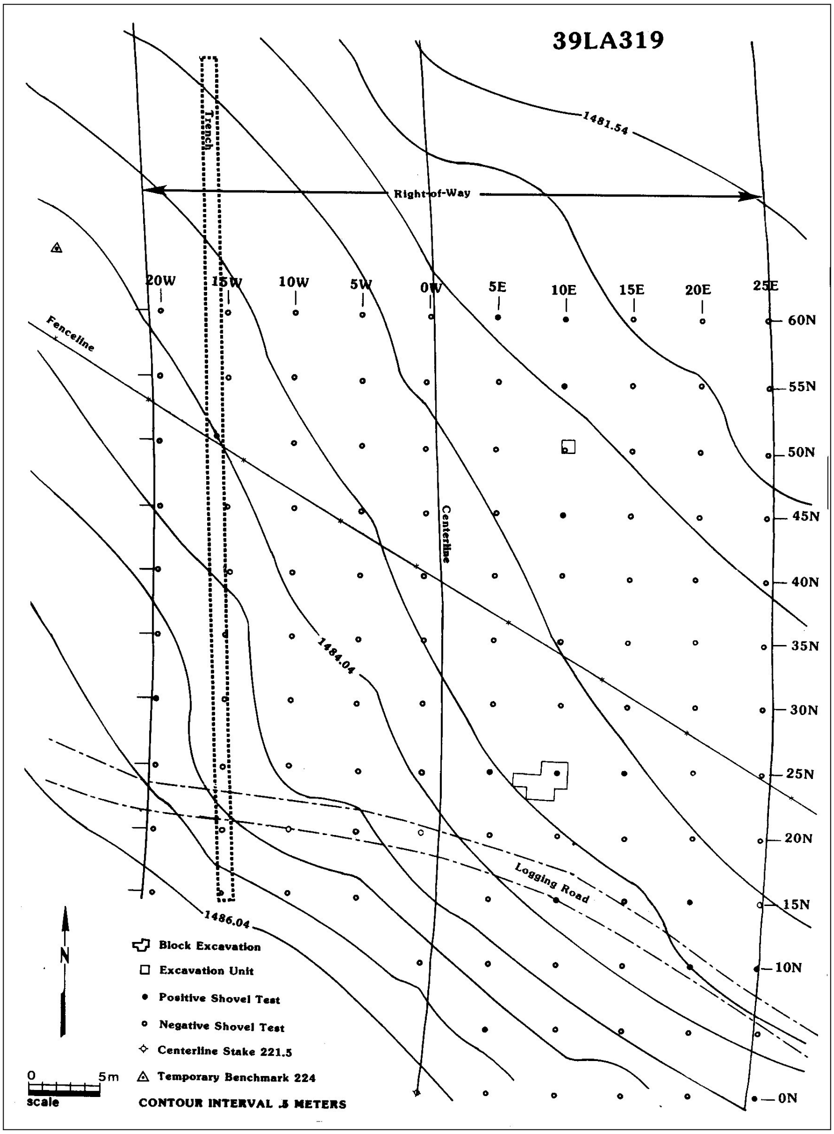
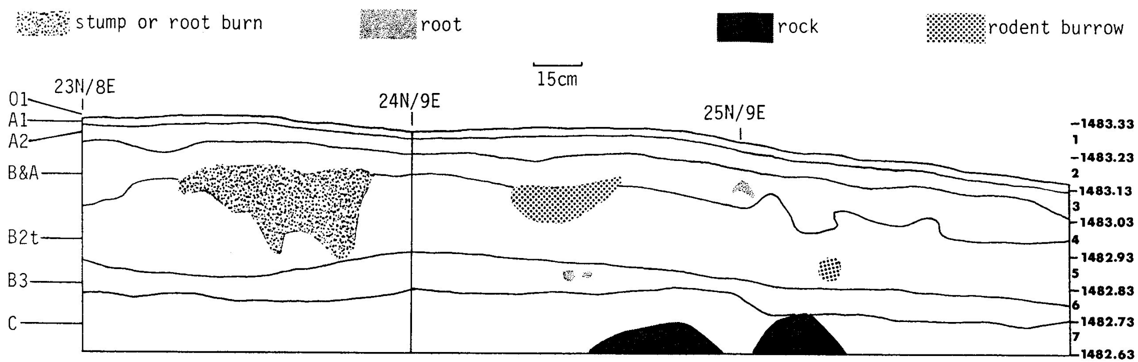


Figure 6.5: Map of 39LA319, showing locations of 1988 shovel tests and excavation units



Citadel series

01-forest litter, duff, and sod.

A1-very dark gray(10YR 3/1) loam, black (10YR 2/1) moist; weak very fine granular structure; soft, very friable; many fine and medium roots; medium acid.

A2-light brown (7.5YR 6/3) fine sandy loam, dark brown (7.5YR 4/3) moist; weak thin and medium platy structure; soft, very friable; many fine and medium roots; medium acid.

B&A-reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5Y 3/4) moist (B2t) with light reddish brown (5YR 6/4) very fine sandy loam, yellowish red (5YR 5/6) moist (A2); weak fine and medium subangular blocky structure; slightly hard, friable; common fine and medium roots; strongly acid.

B2t-reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5Y 3/4) moist; strong medium blocky structure; hard, firm, sticky and plastic; common medium and coarse roots; 10 percent by volume fragments of rock; medium acid.

B3-red (2.5YR 4/6) gravelly clay loam, dark reddish brown(2.5YR 3/4) moist; strong fine and medium blocky structure; hard, friable, slightly sticky and slightly plastic; 30 percent by volume fragments of rock; common accumulations of carbonate; strong effervescence; mildly alkaline.

C-red(2.5YR 5/6) cobbly loam, (2.5YR 4/6) moist; massive; soft, very friable; 35 percent by volume fragments of rock; strong effervescence; moderately alkaline.

Figure 6.6: Representative soil profile, 39LA319

Based on the results of the shovel tests, 1 x 1-m excavation units were placed at coordinates 24N/10E and 25N/10E. These two units were excavated in 10-cm arbitrary levels as measured from the elevation of coordinate 25N/10E. Each level was dug by carefully shovel-skimming and troweling the soil into buckets. Every effort was made to piece-plot all artifacts encountered. Soil from each level was screened through 1/4" mesh. All artifacts, whether found in the excavation unit or in the screen, were bagged and labeled with the appropriate provenience. A level summary form (Appendix B) was completed for each 10-cm level excavated. Excavation was terminated upon encountering a sterile level. After a square had been excavated, a unit summary form (Appendix B) was completed and a profile of at least one wall of the unit was drawn. Finally, a 35-mm camera was used to take a color slide and a black-and-white photograph of the excavated unit.

The cultural material recovered from Units 24N/10E and 25N/10E is composed almost entirely of knapping debris. As can be seen from Figure 6.7, there is a relatively thick deposit of cultural material in this area of the site. The cultural level did not extend into the C soil horizon.

The lack of a distinct, well-defined cultural level suggests this portion of 39LA319 had been disturbed. The cultural deposit appears to have been affected by pedoturbation of the matrix. While a number of pedoturbation processes have been identified (Hole 1961:375–377), evidence of both faunal and floral disturbance was encountered in excavation Units 24N/10E and 25N/10E. The extant agent of faunal disturbance is earthworms, observed throughout the excavation units. Other terrestrial invertebrates have probably also contributed to the mixing of the soil. The presence of numerous root systems throughout every level of both squares is an indication that floral disturbance was occurring, as well. Roots ranged in size from several millimeters to over 4 cm in diameter. The small hump at coordinate 25N/10E is probably the result of a tree fall, also contributing to soil disturbance.

Since the integrity of the cultural deposit in this portion of the site appears to have been disturbed by natural transformation processes, a slight modification of the excavation methodology was implemented. The amount of soil removed by each series of shovel skims was increased from 1.5 to about 3 cm. The last centimeter of soil from each level was removed with a trowel.

A tool fragment found in Shovel Test 25N/5E led to the decision to expand the excavation to Units 24N/9E and 25N/9E. Additional evidence of faunal disturbance was found in both units. The presence of krotovina indicates that burrowing mammals have also contributed to the pedoturbation process. Earthworms and roots continued to be pervasive.

The cultural material recovered from Units 24N/9E and 25N/9E is composed almost entirely of lithic debitage; however, a reworked Paleoindian projectile point base was discovered in Level 1 of Unit 24N/9E. The cultural horizon continued to occur in a broad band. The graph of Unit 24N/9E is interesting because Level 5 contained more artifacts than were recovered from each of the other three excavation units.

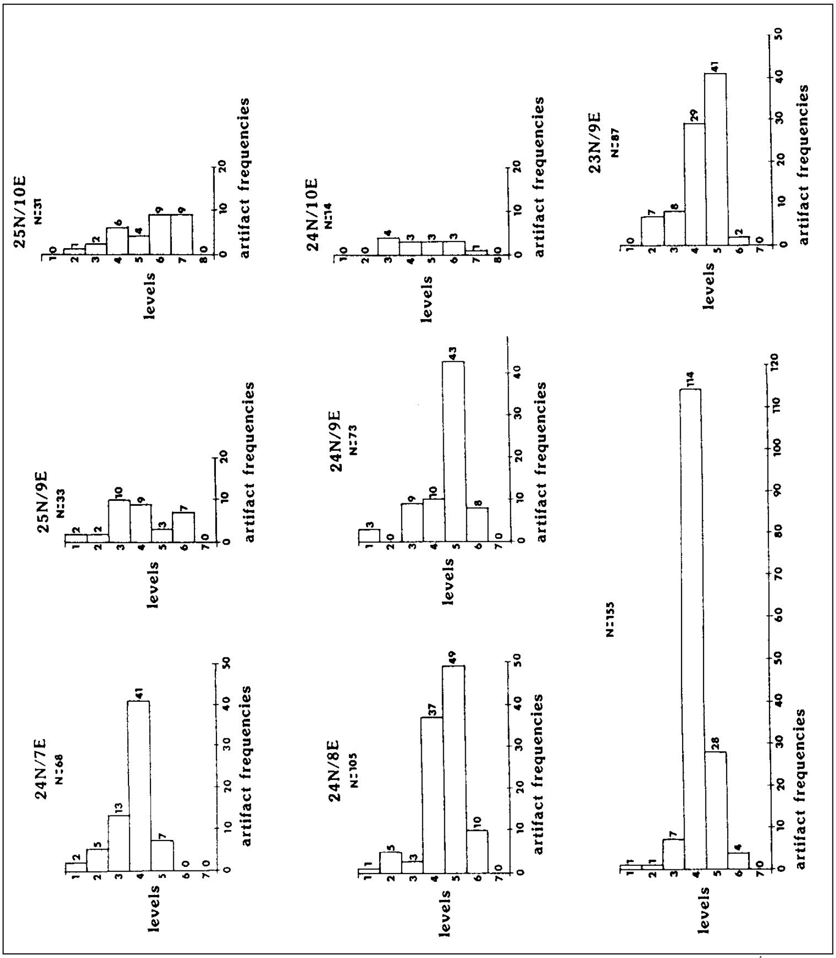


Figure 6.7: Vertical distribution of artifacts from 39LA319

Because of the increase in the number of artifacts in the southwest quadrant of the 2 x 2-m block excavation, Units 23N/9E and 24N/8E were dug next. The total number of artifacts recovered from these two squares continued to increase. Several very small splinters of calcined bone were present in Level 5 of Unit 24N/8E. Otherwise, the conditions encountered during the excavation of Units 23N/9E and 24N/8E were similar to those found in the other four units.

In order to determine whether the trend of increasing artifact density continued to the south and west of coordinate 25N/10E, the excavation was expanded to Units 23N/8E and 24N/7E.

Unit 24N/7E contained approximately one-third fewer artifacts than Unit 24N/8E; however, more artifacts were found in Level 4 of Unit 23N/8E than in any of the other units. While this concentration of cultural material is composed primarily of lithic debitage, a Paleoindian projectile point base (Cat. 89-87-238) was discovered in the upper part of Level 4.

An oval patch of burned earth and animal burrows was exposed in Level 3 of Unit 23N/8E. This soil anomaly was initially treated as a cultural feature; however, the irregularity of its profile indicated that it resulted from a stump or root burn.

After a preliminary assessment of the data recovered from the eight units, it was decided that excavation would be terminated in this portion of 39LA319. This decision was based on three factors. First, various kinds of pedoturbation had affected the integrity of the cultural deposit in this part of the site, to the extent that intact features could not be expected. Second, the data being recovered were largely redundant. Third, a sufficient sample of consistent, temporally diagnostic materials had been recovered.

Four 10-cm levels were excavated from Unit 50N/10E. No artifacts were present in the first level. Levels 2 and 3 produced one piece of lithic debitage each. Two flakes were found in Level 4.

Soils in this unit are similar in composition to, but slightly shallower than, those encountered in the block excavation. Roots and earthworms were present throughout Unit 50N/10E. Due to the limited amount of cultural material from this unit, it was difficult to ascertain the extent to which pedoturbation has affected the integrity of the cultural deposits in this portion of the site.

Excavation of Unit 50N/10E was terminated at this point because the landowner denied access to this portion of 39LA319. Based on a limited amount of data, this part of the site appears to consist of a light concentration of lithic debitage.

The final phase of investigation of 39LA319 consisted of a geomorphological analysis of the landform on which the site is located. This study was accomplished by examining the stratigraphy exposed in a trench dug along the western edge of the right-of-way. The geomorphology report is presented as Appendix A.

6.6 Stratigraphy

The soils in this area of the site are classified as part of the Citadel series. They are composed of deep, well-drained soils formed in material weathered from calcareous sandstone, limestone, and soft shale (Meland 1979:67). Occasional flecks of charcoal were present throughout the soil profile. Soils are shallower on the northern side of the site toward the hill slope. None of the soil horizons could be identified by their appearance as being associated with the cultural level, which extends into the A, AB, and B soil horizons.

Pedoturbation has obscured any distinct cultural horizon that may have once existed at the site. Cultural materials occur in a thick zone, from approximately 10 to 50 cm below surface, with the greatest concentration between 30 and 50 cm below surface. A single cultural component is suggested by the vertical distribution of artifacts.

Based on sedimentology, geomorphic position, and time-diagnostic artifacts found within the archaeological deposits at 39LA319, it is believed that this site occurs on and in a remnant of the same (upper) terrace at 39LA117 in which late Paleoindian and Early Archaic materials appeared. It appears that a period of drying occurred sometime prior to the onset of the late Paleoindian period, forming a broad terrace across the Little Elk Creek Valley. A later period of down cutting, probably resulting from increased precipitation, removed the central portion of the terrace, leaving remnants on both sides of the valley. The lower, Middle Archaic terrace later formed between and around the remnants of the older terrace. On the south side of the valley, the later terrace attained an elevation close to that of the older terrace, making the two surfaces difficult to distinguish, except through their different archaeological components.

6.7 Laboratory Methods

Processing, cataloging, and initial analysis of materials from 39LA319 were essentially the same as those used for 39LA117. The field methods resulted in the recovery of flakes of size grade 1 and 2; smaller debitage was not recovered. In addition to the standard classification by lithic raw material type, debitage or tool type, color, and size, alteration to artifacts due to heat was noted for each artifact. Evidence for heat alteration included pot lid and hinge fractures, color alteration, crazing and cracking, and altered luster.

The presence of cortex on lithic debitage was also noted. Decortication flakes, shatter, and chunks are defined as any pieces with cortex visible on one or more surfaces. During earlier investigations (Church et al. 1985), the terms *primary*, *secondary*, *tertiary*, and *micro-debitage* were used to describe debitage resulting from the various stages of core-reduction. Primary and secondary debitage contains large or small amounts of cortex, while tertiary and micro debitage exhibit no cortex. In these earlier reports, the term non-diagnostic refers to what is called shatter in this report.

6.8 Results

The systematic shovel testing of the construction right-of-way revealed that approximately 1200 m^2 of site 39LA319 are located between the centerline and the eastern edge of the right-of-way. The mitigative data recovery phase of this project investigated just over one percent of this part of the site; hence, the following information applies specifically to the portion of 39LA319 within the right-of-way and may not be an accurate characterization of the entire site.

As with many other sites in the Black Hills, lithics are the only class of artifacts recovered from 39LA319. Unaltered organic artifacts usually are not preserved in the acidic soils of the coniferous forest. The artifact assemblage from 39LA319 is composed almost entirely of chipping debris. The few stone tools recovered from the site are broken. In total, 587 artifacts have been collected from the site, of which 21 are tools (Table 6.1; Table 6.2).

6.9 Discussion

After excavating the first two units, it was apparent that the integrity of the buried lithic scatter had been affected by pedoturbation. In an attempt to assess the extent of the disturbance, the artifact totals from each level of the block excavation were compared (Figure 6.8). Over seventy-five percent of the artifacts were recovered from Levels 4 and 5. This concentration of cultural material is believed to correlate approximately with the ground surface on which the artifacts were originally deposited. Fifteen percent of the artifacts were encountered in the three levels above this concentration and nine percent of the material was located in the two levels below it. With twenty-five percent of the artifacts displaced from the cultural level, an intensive spatial analysis of the material probably would be futile. In general, the greatest concentration of artifacts occurred in Units 23N/8E and 24N/8E. Artifact frequency gradually declines to the east and west of these two units.

While natural transformation processes have disrupted much of the spatial information, several artifacts recovered from 39LA319 suggest an approximate age for the site. The projectile point base (Figure 6.4a) recovered during the survey and testing phase of this project and the two projectile point bases discovered during mitigative data recovery all appear to date to the late Paleoindian (Plano) period. As in other late Paleoindian assemblages from the Black Hills, the projectile points include types similar to types found in mountainous areas elsewhere in the Northwestern Plains. It is difficult to determine what types of Paleoindian points are represented by the four fragments; however, the variation in form among the three bases suggests more than one Paleoindian point type may be represented at the site. No separate components were noted within the mixed cultural deposit at 39LA319.

In addition to the four projectile point fragments, the tool assemblage includes two projectile point preforms, four endscrapers (including one reworked from a projectile point base), two light scrapers, two bifacial knives, two flake

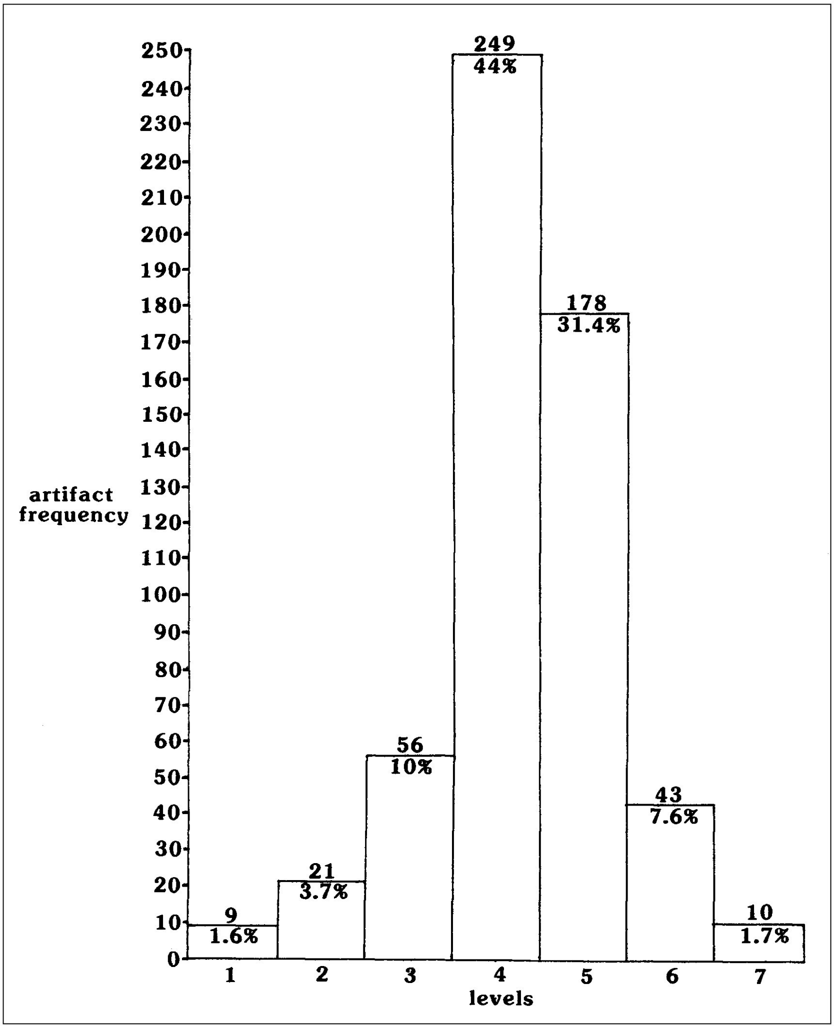


Figure 6.8: 39LA319 artifact totals by level

knives, one biface fragment, and one perforator. Three distinct activities are represented by this tool assemblage: projectile point production, posthunt weapon repair, and hide processing. The site thus seems to have been occupied both before and after a hunt.

The debitage assemblage includes decortication flakes and shatter, indicating that some primary tool production took place at the site. A few bifacial thinning flakes were also recovered, suggesting that advanced stages of stone tool production, in the form of finishing or repair of finished bifacial tools, also took place at the site.

The ratio of tools to debitage is 1:34, roughly equal to that of three other Black Hills sites (see Table 4.11). Site 39CU544, a Middle Archaic site devoted to plant food processing and preparation of hunting weapons had a 1:32 tool-debitage ratio. A 1:29 tool-debitage ratio was derived from the Middle Plain Archaic component of 39FA396, a possible camp at which hunting, butchering, plant-food processing, and tool manufacturing took place. Site 39PN90, a Middle Plains Archaic camp, yielded a tool-debitage ratio of 1:30. Tool-to-debitage ratios are lacking for late Paleoindian components from the Black Hills, with the exception of a 1:12 ratio from a Plano or Late Archaic multifunction site (39PN77) and a 1:21 ratio from a mixed Paleoindian and Archaic hunting, butchering, and lithic production site (39PN97). All were investigated using recovery techniques comparable to those employed at 39LA319. The ratio of tools to debitage thus suggests that stone tool production and/or repair took place at 39LA319, but that the site was not devoted exclusively to lithic production.

All of the debitage and tools were of local lithic materials, primarily cherts and quartzites, with smaller amounts of chalcedonies, petrified wood, and silicified siltstone (Tables 6.1 and 6.2). This lack of exotic materials suggests that a Black Hills–based group is represented by the 39LA319 remains.

No features were found at the site. Whether this was due to sampling error, soil disturbance, or the pattern of cultural activity represented by the site is unclear. It is difficult to imagine that either secondary butchering or the time- and labor-intensive process of hide preparation took place in the absence of at least cooking fires, if not artificial shelter. Perhaps the most satisfactory explanation for the lack of hearths and other features is that the investigated portion of 39FA319 represents an activity area separate from a nearby base camp, to which people could retire for cooking and sleeping.

6.10 Conclusions

Site 39LA319 is a small, special activity site dating to the late Paleoindian (Plano) period and apparently devoted to the repair and manufacture of hunting weapons, a limited amount of secondary butchering, and hide working. The preponderance of expended projectile points and other bifacial tools suggests a posthunt tool repair site; however, the presence of projectile point preforms and decortication flakes suggests a prehunt weapon preparation site. The fairly large percentage of endscrapers and the single perforator indicate that hide working

Table 6.1: Summary of tools and debitage recovered from 39LA319 during 1984 and 1988 investigations

Catalog	Artifact type	Chert	Chalcedony	Quartzite	Silicified wood	Silicified silt	Total
84-581	Flake	1	1				2
	Proj Point Frag			1			1
84-581	Flake	18	4	18			40
	Proj Point Frag				1		1
	Endscraper	2		1			3
	Preform	1					1
	Light Scraper		1	1			1
89-87	G1 Flake	5		28			33
	G1 Shatter			13			13
	G1 Chunk				1		1
	G1 Deco Flake			9			9
	G1 Deco Sh			1			1
	G1 Bif Th Fla	2		3			5
89-87	G2 Flake	41	6	289		1	337
	G2 Shatter	13	1	141		1	156
	G2 Chunk	1					1
	G2 Deco Flake	9	1	3			13
	G2 Deco Sh	1		5			6
	G2 Bif Th Fla			1			1
89-87	Proj Point Frag			1			1
	Pt/Endscraper	1					1
	Drill Frag				1		1
	Biface Preform			1			1
	Biface Frag			1			1
	Biface Knife			1	1		2
	Scraper Frag	1		1			2
	Flake Knife			2			2
Total Debitage		91	13	511	1	2	618
Total Tools		8	3	7	0	0	18
Total Artifacts		99	16	518	1	2	636

Table 6.2: Tools from 39LA319. Horizontal divisions correspond to 1984 (Acc. 84-581) and 1988 (Acc. 89-87) collections

No.	Tool Type	Material Type	Length	Max Width	Thickness	Weight
02	Proj Pt Frag	Quartzite	N/A	25.7	7.1	5.3
03	Endscraper	Chert	N/A	N/A	6.4	4.3
05	Endscraper	Quartzite	26.4	23.0	6.6	4.6
06	Endscraper	Quartzite	N/A	35.7	10.9	24.8
08	Proj Pt Frag	Silic Wood	N/A	18.5	5.3	3.1
17	Pt Preform	Chert	N/A	23.9	9.0	8.3
18	Lt Scraper	Chalcedony	N/A	N/A	3.1	.4
10	Biface Knife	Silic Wood	N/A	N/A	6.5	8.9
15	Lt Sc Frag	Chert	N/A	N/A	3.5	.2
24	Perforator	Silic Wood	33.4	8.1	15.5	3.4
50	Flake Knife	Quartzite	22.6	17.7	7.4	2.6
84	Lt Ret Fl Kn	Quartzite	N/A	N/A	5.1	1.2
116	Endscraper/Pt	Chert	29.3	20.9	7.0	5.1
134	Biface Frag	Quartzite	38.9	35.2	9.1	19.3
200	Scraper Frag	Quartzite	17.1	11.5	4.0	1.0
238	Proj Pt Frag	Quartzite	N/A	N/A	5.4	1.5
239	Biface Knife	Quartzite	N/A	39.7	24.4	14.9
240	Preform	Quartzite	N/A	19.6	7.1	3.3

also took place at the site. The light scrapers and knives suggest secondary butchering. These activities match the hypothesized use of the interior Black Hills during this period for small-scale hunting forays (Tratebas 1986).

Other late Paleoindian sites in the interior Black Hills also seem to have been used for a combination of pre- and posthunt activities (Tratebas 1986). A variety of staging and posthunt activities were indicated for the Trail Draw site, in the western Limestone zone; however, this site differs from 39LA319 in that it contained possible habitation features and lacked evidence for hide working (Tratebas 1986). Since ethnographic data consistently list hide working as a female activity (S. Hughes 1991), this has important implications regarding the make-up of the group occupying the site. The 39LA319 assemblage suggests occupation by a family group, rather than a special hunting task force composed only of men.

The site confirms that the high-altitude meadows were part of the Paleoindian subsistence round, but does not contradict the hypothesis that Paleoindian use of this area was confined to short-term use by small groups on hunting expeditions (Tratebas 1986). This use of the interior Black Hills is hypothesized to have taken place during the warm seasons, because game animals move to the lower elevations during the winter months. The complete lack of exotic lithic material, however, suggests that the site functioned within a Black Hills-based subsistence round (cf. Sundstrom 1989), rather than a plains-based economy (Tratebas 1986). Possibly, more than one subsistence and settlement pattern coexisted in the Black Hills during the Paleoindian period: the plains-based pattern recognized by Tratebas and a second, Black Hills-based pattern, suggested by the cultural remains from 39LA319.

If such a montane adaptation existed alongside the plains-based pattern, it is not easily recognized in the archaeological record as it currently stands. If groups subscribing to both patterns used the interior Black Hills for warm-season hunting forays, the location and focus of their winter camps remain undefined. Since late Paleoindian sites are rare outside of the interior Black Hills, it may be that the missing winter occupations of this seasonal round are represented by as-yet undiscovered sites in the caves and rockshelters or deeply-buried terraces in the hogback zone surrounding the interior Black Hills (Tratebas 1986).

Another, more fundamental question concerns the nature of interaction between groups following the hypothesized subsistence rounds. Several possibilities can be proposed. First, the interior Black Hills may have been so sparsely used that virtually no contact, and consequent conflict, took place between the groups. Alternatively, the different groups may have occupied the interior during different seasons (i.e. summer versus fall), or for somewhat different activities, and thus have avoided territorial conflict. It is also possible that subsistence patterns fluctuated over time, such that the two settlement patterns were not actually contemporaneous. At this point, these issues are a matter of speculation; however, the 39LA319 data at least demonstrate the need for more research on late Paleoindian settlement and subsistence patterns in the Black Hills region.

In summary, bifacial thinning flakes and broken bifaces and projectile points provide evidence for hunting-tool repair, while utilized knives and endscrapers indicate use of the site for posthunt faunal processing, including hide preparation. Primary lithic tool manufacture is also evidenced by small amounts of decortication debitage and by the presence of projectile point preforms; however, a major lithic workshop is not suggested by the rather sparse artifact assemblage. The sparse lithic assemblage and the lack of features and nonlithic artifacts prevent further conclusions regarding 39LA319. Since the portion of the site lying west of the right-of-way was not investigated, the possibility remains that a more extensive cultural deposit exists there.

Chapter 7

Research Conclusions

7.1 Tests of Hypotheses

This study was based on a research design (Chevance 1987) that proposed a series of hypotheses which were to be tested by the results of investigations at the three mountain meadow sites. Each of these hypotheses is treated separately in the following discussion. (The hypotheses appear in boldface print.)

Site 39LA117 was used for final meat processing rather than initial butchering. This hypothesis was suggested by the survey and testing project report, which listed secondary meat processing as a potential function of 39LA117 (Church et al. 1985). Alternative hypotheses can be stated as: 1) 39LA117 was used for initial butchering, rather than, or in addition to, final meat processing; 2) the function of 39LA117 is unrelated to faunal processing; and 3) the function of 39LA117 cannot be determined.

The research design called for this hypothesis to be tested by comparing a series of hypothesized tool kits (see Tratebas 1986) with the tool kit from 39LA117. The hypothesis is rejected if few or no initial butchering tools are present, and accepted if significant numbers of initial butchering tools are present.

The hypothesis test as stated in the research design apparently assumed that no bone would be present at the site. Faunal remains provide more direct, and presumably more accurate, evidence for butchering processes and stages than do tool kits, whose function may be equivocal. It also assumes a single component site, since multiple components would not necessarily have the same functions. Neither of these assumptions is true for 39LA117; therefore, the question of function is treated somewhat differently here than was proposed in the research design.

In a principal components analysis of tools from the interior Black Hills, Tratebas (1986) identified one initial and two secondary butchering components. The initial butchering component comprises two major attributes, choppers and faunal remains, and three minor attributes, bifacial knives, uniface fragments, and utilized flakes. The two secondary butchering components, by contrast, comprise retouched flakes, sidescrapers, keeled scrapers, gravers, and biface thinning flakes (Tratebas 1986).

The tool assemblage from the in situ Middle and Late Archaic components at 39LA117 fits the pattern expected for secondary butchering. It includes a large number of retouched flakes and scrapers and three gravers, and lacks the predominance of bifacial tools and choppers expected for an initial butchering station. The redeposited late Paleoindian and Early Archaic materials, on the other hand, include a large number of bifacial tools and three bifacial choppers. These provide a good match for the hypothesized initial butchering tool kit. Because in situ materials are apparently lacking from the Paleoindian and Early Archaic components within the project area, no faunal remains can be definitely assigned to this component, which might otherwise serve to confirm the use of 39LA117 for primary butchering. The mixed Middle and Late Archaic components contain significant amounts of extremely fragmented bone suggestive of secondary butchering and final meat processing. The hypothesis thus is confirmed for the main, in situ, Middle and Late Archaic components, and rejected for the redeposited Paleoindian and Early Archaic components.

No primary manufacture of stone tools took place at 39LA117 or 39LA319. Alternative hypotheses can be stated as: 1) both primary and secondary stone tool manufacturing took place at the sites; 2) only primary manufacture of stone tools took place at the sites; 3) no stone tool manufacturing took place at the sites; and, 4) the stage(s) of stone tool manufacturing at these sites cannot be determined. The research design specifies that the hypothesis is accepted if little or no cortical material or shatter (nonflake debitage) is present at the two sites. Another test, not specified in the research design, is comparison of debitage size. If primary stone tool production took place at the sites, a high ratio of large to small debitage would be expected, whereas the opposite would be true if the sites were used predominantly for secondary tool production and refinishing.

For 39LA117, the hypothesis that *no* primary tool manufacturing took place is rejected. The site assemblage includes cores, shatter, decortication flakes, and flakes that can be refitted to cores. From these materials, it is obvious that some primary stone tool production did take place at the site. The debitage size-grade analysis yielded ratios of large to small pieces of 1:2 by weight and 1:129 by number of pieces. These ratios indicate that stone tool production at the site was mainly secondary (finishing roughed-out tools or flakes and resharpening finished tools), but that a significant amount of primary stone tool production also took place.

At 39LA319, only G1 and G2 flakes were collected; thus, size-grade analysis cannot be applied. The assemblage included decortication flakes, nondiagnostic shatter, and two "chunks," comprising 35 percent of the total debitage assemblage. This high proportion of decortication flakes and shatter to secondary flakes (1:1.8) suggests an emphasis on primary (decortication) stone tool production at the site, as does the observed predominance of large (G1 and G2) debitage. Specific evidence for secondary stone tool manufacture is provided by several bifacial thinning flakes. The hypothesis as stated is thus rejected for both sites, and the second alternative hypothesis—that both primary and secondary stone tool manufacture took place at the sites–is accepted.

The cultural manifestations at 39LA117 and 39LA319 represent seasonal or temporal differences within the same general settlement or subsistence system. The intent of this hypothesis is to explore the question of whether use of the higher Black Hills changed over time or remained essentially the same throughout the prehistory of the area. Tratebas (1986) and Sundstrom (1989) hypothesize that use of the interior and exterior Black Hills shifted several times, such that no single prehistoric settlement and subsistence system can be defined. Instead, each period of Black Hills prehistory has a characteristic settlement and subsistence pattern.

The hypothesis states that if the two sites have no significant differences, except those that can be attributed to either temporal differences in artifact styles or seasonality of occupation, the use of the high-altitude meadow did not change over time, and consequently a stable settlement and subsistence pattern can be inferred for the area. If the two assemblages display essential differences attributed to their inferred use of the local environment, a fluctuating settlement and subsistence pattern is indicated.

The question of long-term stability or instability in settlement patterns is a complex one. Virtually all settlement and subsistence systems have some built-in flexibility, to adapt to fluctuations in population, resource availability, climate, and the like. This may make long-term patterns difficult to discern from single sites. Assuming that 39LA117 and 39LA319 were not occupied simultaneously, it would be necessary to determine whether they are typical of a particular settlement and subsistence pattern or represent a short-term adjustment to change. The question is further complicated by the fact that all subsistence and settlement patterns of the pre-equestrian Black Hills were of the same basic type: nomadic hunting and gathering. This means that whatever differences are revealed by the archaeological record are a matter of degree rather than kind.

For these reasons, the hypothesis as stated can be neither rejected nor accepted on the basis of investigations at 39LA117 and 39LA319. Nevertheless, it is possible to state whether the assemblages from these sites *tend* to confirm or deny the hypothesis—that is, whether the sites suggest that the area was used for the same subsistence activities and settlement types throughout its history, or was used differently by different groups.

The two assemblages identified for 39LA117 indicate different subsistence and settlement patterns. The redeposited late Paleoindian and Early Archaic assemblage fits the hypothesized pattern for a short-term special-task-group camp devoted to posthunt initial butchering and biface repair (cf. Tratebas 1986). The main, in situ, Middle and Late Archaic components reflect a pattern of more intensive and/or prolonged occupation of the area, presumably by an entire social unit, such as a family group. The Middle and Late Archaic components suggest multiple activities, including primary and secondary stone tool production, wood tool production, secondary butchering, and, possibly, bone marrow extraction and processing. The presence of endscrapers, which are consistently identified as part of a women's tool kit, based on ethnographic data (S. Hughes 1991:31), indicate occupation of the site by a family, band, or other complete social unit. The tool kit from the earlier components, by contrast, is consistent with the pattern expected for a male-only hunting party. These two cultural horizons reflect quite different settlement and subsistence patterns, which cannot readily be attributed to seasonality. (Both are hypothesized to be warm-season occupations.) The hypothesis that the area was used in basically the same way throughout its prehistory thus is negated by the 39LA117 assemblages.

Site 39LA319 is a Paleoindian site apparently devoted to stone tool manufacture, including both primary reduction, secondary (preform) manufacture, reworking of broken or worn out tools, and secondary butchering and hide working. The site reflects somewhat different and more limited activities than those suggested for 39LA117, and appears to have had only short-term use. This combination of pre- and posthunt activity also characterized the Middle and Late Archaic component of 39LA117; however, hide processing was not emphasized at 39LA319 to the degree it was at 39LA117. Seasonality of the sites could not be conclusively determined; however, warm-season occupation is most likely for both since neither artifacts nor features suggest winter occupation. The hypothesis as stated thus is not supported by the mountain meadows site data. Judging by data from these sites, subsistence and settlement patterns did change between the late Paleoindian–Early Archaic period and the Middle Archaic.

The inhabitants of 39LA314 exhibited "wasteful behavior" by the abandonment of quantities of usable exotic raw materials, especially in the form of usable pieces of obsidian. This hypothesis is based on a suggestion that usable obsidian, a lithic material rare or absent in the Black Hills, and nonlocal yellow chert were discarded at 39LA314 (Church et al. 1985). The alternative hypothesis is that the inhabitants of 39LA314 were not wasteful of obsidian or other exotic materials. The hypothesis can be tested by tabulating the size and amount of obsidian and yellow chert debitage at the site. If large amounts of usable pieces of obsidian and yellow chert are present at the site, the hypothesis is accepted; if few or no usable pieces of obsidian are present, the hypothesis is rejected.

This hypothesis test rests on two somewhat subjective questions. First, what size and quality of obsidian and other exotic material is to be considered usable? Second, what constitutes significant amounts of discarded exotic lithic material? For purposes of testing this hypothesis, any flake, shatter, or core fragment larger than the smallest tools found on the site is considered to be of usable size. Further, the chert and obsidian are considered of usable quality if they do not contain obvious inclusions or fracture planes that would render them impossible to flake. Given these standards, any (rather than a large amount of) discarded usable obsidian or other exotic material is sufficient to validate the hypothesis as stated.

Yellow cherts occur throughout the Black Hills, although it is not known whether the specific type found at 39LA314 outcrops locally (Church 1986). Thus, a local source for this material cannot be ruled out, in the absence of detailed petrographic study. Pitchstone and obsidian outcrop in a few places in the northern Black Hills (Tratebas 1986), including the vicinity of 39LA314 (R. Alex personal communication 1982; Church personal communication 1991); however, petrographic analysis of samples from 39LA314 confirm that the material is not local, but is derived from a source in Bear Gulch, Idaho (Church personal communication 1991).

Over a thousand pieces of yellow chert debitage were recovered during various investigations at the site. This includes red and gray varieties of the yellow chert. The vast majority of these pieces of debitage weighed less than 1 g, although a few much larger pieces were recovered. The largest obsidian flake in the 39LA314 collection weighed 2.5 g; three other flakes weighed between 1 and 2 g; and the remaining four flakes weighed less than .5 g.

The smallest complete tool from 39LA314, a light retouched flake knife weighed 2.6 g. The smallest shaped tool, the extreme tip of a biface, weighed .1 g; however, the more complete biface specimens (all were broken) weighed between 8.3 and 25.9 g. Complete or nearly complete unifacial tools weighed between 2.6 and 14 g. The perforator, apparently manufactured elsewhere and carried to the site, weighed 42.9 g.

Unless these tools are unrepresentative of the entire assemblage manufactured at the site, the obsidian found at 39LA314 does not represent wasteful behavior, because the pieces are not big enough for the manufacture of retouched flakes or shaped tools. No very small, whole or nearly whole tools were found at the site, although none of the tools recovered were made of obsidian. The hypothesis that obsidian was wasted at 39LA314 is thus rejected based on the available evidence.

It can be concluded, however, that usable pieces of yellow chert were discarded. While this does constitute "wastefulness," in Church's terms (Church et al. 1985), several possible explanations for the wastefulness suggest themselves. The explanation implicit in the hypothesis, that the chert was devalued due to adoption of metal tools, is not supported by the data. There is no indication that the people represented by 39LA314 had metal tools or any other Euro-American trade goods in their material culture assemblage. (The single trade bead found on the surface of the site apparently represents a recent discard, unrelated to the buried archaeological component.) The emphasis on biface production also militates against this explanation, since bifacial knives and projectile points were invariably among the first stone tools to be replaced by metal ones when the latter became available. Even if all metal was removed from the site for reuse elsewhere, one would expect discard of usable as well as broken bifaces if bifacial tools had suddenly been replaced by metal ones. Contrary to this expected pattern, only broken bifaces were discarded at 39LA314 (with one exception).

Another possible explanation for the observed waste of yellow chert is that biface production at the site represents prehunt weapon preparation. Presumably, hunting task groups would not want to be encumbered by a large amount of lithic raw material. This is especially true in an area such as the interior Black Hills where deer, elk, or mountain sheep probably were the intended quarry. Hunting such animals in a forested area demands a high degree of mobility, which might be compromised if the group were carrying large amounts of unused rock.

A final explanation, related to the last idea, is that the person or persons who produced the knapping feature at 39LA314 were aware of the ready availability of good quality lithic raw material in the Black Hills, and thus had no incentive to preserve what remained of the imported chert. This, of course, does not explain why the chert was imported in the first place. If the chert is local, rather than imported from outside the Black Hills, there would probably be no reason to conserve it. The hypothesis test with regards to the yellow chert is inconclusive, because it cannot be established on the basis of currently available data whether the chert is local or exotic. The most reasonable explanation, based on the present data, is that the person or persons represented by the knapping feature at 39LA314 used as much of the chert as was needed to produce an ample supply of biface preforms and then discarded the rest as unnecessary to the tasks to follow.

Site 39LA314 reflects a cultural degeneration caused by the influx of European trade goods and the resultant devaluation of native technologies. This hypothesis is based on the observation (Church 1986) that both large amounts of discarded usable lithic material and a trade bead were found on the site. The hypothesis provides a possible explanation for this observed pattern. Unfortunately, the hypothesis as stated seems to equate "cultural degeneration" with the acceptance of nonnative technologies or material culture. In fact, cultures can and do borrow technologies and material items from one another without "degeneration" or loss of cultural identity taking place. For example, the development of the Plains Equestrian pattern, which rested on the adoption of the horse and gun, is more often viewed as a cultural fluorescence than as a degeneration. Therefore, the present author would restate the hypothesis as: the pattern of lithic raw material discard at 39LA314 resulted, at least in part, from replacement of lithic tools by metal trade items.

Having set aside the question of cultural degeneration, which cannot be gauged by the hypothesis test proposed here, three other issues need be raised. The first is whether the obsidian and yellow chert at the site were indeed usable. As has already been noted, the 39LA314 obsidian occurs in pieces generally smaller than the smallest tools at the site, suggesting that they would not have been large enough to be used for tool production. It would also have to be demonstrated that the obsidian and nonlocal chert were equal or superior in quality to locally available rocks, in terms of knappability, strength, and durability. Otherwise, their discard can be explained in terms of preference for local lithics, rather than nonnative trade items.

The second part of this issue is whether the yellow chert is in fact nonlocal. (As discussed above, the obsidian is from a source in Idaho.) The yellow chert was identified as nonlocal on the basis that it shows characteristics of cherts formed in lake beds. Since the formation processes for Black Hills cherts are not completely described, it is possible that this chert is actually a local material. Yellow cherts outcrop in several areas of the Black Hills (Tratebas 1986; L. Alex 1991). The chert thus cannot be assumed to have been highly valued, as opposed to simply convenient, unless it can be shown conclusively that this particular variety is nonlocal. If the yellow chert is, in fact, local, it may have been discarded simply because there was no incentive to conserve it.

The third issue in considering this hypothesis is the logic of the hypothesis test. The research design basically states that the hypothesis is accepted if trade goods are present in the 39LA314 assemblage, and rejected if trade goods are lacking in the assemblage. This oversimplifies this question. Different trade items were received and adopted at different times and to different degrees. The adoption of glass beads in itself is unrelated to devaluation of native chipped stone technologies, because beads do not replace chipped stone tools. Native populations may have acquired glass beads well before metal items were widely available to them. On the other hand, the import of metal for the production of knives, projectile points, and other tools did eventually lead to the abandonment of native stone tool technologies. Even this complete loss of chipped stone technology, however, did not happen overnight, or at a single campsite. Instead, it was part of a gradual process of technological change.

The presence or absence of trade items, then, is not the key to understanding the abandonment of native technologies in the face of introduction of items of nonnative material culture. If metal was preferred to previously highly valued lithic material types, it presumably would not be discarded alongside the lithics. The very characteristics of durability and malleability that makes metal so desirable as a raw material also mean that broken tools and manufacturing byproducts can be saved and reworked into new tools. Thus, an *absence* of metal on the site would be expected, especially on sites from periods of relative scarcity of metal. When metal became cheaper and more abundant, it may have been more economical to trade for new metal tools than to reuse metal discards—a pattern that would be reflected in an increase in metal, not lithics, in archaeological deposits.

To summarize, this hypothesis should be evaluated by asking the following questions: Were the discarded lithics actually exotic and usable? Was there any reason not to waste the yellow chert (i.e. was it rare, hard to obtain, or of superior quality)? Does the site actually date to the Protohistoric period? What kind and quantity of Euro-American trade goods are included in the 39LA314 assemblage? What is the presumed value of these in terms of replacing specific native technologies? If the discarded lithics are indeed exotic and/or difficult to replace and if evidence exists that a metal-based tool technology was replacing the chipped stone tool technology, the hypothesis can be accepted, as regards 39LA314.

The mitigative data recovery at 39LA314 did not locate any time-diagnostic artifacts. The absence of Euro-American trade items associated with the lithic material means that the identification of this site as Protohistoric rests on the single occurrence of a glass bead on the surface of the site. It should be noted that a few modern nails were found below the surface in test excavations dug in 1984. Thus, no significant association can be drawn between the glass bead and the subsurface lithic material. At present, the age of 39LA314 is unknown, as neither diagnostic lithics nor Euro-American trade items were found in the intact site deposits. A possible side-notched projectile point fragment tentatively suggests an unspecified Archaic age for the site; however, the artifact is not clearly a projectile point fragment.

Since no valid evidence exists that 39LA314 is Protohistoric, and no evidence exists of the replacement of stone tools by metal ones, we can reject the hypothesis that the pattern of wasting valuable lithic material resulted from the adoption of metal trade goods by native groups. This leaves open the question, discussed above, of why the lithic material was discarded, if it indeed was exotic and usable.

Most use of the higher elevations of the Black Hills was short term. During most periods the higher elevations were used for brief forays focused on hunting or other tasks. Only during the Archaic were longer duration bases of operation established. These hypotheses are taken from Tratebas's 1986 study of Black Hills settlement patterns. In order to be directly evaluated, they must be broken down into separate alternative hypotheses. These are: 1) only short term use was made of the higher elevations of the Black Hills; 2) during the Archaic long-term use was made of the higher elevations; 3) both long- and short-term use was made of the higher elevations throughout Black Hills prehistory; 4) only single task, special activity sites are found in the higher elevations; and 5) multiple activity sites, as well as special activity sites, are found in the higher elevations.

Several site attributes have been suggested as indicative of long-term occupations (Tratebas 1986). These include large amounts of lithic debitage, significant amounts of imported (as opposed to local) raw material, resharpened tools and resharpening flakes, and tools indicative of a wide variety of tasks. The combined Middle and Late Archaic assemblage from 39LA117 fits this pattern to some degree. A variety of activities, including wood and stone tool production, tool maintenance, and secondary butchering, took place at the site. Lithic raw material includes both local and imported types, although local types dominate. In addition, the size and density of the cultural deposit suggests longer-term occupations than those represented by other sites, such as 39LA314 and 39LA319. On the other hand, evidence for very long-term use of 39LA117 is lacking. Instead, a base camp, periodically reused for limited periods of resource extraction, is indicated. If this kind of temporary base camp fits the definition of long-term occupation intended by the hypothesis, it can be concluded that long-term occupation of the higher Black Hills did take place at least during the Middle and Late Archaic periods. Hypotheses 1 and 4, above, thus are rejected, and hypotheses 2 and 5 are confirmed.

The redeposited late Paleoindian and Early Archaic assemblage at 39LA117, by contrast, suggests short-term use of the area for posthunt tool maintenance and primary butchering. This indicates that short-term, as well as long-term, use was made of the area during the Archaic; however, there is no archaeological basis for lumping the Early and Middle Archaic sites together.

On the contrary, differences in settlement pattern between the Early and Middle Archaic were probably as pronounced as those between any other periods (Tratebas 1986; Sundstrom 1989). The differences between the Early and

Middle Archaic components at 39LA117 tend to support the idea of distinct Early and Middle Archaic settlement patterns. The Paleoindian component at 39LA319 also suggests a special activity site, devoted to chipped stone tool production related to hunting and posthunt faunal processing (secondary butchering and hide preparation). This also suggests a settlement pattern different from that represented by the Middle and Late Archaic components at 39LA117. The Paleoindian component of 39LA319 and the mixed Paleoindian and Early Archaic components of 39LA117 differ in that hide working was an important activity at 39LA319, but was lacking at 39LA117. The presence of hideworking tools, alongside hunting weapons and butchering tools, suggests occupation of the site by a family group including both males and females, as opposed to a special task hunting party composed only of males. This would seem to indicate a fundamental difference in the way in which hunting was carried out during different periods of Black Hills prehistory, if the three components are representative of larger settlement and subsistence systems.

On the basis of these three assemblages alone, subsistence patterns can be hypothesized to have shifted twice between the late Paleoindian and Late Archaic periods. The first, and less pronounced, shift took place during or at the end of the late Paleoindian period, when family-based hunting groups were replaced by hunting parties composed only of men. Alternatively, these two hunting patterns may have coexisted during the late Paleoindian and Early Archaic, with local resource availability dictating the particular pattern followed on any given occasion. The second shift took place between the Early and Middle Archaic period, when short term hunting forays into the area were supplanted by longer term camps used as a base for a variety of activities. The Middle and Late Archaic occupations of 39LA117 seem to be essentially similar, as are the late Paleoindian and Early Archaic occupations of the site. All components at 39LA117 appear to represent locally oriented groups, judging by their limited use of imported lithic raw materials and tools.

Site 39LA314 appears to be a special activity site, possibly related to prehunt weapons preparation; however, because the site could not be dated, except tentatively as a unspecified Archaic occupation, it does not contribute to tests of this hypothesis. In contrast to the 39LA117 and 39LA319 components, 39LA314 seems to represent a group oriented to the west of the Black Hills proper, judging by the relative frequency of exotic lithics.

In conclusion, 39LA117 and 39LA319 suggest that the high elevation meadows were used differently during the Middle and Late Archaic than during the late Paleoindian and Early Archaic. From this, separate subsistence and settlement patterns can be inferred; however, the patterns cannot be fully defined on the basis of the limited data presented here. In general, most intensive use of the higher elevations is indicated for the Middle and Late Archaic, with Paleoindian and Early Archaic use of the vicinity limited to brief hunting expeditions.

During the Paleoindian period, the interior Black Hills were used mainly for special activity camps for prehunt preparation and posthunt butchering and tool repair. The research design specifies that this hypothesis is to be accepted if the Paleoindian component at 39LA117 represents a hunt-related special activity site, and rejected if the component suggests a longer-duration campsite. In fact, it is not possible to test the hypothesis as stated by looking at a single site. The existence of a single residence site would not negate the idea that the *main* site type is a small, special activity camp. Nevertheless, the question can be explored in terms of the particular locality in which 39LA117 and the other two sites occur.

The late Paleoindian material from 39LA117 co-occurs with Early Archaic material. The combined assemblage suggests a short-term, special activity site devoted to posthunt tool repair and initial butchering. Occupation by hunting parties composed of men is indicated.

Site 39LA319 dates to the late Paleoindian period. This site fits the pattern expected for a pre- or posthunt weapon preparation and maintenance station, as it contains a large amount of chipping debris and a tool assemblage dominated by projectile points and other bifaces. This tends to support the hypothesis as stated. On the other hand, endscrapers make up a significant portion of the 39LA319 tool assemblage, indicating that hide preparation took place at the site, as well. This strongly suggests use of the site by a family or other mixed-sex social unit (S. Hughes 1991), rather than an exclusively male hunting party. The presence of a complete social unit would have facilitated longer-duration occupation of the area, because people would be available to do all the tasks necessary to the group's subsistence. Actual evidence for long-term use of the interior area during the late Paleoindian period is, however, lacking to date. The hypothesis can be accepted insofar as duration of occupation is concerned, but should be expanded to include hide preparation as a task performed in the interior Black Hills.

From the Middle Archaic on, wood tool manufacturing took place in the hogback, but not in the interior Black Hills. The null hypothesis is that wood tool manufacturing did take place in the interior Black Hills during the Middle Archaic and other periods. The hypothesis is related to a proposed settlement pattern in which the hogback zone was used to gear up for hunting trips into the interior Black Hills and the surrounding plains (Tratebas 1986). The hypothesis is accepted if a proposed wood tool manufacturing tool kit (see Tratebas 1986) is not found at any of the sites, and rejected if such a tool kit is found. The tool kit identified as being related to initial wood or bone tool manufacturing included adzes, large endscrapers, utilized flakes, chisels, gravers, spokeshaves, and notches. (Two other proposed tool kits, related to hafting and shafting, were similar, but contained denticulates and lacked spokeshaves [Tratebas 1986].)

Tools from the combined Paleoindian and Early Archaic assemblage of 39-LA117 include a combination chopper/adze. The combined Middle and Late Archaic components contain three gravers, including one with an edge that may have served as a burin or chisel, and a flake utilized as a chisel. Endscrapers and utilized flakes from the latter component bear use wear consistent with hide working and general cutting tasks, rather than woodworking. No spokeshaves, notches, or denticulates were found at the site. This indicates that only limited, if any, woodworking took place at 39LA117, and tends to confirm the hypothesis that most woodworking, including shaft preparation, took place elsewhere.

Spokeshaves, notches, and denticulates are also lacking from the 39LA314 assemblage, with the exception of a possible side notched projectile point fragment that may have been reworked into a notch or spokeshave. (The specimen is too fragmentary for accurate classification.) Since the site could not be dated, however, it is inconclusive as regards the stated hypothesis. Site 39LA319 did not contain either woodworking tools or post–Late Archaic cultural deposits; thus, it too is inconclusive in regards to this hypothesis. As far as the data from the present project are concerned, the hypothesis is confirmed.

The most frequent Late Prehistoric use of the mountain uplift was for winter camps; the hogback was used for a variety of purposes during this period. This hypothesis is taken from Tratebas's 1986 study of Black Hills settlement patterns. The alternative hypothesis can be stated as: both the hogback and the interior Black Hills were used for a variety of purposes during the Late Prehistoric. The hypothesis as stated refers to a trend and is not testable by looking at a single site; however, if any Late Prehistoric components at the three mountain meadow sites indicate warm-season camps, some refinement of the hypothesis might be called for. If such components represent winter camps, the hypothesis would be supported.

This hypothesis rests on the assumption that 39LA319 contained a Late Prehistoric component, based on the radiocarbon date derived from the posthole feature. It is concluded here that the posthole is recent and unrelated to the prehistoric occupation of the site, and that no Late Prehistoric component is present at the site. Neither of the other two sites contained Late Prehistoric components; thus, the hypothesis cannot be tested using data from the current study.

In a curated technology, patterned (shaped) tools are more highly curated (reshaped and resharpened) than nonpatterned tools. The intent of this hypothesis is that some classes of tools are made and maintained to a consistent shape and that these shaped tools are more likely to be reworked than other, nonpatterned tool classes. The alternative hypothesis is that expedient, nonpatterned tools are treated the same as patterned tools, or are more highly curated than patterned tools. Since patterned tool classes, such as projectile points, are by definition more consistent in shape than nonpatterned tool classes, the existence of intentionally shaped tools is treated here as a given characteristic of the data, rather than as a hypothesis. The stated hypothesis is not tested directly. Instead, the two more specific hypotheses that follow are used to explore whether curated technologies are represented by the mountain meadow artifact assemblages.

Highly patterned tools in a curated technology will appear in the archaeological record as broken, worn-out items. A large proportion of expedient (nonpatterned) tools will appear in the archaeological record as whole, like-new tools. This hypothesis expresses the idea that the more effort put into shaping a tool, the more likely it is to be curated, rather than discarded after initial use. Rather than being discarded at the location of their use, patterned tools are returned to a residence base for repair and reuse. The alternative hypothesis is that patterned and nonpatterned tools are saved or discarded with about the same frequency. This hypothesis is tested by applying a simple index of breakage to each tool and then comparing the patterned and nonpatterned tool assemblages.

The tool assemblage from 39LA314 does not support the hypothesis, as stated in the research design. This assemblage contained 16 shaped tools (ten biface fragments, three bifacial knives, one projectile point fragment, one perforator, and one endscraper). Of the 16 shaped tools, 15 were broken and one (the perforator) was heavily worn. The assemblage contained five nonpatterned tools (light retouched flake knives, light scrapers, and a utilized flake), of which three were broken. At this site, then, all (100 percent) of the patterned tools were broken or worn out, while only 60 percent of the expedient, nonpatterned tools were broken. Because of the small size of the sample and low expected values in some cells, the Fisher test statistic was used to test this hypothesis (Table 7.1). This statistic, however, does not show a significant tendency for unifacial and nonpatterned tools to appear as whole specimens, and, conversely, for bifacial and patterned tool classes to contain broken specimens. The hypothesis thus is not confirmed by the 39LA314 data.

This assemblage points out a weakness in the hypothesis test as stated in the research design. Specifically, no distinction is drawn between tools broken during manufacture and tools broken during or after use. It probably is more than coincidental that the only two unbroken tools found at the site were unifacial, nonpatterned types and that the bifaces all appeared to have been broken during manufacture, rather than in use. The latter observation would seem to argue for a curated technology, as the bifaces that did not break during manufacture presumably were removed from this site and taken elsewhere for use and ultimate discard. If artifacts broken during manufacture had been treated as debitage, rather than tools, a different pattern would emerge from the data. In this instance, however, the resulting sample would be too small for meaningful statistical analysis.

The 39LA319 assemblage contained 14 patterned and four nonpatterned tools. All but one of the 14 patterned tools (93 percent) were broken, and three of the four nonpatterned tools (75 percent) were broken. The Fisher test was again used to test the hypothesis. This statistic revealed no significant differences in the distribution of broken and whole tools among the bifacial, unifacial, patterned, and nonpatterned tools classes. This assemblage thus lends no support to the stated hypothesis.

A different pattern characterizes the larger 39LA117 assemblage. In this instance the χ^2 statistic was used to test the hypothesis. Both the unifacial and bifacial tool classes deviated significantly from the expected distribution of broken and whole tools. There were more whole and fewer broken unifaces than would be expected if broken and whole artifacts were evenly distributed across tool classes. Conversely, more bifacial tools appeared as broken specimens than expected. Overall, 82 percent of the bifacial tools were broken, while only 53 percent of the unifacial tools were broken. By contrast, 72 percent of patterned tools and 61 percent of nonpatterned tools appeared as broken specimens.

Table 7.1: Chi-square and Fisher test statistics comparing the distribution of broken and whole bifacial, unifacial, patterned, and nonpatterned tools. For all tests, the null hypothesis is that Observed=Expected, d.f.=1, 0.50 level of significance. For the Chi-square test (39LA117), the null hypothesis is rejected if $\chi^2 > 3.84$. For the Fisher test (39LA314 and 39LA319), the null hypothesis is rejectedif the observed value of C is equal to or less than the critical value as determined from a table of critical values in the Fisher test (Siegel 1956:256–270)

	39LA117				
	Observed		Expected		χ^2
	Broken	Whole	Broken	Whole	
Bifacial	50	11	40.26	20.74	6.93
Unifacial	39	34	48.18	24.82	5.14
Patterned	48	19	44.22	22.78	0.95
Nonpatterned	41	26	44.22	22.78	0.69
	39LA314				
	Observed		Observed Value of C		Critical Value of C
	Broken	Whole			
Bifacial	15	0			
Unifacial	4	2	4		3
Patterned	16	0			
Nonpatterned	3	2	3		2
	39LA314				
	Observed		Observed Value of C		Critical Value of C
	Broken	Whole			
Bifacial	10	0			
Unifacial	6	2	6		4
Patterned	13	1			
Nonpatterned	3	1	3		1

While bifacial tools are more likely than unifacial tools to appear as broken specimens, this trend is rather weak in the 39LA117 data set. The even distribution of whole and broken tools among the patterned and nonpatterned tool classes can be attributed to a high proportion of broken tools in every class, as opposed to a low number of broken tools in the bifacial and patterned classes. This would seem to indicate that, at this site, both shaped and expedient tools were used until they broke or wore out, although more shaped than expedient tools were treated this way. The reasons for this are a matter of speculation; however, it cannot be concluded that a noncurated technology is represented. On the contrary, a curated assemblage is clearly indicated by the presence of tools made from exotic lithics, bifacial thinning flakes, and resharpened tools. Unlike the other two sites, a quantifiable pattern of tool curation is indicated for 39LA117. The most persuasive explanation for this pattern of discard is that a base camp, rather than a special activity site, is represented. The more intensive and ongoing use of both bifacial and unifacial tools in the camp setting apparently resulted in heavier use and delayed discard of both tool classes, with bifacial tools receiving most curation.

In a curated technology, there is no regular relationship between the patterned tools and the raw material of manufacturing debris recovered from a site. Conversely, there is a direct relationship between expedient tools and manufacturing debris at a site. The hypothesis again expresses the idea that highly patterned tools are not discarded at the location of their use or manufacture, but are returned to a base camp for repair. Nonpatterned, expedient tools, by contrast, are made, used, and discarded on the spot. Alternative hypotheses can be stated as: 1) patterned tools and chipping debris are made of the same material, and 2) nonpatterned tools and chipping debris are of different materials. The hypothesis can be tested by comparing the raw material types used for patterned and nonpatterned tools with those of the debitage assemblage. Debitage Size Grades 1–4 (where available) were included in this analysis.

For this analysis, patterned tools included all formal tool classes (projectile point, scraper, chopper, biface, endscraper, etc.), while only retouched and utilized flakes and some flake scrapers were considered nonpatterned tools. Bifacial thinning flakes were included in the patterned tool category, because they reflect the presence of bifacial tools. Raw material groupings were condensed into two categories: cryptocrystalline types (chert, chalcedony, porcellanite, silicified wood, and silicified slate) and micro- and macrocrystalline types (quartzite and silicified siltstone).

Separate analyses were done to test whether raw material preferences differ between bifacial and unifacial tools and between patterned and nonpatterned tools.

Table 7.2 summarizes the results of χ^2 and Fisher tests of tool and debitage similarity at 39LA117, 39LA314, and 39LA319. The statistics show that, overall, the 39LA117 tools were made from similar proportions of macrocrystalline and cryptocrystalline material as the debitage found at the site. The debitage assemblage contained 77 percent cryptocrystalline, while the tool assemblage contained 75 percent cryptocrystalline. The raw material used for patterned and for bifacial tools, however, deviates from the expected pattern of distribution based on the debitage raw material (.05 significance level).

This deviation takes the form of a preference for macrocrystalline material for the production of bifacial and patterned tools. This statistic reflects the predominance of bifacial tools in the patterned tool class, rather than indicating a separate pattern of preference macrocrystalline rock for patterned tools in general. The unifacial tools and nonpatterned tool classes were not significantly different from the debitage in raw material preference.

The χ^2 statistic was also computed for the 39LA117 assemblage using only tool data, to determine whether different raw material preference patterns were present in the tool assemblage alone (Table 7.3). This confirmed that pattern noted above of macrocrystalline material being preferred for bifacial and

Table 7.2: Chi-square and Fisher test statistics comparing the distribution of macrocrystalline and cryptocrystalline bifacial, unifacial, patterned, and non-patterned tools. For all tests, the null hypothesis is that Observed=Expected, d.f.=1, 0.50 level of significance. For the Chi-square test (39LA117), the null hypothesisis rejected if $\chi^2 > 3.84$. For the Fisher test (39LA314 and 39LA319), the null hypothesis is rejectedif the observed value of C is equal to or less than the critical value as determined from a table of critical values in the Fisher test (Siegel 1956:256–270)

	39LA117				
	Observed		Expected		χ^2
	Crypto	Macro	Crypto	Macro	
Bifacial	50	11	40.26	20.74	6.93
Unifacial	39	34	48.18	24.82	5.14
Patterned	48	19	44.22	22.78	0.95
Nonpatterned	41	26	44.22	22.78	0.69
Total tools	100	34	103.82	30.82	0.43
	39LA314				
	Observed		Observed Value of C		Critical Value of C
	Crypto	Macro			
Bifacial	14	1			
Unifacial	6	0	6		2
Patterned	15	1			
Nonpatterned	5	0	5		3
	39LA314				
	Observed		Observed Value of C		Critical Value of C
	Crypto	Macro			
Bifacial	5	5			
Unifacial	4	4	4		0
Patterned	7	7			
Nonpatterned	2	2	2		0

patterned tools. This is most strongly expressed as a preference for macrocrystalline material for bifacial tools. In addition, a significant preference for cryptocrystalline material for nonpatterned tools was also indicated by the χ^2 test.

These patterns support the research hypothesis that patterned tool raw material deviates from that of the debitage assemblage and that nonpatterned tool raw material is essentially the same as that of the debitage assemblage. Since almost all bifaces were considered patterned tools, and most nonpatterned tools were unifacial, the bifacial and patterned categories largely overlap one another, as do the unifacial and nonpatterned tool categories. It is not surprising that

Table 7.3: Chi-square statistic comparing the distributions of raw material preferences for bifacial, unifacial, patterned, and nonpatterned tool classess, 39LA117. Expected distributions are based on tool data. Bifacial thinning flakes are included as bifacial tools. The null hypothesis that Observed=Expected is rejected if $\chi^2 > 3.84$ (d.f.=1, .050 level of significance)

	39LA117				
	Observed		Expected		χ^2
	Crypto	Macro	Crypto	Macro	
Bifacial	50	11	40.26	20.74	6.93
Unifacial	39	34	48.18	24.82	5.14
Patterned	48	19	44.22	22.78	0.95
Nonpatterned	41	26	44.22	22.78	0.69
Total tools	100	34	103.82	30.82	0.43
	39LA314				
	Observed		Observed		Critical
	Crypto	Macro	Value of C		Value of C
Bifacial	14	1			
Unifacial	6	0		6	2
Patterned	15	1			
Nonpatterned	5	0		5	3
	39LA314				
	Observed		Observed		Critical
	Crypto	Macro	Value of C		Value of C
Bifacial	5	5			
Unifacial	4	4		4	0
Patterned	7	7			
Nonpatterned	2	2		2	0

the overlapping classes tended to yield the same results in the χ^2 tests. The preference for macrocrystalline rock for bifacial and patterned tools very likely reflects the importation of finished tools, probably produced in the hogback zone, where good quality quartzites are abundant, to the 39LA117 site area. This confirms the presence of a curated technology, as defined in the research design.

A different pattern emerges at 39LA314. Here, both expedient, nonpatterned tools and patterned tools are made of the same materials, primarily a distinctive yellow chert. This yellow chert was used for 13 (81 percent) of the 16 patterned tools and for all five (100 percent) of the nonpatterned tools. Other chert was used for one (5 percent) of the patterned tools, as was porcellanite. Quartzite was used for one (5 percent) of the patterned tools. Significantly, the single quartzite tool is unrelated to the main site function and is hypothesized to have been brought to the site from elsewhere.

There were no differences between bifacial and unifacial tools, or between patterned and nonpatterned tools in the distribution of macrocrystalline and cryptocrystalline materials. The Fisher test was used for this assemblage, due to the small sample size and low expected values in some cells. Formal comparison of the total tool assemblage with the total debitage assemblage was not possible, due to differences in tabulation methods used during various stages of investigations at the site; however, an informal look at the debitage suggests it is more diverse in terms of lithic raw material than the tool assemblage.

This distinctive pattern at 39LA314 is the result of the function of the site as a stone tool manufacturing locus. Most of the tools found on the site were unfinished and never used, due to breakage during manufacture. The only exceptions to this were a few expedient tools and the aforementioned quartzite perforator.

This does not negate the hypothesis that patterned tools and debitage will exhibit different patterns of lithic raw material preference at a site. Because the discarded patterned tools were never used, they might more accurately be described as byproducts of tool manufacture rather than as tools proper. The fact that only one of the bifaces was complete supports the idea of a curated technology, since the completed bifaces presumably were removed from the site for use elsewhere. The presence of the heavily worn quartzite perforator also supports the hypothesis of curated technologies, as its raw material is at odds with that of the other tools and most of the debitage.

The 39LA319 assemblage also exhibited no significant differences in the distribution of raw material types over various tool classes. It is worth noting, however, that the debitage comprised 17 percent cryptocrystalline material, while the tools were 50 percent cryptocrystalline. This suggests that the possibility that tools were imported, rather than being manufactured on site. The even distribution of macrocrystalline and crytocrystalline raw material types further suggests that both patterned and nonpatterned were being imported to the site and that no specific materials were preferred for particular types of tools.

Comparisons of debitage raw material preference with that of tools at 39LA-117 thus support the hypothesis that, in a curated technology, the patterned tools found at a site are unrelated to the debitage found at the site, as regards raw material preference, while the nonpatterned, expedient tools do not differ significantly from the debitage in this regard. At 39LA319, debitage and tools differed in percentages of different raw material types; however, no differences were found among the various tool classes. This comparison could not be made for the 39LA314 assemblage; however, informal observations of attributes of this assemblage also suggest that it was curated. Specifically, all but two of the tools found on the site were broken during manufacture. This suggests that those tools that were successfully completed were removed for use elsewhere. Further, the tool assemblage was less diverse than the debitage assemblage in lithic raw material type, suggesting differential use and discard of tools versus debitage.

The final three hypotheses can be combined into the more general hypothesis that the archaeological assemblages from the three mountain meadow sites represent curated assemblages (Binford 1977; Chevance 1984). This can help to clarify whether tools were discarded at their place of use, and thus provide an index to site function, or whether tools found on a site bear little relationship to site function. It can also help identify what kinds of tools are likely to have been discarded after initial use and what types are likely to have been kept for reuse and repair. This has important implications regarding studies such as Tratebas's 1986 analysis of Black Hills settlement patterns, in which tools are assumed to have been discarded at their use locations.

The differences in raw material preference at 39LA117 strongly suggest existence of just such a curated technology. The strongest trend noted in the 39LA117 data was a lack of similarity between patterned tool raw material and that of the debitage assemblage. The next strongest trend was a lack of similarity between bifacial tool raw material and that of the debitage assemblage. Patterned tools, especially bifaces, deviate widely from the expected distribution of lithic raw material types (based on the debitage assemblage). This can most easily be interpreted as bifacial, patterned tools having been brought to the site from outside places of manufacture and nonpatterned, unifacial tools, for the most part, having been manufactured and discarded on the spot.

A weaker trend within the 39LA117 tool data suggests a significant preference for cryptocrystalline raw material for unifacial and nonpatterned tools, with bifacial and patterned tools exhibiting a preference for macrocrystalline raw material, proportionate to their relative abundance in the tool assemblage. This may echo the other trend, since cryptocrystalline rocks outcrop closer to 39LA117 than do good quality macrocrystalline quartzites and silicified siltstone. It appears likely that the pattern of using the hogback as a locale for hunting tool preparation (Tratebas 1986) is reflected in the differences in lithic raw material preference between patterned, bifacial tools and nonpatterned unifacial tools. Clearly, some of these tools were manufactured elsewhere, probably near quartzite outcrops in the hogback zone, and imported to the site (i.e. curated), while others were manufactured on site using the local cherts and chalcedonies. Most of the expedient flake tools, by contrast, were made on site, from local cryptocrystalline rocks.

At 39LA314, the bulk of tools discarded on the site were either expedient flake tools or tools broken during manufacture. The one notable exception was a heavily worn quartzite drill, which apparently had been brought to the site and discarded there. A curated technology is suggested, both by the anomalous quartzite drill and the lack of whole, unbroken tools in this lithic workshop site.

At 39LA319, both patterned and nonpatterned, bifacial and unifacial tools seemed to have been manufactured elsewhere and brought to the site. In this assemblage, no significant preferences for raw material types for certain classes of tools was indicated. The 39LA319 data support the idea that expediency, rather than special properties of the raw materials, explains the discrepancies between the various tool classes.

Alternatively, the latter trend might be explained in terms of suitability of certain kinds of rock to certain kinds of tools. This alternative hypothesis finds support in the 39LA117 data, but not the data from the other two sites. Table 7.3 indicates that distinct preferences for cryptocrystalline versus macrocrystalline raw material were evident in the bifacial, patterned, and nonpatterned tool classes at 39LA117, but not at 39FA314 or 39LA319. At the latter two sites, the two raw material types were evenly distributed across tool classes. At 39LA117 about one-quarter of the tools were made of macrocrystallines. This proportion increases to one-half at 39LA319, but decreases to 5 percent at 39LA314 (Table 7.4). Thus, no consistent raw material preferences are evident in the data from the three sites. At 39LA314 and 39LA319, the amount of macrocrystalline material used for tools at these sites seems to have depended mostly on whether tools were made on site or were imported from elsewhere.

The three sites also have different patterns of lithic raw material preference for different tool classes, lending further support to the primacy of expediency in explaining raw material preference. At 39LA117, preference for cryptocrystalline versus macrocrystalline rock was evident in the bifacial, patterned, and nonpatterned tool assemblages, while with the unifacial tools showing no raw material preference. At the other two sites, no significant raw material preferences were revealed. Clearly, then, raw material choice is not solely a matter of smooth rock being better suited to the manufacture of scraping tools and grainy rock being more suitable for cutting tools. Instead, raw material preference seems to have been partially a matter of what rock was closest at hand at the time tools were manufactured.

The demonstration that prehistoric technologies in the Black Hills were curated (cf. Binford 1979; Chevance 1984) raises questions about the validity of studies, such as Tratebas 1986, which rest on the assumption that tools were discarded at the location where they were used. The research design upon which the present study is based, states that, if curated technologies are present, "there would be serious doubt as to whether the interpretation of the components was meaningful" (Chevance 1987).

It does appear from the perspective of the mountain meadow sites that patterned tools were brought to the sites from elsewhere, and then discarded because they were irreparably broken or worn out. Nevertheless, the tool assemblages found at the three sites could be readily related to the principal components outlined in Tratebas's study, and site function accurately inferred.

The two operative assumptions here—the existence of curated technologies and the discard of tools at their use location—are not fundamentally in conflict with one another. Several localities are potentially associated with a single tool—the place it was made, the place or places it was used, and the place it was discarded. Analyses based on the assumption of discard at primary use location are misled only when the tool is discarded, before use, at its place of manufacture, or when the tool is accidentally lost. Otherwise, discarded tools are very likely related to site function. It simply must be kept in mind that the tool may have been used elsewhere and/or for other tasks before its final use

Table 7.4: Summary of tool raw material type preferences, 39LA117, 39LA314, and 39LA319

Site	Material type	#	%	Weight	%
39LA117	Pl. chalcedony	2	2	3.1	0.2
	Porcel. & sil. silt	10	8	33.3	1.7
	Silicified silt	7	5	42.1	2.1
	Silicified wood	7	5	26.5	1.3
	Chalcedony	11	8	47.7	2.4
	Quartzie	27	20	1536.8	76.3
	Chert	68	52	323.6	16.1
Total		132	100	2013.1	100.1
39LA314	Porcellanite	1	5	0.7	0.4
	Quartzite	1	5	42.9	24.0
	Chert	19	90	134.9	75.6
Total		21	100	178.5	100.0
39LA319	Chalcedony	1	6	0.4	0.3
	Silicified wood	3	17	15.4	13.7
	Chert	5	28	22.5	20.1
	Quartzite	9	50	73.9	65.9
Total		18	100	103.9	100.0
Total sites	Pl. chalcedony	2	1	3.1	0.1
	Silicified silt	7	4	42.1	1.8
	Porcellanite	11	6	34.0	1.5
	Silicified wood	10	6	41.9	1.8
	Chalcedony	12	7	48.1	2.1
	Quartzite	38	22	1653.6	71.8
	Chert	92	53	481.0	20.9
Total		171	99	2303.8	100.0

and discard.

For example, the bifacial tools discarded at 39LA117 can be tied to posthunt tool maintenance. Another posthunt activity, bone marrow processing, may also have been a focus of this site. The worn and discarded projectile points, as well as the bifacial thinning flakes that presumably resulted from biface repair, thus mesh with the overall function of the site. The lack of large bone and the presence of large amounts of debitage and tools not related to hunting and faunal processing prohibit the false conclusion that this is a hunting and initial butchering site, in spite of the presence of tools used for hunting.

A similar example is provided by the expended projectile point base from 39LA319 that was reworked to form an endscraper. It seems unlikely that this and the three other fragmentary projectile points from the site would be mistaken for the remains of an animal kill. Although, the site function, posthunt tool repair, is related to hunting, and the tool assemblage includes hunting weapons, it does not match the pattern expected for a kill site, as defined by Tratebas (1986), which would include large bones and heavy-duty choppers.

Thus, it appears that Tratebas's (1986) findings are valid even when applied to curated assemblages. The reason for this is that, even though discard may not take place at the use location, it is not random. If tools are brought back to a residence site for repair and discard, or if hunting tools are sorted and either repaired or discarded at a special posthunt activity site, their discard is patterned. Randomness is introduced only if tools are accidentally lost, which is by definition a rare event in a curated technology. While Tratebas assumes that the tools found at a site are somehow related to its function, she does not assume that the presence of a tool at a site is related to its *primary* function, or that this primary tool function corresponds directly with site function. For this reason, the principal components analysis works even given the presence of curated technologies. In fact, the definition of principal components may minimize misinterpretation of sites, because function is inferred from co-occurring tool clusters, rather than from individual tool function.

The kind of analysis represented in Tratebas's (1986) study could easily be refined to define broken and whole, and used and unused, tools separately. This would address the different patterns of discard of patterned versus expedient tools, and would be able to isolate those tools broken and discarded during manufacture. This might result in a somewhat cleaner picture of site function, but probably would not alter the general patterns of site function and inferred settlement proposed in the original study (Tratebas 1986). In short, the presence of curated technologies in the Black Hills suggests the need for refinement, not rejection, of the principal components analysis.

7.2 Implications for Northern Black Hills Prehistory

As was mentioned above, archaeological research in the Black Hills has been hampered by the lack of an independently established local cultural sequence. Unfortunately, none of the three sites contained materials suitable for radiocarbon age determination. Instead, the various site components were dated on the basis of projectile point typology and, to a lesser extent, stratigraphic position. While time-diagnostic artifacts provide reasonable estimates of the age of archaeological deposits, they may be misleading in two ways. First, such dates are necessarily general, rather than specific. They cannot pinpoint specific episodes of occupation and abandonment of an area within the broad cultural periods they indicate (cf. Wright 1982). This means that abandonment of an area for a period of decades or even centuries will go undetected. Second, the use of time-diagnostic artifacts in dating cultural deposits rests on the assumption that local projectile point types do not deviate from types recognized regionally.

Both of these problems limit the usefulness of the present study in reconstructing Black Hills prehistory. It cannot be established whether the two smaller sites were occupied only once or serially, nor is it possible to determine how frequently 39LA117 was used. Projectile points from the cultural components investigated as part of the present project include types dating to the late Paleoindian, Early Archaic, Middle Archaic, and Late Archaic periods; however, their specific relationship to projectile point types defined for other areas is unclear.

The fragments of large, parallel-flaked lanceolate points from 39LA319 and 39LA117 fall within the general range of variation of late Paleoindian projectile points from elsewhere in the Northwestern Plains; however, they do not match exactly any of the defined types. These fragments suggest the existence of local variants of Hell Gap, Agate Basin, Angostura, Pryor Stemmed or other lanceolate types in the northern Black Hills, but are not sufficiently complete to allow their description or definition.

The Middle and Late Archaic projectile points from 39LA117 show less variation from established types. Even these, however, are not identical to types from elsewhere in the region, suggesting the persistence of local technologies within the broader Northwestern Plains lithic traditions. One possibility, discussed below, is that the Northwestern Plains subarea was home to two separate lithic traditions, one based in the open plains and one based in the Rockies and other mountainous areas (Black 1991). While the projectile point data from the present study contribute to recognition of local variability in lithic traditions, their main value lies in underscoring the need for locally defined and independently dated projectile point chronologies.

The mountain meadow sites, spanning the late Paleoindian through the Late Archaic periods, document shifts in the way in which the northern Black Hills were used and perceived by prehistoric peoples. During the Paleoindian and Early Archaic periods, use of the high altitude meadows seems to have been restricted to prehunt staging and posthunt weapons repair and butchering activities. The area thus was viewed mainly as a hunting ground by its pre-Middle Archaic inhabitants. Such hunting probably was focused on the taking of individual deer, mountain sheep, or elk, rather than herds of bison or pronghorn.

The Paleoindian and Early Archaic groups apparently had their base camps elsewhere, either in the hogback surrounding the Black Hills or in the open country away from the mountains. The sparsity of exotic lithics in the Paleoindian and Early Archaic assemblages suggests Black Hills–oriented groups, with limited connections to the Powder River Basin to the west. The small size and limited tool assemblages of the sites suggests short-term occupation by hunting task groups. At 39LA117 a male-only hunting party is suggested, while the 39LA319 data suggest occupation by a complete family or band unit.

Lacking from the three mountain meadow sites is evidence for nonhunting subsistence activities and for cold-season camps. Paleoindian and Early Archaic winter camps have not been identified anywhere in the Black Hills. This suggests either that the cold-season portion of the seasonal round took place on the Plains or perhaps in the Bighorn Basin, or that Paleoindian and Early Archaic groups wintered in rockshelters in the hogback zone, which have not been archaeologically investigated (Tratebas 1986). Another possibility is that use of the interior Black Hills was sporadic and limited to occasional warm-season forays. Late Paleoindian and Early Archaic sites in and near the southern Black Hills contain evidence of a diversified economy, including a variety of game animals and probably plants, as well (Frison and Stanford 1978; Tratebas 1986; L. Alex 1991).

In the absence of radiocarbon dates from the mountain meadow sites, it cannot be established whether they are contemporaneous with the southern Black Hills sites. More data, including independently derived dates, will be required before the gaps in the late Paleoindian and Early Archaic subsistence round can be filled in. The mixing of Early Archaic materials with late Paleoindian materials is a consistent occurrence in the Early Archaic sites thus far investigated in the interior Black Hills. These sites suggest that Early Archaic settlement and subsistence, as well as climate, were little different from those of the late Paleoindian period (Tratebas 1986), except that Early Archaic population density appears to have been significantly reduced.

A distinct shift in settlement and subsistence is indicated by the Middle and Late Archaic component of 39LA117. During this period, the high altitude meadows appear to have been used for base camps at which a variety of activities took place, including hunt preparation, weapons repair, secondary butchering, and hide processing. Complete family or band units, rather than specialized hunting parties were now occupying the site. The diverse subsistence suggested by other Black Hills and Northwestern Plains Middle Archaic sites is not in evidence at 39LA117; however, activities such as plant-food processing would not necessarily leave visible traces in the archaeological record, particularly when whatever features once existed at the site are now obliterated. Hunting is the only subsistence activity clearly indicated by the 39LA117 record. Like other Middle Archaic hunting base camps in the interior Black Hills (Tratebas 1986), 39LA117 contained a hunting oriented tool assemblage, with no grinding stones or features indicative of plant food processing.

The Middle and Late Archaic form a single artifact concentration at 39LA-117; thus, shifts in settlement or subsistence that may have accompanied the technological changes apparent in the projectile point assemblage cannot be delineated on the basis of the present study. It has been hypothesized elsewhere (Tratebas 1986; Sundstrom 1989) that the Late Archaic was marked by a return to less intensive use of the interior Black Hills and a renewed emphasis on use of the open plains for communal hunting. This hypothesis cannot be tested with the mixed cultural deposit present at 39LA117; however, the site in no way negates such a hypothesis. The only cultural pattern at the site that can be specifically attributed to the Late Archaic occupation is the consistent occurrence of whole, rather than broken, projectile points dating to the latter portion of the Late Archaic. This discard pattern presumably reflects some shift in hunting methods and use of the high altitude meadows. The specific implications of this, however, are not clear from the limited data available.

The Middle and Late Archaic components of 39LA117, and possibly 39LA-314, suggest groups with contacts to the west and east of the Black Hills proper. The presence of porcellanite and obsidian in these assemblages indicates travel to or trade with areas to the west of the Black Hills. The occurrence of Badlands plate chalcedony at 39LA117 indicates connections to the east. The movements of the Middle and Late Archaic occupants of the Black Hills may well have encompassed the White River Badlands to the east, the Powder River Basin to the west, and the Cave Hills and Tongue River areas to the north (Tratebas 1986; Keyser 1985). Whether such a broad area comprised a seasonal round or represents long-term migrations is not clear from the archaeological record as it currently stands, although a fairly large territory is indicated for at least one identifiable Middle Archaic population (Keyser 1985). Obsidian from Idaho suggests an even farther-flung territory and might more convincingly be attributed to trade with western groups.

For Middle Archaic groups, the northern Black Hills seems to have been one of a number of widely variable temporary bases for resource exploitation. These groups apparently entered the area to hunt deer, elk, or mountain sheep and to replenish their supply of lithic tools and raw materials. Use of the mountain meadows seems to have been limited to summer or early fall, with winter camps occurring in the hogback, foothills, or away from the Black Hills, and spring and summer bison hunts taking place on the open plains.

Late Archaic perceptions of the northern Black Hills do not seem to have changed radically from those of the preceding Middle Archaic. Instead, a gradual shift away from extensive use of the area is suggested. Probably this took the form of less frequent and shorter duration stops in the Black Hills, with increasingly more time being spent in the foothills and open plains.

The lack of pre-Plano sites in the project area, and in the interior Black Hills in general, may indicate that the area was not a significant part of Clovis or Folsom period settlement systems. Alternatively, this perceived pattern may be the result of sampling error or lack of preservation of early sites. Components dating to the Late Prehistoric and Protohistoric periods are also lacking in the project area. This indicates that the shift away from use of the interior uplift, already visible in the Late Archaic data, continued throughout the remainder of northern Black Hills prehistory. Extensive use of the high-altitude meadows thus appears to have been primarily a Middle Archaic settlement pattern, with more limited use during the Paleoindian-Archaic transition, the Early Archaic, and the Late Archaic. The importance of the Black Hills as a resource store probably continued to decline throughout the remainder of its prehistory, as bison became more abundant on the open plains and technologies were developed and adapted from Euro-American material culture to increase bison hunting efficiency.

7.3 Implications for Northern Great Plains Prehistory

The results of mitigative data recovery from the three mountain meadow sites underscore the uniqueness of the Black Hills in terms of cultural development. While the sites fit the general pattern for prehistoric lithic scatters typical of the Northwestern Plains, they suggest ongoing, localized adjustments to the basic Northwestern Plains hunter-forager subsistence pattern.

The mountain meadow sites mirror the Black Hills archaeological record as a whole in their dearth of materials from the Clovis, Folsom, and post-Archaic periods. No Clovis sites are known to exist in the Black Hills proper, although a small remnant of a Clovis occupation was found at the Agate Basin site in the southwestern foothills. Folsom and post-Archaic sites are poorly represented in the Black Hills, compared with the late Paleoindian and Archaic periods.

The lack of Clovis sites in mountainous regions can be hypothesized to have resulted from Clovis culture having developed as an open plains adaptation. This may be due to Clovis having taken on its distinctive form during the passage from Siberia to North America via Beringia and the Ice-Free Corridor. The Black Hills lie near the hypothesized migration corridor and remained ice free during the Pleistocene glaciations; thus, the best current explanation for the lack of Clovis sites in the vicinity is that the Black Hills environment was not suited to the particular adaptations of Clovis culture. The existence of a less variable climate (as compared with those to follow) during the Clovis period (Martin 1987) may have resulted in a more predictable food supply and less need for group mobility and use of diverse environments (Todd et al. 1990). Lack of suitable game was not the deciding factor in this case, as mammoths are known to have inhabited at least the southern perimeter of the Black Hills (e.g. Agenbroad 1977; Frison and Stanford 1978). Instead it appears that open plains areas were more easily exploited by Clovis peoples than were mountainous areas such as the Black Hills. The population pressures and climatic change that would later lead to diversification of Northwestern Plains cultures had not yet mounted to the extent that occupation of marginal environments was necessary.

Folsom use of the Black Hills appears to have been limited to small hunting stations in the western Limestone zone and the northwestern foothills. Whether these sites represent part of the seasonal round of the Folsom culture represented by the large bison kill sites on the open plains, or a separate, contemporary cultural pattern, is not clear at this time. Unfortunately, the mountain meadow sites contained no information of relevance to this problem, except the expected lack of Folsom components.

Two late Paleoindian components were investigated in the mountain meadow project area. Both seem to represent small, special activity sites related to hunting, more specifically hunt preparation and posthunt weapons repair and butchering. Two observations about these sites are worth reiterating. First, the sites suggest the beginnings of a more distinct, Black Hills–oriented, settlement and subsistence pattern. The lack of correspondence between projectile points from 39LA117 and 39LA319 and those from Plano sites elsewhere on the Northwestern Plains may reflect the development of nascent local cultures and concomitant increased ethnicity in the region. The reasons for this shift are not clear; however, the more intensive use of small game and nongame resources suggests that population pressures, climatic change, or both spurred the development of localized cultures.

The second significant aspect of the late Paleoindian components in the mountain meadow area is that they are essentially similar to the Early Archaic sites in the area. The Early Archaic in the Black Hills seems to be basically a continuation of a pattern of settlement and subsistence established during the late Paleoindian period. The single Early Archaic component in the project area was mixed with a late Paleoindian component. This pattern is typical of the Black Hills, and suggests two conclusions. First, site location and use were essentially the same during the two periods, at least in those portions of the Black Hills that have been archaeologically investigated.

Second, geomorphic processes have resulted in materials from both periods co-occurring, with little or no horizontal separation. In the mountain meadow project area, late Paleoindian and Early Archaic components co-occur on and near the surface of a remnant terrace overlooking a lower terrace of Middle to Late Archaic age. The upper terrace at 39LA117 appears to be a pre-Altithermal terrace. In mountainous areas with open forest such as the Black Hills, valley fill terraces are most likely to represent episodes of decreased rainfall leading to a combination of increased run off and sediment load, due to more open vegetation, and decreased stream velocity and carrying capacity. Sediment-choked streams deposit their loads as gradient decreases at the base of hills. In the immediate project area, this effect may have been compounded by lowering of the water table and consequent loss of spring flow further reducing stream capacity.

This suggests that the reduction in rainfall associated with the Altithermal climatic episode began prior to the onset of the Early Archaic cultural period, resulting in limited soil deposition and/or deflation and terrace stabilization throughout the late Paleoindian and Early Archaic periods. It may be that the effects of the Altithermal were felt earlier in the Black Hills than elsewhere on the Northwestern Plains. A pre-Altithermal drought throughout western North America has been hypothesized (Haynes 1991).

The down cutting and subsequent valley filling represented by the lower, Middle to Late Archaic terrace may indicate that an increase in precipitation followed by a second episode of relatively dry conditions took place prior to or during the Middle Archaic. This deviates from the classic model of a single, dry episode coinciding with the Early Archaic period (cf. Antevs 1948). It is clear that the climatology of the Altithermal is more complex than originally recognized (Meltzer 1991). A mid-Altithermal wet period or periods have been proposed for areas of the Rocky Mountains (Benedict and Olson 1978; Benedict 1979), the Snake River Plain (Davis et al. 1986), northwestern Minnesota (Dean et al. 1984), and the southern Great Plains (Holliday 1990). Unfortunately, the climatic history of the northern Great Plains is largely unknown for this period

(Barnosky et al. 1987). Whether terrace formation in the project area reflects a period of increased rainfall during the otherwise dry Altithermal is not clear, since factors other than precipitation may result in the same pattern of terrace formation and destruction. In any case, the geomorphology of the high meadows merits further consideration and study by paleoclimatologists and researchers interested in climate-culture interactions in the Northwestern Plains.

The Altithermal has traditionally been viewed as a direct agent in the development of the diversified, Basinlike adaptations characteristic of the Archaic period of Northwestern Plains prehistory. Both the archaeology and the geomorphology of the mountain meadows sites suggest otherwise. Instead, they suggest the existence of what might be considered a "pre-Archaic" adaptation during the late Paleoindian period, which may have been spurred as much by population increases as by climatic change and the concomitant loss of Pleistocene megafauna. With the exception of an apparent change in population density, subsistence and settlement patterns within the Black Hills do not appear to have changed significantly between the late Paleoindian and Early Archaic periods, nor is there direct evidence of pronounced climatic change during the late Paleoindian through Early Archaic time span.

Currently available data suggest that rather than serving as a refuge for displaced bison hunters during the Altithermal, the Black Hills were used just as they had been since late Paleoindian, if not Folsom, times. Just as the Hawken Site appears to carry on the classic Paleoindian plains-oriented big game hunting tradition (Frison 1978), the Early Archaic component of 39LA117 seems to carry on a mountain-oriented pattern of small-scale hunting forays, established during the late Paleoindian period. While the relationship of these two subsistence patterns is not clear at this time, the coexistence of two separate cultural patterns cannot be ruled out.

In fact, aside from the Hawken site, in the northwestern Black Hills, little or no evidence exists to support the notion of an Altithermal refuge. Rather than an influx of people, archaeological data suggest a drop in population density during this period (Tratebas 1986; Sundstrom 1989). Early Archaic components from 39LA117 (this report), from the Beaver Creek Site in the southern Black Hills (L. Alex 1991), and from various sites located in the hogback and interior uplift (Tratebas 1986) all support the idea of a diversified seasonal round of subsistence activities, including small-scale hunts in the Black Hills, rather than a pattern of large-scale communal bison hunting. This basic pattern persisted throughout the remainder of the Archaic period, with intensity of use of the Black Hills environment reaching a peak during the Middle Archaic period and tapering off slightly during the Late Archaic.

From the perspective of the mountain meadow sites, then, the Middle Archaic is seen more as an intensification and refinements of a much older subsistence and settlement pattern than as a radical change in lifeways. This meshes well with the hypothesis that the McKean complex arose out of preexisting mountain-oriented mixed hunting and foraging settlement pattern (Benedict and Olson 1973), or that separate plains- and mountain-oriented adaptations characterized the Northwestern Plains from the late Paleoindian period through the Late Archaic (Frison 1978; Sundstrom 1989; Black 1991).

The in situ cultural horizon of 39LA117 indicates that the Middle and Late Archaic periods also spanned a stable, dry climatic episode, perhaps following a period of increased rainfall sometime between the Early and terminal Middle Archaic periods. Settlement and subsistence appear to have been essentially similar throughout the Middle and Late Archaic, just as they were the same for the preceding two periods. More intensive use of the interior uplift, including occupation of the vicinity by entire social units, is indicated by the Middle and Late Archaic component. The relationship of this settlement pattern to other Middle and Late Archaic cultural patterns is not clear at this time. What is clear is that no single "Archaic" or "McKean" rubric adequately encompasses the variety of Middle Archaic adaptations found in various Northwestern Plains settings.

In a recent article, Black (1991) goes so far as to propose the existence of two completely separate Archaic cultural patterns in the Northwestern Plains culture area, which he terms the Mountain Tradition and the Plains Archaic Tradition. The two traditions are differentiated on the basis of subsistence, settlement pattern, artifact typology (particularly of projectile points and microtools), rock art, architecture, and lithic reduction technology. Geographic distribution of sites is used to delineate the two traditions, although Black notes that local territories may have overlapped seasonally. This Mountain tradition was in place in the Middle Rockies and their outliers by at least 8000 B.P. and perhaps as early as 10,000–9500 B.C. (Black 1991). It is hypothesized to have originated in the Great Basin rather than in the classic Big-Game hunting tradition of the Paleoindian period on the Great Plains.

The results of the mountain meadow mitigation project support Black's hypothesized Mountain Tradition and suggest that it extended as far east as the Black Hills. Subsistence, settlement pattern, and projectile points derived from these and other Black Hills sites correspond to those expected for Mountain Tradition complexes. In addition, Archaic rock art from the Black Hills is recognizably related to a general, western or Great Basin tradition (Sundstrom 1990), as expected for Mountain Tradition sites (Black 1991). The mud-and-stick pithouses found in the Colorado Rockies and Wyoming Basins, however, have no recognized counterpart in the Black Hills, nor has a microtool tradition been defined for the area. Black (1991) also recognizes a split-cobble tool technology as typical of the Mountain Tradition; this is discussed below.

Black (1991) further hypothesizes that the development of the Mountain Tradition north of the southern Rockies was interrupted by the appearance of the McKean complex. McKean may represent a convergence of mountain and plains traditions (cf. Husted 1969), or may have some other origin (e.g. Benedict and Olson 1973). In any case the rapid expansion of the McKean complex in the Montana and Wyoming portions of the Rocky Mountains and their outliers replaced or altered the Mountain Tradition in those areas.

The cultural remains at 39LA117 and other Black Hills sites support this hypothesized break in cultural continuity. The Middle and Late Archaic component at 39LA117 represents a base camp occupied by an entire social group, rather than a special activity station. Black Hills Middle Archaic sites in general indicate a shift in settlement pattern toward more permanent or frequent use of both the interior uplift and hogback zone, including winter occupations; more diverse subsistence activities; more emphasis on bison; and increases in population. Middle Archaic sites also typically include lithic materials from outside the Black Hills, including Badlands chalcedonies, Power River Basin porcellanite, and Tongue River silicified sediment. Seasonal movements beyond the borders of the Black Hills are indicated (Tratebas 1986; Keyser 1985); although nothing precludes the simultaneous existence of a Black Hills–based settlement pattern (Sundstrom 1989). Lithic technologies include the production of both flake and blade tools.

Of particular relevance to Black's (1991) proposed Mountain Tradition is the presence of three split-cobble cores and core tools from a probable Middle Archaic component from the eastern Black Hills (Sundstrom 1981). These are identical in morphology and use-wear to split-cobble core tools described by Black (1991). These form part of a blade technology, which may or may not prove diagnostic of the McKean complex in the area (Sundstrom 1981). If, as Black (1991) proposes, split-cobble lithic technology is an index of both the Mountain Tradition and its Great Basin antecedents, the occurrence of this apparently rare lithic type in the Black Hills may represent either a hold over from Mountain Tradition lithic technologies, or a later influx of people or technologies from the Great Basin area. Perhaps, as was suggested above, the McKean complex of the Black Hills evolved from an overlay of new elements onto a preceding mountain-oriented cultural tradition. Although split-cobble tools have not been recognized in Early Archaic sites in the Black Hills, future researchers should be alert to their importance in relating Black Hills materials to the hypothesized Mountain Tradition.

Following the Late Archaic, site density decreased throughout the Black Hills, as is reflected in the absence of Late Prehistoric and Protohistoric components in the three excavated sites. This suggests a decline or even demise of the Mountain Tradition in the area, and a corresponding resurgence of open plains adaptations. A shift in subsistence to larger scale communal bison hunting and a shift in settlement pattern toward plains-based settlement is indicated for the post-Archaic period. In other words, the Black Hills at this time became part and parcel of Plains, as opposed to Mountain Tradition, cultural developments.

Judging by lithic raw material alone, the inhabitants of the mountain meadow area had contacts to the west, east, and possibly the north. The smaller Paleoindian site, 39LA319, contained little or no exotic lithic material; however, both the late Paleoindian–Early Archaic and the Middle to Late Archaic cultural horizons at 39LA117 contained porcellanite, probably from the Powder River country to the west of the Black Hills. In addition, two tools made from Badlands plate chalcedony were recovered from the mixed Middle and Late Archaic components. The remaining site, 39LA314, contained the most exotic material—obsidian from Bear Gulch, Idaho; however, the site could not be dated. Overall, limited contacts with adjacent regions are indicated for the entire time span represented by the mountain meadow sites. The nature and extent of such contacts are unknown, but the data do serve to remind us that the Black Hills cultures did not develop in isolation.

One question of interest to an understanding of Northwestern Plains cultural dynamics is why any lithic material would be imported to the Black Hills. It would be difficult to reach the project area from anywhere outside the Black Hills without directly passing outcrops of good quality cherts, chalcedonies, and quartzites. In the case of 39LA117, much of the exotic material appears in the form of finished tools and debris from tool resharpening, and thus can be explained in terms of tool curation.

The obsidian and possible nonlocal yellow chert found at 39LA314, however, clearly represent raw materials being manufactured into tools at the site. Tool curation thus cannot be called on to explain the presence of the nonlocal lithics. A more plausible explanation is that these materials operated as goods in some sort of exchange network and were afforded value above and beyond their usefulness for tools which would justify the expense of human energy in transporting them to the lithic-rich Black Hills. Although this is purely speculation at present, it does suggest a line of inquiry that may eventually prove valuable in understanding intergroup interactions in the prehistoric Great Plains.

Finally, the demonstrated presence of curated tool assemblages in some of the mountain meadow components has theoretical implications for functional analysis of prehistoric sites. If artifacts are not discarded at the locale of their use, as appears to be the case in the three mountain meadow sites, site function is one step removed from tool typology. This means that more complete models of tool typology, including patterns of co-occurrence and discard, are needed to infer function from tools. By demonstrating the existence of curated technologies in the various components at the three sites, and examining the evidence for and nature of such tool curation, the present study can contribute to the development of such models for other areas of the Northwestern Plains.

Chapter 8

References Cited

Agenbroad, Larry D.

1978 *The Hudson-Meng Site: An Alberta Bison Kill in the Nebraska High Plains*. Washington: University Press of America.

Ahler, Stanley A.

1975 *Pattern and Variability in Extended Coalescent Lithic Technology.* Ph.D. dissertation, Department of Anthropology, University of Missouri, Columbia.

Alex, Lynn

1979 39BU2: A Fortified Site in Western South Dakota. *South Dakota Archaeological Society Newsletter* 9:3–7.

1991 *The Archaeology of the Beaver Creek Shelter (39CU779): A Preliminary Statement.* South Dakota School of Mines and Technology, Rapid City.

Alex, Robert A.

1981a Village Sites Off the Missouri River. In *The Future of South Dakota's Past*, Larry J. Zimmerman and Lucille C. Stewart, eds. South Dakota Archaeological Society Special Publications, 2.

1981b *The Village Cultures of the Lower James River Valley, South Dakota.* Ph.D. dissertation, Department of Anthropology, University of Wisconsin, Madison.

1982 Personal communication, South Dakota Archaeological Research Center.

Antevs, Ernst

1948 The Great Basin, with Emphasis on Glacial and Post-glacial Times. *University of Utah Bulletin* 38:168–191.

Bamforth, Douglas B.
1988 *Ecology and Human Organization on the Great Plains.* New York and London: Plenum.

Barnosky, Cathy W., Eric C. Grimm, and H.E. Wright, Jr.
1987 Towards a Postglacial History of the Northern Great Plains: A Review of the Paleoecologic Problems. *Annals of the Carnegie Museum* 56:259–273.

Bauxer, J. Joseph
1947 *Preliminary Appraisal of the Archeological and Paleontological Resources of Angostura Reservoir, Fall River County, South Dakota.* Smithsonian Institution, River Basin Surveys, Missouri Basin Project. National Park Service, Midwest Archeological Center, Lincoln, Neb.

Beaubien, Paul L.
n.d. *Summary of Archeological Sites in Region Two Considered for Basin-Wide Report, 1856.* National Park Service, Midwest Archeological Center, Lincoln, Neb.

Beckes, Michael R., and James D. Keyser
1983 *The Prehistory of the Custer National Forest: An Overview.* USDA Forest Service, Custer National Forest, Billings, Mont.

Benedict, James B.
1981 *The Fourth of July Valley: Glacial Geology and Archaeology of the Timberline Ecotone.* Center for Mountain Archeology Research Reports, 2. Ward, Colo.

Benedict, James B., and Byron L. Olson
1973 Origin of the McKean Complex: Evidence from Timberline. *Plains Anthropologist* 18:323–327.

1978 *The Mount Albion Complex: A Study of Prehistoric Man and the Altithermal.* Center for Mountain Archeology Research Reports, 1. Ward, Colo.

Binford, Lewis R.
1977 Forty-seven Trips: A Case Study in the Character of Archaeological Formation Processes. *Stone Tools as Cultural Markers: Change, Evolution, and Complexity*, edited by R.V.S. Wright, pp. 24–36. Australian Institute of Aboriginal Studies, Canberra.

1979 Organization and Formation Processes: Looking at Curated Technologies. *Journal of Anthropological Research* 35:255–273.

Black, Kevin D.
1991 Archaic Continuity in the Colorado Rockies: The Mountain Tradition. *Plains Anthropologist* 36:1–29.

Blatt, Harvey, Gerard Middleton, and Raymond Murray
1980 *Origin Of Sedimentary Rocks.* Prentice-Hall, Englewood Cliffs, New Jersey.

Boen, Renee
1977 *Preliminary Report on the Cultural Resources Survey of Kelly (N18) Timber Sale, Nemo District, Black Hills National Forest.* South Dakota Archaeological Research Center.

Breternitz, David A., editor
1971 Archaeological Investigations at the Wilbur Thomas Shelter, Carr, Colo. *Southwestern Lore* 36:53–99.

Buchner, Anthony P.
1980 *Cultural Responses to Altithermal (Atlantic) Climate Along the Eastern Margins of the North American Grasslands, 5500 to 3000 B.C.* National Museum of Man Mercury Series, Archaeological Survey of Canada Papers, 97.

Buechler, Jeff
1984 *Report of Data Retrieval and Test Excavations at the Deerfield Site (39PN214), Pennington County, South Dakota.* South Dakota Archaeological Research Center, Contract Investigation Series, 106.

Buker, Leon W.
1937 Archaeology of the Southern Black Hills. *American Antiquity* 3:79–80.

Cassells, E. Steve
1986 *Prehistoric Hunters of the Black Hills.* Boulder, Colorado: Johnson Books.

Cassells, E. Steve, David B. Miller, and Paul V. Miller
1984 *Paha Sapa: A Cultural Resource Overview of the Black Hills National Forest, South Dakota and Wyoming.* USDA Forest Service, Black Hills National Forest, Custer, S.D.

Chevance, Nicholas
1978 *Cultural Resources Survey in the Driftwood Canyon and Pass Creek Regions, Fall River and Custer Counties, South Dakota.* South Dakota Archaeological Research Center, Contract Investigation Series, 1.

1979 *Cultural Resources Survey in the Driftwood Canyon and Long Mountain Regions, Fall River County, South Dakota.* South Dakota Archaeological Research Center, Contract Investigation Series, 10.

1984 Curation Theory and Assemblage Variability: A Test from the Smiley-Evans Site (39BU2), South Dakota. M.A. thesis, Department of Anthropology, University of Nebraska, Lincoln.

1987 *A Research Design for Mitigative Data Recovery at Three Sites Along the Proposed Realignment of the Nemo-Sturgis Road F.H.26-1(1) in Lawrence County, South Dakota.* Unpublished manuscript, South Dakota Archaeological Research Center, Rapid City, S.D.

1988 Personal communication. South Dakota Archaeological Research Center.

Church, Tim

1986 *Salvage Excavations at Feature 1, A Lithic Workshop, 39LA314, Black Hills National Forest, South Dakota.* Manuscript on file, Black Hills National Forest, Custer, S.D.

1989 *Prehistoric Lithic Resources of the Black Hills, South Dakota: Progress Report—1988.* Unpublished manuscript, Department of Anthropology, University of Montana.

1990 *Prehistoric Lithic Resources of the Black Hills, South Dakota: Progress Report, 1989–1990.* Ms. on file, South Dakota Archaeological Research Center.

1991 Personal communication, University of Montana, Missoula.

Church, Tim, Therese Chevance, and Patricia Malone

1985 *Cultural Resource Investigations Along the Vanocker Canyon Road, Lawrence and Meade Counties, South Dakota.* South Dakota Archaeological Research Center, Contract Investigation Series, 143.

Cooper, Paul L.

1947 *Preliminary Appraisal of the Archeological and Paleontological Resources of Deerfield Reservoir, Pennington County, South Dakota.* Smithsonian Institution, River Basin Surveys, Missouri Basin Project. National Park Service, Midwest Archeological Center, Lincoln, Neb.

Craig, Carolyn

1983 *Lithic Source Analysis and Interpretation in Northeastern Wyoming and Southeastern Montana.* M.A. thesis, Department of Anthropology, University of Wyoming, Laramie.

Dandavati, Kumar S.
1981 Continental and Near-Shore Depositional Environments of the Inyan Kara Group, Southeastern Black Hills, South Dakota. In *Geology of the Black Hills, South Dakota and Wyoming*, edited by Frederick J. Rich, pp. 19–31. American Geological Institute, Falls Church, Va.

Darton, N.H., and Sidney Paige
1925 *Central Black Hills Folio.* U.S. Geological Survey Bulletins, 219.

Davis, O.K., J. Sheppard, and S. Robertson
1986 Contrasting Climatic Histories for the Snake River Plain, Idaho, Resulting from Multiple Thermal Maxima. *Quaternary Research* 26:321–339.

Dean, W.E., J.P. Bradbury, R.Y. Anderson, and C.W. Barnosky
1984 The Variability of Holocene Climatic Change: Evidence from Varved Lake Sediments. *Science* 226:1191–1194.

DeWitt, Ed, J.A. Redden, Anna Burack Wilson, and David Buscher
1986 *Mineral Resource Potential and Geology of the Black Hills National Forest, South Dakota and Wyoming.* U.S. Geological Survey Bulletin 1580.

Ebright, Carol A.
1987 Quartzite petrography and its implications for prehistoric use and archaeological analysis. *Archaeology of Eastern North America* 15:29–45.

Eckleman, W.R., and J.L. Kulp
1957 *Uranium-Lead Method of Age Determination; Part Two: North American Localities.* Geological Society of America Bulletins, 68.

Folk, Robert L.
1980 *Petrology of Sedimentary Rock.* Austin, Tex.: Hemphill Publishing.

Fredlund, Dale E.
1976 Fort Union Porcellanite And Fused Glass: Distinctive Lithic Materials Of Coal Burn Origin On The Northern Plains. *Plains Anthropologist*, Volume 21:207 211.

Frison, George C.
1974 *The Casper Site: A Hell Gap Bison Kill on the High Plains.* New York: Academic.

1978 *Prehistoric Hunters of the High Plains.* New York: Academic.

Frison, George C., R.L. Andrews, R.C. Carlisle, and Robert Edgar
1986 A Late Paleoindian Animal Trapping Net from Northern Wyoming. *American Antiquity* 51;352–361.

Frison, George C. and Dennis J. Stanford

1982 *The Agate Basin Site: A Record of the Paleoindian Occupation of the Northwestern High Plains.* New York: Academic.

Froiland, Sven G.

1978 *Natural History of the Black Hills.* Center for Western Studies, Augustana College, Sioux Falls, S.D.

Gant, Robert, and Wesley R. Hurt, Jr.

1965 39MD9, The Gant Site. *Museum News,* No. 26, University of South Dakota Museum.

Geological Society of America

1984 *Rock Color Chart.* Printed in the Netherlands by Huyskes-Enschede. Distributed by Geological Society of America, Boulder, Colorado.

Gilmore, Melvin R.

1977 *Uses of Plants by the Indians of the Missouri River Region.* Lincoln: University of Nebraska Press. [Reprinted from the Bureau of American Ethnology Annual Reports, 33.]

Hannus, L. Adrien.

1983 [Editor.] *A Cultural Resources Survey of a Portion of the South Fork of the Cheyenne River, Fall River County, South Dakota.* South Dakota State University Archaeology Laboratory Publications in Anthropology, 1.

1986 Report on 1985 Test Excavations at the Ray Long Site (39FA65), Angostura Reservoir, Fall River County, South Dakota. *South Dakota Archaeology* 10:48–104.

Haug, James K.

1977 *Cultural Resources Survey of the Proposed U.S. Highway 18 Right-of-Way, Between Edgemont and Minnekahta, South Dakota.* South Dakota Archaeological Research Center.

1978a *Cultural Resources Survey in the Southern Black Hills, South Dakota.* South Dakota Archaeological Research Center.

1978b *Cultural Resources Survey of Selected Silver King Mine Properties in Custer and Fall River Counties, South Dakota.* South Dakota Archaeological Research Center.

1979 *Archaeological Test Excavations at Long Mountain, South Dakota.* South Dakota Archaeological Research Center, Contract Investigation Series, 2.

1981 Approaches to the Analysis of Large Lithic Scatters: The Highway 18 Project, South Dakota. *The Future of South Dakota's Past.* Larry J. Zimmerman, ed. South Dakota Archaeological Society Special Publications, 2.

Haug, James K., Jeanette E. Buehrig, John A. Moore, and James A. Sartain
1980 *Archaeological Excavations in the Highway 18 Right-Of-Way, Fall River County, South Dakota, 1978–1979.* South Dakota Archaeological Research Center, Contract Investigation Series, 20.

Haynes, C. Vance, Jr.
1969 The Earliest Americans? *Science* 166:709–715.

1991 Geoarchaeological and Paleohydrological Evidence for a Clovis-Age Drought in North America and Its Bearing on Extinction. *Quaternary Research* 35:438–450.

Hodge, F.W.
1907 *Handbook of American Indians North of Mexico.* Bureau of American Ethnology Bulletins, 30.

Hofman, Jack, and Eric Ingbar
1988 A Folsom Hunting Overlook in Eastern Wyoming. *Plains Anthropologist* 3:337–350.

Hole, F.D.
1961 A Classification of Pedoturbations and Some Other Processes and Factors of Soil Formation in Relation to Isotropism and Anisotropism. *Soil Science* 91:375–377.

Holliday, Vance T.
1990 Late Pleistocene Valley Fills on the Southern High Plains. *Current Research in the Pleistocene* 7:135–138.

Hovde, David M.
1981 *Archaeological Excavations of Stone Circle Sites on the Southern Black Hills Periphery and Cheyenne River Drainage.* South Dakota Archaeological Research Center, Contract Investigation Series, 36a.

Hughes, Jack T.
1949 Investigations in Western South Dakota and Northeastern Wyoming. *American Antiquity* 14:226–277.

Hughes, Jack T., and Theodore E. White
n.d. *The Long Site: An Ancient Camp in Southwestern South Dakota* . National Park Service, Midwest Archeological Center, Lincoln, Neb.

Hughes, Susan S.
1991 Division of Labor at a Besant Hunting Camp in Eastern Montana. In *Approaches to Gender Processes on the Great Plains*, edited by Marcel Kornfeld. Plains Anthropologist Memoirs, 26.

Irwin, Henry J. and Cynthia Irwin
1959 *Excavations at the LoDaisKa Site.* Denver Museum of Natural History Proceedings, 8.

Irwin-Williams, Cynthia, and Henry J. Irwin
1966 *Excavations at Magic Mountain: A Diachronic Study of Plains-Southwest Relations.* Denver Museum of Natural History Proceedings, 12.

Johnson, James R., and James T. Nichols
1970 *Plants of South Dakota Grasslands: A Photographic Study.* South Dakota State University Agricultural Experiment Station Bulletins, 56.

Keyser, James D.
1985 The Archaeological Identification of Local Populations: A Case Study from the Northwestern Plains. *Plains Anthropologist* 30:85–102.

Keyser, James D., and Carl M. Davis
1984 Lightning Spring: 4000 Years of Pine Parkland Prehistory. *Archaeology in Montana* 25:1–64.

Kindscher, Kelly
1987 Edible Wild Plants of the Prairie: An Ethnobotanical Guide. Lawrence, Kan.: University Press of Kansas.

Kingsbury, George W.
1915 *History of Dakota Territory.* Chicago: S.J. Clarke.

Knight, George C., and James D. Keyser
1983 A Mathematical Technique for Dating Projectile Points Common to the North western Plains. *Plains Anthropologist* 28:199–207.

Kornfeld, Marcel
1988 The Rocky Folsom Site: A Small Folsom Assemblage from the Northwestern Plains. *North American Archaeologist* 9:197–222.

1989 *Affluent Foragers of the Northwestern High Plains: An Analysis of the Spatial Organization of Technology.* Unpublished dissertation prospectus, Department of Anthropology, University of Massachusetts, Amherst.

Kornfeld, Marcel, Kaoru Akoshima, and George C. Frison
1990 Stone Tool Caching on the North American Plains: Implications of the McKean Site Tool Kit. *Journal of Field Archaeology* 17:301–309.

Kornfeld, Marcel, and M. L. Larson
1986 Identification and Characterization of Surfaces at the McKean Site. *Wyoming Archaeologist* 29:69–82.

Kornfeld, Marcel, and Lawrence C. Todd, editors
1985 *McKean/Middle Plains Archaic: Current Research.* University of Wyoming Occasional Papers on Wyoming Archaeology, 4.

Lindstrom, Carl S.
1980 *Cultural Resource Survey of the Dalton Timber Sale, Black Hills National Forest.* Manuscript on file, South Dakota Archaeological Research Center.

Lippincott, Kerry
1980 *A Report of a Cultural Resources Survey on United States Forest Service Property, Black Hills National Forest, South Dakota.* Tennessee Valley Authority.

Lisenbee, Alvis
1981 Studies of the Tertiary Intrusions of the Northern Black Hills Uplift, South Dakota and Wyoming: A Historical Review. In *Geology of the Black Hills, South Dakota and Wyoming*, edited by Frederick J. Rich, pp. 106–125. American Geological Institute, Falls Church, Va.

Longiaru, Samuel
1987 Visual Comparators for Estimating the Degree of Sorting from Plane and Thin Section. *Journal of Sedimentary Petrology*, 57:791–794.

Ludlow, William
1875 *Report of a Reconnaissance of the Black Hills of Dakota, Made in the Summer of 1874.* Washington: U.S. Government Printing Office.

Mallory, Oscar L.
1967 Unpublished field notes and weekly reports, Cottonwood Springs project. Smithsonian Institution, River Basin Surveys. On file, South Dakota Archaeological Research Center, Rapid City, S.D.

Martin, Larry D.
1987 Equability in the Late Pleistocene. In *Quaternary Environments of Kansas*, edited by William C. Johnson, pp. 123–127. Kansas Geological Survey Guidebook Series, 5.

McGimsey, Charles R., III., and Hester A. Davis

1977 *The Management of Archaeological Resources: The Airlie House Report.* The Society for American Archaeology, Washington, D.C.

McIntosh, A.C.

1931 A Botanical Survey of the Black Hills of South Dakota. *Black Hills Engineer* 12:159–276.

Meland, Arvid C.

1979 *Soil Survey of Lawrence County, South Dakota.* U.S. Department of Agriculture, Soil Conservation Service.

Meleen, Elmer E., and J.J. Pruitt

1941 A Preliminary Report on Rock Shelters in Fall River County, South Dakota. Unpublished manuscript on file, South Dakota Archaeological Research Center, Rapid City, S.D.

Meltzer, David J.

1991 Altithermal Archaeology and Paleoecology at Mustang Springs, on the Southern High Plains of Texas. *American Antiquity* 56:236–267.

Michels, Joseph W.

1983 *Hydration Rate Constants for the Black Hills Obsidian Source, South Dakota.* MOHLAB Technical Report, No. 28.

Montet-White, Anta, Lewis R. Binford, and M.L. Papworth

1963 *Miscellaneous Studies in Typology and Classification.* University of Michigan Museum of Anthropology, Anthropological Papers, 19:192–221. Ann Arbor.

Mooney, James

1898 *Calendar History of the Kiowa Indians.* Bureau of American Ethnology Annual Reports, 17.

Mulloy, William T.

1954 The McKean Site in Northeastern Wyoming. *Southwestern Journal of Anthropology* 10:432–460.

1958 *A Preliminary Historical Outline for the Northwestern Plains.* University of Wyoming Publications in Science, 22(1).

Newton, Henry, and W.P. Jenney

1880 *Report on the Geology and Resources of the Black Hills of Dakota.* Washington, D.C.: U.S. Government Printing Office.

Over, William H.

1924 A Prehistoric Flint Quarry in South Dakota. *Sunshine State Magazine* 5:28–29.

1934 *Archaeology in South Dakota.* University of South Dakota Museum, Archaeological Studies Circulars, 1.

1941 *Indian Picture Writing in South Dakota.* University of South Dakota Museum, Archaeological Studies Circulars, 4.

1948 Prehistoric Mining in South Dakota. *Museum News* 9. University of South Dakota Museum, Vermillion.

Prucha, J.J., J.A. Graham, and R.P. Nickelson

1965 Basement-Controlled Deformation in Wyoming Province of Rocky Mountain Forelands. *American Association of Petroleum Geologists Bulletin* 49:966–992.

Rahn, P.H.

1970 General Geology of the Black Hills, South Dakota, and Its Relationship to Streamflow. [Map.] *Guidebook and Road Logs for 23rd Annual Meeting, Rocky Mountain Section, Geological Society of America.* J.P. Gries, ed. South Dakota School of Mines and Technology, Rapid City.

Redden, Jack A.

1981 Summary of the Geology of the Nemo Area. In *Geology of the Black Hills, South Dakota and Wyoming*, edited by Frederick J. Rich, pp. 193–209. American Geological Institute, Falls Church, Va.

Reeves, Brian O.K.

1983 *Culture Change in the Northern Plains: 1000 B.C. to A.D. 1000.* Archaeological Survey of Alberta Occasional Papers, 20.

1985 Northern Plains Culture Historical Systems. *Contributions to Plains Prehistory: The 1984 Victoria Symposium.* David B. Burley, ed. Archaeological Survey of Alberta Occasional Papers, 26.

Reher, Charles A.

1977 Ethnology and Ethnohistory. *Archaeology of the Eastern Powder River Basin, Wyoming.* George M. Zeimans and Danny N. Walker, eds. Office of the Wyoming State Archaeologist, Laramie.

Reher, Charles A., and George C. Frison

1980 *The Vore Site, 48CK302, A Stratified Buffalo Jump in the Wyoming Black Hills.* Plains Anthropologist Memoirs, 16.

Reher, Charles A., and Larry A. Lahren

1977 *A Preliminary Evaluation of Archaeological Resources and an Assessment of Impacts: Wolf Canyon Project, Fall River County, South Dakota.* Anthro Research, Inc., Livingston, Mont.

Renaud, E.B.
1936 *Archaeological Survey of the High Western Plains: Southern Wyoming and Southwestern South Dakota, Summer 1935; Seventh Annual Report.* Department of Anthropology, University of Denver.

Rich, Frederick J., editor
1981 *Geology of the Black Hills, South Dakota and Wyoming* . American Geological Institute, Falls Church, Va.

Rittenhouse, R.
1943 A Visual Method of Estimating Two-Dimensional Sphericity. *Journal of Sedimentary Petrology* 13:79–81.

Roberts, Frank H.H.
1943 A New Site. *American Antiquity* 8:300.

Rogers, Dilwyn J.
1980 *Lakota Names and Traditional Uses of Native Plants by Sicangu (Brule) People in the Rosebud Area, South Dakota: A Study Based on Father Eugene Buechel's Collection of Plants of Rosebud Around 1920.* Rosebud Educational Society, St. Francis, S.D.

Secoy, Frank R.
1953 *Changing Military Patterns on the Great Plains.* American Ethnological Society Monographs, 21.

Siegel, Sidney
1956 *Nonparametric Statistics for the Behavioral Sciences.* New York: McGraw-Hill.

Sigma Gamma Epsilon
n.d. Grain Size/Sphericity/Roundness Chart. Prepared by Gamma Zeta Chapter, Kent State University.

Sigstad, John S., and Robert Jolley
1975 *An Archaeological Survey of Portions of Fall River and Custer Counties, South Dakota.* South Dakota Archaeological Research Center.

Smith, Harlan I.
1908 An Archaeological Reconnaissance in Wyoming. *American Museum of Natural History Journal* 8:23–26, 106–110.

Smith, Marian W.
1937 The War Complex of the Plains Indians. *Proceedings of the American Philosophical Society* 78:425–461.

Stanford, Dennis J.
1982 A Critical Review of Archaeological Evidence Relating to the Antiquity of Human Occupation of the New World. *Plains Indian Studies: A Collection of Essays in Honor of John C. Ewers and Waldo R. Wedel.* Douglas H. Ubelaker and Herman J. Viola, eds. Smithsonian Contributions to Anthropology, 30.

Steege, L.C., and D.G. Paulley
1964 Lissolo Cave. *Wyoming Archaeologist* 7:25–33.

Steventon, Raymond L., and John E. Kutzbach
1986 University of Wisconsin Radiocarbon Dates. *Radiocarbon* 28:1206–1223.

Sundstrom, Linea
1981 *Hermosa-Hayward Project: Test Excavations in the Eastern Black Hills.* South Dakota Archaeological Research Center, Contract Investigation Series, 34.

1984 Rock Art of the Southern Black Hills. *Rock Art of Western South Dakota.* L. Adrien Hannus, ed. South Dakota Archaeological Society Special Publications, 9.

1989 *Culture History of the Black Hills with Reference to Adjacent Areas of the Northwestern Plains.* Lincoln, Neb.: J & L Reprint Company.

1990 *Rock Art of the Southern Black Hills: A Contextual Approach.* New York: Garland.

Tratebas, Alice M.
1977 Excavations at the Boulder Canyon Site. *South Dakota Archaeological Society Newsletter* 7:4–5.

1978a *Archaeological Surveys in the Black Hills National Forest, South Dakota, 1975–1977.* South Dakota Archaeological Research Center.

1978b Preliminary Report on Archaeological Investigations Near Stone Quarry Canyon, Fall River County. *South Dakota Archaeological Society Newsletter* 8:7–9.

1979a *Archaeological Excavations Near Stone Quarry Canyon, Black Hills National Forest, South Dakota.* South Dakota Archaeological Research Center, Contract Investigation Series, 7.

1979b *Archaeological Survey in the Black Hills National Forest, South Dakota: 1977–1978.* South Dakota Archaeological Research Center, Contract Investigation Series, 5.

1983 Getting Architecture from Stone Circle Remains: A Southern Black Hills Example. *From Microcosm to Macrocosm: Advances in Tipi Ring Investigation and Interpretation*, edited by Leslie B. Davis, Plains Anthropologist Memoirs, 19.

1986 *Black Hills Settlement Patterns: Based on a Functional Approach.* Ph.D. dissertation, Department of Anthropology, Indiana University, Bloomington.

Tratebas, Alice M., and Kristi Vagstad

1979 *Archaeological Test Excavations of Four Sites in the Black Hills National Forest, South Dakota.* South Dakota Archaeological Research Center, Contract Investigation Series, 6.

Turner, R.W.

1974 *Mammals of the Black Hills of South Dakota and Wyoming.* University of Kansas Museum of Natural History, Miscellaneous Publications, 60.

Van Bruggen, Theodore

1971 *Wildflowers of the Northern Plains and Black Hills.* National Park Service, Badlands Natural History Association, Bulletin, No. 3.

Vickers, J. Roderick

1974 *Alberta Plains Prehistory: A Review.* Archaeological Survey of Alberta Occasional Papers, 27.

1986 *Alberta Plains Prehistory: A Review.* Archaeological Survey of Alberta Occasional Papers, 27.

Wedel, Waldo R.

1961 *Prehistoric Man on the Great Plains.* Norman: University of Oklahoma Press.

1978 The Prehistoric Plains. *Ancient Native Americans.* Jesse D. Jennings, ed. San Francisco: Freeman.

Weston, Timothy, editor

1983 *Archeological Investigations at Cold Brook and Cottonwood Springs Reservoirs, Fall River County, South Dakota.* University of Kansas Museum of Anthropology, Project Report Series, 50.

Wheeler, Richard P.

1950 Archaeological Investigations in Angostura Reservoir, Cheyenne River Basin, South Dakota. [Abstract.] *Nebraska Academy of Sciences and Affiliated Societies Proceedings.*

1957 *Archeological Remains in the Angostura Reservoir Area, South Dakota, and in the Keyhole and Boysen Reservoir Areas, Wyoming.* National Park Service, Midwest Archeological Center, Lincoln, Neb.

Whitten, D. G. A., with J. R.V. Brooks
1975 [1972] *A Dictionary of Geology.* Hazell Watson and Viney Ltd., Aylesbury, Bucks, Great Britain.

Winham, R. Peter, and L. Adrien Hannus
1990 *South Dakota State Plan for Archaeological Resources.* South Dakota Archaeological Research Center, Rapid City, S.D.

Wright, Gary A.
1982 Notes on Chronological Problems on the Northwestern Plains and Adjacent High Country. *Plains Anthropologist* 27:145–160.

Zartman, R.E., J.J. Norton, and T.W. Stern
1964 Ancient Granite-Gneiss in the Black Hills, South Dakota. *Science* 145:479–481.

Zeier, Charles D.
1987 Besant Projectile Points from the Antonsen Site (24GA660), Gallatin County, Montana: Within Sample Variance. *Archaeology in Montana* 24:1–57.

Appendix A

Stratigraphy and Geomorphology of the Terraces along Little Elk Creek at Archaeological Sites 39LA117 and 39LA319, Lawrence County, South Dakota.

by James E. Martin[1]

A.1 Introduction

Two sites in the central Black Hills have recently produced artifacts indicative of prehistoric cultures. These artifacts were found in terrace fills and on terrace surfaces along Little Elk Creek, just south of the Meade-Lawrence County line in the NW 1/4, Sec. 4, T.3N, R.5E. One site occurs south of Little Elk Creek and has been termed 39LA319, whereas the other site lies north of the creek and is 39LA117. Both sites were investigated due to the impending construction along the Vanocker Canyon road (FH26) that will damage the sites. Two other sites occur in the immediate area: 1) 39LA29, which was designated as a historic site due to structures erected along the creek, and 2) 39LA118, a

[1]Certified Professional Geologist 7367; Associate Professor, Department of Geology and Geological Engineering, South Dakota School of Mines and Technology

site on a high terrace northwest of the buildings. The latter site is somewhat germane to this study as it occurs on the highest terrace in the area and lithics suggestive of the Paleoindian and Early Archaic periods were obtained there (Chevance personal communication, 1988). Due to access problems, the author was unable to investigate this site.

The reason for undertaking this study was to provide information concerning the geology of the terraces on which and within which artifacts occur. When initial collections were made (Church et al. 1985), possible mixing of lithics was suspected. In particular, from approximately the same level on 39LA117, a suite of artifacts diagnostic of the McKean complex was encountered, suggesting a Middle Archaic date (approximately 2500–5000 years B.P.). A projectile point suggestive of the Paleoindian period (approximately 7500–10,000 B.P.) was found in a shovel test just to the east. Because all the lithics were derived from approximately the same level, mixing was suspected, although other possibilities were envisioned. Secondly, a projectile point base found at 39LA319 (Church et al. 1985), which lies at the same elevation as 39LA117, was initially identified as diagnostic of the Hell Gap complex, dating to the late Paleoindian period (approximately 9500–10,000 B.P. [Frison 1978]). The point was later reidentified as a Paleoindian type of unspecified cultural affiliation. It is the purpose of this study to provide information to determine whether the different lithics are from the same stratigraphic/geomorphic unit or if mixing of sediments and artifacts occurred.

A.2 Methods

In order to assess the geological context of the artifacts from 39LA117 and 39LA319, investigation of the geomorphology and stratigraphy of the sites was undertaken. First, geomorphic surfaces were determined and correlated. Second, locations of trenches were delineated in order to understand the stratigraphic successions within terraces at the archaeological sites. Three short trenches at 39LA117 and one long trench at 39LA319 (Figures 4.2, 6.5, A.1–A.3) were excavated, using a backhoe with a four-foot wide bucket. The depths of the trenches varied, but that at 39LA319 attained a maximum depth of 4.4 m. Third, the trenches were profiled (Figures A.1–A.3) to determine the stratigraphic succession in each trench. The mapping was done by laying a meter tape along the surface, and at selected intervals of 2.5 or 5 m, the stratigraphic sections exposed below in the trench walls were measured. These stratigraphic (lithic) units within the trenches were correlated both within and among trenches. Fourth, samples from distinct lithic units were taken for later inspection. Those samples from the three trenches at 39LA117 were numbered according to trench and sample. Therefore, a number such as T3,S1 indicates the first sample (S1) taken from the third trench (T3). Those samples from the single trench at 39LA319 were numbered successively starting with S1. From these samples, which are listed below, composition of the various units could be substantiated and reinforce and/or provide the basis for correlation of units

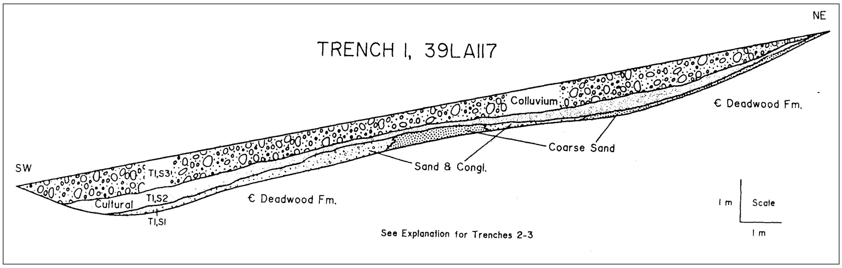


Figure A.1: Cross-section of Trench 1, 39LA117

among the trenches. It was hoped that the results of these methods would be a stratigraphically superposed succession that could be correlated from one site to another.

A.3 Physiology and Bedrock Geology

In studies of geomorphology, physiography is one of the most important data sources. Through the NE of section 4, T3N, R5E, Little Elk Creek flows southeasterly. Near the center of the quarter section, a tributary from the west joins the primary branch of the creek near a natural spring. At this point the flood plain of the creek widens to twice its previous width. About 15 feet above the creek is one flat terrace surface, and 30 feet above the creek lies a second terrace surface. The second surface is at an elevation of approximately 4890 feet and occurs in the northern portion of the quarter section and on the ridge intervening between Little Elk Creek and its tributary. The lower terrace surface covers most of 39LA117 and is at the same elevation (approximately 4875 feet) at 39LA319.

To the east in the NE of section 4 is a large hill almost 5000 feet in elevation. This resistant hill is composed of Precambrian schist which strikes north-northwesterly. The shallow valley just to the east of the mountain, which trends in approximately the same direction as strike, may represent eroded phyllite. Precambrian taconite forms the western wall of this valley and comprises a distinct north-south trending spur. This spur and the remainder of the ridge in the northern portion of the quarter section extend northward about a mile to Flagstaff Mountain. Most of this ridge in the study area is composed of basal sandstones of the Deadwood Formation (see Gries and Martin 1985 for an overview of the formation). Therefore, the contact between the Deadwood Formation of Cambrian age and the metasedimentary rocks of Precambrian age lies within the study area. It is not surprising, therefore, that both rock types contribute to the overlying terrace fills.

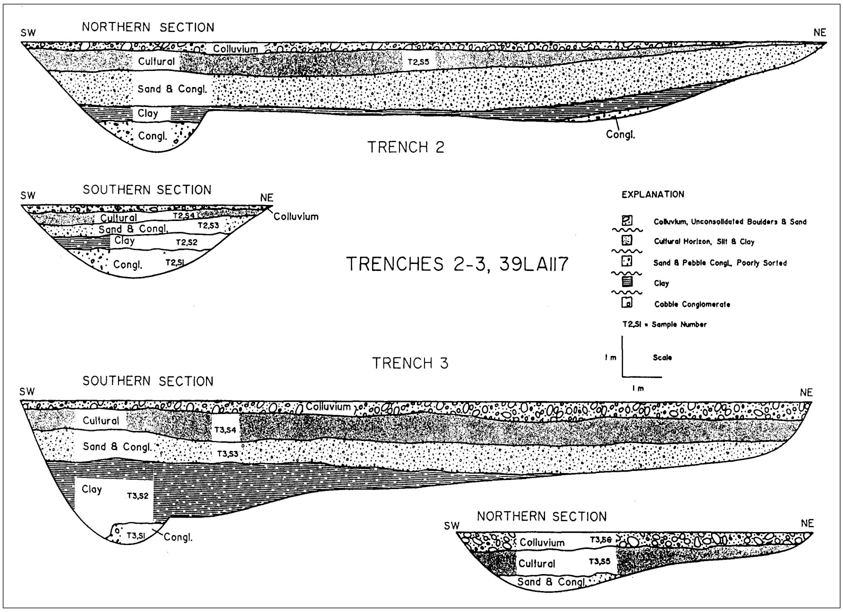


Figure A.2: Cross-section of Trenches 2 and 3, 39LA117

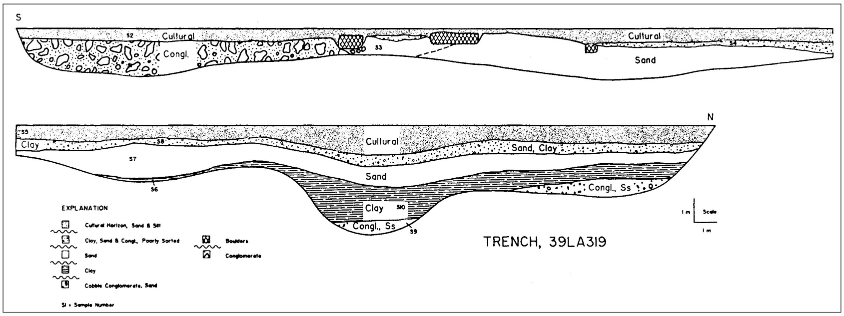


Figure A.3: Cross-section of trench at 39LA319

A.4 Terraces

In addition to the modern flood plain, two terraces occur in the study area. The older terrace occurs higher above the creek level than the other and is termed Qt_1. The second terrace, which is just above creek level, as discussed above, is designated Qt_2. The modern flood plain may be considered a third terrace level. The planar surfaces of the terraces are at approximately the same elevation and should be of approximately the same age, representing a time just prior to changing conditions when base level changed and Little Elk Creek cut a deeper channel. However, the age of the terrace fills (those sediments below the terrace surface) may be different due to varying depositional history that is masked by the recent surface. Therefore, to determine if a similar depositional history occurred throughout the deposition of the terrace fill, the stratigraphic succession must be determined and correlated. This was accomplished through inspection of trenches cut approximately perpendicular to Little Elk Creek.

A.5 Terrace Stratigraphy

In typical terrace discussion, the terraces will be treated chronologically. Because of reverse stratigraphy due to stream down-cutting, the highest occurring and oldest terrace will be examined first.

A.5.1 Qt_1

Qt_1 was not trenched because no part of the terrace was in the highway right-of-way; therefore, the depositional history could not be precisely evaluated. Two prospect pits adjacent to one another on the eastern edge of the terrace did supply some compositional information. These two old prospect pits lie just west of the taconite spur on the eastern edge of the upper terrace. Because the pits are old, slumped, and partially covered with vegetative regrowth, not a great amount of information could be gleaned. Both pits are approximately 2 m deep, and some exposures remain in the walls. The northwestern pit contains about 2 m of red, highly micaceous, silty soil. Some angular cobbles composed of black Precambrian schist and altered Deadwood sandstone are associated with the soil. The southeastern pit also contains a micaceous soil that appears to be derived from Precambrian schist, as well as a soil that is light tan to yellow, has both clay and sand, and appears as deeply weathered/reworked Deadwood Formation. Some poor exposures in the pit contain cobble clasts that appear composed of altered Deadwood Formation and Precambrian schist. The weathered schist is the source of almost a meter of micaceous soil in this pit. Therefore, this terrace fill appears composed of sandy, micaceous soil with clasts of Cambrian Deadwood Formation and Precambrian schist.

Due to poor exposure, it is recommended that this terrace be trenched to determine precise lithology and the stratigraphic progression within the terrace.

A.5.2 Qt_2

Because the sites on Qt_2 will be impacted by highway construction, monies were available for trenching of this terrace. Three parallel trenches, numbered successively from east to west, were dug at 39LA117, and a single, long trench was excavated at 39LA319. Trench 1 at 39LA117 (Figure A.1) was placed about a meter to the east of where a lithic assigned to the Paleoindian period was found. The trench tended N35^{o}W, extended 20 m, and was shallow (1.2 m) due to the encounter of Deadwood sandstone bedrock just under the surface. Trench 2 (Figure A.2) lies just to the west of the archaeological excavation which encountered Middle and Late Archaic materials and was excavated in two sections: one north of the present road, which tended N65^{o}E, extended 16 m, and was excavated to a maximum depth of 2.6 m; the southern section tended N55^{o}E, extended 6.3 m, and was excavated to a depth of 1.7 m. Trench 3 (Figure A.2) was placed just to the west of the Middle and Late Archaic bearing excavation units and provided a great amount of stratigraphic information; therefore, this trench will be discussed first in the succeeding section concerning stratigraphy. Like Trench 2, this trench was also excavated in two sections: the section north of the road tended N63^{o}E, extended 9 m, and was dug to a depth of 1.7 m; the southern section tended N50^{o}E, extended 20 m, and was excavated to a depth of 3.5 m.

The trench at 39LA319 (Figure A.3) was much longer and deeper than those at 39LA117. This long trench tended N15^{o}E, extended 65 m, and was a maximum of 4.4 m deep. This trench was excavated just to the west of the location where a lithic assigned to the Paleoindian period was encountered.

A.6 Stratigraphy of Qt_2

A.6.1 39LA117: Trench 3

Trench 3 was the deepest trench excavated at 39LA117 and revealed a stratigraphic succession that could be correlated to other trenches. Figure A.2 is a cross-section of the eastern wall of Trench 3 and illustrates the superposed stratigraphic units discussed below: basal conglomerate, clay, mottled sand and conglomerate, the cultural horizon consisting of sandy clay, and recent colluvium.

Although the base of the unit was not exposed, the basal conglomerate as exemplified by sediment sample T3,S1 (see below) consists of .5 m of a dark yellowish orange, pebble to cobble, poorly sorted conglomerate with subrounded clasts composed of chert concretions, reworked Deadwood sandstone, and some Precambrian schist. A few soft, white clasts are highly weathered sandstone, but some clasts are weathered to clay and may be of another origin, perhaps volcanic. Also, some Precambrian clasts are soft and consist of iron-stained clay. A quartz sand matrix with some Precambrian grains is composed of moderate to well-sorted, medium- to fine-grained, rounded grains with very little mica. Rootlets occur and are often associated with manganese staining. The orange staining is due to oxidation of iron which may be due to the weathering of glauconite, a mineral which occurs in many of the sandstone clasts. The color may also be due to weathering of the Precambrian metamorphic clasts in which iron is ubiquitous.

A clay unit disconformably overlies the conglomerate; a 70-cm cut-and-fill structure occurs in the southern end of the trench. This cut into the conglomerate, coupled with the overall sharp and undulatory contact, suggests a disconformity between the units. Some reworking of the sand from the conglomerate into the basal portion of the clay does occur in 2–4 cm interbeds composed of iron-stained sandy clay and gray clay layers. The interbeds grade into a massive sandy clay for most of the unit thickness. The unit itself (e.g. sample T3,S2) is 1.6 m of moderate yellowish orange clay with fine-grained, well-sorted, rounded quartz grains with a few Precambrian schist grains. Rootlets are associated with manganese and iron staining.

Overlying the clay is a poorly sorted, mottled sand and conglomerate. The intervening contact is sharp and undulatory, and the coarse unit suprajacent to the fine clay suggests a disconformable relationship. The sand and conglomerate is very poorly sorted and ranges from a moderate yellow to a light olive brown. The unit is .75 m thick and contains rounded, pebble-sized clasts of a salt-and-pepper sandstone. The dark grains in some clasts may be glauconite and/or Precambrian schist, whereas the light grains are quartz. The sand matrix is of a similar composition, containing almost equal parts quartz and mafic minerals, with some mica flakes. The grains are fine-grained, poorly sorted due to the two grain types, and subrounded to rounded. Clay fills some interstitial spaces between grains as it does in all the units.

Disconformably overlying the mottled sand and conglomerate is the cultural horizon from which the lithics indicative of Middle and Late Archaic cultural complexes were obtained. The contact is sharp, with small-scale (10-30-cm) cut and fills. A distinct lithic change occurs above the contact from a yellowish unit to a pink, sandy claystone. No longer does the yellowish iron-stained color predominate as it has in all underlying units. Overall, the cultural horizon, Sample T3,S4, consists of .5 to 1.5 m of dark to moderate reddish brown sandy clay. The sand component comprises about 25 percent of the unit and is mostly fine- to medium-grained, moderately sorted, rounded to subrounded quartz grains with some Precambrian chlorite(?) schist and mica flakes. The clay weathers to a blocky surface and contains an extraordinary root content, both micro- and macroscopically compared to the lower units. The roots, coupled with the blocky weathering characteristic, result in a fluted weathering profile. It should be noted that Sample T3,S5 from the northern section of Trench 3 (Figure A.2) is almost identical to T3,S4 but may be darker (10R3/4), perhaps due to greater humic content, and may be slightly more blocky in some areas when weathered.

Suprajacent to the cultural horizon is the recent colluvium. This unit consists of .2–.5 m of unconsolidated, moderate reddish brown sandy silt with cobble to boulder-sized clasts of locally derived Deadwood sandstone. The sand portion of the colluvium is very fine-grained, moderately sorted, subrounded to rounded quartz grains with some Precambrian schist and mica flakes. Indistinct horizontal bedding contrasts with the vertical weathering profile of the subjacent cultural horizon. The change in weathering profile, the unconsolidation of the unit, and the boulders suspended in the loose matrix indicates the colluvium disconformably overlies the cultural horizon. The similarity in color between the two uppermost units suggests that the colluvial matrix may have been partially derived from the cultural horizon. Also, the colluvium becomes slightly more sandy in the northern section of the trench because it is nearer the exposures of Deadwood sandstone.

A.6.2 39LA117: Trench 2

The stratigraphy of Trench 2 is very similar to that in Trench 1, although the units are thinner. The thinning may be due to the position of Trench 2 nearer the edge of the terrace. Figure A.2 illustrates the cross-section of Trench 2 and its similarity to Trench 3.

The base of this trench was composed of .7 m of yellowish pebble to cobble conglomerate, whose base was not determined. The conglomerate is almost identical to that exposed in Trench 3, although the clasts in Trench 2 are more often coated with white caliche, especially the concretions, and some caliche may be found in the sandy matrix. Of course, caliche is a diagenetic feature and does not preclude the identity of the two units. The color may be slightly lighter (Sample T2,S1) in Trench 2, and more Precambrian schist clasts occur here, although that may be due to localized sampling. The major difference between samples from the two trenches are the turquoise mineral ghosts representing weathered grains in the sandy matrix from Trench 2. This disparate occurrence, too, may be the result of sampling.

The clay unit in Trench 2 is also almost identical to that in Trench 3. Microscopically, Sample T2,S2 may contain sand matrix which is slightly less mature, and some clasts of salt and pepper sandstone were found. In outcrop, the clay in Trench 2 appears more mottled with a greater green component, but hand samples from Trench 2 and 3 had an identical color, moderate yellowish orange (10YR5/4). Overall, no major lithological changes occur between samples from the two trenches.

Just as in Trench 3, a mottled, poorly sorted unit overlies the clay unit. The poorly sorted units are very similar, although that collected from Trench 2 (Sample T2,S3) may be slightly greener and contain a few more slightly coarser Precambrian schist grains. The same salt and pepper clasts are common in this unit as in that at Trench 3. No differences are great enough to preclude this unit from being identical to that in Trench 3.

In similar stratigraphic position as in Trench 3, the cultural horizon of Trench 2 overlies the poorly sorted, mottled unit. In the southern section of Trench 2 (Sample T2,S4), the cultural horizon is .3 m thick and more sandy than in Trench 3, containing more Precambrian grains, probably derived from the underlying layer which has more Precambrian grains than its counterpart in Trench 3. The color of T2,S4 is more yellowish, again associated with local derivation. The unit in the northern section of Trench 2 is thicker, up to

.5 m, and Sample T2,S5 is identical to that in Trench 3. All samples commonly contain roots.

The colluvium is thin, only .2–.3 m, but is similar in lithology to that exposed in Trench 3.

A.6.3 5 39LA117: Trench 1

As noted above, Trench 1 is shallow because the bedrock of the Cambrian Deadwood formation is close to the surface. Also, this trench was excavated on a 12^o slope as indicated in Figure A.1. Correlation between units in this trench and the other two was hindered by thin exposure. However, the cultural horizon and colluvium were identical with those described previously.

The basal unit in Trench 1 consists of varying lithologies up to .3 m thick which lie directly over the sandstone bedrock. Not surprisingly, the unit reflects the underlying lithology. In some places (Figure A.1), the unit is a regolith of weathered sandstone clasts, and in others, sand deposits represent weathering products of more friable sandstone layers. Therefore, the unit is a residuum and reflects the subjacent lithology; the variable lithologies of the unit were grouped and termed sand and conglomerate. Sample T1,S1 is representative, containing both sand and cobbles. This unit contains dark yellowish orange quartz sand and reworked sandstone cobbles. The quartz sand is very coarse-grained, well sorted and rounded, reflecting the composition and grain size of the underlying Deadwood sandstone layers.

Disconformably overlying the residuum is the cultural horizon. Here, the horizon is very similar, especially in weathering profile, clay content, and abundance of roots, to that in Trenches 2 and 3, although it is slightly more yellow due to local reworking of the underlying Deadwood Formation. Also, some of the sand grains suspended in the clay are very coarse, owing to their derivation from the underlying Deadwood sandstone.

The colluvium greatly resembles that of the other trenches, especially Sample T3,S6, but is slightly lighter in color, and like the cultural horizon, contains coarse, locally derived quartz sand grains.

A.6.4 39LA319

The trench at 39LA319 revealed a somewhat more complex suite of sediments, but some similarities with the trenches at 39LA117 may be discerned. Two units which occur at 39LA319 did not occur in Trenches 1-3. On the southern margin of the trench, a thick, purple conglomerate occurs, which cannot with certainty be correlated with other units in the trench or with conglomerates at 39LA117. Also, above the clay unit at 39LA319 is a thick purple sandstone, which may be a lateral equivalent of the conglomerate or a unique stratum. At any rate, this unit is missing from the succession at 39LA117. Overall, however, a number of similarities occur between the sites.

The purple conglomerate, Sample S1, at the southern end of the trench Figure A.3) is composed of a greatly unsorted, subangular, purple (very dark red, 5R2/6), pebble- and cobble-sized schist conglomerate with a sandy, micaceous matrix. The matrix is also very unsorted with a high (approximately 75 percent) content of coarse, subangular grains of schist and about 20 percent rounded, medium-grained quartz grains derived from the well-sorted sandstone of the basal Deadwood Formation. The unit grades from a sandier matrix at the base of the trench to one with less sand.

At the southern end of the trench, this conglomerate is disconformably overlain by .5 m of the cultural horizon, Sample S2. At this site, the horizon is more sandy and more poorly sorted than that in Trenches 1-3. At 39LA319, the cultural horizon is a dark reddish brown, unconsolidated sandy silt. The sand grains are principally quartz with some Precambrian schist and mica flakes. The quartz grains are fine-grained and subangular to subrounded.

At approximately 10 m from the southern end of the trench, the conglomerate lies below a boulder of Deadwood sandstone. This boulder appears to be one of several (Figure A.3) that may be part of a channel that was incised into the purple conglomerate. The channel fill is composed of sand and boulder conglomerate. Unfortunately, the base of the trench did not cut to a level to enable determination of whether the conglomerate was completely cut out or whether it grades laterally into a purple sand that occurs on the northern side of the channel.

The channel fill is composed of a very dark red boulder conglomerate with a medium-grained, well-sorted, subrounded quartz sand matrix, Sample S3. The clasts are subangular and composed of yellow sandstone from the Deadwood Formation and of a Precambrian metasedimentary rock which is composed of moderate red (5R4/6) grains that weather to metallic sheen.

From about 30 m from the southern end of the trench to the northern end at 65 m, a successional depositional history may be observed. The lowest unit is a pebble to cobble conglomerate, overlain successively by a dark reddish brown clay, a purple sand, a poorly sorted sandy clay, the cultural horizon, and thin colluvium. This succession attains a thickness of 4.4 m in the deepest portion of the excavation.

The conglomerate exposed in the base of the trench is very similar to the lowest exposed conglomerate in Trenches 2-3; however, like every unit at 39LA319 compared to the units at 39LA117, the former have a red to purple tint derived from the greater amount of Precambrian rocks in this area. This conglomerate represented by Sample S9 compares well with Sample T3,S1, although it is somewhat poorer sorted. Similar to that at 39LA117, Sample S9 is a dark yellowish orange, although purple and yellow layers were distinct in exposure; consists of yellow, somewhat friable sandstone, salt and pepper sandstone, and greatly silicified sandstone clasts derived from the Deadwood Formation. A few Precambrian clasts occur, including the metallic type which appears to be a chlorite schist; some soft, white and purple clay clasts were collected. The matrix is an argillaceous, fine- to medium-grained, poorly to moderately sorted, rounded quartz sand with some Precambrian schist fragments.

Two samples of the overlying clay were collected, S6 and S10 (Figure A.3). Sample S6, collected 40 m from the southern end of the trench, is a dark reddish brown clay with some fine-grained, moderately sorted, rounded quartz grains with a few Precambrian schist grains and mica flakes. The unit is very similar to the clay unit in Trench 3 (Sample T3,S2), although S6 has more red in hand sample; in exposure it exhibits a more typical yellow and red. Sample S10, procured from a point 50 m north of the southern end of the trench, is a coarser facies of the same unit. It consists of a light brown, sandy clay with scattered yellow to rust Deadwood sandstone pebbles. Some of these clasts are highly weathered and altered with the quartz grains recrystallized and only goethite ghosts representing weathered glauconite. The sand is fine- to medium-grained, moderately sorted, subrounded quartz sand with some Precambrian schist and mica flakes. Similar to the clay in the other trenches, this unit has black staining and a few soft white clay clasts. The contact between the subjacent conglomerate and the clay is sharp and undulatory, suggesting here as in the other trenches that the contact is disconformable.

Disconformably above the clay is a unit which is not found to the north in Trenches 1-3. This unique unit is a very dark red, fine-grained, poorly sorted, subangular to subrounded sand composed of metallic-like Precambrian rock grains with some quartz. The unit appears to be composed of grains weathered from a Precambrian metasedimentary rock, clasts of which are in the channel of Sample S3 and the conglomerate, Sample S9. A metallic sheen is in the detritus, but fewer sand grains occur than in S3 or S9.

Separated from the sandstone by a disconformity is a suprajacent unit which exhibits some lateral variation. This unit is a clay (e.g. Sample 4) on the southern portion of its exposure and grades laterally into an argillaceous sand with scattered quartz sandstone pebbles (e.g. Sample 8) to the north (Figure A.3). This unit greatly resembles the poorly sorted, mottled unit which lies in a similar position below the cultural layer in Trenches 2-3. The clay of Sample 4 is moderate reddish brown to moderate yellowish brown and contains fine-grained, poorly sorted, sub- rounded quartz, Precambrian schist, and mica flakes. The clay grades laterally into the argillaceous sand which is fine- to medium-grained, poorly to moderately sorted, and subrounded. Salt and pepper sandstone pebble clasts occur, and some clasts are covered with caliche; caliche stringers occur in the matrix. Rootlets are somewhat common.

The cultural horizon lies disconformably above the poorly sorted, mottled unit in the northern portion of the trench. Sample 5 represents the horizon in this area and consists of moderate reddish brown sandy siltstone and clay. The sand is a minor fraction consisting of fine-grained, poorly sorted, subrounded grains of quartz, Precambrian schist, and mica. The unit weathers overall to a somewhat blocky profile and is filled with roots.

The colluvium is poorly represented in this trench by a layer of humic material filled with pine needles and other vegetative debris.

A.7 Analysis

A.7.1 Stratigraphy

Considering the typical nature of channel deposition, the lateral consistency among the trenches is surprising. Undoubtedly, all the units between Trenches 2 and 3 may be correlated, although the lowest conglomerate and the clay unit are thinner in Trench 2. This thinning may be due to original thin deposition on the margin of the terrace or subsequent erosion due to greater fluvial energy on the edge of the terrace after each depositional episode. Trench 1 is very shallow, but the lithology of the cultural horizon and the suprajacent colluvium is identical with that of the corresponding units in Trenches 2 and 3. Therefore, the correlation of these units among all three trenches is reliable.

Correlation of the trench at 39LA319 with those at 39LA117 is more tentative, but many units appear correlative. The conglomerate at the deepest portion of the trench at 39LA319 corresponds lithically and in stratigraphic position to the lowest conglomerate in Trenches 2 and 3. Also correlative to these trenches is the overlying clay. However, in the trench at 39LA319, a purple sandstone overlies the clay, which in turn is overlain by a poorly sorted, mottled unit. In Trenches 2 and 3, this sand is absent. Otherwise, the succession in the northern end of the trench corresponds well with the succession at 39LA117. At the southern end of the trench is a purple conglomerate which may be a lateral equivalent of the purple sand and a channel which has cut into both purple units. None of these lithologies occur at 39LA117. Overall, however, a relatively good correlation appears between the trench at 39LA319 and Trenches 2 and 3 at 39LA117. In particular, the upper three units (the poorly sorted, mottled unit, the cultural horizon, and the colluvium) appear as correlatives. Therefore, based on stratigraphic position and lithologic similarity, the cultural horizon among all the trenches should be identical. Certainly, the cultural horizon among Trenches 1, 2, and 3 is identical, and the only possibility that a separate unit occurs at 39LA319 would entail deposition and mixing of the separate units into a single component. The great number of roots in this unit is supportive of this possibility, but no distinct evidence of mixing was observed.

A.7.2 Lithic Sources

The best evidence for the Middle to Late Archaic age of the cultural horizon occurs in the archaeological excavation between Trenches 2 and 3. Excellent representatives of the Middle and Late Archaic cultural complexes were found in association with numerous flakes that appeared associated with the projectile points. Good representatives were found at a level of 38 cm below the surface (R. Williams personal communication 1988). Inspection of the archaeological excavation confirmed that the artifacts were derived from the clay of what is herein termed the cultural horizon. Therefore, the best evidence indicates a Middle to Late Archaic age for Qt_2 at 39LA117.

The question arises as to why a projectile point of possible Paleoindian age was found at approximately the same level as the Middle and Late Archaic points to the east near Trench 1. It might be parenthetically inserted here that artifacts suggestive of a similar older age were found on the Forest Service road that crosses Qt_1 above the site of the trench and the problematical lithic (Church et al. 1985; N. Chevance personal communication 1988). The questionable point was derived from a shovel test that was from 5 to 15 cm below the present surface. Figure A.2 illustrates that, in the trench adjacent to the source of the lithic, the colluvium is at least four times as thick as the shovel test; therefore, it is very doubtful that the point was derived from the cultural horizon, which here occurs 60–70 cm below the surface. More likely, the point occurred in the colluvium which represents unconsolidated wash of sediment and boulders from up slope. This up- slope region is the same area where artifacts suggestive of an older age were encountered in previous surveys; therefore, the stratigraphic evidence suggests that the point diagnostic of the Paleoindian period was washed from the high terrace, Qt_1, into the colluvium over the Middle to Late Archaic cultural horizon.

Finally, the most problematical of the lithic occurrences is the Paleoindian projectile point from 39LA319. The point and associated flakes were secured 39 cm below the surface (S. Keller personal communication 1988) in sediments which appear very similar to those of the cultural horizon in the adjacent trench. The depth of the occurrence precludes contamination by wash from above, and the association of the flakes with the point also suggests that this point is in place. Therefore, the stratigraphy cannot explain this occurrence,and it can only be hypothesized that mixing of sediments occurred, more than one stratigraphic horizon is represented by the cultural horizon, or point typology cannot be applied to sites within the Black Hills.

A.8 Conclusions

The stratigraphy and geomorphology of the study area are in all cases but one consistent with the established lithic chronology. Consistent stratigraphy can be found among Trenches 1-3 at 39LA117 and consists successively of a conglomerate, a clay, a poorly sorted mottled unit, the cultural horizon, and recent colluvium. The Middle Archaic McKean cultural complex and two Late Archaic complexes are represented in the cultural horizon at 39LA117 and provide the most reliable date for Qt_2. A specimen suggestive of the Paleoindian period appears to be derived from recent colluvium and may be part of sheet wash from the higher terrace, Qt_1. Most of the stratigraphic units in the trench at 39LA319 may be correlated with those at 39LA117. The two basal units correlate with the two basal units in Trenches 2 and 3, and the upper three units also correlate with the upper three units in the trenches at 39LA117. Only the purple sandstone lying between the clay and the unsorted, mottled unit are unique in the stratigraphic progression at 39LA319. This sand may grade laterally into the purple conglomerate in the northern portion of the trench, and a later channel cut into these two units. Overall, however, the stratigraphy and general lithology of the artifact-bearing units are similar among trenches. For these reasons, the occurrence of a Paleoindian projectile point within a unit which otherwise appears to represent the Middle and Late Archaic is problematical. A number of hypotheses may be presented, but none can be positively proved through the geological investigation: 1) numerous roots were observed in the cultural horizon and may have mixed artifact-bearing sediments; 2) both Paleoindian and Archaic intervals are represented in the thin cultural horizon, and separate layers cannot be differentiated, although artifacts occurring higher on Qt_1 lessen this possibility; or 3) the lithic chronology developed for the rest of the Northwestern Plains does not persist into this region. It is suggested, therefore, that efforts to date the terrace fills in the Black Hills be initiated to determine which of these possibilities is the most probable.

A.9 Sample Analysis

See Figures A.1–A.3 for the location of the samples.

A.9.1 39LA117: Trench 1

Sample T1,S1–Sand and Conglomerate

Color:	Dark yellowish orange (Munsell 10YR6/6)
Composition:	Quartz sand and sandstone cobbles
Cobbles:	Sandstone clasts, some very coarse, some fine-grained with coarse grains suspended in matrix; all locally derived from the bedrock of the underlying basal sandstones of the Deadwood Formation
Sand:	90 percent quartz, also locally derived as a weathering product of the Deadwood sandstones
Grain size:	-0.5 to -1.0 phi, very coarse-grained
Sorting:	Well-sorted, due to well-sorted source rock
Roundness:	Well-rounded, due to well-rounded source rock
Miscellaneous:	Represents residuum from underlying Cambrian Deadwood Formation and reflects laterally the varying composition and grain size of the underlying sandstone layers.

Sample T1,S2–Cultural Horizon

Color:	Dark yellowish brown (10YR4/2)
Composition:	Sandy clay with large quartz grains suspended in clay
Grain size:	Sand; -0.5 to -1.0 phi, very coarse-grained
Sorting:	Well-sorted
Roundness:	Well-rounded

Miscellaneous: Many roots; fine-grained Deadwood sandstone cobble clasts with large quartz grains suspended in finer-grained sandstone

Sample T1,S3–Colluvium

Color:	Moderate brown (5YR4/4) to moderate reddish brown (10R4/6)
Composition:	Unconsolidated sandy silt with boulders of Deadwood sandstone
Grain size:	Sand; bimodal, -0.5 to -1.0 phi, very coarse to 3.0 to 3.5 phi, very fine-grained
Sorting:	Medium sorting
Roundness:	Subrounded to rounded
Miscellaneous:	The coarse sand content is locally derived from the large grains of the underlying Deadwood sandstone

A.9.2 39LA117: Trench 2

Sample T2,S1, southern section of trench–Conglomerate

Color:	Moderate yellowish brown (10YR5/4) to dark yellowish orange (10YR6/6)
Composition:	Pebble to cobble conglomerate with sand matrix
Clasts:	Mostly chert with caliche coating, similar to concretions; some weathered Precambrian schist clasts and Deadwood sandstone
Matrix:	Quartz grains, few Precambrian schist grains, very little mica, and turquoise weathered grain ghosts
Grain size:	2.0 to 2.5 phi, medium- to fine-grained
Sorting:	Moderate sorting
Roundness:	Rounded
Miscellaneous:	Almost identical to the conglomerate T3,S1; turquoise ghosts and a few more Precambrian clasts are major differences

Sample T2,S2, southern section of trench–Clay

Color:	Moderate yellowish orange (10YR5/4)
Composition:	Sandy clay
Grain size:	Sand; 1.5 to 2.5 phi, medium- to fine-grained
Sorting:	Moderate to well-sorted
Roundness:	Subrounded
Miscellaneous:	Mottled in outcrop, greenish to yellow; has deeply weathered white, soft pebble clasts, clasts of Deadwood sandstone, and some salt-and-pepper sandstone; iron-manganese staining around roots

Sample T2,S3, southern section of trench–Poorly sorted, mottled Sand and Conglomerate

Color:	Light olive brown (5Y5/6)
Composition:	Almost equal parts quartz and Precambrian schist, although the Precambrian grains may be slightly more numerous; mica flakes are common; clasts are composed of rounded salt-and-pepper sandstone.
Grain size:	2.0 to 3.0 phi, medium- to fine-grained
Sorting:	Poorly sorted
Roundness:	Subrounded to rounded
Miscellaneous:	Derived from salt-and-pepper sandstone; very similar to T3,S3

Sample T2,S4, southern portion of trench–Cultural Horizon

Color:	Moderate yellowish brown (10YR5/4)
Composition:	Sandy siltstone
Grain size:	Sand; 2.5 to 3.0 phi, fine-grained
Sorting:	Moderate sorting
Roundness:	Subrounded
Weathering:	Vertical and blocky, but not as extreme as in Trench 3
Miscellaneous:	The cultural horizon is sandier than in Trench 3 with greater numbers of Precambrian grains, probably derived from the underlying layer which has more Precambrian grains than in Trench 3; the color is more yellowish for the same reason

Sample T2,S5, northern section of trench–Cultural Horizon

Color:	Dark reddish brown (10R3/4)
Composition:	Sandy clay with muscovite flakes
Grain size:	Sand; 2.0 to 2.5 phi, fine-grained
Sorting:	Moderate to well-sorted, few Precambrian grains
Roundness:	Subrounded
Weathering:	Vertical and blocky
Miscellaneous:	Typical lithologic and weathering characteristic of this unit

A.9.3 39LA117: Trench 3

Sample T3,S1, southern section of trench–Conglomerate

Color:	Dark yellowish orange (10YR6/6)
Composition:	Pebble to cobble conglomerate with sand matrix
Clasts:	Chert concretions coated with caliche, silicified quartz sandstone, soft white clay clasts, Precambrian schist
Matrix:	Approximately 75 percent quartz and 25 percent Precambrian schist; very little mica

Grain size:	Sand; bimodal, 1.0 to 1.5 phi; 2.5 to 3.0 phi; medium- to fine-grained
Sorting:	Moderate to well-sorted
Roundness:	Rounded
Miscellaneous:	Rootlets common and associated with manganese staining

Sample T3,S2, southern section of trench–Clay

Color:	Moderate yellowish orange (10YR5/4)
Composition:	Sandy clay
Grain size:	Sand; 2.5 to 3.0 phi, fine-grained
Sorting:	Well-sorted; 90 percent quartz, 10 percent Precambrian schist
Roundness:	Well-rounded
Bedding:	2–4-cm beds of iron-stained sandy clay interbedded with gray clay layers at base of unit; manganese dioxide and soft, white clasts often occur in the sand beds
Contact:	Disconformable over conglomerate, 70-cm cut-and-fill at southern end of trench
Miscellaneous:	White calcareous root casts, clay clasts often associated with roots in this layer; many small rootlets associated with iron-manganese staining

Sample T3,S3, southern section of trench–Poorly sorted, mottled Sand and Conglomerate

Color:	Mottled to give a greenish yellow, ranging from moderate yellow (5Y6/6) to light olive brown (5Y5/6)
Composition:	Primarily sand with some sandstone pebbles
Clasts:	Rounded salt-and-pepper quartz sandstone
Matrix:	50 percent white quartz, 50 percent dark mafic minerals with some mica
Grain size:	Sand; 2.5 to 3.0 phi, fine-grained
Sorting:	Poorly sorted
Roundness:	Subrounded to rounded
Contact:	Disconformable, sharp and undulatory
Miscellaneous:	Rootlets; quartz sand overgrowths and recrystallization in sandstone clasts

Sample T3,S4, southern section of trench–Cultural Horizon

Color:	Dark reddish brown (10YR3/4) to moderate reddish brown (10R4/6)
Composition:	Sandy claystone with mica flakes; grains of quartz with minor amounts of Precambrian schist
Grain size:	Sand; 1.5 to 2.5 phi, fine- to medium-grained

Sorting: Moderate sorting
Roundness: Subrounded to rounded
Contact: Disconformable, sharp with small-scale cut and fills
Weathering: Vertical and blocky
Miscellaneous: Contains many roots, both macro- and microscopically; combined with blocky weathering forms a vertical fluted appearance; very few yellow cobble-sized clasts of Deadwood sandstone were suspended in the clay

Sample T3,S5, northern section of trench–Cultural Horizon

Color: Dark reddish brown (10R3/4)
Composition: Sandy claystone with mica flakes; grains of quartz with minor amounts of Precambrian schist
Grain size: Sand; 1.5 to 2.5 phi, fine- to medium-grained
Sorting: Moderate sorting
Roundness: Subrounded to rounded
Contact: Disconformable; sharp with small-scale cut-and-fills
Weathering: Vertical and blocky
Miscellaneous: Very similar to T3,S4, although slightly darker and a somewhat more blocky weathering profile

Sample T3,S6, northern section of trench–Colluvium

Color: Moderate reddish brown (10R4/6)
Composition: Unconsolidated sandy siltstone with cobble to boulder Deadwood sandstone clasts; the sandy matrix is composed of quartz, Precambrian schist, and mica
Grain size: Sand; 3.0 to 3.5 phi, very fine-grained
Sorting: Moderate sorting
Roundness: Subrounded to rounded
Contact: Disconformable due to size differential and consolidation difference; contact not well exposed
Bedding: Horizontal
Miscellaneous: This unit may be differentiated on the basis of coarser sediment, horizontal bedding, and unconsolidated nature; some material is derived from underlying Cultural Horizon and imparts similar color

A.9.4 39LA319

Sample S1–Conglomerate

Color: Very dark red (5R2/6)

Composition: Pebbles and cobbles of Precambrian schist in sandy, micaceous matrix
Clasts: Unsorted chlorite schist clasts and schist clasts with free quartz
Matrix: Sand composed of Precambrian schist fragments (about 75 percent) and rounded quartz grains (about 25 percent)
Grain size: Sand; 0 to 0.5 phi, coarse-grained schist; 1.0 to 1.5 phi, medium-grained quartz
Sorting: Poorly sorted
Roundness: Subangular Precambrian grains; rounded quartz grains
Miscellaneous: Occurs only in southern portion of the trench for the first 10 m; grades from sandier matrix at the base of the trench to more conglomeratic at the top

Sample S2–Cultural Horizon over conglomerate in southern portion of trench

Color: Dark reddish brown (10R3/4)
Composition: Sandy silt with unconsolidated quartz grains and little mica and Precambrian schist
Grain size: Sand; 2.0 to 3.0 phi, fine-grained
Sorting: Moderate sorting
Roundness: Subangular to subrounded
Miscellaneous: Common roots

Sample S3–Sand and Boulder Conglomerate

Color: Very dark red (5R2/6)
Composition: Quartz sand and boulder conglomerate
Clasts: Subangular Deadwood sandstone, some yellow and metallic weathered Precambrian (?) schist
Matrix: Moderate red (5R4/6) quartz
Grain size: Sand; 1.5 to 2.0 phi, medium-grained
Sorting: Well-sorted
Roundness: Subrounded
Miscellaneous: This unit may represent a channel fill from a paleochannel incised into the purple conglomerate (S1) and purple sand (S7)

Sample S4–Clay below Cultural Horizon

Color: Moderate reddish brown (10R4/6) to moderate yellow brown (10YR5/4)
Composition: Sandy clay; sand is composed of quartz, Precambrian schist, and mica
Grain size: Sand; 2.0 to 3.0 phi, fine-grained
Sorting: Poorly sorted

Roundness: Subrounded
Weathering: Somewhat blocky
Miscellaneous: Common roots; dark color derived from Precambrian metasediments

Sample S5–Cultural Horizon

Color: Moderate reddish brown (10R4/6)
Composition: Sandy silt with clay, sand matrix is quartz, Precambrian schist, and mica
Grain size: Sand; 2.0 to 3.0 phi, fine-grained
Sorting: Poorly sorted
Roundness: Subrounded
Weathering: Somewhat blocky
Miscellaneous: Appears to be derived from unit below

Sample S6–Clay

Color: Dark reddish brown (10R3/4)
Composition: Clay with some quartz and minor Precambrian schist and mica
Grain size: Sand; 2.0 to 2.5 phi, fine-grained
Sorting: Moderate sorting
Roundness: Rounded
Miscellaneous: Some soft yellow Deadwood sandstone clasts and more consolidated pebbles are suspended in the clay; mottled yellow and red in outcrop

Sample S7–Sand

Color: Very dark red (5R2/6)
Composition: Mostly metallic-appearing Precambrian (?) rock grains with minor quartz grains
Grain size: Bimodal; 2.5 to 3.0 phi, fine-grained; -0.5 to -1.0 phi, very coarse-grained
Sorting: Poorly sorted
Roundness: Subangular to subrounded
Miscellaneous: Metallic sheen characteristic of detritus; no observed equivalent at 39LA117

Sample S8–Argillaceous Sand with few sandstone pebbles below Cultural Horizon

Color: Moderate yellowish brown (10YR5/4)
Composition: Argillaceous sand with few sandstone pebbles

Clasts:	Deadwood sandstone pebbles, including salt-and-pepper sandstone
Sand:	Argillaceous quartz sand with approximately 30 percent Precambrian schist fragments and minor mica
Grain size:	1.5 to 3.0 phi, fine- to medium-grained
Sorting:	Poor to moderate sorting
Roundness:	Subrounded
Miscellaneous:	Some caliche coatings and stringers; laterally grades into clay with sand

Sample S9–Conglomerate at base of trench

Color:	Dark yellowish orange (10YR6/6)
Composition:	Pebble to cobble conglomerate with argillaceous and sandy matrix
Clasts:	Yellow Deadwood sandstone; salt-and-pepper sandstone; recrystallized sandstone; few Precambrian clasts, including metallic type which here appears to be a chlorite schist; some soft, white and purple clay clasts
Matrix:	Argillaceous sand composed of quartz and Precambrian schist grains
Grain size:	1.0 to 2.0 phi, fine- to medium-grained
Sorting:	Poor to moderate sorting
Roundness:	Rounded
Miscellaneous:	Very similar to T3,S1, although somewhat poorer sorted

Sample S10–Clay

Color:	Mottled light brown (5YR5/6) to moderate reddish brown (10R4/6)
Composition:	Sandy clay with few suspended Deadwood pebbles
Clasts:	Yellow to rust, rounded Deadwood sandstone pebbles, some recrystallized with goethite ghosts as alteration products of glauconite
Matrix:	Quartz grains with minor Precambrian schist and mica
Grain size:	Sand; 1.5 to 2.5 phi, fine- to medium-grained
Sorting:	Moderate sorting
Roundness:	Subrounded
Miscellaneous:	Black manganese staining; few soft, white clay clasts

A.10 References

Church, Tim, Therese Chevance, and Patricia Malone

1985 *Cultural Resource Investigations along the Vanocker Canyon Road, Lawrence and Meade Counties, South Dakota.* South Dakota Archaeological Research Center, Contract Investigation Series 143.

Frison, George C.
1978 *Prehistoric Hunters of the High Plains.* New York: Academic Press.

Gries, J.P., and James E. Martin
1985 Composite Outcrop Section of the Paleozoic and Mesozoic Strata in the Black Hills and Surrounding Areas. In *Geology of the Black Hills, South Dakota and Wyoming*, second edition, edited by F.J. Rich, pp. 261–292. American Geological Institute.

Appendix B

Additional Lithic Data from 39LA117

Table B.1: Distribution of debitage lithic raw material type percentages by excavation unit, 39LA117

	Clear Chal.	Light Chal.	Dark Chal.	Brown Chal.	Light Chert	Dark Chert	White Qtzite	Tan Qtzite	Brown Qtzite
1	0.0	6.4	0.9	0.0	0.2	3.6	0.7	3.7	10.9
1&2	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
2	0.0	24.8	5.6	0.0	9.2	2.3	0.7	10.3	1.5
3	0.0	1.2	0.0	0.0	16.3	8.2	8.0	2.1	1.5
4	2.4	1.8	0.0	0.0	7.0	3.2	5.5	0.2	6.6
5	0.0	0.7	0.0	<0.1	4.7	9.4	0.3	10.4	18.4
6	0.4	0.7	0.0	<0.1	15.5	27.1	8.3	7.6	7.7
7	0.0	0.0	0.9	0.0	2.0	0.4	0.3	0.2	0.0
8	0.0	0.0	0.0	0.0	0.0	<0.1	0.4	0.0	0.6
9	0.0	<0.1	0.0	0.0	0.3	0.0	0.0	1.2	0.0
10	2.0	0.0	0.0	0.0	3.3	0.3	0.0	0.3	0.0
11	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
12	0.0	0.3	0.0	0.0	2.1	7.6	16.3	6.7	0.2
13	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	2.4
15	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	8.4	2.0	8.3	<0.1	0.1	0.4	1.7	0.0	0.0
17	0.4	0.1	0.0	0.0	1.7	2.6	0.0	0.0	0.0
18	0.4	24.8	23.2	<0.1	12.4	0.0	2.4	1.3	10.0
19	1.2	1.5	2.8	<0.1	0.5	5.9	1.7	0.0	0.0
20	0.0	<0.1	0.0	0.0	0.1	1.8	0.0	1.5	1.4
21	2.0	0.0	0.0	0.0	0.2	2.1	0.0	0.0	0.0
22	0.8	0.0	0.9	0.6	0.2	0.8	0.0	0.0	0.0
23	0.4	0.5	0.0	0.0	0.3	0.0	0.4	0.3	0.2
24	10.7	0.4	0.0	<0.1	0.6	5.8	0.4	33.2	22.1
25	0.0	0.0	0.0	<0.1	0.1	0.2	0.0	0.3	0.0
26	15.9	1.8	0.0	11.4	0.5	0.1	17.9	2.2	4.6
27	0.8	0.8	0.0	<0.1	0.6	0.2	0.0	0.9	1.0
28	2.4	0.6	0.0	20.7	0.2	0.1	0.7	0.2	2.2
29	0.0	<0.1	0.0	2.1	0.8	0.0	0.0	0.6	0.0
30	1.2	0.1	0.9	0.0	1.2	0.1	0.4	1.8	0.0

Table B.1: continued

31	0.8	0.5	0.0	16.0	1.9	1.2	15.6	3.2	8.2
32	0.0	<0.1	0.0	0.4	0.0	0.0	0.0	0.0	0.0
33	1.2	0.5	0.9	0.0	0.3	1.2	1.0	0.0	0.0
34	0.0	0.5	3.7	0.0	0.6	0.5	0.7	3.1	0.0
35	48.6	1.4	7.4	48.4	2.1	0.6	5.2	2.9	0.0
36	0.0	0.0	0.0	0.1	0.2	0.6	6.9	0.0	0.0
37	0.0	17.0	7.4	<0.1	5.3	2.7	1.0	3.1	0.0
38	0.0	10.1	16.7	0.0	7.3	7.1	0.0	0.2	1.0
39	0.0	0.7	20.4	0.0	0.8	1.4	3.1	2.1	0.0
40	0.0	0.5	0.0	0.0	0.2	1.3	0.4	0.4	0.0
	100.0	99.8	100.0	99.7	100.0	98.9	100.0	100.0	100.5
	Red Quart	Purple Quart	Quartz	Red Shale	Gray Shale	Silic. Slate	Gray Silic. Silt	Tan Silic. Silt	Porcel
1	1.1	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0
1&2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	2.0	2.2	0.0	0.0	0.0	0.0	7.4	16.0	0.0
3	5.6	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0
4	4.7	0.0	0.0	20.0	0.0	0.0	0.0	40.9	0.0
5	0.4	0.9	0.0	0.0	0.0	0.4	6.6	0.0	0.0
6	1.8	3.9	0.0	0.0	0.0	0.0	0.0	0.7	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	29.0	2.8	0.0
9	0.0	0.0	28.6	0.0	0.0	0.6	0.0	0.0	0.0
10	2.5	0.0	0.0	0.0	0.0	0.0	2.9	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0
12	42.5	0.5	0.0	0.0	0.0	0.0	2.6	0.0	0.0
13	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.7	3.9	0.0	30.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
18	1.3	0.5	0.0	10.0	0.0	0.0	31.9	31.2	0.0
19	0.0	76.2	14.3	0.0	0.0	0.0	0.0	0.0	0.0
20	0.0	2.0	0.0	0.0	0.0	0.1	4.5	4.2	0.0
21	0.0	0.0	0.0	0.0	0.0	23.1	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0	58.5	0.0	0.0	0.0
23	1.1	0.0	4.8	0.0	11.1	0.0	0.0	0.0	0.0
24	24.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0
26	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0
29	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	2.7	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0
31	1.1	0.0	0.0	0.0	0.0	0.0	0.0	2.8	100.0
32	0.0	0.0	0.0	0.0	0.0	12.3	5.5	0.0	0.0
33	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	0.4	0.2	0.0	10.0	0.0	0.0	0.0	0.0	0.0
35	0.9	3.6	42.8	0.0	0.0	0.6	0.5	0.0	0.0
36	0.4	0.0	0.0	10.0	0.0	2.7	0.0	0.0	0.0
37	0.0	5.0	0.0	0.0	0.0	0.0	0.3	1.2	0.0
38	0.2	0.2	9.5	0.0	0.0	0.0	1.8	0.0	0.0
39	0.4	0.7	0.0	20.0	88.9	0.0	0.3	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.8	100.0

Table B.2: Debitage raw material percentage distributions in rank order by percent of total weight in each unit, 39LA117

Raw Material Type	Rank	Unit(s)	Percentage
Clear Chalcedony	1	35	48.60
	2	26	15.90
	3	24	10.70
	4	16	8.40
	5	4, 28	2.40
	6	10, 21	2.00
	7	19, 30, 33	1.20
	8	22, 27, 31	0.80
	9	6, 17, 18, 23	0.40
	10	5, 36	<0.10
Brown Chalcedony	1	35	48.40
	2	28	20.70
	3	31	16.00
	4	26	11.40
	5	29	2.10
	6	22	0.60
	7	32	0.40
	8	5, 16, 18	0.07
	9	36, 37	0.05
	10	19, 24, 25	0.03
	11	6, 20, 23, 27, 33	<0.03
Light Chalcedony	1	2, 18	24.80
	2	37	17.00
	3	38	10.10
	4	1	6.40
	5	16	2.00
	6	4, 26	1.80
	7	19	1.50
	8	35	1.40
	9	3	1.20
	10	27	0.80
	11	5, 6, 39	0.70
	12	28	0.60
	13	23, 31, 33, 34, 40	0.50
	14	24	0.40
	15	12	0.30
	16	15, 17, 30	0.10
	17	9, 20, 29, 32	0.05
	18	1-2, 8, 10	<0.05
Light Chert	1	3	16.30
	2	6	15.50
	3	18	12.40
	4	2	9.20
	5	38	7.30
	6	4	7.00
	7	37	5.30
	8	5	4.70
	9	10	3.30
	10	12, 35	2.10
	11	7	2.00
	12	31	1.90
	13	17	1.70
	14	30	1.20

Table B.2: continued

Raw Material Type	Rank	Unit(s)	Percentage
	15	13	0.90
	16	29, 39	0.80
	17	24, 27, 34	0.60
	18	19, 26	0.50
	19	9, 11, 23, 33	0.30
	20	1, 21, 22, 28, 36, 40	0.20
	21	16, 20, 25	0.10
Dark Chert	1	6	27.10
	2	5	9.40
	3	3	8.20
	4	12	7.60
	5	38	7.10
	6	19	5.90
	7	24	5.80
	8	1	3.60
	9	4	3.20
	10	37	2.70
	11	17	2.60
	12	2	2.30
	13	21	2.10
	14	20	1.80
	15	39	1.40
	16	40	1.30
	17	31, 33	1.20
	18	18	1.10
	19	22	0.80
	20	35, 36	0.60
	21	34	0.50
	22	7, 16	0.40
	23	10	0.30
	24	25, 27	0.20
	25	1-2, 26, 28, 30	0.10
White Quartzite	1	26	17.90
	2	12	16.30
	3	31	15.60
	4	6	8.30
	5	3	8.00
	6	36	6.90
	7	4	5.50
	8	35	5.20
	9	39	3.10
	10	18	2.40
	11	16, 19	1.70
	12	33, 37	1.00
	13	1, 2, 28, 34	0.70
	14	8, 23, 24, 30, 40	0.40
	15	5, 7	0.30
Brown Quartzite	1	24	22.10
	2	5	18.40
	3	1	10.90
	4	18	10.00
	5	31	8.20
	6	6	7.70
	7	4	6.60
	8	26	4.60

Table B.2: continued

Raw Material Type	Rank	Unit(s)	Percentage
	9	13	2.40
	10	28	2.20
	11	2, 3	1.50
	12	20	1.40
	13	27, 38	1.00
	14	8	0.60
	15	12, 23	0.20
Tan Quartzite	1	24	33.20
	2	5	10.40
	3	2	10.30
	4	6	7.60
	5	12	6.70
	6	1	3.70
	7	31	3.20
	8	34, 37	3.10
	9	35	2.90
	10	26	2.20
	11	3, 39	2.10
	12	30	1.80
	13	20	1.50
	14	18	1.30
	15	9	1.20
	16	27	0.90
	17	29	0.60
	18	40	0.40
	19	10, 23, 25	0.30
	20	4, 7, 28, 38	0.20
Red Quartzite	1	12	42.50
	2	24	24.00
	3	3	5.60
	4	4	4.70
	5	30	2.70
	6	10	2.50
	7	33	2.20
	8	2, 29	2.00
	9	6	1.80
	10	18	1.30
	11	1, 23, 31	1.10
	12	13, 27, 35	0.90
	13	16	0.70
	14	5, 34, 36, 39	0.40
	15	26, 38	0.20
Purple Quartzite	1	19	76.20
	2	6, 16	3.90
	3	35	3.60
	4	2	2.20
	5	20	2.00
	6	5	0.90
	7	39	0.70
	8	12, 18	0.50
	9	26, 34, 38	0.20
Gray Silcified Silt	1	18	31.90
	2	8	29.00
	3	2	7.40
	4	5	6.60

Table B.2: continued

Raw Material Type	Rank	Unit(s)	Percentage
	5	32	5.50
	6	20	4.50
	7	10	2.90
	8	12	2.60
	9	30	2.10
	10	25	1.90
	11	38	1.80
	12	11	1.30
	13	40	0.80
	14	35	0.50
	15	36	0.30
Tan Silicified Silt	1	4	40.90
	2	18	31.20
	3	2	16.00
	4	20	4.20
	5	8, 31	2.80
	6	37	1.20
	7	6	0.70
	8	7	0.20
Silcified Silt	1	22	58.50
	2	21	23.10
	3	32	12.30
	4	36	2.70
	5	28	1.40
	6	9, 35	0.60
	7	1	0.40
	8	17	0.30
	9	20	0.10
Gray Shale	1	39	88.90
	2	23	11.10
Red Shale	1	16	30.00
	2	4, 39	20.00
	3	18, 34, 36	10.00
Porcellanite	1	31	100.00
Quartz	1	35	42.80
	2	9	28.60
	3	19	14.30
	4	38	9.50
	5	23	4.80

Appendix C

Tool and Use Wear Descriptions from 39LA117, 39LA314 and 39LA319

Use wear descriptions are based on classifications defined in Tratebas, 1986, insofar as possible. For complete definitions of tool classes see Tratebas 1986:71–95. Tool Class 21a was redefined as follows: *biface fragments* are pieces of bifaces that lack adequate wear or edges to determine their possible function. Examination of flaking technology shows them to be bifacially worked artifacts, but which show little or no use wear. Lithic raw material classification also generally follows Tratebas, 1986; however, it was found that these lithic classes were inadequate to accurately describe the range of variation of lithic material encountered in the Mountain Meadow project artifact assemblage. For this reason, additional information on lithic raw material attributes is included in the descriptions given here.

Lithic analysis included the following determinations: color, fluorescence (presence/absence and color), translucency, luster, patination (presence/absence and characteristics), cortex (presence/absence and color), fracture (blocky, conchoidal, etc.), quality of rock for knapping, evidence for heating (color change, spalling, etc.), character of inclusions, if any, and general attributes such as presence of glauconite, mottling, and texture. In addition, quartzites were analyzed for texture type (Church 1990:27, Ebright 1987:31), grain size (Folk 1980:23), sphericity of grains (Rittenhouse 1943), roundness of grains (Powers 1958), and sorting (Longiaru 1987:793). Magnification at 4.5x was used for the latter determinations.

Where possible, lithics were identified as to geological formation, for example Deadwood Formation quartzite or Tongue River silicified sediment. SARC comparative samples from the following formations were used in the analysis: Deadwood, Paha Sapa, Minnelusa, Spearfish, Morrison, Lakota, Fall River, Fort Union, Tongue River, and White River Group. It was not possible, based on either the comparative samples or Tratebas' (1986) criteria to consistently discriminate between the various cherts and chalcedonies of the Paha Sapa, Minnelusa, Spearfish, Lakota, and Morrison formations. Deadwood quartzite was readily recognizable from the presence of glauconite grains in the specimens. The differentiation of the Lakota, Fall River, and Minnelusa formation quartzites is more tentative. These might more reliably be treated as a single unit termed "Hogback quartzites." Some specimens of fine-grained, grayish silicified sediment could be assigned to the Tongue River Formation; other specimens could have derived from either the Tongue River or the Morrison Formation. Badlands plate chalcedony from the White River Group and Fort Union Formation porcellanite could be reliably identified due to the unique properties of each.

Projectile point terminology follows Montet-White et al. (1963).

Artifacts are grouped according to site and listed by catalog number with projectile point data presented first.

C.1 39LA117

Tool type and no.: Projectile point fragment 84-580-01
Site/provenience: 39LA117 surface
Level/depth: Surface
Collection: 1984 Vanocker Survey surface collection
Time period/classification: Early Plains Archaic/Hawken?
Material type: Chert. Translucent, semimat luster, no fluorescence; concoidal fracture; good quality; includes wide bands of more siliceous, chert
Material color: 10YR8/2 very pale orange with bands of 10YR7/4 grayish orange
Axial length: NA
Max width: 17.2 mm
Max thickness: 4.1 mm
Wt.: 2.8 g
Blade shape: NA
Longitudinal section: Biconvex?
Transverse section: Biconvex
Description of flake scars: Primary flakes obscured; secondary scars ovate, bifacial-bilateral and continuous
Base: Subconvex, bifacial thinning, ground, even base; a small indentation in the middle may have been caused by a thinning flake, rather than intentional
Shoulder: Non-barbed; straight to slightly concave; asymmetrical
Haft: Lateral-lateral, right-angled circular notch, ground; notch length 3.5 mm
Tang: Parallel expanding, right-angle juncture in base on complete side; length 7.0 mm; width 13.6 mm
Additional comments: Impact fracture on tip, corner of base missing. Step flaking and smoothing along sinuous edge; notch exhibits moderate smoothing.
Illustration: Figure 4.11h

Tool type and no.: Projectile point fragment 89-88-0001
Site/provenience: 39LA117 surface
Special provenience: Approx. 12 m northeast of FH26 on dirt trail
Level/depth: Surface
Collection: 1987 revisit of 1984 Vanocker Survey site
Time period/classification: Early Plains Archaic/Hawken
Material type: Chert. Translucent, no fluorescence, semimat luster; good quality, concoidal fracture; small siliceous inclusions
Material color: 10YR8/2 very pale orange
Axial length: NA
Max width: NA
Max thickness: 4.1 mm?
Wt.: 1.9 g
Blade shape: Unknown, snapped off above shoulder
Longitudinal section: NA
Transverse section: possibly asymmetrically biconvex
Description of flake scars: Unknown
Base: Subconcave base with a few thinning flakes removed from both sides; bifacial longitudinal scars in middle; ground three-quarters across, then irregular; 18.4 mm wide
Shoulder: Non-barbed, slightly concave to straight from distal portion to distal median portion; 2.2 mm wide
Haft: Ground, lateral-lateral juncture, obtuse-circular notch; notch 4.4 mm long
Tang: Contracting-expanding, lower portion of tang convex; 11.2 mm long, 13.2 width
Additional comments: Only one notch intact.
Illustration: Figure 4.11g

Tool type and no.: Projectile point fragment 89-88-0003
Site/provenience: 39LA117 surface
Special provenience: Approx. 30 m east-northeast of FH26 along edge of dirt trail
Level/depth: Surface
Collection: Revisit of 1984 Vanocker Survey site
Time period/classification: Early Plains Archaic/unnamed side-notched type
Material type: Chert. Translucent to opaque, semimat luster; no fluorescence; good quality, concoidal fracture; faint yellow streaks and spots
Material color: 5YR8/1 pinkish gray
Axial length: NA
Max width: NA
Max thickness: 5.6 mm?
Wt.: 3.4 g
Blade shape: Excurvate
Longitudinal section: Planoconvex
Transverse section: Asymmetrical biconvex

Description of flake scars: Reworked, primary scars obscured; secondary scars discontinuous
Base: Subconvex, longitudinal thinning flakes on both faces, grinding present, even basal edge; 17.1 mm wide
Shoulder: Non-barbed, concave
Haft: Lateral-lateral juncture, ground, obtuse-circular notch; notch 5.1 mm long
Tang: Contracting-expanding, convex proximal edge; 9.3 mm long; 12.2 mm wide
Additional comments: Tip has an impact fracture, one lateral edge incomplete. Step fractures and smoothing along sinuous edge; moderate smoothing of notch.
Illustration: Figure 4.11f

Tool type and no.: Projectile point 89-88-0004
Site/provenience: 39LA117 surface
Special provenience: Approx. 75 m east of FH 26 along dirt trail
Level/depth: Surface
Collection: 1987 revisit of 1984 Vanocker Survey site
Time period/classification: Late Paleoindian/unspecified Plano lanceolate
Material type: Silicified siltstone. Opaque, mat luster; no fluorescence; good quality, concoidal fracture; a few brown grains and some find sand inclusions, dark grain aggregates; Texture Type I, very fine sand to coarse silt, 2.0, 3.5–3.0 phi; .89–.75 sphericity, average .81; .1–.6 roundness, average .4; .50 sorting
Material color: 10YR7/4 grayish orange
Axial length: 41.9 mm(inc.)
Max width: 21.5 mm
Max thickness: 6.8 mm
Wt.: 6.9 g
Blade shape: Contracting-ovate; 22.6 mm long; 19.9 mm wide
Longitudinal section: Biconvex
Transverse section: Biconvex
Description of flake scars: Reworked, primary scars obscured; retouching unifacial-bilateral, concoidal and continuous
Base: Straight; bifacial thinning flakes, grinding present along entire base; even; 15.6 mm wide
Shoulder: Absent
Haft: Lateral-base, straight, grinding present
Tang: Contracting; straight proximal-lateral edge; entire length of lateral edges are ground; 19.2 mm long; 21.5 mm wide
Additional comments: Extreme tip missing, probably an impact fracture; reworked. Edge sinuous with step flaking and light smoothing. Base is ground and very well rounded.
Illustration: Figure 4.11a

Tool type and no.: Projectile point fragment 89-88-0005
Site/provenience: 39LA117 surface
Special provenience: Approx. 80 m northeast of FH26 along dirt trail

Level/depth: Surface
Collection: 1987 revisit of 1984 Vanocker Survey site
Time period/classification: Early Plains Archaic(?)/unnamed local side-notched type
Material type: Chert. Opaque; mat luster; no fluorescence; concoidal fracture; many silica inclusions (cortex), chert in middle, vugs; cherty cortex
Material color: Interior 10YR6/6 dark yellowish orange, exterior 10YR8/6 pale yellowish orange
Axial length: NA
Max width: NA
Max thickness: NA
Wt.: 7.2 g
Blade shape: NA
Longitudinal section: NA
Transverse section: Biconvex?
Description of flake scars: Primary scars massive, flat, expanding and on the external face only; secondary scars angular expanding, pattern clustered and bifacial bilateral
Base: Subconcave, small thinning flakes removed from both faces, grinding present along entire base, even base, one "ear" missing
Shoulder: Non-barbed, straight; 27.9, width
Haft: Lateral-lateral, obtuse-circular notch, small primary scars, ground, asymmetrical; notch 10.4 mm long
Tang: Parallel-expanding, "ears" are ground
Additional comments: Large, blocky, point fragment with upper portion of the blade missing and a corner of one "ear" on base missing. Edge is sinuous with step fractures in the concavities along the edge. Appears to be a local Early Plains Archaic side-notched type comparable to EPA points from LoDaisKa and Mummy Cave.
Illustration: Figure 4.11i

Tool type and no.: Projectile point fragment 89-88-0007
Site/provenience: 39LA117 surface
Special provenience: Found in trail east of FH26
Level/depth: Surface
Collection: 1988 Vanocker Mitigation surface collection
Time period/classification: Middle Plains Archaic/McKean Hanna
Material type: Chert. Opaque, mat luster; no fluorescence; fair quality, concoidal fracture; surface pocked by small vugs; speckles and stripes of silica
Material color: 5Y6/1 light olive gray
Axial length: NA
Max width: 19.8 mm(inc)
Max thickness: 5.9 mm(inc)
Wt.: 3.6 g
Blade shape: Lower portion straight; 19.8 mm(incomplete) wide
Longitudinal section: Biconvex

Transverse section: Planoconvex
Description of flake scars: Primary scars obscured; secondary scars concoidal, bifacial-unilateral and continuous
Base: Irregular base with slight indentation in middle; not ground; appears complete; 14.6 mm wide
Shoulder: Broken off on both sides
Haft: Probably slightly convex, basal juncture
Tang: Nearly parallel, slightly expanding near base; 5.0 mm long (?); 12.6 mm wide (?)
Additional comments: Broken while in trail; three fragments. Quartz vein probably caused tip to break. Edge sinuous, with irregularly occurring step-fractures and light smoothing.
Illustration: Figure 4.12d

Tool type and no.: Projectile point fragment 89-88-2
Site/provenience: 39LA117 70S/14W
Level/depth: 33-x-33-x-20-cm shovel test
Collection: 1988 Vanocker Mitigation shovel testing
Time period/classification: Late Paleoindian/lanceolate similar to Hell Gap and Angostura types
Material type: Quartzite, probably Fall River Formation. Opaque; granular mat luster; no fluorescence; fair quality; subconcoidal fracture; varicolored inclusions, gray areas with large amount of white cement; Texture Type II; fine-very fine sand grain size, 2.0–3.0 phi; .85– .57 sphericity, average .71; .2–.5 roundness, average .3; .50 sorting
Material color: N6 (medium light gray); 10R4/2, 4/6, 3/4 (reds/browns); 5YR-3/2, 3/4, 4/4, 5/6 (browns)
Axial length: NA
Max width: 19.9 mm
Max thickness: 5.7 mm
Wt.: 4.5 g
Blade shape: Unknown; 19.9 mm side (incomplete)
Longitudinal section: Possibly excurvate
Transverse section: Possibly biconvex
Description of flake scars: Primary scars obscured, secondary scars expanding, bifacial-bilateral and continuous
Base: Straight, except for a small fragment missing at the lateral-base juncture; some basal thinning apparent; grinding not definitely apparent; 12.4 mm wide (incomplete)
Shoulder: Absent
Haft: Lateral-base juncture, no medial points between the two junctures
Tang: Contracting, straight, ground lateral edges; 14.0 mm long; 16.3 mm wide
Additional comments: Impact fracture at a point along the blade element; a small corner of the base is also missing; base may be reworked. Edge sinuous and fairly sharp; no step fractures.
Illustration: Figure 4.11b

Tool type and no.: Projectile point fragment 89-88-3
Site/provenience: 39LA117 near 18W/33S
Level/depth: 8–12 cm b.s.
Collection: 1988 Vanocker Mitigation grader cut
Time period/classification: Middle Plains Archaic/McKean Duncan or Hanna
Material type: Chert. Translucent, semi-vitreous luster, no fluorescence; good quality, concoidal fracture; very siliceous
Material color: 5Y6/1 light olive gray
Axial length: NA
Max width: NA
Max thickness: NA
Wt.: 0.8 g
Blade shape: Unknown
Longitudinal section: Unknown
Transverse section: Unknown
Description of flake scars: Unknown
Base: Uneven to nearly straight, grinding present, bifacially thinned; 15.1 mm wide
Shoulder: May have been barbed, concave
Haft: Lateral-basal juncture(?), grinding present
Tang: Parallel-expanding edges(?); 9.0 mm long?; 11.9 mm wide
Additional comments: Hinge fracture occurs just above the tang/blade juncture. Sides of base are ground with crushing and step flaking; basal edge is unground.
Illustration: Figure 4.12c

Tool type and no.: Projectile point 89-88-226
Site/provenience: 39LA117 4–4.5S/47–48W
Level/depth: 10–15 cm b.s.
Collection: 1988 Vanocker Mitigation grader cut
Time period/classification: Late Plains Archaic/Avonlea or Besant variant
Material type: Chert. Translucent, semimat luster; no fluorescence; good quality; concoidal fracture; includes a few brown speckles
Material color: 5YR7/2 grayish orange pink
Axial length: 24.0 mm (inc)
Max width: 13.6 mm (inc) *Max thickness*: 3.3 mm
Wt.: 1.1 g
Blade shape: Triangular' 20.7 mm(incomplete) long; 13.6 mm(inc) wide
Longitudinal section: Biconvex
Transverse section: Biconvex
Description of flake scars: Primary scars diminutive, flat, expanding, and bificial; secondary scars expanding, bilateral; bifacial and patterned scar clusters
Base: Subconcave, even, ground, thinned bifacially; 13.3 mm wide
Shoulder: Non-barbed, straight outline; 13.4 mm (inc)
Haft: Lateral-lateral juncture (?); 3.5 mm long
Tang: Parallel-expanding, rounded "ears"; 4.7 mm long; 11.7 mm wide
Additional comments: Alternately beveled edges occur on the blade; may be

reworked; only one notch is complete. Edges appear reworked; some areas of edge have more smoothing and step flaking. Base has prominent step flaking and crushing caused by grinding.
Illustration: Figure 4.12a

Tool type and no.: Projectile point fragment 89-88-227
Site/provenience: 39LA117 near 32S/16W
Level/depth: Unknown
Collection: 1988 Vanocker Mitigation grader cut
Time period/classification: Middle Plains Archaic?/McKean Duncan?
Material type: Silicified sediment, Tongue River or Morrison Formation. Opaque; glassy granular luster; no fluorescence; good quality; sub-concoidal; mottled inclusions; Texture Type II; very fine to fine sand grain size, 2.5–3.5 phi; .89–.59 sphericity, average .73; .6–.4 roundness, average .4; .35 sorting
Material color: 5R6/2 pale red and 10YR7/4 grayish orange
Axial length: NA
Max width: NA
Max thickness: NA
Wt.: 1.1 g
Blade shape: Snapped off just above the tang
Longitudinal section: Unknown
Transverse section: Unknown
Description of flake scars: Unknown
Base: Subconcave, asymmetrical, thinned bifacially, uneven, not ground; 13.6 mm wide
Shoulder: Unknown
Haft: Possibly lateral-base juncture; grinding present
Tang: Straight to slightly convex, nearly parallel edges; ground; 1.0 mm long; 13.8 mm wide
Additional comments: Hinge fracture seems to occur just above tang; no blade portion intact; base is unground; sides are ground and exhibit step-flaking.
Illustration: Figure 4.12b

Tool type and no.: Projectile point preform 89-88-228
Site/provenience: 39LA117 approx. 35 m west-southwest of 0/0
Level/depth: Unknown
Collection: 1988 Vanocker Mitigation grader cut
Time period/classification: Early Plains Archaic?/unnamed local side-notched type
Material type: Silicified siltstone, Tongue River Formation. Opaque; mat luster; no fluorescence; good quality; concoidal fracture; mottled; lightly speckled with red spots; Texture Type I; coarse silt grain size, 4.0– 4.5 phi; .89–.59 sphericity, average .73; .7–.4 roundness, average .4; 0.0 sorting
Material color: 5Y7/2 yellowish gray
Axial length: 61.3 mm
Max width: 26.9 mm
Max thickness: 9.5 mm

Wt.: 19.7 g
Blade shape: Ovate, quite irregular on one lateral edge; 43.6 mm long; 26.9 mm wide
Longitudinal section: Biconvex
Transverse section: Convexo-triangular
Description of flake scars: Primary scars massive, deep, expanding and on the external face only; no secondary scars; edge smoothing present
Base: Concave base, bifacially thinned, grinding present, has "ears" that are straight and form nearly right angles between base and proximal juncture; 25.0 mm wide
Shoulder: Non-barbed, straight; 26.3 mm wide
Haft: Lateral-lateral juncture; grinding present; notch 17.0 mm long
Tang: Contracting-expanding; grinding present; 17.2 mm long; 20.9 mm wide
Additional comments: May be a hafted knife, rather than a projectile point preform. Tip very blunt but sides unworn; no secondary flaking. Appears to be a local variant of Early Plains Archaic side-notched points comparable to EPA types from Wilbur-Thomas Rock Shelter (Benedict and Olson 1978).
Illustration: Figure 4.11j

Tool type and no.: Projectile point fragment 89-88-229
Site/provenience: 39LA117 near 46W/30S
Level/depth: Unknown
Collection: 1988 Vanocker Mitigation grader cut
Time period/classification: Late Plains Archaic/Pelican Lake variant
Material type: Chert. Semi-opaque; semimat luster; no fluorescence; good quality; concoidal fracture; mottled inclusions
Material color: 5YR4/1 brownish gray and 10R8/2 grayish orange pink
Axial length: NA
Max width: 19.9
Max thickness: 4.1 mm
Wt.: 1.5 g
Blade shape: Triangular; 19.9 mm wide
Longitudinal section: NA
Transverse section: Biconvex
Description of flake scars: Primary scars obscured; secondary scars smooth, lamellar, unifacial-unilateral, concoidal, continuous
Base: Straight, bifacially thinned, grinding absent
Shoulder: Barbed, straight; one flake probably removed by the grader; 19.9 mm wide
Haft: Probably lateral-basal juncture, thinned corner-notched
Tang: Contracting-expanding proximal points of base are snapped off, probably by the grader; 4.7 mm long; 10.5 wide
Additional comments: Distal portion of blade is snapped off. Edge is straight with bifacial step-flaking; no grinding; shoulder flake and broken "ears" look fresh, probably caused by grader.
Illustration: Figure 14.12l

Tool type and no.: Projectile point 89-88-302
Site/provenience: 39LA117 XU1, 8S/42W
Special provenience: 8.04S/42.89W
Level/depth: Level 4, 32 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Time period/classification: Late Plains Archaic/Besant variant
Material type: Quartzite, probably Fall River Formation. Opaque; light, granular luster; good quality; subconcoidal fracture; small white grain inclusions; Texture Type II; fine-sand grain size, 2.5–2.0 phi; .95-.73 sphericity, average .79; .8-.6 roundness, average .4; .35 sorting.
Material color: 5R2/6 very dark red
Axial length: 29.3 mm
Max width: 18.2 mm
Max thickness: 4.9 mm
Wt.: 3.2 g
Blade shape: Parallel-ovate; 23.7 mm long; 18.2 mm wide
Longitudinal section: Biconvex
Transverse section: Biconvex
Description of flake scars: Primary scars diminutive, deep, expanding, and bifacial; secondary flakes angular, expanding, alternating face-bilateral and continuous
Base: Subconcave, bifacially thinned, grinding probably present, straight to slightly rounded ears; 15.6 mm wide
Shoulder: Non-barbed, straight to slightly angled; 17.9 mm wide
Haft: Lateral-basal juncture, grinding present, notches 3.5-3.7 mm long
Tang: Expanding; 5.4 mm long; 14.1 mm wide
Additional comments: Small trowel nick at juncture of tip and lateral edge; tip is blunted, rounded and smoothed; edges sharp and sinuous; some step-fractures from manufacture; notches are ground; base is unground.
Illustration: Figure 4.12j

Tool type and no.: Projectile point fragment 89-88-521
Site/provenience: 39LA117 XU3, 8S43W
Level/depth: Level 4, upper half, 40-45 cm b.d.
Collection: Recovered in lab from 1/16" waterscreen sample, 1988 Vanocker Mitigation excavation
Time period/classification: Middle Plains Archaic/McKean Duncan
Material type: Quartzite, probably Lakota Formation. Opaque; granular luster; no fluorescence; fair quality; subconcoidal fracture; includes black flecks, with loose, almost crumbly texture; Texture Type I; fine sand grain size, 2.0–2.5 phi; .89–.77 sphericity, average .83; .4– .7 roundness, average.4; .35 sorting
Material color: N9 (white) with flecks of N1 (black)
Axial length: NA
Max width: NA
Max thickness: NA
Wt.: 0.7 g

Blade shape: NA
Longitudinal section: NA
Transverse section: Planoconvex (for this fragment)
Description of flake scars: NA
Base: Subconcave, uneven, bifacially thinned; grinding absent; right angled juncture between basal edge and proximal edge of tang; width 12.7 mm
Shoulder: NA
Haft: Grinding present along entire edge, nearly parallel to slightly expanding; notch length 18.5 mm
Tang: Expanding-contracting; entire edge modified; length 18.5 mm; width 12.4 mm
Additional comments: Blade is snapped off at the proximal end, just above the tang.
Illustration: Figure 4.12a

Tool type and no.: Projectile point 89-88-623 and 89-88-1656
Site/provenience: 39LA117 XU38, 10S/43W, and XU4, 9S/43W
Level/depth: 27–30 cm b.d.; 0–30 cm b.s.
Collection: 1988 Vanocker Mitigation excavation
Time period/classification: Middle Plains Archaic/McKean Hanna
Material type: Quartzite, probably Fall River Formation. Opaque; no fluorescence; granular luster; good quality; concoidal fracture; includes white and black grains; Texture Type II; fine sand grain size, 2.5–2.0 phi; 95–.81 sphericity, average .87; .4–.9 roundness, average .5; .35 sorting
Material color: 5R2/2 blackish red
Axial length: 34.4 mm
Max width: 17.3 mm
Max thickness: 3.5 mm
Wt.: 2.5 g
Blade shape: Ovate; 33.1 mm long; 17.3 mm wide
Longitudinal section: Planoconvex
Transverse section: Biconvex
Description of flake scars: Primary scars diminutive, flat, and lamellar and bifacial; secondary scars continuous, concoidal, and bifacial-bilateral
Base: Concave, flat ears, basally ground, thinned (bifacially?) incurvate, 16.7 mm wide
Shoulder: Non-barbed, concave, sloping; 17.3 mm wide
Haft: Lateral-lateral juncture, grinding present; notch 3.6 mm long
Tang: Contracting-expanding; proximal point-basal juncture not ground; 5.5 mm long; 15.2 mm wide
Additional comments: Very tip of blade is missing, probably lost on impact. Edge is sinuous, step-fractured, may have been reworked on some portions; notches are ground; base is unground.
Illustration: Figure 4.12g

Tool type and no.: Projectile point fragment 89-88-1075, 89-88-1654, and 89-88-1136

Site/provenience: 39LA117 XU18, 10S/42W, and XU38, 10S/43W
Level/depth: 35–45 cm b.d.; Level 5, 40–45 cm b.d.
Collection: 1988 Vanocker Mitigation excavation waterscreen samples and excavation
Time period/classification: Indeterminate
Material type: Chert. Opaque; mat luster; no fluorescence; fair quality; concoidal fracture; mottled, chalky inclusions
Material color: 10R4/2 grayish red
Axial length: NA
Max width: NA
Max thickness: NA
Wt.: 2.0 g
Blade shape: NA
Longitudinal section: NA
Transverse section: Possibly biconvex
Description of flake scars: Primary scars obscured; secondary scars smooth, lamellar, unifacial unilateral, continuous
Base: Rectangular, unnotched, unstemmed; unground
Shoulder: NA
Haft: NA
Tang: NA
Additional comments: Three fragments reattached. The point shows evidence of pot-lid fractures with slight luster, sugary texture, and crazing indicating unintentional thermal alteration, which caused at least some of the breakage of this point. Blade is snapped off and the correct orientation of the specimen was difficult to determine. Edge is only faintly sinuous with fine flaking. Edge is sharp, not worn; portions of edges are thinned; base in unground.
Illustration: Figure 4.11c

Tool type and no.: Projectile point fragment 89-88-1076
Site/provenience: 39LA117 XU18, 10S/42W
Level/depth: 30–35 cm b.d.
Collection: 1988 Vanocker Mitigation excavation waterscreen samples
Time period/classification: Indeterminate
Material type: Chalcedony. Translucent with opaque patina; light green fluorescence; mat to semimat luster; good quality; concoidal fracture; unknown formation, not Knife River
Material color: 5YR2/2 dusky brown
Axial length: NA
Max width: NA
Max thickness: NA
Wt.: 0.1 g
Blade shape: NA
Longitudinal section: Possibly biconvex
Transverse section: Possibly biconvex
Description of flake scars: Secondary scars on tip angular, expanding, bifacial-

unilateral continuous and bifacial-unilateral discontinuous; primary scars obscured
Base: NA
Shoulder: NA
Haft: NA
Tang: NA
Additional comments: Only tip is present; tip is lightly blunted; edge lightly sinuous; unfinished, possibly broken during manufacture

Tool type and no.: Projectile point 89-88-1146
Site/provenience: 39LA117 XU19, 20S/38W
Special provenience: 20.55S/38.58W
Level/depth: Level 2, 17 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Time period/classification: Middle Plains Archaic/McKean Duncan or Hanna variant
Material type: Chert. Opaque; semimat luster; no fluorescence; good quality; concoidal fracture; includes a few brown speckles
Material color: N7 light gray
Axial length: 19.7 mm
Max width: 17.8 mm
Max thickness: 3.8 mm
Wt.: 1.6 g
Blade shape: Excurvate-incurvate; 16.3 mm long; 17.8 mm wide
Longitudinal section: Planoconvex
Transverse section: Planoconvex
Description of flake scars: Reworked; primary scars obscured; secondary scars roughly concoidal, discontinuous
Base: Subconcave, bifacially thinned, rounded "ears", ears and base are unground; 14.6 mm wide
Shoulder: Non-barbed, straight, asymmetrical 17.0 mm wide
Haft: Lateral-lateral; juncture (side-notch) asymmetrical; notch 2.6 mm long
Tang: Expanding, flake removed from alternately opposed edges of notches; 3.7 mm long; 13.2 mm wide
Additional comments: Appears to have been broken at the tip during manufacture, then discarded after some attempt to rework the tip; probably represents a reworked Hanna or other McKean complex type.
Illustration: Figure 4.12e

Tool type and no.: Projectile point 89-88-1330
Site/provenience: 39LA117 XU25, 34S/18W
Special provenience: 34.28S/18.33W
Level/depth: Level 2, 17–22 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Time period/classification: Middle Plains Archaic/McKean lanceolate
Material type: Silicified siltstone, probably Morrison Formation. Opaque; granular luster; no fluorescence; good quality; concoidal fracture; includes some

quartz grains and some black grains; Texture Type I; silt grain size <4.0 phi; .79–.45 sphericity, average .65; .4–.6 roundness, average .4; .50 sorting
Material color: 10YR7/4 grayish orange, N7 light gray, 5R4/2 grayish red, 5R6/2 pale red
Axial length: 41.7 mm (inc)
Max width: 16.2 mm *Max thickness*: 5.7 mm
Wt.: 4.4 g
Blade shape: Excurvate; 33.5 mm long; 16.2 mm wide
Longitudinal section: Asymmetrically biconvex
Transverse section: Biconvex proximal end; planoconvex distal end
Description of flake scars: Primary scars obscured; secondary scars concoidal, bifacial-bilateral and continuous.
Base: Subconcave with rounded "ears"; bifacially thinned; 12.5 mm wide; not ground?
Shoulder: Non-barbed, concave; 15.0 mm wide
Haft: Lateral-basal juncture; notches 1.0 mm long
Tang: Contracting, straight; 1.0 mm long; 12.2 mm wide
Additional comments: Tip is missing, possibly broken during excavation; edges are strongly sinuous, probably reworked; "ears" are ground; step-flaking along sides; crushing near tip. This specimen is similar to the Late Paleoindian Lovell Constricted point type, but is smaller and lacks the parallel-oblique flaking expected for that type; it probably is a local variant of the McKean lanceolate type.
Illustration: Figure 4.12f

Tool type and no.: Projectile point or biface fragment 89-88-1337
Site/provenience: 39LA117 XU26, 16S/50W
Level/depth: Level 1, 0–10 cm b.d.
Collection: 1988 Vanocker Mitigation excavation waterscreen samples
Time period/classification: Indeterminate
Material type: Plate chalcedony, White River Badlands Oligocene. Transparent; glassy luster; bright lime green fluorescence; good quality; concoidal fracture; a few dark brown inclusions; a small piece of cortex remains on one side
Material color: Clear
Axial length: NA
Max width: NA
Max thickness: NA
Wt.: 0.9 g
Blade shape: NA
Longitudinal section: Plano
Transverse section: Biconvex
Description of flake scars: Reworked lateral edge; secondary scars on unreworked edge concoidal, bifacial-unilateral, continuous
Base: NA
Shoulder: NA
Haft: NA

Tang: NA
Additional comments: Only distal portion of blade has been found. May represent either a biface knife or a projectile point. Unreworked edge exhibits rounding and step-flaking. Reworked edge has much less rounding and less step-flaking.
Illustration: Figure 4.12i

Tool type and no.: Projectile point fragment 89-88-1380
Site/provenience: 39LA117 XU 28, 15.5S/50W
Special provenience: 15.56S/50.41W
Level/depth: Level 1, 3 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Time period/classification: Indeterminate
Material type: Plate chalcedony, White River Badlands. Transparent; glassy luster; bright lime green fluorescence; good quality; concoidal fracture; cortex remains on both sides
Material color: Clear
Axial length: NA
Max width: NA
Max thickness: NA
Wt.: 2.2 g
Blade shape: NA
Longitudinal section: Biplano
Transverse section: Biconvex
Description of flake scars: Primary scars obscured; secondary scars concoidal, possibly bifacial bilateral, possible continuous (obscured by wear)
Base: NA
Shoulder: NA
Haft: NA
Tang: NA
Additional comments: Only blade portion found, broken at midsection and extreme tip; reworked; well rounded on sides near tip; heavy step flaking; tip blunted, tip edge sharper than immediate sides
Illustration: Figure 4.12h

Tool type and no.: Projectile point fragment 89-88-1482
Site/provenience: 39LA117 XU32, 67S/11W
Special provenience: 67.27S/11.47W
Level/depth: Level 1, 16 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Time period/classification: Early Plains Archaic/Hawken variant
Material type: Porcellanite. Opaque; no fluorescence; mat luster; fair quality; shaley to concoidal fracture; few white silica grain inclusions under magnification, darker black platey inclusions; area on one side contains visible quartz?, plagioclase, and biotite
Material color: 5YR3/2 grayish brown to 10YR2/2 dusky yellowish brown
Axial length: NA

Max width: NA
Max thickness: NA
Wt.: 1.3 g
Blade shape: NA
Longitudinal section: NA
Transverse section: Biplano?
Description of flake scars: NA
Base: Possibly subconvex; base edge irregular; square, ground “ears”
Shoulder: Non-barbed, straight
Haft: Right-angled; bifacially thinned notch, possibly ground; lateral-lateral juncture; notch 4.5 mm long, 1.8 mm deep
Tang: Expanding, grinding present
Additional comments: Projectile point or biface fragment; broken above shoulder; one side with notch fairly intact; corner of base is missing; shoulder remnant is thick and ground; notch is ground; “ear” appears ground, incomplete
Illustration: Figure 4.11d

Tool type and no.: Projectile point fragment 89-88-20
Site/provenience: 39LA117 backdirt from geomorph trench west of road
Special provenience:
Level/depth: unknown
Collection: Recovered 6-13-92
Time period/classification: unknown, possibly Early Plains Archaic
Material type: Porcellanite.
Material color: 10 R 5/2, pale grayish red
Axial length: NA
Max width: 23.2 mm
Max thickness: 6.0 mm
Wt.: 9.1 g
Blade shape: Orate
Longitudinal section: Biconvex
Transverse section: Biconvex
Description of flake scars: Primary scars obscured, secondary scars concoidal, bifacial-bilateral and continuous
Base: Subconvex, base edge irregular; ground “ears”
Shoulder: Barbed, Concave
Haft: Lateral-basal juncture, biacute angle; notch 8.0 mm long, 4.5 mm deep
Tang: Contracting-expanding, unground
Additional comments: Blade tip missing, may be manufacturing error
Illustration: Figure 4.11e

Tool type and no.: Biface or projectile point fragment 77-325-0001-1
Site/provenience: 39LA117 surface
Special provenience: 39.85 m southeast of datum
Level/depth: Surface
Collection: 1977 Kelly Timber Sale surface collection
Material type: Quartzite, Deadwood Formation. Opaque; very glassy granular

luster; no fluorescence; good quality; subconcoidal fracture; small inclusions of dark red in clear cement; Texture Type III; indeterminate grain size
Material color: 5R4/2 grayish red
Axial length: 12.0 mm
Max width: 20.9 mm
Max thickness: 4.4 mm
Wt.: 2.5 g
Tool type and description: Rectangular biface fragment; ends terminate in snap fractures; most of lateral edges broken away; remnant edge exhibits bifacial flaking; no evidence of use wear; may be a projectile point base.

Tool type and no.: Bifacial knife 77-325-0001-2
Site/provenience: 39LA117 surface
Special provenience: 13 m north-northwest of datum
Level/depth: Surface
Collection: 1977 Kelly Timber Sale surface collection
Material type: Quartzite, Lakota Formation. Opaque; granular; no fluorescence; good quality; subconcoidal fracture; Texture Type I; medium sand grain size, 1.0– 2.0 phi; .89–.75 sphericity, average .5; .35 sorting
Material color: 5R3/4 dusky red
Axial length: 33.5 mm
Max width: 20.2 mm
Max thickness: 7.1 mm
Wt.: 6.3 g
Tool type and description: Biface knife base; base and midsection only; tip missing; ovate; longitudinal section excurvate; transverse section biconvex. Edge sinuous, slightly rounded. Secondary flake scars concoidal, bifacial-bilateral and continuous. Moderate smoothing on one edge, other lateral edges are sharp, possibly retouched. Some heat alteration.

Tool type and no.: Preform 77-325-0001-3
Site/provenience: 39LA117 surface
Special provenience: 13.25 m east-northeast of datum
Level/depth: Surface
Collection: 1977 Kelly Timber Sale surface collection
Material type: Chert. Opaque; mat luster; no fluorescence; good quality; concoidal fracture; faint yellow banding and hair-thin silica veins
Material color: 5YR8/1 pinkish gray and 5Y8/1 yellowish gray
Axial length: 46.3 mm
Max width: 29.2 mm
Max thickness: 10.9 mm
Wt.: 16.4 g
Tool type and description: Ovate, bifacially flaked preform showing no edge wear. Manufacturing did not progress far enough to indicate final tool form. Biconvex in cross-section.

Tool type and no.: Light retouched flake knife 77-325-0001-4
Site/provenience: 39LA117 surface

Level/depth: Surface
Collection: 1977 Kelly Timber Sale surface collection
Material type: Quartzite, probably Fall River Formation. Opaque; granular mat luster; no fluorescence; fair quality; subconcoidal fracture; irregular white quartz inclusions; medium sand grain size 1.5–2.0 phi; .95–.75 sphericity, average .89; .6–.9 roundness, average .6; .35 sorting
Material color: 5YR3/4 moderate brown
Axial length: 27.5 mm
Max width: 32.8 mm
Max thickness: 8.4 mm
Wt.: 10.2 g
Tool type and description: Oval, tertiary flake, size grade G2. Utilized along one straight edge. Edge exhibits nicking to deep, scalar removals. Adjacent edge appears lightly retouched; this edge is sharp, not utilized.

Tool type and no.: Chopper 78-534-0002-1
Site/provenience: 39LA117 surface
Level/depth: Surface
Collection: 1978 Kelly Timber Sale surface collection
Material type: Quartzite, Deadwood Formation. Opaque; granular mat luster; no fluorescence; fair quality; subconcoidal fracture; includes white quartz and glauconite grains and unidentified black mineral; Texture Type II; medium sand grain size, 1.5–1.0 phi; .45–.77 sphericity, average .77; .1–.4 roundness, average .4; .50 sorting
Material color: 5R2/2 blackish red
Axial length: 127.0 mm
Max width: 117.5 mm *Max thickness*: 37.9 mm
Wt.: 741.8 g
Tool type and description: Large chopper, squared off on two sides, rounded on two sides. Working edge bifacially flaked and retouched. Crushing and rounding on the working edge. Biconvex in cross-section.

Tool type and no.: Chopper/adze 78-534-0002-2
Site/provenience: 39LA117 surface
Level/depth: Surface
Collection: 1978 Kelly Timber Sale surface collection
Material type: Quartzite, Deadwood Formation. Opaque; granular mat luster; fair quality; subconcoidal; no fluorescence; includes grains of unidentified black mineral, white quartz, and glauconite; Texture Type II; medium sand grain size, 1.5–1.0 phi; .45–.77 sphericity, .77 average; .1–.4 roundness, average .4; .50 sorting
Material color: 5YR2/2 dusky brown
Axial length: 132.5 mm
Max width: 67.0 mm
Max thickness: 54.3 mm
Wt.: 467.8 g
Tool type and description: Chopper/adze (two edges). Marginally retouched on

one side of a lateral edge; flat facts occur on both corners of the working edge; thick and planoconvex in cross-section. Pronounced smoothing and rounding of working edge; step-flaking occurs along the edge.

Tool type and no.: Scraper/bifacial knife 84-580-02
Site/provenience: 39LA117 surface
Level/depth: Surface
Collection: 1984 Vanocker Survey surface collection
Material type: Chert. Opaque; mat luster; no fluorescence; good quality; concoidal fracture; siliceous inclusions in the form of N7 (light gray) bands
Material color: 5YR8/1 pinkish gray
Axial length: 33.7 mm
Max width: 44.7 mm
Max thickness: 6.7 mm
Wt.: 15.4 g
Tool type and description: Fragment with bifacial and unifacial retouch; ends terminate in snap fractures. The scraper/bifacial knife is unifacially retouched along one lateral edge and bifacially retouched along the other edge. Unifacial retouched edge is steeply beveled. Bifacially retouched edge slightly curved and strongly sinuous. Step-fractures in concavities. Smoothing and step-fractures on bifacial knife edge; scraper edges smoothed, with large step-fractures.
Illustrations: Figure 4.13c

Tool type and no.: Sidescraper 84-580-03
Site/provenience: 39LA117 surface
Level/depth: Surface
Collection: 1984 Vanocker Survey surface collection
Material type: Chert. Opaque; mat luster; no fluorescence; good quality; concoidal fracture; pale yellowish orange bands and streaks and spots of iron oxide
Material color: 5Y8/1 yellowish gray and 10YR8/6 pale yellowish orange
Axial length: 54.1 mm
Max width: 21.7 mm
Max thickness: 5.6 mm
Wt.: 6.7 g
Tool type and description: Sidescraper with bifacial retouching on a long lateral edge. Working edge straight and lightly sinuous. Edge exhibits pronounced smoothing and rounding.

Tool type and no.: Light retouched flake knife 84-580-04
Site/provenience: 39LA117 surface
Level/depth: Surface
Collection: 1984 Vanocker Survey surface collection
Material type: Chalcedony. Opaque; light green fluorescence; semimat luster; good quality; concoidal fracture
Material color: N7 light gray to 5Y8/1 yellowish gray
Axial length: 38.0 mm
Max width: 26.0 mm
Max thickness: 5.9 mm

Wt.: 3.5 g
Tool type and description: Retouched secondary decortication flake. Unifacial retouch along the concave lateral edge; triangular; concavo-convex in longitudinal section; working edge slightly curved. Use wear along the concave lateral edge and around a portion of the convex corner of the flake (ends in snap fracture). Edges smoothed, straight, except wavy near tip (bifacially retouched); feather-flaking.

Tool type and no.: Scraper fragment 84-580-05
Site/provenience: 39LA117 surface
Level/depth: Surface
Collection: 1984 Vanocker Survey surface collection
Material type: Chert. Opaque; mat luster; no fluorescence; good quality; concoidal fracture; faint pink and yellow bands
Material color: 10R7/4 moderate orange pink and 10YR8/2 very pale orange
Axial length: 15.3 mm
Max width: 14.3 mm
Max thickness: 5.0 mm
Wt.: 1.6 g
Tool type and description: Square secondary G3 decortication flake, originally a scraper. Edge utilized (nicked, feather-flaking).

Tool type and no.: Light retouched flake knife 84-580-06
Site/provenience: 39LA117 surface
Level/depth: Surface
Collection: 1984 Vanocker Survey surface collection
Material type: Silicified wood. Transparent to translucent; semimat luster; yellow fluorescence; good quality; good concoidal fracture; some banding
Material color: 5YR3/4 moderate brown
Axial length: 28.0 mm
Max width: 16.7 mm
Max thickness: 4.5 mm
Wt.: 2.5 g
Tool type and description: Triangular tertiary flake, unifacially retouched along one lateral edge. Edge is step-flaked.

Tool type and no.: Side-scraper 84-580-07
Site/provenience: 39LA117 surface
Level/depth: Surface
Collection: 1984 Vanocker Survey surface collection
Material type: Silicified wood. Transparent to translucent; semimat luster; yellow fluorescence; good quality; good concoidal fracture; some cloudy streaks and blebs
Material color: 5YR2/2 dusky brown
Axial length: 34.4 mm
Max width: 24.0 mm
Max thickness: 6.5 mm
Wt.: 6.5 g

Tool type and description: Rectangular tertiary flake, retouched along both lateral edges; both edges terminate in snap fractures; edge beveled. Step-flaking on retouched edges.

Tool type and no.: Biface fragment 84-580-6
Site/provenience: 39LA117 0N/15E
Level/depth: Unknown/shovel test
Collection: 1984 Vanocker Survey shovel testing
Material type: Quartzite, Lakota Formation. Opaque; granular luster; no fluorescence; fair quality; subconcoidal fracture; spotted and streaked, includes white quartz bleb in cement; Texture Type I; medium sand grain size, 2.0–2.5 phi; .87–.75 sphericity, average .79; .4–.9 roundness, average .4; .35 sorting
Material color: 10R5/4 pale red to 10R4/2 grayish red to 5R3/4 dusky red
Axial length: 22.8 mm
Max width: 20.2 mm
Max thickness: 6.7 mm
Wt.: 3.1 g
Tool type and description: Biface fragment. Biconvex in transverse and longitudinal sections; primary scars obscured, secondary scars concoidal, continuous, and bifacial-bilateral. One lateral edge exhibits breakage and unifacial retouching. Retouched edge exhibits no smoothing. Broken lateral edge exhibits moderate smoothing.

Tool type and no.: Perforator 89-88-0002
Site/provenience: 39LA117 surface
Level/depth: Surface
Collection: 1987 Vanocker Revisit surface collection
Material type: Silicified wood. Translucent; semimat luster; yellow fluorescence; good quality; good concoidal fracture; heavy white inclusions
Material color: 10YR8/2 very pale orange and 5B7/1 light bluish gray
Axial length: 14.4 mm
Max width: 8.0 mm
Max thickness: 3.3 mm
Wt.: 0.6 g
Tool type and description: Biface fragment (perforator midsection). Long parallel sides; edges terminate in snap fractures; biconvex in cross-section; edges bifacially flaked, straight; edges rounded and exhibit step-fractures.

Tool type and no.: Bifacial knife 89-88-0006
Site/provenience: 39LA117 surface
Level/depth: Surface
Collection: 1987 Vanocker Revisit surface collection
Material type: Quartzite, probably Lakota Formation. Translucent; glassy-granular luster; no fluorescence; fair quality; subconcoidal fracture; includes tiny crystal-filled vugs; Texture Type I; medium sand grain size, 1.0–2.0 phi; .95–.75 sphericity, average .79; .4–.8 roundness, average .4; .35 sorting
Material color: 10YR6/2 pale yellowish brown
Axial length: 69.1 mm

Max width: 28.0 mm
Max thickness: 9.0 mm
Wt.: 18.7 g
Tool type and description: Lanceolate biface; longitudinal section biconvex; transverse section biconvex; edge sinuous; secondary scars angular, expanding, in patterned clusters, and continuous. Edge smoothed.
Illustrations: Figure 4.13a

Tool type and no.: Side-scraper 89-88-0008
Site/provenience: 39LA117 surface
Special provenience: Found in trail above gate east of road
Level/depth: Surface
Collection: 1988 Vanocker Mitigation surface collection
Material type: Porcellanite, Fort Union Formation. Opaque; mat luster; no fluorescence; granular cortex with some quartz grains; good quality; concoidal fracture; relict bedding visible on one side
Material color: N1 black
Axial length: 50.6 mm
Max width: 30.0 mm
Max thickness: 10.6 mm
Wt.: 22.6 g
Tool type and description: Retouched and utilized flake. Elongate oval; plano-convex in longitudinal section; lateral edge unifacially retouched, steep, straight; secondary scars along edge are concoidal and continuous. Slight feather flaking; no edge smoothing. Unused or very lightly used.

Tool type and no.: Biface fragment 89-88-0009
Site/provenience: 39LA117 10S/20W (5m sq)
Level/depth: Surface
Collection: 1988 Vanocker Mitigation surface collection
Material type: Chert. Opaque; semi-vitreous luster; no fluorescence; good quality; good concoidal fracture; tan portion banded and speckled; purple portion speckled
Material color: 5RP4/2 grayish purple, 10YR5/4 moderate yellowish brown and 10YR8/2 very pale orange
Axial length: 35.0 mm
Max width: 44.3 mm
Max thickness: 12.6 mm
Wt.: 25.0 g
Tool type and description: Biface fragment. Snapped at “midsection”; semi-circular; biconvex in longitudinal and transverse sections; distal end edged by cortex; sides sinuous. Unused or lightly used; light smoothing on edges; rough first-stage biface.

Tool type and no.: Scraper/heavy retouched flake knife; 89-88-0010
Site/provenience: 39LA117 15S/15W (5m sq)
Special provenience: South edge of trail, just south of 10S/12W
Level/depth: Surface

Collection: 1988 Vanocker Mitigation surface collection
Material type: Chert. Opaque; mat luster; no fluorescence; good quality; concoidal fracture; limonite stains and tiny pockmarks; pale yellowish brown band
Material color: 10YR8/2 very pale orange and 10YR7/2 very pale yellowish brown band
Axial length: 35.5 mm
Max width: 39.6 mm
Max thickness: 4.4 mm
Wt.: 13.2 g
Tool type and description: Retouched and utilized biface. Ends terminate in snap fractures; rectangular; biplano in cross-section; entire tool concavo-convex; steep unifacial retouch along one edge; opposite edge bifacially retouched. Bifacial edge curved and sinuous; unifacial edge steep and straight; knife reworked as scraper. Scraper edge smoothed, exhibits step-fractures; knife edge has moderate smoothing.

Tool type and no.: Chopper 89-88-1
Site/provenience: 39LA117 30S/0W
Level/depth: Unknown
Collection: 1988 Vanocker Mitigation shovel testing
Material type: Quartzite, probably Fall River Formation. Opaque; mat-granular luster; no fluorescence; fair quality; blocky to subconcoidal fracture; white quartz cement cortex; Texture Type II; medium to fine sand grain size, 1.5–2.5 phi; .95–.77 sphericity; average .87; .4–.8 roundness, average .5; .35 sorting
Material color: 5YR4/4 moderate brown
Axial length: 76.6 mm
Max width: 59.5 mm
Max thickness: 28.1 mm
Wt.: 141.5 g
Tool type and description: Bifacial chopper. Bifacially flaked chopper with some cortex remaining on the dorsal and ventral surfaces. Biconvex in cross-section; ovate; flattened across the distal end. Working edge exhibits some hinge-flaking with rounding and some crushing.

Tool type and no.: Heavy retouched flake knife 89-88-4
Site/provenience: 39LA117 38S/30W
Level/depth: Unknown
Collection: 1988 Vanocker Mitigation shovel testing
Material type: Quartzite, probably Minnelusa Formation. Opaque; semimat granular luster; no fluorescence; good quality; subconcoidal fracture; multicolored with red edges; scattered, tiny black specks; Texture Type I; fine sand grain size, 1.5–2.0 phi; .95–.79 sphericity; average .89; .9–.4 roundness, average .6; .35 sorting
Material color: 10YR5/4 moderate yellowish brown and 5RP 4/2 grayish red purple
Axial length: 44.9 mm
Max width: 38.3 mm

Max thickness: 8.9 mm
Wt.: 18.9 g
Tool type and description: Retouched and utilized flake. Square; planoconvex in cross-section; retouching along one lateral edge. Edge sharp; little or no use wear visible.

Tool type and no.: Heavy retouched flake knife 89-88-5
Site/provenience: 39LA117 42S/32W
Level/depth: Unknown
Collection: 1988 Vanocker Mitigation shovel testing
Material type: Chert. Translucent; semimat luster; good quality; concoidal; no fluorescence; banded at base
Material color: 5RP8/2 pale pink and 10R6/2 pale red (bands)
Axial length: 24.7 mm
Max width: 27.7 mm
Max thickness: 6.3 mm
Wt.: 6.0 g
Tool type and description: Rectangular utilized and retouched flake. Ends terminate in snap fractures. Planoconvex in longitudinal section; unifacial-bilateral flaking along both straight lateral margins; both edges retouched; a portion of cortex remains. Edges exhibit step-flaking, hinge flaking, and pitting.

Tool type and no.: Biface fragment 89-88-6
Site/provenience: 39LA117 52S/32W
Level/depth: Unknown
Collection: 1988 Vanocker Mitigation shovel testing
Material type: Chert. Opaque; vitreous luster; no fluorescence; poor quality due to heat fracture; concoidal fracture; crazed from heating
Material color: 5R3/4 dusky red
Axial length: 30.2 mm
Max width: 41.9 mm
Max thickness: 12.8 mm
Wt.: 21.2 g
Tool type and description: Truncated oval section of biface. Heat-altered; snapped at midsection (probable); planoconvex in longitudinal and transverse sections; cracks/crazing on surface; a small section of unifacial retouching on lateral edge. Edges sharp; no evidence of use wear.

Tool type and no.: Bifacial knife fragment 89-88-7
Site/provenience: 39LA117 56S/32W
Level/depth: Unknown
Collection: 1988 Vanocker Mitigation shovel testing
Material type: Chert. Translucent; semimat luster; no fluorescence; good quality; concoidal fracture; includes faint yellow bands and blotches
Material color: 10YR8/2 very pale orange
Axial length: 20.9 mm
Max width: 25.0 mm
Max thickness: 7.8 mm

Wt.: 3.6 g
Tool type and description: Biface tip. Biconvex in longitudinal and transverse sections; edge sinuous; marginal retouching along one lateral edge; light to moderate smoothing on other edge.

Tool type and no.: Projectile point preform 89-88-8
Site/provenience: 39LA117 12S/34W
Level/depth: Unknown
Collection: 1988 Vanocker Mitigation shovel testing
Material type: Chalcedony. Transparent to translucent; semimat luster; light green fluorescence; poor quality because heavily fractured; subconcoidal fracture
Material color: N5 medium gray
Axial length: 21.0 mm
Max width: 19.1 mm
Max thickness: 3.4 mm
Wt.: 1.5 g
Tool type and description: Biface fragment, probably a projectile point preform. A portion of the base, shoulder, and tip broken away; blade triangular; shoulder form abrupt; corner-notched; straight blade form; planoconvex in transverse section; concavo-convex in longitudinal section. Appears to be a preform of a Late Plains Archaic Pelican Lake variant type.

Tool type and no.: Bifacial knife fragment 89-88-9
Site/provenience: 39LA117 2S/48W
Level/depth: Unknown
Collection: 1988 Vanocker Mitigation shovel testing
Material type: Chert. Opaque; semimat luster; no fluorescence; good quality; concoidal fracture; includes yellow, brown, and orange bands and spots; white corner
Material color: 5B7/1 light bluish gray and N7 light gray
Axial length: 29.3 mm
Max width: 23.1 mm
Max thickness: 6.3 mm
Wt.: 6.5.g
Tool type and description: Biface fragment. Rectangular; end terminates in snap fracture; irregular biconvex in cross-section; lateral edges sinuous. Lightly polished edge. Retouched except for a portion of a lateral edge showing light rounding; step-flaking occurs along the edge and is particularly noticeable on a short portion of opposite lateral edges. Lightly used cutting tool.

Tool type and no.: Light retouched flake knife 89-88-14
Site/provenience: 39LA117 22N/38W
Level/depth: Unknown
Collection: 1988 Vanocker Mitigation shovel testing
Material type: Silicified sediment, Tongue River Formation. Opaque; mat luster; no fluorescence; fair quality; subconcoidal to concoidal fracture; appears blotchy; Texture Type I; coarse silt grain size, 4.0– 4.5 phi; .89–.65 sphericity, average .65; .4–.1 roundness, average .2; 0.0 sorting

Material color: 5Y6/1 light olive gray
Axial length: 47.9 mm
Max width: 22.9 mm
Max thickness: 7.4 mm
Wt.: 6.6 g
Tool type and description: Retouched flake (two portions of one flake). Triangular flake broken in half by shovel. Small amount of unifacial retouching along portions of two lateral edges.

Tool type and no.: Utilized flake knife 89-88-15
Site/provenience: 39LA117 4S/40W
Level/depth: Unknown
Collection: 1988 Vanocker Mitigation shovel testing
Material type: Chert. Translucent; mat luster; no fluorescence; good quality; concoidal fracture; small vug on one side
Material color: 10YR7/4 grayish orange
Axial length: 34.0 mm
Max width: 22.23 mm
Max thickness: 3.2 mm
Wt.: 3.2 g
Tool type and description: Triangular tertiary flake with utilized longitudinal edge. Edge nicked with feather flaking; ventral surface exhibits striations or scratches perpendicular to the utilized edge.

Tool type and no.: Biface fragment 89-88-16
Site/provenience: 39LA117 12S/40W
Level/depth: Unknown
Collection: 1988 Vanocker Mitigation shovel testing
Material type: Silicified wood. Transparent to opaque; semimat luster; yellow fluorescence; good quality; concoidal fracture; mottled
Material color: 10YR6/2 pale yellowish brown to 10YR4/2 dark yellowish brown
Axial length: 23.8 mm
Max width: 20.0 mm
Max thickness: 4.8 mm
Wt.: 3.2 g
Tool type and description: Unretouched bifacial thinning flake. Snap fracture at midsection; triangular, originally ovate; concave-convex in longitudinal section. Not utilized after struck from the biface.

Tool type and no.: Unused tool fragment 89-88-72
Site/provenience: 39LA117 6N/20W
Level/depth: Unknown
Collection: 1988 Vanocker Mitigation shovel testing
Material type: Silicified sediment. Heat-treated.
Material color: N7 light gray and N6 medium light gray
Axial length: 23.4 mm
Max width: NA
Max thickness: 0.58?mm

Wt.: 9 g
Tool type and description: Unused tool fragment, possibly from a preform broken during manufacture. Oval to lanceolate, G3 flake; some step flaking caused by manufacture; edges unworn.

Tool type and no.: Light retouched flake knife 89-88-82 and 89-88-83
Site/provenience: 39LA117 56S/32W
Level/depth: Unknown
Collection: 1988 Vanocker Mitigation shovel testing
Material type: Silicified wood.
Material color: 10YR5/4 moderate yellowish brown and 10YR4/2 dark yellowish brown
Axial length: 43.3 mm
Max width: 22.2 mm
Max thickness: 0.5 mm
Wt.: 3.3 g
Tool type and description: Light retouched flake knife, fits with 89-88-83. Utilized flake with parallel sides and pointed ends. Some hinge flaking; noticeable feather-flaking; feather-flaking most prominent along one edge; some on both surfaces; hinge flaking indicates some sawing motion; edge shows light smoothing and polish.

Tool type and no.: Light scraper fragment 89-88-197
Site/provenience: 39LA117 26S/48W
Level/depth: Unknown
Collection: 1988 Vanocker Mitigation shovel testing
Material type:
Material color: N6 medium light gray; 10R7/4 moderate orange pink
Axial length: 0.9 mm
Max width: 15.2 mm
Max thickness: 1.4 mm
Wt.: 0.2 g
Tool type and description: G3 flake fragment from a light scraper. Unifacial retouching along a portion of one edge; light retouched on the remaining portion of the edge; lightly retouched portion is not beveled and has fairly steep edge; retouched edge is beveled and has small step fractures on dorsal surface; edge rounded and polished.

Tool type and no.: Retouched flake 89-88-197
Site/provenience: 39LA117 26S/48W
Level/depth: Unknown
Collection: 1988 Vanocker Mitigation shovel testing
Material type: Chert.
Material color: 10R7/4 moderate orange pink; 10R6/2 pale red; 5R4/6 moderate red speckles
Axial length: 14.3 mm
Max width: 17.3 mm
Max thickness: 2.1 mm

Wt.: 0.7 g
Tool type and description: Retouched G3 flake. A small portion of one edge exhibits unifacial retouch; edge steep; no evidence of use wear, probably broken during manufacture.

Tool type and no.: Sidescraper 89-88-200
Site/provenience: 39LA117 16N/48W
Level/depth: Unknown
Collection: 1988 Vanocker Mitigation shovel testing
Material type: Silicified sediment.
Material color: N6 medium light gray and N7.5 light gray
Axial length: 24.7 mm
Max width: 18.1 mm *Max thickness*: 6.5 mm
Wt.: 2.5 g
Tool type and description: Flake utilized as a sidescraper. Oval G2 flake; two adjacent edges unifacially beveled. Edge rounded and smoothed; lightly used.

Tool type and no.: Side-scraper 89-88-230
Site/provenience: 39LA117
Special provenience: Near 0W/28S, adjacent to trail
Level/depth: Unknown
Collection: 1988 Vanocker Mitigation grading
Material type: Chert. Translucent; semimat; no fluorescence; good quality; concoidal fracture; mottled and speckled red
Material color: 5YR8/1 pinkish gray to 10R6/2 pale red to 10R6/6 moderate reddish orange
Axial length: 27.3 mm
Max width: 27.3 mm
Max thickness: 7.5 mm
Wt.: 7.4 g
Tool type and description: Retouched and utilized flake. Irregular ovate shape; planoconvex in longitudinal section. One lateral edge and top unifacially retouched, edge steep and straight, step-fractures and smoothing; opposite lateral edge nicked with a few feather flakes; edges have step fractures and light polish; scratches on ventral surface perpendicular to edge.

Tool type and no.: Keeled endscraper 89-88-231
Site/provenience: 39LA117 38W/14N (1x1m unit)
Special provenience: Loose in grader screening
Level/depth: Unknown
Collection: 1988 Vanocker Mitigation grading
Material type: Chert. Opaque; semimat luster; no fluorescence; good quality; concoidal fracture; includes vugs with calcite crystals and thin silica veins
Material color: 10R6/6 moderate reddish orange to 10YR5/4 moderate yellowish brown
Axial length: 51.4 mm
Max width: 31.1 mm
Max thickness: 13.0 mm

Wt.: 24.2 g
Tool type and description: Ovate retouched flake. Planoconvex in longitudinal and transverse cross-sections; distal end convex; unifacially retouched. Moderate smoothing; rounding; some noticeably stepped cross-sections on edge; some striations on ventral surface.
Illustration: Figure 4.13e

Tool type and no.: Heavy retouched flake knife 89-88-232
Site/provenience: 39LA117
Special provenience: Grader Cut Area A
Level/depth: Unknown
Collection: 1988 Vanocker Mitigation grading
Material type: Chalcedony. Transparent to translucent; semimat luster; light green fluorescence; poor quality due to numerous inclusions and vugs; rough or botyroidal chalcedony cortex
Material color: N2 grayish black to clear
Axial length: 53.7 mm
Max width: 33.9 mm
Max thickness: 10.2 mm
Wt.: 27.7 g
Tool type and description: Retouched and utilized flake. Rectangular; snap fracture along one short and one long edge; planotriangular in transverse section; planoconvex in longitudinal section; one corner rounded and beveled, unifacially retouched; opposite lateral edge unifacially retouched, lightly polished and rounded; beveled corner exhibits no use wear; lateral edge quite irregular, light smoothing.

Tool type and no.: Heavy retouched flake knife 89-88-233
Site/provenience: 39LA117
Special provenience: Grader cut near 26S/15W
Level/depth: Unknown
Collection: 1988 Vanocker Mitigation grading
Material type: Chert. Opaque; mat luster; light patina on one face; no fluorescence; fair quality; chalky texture, like porcellanite; concoidal fracture; includes speckles and brown stains
Material color: 5YR8/1 pinkish gray
Axial length: 48.2 mm
Max width: 27.9 mm
Max thickness: 7.6 mm
Wt.: 12.2 g
Tool type and description: Retouched and utilized flake, size grade G3. Elongate rectangular; concavo-convex in longitudinal section; striking platform at distal end; unifacial retouch along one curving lateral edge; other lateral edge utilized but not retouched. Retouched edge exhibits large step-flakes and smoothing; utilized edge has smoothing and feather-flaking.

Tool type and no.: Light scraper 89-88-249 and 89-88-251
Site/provenience: 39LA117 near 30S/40W

Level/depth: Unknown
Collection: 1988 Vanocker Mitigation grader cut
Material type: Chert.
Material color: 5RP6/2 pale red purple
Axial length: NA
Max width: 28.0 mm
Max thickness: 8.8 mm
Wt.: 6.2 g
Tool type and description: Two flakes that fit together, one used as a light scraper, the other bifacially retouched but exhibiting little wear. No. 249 is a G2 flake with unifacial retouching and numerous step flakes; edge broken along much of its length; edge is not sinuous. No. 251 is a G3 flake with sinuous, bifacially retouched edge with little or no wear. No. 251 was reworked after breaking off from No. 249. No. 249 was utilized only after No. 251 was broken off from it.

Tool type and no.: Light retouched flake knife 89-88-263
Site/provenience: 39LA117 15–16S/47–50W
Level/depth: Unknown
Collection: 1988 Vanocker Mitigation grader cut uncontrolled screenings
Material type: Chalcedony.
Material color: Clear; 5YR3/4 moderate brown; N3 dark gray; 5YR7/2 grayish orange pink
Axial length: 22.9 mm
Max width: 22.0 mm
Max thickness: 3.4 mm
Wt.: 2.3 g
Tool type and description: G3 Trapezoidal flake fragment used as a light retouched flake knife. One half of the utilized edge exhibits light retouch; some feather-flaking on the ventral edge; edge not sinuous; no step-flaking. Edge displays nicking on utilized/unretouched portion; retouched edge displays comminution.

Tool type and no.: Utilized flake knife 89-88-273
Site/provenience: 39LA117 28S/48–49W
Level/depth: Unknown
Collection: 1988 Vanocker Mitigation grader cut screenings
Material type: Chert.
Material color: N7 light gray and 5YR8/1 pinkish gray
Axial length: 15.2 mm
Max width: 15.2 mm
Max thickness: 3.3 mm
Wt.: 1.3 g
Tool type and description: G3 flake utilized as a knife. Feather-flaking along utilized edge; edge not sinuous. Edge is nicked and has light polish; little edge rounding; little use wear.

Tool type and no.: Sidescraper 89-88-290
Site/provenience: 39LA117 Grader cut, Area B
Level/depth: Unknown
Collection: 1988 Vanocker Mitigation grader cut
Material type: Chert.
Material color: N7 light gray; N9 white; N8 very light gray
Axial length: 14.4 mm
Max width: 20.0 mm
Max thickness: 3.4 mm
Wt.: 1.2 g
Tool type and description: G3 flake utilized as a sidescraper. Rounded retouched area with serration. Edge on either side of retouched area shows utilization; a portion of one utilized edge is broken away with remnant serration still visible; projections are 1 mm apart and appear too fine and on too small an edge to be a denticulate or shredder. One small feather-flake occurs between projections; polish and edge rounding of three other edges; some feather-flaking and step-flaking along dorsal edge of retouched edge; no visible striations.

Tool type and no.: Sidescraper 89-88-295
Site/provenience: 39LA117 SW of Unit 33
Level/depth: Unknown
Collection: 1988 Vanocker Mitigation grader cut
Material type: Chert.
Material color: N7 light gray; 5YR8/1 pinkish gray
Axial length: 15.6 mm
Max width: 16.2 mm
Max thickness: 2.4 mm
Wt.: 0.8 g
Tool type and description: G3 flake fragment utilized as a sidescraper. Retouched on one lateral edge with utilization on the opposite lateral edge. Utilized edge has feather flaking along ventral surfaces; striations perpendicular to edge on ventral surface; edge rounded and displays comminution. Retouched edge exhibits obvious step-flaking along steeply beveled edge; some feather-flaking along ventral edge; flat ventral edge exhibits polish.

Tool type and no.: Bifacial knife fragment 89-88-295
Site/provenience: 39LA117 SW of Unit 33
Level/depth: Unknown
Collection: 1988 Vanocker Mitigation grader cut
Material type: Chert.
Material color: N8 very light gray; 5YR5/6 light brown and 5YR3/4 moderate brown bands
Axial length: 27.1 mm
Max width: 10.8 mm
Max thickness: 5.4 mm
Wt.: 1.6 g
Tool type and description: Bifacial knife fragment on G3 flake. Pronounced

edge rounding along sinuous edges; large step flakes; wear is even on both sides of the edge; edge lightly pitted and abraded.

Tool type and no.: Sidescraper 89-88-303
Site/provenience: 39LA117 XU 1, 8S/42W
Special provenience: 8.76S/42.16W
Level/depth: Level 2, 18 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Chert. Opaque; mat luster; no fluorescence; good quality; concoidal fracture; dull flinty texture; includes small black and red spots
Material color: 5R2/2 blackish red
Axial length: 35.7 mm
Max width: 12.1m
Max thickness: 4.3 mm
Wt.: 2.1 g
Tool type and description: Retouched and utilized flake/sidescraper. Unifacially retouched tertiary flake; one straight lateral edge reworked to short, steep angle, beveled. Edge is lightly smoothed; small scale step-fractures occur along edge.

Tool type and no.: Light retouched flake knife 89-88-304
Site/provenience: 39LA117 XU1, 8S/42W
Special provenience: 8.56S/42.96W
Level/depth: Level 3, 29.5 cm b.d.
Collection: 1988 Vanocker Mitigation
Material type: Chert. Opaque; mat to semimat luster; hard, silty cortex; concoidal fracture; good quality; no fluorescence; lightly speckled and mottled inclusions
Material color: 5YR8/1 pinkish gray
Axial length: 29.1 mm
Max width: 19.6 mm
Max thickness: 3.8 mm
Wt.: 2.5 g
Tool type and description: Retouched and utilized flake, size grade G2. Unifacially retouched secondary decortication flake; one straight edge and one notched edge; point of juncture ends in snap fracture. Edges contain smoothing and step fractures either side of snap fracture. Corner of notched edge is U-shaped and damaged during excavation.

Tool type and no.: Sidescraper 89-88-343
Site/provenience: 39LA117 8S/42W
Level/depth: Level 3, 20–30 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Chert.
Material color: N8 very light gray; 5YR6/4 light brown; 5YR5/6 light brown
Axial length: 22.8 mm
Max width: 13.3 mm
Max thickness: 2.1 mm
Wt.: 0.9 g

Tool type and description: Rectangular G3 flake utilized as a sidescraper. Unifacial retouching along a portion of one edge. Large striations appear along the ventral surface of the opposite edge; striae are oblique to the edge; striae are large and intersecting; uniform polish, possible soil sheen or from grit on object being scraped.

Tool type and no.: Utilized flake knife 89-88-408
Site/provenience: 39LA117 XU2, 9S/42W
Level/depth: Level 2, 10–20 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Chert. Opaque; mat luster; no fluorescence; good quality; concoidal fracture; includes thin orange bands
Material color: 5Y8/1 yellowish gray
Axial length: 19.6 mm
Max width: 14.2 mm
Max thickness: 2.6 mm
Wt.: 1.1 g
Tool type and description: Utilized flake, size grade G3. Tertiary flake with use wear in the form of feather flaking along a slightly convex edge.

Tool type and no.: Endscraper 89-88-409
Site/provenience: 39LA117 XU2, 9S/42W
Level/depth: Level 2, 10–20 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Chert. Opaque; semimat luster; no fluorescence; concoidal fracture; poor quality, due to potlids and crazing from unintentional heating; lightly mottled
Material color: 5YR8/1 pinkish gray
Axial length: 16.3 mm
Max width: 15.6 mm
Max thickness: 4.9 mm
Wt.: 2.0 g
Tool type and description: Utilized flake, size grade G3. Ovate tertiary flake with unifacial retouch along the proximal margin; margin is steep and straight. Edge smoothing.

Tool type and no.: Utilized flake knife 89-88-411
Site/provenience: 39LA117 XU2, 9S/42W
Level/depth: Level 3, 25–30 cm b.d.
Collection: 1988 Vanocker Mitigation excavation waterscreen samples
Material type: Chert. Translucent; semimat luster; no fluorescence; good quality; concoidal fracture; speckled; includes one fracture
Material color: 5YR7/2 grayish orange pink
Axial length: 20.8 mm
Max width: 21.0m
Max thickness: 2.6 mm
Wt.: 1.9 g

Tool type and description: Utilized flake, size grade G2. Square tertiary flake with use wear along one lateral edge. Edge nicked and feather-flaked.

Tool type and no.: Light scraper 89-88-414
Site/provenience: 39LA117 XU2, 9S/42W
Special provenience: 9.78S/42.83W
Level/depth: Level 3, 26 cm b.d.
Collection: 1988 Vanocker Excavation mitigation
Material type: Chert. Opaque; mat luster; no fluorescence; good quality; concoidal fracture; white band across top
Material color: N7 light gray and 10R8/2 grayish orange pink
Axial length: 18.5 mm
Max width: 11.6 mm
Max thickness: 2.3 mm
Wt.: 0.8 g
Tool type and description: Utilized flake, size grade G3. Ovate tertiary flake with unifacial retouching along the proximal concave end; working edge short and beveled. Edge step fractured.

Tool type and no.: Utilized flake knife 89-88-415
Site/provenience: 39LA117 XU2, 9S/42W
Special provenience: 9.58S/42.86W
Level/depth: Level 3, 30 cm below datum (=NE corner of XU1)
Collection: 1988 Vanocker Mitigation excavation
Material type: Chert. Opaque; mat luster; no fluorescence; good quality; concoidal fracture; banded
Material color: 5Y4/1 olive gray and 5YR8/1 pinkish gray
Axial length: 32.1 mm
Max width: 16.1 mm
Max thickness: 2.1 mm
Wt.: 1.3 g
Tool type and description: Utilized flake, size grade G2. Tertiary flake with convex lateral edge exhibiting use wear. Edge nicked; scratches perpendicular to working edge on ventral surface.

Tool type and no.: Endscraper 89-88-416
Site/provenience: 39LA117 XU2, 9S/42W
Special provenience: 10.0S/42.91W
Level/depth: Level 4, 36 cm b.d. (=NE corner of XU1)
Collection: 1988 Vanocker Mitigation excavation
Material type: Chert. Opaque; mat luster; no fluorescence; good quality; concoidal fracture
Material color: 5YR7/2 grayish orange pink
Axial length: 26.1 mm
Max width: 17.4 mm
Max thickness: 6.0 mm
Wt.: 3.5 g
Tool type and description: Utilized G2 endscraper. Nicked during excavation;

oval, slightly convex distal margin; a single, long flake has been removed across the dorsal surface along the longitudinal axis, leaving a ridge and producing a planotriangular cross-section; one lateral margin is beveled by the removal of flaked parallel to the longitudinal ridge; secondary retouch occurs along this edge and the distal end; the proximal end retains a striking platform. Polish occurs on the working, transverse edge and to a lesser degree along the beveled, lateral margin.

Tool type and no.: Sidescraper 89-88-522
Site/provenience: 39LA117 XU3, 8S/43W
Special provenience: 8.90S/43.87W
Level/depth: Level 3, 32 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Chert. Opaque; glossy luster; no fluorescence; very good quality; good concoidal fracture; high silicate content; specimen has two pot-lid fractures indicating unintentional heating
Material color: 10R3/4 dark reddish brown and 5YR4/4 moderate brown
Axial length: 65.1 mm
Max width: 41.6 mm
Max thickness: 5.3 mm
Wt.: 15.3 g
Tool type and description: Retouched and utilized flake, size grade G3, used as sidescraper. The sidescraper is a large, flat, excurvate flake; biplano in transverse section; pronounced hinge flaking along the unretouched dorsal and ventral margin of one lateral edge; the other, convex margin is retouched along the dorsal surface and exhibits striations and hinge flakes and some step flaking on the ventral surface. Beveled edge exhibits rounding and polish; unretouched edge exhibits less polish than the beveled edge; striations on beveled edge side of ventral surface.

Tool type and no.: Endscraper 89-88-523
Site/provenience: 39LA117 XU3, 8S/43W
Special provenience: 8.59S/43.39W
Level/depth: Level 3, 31.5 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Quartzite, probably Fall River Formation. Opaque; granular luster; no fluorescence; good quality; concoidal fracture; Texture Type II; fine sand grain size, 2.0–2.5 phi; .95–.79 sphericity, average .89; .4–.9 roundness; average .5; .35 sorting
Material color: 10R2/2 very dusky red
Axial length: 22.8 mm
Max width: 32.8 mm
Max thickness: 7.7 mm
Wt.: 9.0 g
Tool type and description: Unifacial endscraper fragment. Ovate; broken at midsection by snap fracture; planoconvex in longitudinal and transverse sections; unifacially retouched; flat facet at distal end; distal end is convex. Edge-stepped

in cross-section and smoothed.

Tool type and no.: Retouched knife tip 89-88-524
Site/provenience: 39LA117 XU3, 8S/43W
Level/depth: Level 3, 30–35 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Chert. Opaque; mat luster; no fluorescence; good quality; concoidal fracture; flinty texture; includes black and cream spots
Material color: 10R3/4 dark reddish brown
Axial length: 9.1 mm
Max width: 10.0 mm
Max thickness: 2.2 mm
Wt.: 0.3 g
Tool type and description: Triangular fragment of a uniface tip with one lateral edge retouched. Terminates in snap fracture; edge sinuous; small step-flaking along retouched edge.

Tool type and no.: Unifacial tool preform 89-88-595 and 89-88-603
Site/provenience: 39LA117 8S/43W
Level/depth: Level 2, 24–30 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Chert.
Material color: 5R3/4 dusky red; 5YR8/1 pinkish gray; 10R6/6 moderate reddish orange cortex
Axial length: 22.4 mm; 26.4 mm
Max width: 15.3 mm; 13.1 mm
Max thickness: 4.4 mm; 5.3 mm
Wt.: 1.6 g; 1.7 g
Tool type and description: Two fragments of a triangular to oval uniface. Tool exhibits potlid fractures and crazing, suggesting fire-breakage. No fine retouching of edge and no edge wear on No. 595. No. 603 exhibits utilization of one slightly concave lateral edge and use wear in the form of rounding and oblique edge striations along the entire ventral portion of this lateral edge; the long, utilized lateral edge has a steeply beveled edge with large hinge flakes; ventral surface is polished.

Tool type and no.: Light scraper 89-88-624
Site/provenience: 39LA117 XU4, 9S/43W
Special provenience: 9.82S/43.25W
Level/depth: Level 2, 26 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Chert. Opaque; mat luster; no fluorescence; good quality; concoidal fracture; banded; dark speckles at retouched corner
Material color: 5B7/1 light bluish gray and 10YR6/2 pale yellowish brown
Axial length: 19.0 mm
Max width: 15.7 mm
Max thickness: 2.3 mm

Wt.: 1.5 g
Tool type and description: Square tertiary flake used as a light scraper. Light retouch and reworking of one corner and a portion of one lateral edge. Use wear on two corners and one side; step-flaking and light to moderate smoothing.

Tool type and no.: Light retouched flake knife 89-88-625
Site/provenience: 39LA117 XU4, 9S/43W
Special provenience: 9.04S/43.13W
Level/depth: Level 2, 26.5 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Chert. Opaque; mat luster; no fluorescence; good quality; concoidal fracture; lightly mottled; contains a few fractures
Material color: 5YR8/1 pinkish gray
Axial length: 24.2 mm
Max width: 20.8 mm
Max thickness: 3.9 mm
Wt.: 2.3 g
Tool type and description: G2 flake utilized as a light retouched flake knife. Triangular tertiary flake, unifacially retouched along one lateral margin; terminates in snap fracture. Step-flaking along tip edge and retouched edge; a few feather-flakes on the ventral surface.

Tool type and no.: Light scraper 89-88-686
Site/provenience: 39LA117 XU4, 9S/43W
Special provenience: eastern 2/3 of unit, screened
Level/depth: Level 3, 30–32 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Chert.
Material color: 10R8/2 grayish orange pink to 10R6/2 pale red
Axial length: 21.6 mm
Max width: 12.0 mm
Max thickness: 4.0 mm
Wt.: 1.1 g
Tool type and description: Rectangular G3 flake utilized as a light scraper. Large potlid fracture on one side. Utilization along one slightly concave lateral edge; edge gently rounded and smoothed.

Tool type and no.: Utilized flake knife 89-88-692
Site/provenience: 39LA117 XU4, 9S/43W
Special provenience: Upper half of unit, screened
Level/depth: Level 3, 30–35 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Chert.
Material color: N7, light gray; N8 very light gray bands
Axial length: 17.2 mm
Max width: 14.4 mm
Max thickness: 1.9 mm
Wt.: 0.7 g

Tool type and description: Square G3 flake utilized as a knife. Utilized edge is slightly concave; edge rounded and beveled; tiny step flakes along edge; tool edge outline fairly irregular; some hinge flaking along the ventral edge.

Tool type and no.: Endscraper 89-88-695
Site/provenience: 39LA117 XU4, 9S/43W
Level/depth: Level 3, 30–33 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Chert.
Material color: N6–N4 medium light to medium dark gray; 5R8/2 grayish orange pink
Axial length: NA
Max width: 18.5 mm
Max thickness: 3.8 mm
Wt.: 0.7 g
Tool type and description: Endscraper fragment on G3 flake. Possibly heat-treated; unifacial retouching along curved edge; numerous small step flakes along retouched edge; some feather-flaking along ventral edge; tip edge angle fairly steep; sides are not as steep.

Tool type and no.: Scraper 89-88-710
Site/provenience: 39LA117 XU5, 7S/42W
Level/depth: Unknown, probably from north wall of XU5
Collection: 1988 Vanocker Mitigation excavation
Material type: Chert. Translucent; semimat luster; no fluorescence; good quality; concoidal fracture; mottled, with hair-thin black bands
Material color: 10R3/4 dark reddish brown and 5R6/2 pale red
Axial length: 3.2 mm
Max width: 14.7 mm
Max thickness: 4.4 mm
Wt.: 1.0 g
Tool type and description: Scraper fragment on G3 flake. Triangular tip of unifacially reworked flake. Step fractures and light smoothing on edge suggest light use.

Tool type and no.: Possible preform 89-88-711
Site/provenience: 39LA117 XU5, 7S/42W
Special provenience: 7.54S/42.46W
Level/depth: Level 2, 20 cm b.d. (=NE corner of XU1)
Collection: 1988 Vanocker Mitigation excavation
Material type: Chert. Opaque; mat luster; no fluorescence; good quality; concoidal fracture; flinty texture; includes black spots
Material color: 5R4/2 grayish red
Axial length: 30.2 mm
Max width: 20.7 mm
Max thickness: 4.6 mm
Wt.: 2.4 g
Tool type and description: Retouched flake/possible preform. Tertiary flake

with unifacial marginal retouch on the ventral side and on a small portion of the lateral edge of the dorsal side. No use wear is evident. Possible Middle Plains Archaic Duncan/McKean variant projectile point preform.

Tool type and no.: Chisel 89-88-721
Site/provenience: 39LA117 XU5, 7S/42W
Level/depth: Level 3, 20–26 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Chert.
Material color: N8 very light gray to 5YR8/1 pinkish gray; 5YR5/6 light brown bands
Axial length: 26.8 mm
Max width: 20.0 mm
Max thickness: 6.4 mm
Wt.: 2.8 g
Tool type and description: Rectangular G2 flake utilized as a chisel. Utilization of one corner; step fractures along edge; two larger hinge flakes; edge gently rounded; tip blunted; limited amount of use is evident.

Tool type and no.: Preform fragment 89-88-725
Site/provenience: 39LA117 XU5, 7S/42W
Level/depth: Level 3, 20–26 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Quartzite.
Material color: 5YR4/4 light brown
Axial length: NA
Max width: NA
Max thickness: 4.4 mm?
Wt.: 0.2 g
Tool type and description: Tool tip fragment. G4; roughly triangular in cross-section; ridge down one side, rounded on other side; rounded side has flake scars. No visible edge-wear.

Tool type and no.: Utilized flake knife 89-88-736
Site/provenience: 39LA117 XU5, 7S/42W
Level/depth: Level 3, 20–25 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Quartzite.
Material color: 10R3/2 dark grayish red
Axial length: 31.7 mm
Max width: 28.3 mm
Max thickness: 5.4 mm
Wt.: 5.4 g
Tool type and description: Utilized flake knife, possibly used as a notch, as well. Large (G1) triangular flake; pronounced flaking on one lateral edge; unifacially reworked on one ventral edge, resulting in slightly sinuous edge; opposite, dorsal edge utilized. Edge wear visible on dorsal, nonsinuous edge; none on ventral, sinuous edge; ventral edge appear reworked; one small concavity along the dor-

sal/nonsinuous edge appears to have wear along its ventral side; smoothing and deep, scalar removals along utilized edge. The notch along the one side has a steep, almost vertical edge-angle, U-shaped.

Tool type and no.: Endscraper 89-88-769
Site/provenience: 39LA117 XU6, 7S/43W
Level/depth: Level 2, 25–30 cm b.d.
Collection: 1988 Vanocker Mitigation excavation waterscreen samples
Material type: Chert. Opaque; mat luster; no fluorescence; good quality; concoidal fracture
Material color: 5R4/2 grayish red
Axial length: 26.1 mm
Max width: 21.1 mm
Max thickness: 4.0 mm
Wt.: 2.1 g
Tool type and description: G2 flake used as an endscraper. Unifacial retouching along the end of a triangular tertiary flake; end steep, beveled.

Tool type and no.: Utilized flake knife 89-88-770
Site/provenience: 39LA117 XU6, 7S/43W
Special provenience: Concentration in SE corner of unit
Level/depth: Level 2, 25–30 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Porcellanite, Fort Union Formation. Opaque; mat luster; no fluorescence; fair quality; concoidal fracture; includes black and cream spots and flecks
Material color: 5R4/2 grayish red
Axial length: 20.8 mm
Max width: 27.1 mm
Max thickness: 1.8 mm
Wt.: 1.7 g
Tool type and description: Rectangular G2 tertiary flake with utilization the lateral margins. Edge nicked; striations on ventral surface oblique to the margins.

Tool type and no.: Biface knife 89-88-771 through 89-88-774
Site/provenience: 39LA117 XU6, 7S/43W
Special provenience: South half of unit
Level/depth: Level 2, 27 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Quartzite, probably Lakota Formation. Opaque; granular luster; no fluorescence; fair quality; subconcoidal fracture; Texture Type II; medium sand grain size, 1.5–2.0 phi; .95–.81 sphericity, average .89; .4–.9 roundness, average .5; .35 sorting
Material color: 10YR5/4 moderate yellowish brown
Axial length:
Max width:
Max thickness:

Wt.:
Tool type and description: Biface fragment reconstructed from 771–774, four fragments composing approximately half of a biface. Ovate; biconvex in longitudinal and transverse section; edge bifacially retouched and lightly sinuous. Moderate edge smoothing.

Tool type and no.: Hafted bifacial knife 89-88-775
Site/provenience: 39LA117 XU6, 7S/43W
Special provenience: 7.87S/43.60W
Level/depth: Level 3, 32 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Quartzite, probably Lakota Formation. Opaque; mat luster; no fluorescence; good quality; concoidal fracture; tip reddish-mottled purple; brownish vein on one side; Texture Type I; fine sand grain size, 3.0- -2.5 phi; .87–.59 sphericity, average .77; .8–.4 roundness, average .5; .35 sorting
Material color: 5Y6/1 light olive gray, 5R4/2 grayish red, and 5RP4/2 grayish red purple
Axial length: 93.7 mm
Max width: 41.0 mm
Max thickness: 7.0 mm
Wt.: 35.7 g
Tool type and description: Biface, composed of 5 shovel-damaged fragments. Asymmetrical lanceolate; one lateral edge retouched; transverse and longitudinal sections biconvex; edge is not sinuous. Battered, scratched and rounded base and retouched edge, perhaps indicating hafting; retouched edge secondary scars are smooth, lamellar, bifacial, and continuous; unretouched edge nicked with moderate smoothing. Asymmetrical shape probably resulted from reworking. Resembles some Late Archaic knives.
Illustration: Figure 4.13b

Tool type and no.: Endscraper 89-88-776
Site/provenience: 39LA117 XU6, 7S/43W
Level/depth: Level 3, 30–35 cm b.d.
Collection: 1988 Vanocker Mitigation excavation waterscreen samples
Material type: Quartzite, Lakota Formation. Opaque; shiny granular luster; fluorescence; good quality; concoidal fracture; includes black and cream grains; Texture Type I; fine sand grain size, 3.0–2.5 phi; .79 average sphericity; .6–.3 roundness, average .4; .35 sorting
Material color: 5RP6/2 pale red purple and 5RP2/2 very dusky red purple
Axial length: 50.9 mm
Max width: 35.6 mm
Max thickness: 6.3 mm
Wt.: 12.9 g
Tool type and description: G1 flake used as an endscraper. Rectangular tertiary flake utilized on one convex end; thin and convex in longitudinal section. Utilized edge shows moderate rounding; one lateral edge shows utilization in the form of edge smoothing.

Tool type and no.: Biface knife 89-88-971
Site/provenience: 39LA117 XU12, 9S/44W
Special provenience: 9.83S/44.95W
Level/depth: Level 3, 34 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Quartzite, possibly Minnelusa Formation. Opaque; mat granular luster; no fluorescence; good quality; concoidal fracture; dark brown speckles; dendritic; Texture Type II; fine sand grain size 3.0– 2.0 phi; .83–.73 sphericity, average .79; .9–.4 roundness, average .7; .35 sorting
Material color: 10YR5/4 moderate yellowish brown
Axial length: 34.8 mm
Max width: 30.0 mm
Max thickness: 10.5 mm
Wt.: 11.7 g
Tool type and description: Biface used as a knife. Ovate; end terminates in snap fracture; biconvex in longitudinal and transverse section; edges unifacially retouched. Edges smoothed.

Tool type and no.: Biface fragment 89-88-1025
Site/provenience: 39LA117 XU16, 12S/34W
Special provenience: 12.43S/34.54W
Level/depth: Level 2, 17 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Chert. Translucent; semimat luster; no fluorescence; good quality; concoidal fracture; banded
Material color: 5YR7/2 grayish orange pink
Axial length: 23.8 mm
Max width: 17.2 mm
Max thickness: 4.6 mm
Wt.: 1.8 g
Tool type and description: Biface fragment on G1 flake. Triangular; irregular biconvex in transverse and longitudinal section. No use wear; apparently broken before use.

Tool type and no.: Scraper 89-88-1026
Site/provenience: 39LA117 XU16, 12S/34W
Special provenience: 12.73S/34.65W
Level/depth: Level 2, 19.5 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Chalcedony. Transparent; semi-vitreous luster; light green fluorescence; poor quality, very fractured; concoidal fracture
Material color: 5Y6/1 light olive gray
Axial length: 16.8 mm
Max width: 18.1 mm
Max thickness: 7.3 mm
Wt.: 2.6 g
Tool type and description: Scraper on G2 flake. Oval; convex distal margin;

planoconvex in cross-section with dorsal flake scars perpendicular and oblique to the longitudinal axis of the endscraper; retouched along the dorsal margins; a portion of the cortex remains on the top of the dorsal distal end. Light polish on the dorsal working edge.

Tool type and no.: Light scraper 89-88-1077
Site/provenience: 39LA117 XU18, 10S/42W
Special provenience: Southwest quarter of southwest quarter of unit
Level/depth: Level 4, 32 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Chert. Opaque; mat luster; no fluorescence; good quality; concoidal fracture; some limonite staining; includes yellow bands and speckles
Material color: 5Y8/1 yellowish gray
Axial length: 30.5 mm
Max width: 21.7 mm
Max thickness: 8.2 mm
Wt.: 5.5 g
Tool type and description: G2 flake used as a light scraper. Rectangular tertiary flake with
unifacial use wear on one end. Working edge is straight, short, and slightly beveled in longitudinal view. Light edge smoothing.

Tool type and no.: Biface fragment 89-88-1078
Site/provenience: 39LA117 XU18, 10S/42W
Level/depth: Level 4, 30–35 cm b.d.
Collection: 1988 Vanocker Mitigation excavation waterscreen samples
Material type: Chert. Opaque; mat luster; no fluorescence; good quality; concoidal fracture; includes large white bands
Material color: N9 white and 5Y6/1 light olive gray
Axial length: 47.2 mm
Max width: 16.2 mm
Max thickness: 5.1 mm
Wt.: 5.6 g
Tool type and description: Diamond-shaped G2 biface fragment. Biconvex in longitudinal section. No use wear; may have been broken during manufacture.

Tool type and no.: Scraper fragment 89-88-1079
Site/provenience: 39LA117 XU18, 10S/42W
Level/depth: Level 4, 30–35 cm b.d.
Collection: 1988 Vanocker Mitigation excavation waterscreen samples
Material type: Chalcedony. Translucent; semimat luster; light green fluorescence; good quality; concoidal fracture; includes faint yellow banding and brown speckles
Material color: N7 light gray
Axial length: 21.9 mm
Max width: 12.2 mm
Max thickness: 6.2 mm
Wt.: 2.0 g

Tool type and description: G3 flake utilized as a scraper. Bifacially retouched; planoconvex in longitudinal section. Edge exhibits large step-flakes and smoothing.

Tool type and no.: Utilized flake knife 89-88-1109
Site/provenience: 39LA117 XU18, 10.56S/42.0W
Level/depth: Level 4, 34 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Chert.
Material color: N8 very light gray to N6 medium light gray; 5YR8/1 pinkish gray
Axial length: 26.1 mm
Max width: 19.5 mm
Max thickness: 5.9 mm
Wt.: 3.0 g
Tool type and description: G2 flake utilized as a knife. Utilization of one lateral edge on thinnest part of flake; tool was broken along one edge after utilization; some feather flaking; edge lightly used.

Tool type and no.: Endscraper fragment 89-88-1117
Site/provenience: 39LA117 XU18, 10S/42W
Level/depth: Level 4, 30–35 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Chert.
Material color: N7 light gray; N9 and N6 light gray bands; 5YR8/1 pinkish gray with 5YR6/4 light brown staining
Axial length: 25.6 mm
Max width: 20.9 mm
Max thickness: 4.8 mm
Wt.: 2.2 g
Tool type and description: Endscraper remnant. Retouching along rounded tip; remnant retouch along both sides indicates retouching along edges before breakage; large and small
step-fractures along tip; prominent step-flaking shows transverse use wear; edge appear almost crushed in places; steep edge angle at tip.

Tool type and no.: Graver/burin 89-88-1147
Site/provenience: 39LA117 XU19, 20S/38W
Level/depth: Level 2, 10–20 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Quartzite, Deadwood Formation. Opaque; granular glass luster; no fluorescence; poor quality; blocky to subconcoidal fracture; includes glauconite grains; Texture Type II; medium sand grain size, 1.5–2.0 phi, 97–.77 sphericity, average .89; .9–.5 roundness, average .8; .35 sorting
Material color: 5YR4/1 brownish gray
Axial length: 31.2 mm
Max width: 20.3 mm
Max thickness: 10.3 mm

Wt.: 5.0 g
Tool type and description: Biconvex G2 flake with a short planoconvex projection on one side forming a graver or burin; tip broken and blunted; the sides of the projection are fairly sharp.

Tool type and no.: Retouched flake 89-88-1193
Site/provenience: 39LA117 XU21, 66S/12W
Level/depth: Level 2, 10–20 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Porcellanite.
Material color: N2 grayish black
Axial length: NA
Max width: NA
Max thickness: NA
Wt.: 0.3–0.7 g
Tool type and description: Two unifacially retouched flake fragments from two different tools. The first has unifacial retouching along one edge of remnant; somewhat sinuous retouched edge; edge is sharp, unworn; few step-flakes from manufacture. The second fragment is unifacially retouched with a steeply beveled edge; edge is sharp, unworn. Neither fragment was utilized.

Tool type and no.: Biface fragment 89-88-1204
Site/provenience: 39LA117 XU22, 66S/11W
Special provenience: 66.57S/11.97W
Level/depth: Level 2, 15 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Porcellanite. Opaque; mat luster; no fluorescence; fair quality; concoidal fracture; 3.5–3.0 phi inclusions of silica, forming some bands, apparently along remnant bedding; grains not visible under 4.5x magnification, except silica
Material color: N2 grayish black
Axial length: 26.9 mm
Max width: 10.4 mm
Max thickness: 5.0 mm
Wt.: 1.3 g
Tool type and description: G3 biface thinning flake. Contains a portion of an edge of a biface; fragment is bifacially reworked; edge sinuous; biconvex in longitudinal section. Moderate edge smoothing.

Tool type and no.: Bifacial knife fragment 89-88-1220
Site/provenience: 39LA117 XU 22, 66S/11W
Level/depth: Level 2, 10–15 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Silicified slate.
Material color: N2 grayish black
Axial length: 26.8 mm
Max width: 9.8 mm
Max thickness: 7.0 mm

Wt.: 1.4 g
Tool type and description: Biface fragment. Bifacially retouched along one convex edge of G3 flake; edge not sinuous, but extremely worn; very rounded, with large step-flaking and some crushing; edge blunted and faceted.

Tool type and no.: Preform 89-88-1263
Site/provenience: 39LA117 XU23, 20S/39W
Special provenience: 20.47S/39.41W
Level/depth: Level 3, 25 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Quartzite, probably Fall River Formation. Opaque; granular luster; no fluorescence; fair quality; subconcoidal fracture; mottled with black speckles; Texture Type II; fine sand grain size, 2.5–2.0 phi; .95– .75 sphericity, average .89; .9–.4 roundness, average .7; .35 sorting
Material color: 10R4/2 grayish red to 10R6/2 pale red
Axial length: 36.3 mm
Max width: 20.6 mm
Max thickness: 5.2 mm
Wt.: 4.4 g
Tool type and description: Two pieces of a unifacial preform. Triangular; broken across base and tip; uniplano in cross-section; one lateral edge is slightly beveled. No evidence of retouching or use wear.

Tool type and no.: Light retouched flake knife 89-88-1264
Site/provenience: 39LA117 XU23, 20S/39W
Special provenience: 20.99S/39.70E
Level/depth: Level 3, 28 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Quartzite, probably Minnelusa Formation. Opaque; granular luster; no fluorescence; good quality; concoidal fracture; Texture Type II; fine sand grain size, 3.0–2.0 phi; .63–.73 sphericity, average .79; .9–.4, average .7; .35 sorting
Material color: 10YR4/2 dark yellowish brown
Axial length: 29.5 mm
Max width: 22.6 mm
Max thickness: 5.8 mm
Wt.: 4.5 g
Tool type and description: Triangular G2 flake used as a light retouched flake knife. Unifacial retouching; asymmetrically concavo-convex in longitudinal section; working edge (expanding end of flake) is slightly curved. No use wear on edge.

Tool type and no.: Graver 89-88-1285
Site/provenience: 39LA117 XU 24, 14S/36W
Special provenience: 14.43–14.45S/36.91–36.96W
Level/depth: Level 2, 19.7 cm b.d.
Material type: Silicified wood. Translucent; semimat luster; yellow fluorescence; very good quality; good concoidal fracture; faint yellow banding

Material color: 5YR2/1 brownish black
Axial length: 51.0 mm
Max width: 20.0 mm
Max thickness: 7.2 mm
Wt.: 6.4 g
Tool type and description: Graver. Beveled, concave lateral edge; planoconvex in cross-section. Tip has moderate smoothing and edge rounding; both lateral edges exhibit use wear; smoothing and step-fracturing occur on the convex lateral edge on the dorsal and ventral sides; step-fracturing occurs on the dorsal surface of the concave lateral edge.
Illustration: Figure 4.13d

Tool type and no.: Light retouched flake knife 89-88-1286 and 89-88-1287
Site/provenience: 39LA117 XU24, 14S/36W
Level/depth: Level 2, 15–20 cm b.d.
Collection: 1988 Vanocker Mitigation excavation waterscreen samples
Material type: Chert. Opaque; mat luster; no fluorescence; good quality; concoidal fracture; includes a few black speckles
Material color: 10R4/2 grayish red
Axial length: 60.1 mm
Max width: 30.4 mm
Max thickness: 7.8 mm
Wt.: 11 g
Tool type and description: Two pieces of lanceolate G3 flake used as a knife. Bifacially retouched along half of one lateral edge; biconvex in longitudinal and transverse sections; edge lightly sinuous. Edge nicking; light scattered feather-flaking.

Tool type and no.: Scraper fragment 89-88-1338
Site/provenience: 39LA117 XU26, 16S/50W
Level/depth: Level 1, 0–10 cm b.d.
Collection: 1988 Vanocker Mitigation excavation waterscreen samples
Material type: Chalcedony. Translucent; semimat luster; light green fluorescence; good quality; concoidal fracture; includes dark thin bands and spots
Material color: N3 dark gray
Axial length: 22.6 mm
Max width: 17.2 mm
Max thickness: 6.9 mm
Wt.: 3.2 g
Tool type and description: Oval G3 fragment struck from a uniface. Retains a portion of edge. Edge steep, unifacially retouched; edge shows light rounding.

Tool type and no.: Light retouched flake knife 89-88-1339
Site/provenience: 39LA117 XU26, 16S/50W
Level/depth: Level 1, 0–10 cm b.d.
Collection: 1988 Vanocker Mitigation excavation waterscreen samples
Material type: Chalcedony. Translucent; semimat luster; light green fluorescence; good quality; concoidal fracture; dark thin bands and spots

Material color: 5Y2/1 olive black
Axial length: 16.1 mm
Max width: 10.7 mm
Max thickness: 2.1 mm
Wt.: 0.5 g
Tool type and description: Unifacially retouched G3 bifacial thinning flake used as a knife. One lightly curved lateral edge shows original bifacial edge; other lateral edge is convex. Convex edge is steep, retouched, and lightly smoothed.

Tool type and no.: Sidescraper 89-88-1340
Site/provenience: 39LA117 XU26, 16S/50W
Level/depth: Level 1, 0–10 cm b.d.
Collection: 1988 Vanocker Mitigation excavation waterscreen samples
Material type: Chalcedony. Translucent; semimat luster; light green fluorescence; good quality; concoidal fracture; includes dark thin bands and spots
Material color: 5Y2/1 olive black
Axial length: 24.3 mm
Max width: 21.0 mm
Max thickness: 5.3 mm
Wt.: 2.6 g
Tool type and description: An irregular triangular G2 sidescraper with a steep edge angle on the retouched working edges. Proximal edge retains a striking platform; lateral edges are slightly convex; irregular planotriangular in cross-section. Distal end exhibits nibbling along the edge; rounding and step-fracturing occur along the working edges.

Tool type and no.: Biface fragment 89-88-1379
Site/provenience: 39LA117 XU 28, 15.5S/50W
Special provenience: 16.59S/49.04W
Level/depth: Level 1, 25 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Silicified wood. Translucent; semimat luster; yellow fluorescence; good quality; good concoidal fracture; includes faint banding
Material color: 10YR2/2 dusky yellowish brown
Axial length: 25.4 mm
Max width: 12.3 mm
Max thickness: 5.1 mm
Wt.: 1.7 g
Tool type and description: Diamond-shaped G3 biface fragment; retouched along a portion of the remaining edge. Biface edge exhibits no use wear.

Tool type and no.: Light retouched flake knife 89-88-1423
Site/provenience: 39LA117 XU29, 15S/41W
Level/depth: Level 2, 10–20 cm b.d.
Collection: 1988 Vanocker Mitigation excavation waterscreen samples
Material type: Quartzite, probably Lakota Formation. Opaque; granular luster; no fluorescence; fair quality; subconcoidal fracture; Texture Type II; medium sand grain size, 1.5–2.0 phi; .95–.63 sphericity, average .79; .9–.4 roundness,

average .8; .35 sorting
Material color: 5YR4/4 moderate brown
Axial length: 27.7 mm
Max width: 21.6 mm
Max thickness: 4.2 mm
Wt.: 3.4 g
Tool type and description: Triangular G2 flake with unifacial retouching along the short edge. Edge is sharp; no use wear.

Tool type and no.: Biface fragment 89-88-1456
Site/provenience: 39LA117 XU31, 16S/49W
Level/depth: Level 1, 0–5 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Quartzite.
Material color: 5YR5/2 pale brown
Axial length: NA
Max width: NA
Max thickness: 3.1 mm?
Wt.: 0.4 g
Tool type and description: Biface fragment, possibly from a perforator. G3 flake; portions of one lateral edge are unbroken and show bifacial retouching; a portion of the opposite edge has unifacial retouching, remainder is broken. Edge rounded, step-fractures in the concavities.

Tool type and no.: Two small tool fragments 898-88-1457
Site/provenience: 39LA117 XU31, 16S/49W
Level/depth: Level 1, 0–5 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Porcellanite or silicified shale with black speckles and quartz veins.
Material color: 5YR2/6 very dark red
Axial length: NA
Max width: NA
Max thickness: NA
Wt.: 0.7 g
Tool type and description: Two tool fragments on G3 flakes. Retouched along steeply beveled edges. Not utilized; may have broken during manufacture.

Tool type and no.: Light scraper 89-88-1458
Site/provenience: 39LA117 XU31, 16S/49W
Level/depth: Level 1, 0–5 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Chert.
Material color: 5R4/2 grayish red
Axial length: NA
Max width: NA
Max thickness: NA

Wt.: 0.3 g
Tool type and description: G3 flake utilized as a light scraper. Corner and rounded end retouched; most of end is broken away. Lateral edge exhibits utilization; tip steeply angled with small step-fractures along the dorsal edge; edge smoothed; lateral edge utilized, especially along upper 2/3. Upper portion of lateral edge beveled with small step-fractures along the smoothed edge; lower 1/3 not beveled as much and less rounded. A very thin, delicate scraper.

Tool type and no.: Graver 89-88-1458
Site/provenience: 39LA117 XU31, 16S/49W
Level/depth: Level 1, 0–5 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Chert.
Material color: N3 dark gray; 5R7/4 moderate pink; 10YR8/6 pale yellow orange; clear edges
Axial length: 29.0 mm
Max width: 18.0 mm
Max thickness:
Wt.: 1.2 g
Tool type and description: Flake utilized as a graver. Utilized G3 flake with more wear on tip; wear mostly on one side of tip; feather-flaking and some comminution extend down the edge; some feather-flaking along the ventral portion of the edge; small amount of edge rounding; lightly used.

Tool type and no.: Light retouched flake knife fragment 89-88-1467
Site/provenience: 39LA117 XU31, 16S/49W
Level/depth: Unknown
Collection: 1988 Vanocker Mitigation waterscreen samples
Material type: Quartzite.
Material color: N4 medium dark gray; N7 light grey; N2 grayish black
Axial length: NA
Max width: NA
Max thickness: 2.0 mm?
Wt.: 0.5 g
Tool type and description: Utilized G3 flake fragment. Edge sinuous; light retouching along a lateral edge; edge does not display any edge rounding; may be unutilized.

Tool type and no.: Light scraper 89-88-1475
Site/provenience: 39LA117 XU3, 16S/49W
Level/depth: Level 2, 10–15 cm b.d.
Collection: 1988 Vanocker Mitigation waterscreen sample
Material type: Chert.
Material color: 5RP4/2 grayish red purple; 5 gY4/1 dark greenish gray; 5YR5/1 light brownish gray
Axial length: 26.5 mm
Max width: 19.2 mm
Max thickness: 5.9 mm

Wt.: 2.1 g
Tool type and description: Oval G2 flake used as a light scraper. Retouching along a convex, U-shaped portion of a lateral edge; 4.5 mm across; steep edge angle; numerous tiny step-fractures along the curved edge; retouching along occurs along the edge past a broken portion, part of the same tool edge; one corner of flake used as a scraper.

Tool type and no.: Endscraper 89-88-1537
Site/provenience: 39LA117 XU35, 16S/51W
Level/depth: Level 1, 5–10 cm b.d.
Collection: 1988 Vanocker Mitigation excavation waterscreen samples
Material type: Chert. Opaque; mat luster; no fluorescence; good quality; concoidal fracture; uniform mottling
Material color: 10YR4/2 dark yellowish brown and 10YR5/4 moderate yellowish brown
Axial length: 34.7 mm
Max width: 33.7 mm
Max thickness: 9.9 mm
Wt.: 15.6 g
Tool type and description: Endscraper made from an expanding decortication flake. Cortex retained on about 50 percent of the dorsal surface; slightly convex distal margins; a crescentic, cortex-covered concavity on the distal margin exhibits some nibbling; irregular planoconvex in cross-section. Moderate rounding on distal ends of the scraper and the tips of the concavity; rounding also occurs on one of the lateral margins; step-fracturing occurs along the distal edge.

Tool type and no.: Biface fragment 89-88-1539
Site/provenience: 39LA117 XU35, 16S/51W
Level/depth: Level 1, 0–5 cm b.d.
Collection: 1988 Vanocker Mitigation waterscreen samples
Material type: Quartzite.
Material color: 5YR2/2 dusky brown
Axial length: NA
Max width: NA
Max thickness: 7.3 mm?
Wt.: 1.6 g
Tool type and description: Fragment of biface preform. Unifacially retouched and bifacially worked on G2 flake; no edge wear.

Tool type and no.: Utilized flake 89-88-1551
Site/provenience: 39LA117 XU35, 16S/51W
Level/depth: Level 1, 5–10 cm b.d.
Collection: 1988 Vanocker Mitigation waterscreen samples
Material type: Chalcedony.
Material color: 5YR2/2 dusky brown to clear
Axial length: NA
Max width: NA
Max thickness: 6.8 mm?

Wt.: 1.7 g
Tool type and description: Utilized G3 flake. Feather-flaking along a slightly convex edge; edge has minimal smoothing.

Tool type and no.: Biface knife 89-88-1655
Site/provenience: 39LA117 XU38, 10S/43W
Special provenience: Southwest corner of unit
Level/depth: 30 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Porcellanite. Opaque; mat luster; no fluorescence; fair quality; concoidal fracture; includes spots and stains on surface only; claystone-like texture; exhibits unintentional heat-alteration
Material color: 10R4/2 grayish red
Axial length: 65.0 mm
Max width: 59.0 mm
Max thickness:
Wt.: 3.3 g
Tool type and description: Biface knife or projectile point fragment; triangular distal fragment, bifacially retouched on lateral edges; planoconvex in longitudinal and transverse sections; broken midsection. Edge is lightly sinuous; no fine retouch or use wear.

Tool type and no.: Endscraper 89-88-1657
Site/provenience: 39LA117 XU38, 10S/43W
Level/depth: Level 4, 30–40 cm b.d.
Collection: 1988 Vanocker Mitigation excavation waterscreen samples
Material type: Chert. Opaque; mat luster; no fluorescence; good quality; concoidal fracture; includes orange bands
Material color: 5B7/1 light bluish gray
Axial length: 23.2 mm
Max width: 17.8 mm
Max thickness: 7.5 mm
Wt.: 3.4 g
Tool type and description: Endscraper. Slightly triangular; convex distal margin; planotriangular in cross-section; dorsal flake scars perpendicular and oblique to the longitudinal axis; retouching occurs around the dorsal margin; proximal end retains a remnant striking platform. Working edge is polished and rounded.

Tool type and no.: Light scraper 89-88-1661
Site/provenience: 39LA117 XU38, 10S/43W
Level/depth: Level 3, 0–30 cm b.d.
Collection: 1988 Vanocker Mitigation waterscreen samples
Material type: Chert.
Material color: 5R8/2 grayish pink; 5P4/2 grayish purple
Axial length: 22.9 mm
Max width: 20.0 mm
Max thickness: 4.0 mm
Wt.: 1.8 g

Tool type and description: Oval G2 flake utilized as a light scraper. Utilization along a portion of a concave edge opposite striking platform; step fractures along edge; cross-section faceted; steep edge-angle.

Tool type and no.: Utilized flake knife 89-88-1661
Site/provenience: 39LA117 XU38, 10S/43W
Level/depth: Level 3, 0–30 cm b.d.
Collection: 1988 Vanocker Mitigation waterscreen samples
Material type: Chert.
Material color: 10YR7/2 very pale yellowish brown; N9 white bands
Axial length: NA
Max width: 21.3 mm
Max thickness: 4.8 mm
Wt.: 1.4 g
Tool type and description: G2 flake utilized as a knife. Edge smoothed; tiny feather flakes along a convex portion of one ventral edge resulting from use of tip.

Tool type and no.: Endscraper 89-88-1684
Site/provenience: 39LA117 XU39, 8S/44W
Level/depth: Level 4, 30–40 cm b.d.
Collection: 1988 Vanocker Mitigation excavation waterscreen samples
Material type: Chert. Opaque; mat luster; no fluorescence; good quality; concoidal fracture; includes orange bands
Material color: 5Y6/1 light olive gray with 5YR5/6 light brown banding
Axial length: 26.8 mm
Max width: 20.5 mm
Max thickness: 6.1 mm
Wt.: 4.1 g
Tool type and description: Triangular endscraper with convex distal margin. Planoconvex in cross-section; dorsal flake scars are perpendicular and oblique to the longitudinal axis; retouching along the entire dorsal margin. Light polishing occurs along the working edge; step-fracturing is noted at the distal ends of the working edge.

C.2 39LA314

Tool type and no.: Poss. projectile point fragment 84-582-24
Site/provenience: 39LA314 25N/11E
Special provenience: Northwest quarter of unit
Level/depth: Level 1, 0–20 cm b.d.
Collection: 1984 Vanocker Survey surface collection
Time period/classification: Indeterminate
Material type: Chert. Opaque; semimat luster; no fluorescence; good quality; concoidal fracture; red exterior, yellow exterior; heat spalls; material was heated
Material color: 10YR5/4 moderate yellowish brown and 10R3/4 dark reddish brown

Axial length: NA
Max width: NA
Max thickness: 5.4 mm
Wt.: 1.9 g
Blade shape: Unknown, broken and heat-spalled
Longitudinal section: NA
Transverse section: NA
Description of flake scars: Unknown
Base: Unknown, broken and heat-spalled
Shoulder: Unknown, broken and heat-spalled
Haft: Lateral-lateral juncture, medial juncture acute, bifacially thinned notch, distal juncture obtuse-circular; notch 4.4 mm long, 5.3 to 2.5 mm wide
Tang: Unknown
Additional comments: Badly broken tool exhibiting a deep notch on the remaining lateral edge; heat-treated.
Illustration: Figure 5.7a

Tool type and no.: Biface fragment 84-582-01
Site/provenience: 39LA314 general
Level/depth: Surface
Collection: 1984 Vanocker Survey surface collection
Material type: Chert. Opaque; semimat luster; no fluorescence; fair quality; concoidal fracture; includes veinlets and blebs of more siliceous material; pocked by tiny vugs, some with calcite crystals
Material color: 10YR6/6 dark yellowish orange
Axial length: NA
Max width: 29.3 mm
Max thickness: 9.3 mm
Wt.: 8.3 g
Tool type and description: Biface fragment. Rough oval biface; irregular; asymmetrical biconvex in transverse and longitudinal section; no fine retouch of edges; secondary thinning and shaping; edge angle 180 degrees. No use wear.

Tool type and no.: Light retouched flake knife 84-582-02
Site/provenience: 39LA314 general
Level/depth: Surface
Collection: 1984 Vanocker Survey surface collection
Material type: Chert. Opaque; semimat luster; no fluorescence; good quality; concoidal fracture; red edges indicating heating; includes veins of calcite
Material color: 10YR5/4 moderate yellowish brown and 10R3/4 dark reddish brown
Axial length: 38.8 mm
Max width: 23.9 mm
Max thickness: 10.5 mm
Wt.: 6.4 g
Tool type and description: Retouched secondary G2 flake knife. Minimal retouching along one lateral edge; heat-treated before retouch; edge angle 35.

Very light smoothing of the edge, probably caused during manufacture; no evidence of use.

Tool type and no.: Bifacial knife tip 84-582-177
Site/provenience: 39LA314 25N/11E
Special provenience: Southwest quarter of southwest quarter
Level/depth: Level 2, 20–30 cm b.d.
Collection: 1988 Vanocker Survey testing
Material type: Chert. Opaque; mat luster; no fluorescence; good quality; concoidal fracture
Material color: 10YR5/4 moderate yellowish brown
Axial length: NA
Max width: NA
Max thickness: 1.8 mm
Wt.: 0.1 g
Tool type and description: Extreme tip of finished or nearly finished biface. Edge exhibits step-fractures, especially at the tip, and moderate smoothing and polish.

Tool type and no.: Biface fragment 90-168-7
Site/provenience: 39LA314 10E/30N
Level/depth: 0–25 cm b.s.
Collection: 1988 Vanocker Mitigation shovel tests
Material type: Porcellanite. Opaque; mat luster; no fluorescence; poor quality; poor concoidal fracture; includes silica veins and white, orange, and black speckles
Material color: 5R2/6 very dark red
Axial length: NA
Max width: 14.0 mm
Max thickness: 3.8 mm
Wt.: 0.7 g
Tool type and description: Biface fragment or bifacial thinning flake. No use wear.

Tool type and no.: Biface fragment 90-168-9
Site/provenience: 39LA314 0/30N
Level/depth: Level 4, 30–40 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Chert. Opaque; mat luster; no fluorescence; poor quality; poor concoidal fracture; surface pocked; softened by ground-water weathering
Material color: N8 very light gray, with patina 10YR6/4 pale yellowish brown
Axial length: NA
Max width: 20.6 mm
Max thickness: 6.9 mm
Wt.: 3.0 g
Tool type and description: Biface midsection. Biconvex in transverse and longitudinal section; edge angles 87 and 80 degrees; working edges are sinuous in longitudinal view; apparently broken during manufacture. Edge is fairly sharp;

patina obscures fine detail; no noticeable use wear; one lateral edge contains a step-flake from manufacture.
Illustration: Figure 5.7b

Tool type and no.: Light retouched flake knife 90-168-23
Site/provenience: 39LA314 0/30N
Level/depth: Level 4, 30–40 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Chert. Opaque; mat luster; no fluorescence; good quality; good concoidal fracture; good uniform texture; includes a white spot on one edge
Material color: 5RP4/2 grayish red purple
Axial length: 22.3 mm
Max width: 20.5 mm
Max thickness: 4.8 mm
Wt.: 2.6 g
Tool type and description: Utilized G2 flake. Irregular flake scars along dorsal edge; a pointed portion of one lateral edge is lightly retouched. Some feather-flakes on ventral surface; very light smoothing; only light utilization.

C.3 39LA319

Tool type and no.: Projectile point fragment 84-581-02
Site/provenience: 39LA319 general
Level/depth: Surface
Collection: 1984 Vanocker Survey surface collection
Time period/classification: Unspecified Paleoindian/Plano
Material type: Quartzite, probably Lakota Formation. Opaque; granular luster; no fluorescence; fair quality; blocky to subconcoidal fracture; lightly pocked; white quartz cement with clear quartz grains; Texture Type I; medium sand grain size, 1.0–2.0 phi; .87–.63 sphericity, average .89; .4–.9 roundness, average .4; .35 sorting
Material color: N7 light gray and N9 white
Axial length: NA
Max width: 25.7 mm
Max thickness: 7.1 mm
Wt.: 5.3 g
Blade shape: Probably excurvate; snapped off below midsection
Longitudinal section: Biconvex
Transverse section: Biconvex
Description of flake scars: Unknown
Base: Concave, transverse; bifacially thinned; possibly ground; 12.1 mm wide
Shoulder: No shoulder
Haft: NA
Tang: Contracting; rounded ears or tabs
Additional comments: Edge angles 55 and 70 degrees per side. Point is most

like Paleoindian types in general morphology, size and flaking technique, but is not identical to any described type
Illustration: Figure 6.4a

Tool type and no.: Projectile point fragment 84-581-08
Site/provenience: 39LA319 20N/60E
Level/depth: Level 3, 20–30 cm b.d.
Collection: 1984 Vanocker Survey testing
Time period/classification: Probably late Paleoindian
Material type: Silicified wood. Transparent to translucent; semi-vitreous luster; yellow fluorescence; good quality; good concoidal fracture; includes cloudy areas when held to light
Material color: 5YR3/4 moderate brown
Axial length: NA
Max width: 18.5 mm
Max thickness: 5.3 mm
Wt.: 3.1 g
Blade shape: Ovate; broken above base, tip missing
Longitudinal section: asymmetrically biconvex
Transverse section: Biconvex
Description of flake scars: Primary scars are massive (but often obscured), expanding and unifacial. The point is reworked. Secondary scars are angular and expanding, discontinuous pattern.
Base: Concave, transverse; bifacially thinned; unground
Shoulder: No shoulder
Haft: NA
Tang: NA
Additional comments: Point is most like Paleoindian types in general morphology, size and flaking technique, but is not identical to any described type
Illustration: Figure 6.4b

Tool type and no.: Projectile point fragment 89-87-238
Site/provenience: 39LA319 23N/8E
Special provenience: 23.715N/8.955E
Level/depth: 39 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Time period/classification: Paleoindian
Material type: Quartzite, probably Fall River Formation. Opaque; glassy-granular luster; no fluorescence; fair quality; blocky to subconcoidal fracture; includes brown grain aggregates in white cement; has whitish areas of raised grains; Texture Type II; fine sand grain size, 2.0– 2.5 phi; .65–.95 sphericity, average .85; .3–.9 roundness, average .4; .35 sorting
Material color: 5YR4/4 moderate brown
Axial length: NA
Max width: NA
Max thickness: 5.4 mm?
Wt.: 1.5 g

Blade shape: Unknown, snapped off below shoulder area
Longitudinal section: NA
Transverse section: Possibly asymmetrical biconvex
Description of flake scars: Unknown
Base: Based of unshouldered projectile point; bifacially thinned; edge ground along sides; subconcave; 18.7 mm wide
Shoulder: Unshouldered
Haft: NA
Tang: Contracting, straight proximal lateral edge; lateral edge ground; 13.0 mm wide

Tool type and no.: Endscraper 84-581-03
Site/provenience: 39LA319 20N/60E
Level/depth: Level 3, 20–30 cm b.d.
Collection: 1984 Vanocker Survey testing
Material type: Chert. Opaque; mat luster; no fluorescence; good quality; good concoidal fracture; lightly mottled; small silica inclusions cover surface
Material color: N5 medium gray
Axial length: NA
Max width: NA
Max thickness: 6.4 mm
Wt.: 4.3 g
Tool type and description: Unifacially retouched flake used as an endscraper. Original platform evident along one edge exhibits battering from detachment; remaining lateral edge is unifacially retouched; edge angle 65 degrees; planoconvex in transverse section; asymmetrically concavo-convex in longitudinal view; remaining edge convex, steep, beveled. Edge is lightly polished.

Tool type and no.: Endscraper 84-581-05
Site/provenience: 39LA319 20N/60E
Level/depth: Level 3, 20–30 cm b.d.
Collection: 1984 Vanocker Survey testing
Material type: Chert. Opaque; mat luster; no fluorescence; good quality; good concoidal fracture; lightly mottled; small silica inclusions cover surface
Material color: N6 medium light gray
Axial length: 26.4 mm
Max width: 23.0 mm
Max thickness: 6.6 mm
Wt.: 4.6 g
Tool type and description: Triangular uniface with unifacial retouch along three edges. Edge angles 45, 35, and 80 degrees; one edge straight, others slightly convex; edges steep, beveled; tabular in cross-section. Edges exhibit moderate smoothing and step-flaking; use wear continues around two of the corners of the scraper.

Tool type and no.: Endscraper 84-581-06
Site/provenience: 39LA319 20N/60E

Level/depth: Level 3, 20–30 cm b.d.
Collection: 1984 Vanocker Survey testing
Material type: Quartzite, probably Lakota Formation. Opaque; granular luster; no fluorescence; fair quality; blocky to subconcoidal fracture; mottled; includes clear quartz grains in white quartz cement; Texture Type I; medium sand grain size, 1.0–2.0 phi; .93–.63 sphericity, average .79; .4–.9 roundness, .5 average; .35 sorting
Material color: N6 medium light gray and N8 very light gray
Axial length: NA
Max width: 35.7 mm
Max thickness: 10.9 mm
Wt.: 24.8 g
Tool type and description: Portion of a larger tool unifacially retouched or resharpened and used as an endscraper. Edge angle 75 degrees; very little edgewear; light smoothing on edge; some step flaking, probably from retouching.

Tool type and no.: Preform 84-581-17
Site/provenience: 39LA319 20N/60E
Special provenience: 19.84N/60.38E
Level/depth: Level 3, 24 cm b.d.
Collection: 1984 Vanocker Survey testing
Material type: Chert. Opaque; mat luster; no fluorescence; poor quality; subconcoidal fracture; silty patina; soft, grainy, and crumbly; poor choice for knapping
Material color: N8 light gray with patina 5YR6/4 light brown
Axial length: NA
Max width: 23.9 mm
Max thickness: 9.0 mm
Wt.: 8.3 g
Tool type and description: Roughly shaped biface, shaped vaguely like a projectile point. Notch-like indentations are recent shovel dents; some secondary flaking was begun along both sides of one lateral edge and near the tip; base unformed.
Illustration: Figure 6.4c

Tool type and no.: Light scraper 84-581-18
Site/provenience: 39LA319 general
Level/depth: Surface
Collection: 1984 Vanocker Survey testing
Material type: Chalcedony. Transparent; semimat luster; light green fluorescence; good quality; concoidal fracture
Material color: N9 white
Axial length: NA
Max width: NA
Max thickness: 3.1 mm
Wt.: 0.4 g
Tool type and description: Retouched tertiary flake with unifacial retouch along

one straight lateral edge. Edge has slight curvature in longitudinal view; edge angle 20 degrees; edge faceted and beveled in transverse section. Edge has noticeable step-flaking and polish.

Tool type and no.: Bifacial knife 89-87-10
Site/provenience: 39LA319 25N/15E
Level/depth: 20–40 cm b.s.
Collection: 1988 Vanocker Mitigation shovel testing
Material type: Silicified wood. Opaque; mat luster; yellow fluorescence; limestone-like vuggy cortex; fair quality; good to poor concoidal fracture; visible woody structure
Material color: 5YR2/2 dusky brown
Axial length: NA
Max width: NA
Max thickness: 6.5 mm
Wt.: 8.9 g
Tool type and description: Bifacial knife fragment, broken at top and base. Cortex remains on dorsal and ventral surfaces; flakable material thins toward longitudinal axis of tool; biconvex in transverse and longitudinal section; working edge sinuous from removal of flakes from alternate faces. Light to moderate edge smoothing; some step flakes.

Tool type and no.: Light scraper fragment 89-87-15
Site/provenience: 39LA319 15N/20E
Level/depth: 0–18 cm b.s.
Collection: 1988 Vanocker Mitigation shovel testing
Material type: Chert. Opaque; mat luster; no fluorescence; good quality; concoidal fracture; lightly mottled
Material color: 5R4/6 moderate red with N5 medium gray band
Axial length: NA
Max width: NA
Max thickness: 3.5 mm
Wt.: 0.2 g
Tool type and description: Triangular utilized flake fragment, with convex edge utilized for light scraping. Planoconvex in longitudinal section. Edge faceted and smoothed.

Tool type and no.: Perforator 89-87-24
Site/provenience: 39LA319 24N/10E
Level/depth: 27–30 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Silicified wood. Translucent to opaque; semi-vitreous luster; yellow fluorescence; fair quality; concoidal to subconcoidal fracture; includes vugs containing quartz crystals
Material color: 5YR2/2 dusky dark brown and 10YR8/2 very pale orange around vugs
Axial length: 33.4 mm

Max width: 8.1 mm
Max thickness: 15.5 mm
Wt.: 3.4 g
Tool type and description: Triangular biface used as a drill-type perforator. Biconvex in transverse section; primary flake scars diminutive, flat, and lamellar; blade edges wavy, with moderate to heavy step fractures in the concavities. Step fracture noticeable on either side of tip; edge smoothing, particularly at tip, noticeably light; tool saw little use before breaking.
Illustration: Figure 6.4d

Tool type and no.: Utilized flake knife 89-87-50
Site/provenience: 39LA319 25N/10E
Level/depth: Level 6, 50–60 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Quartzite, probably Fall River Formation. Opaque; granular luster; no fluorescence; fair quality; blocky to subconcoidal fracture; Texture Type II; medium sand grain size 1.5–2.0 phi; .95–.65 sphericity, average .81; .4–.9 roundness, average .5; .35 sorting
Material color: 5YR4/4 moderate brown
Axial length: 22.6 mm
Max width: 17.7 mm
Max thickness: 7.4 mm
Wt.: 2.6 g
Tool type and description: Utilized flake. Triangular tertiary flake with utilization of one lateral edge. Edge flaked and nicked, indicating light use.

Tool type and no.: Light retouched flake knife fragment 89-87-84
Site/provenience: 39LA319 24N/7E
Level/depth: Level 1, 0–10 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Quartzite, probably Fall River Formation. Opaque; granular luster; no fluorescence; fair quality; blocky to subconcoidal fracture; Texture Type II; medium sand grain size, 1.5–2.0 phi; .95–.65 sphericity, average .89; .4–.9 roundness, average .5; .35 sorting
Material color: 5YR4/4 moderate brown
Axial length: NA
Max width: NA
Max thickness: 5.1 mm
Wt.: 1.2 g
Tool type and description: Utilized flake. Triangular tertiary flake with light retouch along one lateral edge. Edge is sharp, no use wear.

Tool type and no.: Endscraper reworked from Paleoindian projectile point base 89-87-116
Site/provenience: 39LA319 24N/9E
Special provenience: North half of unit
Level/depth: Level 1, 0–10 cm b.d.
Collection: 1988 Vanocker Mitigation excavation

Material type: Chert. Opaque; mat luster; no fluorescence; good quality; concoidal fracture; lightly mottled; includes thin, faint orange bands
Material color: 5 gY8/1 light green gray
Axial length: 29.3 mm
Max width: 20.9 mm
Max thickness: 7.0 mm
Wt.: 5.1 g
Tool type and description: Oval endscraper with a convex distal margin, reworked from parallel-flaked lanceolate projectile point base. Planoconvex to planotriangular in transverse section, with flake scars perpendicular to the longitudinal axis; unifacially retouched. Sides show moderate edge smoothing; distal margin exhibits light smoothing; end reworked; edges faceted and step-flaked.

Tool type and no.: Biface fragment 89-87-134
Site/provenience: 39LA319 24N/9E
Level/depth: Level 5, 40–50 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Quartzite, probably Lakota Formation. Opaque; glassy-granular luster; no fluorescence; fair quality; blocky to subconcoidal fracture; includes black speckles; Texture Type I; medium sand grain size, 1.0– 2.0 phi; .87–.75 sphericity, average .79; .4–.8 roundness, average .4; .35 sorting
Material color: N4 medium gray
Axial length: 38.9 mm
Max width: 35.2 mm
Max thickness: 9.1 mm
Wt.: 19.3 g
Tool type and description: Two pieces of a biface fragment. Rectangular biface with bifacial flaking along three of the margins; proximal margin broken, one fragment recovered; planoconvex in transverse and longitudinal section. No noticeable edge-wear; battering occurs along a short portion of one lateral edge.

Tool type and no.: Possible scraper fragment 89-87-200
Site/provenience: 39LA319 24N/8E
Level/depth: Level 4, 30–40 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Quartzite, probably Fall River Formation. Opaque; glassy granular luster; no fluorescence; fair quality; blocky to subconcoidal fracture; includes dark brown grainy aggregates; Texture Type II; medium sand grain size, 1.5–2.0 phi; .89–.73 sphericity, average .79; .6–.8 roundness, average .4; .35 sorting
Material color: 5R2/6 very dark red
Axial length: 17.1 mm
Max width: 11.5 mm
Max thickness: 4.0 mm
Wt.: 1.0 g
Tool type and description: Fragment of unifacially retouched G3 flake. Unifacially retouched along one lateral margin; flake scars indicate that this was part of a larger tool; working edge convex in longitudinal view; edge angle is steep.

Edge shows no wear; broken in manufacture or during heat treatment.

Tool type and no.: Biface knife 89-87-239
Site/provenience: 39LA319 23N/8E
Level/depth: Level 4, 30–40 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Quartzite, probably Fall River Formation. Opaque; glassy-granular luster; no fluorescence; fair quality; blocky to subconcoidal fracture; includes raised grains and areas of white quartz cement; Texture Type II; coarse to fine sand grain size, .5.–2.0 phi; .65– .95 sphericity, average .79; .4–.9 roundness, average .5; .35 sorting
Material color: 5YR4/4 moderate brown
Axial length: NA
Max width: 39.7 mm
Max thickness: 24.4 mm
Wt.: 14.9 g
Tool type and description: Biface knife fragment. Marginal retouch along convex lateral margins; biconvex in transverse and longitudinal section; primary scars obscured; secondary flake scars concoidal-bifacial-unilateral; obscured on internal face; edge sinuous in longitudinal view. Some step-flaking in concavities along side, probably caused in manufacture. Roughly formed; no noticeable use wear; probably broken in manufacture.

Tool type and no.: Bifacial preform fragment 89-87-240
Site/provenience: 39LA319 23N/8E
Level/depth: Level 4, 30–40 cm b.d.
Collection: 1988 Vanocker Mitigation excavation
Material type: Quartzite, probably Fall River Formation. Opaque; glassy-granular luster; no fluorescence; fair quality; blocky to subconcoidal fracture; includes areas of white quartz cement; Texture Type II; medium sand grain size, 1.5–2.0 phi; .79–.95 sphericity, average .83; .4–.9 roundness, average .5; .35 sorting
Material color: 5YR4/4 moderate brown
Axial length: NA
Max width: 19.6 mm
Max thickness: 7.1 mm
Wt.: 3.3 g
Tool type and description: Biface fragment with marginal bifacial retouch. Asymmetrical bitriangular in transverse section; asymmetrical biconvex in longitudinal section; working edge sinuous in longitudinal view; primary scars massive and deep on external face; primary scars obscured on internal face. Internal face damaged by breakage across the biface near the tip. Roughly formed; no fine retouch; no edge wear.