



1999

Excavations at the Bluff Creek Sites: 41MK10 and 41MK27, McCulloch County, Texas

Ann M. Irwin

Brett A. Houk

Doug Drake

Phil Dering

John G. Jones

See next page for additional authors

Follow this and additional works at: <http://scholarworks.sfasu.edu/ita>

 Part of the [American Material Culture Commons](#), [Archaeological Anthropology Commons](#), [Cultural Resource Management and Policy Analysis Commons](#), [Historic Preservation and Conservation Commons](#), [History Commons](#), [Human Geography Commons](#), [Other Anthropology Commons](#), [Other Arts and Humanities Commons](#), [Other History of Art, Architecture, and Archaeology Commons](#), [Other Social and Behavioral Sciences Commons](#), and the [Technical and Professional Writing Commons](#)

Tell us how this article helped you.

Recommended Citation

Irwin, Ann M.; Houk, Brett A.; Drake, Doug; Dering, Phil; Jones, John G.; Lavold, Lisa D.; and Miller, Kevin A. (1999) "Excavations at the Bluff Creek Sites: 41MK10 and 41MK27, McCulloch County, Texas," *Index of Texas Archaeology: Open Access Gray Literature from the Lone Star State*: Vol. 1999 , Article 17. <https://doi.org/10.21112/ita.1999.1.17>

ISSN: 2475-9333

Available at: <http://scholarworks.sfasu.edu/ita/vol1999/iss1/17>

Excavations at the Bluff Creek Sites: 41MK10 and 41MK27, McColloch County, Texas

Authors

Ann M. Irwin, Brett A. Houk, Doug Drake, Phil Dering, John G. Jones, Lisa D. Lavold, and Kevin A. Miller

Licensing Statement

This is a work produced for the Texas Department of Transportation (TxDOT) by the report producer. TxDOT and the report producer jointly own all rights, title, and interest in and to all intellectual property developed under TxDOT's contract with the report producer. The report may be cited and brief passages from this publication may be reproduced without permission provided that credit is given to both TxDOT and the report producer. Permission to reprint an entire chapter, section, figures or tables must be obtained in advance from either the Supervisor of the Archeological Studies Branch, Environmental Affairs Division, Texas Department of Transportation, 125 East 11th Street, Austin, Texas, 78701 or from the report producer.

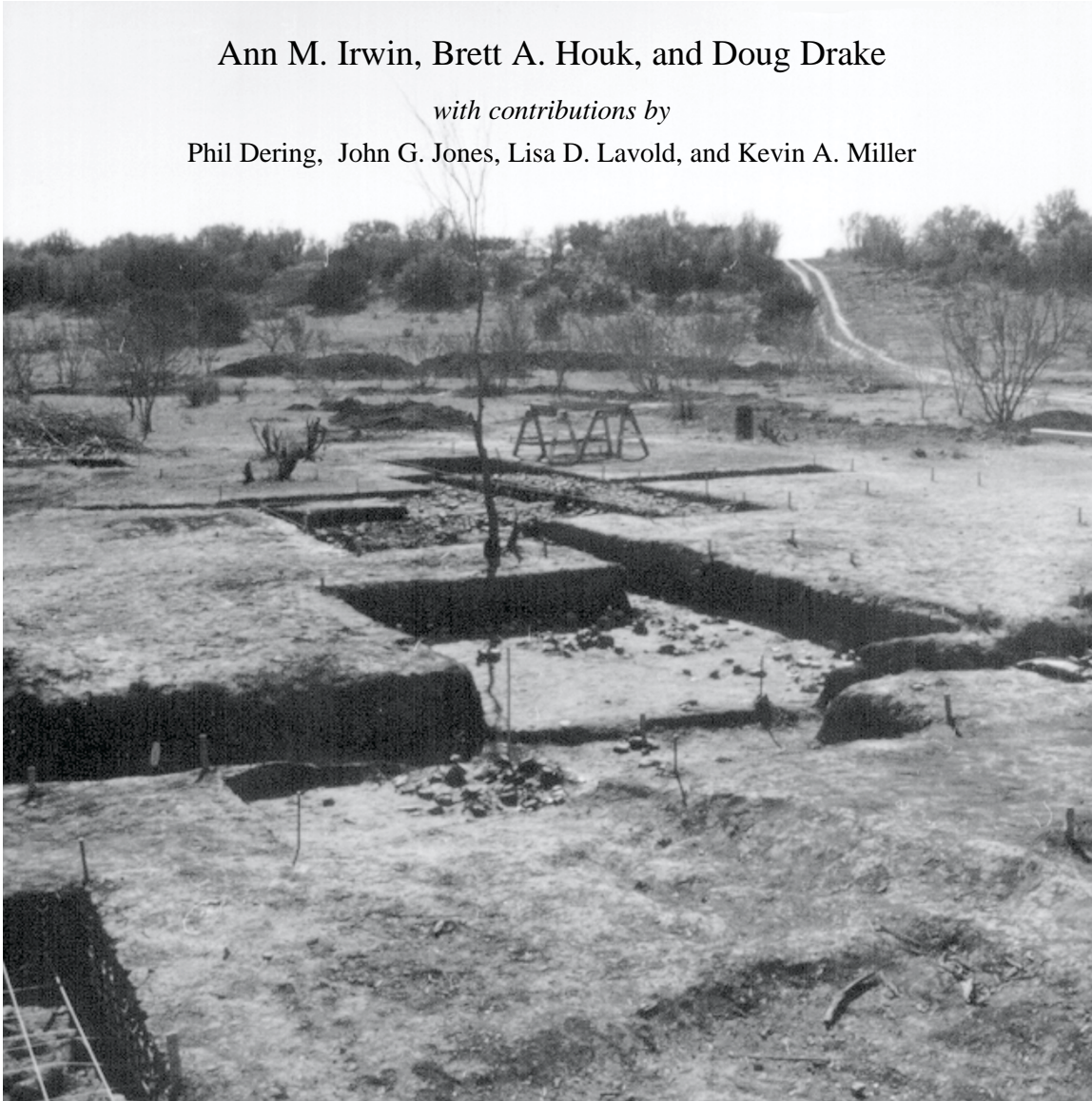
EXCAVATIONS AT THE BLUFF CREEK SITES:

41MK10 AND 41MK27, McCULLOCH COUNTY, TEXAS

Ann M. Irwin, Brett A. Houk, and Doug Drake

with contributions by

Phil Dering, John G. Jones, Lisa D. Lavold, and Kevin A. Miller



Texas Department of Transportation
Environmental Affairs Division
Archeology Studies Program, Report 16

SWCA, Inc. Environmental Consultants
Texas Cultural Resources Division
SWCA Cultural Resource Report 99-61

1999

**EXCAVATIONS AT THE BLUFF CREEK SITES:
41MK10 AND 41MK27,
McCULLOCH COUNTY, TEXAS**

by

Ann M. Irwin, Brett A. Houk, and Doug Drake

with contributions by

Phil Dering
John G. Jones
Lisa D. Lavold
and
Kevin A. Miller

Principal Investigator

Kevin A. Miller

Texas Antiquities Permit 232

**SWCA, Inc. Environmental Consultants
Texas Cultural Resources Division
SWCA Cultural Resource Report 99-61**

and

**Texas Department of Transportation
Environmental Affairs Division
Archeology Studies Program, Report 16**

October 1999

ABSTRACT

From late 1978 through early 1979, Ann M. Irwin of the Texas Department of Transportation (TxDOT) supervised excavations of two prehistoric archeological sites, 41MK10 and 41MK27, that were to be affected by construction along FM 765 in McCulloch County, Texas. The sites are located on Bluff Creek in the northern part of McCulloch County. Analyses of sites 41MK10 and 41MK27 and their cultural materials were conducted by TxDOT personnel in 1979, and an initial draft form of the report was prepared by Irwin in the early 1980s. TxDOT subsequently contracted SWCA, Inc. Environmental Consultants in 1999 to complete the report of the results of archeological investigations at 41MK10 and 41MK27 and to prepare the artifacts and records for curation.

Site 41MK27 contained a small burned rock midden, Feature I. This midden was approximately 8 to 10 m in diameter, and 50 cm thick, and annular in form. A single internal feature (Feature IA), a rock-lined pit or hearth, was located in the approximate center and bottom of the midden. Lying between the midden and Bluff Creek were a series of small hearths, of which eight were excavated and designated as Features III through X. These small hearths, most of which had been at least somewhat disturbed, appeared to have been simple structures composed of one or more layers of rock. Many of the individual rocks appear to have been fire-fractured in place. No true basin-shaped hearths were observed. Associated with these hearths were an accompanying scatter of living debris in the form of flint and burned rock and significant quantities of freshwater mussel shell. Although the individual specimens are relatively small, the quantities recovered suggest that they served as a source of food. Radiocarbon data suggest that the site was intermittently occupied from the Late Archaic through the Late Prehistoric. The midden apparently dates to the Late Prehistoric, although the Transitional Archaic period may have been the period of most intense occupation at the site.

Site 41MK10 was smaller than 41MK27 and not as intensively investigated. Two small burned rock features were excavated. The site was at least visited in the Late Archaic times, as is evidenced by the presence of a *Castroville* point, and in the Transitional Archaic, indicated by the recovery of two *Ensor* projectile points. It is likely, though by no means firmly established, that these dart point types are in fact associated with the use of the features.

TABLE OF CONTENTS

| | |
|------------------------------------------------|-------|
| Abstract | i |
| Table of Contents | iii–v |
| List of Figures | vii |
| List of Tables | ix |
| Acknowledgments | xi |
| Chapter 1: Introduction | |
| <i>by Ann M. Irwin and Doug Drake</i> | 1 |
| Project Background | 1 |
| Report Organization | 4 |
| Chapter 2: Archeological Background | |
| <i>by Brett A. Houk and Ann M. Irwin</i> | 5 |
| Introduction | 5 |
| Background to the Culture History | 5 |
| Chronology | 6 |
| Paleoindian Period | 6 |
| Archaic Period | 8 |
| Late Prehistoric | 9 |
| Previous Investigations | 10 |
| The Burned Rock Midden Project | 10 |
| The Slab Site | 11 |
| The Lion Creek Site | 11 |
| The O. H. Ivie Reservoir Project | 12 |
| Onion Creek | 12 |
| Wurzbach Project | 13 |
| Culebra Creek Site | 13 |
| Summary | 13 |
| Chapter 3: Environmental Setting | |
| <i>by Doug Drake and Ann M. Irwin</i> | 15 |
| Introduction | 15 |
| Environmental Reconstructions | 15 |
| Paleoenvironmental Periods | 16 |
| The Natural Environment | 17 |
| Geology | 17 |
| Hydrology | 19 |
| Soils | 20 |
| Vegetation | 20 |
| Wildlife | 23 |
| Climate | 23 |

| | |
|------------------------------------------------------------------------------|----|
| Chapter 4: Research Design and Methodology for 41MK27 | |
| <i>by Ann M. Irwin, Doug Drake, and Brett A. Houk</i> | 25 |
| Site Description | 25 |
| Research Design and Excavation Strategy | 26 |
| Methodology and Work Accomplished | 27 |
| Description of Excavation Procedures | 27 |
| Analytical Methodology | 30 |
| Chapter 5: Results of Excavations at 41MK27 | |
| <i>by Ann M. Irwin, Doug Drake, and Brett A. Houk</i> | 33 |
| Introduction | 33 |
| Soils at 41MK27 | 33 |
| Features | 34 |
| Feature I | 34 |
| Feature IA | 38 |
| Feature II | 39 |
| Feature III | 39 |
| Feature IV | 39 |
| Feature V | 40 |
| Feature VI | 40 |
| Feature VII | 42 |
| Feature VIII | 42 |
| Feature IX | 42 |
| Feature X | 42 |
| Description of Materials Recovered | 42 |
| Artifacts | 42 |
| Faunal Material | 75 |
| Chapter 6: Summary and Conclusions for 41MK27 | |
| <i>by Brett A. Houk, Doug Drake, Ann M. Irwin, and Kevin A. Miller</i> | 81 |
| Distribution of Recovered Materials | 81 |
| Dating the Site | 87 |
| Relative Dating | 87 |
| Radiocarbon Dating | 88 |
| Summary | 89 |
| Paleoenvironment | 89 |
| The Excavations at 41MK27 in Light of the Burned Rock Midden Project | 89 |
| BRM Project Recommendations | 90 |
| The Corn Creek Sites | 91 |
| Fitting 41MK27 into the Regional Picture | 92 |
| Site Summary | 93 |
| Concluding Remarks | 93 |
| Chapter 7: Excavations at 41MK10 | |
| <i>by Ann M. Irwin and Doug Drake</i> | 95 |
| Site Description and | |
| Excavation Procedures | 95 |
| Excavations | 96 |
| Test Unit 1 | 96 |
| Test Unit 2 | 98 |

| | |
|----------------------------------------------------------------------------------------------------------------------|------------|
| Test Unit 3 | 98 |
| Test Unit 4 | 98 |
| Features | 98 |
| Feature I | 98 |
| Feature II | 99 |
| Description of Materials Recovered | 99 |
| Projectile Points | 99 |
| Bifaces | 101 |
| Other Artifacts | 101 |
| Conclusions | 103 |
| References Cited | 105 |
| Appendix A: Metric and Descriptive Artifact Modifiers | 115 |
| Appendix B: Radiocarbon Data from 41MK27 | 139 |
| Appendix C: Macrobotanical analysis of two flotation samples from 41MK27 <i>by Phil Dering</i> | 147 |
| Appendix D: Analysis of pollen and phytoliths from 41MK27 <i>by John G. Jones and Lisa D. Lavold</i> | 153 |

FIGURES

| | | |
|-------|------------------------------------------------------------------------------------|-----|
| 1.1. | Project location map..... | 2 |
| 1.2. | Topography and site areas along FM 765 right-of-way..... | 3 |
| 2.1. | Cultural chronology for Central Texas..... | 7 |
| 3.1. | Biotic provinces of Texas..... | 15 |
| 3.2. | Surface geology of Texas..... | 18 |
| 3.3. | General soil areas of Texas..... | 21 |
| 3.4. | General vegetation regions of Texas..... | 22 |
| 4.1. | View of excavations at 41MK27, looking south..... | 25 |
| 4.2. | Topography and location of excavation areas at 41MK27..... | 29 |
| 5.1. | Stratigraphic profile of 41MK27 north of midden..... | 35 |
| 5.2. | Stratigraphic profile of 41MK27 through midden..... | 36 |
| 5.3. | Locations of features at 41MK27..... | |
| 5.4. | Photograph of Feature I, facing south..... | 38 |
| 5.5. | Photograph of Feature IA..... | 38 |
| 5.6. | Photograph of Feature II, facing east..... | 39 |
| 5.7. | Photograph of Feature III, facing west..... | 39 |
| 5.8. | Plan map of Feature III–V area. No plan maps of Feature IV could be relocated..... | 40 |
| 5.9. | Cross-section of Feature III..... | 41 |
| 5.10. | Plan map of Features VI–X..... | 41 |
| 5.11. | Modified flakes from 41MK27..... | 51 |
| 5.12. | Reduction Stage 1 Bifaces from 41MK27..... | 54 |
| 5.13. | Reduction Stage 2 Bifaces from 41MK27..... | 55 |
| 5.14. | Reduction Stage 3 Bifaces from 41MK27..... | 56 |
| 5.15. | Reduction Stage 4 Bifaces from 41MK27..... | 58 |
| 5.16. | Reduction Stage 5 Bifaces from 41MK27..... | 59 |
| 5.17. | Arrow points and dart points from 41MK27..... | 61 |
| 5.18. | Dart points from 41MK27..... | 64 |
| 5.19. | Gravers from 41MK27..... | 67 |
| 5.20. | Scrapers from 41MK27..... | 70 |
| 5.21. | Cores from 41MK27..... | 72 |
| 5.22. | Hammerstones from 41MK27..... | 74 |
| 5.23. | Mussel shells..... | 78 |
| 5.24. | Vertical distribution of mussel shell in units excavated through Level 7..... | 79 |
| 6.1. | Distribution of debitage by level at 41MK27..... | 85 |
| 6.2. | Distribution of debitage in Levels 4 and 5 at 41MK27..... | 86 |
| 6.2. | Distribution of mussel shell in Levels 4 and 5 at 41MK27..... | 86 |
| 7.1. | Topography and excavation units at 41MK10..... | 97 |
| 7.2. | Feature I at 41MK10..... | 99 |
| 7.3. | Feature II at 41MK10..... | 99 |
| 7.4. | Projectile points and other artifacts from 41MK10..... | 100 |
| 7.5. | Artifacts from 41MK10..... | 102 |
| A.1. | Metric artifact modifiers for contracting stem projectile points..... | 118 |
| A.2. | Metric artifact modifiers for straight stem projectile points..... | 118 |

TABLES

| | | |
|-------|----------------------------------------------------------------------------------|-----|
| 5.1. | Modified Flakes from 41MK27 | 51 |
| 5.2. | Bifaces from 41MK27 | 52 |
| 5.3. | Measurements of Complete and Nearly Complete Projectile Points from 41MK27 | 60 |
| 5.4. | Nearly Complete Untyped Dart Points from 41MK27 | 66 |
| 5.5. | Gravers from 41MK27 | 68 |
| 5.6. | Scrapers from 41MK27 | 69 |
| 5.7. | Cores from 41MK27 | 73 |
| 5.8. | Hammerstones from 41MK27 | 75 |
| 5.9. | Vertebrate Remains from 41MK27 | 76 |
| 5.10. | Mussel Shell Weight (g) by Level at 41MK27 | 78 |
| 6.1. | Distribution of Major Artifact Classes by Level at 41MK27 | 81 |
| 6.2. | Distribution of Bifaces by Level at 41MK27 | 81 |
| 6.3. | Distribution of Cores by Level at 41MK27 | 82 |
| 6.4. | Distribution of Gravers by Level at 41MK27 | 83 |
| 6.5. | Distribution of Hammerstones by Level at 41MK27 | 83 |
| 6.6. | Distribution of Projectile Points by Level at 41MK27 | 84 |
| 6.7. | Distribution of Scrapers by Level at 41MK27 | 88 |
| 6.8. | Radiocarbon Samples from 41MK27 | 88 |
| 6.9. | Comparison of Major Artifact Classes at 41MK8, 41MK9, and 41MK27 | 92 |
| 7.1. | Backhoe Test Data from 41MK10 | 96 |
| C.1. | Macroplant Remains and Proveniences from 41MK27 | 149 |
| D.1. | Pollen Types Identified in the Samples from 41MK27 | 157 |
| D.2. | Phytoliths Identified in the Samples from 41MK27 | 157 |

ACKNOWLEDGMENTS

Texas Department of Transportation

Numerous individuals provided assistance and support during the excavations at 41MK10 and 41MK27. Ben Dillon, Resident Engineer, Brady Residency, provided invaluable assistance with logistics, supplies, the hiring of local field crew, and providing a backhoe and cherry picker when needed. Mr. Dillon also generously provided additional excavation and surveying assistance by assigning his residency field party to work at the site. This team consisted of Alton “Dick” Bradshaw, Paul Bradshaw, Clovis Brown, and Alfred V. Machen, long time employees of the Brady Residency. The contribution of this experienced field team was incalculable and it was an honor to work with them.

John Arthur, Brownwood District Design Engineer, provided support through his ongoing interest and numerous visits to the project. George Ogden, Environmental Engineer for the Brownwood District, served as our district liaison and general problem solver and, in fact, first discovered the presence of site 41MK27 through an observation of chert and mussel shell in the spoil from an animal burrow.

The archeological field crew, supplemented by the field crew from the Brady Residency, worked cheerfully in the heat of the summer as well as the sometimes extreme cold of dead winter. At various times during testing and data recovery, the field crew included TxDOT Archeology Section employees Gene P. Davis, Marshall Eiserer, Martha Hemphill, Colleen Lamb, Charles Schulze, Judy Van Cleve, and Wayne Young, assisted by local residents Coach Bobby Argo, Richard Johnson, Lee Keeling, Gary Lawrence, Johnny Sites, Randy Waugh, and William Wright. Mr. Billy Hughes operated the backhoe with great skill and precision.

Thanks are also due to Charles A. Johnson II for assistance with stratigraphy and soil descriptions and to V. Roxanne Bogucka for providing initial editorial suggestions for the first draft manuscript. Frank A. Weir served as Principal Investigator for the fieldwork.

Ann M. Irwin

SWCA, Inc.

The staff at SWCA was grateful for the opportunity to complete the draft report on the excavations at the Bluff Creek sites. We would like to thank Nancy Kenmotsu, Ann M. Irwin, and Barbara Hickman for their assistance throughout this process. Other TxDOT employees deserving of thanks include Jesus Gonzalez, who took the wonderful artifact photographs, and Sherrill Wilson at the TxDOT Print Shop, who worked with us to insure that the digital version of the report was properly formatted. We would also like to acknowledge a number of SWCA employees whose efforts made the completion of the project possible. Mark Holderby and Kristi Turner prepared the original records and artifacts for curation. Carole Medlar redrafted the figures based on TxDOT’s originals, and Brandon Young read the final version of the report to give us a fresh perspective. Kevin A. Miller served as Principal Investigator for SWCA and made significant contributions to the project at every turn. Finally, we would like to thank Myles Miller at the Texas Historical Commission for reviewing the final product.

Brett A. Houk

CHAPTER 1: INTRODUCTION

Ann M. Irwin and Doug Drake

Project Background

Two archeological sites in McCulloch County were determined to be affected by the first construction phase of a 15-mile project from Fife, Texas, along FM 765 to its intersection with U.S. 377 north of Mercury, Texas. In April 1973, Daymond Crawford of the Texas Department of Transportation (TxDOT) discovered one of these sites, 41MK10, during a routine archeological reconnaissance of the proposed right-of-way. Ann M. Irwin recorded the second, 41MK27, during initial investigations at 41MK10 in the summer of 1978 (Figure 1.1). Both sites lie along the banks of Bluff Creek, approximately 4.5 km south of its confluence with the Colorado River (Figure 1.2).

Preliminary subsurface testing and surface collection, mapping, and evaluation of these sites was conducted by TxDOT personnel under the direction of Ann M. Irwin during the summer of 1978. Results of this initial testing were submitted to the Texas Historical Commission in the report *Test Excavations along FM 765, McCulloch County, Texas*. Further excavation and mitigation at these sites was conducted in late 1978 to early 1979 under Antiquities Permit No. 232, issued by the State of Texas Antiquities Committee.

These two sites, referred to as the Bluff Creek sites, were excavated immediately prior to the excavation of two additional prehistoric sites in northeastern McCulloch County, 41MK8 and 41MK9. A report on 41MK8 and 41MK9 was not completed, and these sites were ultimately subsumed in a recent sweeping study conducted by The University of Texas at Austin on the burned rock midden phenomenon (Black et al. 1997). A detailed discussion of field methodologies by TxDOT personnel during the McCulloch County project is included in that study (Black 1997a:169-175, 183-189), and the reader is directed to that summary for further data.

The discovery, test excavations, and final excavations at the Bluff Creek sites were made in compliance with Public Law 89-670 (The Department of Transportation Act of 1966); 36 C.F.R., Part 60 (*Criteria for Comprehensive Statewide Historic Surveys and Plans*); 36 C.F.R., Part 800 (*Procedures for the Protection of Historic and Cultural Properties*); and the Memorandum of Understanding between the State Department of Highways and Public Transportation and the Texas Antiquities Committee, dated January 5, 1972.

Analyses of sites 41MK10 and 41MK27 and their cultural materials were conducted by TxDOT personnel in 1979, and an initial draft form of the report was prepared by Ann Irwin in the early 1980s. After internal review, the draft report was recently submitted to the Texas Historical Commission (THC), requesting their concurrence with proposed modifications to the original report. These modifications involved reorganizing the report, updating certain sections in light of more recently published reports and articles, and expanding the discussion about the distribution of materials and the conclusions. The THC concurred with these and recommended three additional modifications: 1) corroborating the interpretation that the deposits at 41MK27 were mixed, possibly through the use of radiocarbon dating; 2) enhancing the discussion of the distribution of materials with more statistically grounded analyses; and 3) making minor modifications to data tables.

TxDOT subsequently contracted SWCA, Inc. Environmental Consultants in 1999 to complete the report of the results of archeological investigations at 41MK10 and 41MK27 and to prepare the artifacts and records for curation. The research design guiding the original excavations, analyses, and report preparation emphasized culture history, and TxDOT recommended that this emphasis be maintained in the final report. The Antiquities Permit was transferred to Kevin A.

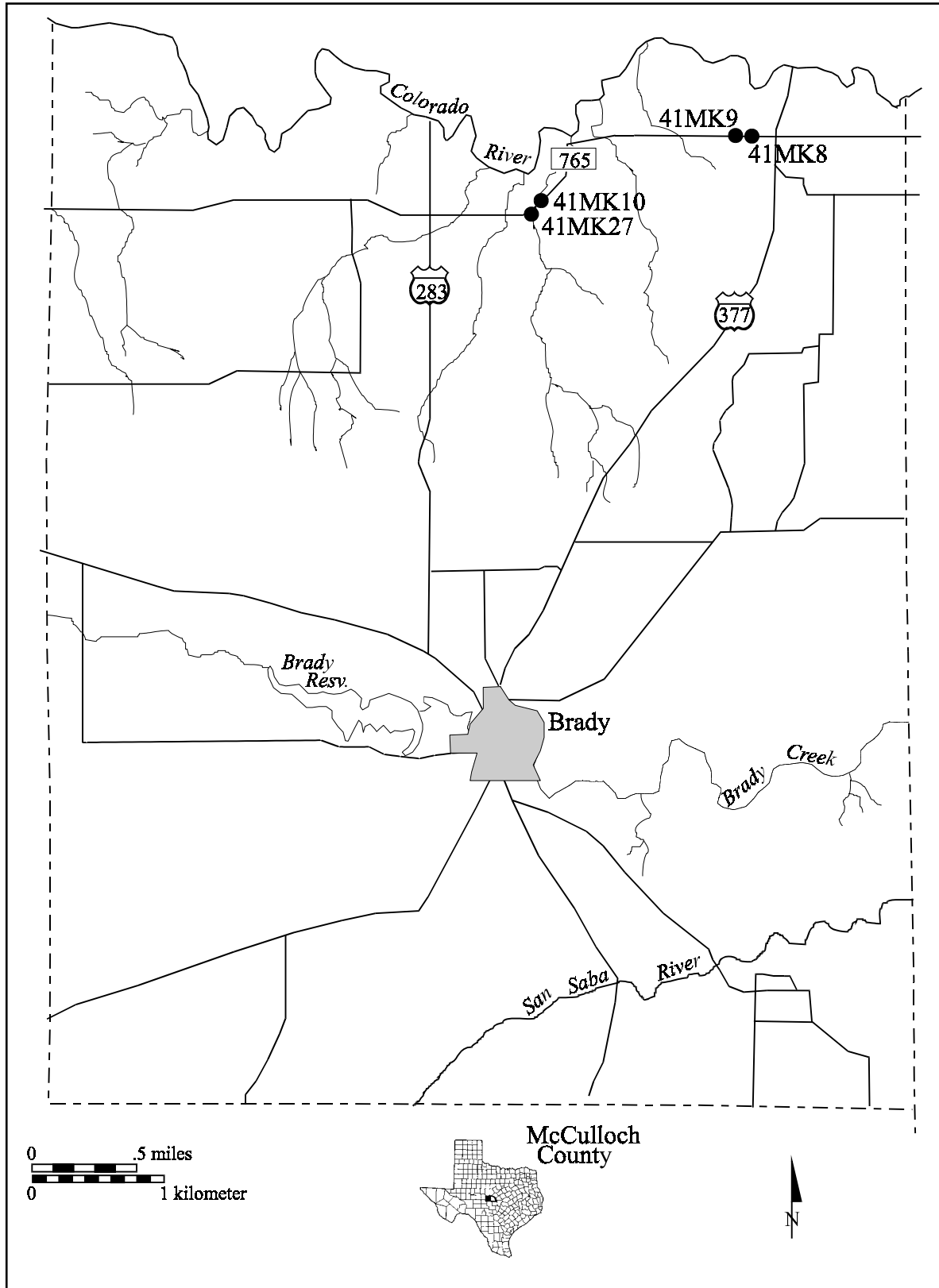


Figure 1.1. Project location map.

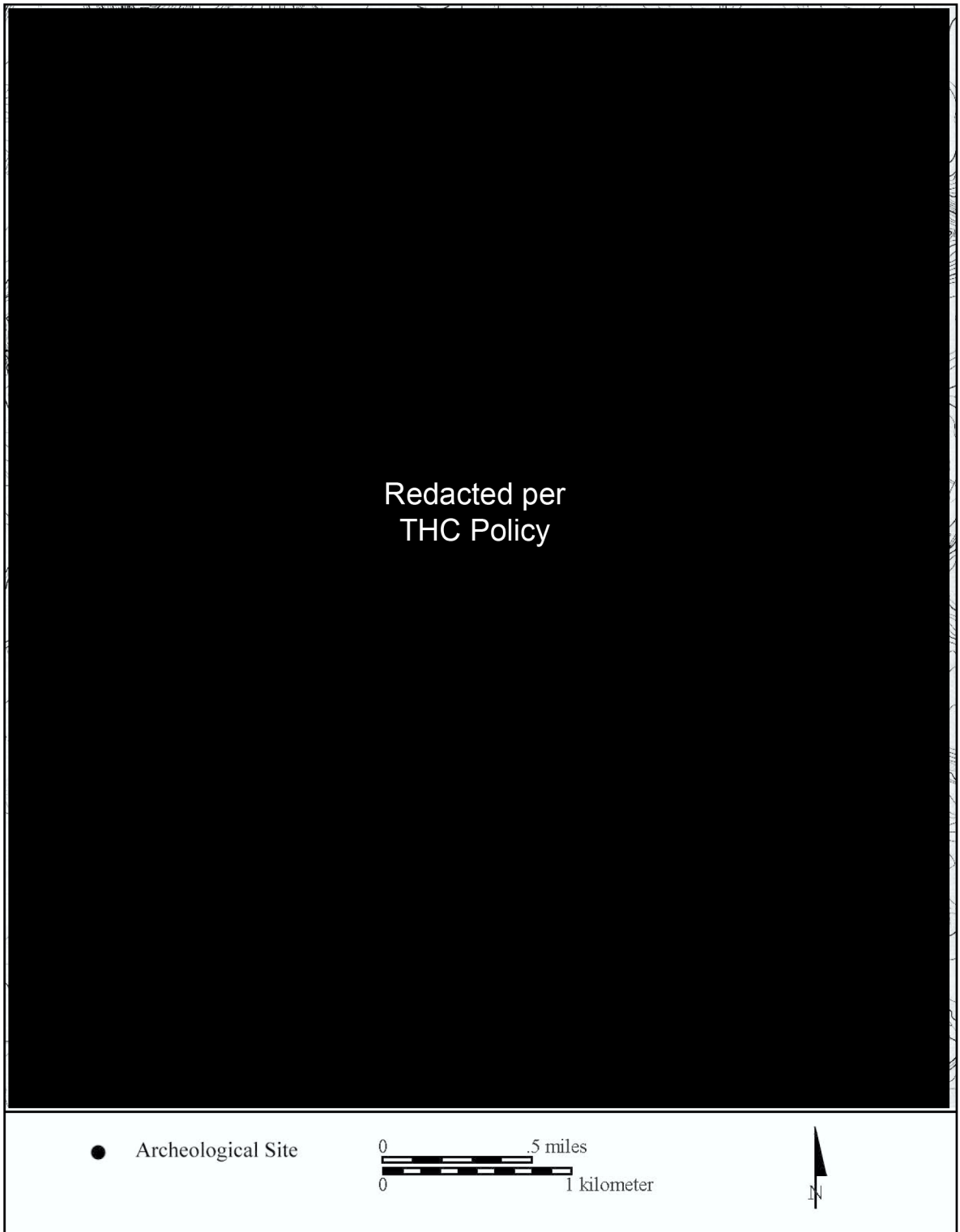


Figure 1.2. Topography and site areas along FM 765 right-of-way.

Miller, the Principal Investigator for SWCA. The original report was reorganized and revised by Brett A. Houk, the Project Archeologist for SWCA, and Doug Drake, the assistant Project Archeologist. Where possible, the original text was not altered substantially. Outdated information was corrected, and new information was incorporated where needed.

Report Organization

The remainder of the report is organized as follows. Chapter 2 presents a summary of the culture history of the Central Texas archeological region. Chapter 3 describes the environmental setting of the area. Chapter 4 includes a description of 41MK27, a discussion of the research design, and a review of the project methods. The results of the excavations at 41MK27, including descriptions of the artifacts and features, are presented in Chapter 5. The distribution of cultural materials and conclusions about the site are discussed in Chapter 6. The final chapter is devoted to the excavations at 41MK10. Supporting information is included in four appendices.

CHAPTER 2: ARCHEOLOGICAL BACKGROUND

Brett A. Houk and Ann M. Irwin

Introduction

This chapter presents a summary of the culture history of the Central Texas archeological region to provide some context for later discussions. Since the completion of the fieldwork, a tremendous amount of information has been collected in the region and our understanding of the prehistory of Central Texas has improved considerably. Excavation data form the basis for the culture history, and the second half of this chapter is devoted to a review of several major archeological projects in the vicinity of 41MK10 and 41MK27 that have contributed significantly to the regional database.

Background to the Culture History

Various attempts have been made to order the archeological remains in Central Texas. J. Charles Kelley (1947, 1959) used the Midwestern Taxonomic System to organize archeological materials into related groups. He referred to what was later termed the Central Texas Archaic as the Edwards Plateau Aspect, employing various types of projectile points to distinguish different foci.

In 1954, Dee Ann Suhm, Alex Krieger, and Edward Jelks summarized the various interpretations of archeological remains in Texas. Their work provided a brief outline of each recognized archeological area of the state, and presented a series of types for both projectile points and ceramics (Suhm et al. 1954). In their chronology, Suhm et al. (1954) used two of Kelley's cultural units—the Edwards Plateau Aspect and the Central Texas Aspect.

Suhm (1960) continued her interest in the archeology of Central Texas, and in 1960 presented a comprehensive study of the historical developments in archeol-

ogy in this area. The Edwards Plateau Aspect remained a useful cultural unit, but she established that the previous attempts to recognize meaningful subdivisions within it had been basically unsuccessful (Suhm 1960). She added the Austin and Toyah foci to the Central Texas Aspect (Suhm 1960).

Two years later, LeRoy Johnson, Dee Ann Suhm, and Curtis Tunnell (1962) summarized what was then the generally accepted broad outline for Central Texas prehistory (as well as for other parts of the state). Their proposed developmental stages were 1) the Paleoindian Stage, 2) the Archaic Stage, 3) the Neo-American Stage, and 4) the Historic Stage. Johnson et al. (1962) divided the Archaic of the Edwards Plateau Aspect into four periods: Early, Middle, Late, and Transitional. The first three of these divisions had been in vernacular usage for some time, but the introduction of a Transitional Archaic was a new development. This period is characterized by dart type projectile points that occur directly prior to the introduction of the bow and arrow in the archeological record and may be coeval with arrow points in some areas (Johnson et al. 1962).

Somewhat later, Johnson (1967) attempted to correlate prehistoric materials and presented a periodization which relied less upon type names as fossil indicators and more upon the descriptive morphology and gross size of the specimens. His period markers, however much one may emphasize their morphological attributes, are recognized point types in the traditional sense. Johnson distinguished five periods, I through V, of which periods III and IV segregate the period markers somewhat differently than the periods established earlier by Johnson, Suhm, and Tunnell (1962).

Frank Weir (1976) presented a classification system with the goal of contributing to our understanding of the people and events represented by the archeological record. He divided the Archaic Stage in Central

Texas, The Central Texas Archaic, into five phases (Weir 1976:14):

- 1) The San Geronimo Phase (8000–4500 B.P.)
- 2) The Clear Fork Phase (5000–4000 B.P.)
- 3) The Round Rock Phase (4200–2600 B.P.)
- 4) The San Marcos Phase (2800–1800 B.P.)
- 5) The Twin Sisters Phase (2000–700 B.P.)

Although certain projectile point types are characteristic of each phase, the phases themselves are based on more than the presence of those projectile points as “type fossils”. Other stone tools were taken into consideration, and features such as burned rock middens, hearths, structures, bedrock mortars and grinding surfaces, human burials, and dog burials were used in deriving the phases. It is suggested that, rather than only representing a constellation of traits, these phases reflect aspects of population dynamics, changes within subsistence strategies, changes in the communication system, and shifts in the sociopolitical organization of the peoples whose archeological remains constitute the Central Texas Archaic, a period lasting for more than 7000 years.

Prewitt (1981, 1985) published a revised chronology for Central Texas, retaining some of Weir’s (1976) phase names but further subdividing the Archaic into eleven phases. Prewitt’s (1981, 1985) Neo-Archaic stage, the successor to the long-lived Archaic, was divided into two phases, the Austin and Toyah, that were originally proposed by Suhm (1960) and refined by Jelks (1962) based on excavations at the Kyle site.

Since Weir (1976) and Prewitt (1981, 1985) first proposed regional phases, the approach has not been universally accepted and has drawn strong criticism from some researchers (e.g., Black 1989; Black and McGraw 1985; Johnson 1987; Johnson and Goode 1994; Peter et al. 1982). The primary weakness with the phase approach in the opinion of Black (1989:22–23) is that the Central Texas archeological region “is environmentally too diverse to expect homogeneous cultural developments as implied by regional phases.” Johnson (1987) attacked the concept of phases on the basis that they should be sociocultural units representing a social group rather than time periods encompassing the activities of many different groups.

More recent chronologies have used the generally accepted cultural framework based on temporal periods rather than regional phases (e.g., Black 1989; Collins 1995; Johnson and Goode 1994; Turner and Hester 1993). Johnson and Goode’s (1994) and Collins’ (1995) chronologies, using extensive radiocarbon data, changed the previously accepted dates of the Archaic and its subperiods. Both chronologies subdivide the archeological periods and subperiods based on projectile point (or archeological) style intervals rather than phases (Collins 1995; Johnson and Goode 1994).

The following cultural-historic outline is based on the chronologies proposed by Collins (1995) and Johnson and Goode (1994). Dates are reported as years before present (B.P.), and the cultural sequence is divided into four periods: Paleoindian, Archaic, Late Prehistoric, and Historic (Figure 2.1). The Archaic period is subdivided into four subperiods: Early, Middle, Late, and Transitional. Because both 41MK10 and 41MK27 do not contain Historic period occupations, the discussion of the chronology is limited to the Paleoindian, Archaic, and Late Prehistoric periods.

Chronology

Paleoindian Period

Paleoindian artifacts and sites date from about 11,500–8800 B.P. and are not uncommon in Central Texas (Collins 1995). The period begins during the close of the Pleistocene with the earliest evidence of humans in the Central Texas region. Diagnostic artifacts of the period include lanceolate-shaped, fluted projectile points such as *Clovis*, *Folsom*, and *Plainview*. These projectile points were hafted onto wooden spears, launched from atlatls (spearthrowers), and often used to hunt big game such as mammoth, mastodons, bison, camel, and horse (Black 1989). During the Paleoindian period, subsistence strategies gradually changed to include increased harvesting of flora and small game as the big game died off and the climate warmed following the end of the Pleistocene ice age. Representative Central Texas Paleoindian sites include Kincaid Rockshelter, Wilson-Leonard, Gault, and St. Mary’s Hall (Collins 1995).

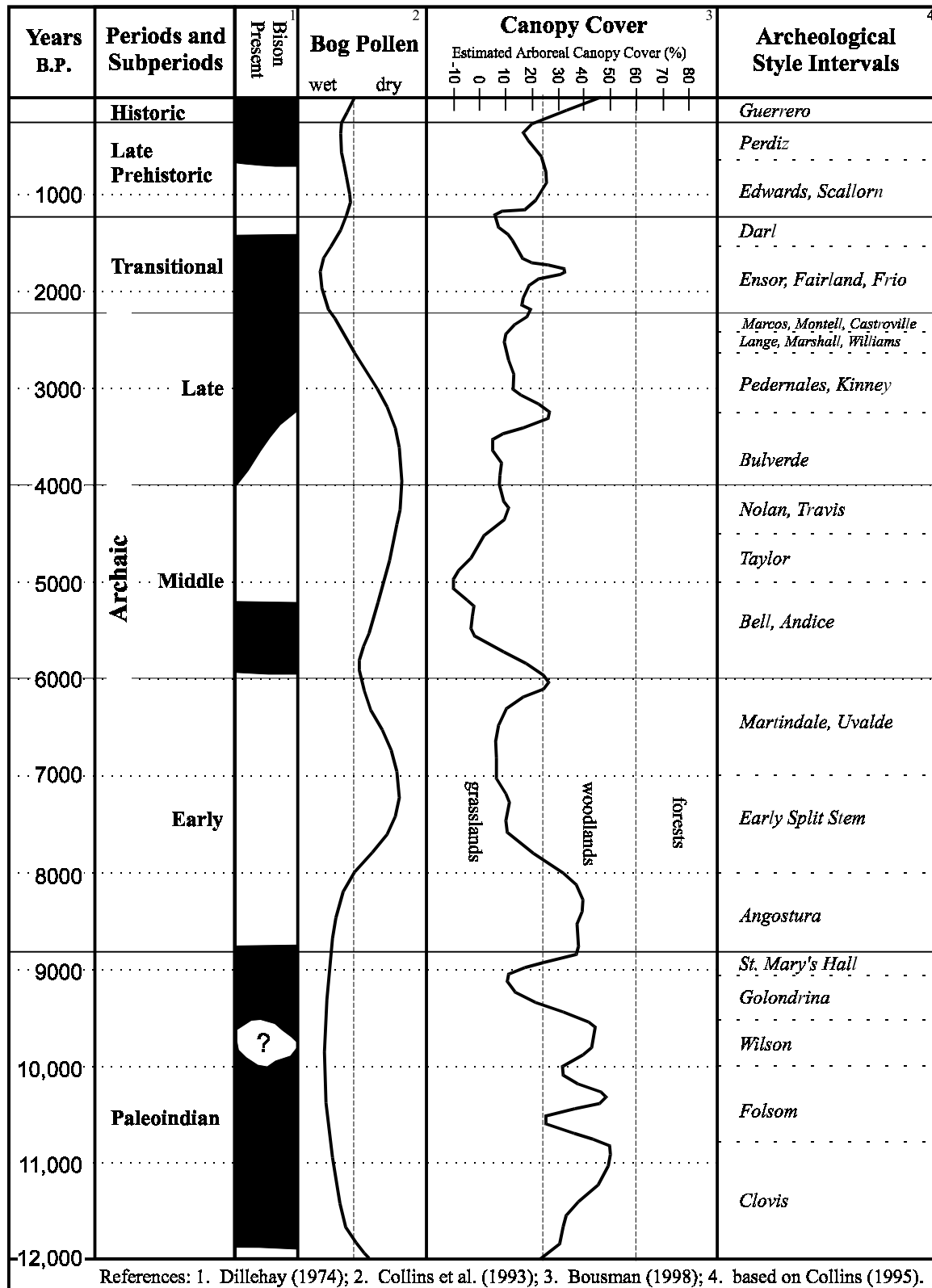


Figure 2.1. Cultural chronology for Central Texas.

Archaic Period

As the Paleoindian period came to an end, humans began to harvest more intensively local floral and faunal resources (Collins 1995). Material culture became more diverse, and the use of burned rock middens and ovens became widespread. This period is known as the Archaic period and dates from approximately 8800 to 1200 B.P. in Central Texas (Collins 1995; Johnson and Goode 1994). While Collins (1995) and Johnson and Goode (1994) subdivide the Archaic into Early, Middle, and Late subperiods, this report recognizes the Transitional Archaic subperiod as the end of the Archaic.

Early Archaic

Early Archaic artifacts and sites date from about 8800 to 6000 B.P. (Collins 1995). Once thought to be Paleoindian in age, some unstemmed point types such as *Angostura* have recently been recognized as the first Early Archaic diagnostic styles (Collins 1995). By about 8000 B.P., these points were replaced by stemmed varieties such as *Early Split Stem*, *Martindale*, and *Uvalde* (Black 1989; Collins 1995). Most sites were open campsites, although cave sites have been found (Collins 1995). Current site distribution data suggest that Early Archaic peoples were concentrated along the eastern and southern margins of Edwards Plateau in areas with more stable water sources (Collins 1995; McKinney 1981). Specialized tools, perhaps used in woodworking, known as Guadalupe and Nueces bifaces, were prevalent in this period (Collins 1995). While subsistence data are sparse, it appears that people were hunting deer and other small animals, fishing, and cooking bulbs in earth ovens (Collins 1995). This strategy evolved, in part, due to the extinction of megafauna and the changing climate at the beginning of the Holocene (McKinney 1981). Representative sites of the Central Texas Early Archaic include the Loeve-Fox, Jetta Court, and Sleeper sites (Collins 1995).

Middle Archaic

Middle Archaic artifacts and sites date from about 6000 to 4000 B.P. with multi-use bifacial knives becoming

more common. Characteristic Middle Archaic projectile points include *Bell*, *Andice*, *Taylor*, *Nolan*, and *Travis*, several of which are deeply notched (Black 1989). These artifacts could have served as knives and projectile points. Bison were hunted intensively at the start of the Middle Archaic, but, as the climate became drier, a reliance on dry climate plants such as sotol (*Dasyilirion* spp.) probably became common. The end of the Middle Archaic may have been the most xeric conditions ever in Central Texas (Collins 1995). The climatic change was accompanied by a technological change as *Nolan* and *Travis* points, which are thick and have narrow blades, first appeared in the archaeological record (Collins 1995). Burned rock middens and earth ovens first appeared circa 5000 B.P. and became increasingly common, although their exact functions may have varied based on the culture and environment (Johnson and Goode 1994). Representative sites of the Texas Middle Archaic include the Landslide, Wounded Eye, Gibson, and Panther Springs sites (Collins 1995).

Late Archaic

Late Archaic artifacts and sites date from about 4000 to 2250 B.P., and increasingly complex and sedentary cultural manifestations first appeared during this period. It is hypothesized that the period began with very xeric conditions but gradually became more mesic (Collins 1995). Characteristic dart point types include *Bulverde*, *Pedernales*, *Marshall*, and *Marcos* (Collins 1995). Sites of the Late Archaic are very common and include burned rock middens, open campsites, and lithic procurement sites. Population increases are evidenced by large cemeteries. Also, trade and exchange networks between cultures appear to have increased in complexity as evidenced by exotic goods in sites and cemeteries (Black 1989). Bement (1991) interprets the evidence for group investment in the Thunder Valley sinkhole cemetery, dated to 2900 B.P. based on stratigraphy, to indicate that groups were declaring control over a particular territorial range during the Late Archaic. Representative sites of the Central Texas Late Archaic include the Anthon and Loeve Fox sites (Collins 1995).

Transitional Archaic

As Collins (1995:384–385) notes, “diverse and comparatively complex archeological manifestations toward the end of the Late Archaic attest to the emergence of kinds of human conduct without precedent in the area.” This period (2250–1250 B.P.), referred to as the Transitional Archaic (Turner and Hester 1993) or Terminal Archaic (Black 1989), is not recognized by all researchers, and other chronologies extend the Late Archaic to 1200–1250 B.P. (Collins 1995; Johnson and Goode 1994). Johnson et al. (1962) originally designated the Transitional Archaic as a subperiod of the Archaic because of the similarities between the latest dart point types and the earliest arrow point types. Since then, however, the designation has failed to be universally accepted by researchers. In two recent chronologies for Central Texas, Collins (1995) does not include the Transitional as a subperiod of the Archaic, and Johnson and Goode (1994) separate the Late Archaic into two subperiods designated Late Archaic I and Late Archaic II. The Transitional Archaic, as it is used here, closely corresponds to Johnson and Goode’s (1994) Late Archaic II, but begins after the appearance of *Marcos* points, not with it. In this scheme, the Transitional Archaic coincides with the last two style intervals recognized by Collins (1995:Table 2) for the Late Archaic subperiod.

During the Transitional Archaic, smaller dart point forms such as *Darl*, *Ensor*, *Fairland*, and *Frio* were developed (Turner and Hester 1993). These points were probably ancestors of the first Late Prehistoric arrow point types and may have overlapped temporally with them (Hester 1995; Houk and Lohse 1993). In Llano County, to the southeast of McCulloch County, numerous Transitional Archaic points were recovered from the Slab Site, a campsite overlooking the Llano River (Patterson 1987).

Several researchers believe that the increased interaction between groups at the end of the Late Archaic was an important catalyst for cultural change (Collins 1995; Johnson and Goode 1994). This change may have included increased regional stress and conflict between groups as interaction became more frequent (Houk et al. 1997). In Bexar County, researchers noted a distinct shift in settlement patterns during this pe-

riod (Houk et al. 1997). It is hypothesized that groups began to use hilltops as camps rather than just lithic procurement locations. These elevated locations would have provided points from which to observe game and other groups of humans as they moved through the surrounding creek valleys and upland prairies (Houk et al. 1997).

Late Prehistoric

By the end of the Transitional Archaic, bow and arrow technologies were introduced, indicated by the increasingly smaller size of projectile points. The subsequent period, once called the Neo-American stage (Johnson et al. 1962) or Neo-Archaic stage (Prewitt 1981), is now commonly referred to as the Post-Archaic era (Johnson and Goode 1994) or the Late Prehistoric period (Black 1989; Collins 1995; Turner and Hester 1993). The Late Prehistoric period dates from 1250 to 260 B.P. (Collins 1995). Characteristic artifacts include small arrowpoints like *Perdiz* and *Scallorn* as well as a variety of specific-use tools. The Austin and Toyah intervals of the Late Prehistoric, originally recognized by Suhm (1960) and Jelks (1962), remain accepted divisions for the period. These style intervals may represent distinct cultural entities (Johnson 1994), although others challenge this view (Black and Creel 1997).

During the earlier Austin interval, burned rock midden use may have reached its maximum based on recent conclusions by Black and Creel (1997). Characteristic arrow point types of the Austin interval include *Scallorn* and *Edwards* (Collins 1995; Turner and Hester 1993). By the Toyah interval, plainware ceramics appeared, indicating possible influence in the Central Texas region from ceramic producing cultures to the east and north (Perttula et al. 1995). Contrary to bog pollen data (Collins et al. 1993), data from Hall’s Cave in Kerr County indicate that the climate of Central Texas began to dry around 1000 B.P. (Toomey et al. 1993). This drying trend may have resulted in a change in vegetation that made central and south Texas more conducive to bison migration into the area. Bison remains in archeological sites in the region became common after 750 B.P. (Dillehay 1974; Huebner 1991).

Most Toyah sites have the distinctive *Perdiz* arrow point type, and some sites also have bison processing tool kits. This technological change has been interpreted as the spread of an ethnic group by Johnson (1994) and as the spread of technological ideas in response to opportunities provided by an increased bison population in the Late Prehistoric by Ricklis (1992). Increasing complexity in subsistence patterns and very high prehistoric populations are postulated for the Late Prehistoric period (Black 1989; Collins 1995). Although no faunal remains were reported from the Slab Site, archeologists recovered numerous *Perdiz* arrow points and Leon Plain ceramics indicating a Toyah occupation (Patterson 1987). Representative sites of the Central Texas Late Prehistoric include the Kyle, Smith, and Currie sites (Collins 1995).

Previous Investigations

Although relatively little archeological work has been done in McCulloch County itself, a significant amount of previous research has been accomplished in the Central Texas region—the archeological region defined by Prewitt (1981) and commonly accepted by other researchers with minor modifications that encompasses the county (see Collins 1995; Ellis et al. 1995; Hester 1989). From these investigations have been derived the basic cultural inventory and chronological schemes for Central Texas. Published investigations of this sort include the work of Sorrow, Shafer, and Ross (1967) in Bell County; Keller and Denton (1976) in Bexar County; Shafer, Baxter, and Stearns (1976) in Brown County; Shafer (1967, 1969) in Coke County; Johnson, Suhm, and Tunnell (1962) in Comal County; McNatt (1978) and Shafer (1975) in Comanche County; Denton (1976) in Gillespie County; Luke (1980) in Kerr County; Luke (1981) in Schleicher County; Crawford (1973), Jarvis and Crawford (1974), and Luke (1981) in Sutton County; and Moore (1978), Scheutz (1957), and Sorrow (1969) in Williamson County. More recently, several major projects have been completed in

Central Texas. Some of those relevant to 41MK10 and 41MK27 are discussed below.

The Burned Rock Midden Project

Two sites in McCulloch County, 41MK8 and 41MK9, referred to as the Corn Creek sites, were excavated by TxDOT in 1978–1979 and reported by Black, Ellis et al. (1997) as part of a larger project that analyzed data from six burned rock middens at four separate sites¹. The Corn Creek sites were both within the impact area of the FM 765 right-of-way and were investigated by TxDOT prior to the construction of the road (Black 1997a:171). They are located on opposite sides of Corn Creek, on raised topography overlooking the creek valley (Black 1997a:171). Both have generally shallow soils, although 41MK9 has been affected by coluvial materials washing down from a higher ridge to the west (Black 1997a:171).

Site 41MK8 contained three burned rock middens, one of which was within the right-of-way of FM 765 and was therefore excavated by TxDOT. The small midden measured approximately 11 m across and was built directly on bedrock (Black 1997a:175). Unfortunately, attempts to radiocarbon date the feature were inconclusive, however, the diagnostic artifacts span the Middle Archaic through Late Prehistoric (Black 1997a:180). Black (1997a:180) notes that the Late Prehistoric “is considered the only definitively dated period of site and midden use.”

Site 41MK9 contained three small burned rock middens in an 80-x-50-m area (Black 1997a:182–183). All three were within the FM 765 right-of-way and were excavated by TxDOT. As was the case with 41MK8, the age of the middens at 41MK9 was difficult to determine due to the shallow stratigraphy and lack of vertical separation of artifacts within the deposits (Black 1997a:195). All three middens, however, were tentatively assigned Late Prehistoric ages based on the available data (Black 1997a:200). Black

¹ Commonly referred to as the Burned Rock Midden Project, TARL conducted an analysis and write-up of four burned rock midden sites that had been excavated by TxDOT between 1978 and 1988. These sites were 41MK8, 41MK9, 41MS32, and 41UV86. Although a fifth site, 41UV88, was originally included in the project, it was reported separately because it was analytically too dissimilar to the other four sites (Black and Ellis 1997:1).

(1997a:201–205) concluded that, of the two sites, 41KM9 was more intensively occupied and that different activities may have occurred at each midden, accounting for their varied forms and associated cultural materials.

In Mason County, immediately south of McCulloch County, TxDOT excavated the Honey Creek site, 41MS32, in 1987–1988 (Black 1997b:101–105). This site, located at the mouth of the Honey Creek canyon, 3.2 km north of the confluence of Honey Creek and the Llano River, contained a circular burned rock midden that was surrounded by a hearth field and scattered cultural materials (Black 1997b:99–101). Black and Creel (1997:273) characterize the midden at the Honey Creek site as “one of the most tightly dated burned rock middens in all of central Texas by virtue of its radiocarbon record.” Twelve assays from within the midden date the feature to A.D. 1100–1700 (approximately 850–250 B.P.), although diagnostic artifacts from within the midden cover a much longer time span (Black and Creel 1997:273, 280).

The fourth site studied by the Burned Rock Midden Project was 41UV86, the Heard Schoolhouse site. Located in Uvalde County along Mine Creek, 41UV86 was excavated in 1982–1983 by TxDOT (Creel and Goode 1997:207). This site contained a small, Austin interval burned rock midden that had been previously damaged by a bulldozer (Creel and Goode 1997:207). Based on nine calibrated radiocarbon dates, the midden formed between A.D. 1000 and 1450 (Creel and Goode 1997:224). The secure radiocarbon dates and the large number of *Sabinal* arrow points lead Black and Creel (1997:234) to suggest that other middens in the general area may also date to this period including those excavated by Huskey (1935) and Houk and Lohse (1993).

One of the most important conclusions to come out of the Burned Rock Midden Project was that Late Prehistoric burned rock middens may contain older artifacts through incorporation and recycling (Black and Creel 1997:280). Older artifacts, already present at the site, become incorporated into the midden’s matrix through pit digging and earth movement. Alternatively, Late Prehistoric peoples scavenged Archaic artifacts as blanks for making new artifacts (Black and

Creel 1997:280). Therefore, it is potentially problematic to date burned rock middens exclusively on the basis of associated, temporally diagnostic artifacts.

Black and Creel (1997:273) suggest, based on an analysis of radiocarbon dates from middens across Central Texas, that “the heyday of middenry began after A.D. 1 and peaked during the Late Prehistoric.” Importantly, they also conclude that Toyah people reoccupied and added to burned rock middens (Black and Creel 1997:282). This conclusion contradicts the long-standing interpretation that burned rock middens ceased to function as cooking features with the appearance of Toyah culture in Central Texas (e.g., Collins 1995:388).

The Slab Site

The Slab site, 41LL78, was excavated by TxDOT in 1980–1981 in nearby Llano County (Patterson 1987). The Slab site is located on a rise above the Llano River and was to be affected by the renovation of a low water crossing on RM 3404. The impact to the portion of the site within the right-of-way was mitigated through the excavation of 62 1-x-1-m units (Patterson 1987:2). The majority of these units was grouped together to form an irregular block that was 40 m long by 10 m wide along its maximum dimensions. Diagnostic artifacts from the site were primarily associated with the Transitional Archaic and Late Prehistoric, but the most important result of the study was the discovery of several circular arrangements of stones that Patterson (1987) believes were structural features. These loosely patterned features appeared to contain central hearths in some cases (Patterson 1987:31). The cultural material at the site was unfortunately compressed, and possibly mixed, in the upper 35 cm of stratigraphy, making it difficult to assess the validity of Patterson’s (1987) conclusion that the features are structural remains. If they are structural features, the compressed stratigraphy makes it impossible to determine with which time period they are associated.

The Lion Creek Site

Another site with even better evidence for prehistoric structures is the Lion Creek site, 41BT105, located west of 41LL78 in Burnet County (Johnson 1997). In 1977,

TxDOT archeologists excavated the portion of 41BT105 that was to be impacted by construction of RM 690 in the location of a pre-existing county road (Johnson 1997). The site, which has been largely destroyed by the construction of the road and by looters who pillaged the surrounding sections, was situated on the upper part of the south bank of Lion Creek (Johnson 1997:3–7). Archeologists uncovered three aboriginal structures—one dating to the Late Prehistoric and two apparently dating to the *Pedernales* style interval of the Archaic (Johnson 1997:30–41).² These structures were composed of circular arrangements of rock around central hearths, and associated artifacts included projectile points, flint knapping debris, and groundstone (Johnson 1997:30–49). The site is one of the few with well-defined aboriginal structures in Central Texas (see Johnson [1997:56–62] for a review of other published accounts of such structures).

The O. H. Ivie Reservoir Project

Northwest of McCulloch County, extensive archeological investigations were conducted along the Colorado and Concho rivers in association with the construction of O. H. Ivie Reservoir between 1980 and 1990 by various cultural resource management firms, culminating with Mariah Associates' testing and mitigation of several sites in 1988–1990 (Lintz, Trierweiler, and Kuhl 1993). Forty prehistoric sites were tested, and, of that sample, eight were mitigated (Trierweiler et al. 1993).

While it is beyond the scope of this report to describe the results of Mariah's investigations in detail, a few of their conclusions relevant to the deposits at 41MK10 and 41MK27 are summarized here. During the Late Archaic (overlapping with the Transitional Archaic as defined above), the prehistoric inhabitants of the area had a diverse subsistence economy, exploiting bison, deer, small mammals, fish, shellfish, and reptiles (Treece 1993:Table 9.5). Several examples of slab-lined hearths dating to the same period were excavated

(Treece 1993:Table 9.5). Annular burned rock middens dating to the early part of the Late Prehistoric were mitigated at three sites. These features may represent a “substantial reliance on plant staples” prior to an increased reliance on bison during the Toyah interval (Treece 1993:561–565). Mariah archeologists also found possible evidence for an aboriginal structure in the form of postholes at 41CN19 (Treece 1993:571).

Onion Creek

In 1989 and 1990, TARL conducted excavations at two prehistoric sites in the Onion Creek Valley of Hays County (Ricklis and Collins 1994:1). Both sites, 41HY202 and 41HY209, along with a historic site (41HY210) that was also mitigated, were to be impacted by the construction of a new segment of FM 1626 (Ricklis and Collins 1994:1). At 41HY209, archeologists excavated a burned rock midden, situated on a bluff, that contained a well-preserved, slab-lined pit near its center (Collins 1994). The majority of the diagnostic artifacts from the midden were Transitional Archaic (as defined in the chronology above) dart points and Late Prehistoric arrow points and ceramics (Collins 1994). Radiocarbon dates from the midden were consistently younger than the Late Archaic (Transitional Archaic) age for the feature assigned by Collins (1994:166).

At a separate area of 41HY209, archeologists excavated an extensive Toyah component (Ricklis 1994). The area contained a bone bed, a bone-filled pit, and a series of burned rock clusters (Ricklis 1994:239–243). Ricklis (1994:285) infers that a Toyah-age structure was present at the site based on the pattern of cultural materials. The primary activities conducted at the Toyah area concerned the processing of large game including deer, antelope, and bison (Ricklis 1994:284). This included butchering, breaking large bones to extract marrow, and fragmenting bones as part of a grease production process (Ricklis 1994:284).

² The Late Prehistoric structure (House 3) was radiocarbon dated to 995±55 B.P. (Beta-44695). Johnson (1997) refers to House 1 as Middle Archaic, but recent revisions to the Central Texas chronology now place the *Pedernales* projectile point type in the Late Archaic (e.g., Collins 1995; Johnson and Goode 1994). In the afterword written in 1995 to the Slab site report, the body of which was written in 1990, Johnson (1997:181–182) presents a revised chronology. Johnson (1997:38–41) is skeptical that “House 2” is actually a structure.

Wurzbach Project

In the early 1990s, TARL conducted testing at several sites along the proposed Wurzbach Parkway right-of-way in north San Antonio for TxDOT (Black 1995:1). Bexar County, in which the project was located, marks the southeastern extent of the Central Texas region. Although several sites were investigated by the project, including 41BX228, which had been previously excavated (Black and McGraw 1979), the most intensively studied site was 41BX184, the Higgins site (Black 1995). Referred to as the Higgins Experiment, the excavations at 41BX184 were “a conscious attempt to depart from the traditional approach to site investigation in Texas archeology” (Black et al. 1998:39). The excavations relied on a total data station to collect and record precise, three-dimensional provenience information on burned rocks and artifacts in a small burned rock midden and adjacent hearth field (Black et al. 1998).

The importance of the project stems from its meticulous discussion of the methods employed, the strengths and weaknesses of the approach, and the types of data that can be generated, not the specific conclusions about the archeology at 41BX184. The project demonstrated that “when archeological problems are clearly stated, the data are well defined, and the methods are tightly controlled, new things can be learned from the archeological record” (Black and Jolly 1998:229). The experiment failed, however, when questions were vague or poorly developed (Black and Jolly 1998:229). The project offers an alternative approach to excavating Central Texas sites. Moreover, the Wurzbach Project was influential in that it developed the first historic contexts for the San Antonio area (see Black and Potter 1995).

Culebra Creek Site

Three separate archeological testing projects were carried out at 41BX126—the first two by TxDOT in 1993 and 1995, and the third by the Center for Archaeological Research at The University of Texas at San Antonio for TxDOT in 1997 (Cargill 1998). The Culebra Creek site, as 41BX126 is known, is located in northwest Bexar County within the city of San Antonio on

Culebra Creek (Nickels 1998:1). The 1997 CAR investigations were prompted by a planned expansion of Loop 1604 into portions of the site that had not been previously assessed (Nickels 1998:1). Excavations targeted a small burned rock midden and surrounding off-midden areas (Nickels et al. 1998). The project concluded that the site has an intact *Nolan* component stratigraphically below the burned rock midden (Bousman and Nickels 1998:216). The core of the midden apparently formed between 4400 and 2000 B.P. during the Late Archaic (Nickels et al. 1998:109). Leach and Bousman (1998:126–135) argue that older artifacts, burned rocks, charcoal, and faunal remains are incorporated into middens through borrowing of nearby sediment to create caps for large earth ovens. This conclusion largely echoes that of Black and Creel (1997) and suggests that middens can not be accurately dated based on associated projectile points.

Summary

The projects listed above and many others not discussed have created the database from which the cultural history of Central Texas has been constructed. As new data are added to this database and as older information is re-evaluated, our understanding of the prehistory of Central Texas changes. In the past few years alone, the types of questions asked by archeological projects, the methods employed, and the types of sites chosen for excavation have changed. Several of the projects discussed here, particularly the Burned Rock Midden Project and the Wurzbach Project, have caused a rethinking of our approaches to Central Texas archeology and have challenged long-held beliefs about the chronology of the region.

CHAPTER 3: ENVIRONMENTAL SETTING

Doug Drake and Ann M. Irwin

Introduction

The following discussion provides an overview of the environmental setting relevant to the current investigations and the long span of human occupation in the vicinity of McCulloch County. In the last fifty years, there have been many attempts at reconstructing the environment of central Texas. With the advent of more sophisticated theories and tools in the last thirty years, many efforts have been made to correlate the ecological and archeological data in hopes of placing the prehistoric human occupation of central Texas in a more concise context. This discussion is presented in three sections: 1) a brief overview of environmental reconstruction efforts, 2) the paleoenvironmental periods associated with human occupation of central Texas, and 3) regional biotic resources available to inhabitants of the area.

Environmental Reconstructions

Following earlier attempts at classifying the Texas environment (Bailey 1905; Dice 1943), Blair (1950) produced the classic reference on the Texas environment, dividing the state into seven distinct biotic provinces based primarily on flora and fauna (Figure 3.1). The project area is within the northern extent of the Balconian Province (Blair 1950:112). Restricted to the Edwards Plateau, this province is described as a “hodge-podge” of biotic resources from four neighboring provinces. In a testament to the ever changing nature of ecological regions, none of the 57 noted mammalian species are endemic to this province. The mixed

grasslands of the Kansan biotic province are within 80 km of 41MK27, providing a macroscale ecotone.

Further work on the Balconian Province followed Blair’s broader framework, focusing on mammalian studies (Davis 1974; Neck 1986; Schmidly 1983), avifauna (Kutac and Caran 1994), herpetofauna (Dixon 1987), and vegetation (Diamond et al. 1987; Enquist 1987; Gould 1969; Lynch 1981). Similar studies are available for the neighboring Kansan and Texan provinces.

A theoretical shift in archeology occurred in the 1960s (i.e., Binford 1962) and was soon being applied to Texas. The New Archeology had as one of its core issues the relationship between humans and their en-

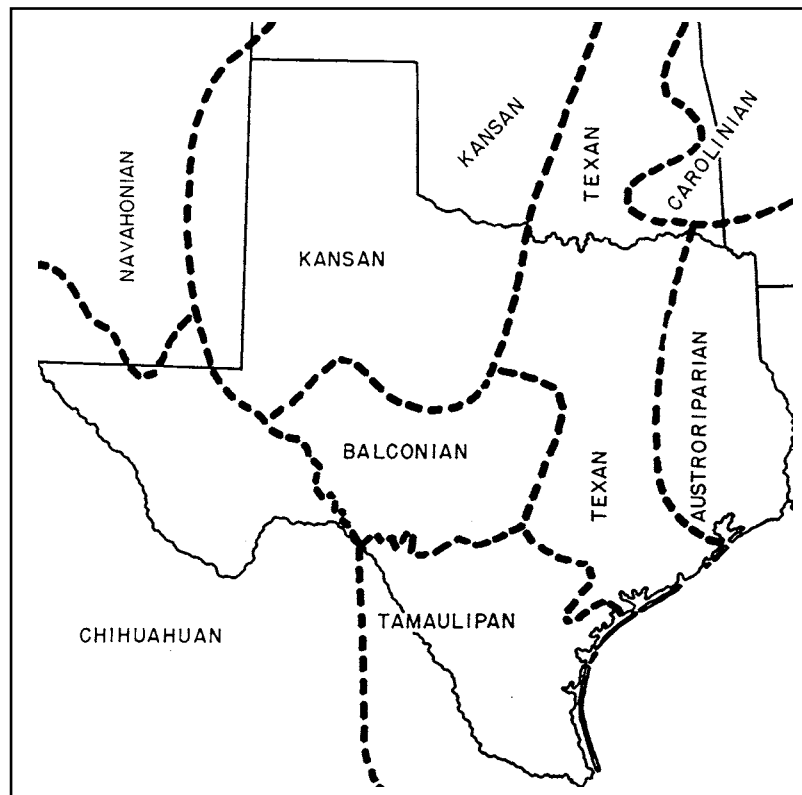


Figure 3.1. *Biotic provinces of Texas.* After Blair (1950:Fig. 1).

vironment. The earliest efforts at New Archeology in Texas were in the Lower Pecos region of southwest Texas, where excellent preservation offered a variety of types of cultural and environmental information (Bryant 1966, 1967, 1969).

Further work in Texas, utilizing pollen analysis, faunal analysis, and climatic data, was accomplished in the next 20 years (Bryant 1977; Bryant and Shafer 1977; Dillehay 1974; Gunn 1984; Gunn and Mahula 1977). A wealth of new information has been generated in the last decade, particularly with the increased use of geomorphology and geoarcheology (Abbott 1993; Blum and Valastro 1992; Lintz et al. 1993; Nordt 1992, 1993). It is now common practice with both large archeological projects and extended academic studies to interpret paleoenvironments on either site-specific or regional scales (Bousman 1998; Collins 1995; Johnson and Goode 1994; Nickels et al. 1998; Potter and Black 1995; Potter et al. 1995; Ricklis and Collins 1994).

Paleoenvironmental Periods

Humans have occupied central Texas for approximately the last 11,500 years (Collins 1995). The earliest inhabitants lived during the late (and/or terminal) Pleistocene Epoch, which ended ca. 10,000 B.P. The vast majority of prehistory has thus occurred in the Holocene Epoch, which is typically divided into early, middle, and late periods. During this time span the environment has fluctuated dramatically, and research to date has yet to produce a consensus on a general paleoenvironmental framework. Subtle variations across the landscape on the micro- and mesoscale, due to niches and biotic "islands" (Ellis et al. 1995), add to the complexity of the issue. Most data comes from pollen analysis and the study of mammalian remains.

Late Pleistocene

The late Pleistocene was on the wane when humans first entered central Texas (11,500–10,500 B.P.). Conflicting data do not offer a clear picture of the climate during this period, and this is exacerbated by gaps in the environmental record (Stahle and Cleaveland

1995:51). Pollen and isotope evidence (Bousman 1992, 1994) suggests a cool, dry period, while faunal evidence generally points to wetter conditions (Toomey et al. 1993). The late Pleistocene was unquestionably the end of the "Ice Age" megafauna. These animals included mammoth, mastodon, camel, horse, bison, saber-toothed cat, dire wolf, glyptodonts, and giant beaver. Vegetation, as recovered from pollen and/or macrobotanical samples, included pine, oak, hazelnut, maple, willow, ash, and birch (Bryant and Holloway 1985). Bousman's (1998) reinterpretation of pollen evidence in central Texas involved assessments of variations in arboreal pollen percentages and modern definitions of canopy cover. Based on this, it is postulated that "most of the Late Pleistocene plant communities were woodlands, and these samples certainly represent a mosaic of open to closed plant communities" (Bousman 1998:211).

Early Holocene

The early Holocene (10,500–7500 B.P.) is in part a transitional period as niches opened by the megafauna die-off were filled by both endemic and colonizing species. Data from Hall's Cave in Kerr County, Texas indicate small mammals more tolerant of drier conditions became more prevalent (Toomey et al. 1993). Pollen data (Bryant and Holloway 1985) generally reinforce this view: grasses became more dominant and trees fluctuated throughout this period. Bousman (1994:80) states that "woodland plant communities are reestablished by 8,700 yr B.P., but by 7,500 yr B.P. grass pollen again dominates." Mammalian communities became relatively modern during this time. A noticeable absence was the smaller, modern bison, the remains of which are scant in archeological and paleontological sites during this period (Dillehay 1974). Representative vegetation included oak, pine, pecan, and mixed grasses (Bryant and Holloway 1985).

Middle Holocene

Data for the middle Holocene (7500–5000 B.P.) exhibit slight inconsistencies that may reflect fluctuations in the environment, but the general trend was towards increased aridity. Soil evidence from Hall's Cave

(Toomey et al. 1993) suggests severe desiccation on the Edwards Plateau. Pollen records (Bryant and Holloway 1985) indicate dry conditions, although Bousman's (1994:80) interpretation of the pollen record is that "arboreal pollen continues to drop until 6,800 yr B.P. After a slight rise in arboreal pollen around 6,000 yr B.P., arboreal pollen declines until 5,000 yr B.P." Prairie dogs are absent from the Hall's Cave deposits during this time, which suggests a loss of preferred soil habitats due to erosion (Toomey et al. 1993). Bison returned to the southern plains around 6000–5200 B.P. (Dillehay 1974), indicating extensive grasslands. Humid tree species such as hazelnut, basswood, and birch disappeared by the end of the middle Holocene from Boriack Bog in Lee County (Bryant and Holloway 1985). A reinterpretation of central Texas pollen evidence concluded that "by 7000 B.P. little arboreal cover remained on the eastern edge of central Texas and it is likely that open plant communities covered much of central Texas in the Middle Holocene" (Bousman 1998:211).

Late Holocene

Environmental reconstruction efforts suggest the environment of the Late Holocene (5000–1000 B.P.) fluctuated greatly. Toomey et al. (1993:309) consider the period of 5000–2500 B.P. "drier than at any time during the last 20,000 years." This is supported by a complete absence of mammals requiring mesic conditions in late Holocene deposits from Hall's Cave, Schulze Cave in Edwards County (Dalquest et al. 1969), and Bering Sinkhole in Kerr County (Bement 1991). Pollen evidence generally supports this strong claim (Bousman 1994). However, contradictory geomorphic evidence (Blum and Valastro 1989) suggests the Pedernales River was continually aggrading due to mesic conditions.

The second half of the late Holocene (2500–1000 B.P.) witnessed the return of more mesic conditions, as evidenced by the recovery in Hall's Cave of mammals that prefer wetter environments (Toomey et al. 1993). Pollen records generally substantiate this, although grass again became dominant around 1600–1500 B.P. (Bousman 1994). Pollen analysis from Weakly Bog in Leon County, Texas records a "shift from oak-wood-

land to savannah-like plant communities between 1500 and 2000 years ago, which is interpreted as the establishment of the present Post Oak Savannah" (Holloway et al. 1987:71). Conversely, geomorphic evidence from the Pedernales River suggests sedimentation associated with xeric conditions starting circa 1000 years ago (Blum and Valastro 1989). Another study utilizing various environmental factors indicates a more xeric Southern Plains climate along with increased bison populations (Huebner 1991).

The Natural Environment

The following section presents data on the natural resources of the northwest Edwards Plateau environment. Data from within an 80-km radius of McCulloch County is used as much as possible to limit discrepancies that may result from geographical gaps.

Geology

The McCulloch County area is located in a geologically complex portion of Texas (Figure 3.2). Situated on the northwestern edge of the Edwards Plateau, the area includes the Llano Uplift immediately to the southeast and the Rolling Plains to the northwest (see Figure 3.2).

The Edwards Plateau is a large limestone area near the center of Texas which reaches elevations from approximately 600 feet above mean sea level (famsl) in its eastern portion to approximately 2,000 famsl in its western portion. This area attained its unique characteristics during the Cretaceous Period (144–66 million years ago), when shallow seas covered the area. Thick layers of limestone formed as calcareous animals died and settled to the bottom of the sea floor, gradually building massive sedimentary rock formations. The Cretaceous Period has been subdivided into the Lower and Upper Cretaceous periods—the older, lower groups are typically found in the eastern portion of the plateau and the younger, upper groups are found across more than half the state. The Cretaceous System consists of nearly level layers, from the bottom upward, of sandstone, marl, and limestone. Limestone is soft in the lower layers and grades upward to hard, frac-

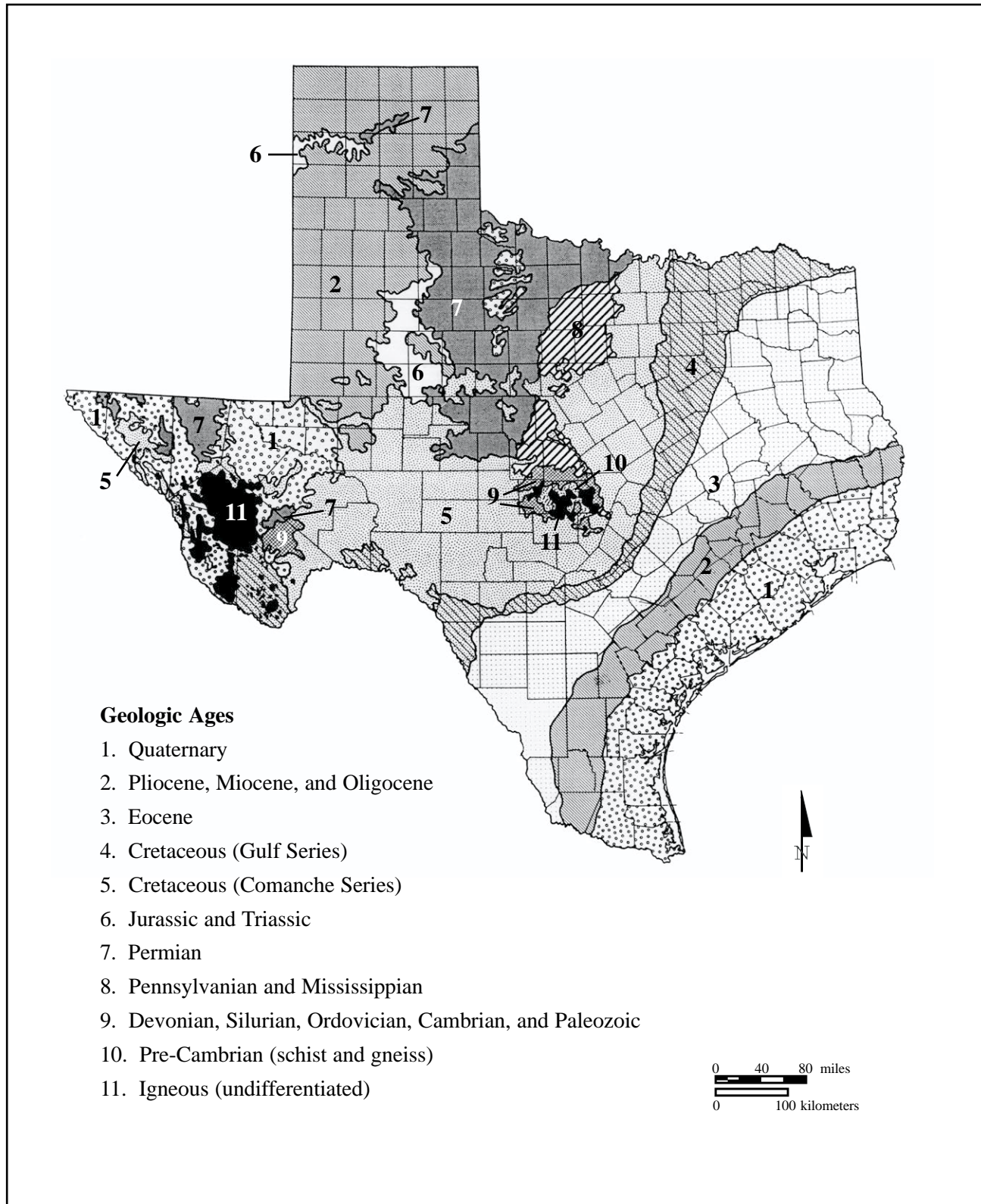


Figure 3.2. *Surface geology of Texas.* After Arbingast et al. (1976).

tured limestone. This system forms an undulating plateau that is covered by short, steep scarps. Kavett, Tarrant, and Valera are the main soils that formed over limestone in the project area (Bynum and Coker 1974:82). Limestone in the project area belongs to the Fredericksburg and Lower Washita groups of the Lower Cretaceous Period. Edwards Plateau limestone is well known for its chert-bearing capacity (Banks 1990).

To the southeast lies a broad structural dome known as the Llano Uplift. Rocks of the Precambrian, Cambrian, Ordovician, Devonian, Mississippian, Pennsylvanian, Permian, and Cretaceous systems are present within the Llano Uplift. The uplift is so named because a section of Precambrian rock protrudes 1,000 fmsl, while surrounding Precambrian rock remains trapped by overlying sedimentary rocks at depths of 5,000 feet below sea level. Cretaceous limestone rings the uplift at higher elevations, thus the uplift is a physiographic basin.

Much of the Precambrian igneous and metamorphic rock in the uplift was first thrust above ground 1.35 billion years ago in a mountain-forming episode (Spearing 1991). Tectonic activity approximately one billion years ago metamorphosed and raised two earlier sediment into two major metamorphic units - Valley Spring gneiss and Packsaddle schist, both of which contain large amounts of mica, hornblende, amphibole, and graphite (Sellards et al. 1981:32–33). Major granite constituents can include “quartz, microcline, and oligoclase with minor albite, biotite, muscovite, magnetite, apatite, zircon, tourmaline, and sericite” (Lidiak et al. 1961:268).

Four hundred million years of erosion nearly leveled the uplifted metamorphic rocks, after which advancing seas began to deposit Paleozoic sediments atop the Precambrian metamorphic rock. Further tectonic activity 300 million years ago tilted and faulted the metamorphic rocks, once again exposing them to erosion.

Cretaceous seas deposited sediments over the exposed Precambrian and Paleozoic rocks for roughly 140 million years. These sediments and the underlying rocks were then thrust upward approximately 2,000 feet in the Tertiary Period, forming the Edwards Plateau

(Spearing 1991:124). Subsequent erosion of the Cretaceous Edwards limestone has once again exposed the Precambrian igneous and metamorphic rock, producing batholiths such as Enchanted Rock and Lone Grove in Llano County.

The Rolling Plains derive their name from a geologic sequence similar to that of the Llano Uplift. During the Pennsylvanian and Permian periods (325–270 million years ago), sediments filled the Ouchita Embayment, a large depression in central Texas caused by tectonic activity, and ultimately became sedimentary rocks. Cretaceous and other later deposits covered these materials, but subsequent erosion has removed everything but the underlying Permian formations, resulting in eroded, rolling topography (Sellards et al. 1981). Included in this topography is the Callahan Divide, an erosional remnant plateau approximately 100 km northwest of the project area. Waterways on the south side of this divide drain to the Colorado River and waterways on the north drain into the Brazos River (Spearing 1991). The Rolling Plains are bounded on the west by the Southern High Plains, on the north by the Red River, and on the east by the Blackland Prairie.

Hydrology

The Edwards Plateau provides the backdrop for a complex system of aquifers, springs, and rivers. The Balcones Escarpment faulted along a hinge line (the Paleozoic Ouchita structural belt) which, based on sedimentation, tectonics, and hydrology, distinguishes the Edwards Plateau from the Rolling Plains and the Gulf Coastal Basin. It is this faulting which is responsible for much of the region’s hydrology.

The Edwards Aquifer is a large (67,200 km²) underground reservoir in west-central Texas in which water percolates through Lower Cretaceous limestone directly overlying relatively impermeable pre-Cretaceous formations (Barker et al. 1994). This percolation results in excellent water sources, including springs, creeks, and rivers.

Rivers near the project area include the Colorado, Concho, San Saba, and Llano rivers. The area is domi-

nated by the Colorado River, which drains all or parts of Blanco, Brown, Burnet, Callahan, Coleman, Gillespie, Hays, Kimble, Lampasas, Llano, McCulloch, Mason, Menard, Mills, San Saba, and Travis counties. This upper watershed consists of 62,624 km². The Concho River drains an area of 17,522 km² in all or parts of Concho, Glasscock, Irion, Schleicher, Sterling, and Tom Green counties. The San Saba and Llano rivers largely drain the Llano Uplift area. Major creeks in the project area that drain into the Colorado River include Brady, Bluff, Corn, and Cow creeks. Bluff Creek is directly adjacent 41MK10 and 41MK27.

Soils

The general soil units as defined by the Soil Conservation Service are discussed here (Bynum and Coker 1974). Frio clay loam and Owens and Tarrant soils are mapped in northern McCulloch County, which is located near the boundary between the Edwards Plateau and Plateau Rolling Plains general soils area (Figure 3.3). These soils are subsumed under the larger, more general classification of the Tarrant-Kavett Association.

Frio clay loam comprises the alluvial constructional bench on which site 41MK27 lies. These soils are mapped along much of the western creek terrace for approximately 10 km upstream from the confluence with the Colorado River. Frio clay loam is most prevalent on inside meander bends, where it often reaches its maximum areal exposure of 300–400 m. These deposits are “deep, well-drained soils on bottom land...formed in calcareous alluvial sediments. Slopes are nearly level to gently sloping, and surfaces are plane to weakly concave” (Bynum and Coker 1974:17).

Owens and Tarrant soils are found in upper elevations in “areas 100 to 300 yards wide and several miles long and range from about 100 acres to 1,000 acres” (Bynum and Coker 1974:28). In the project area, this mapping unit is 165 to 330 m west of Bluff Creek, and extends unbroken for several miles south of the site area. These soils are characterized as “shallow, well-drained soils on uplands” (Bynum and Coker 1974:27). This association is a complex array of at least seven different

soils, all of which have in common a distinct clay content and high colluvial limestone composition.

Vegetation

McCulloch County lies within the northern portion of the Juniper-Oak-Mesquite Savanna vegetation region (Figure 3.4), as defined in the *Atlas of Texas* (1976:13). In his discussion of the biotic provinces of Texas, Blair (1950) treats the Edwards Plateau as a distinct biotic province, one which he terms the Balconian. The project area is in the northern extreme of this province. This region is characterized by an intermixture of faunal elements characteristic of other major biotic provinces. Rainfall decreases from east to west across the Edwards Plateau, ranging from dry subhumid to semi-arid. The most characteristic plant association of the Balconian is a scrub forest of Mexican cedar (*Juniperus mexicana*), Texas oak (*Quercus texana*), stunted live oak (*Quercus virginiana*) and various other less numerous species (Blair 1950:113). Mesquite (*Prosopis glandulosa*) is distributed throughout the province and the floodplains are occupied by a mesic forest of large live oaks, elms (*Ulmus* sp.), hackberries (*Celtis* sp.), and pecans (*Carya* sp.) (Blair 1950).

Perennial grasses, forbs, and weeds in the area include beggarweed, perennial lespedeza, wild bean indiagrass, wild ryegrass, and bluestem. Hardwood woody plants include mesquite, oak, whitebrush, granjeno, catclaw, cherry grape, honey-suckle greenbrier, autumn-olive, and multiflora rose. Annual and perennial wild herbaceous plants which prefer moist-to-wet environments include smart-weed, wild millet, bulrush, spike sedges, rushes, sedges, bur-reeds, wildrice cutgrass, sourdock, and cottontails.

Directly to the north of the project area is the Kansan biotic province (Blair 1950). This province extends north to the Red River and encompasses all of the panhandle region of Texas. The Short-grass Plains district of the Kansan province abuts the northern range of the Balconian province, and, as the name implies, is dominated by buffalo grass, various species of grama grass, and other short grass species (Blair 1950:111). This area of the Kansan province has alternatively been classified as Mesquite Plains (Blair and Hubbell 1938;

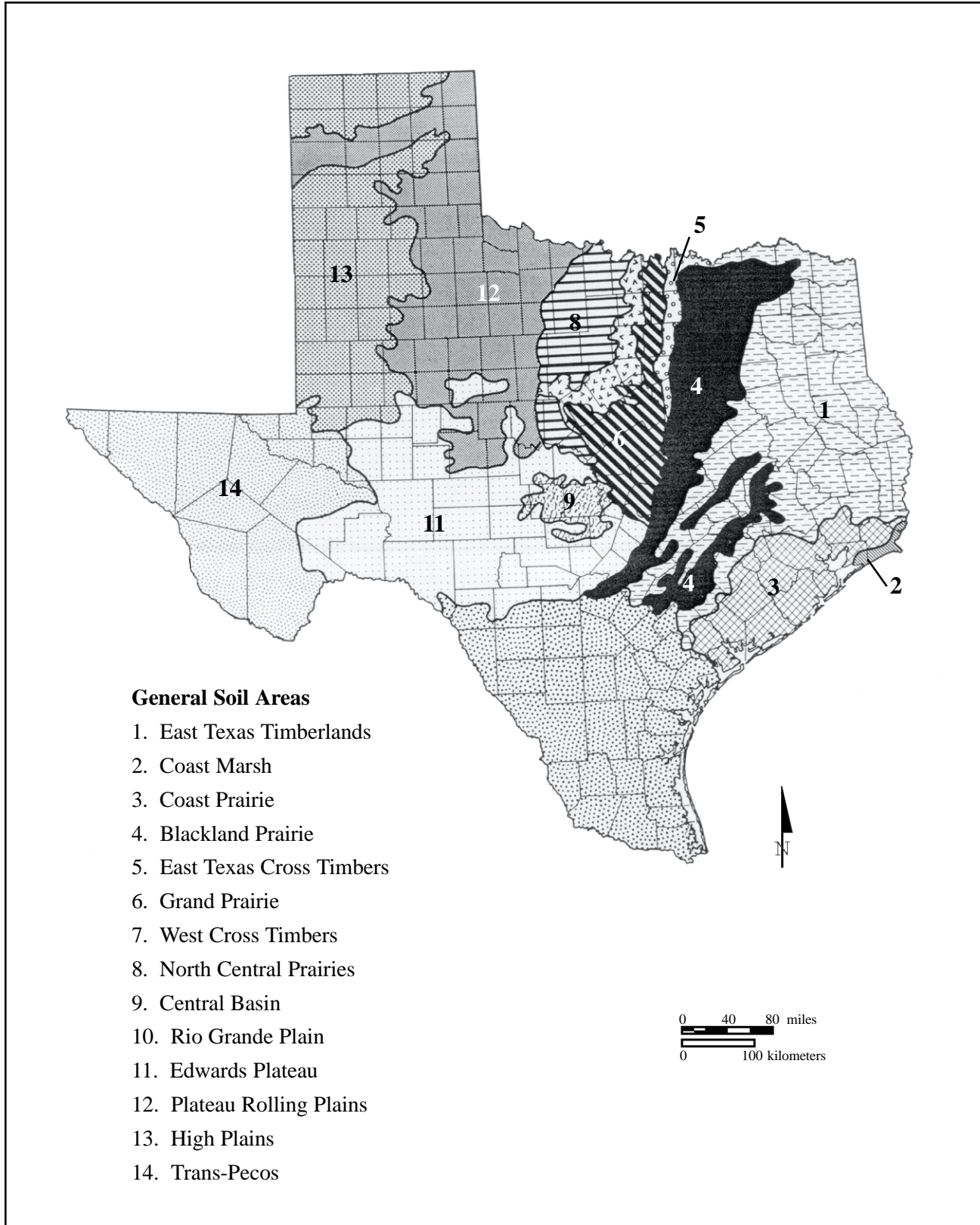


Figure 3.3. *General soil areas of Texas.* After Arbingast et al. (1976).

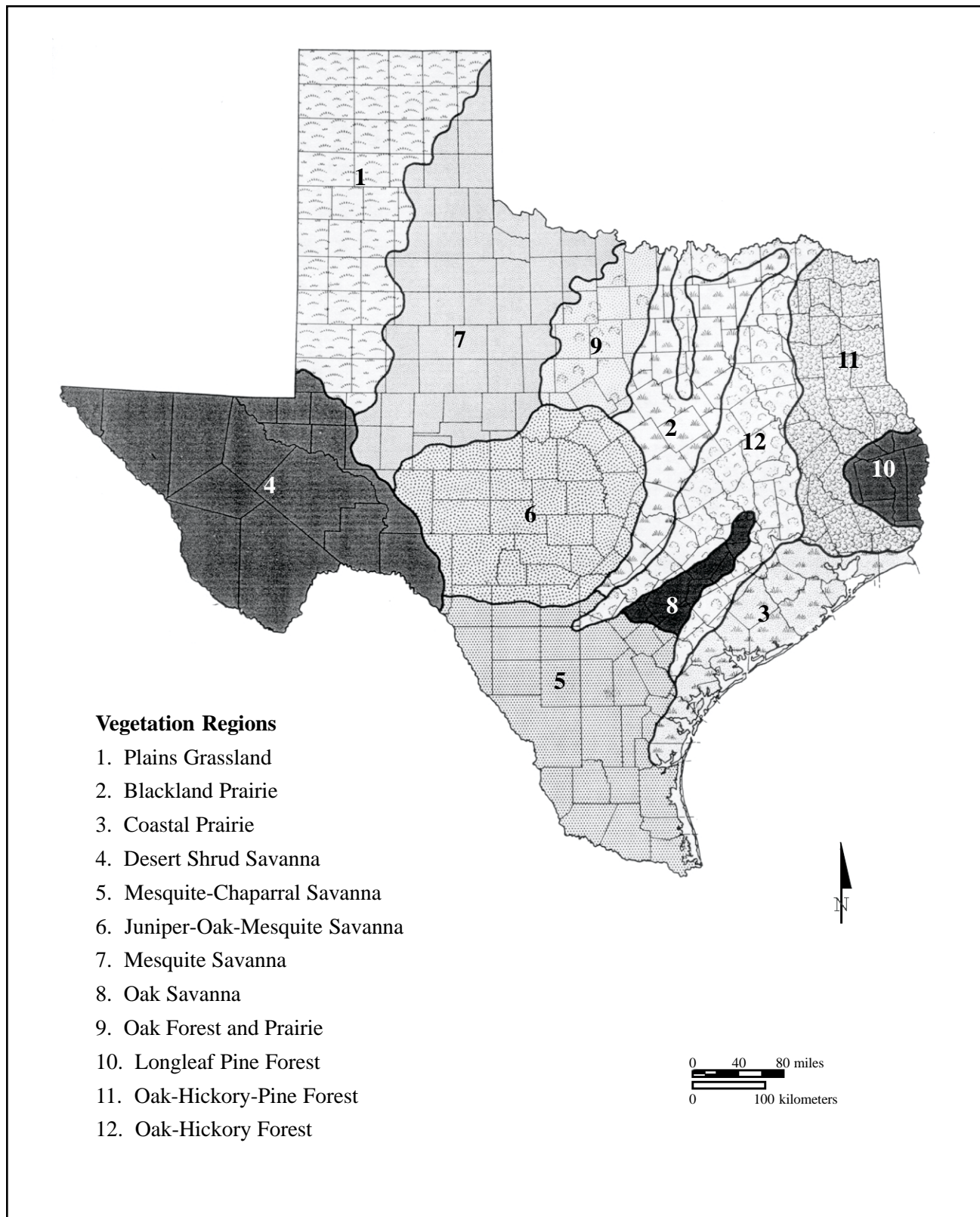


Figure 3.4. *General vegetation regions of Texas.* After Arbingast et al. (1976).

Diamond et al. 1987). Vegetation in this area includes the mesquite, juniper, shin oak, cottonwood, bluestem grass, and grama grasses.

Wildlife

The project area is located on the northern margin of the Balconian biotic zone (Blair 1950). The Balconian zone occurs in central Texas only and is believed to extend from Upton County in west-central Texas south to Val Verde County, east to Bexar County, and north to Comanche County. This zone is contained within the Edwards Plateau geographic province. Blair (1950) states that 57 species of mammals are known from the Balconian province, though none of these are restricted to it. One land turtle, 16 species of lizard, 36 species of snakes, and 15 anuran species are found in the Balconian province.

Population densities of the mammals usually remain low in the Balconian by contrast with the high densities achieved by the same species in the Tamaulipan province to the south. This phenomenon may be due in part to the fact that this is a transitional region in which the various species are approaching the limits of their ecological tolerance (Blair 1950:114). Approximately 50 percent of all nonmarine mammal species in Texas (as identified by Davis 1974) exist along the Balcones Escarpment on the southwestern edge of the plateau (Neck 1986). Common mammals of the area include white-tailed deer (*Odocoileus virginianus*), opossum (*Didelphis virginiana*), raccoon (*Procyon lotor*), nine-banded armadillo (*Dasyurus novemcinctus*), black-tailed jackrabbit (*Lepus californicus*), and deer mouse (*Peromyscus maniculatis*). Less common are the predatory mammals including the bobcat (*Lynx rufus*), coyote (*Canis latrans*), and gray fox (*Urocyon cinereoargenteus*). In addition to these common mammals, bison (*Bison bison*), mountain lion (*Felis concolor*), and black bear (*Ursus americanus*) would have been available to the local prehistoric aborigines.

James Hensen (1974:57) has summarized the modern wildlife situation for McCulloch County in the *Soil Survey of McCulloch County*. He lists white-tailed deer, javelina, fox squirrel, bobwhite quail, scaled

(blue) quail, dove, cottontail rabbit, jackrabbit, and numerous kinds of nongame birds as the principal kinds of wildlife. Additional species present include raccoons, foxes, ringtail cats, skunks, opossums, and other furbearing animals. Predators include bobcats and coyotes.

Bird species composition in the project area is impressive, with 317 species identified in a nearby project area (Lintz, Blum et al. 1993:21). Included in this list are “137 passerines, 34 shorebirds, 28 waterfowl, 23 flycatchers/larks, 22 raptors, 13 wading birds, 12 owls, eight woodpeckers, seven gulls/terns, five loons/grebes, five rails/coots, five swifts, five yaws/crows, four cuckoos, three fowl, three doves, and one each pelican, cormorant, and kingfisher” (Lintz, Blum et al. 1993:21).

Climate

The project area climate is characterized as subhumid as a result of moderate rainfall interacting with mild to warm temperatures (Bomar 1983:208–222). Brady, the county seat of McCulloch County, receives an annual average of 24.66 inches of precipitation, with the largest amounts of rain falling in April, May, and September (Bomar 1983:221). Generally speaking, this precipitation is the result of the turbulent transition between arctic and Gulf of Mexico air masses competing over central Texas to be the dominant weather system.

Average monthly low and high temperatures in Brady, Texas range from 30.4–58.4°F (January) to 69.6–95.7°F (July). The average dates for the first and last freezes in nearby Brownwood are November 16 and March 21, respectively. Brownwood endures an average of 51 freezes in any one year; 79 freezes were recorded in 1976–77 (Bomar 1983:209). The mean length of the warm season, or the number of days between the last frost in the spring and the first frost in the fall, is 230 days.

CHAPTER 4: RESEARCH DESIGN AND METHODOLOGY FOR 41MK27

Ann M. Irwin, Doug Drake, and Brett A. Houk

Site Description

Site 41MK27 is located on the west terrace of a meander of a small tributary of the Colorado River known as Bluff Creek. This location is approximately 4.5 km south of the confluence of Bluff Creek with the Colorado River. Bluff Creek meanders in the area, and the straight-line distance to the Colorado River is only about 1.7 km. On the west side of the creek, the valley floor slopes gently upward to the west until it reaches the bluff itself, which rises above the valley floor to a height of some 442 m above mean sea level (Figure 4.1). Cultural debris from the site was not visible on the surface, with the exception of an area where significant amounts of chert flakes, fire-cracked rock, and a concentrated area of mussel shell fragments were

exposed. These appeared to have been brought to the surface by some burrowing animal, probably an armadillo. It should be noted that chert occurs naturally in the region, and small chert gravels and cobbles can be found at the bottom and along the sides of the bluffs. Small, naturally broken and intact pieces of chert with a thick rind or cortex are common on the surface. The initial observation of chert, mussel shell, and thermally altered rock on the surface just west of highway station marker 920 led to testing by backhoe. Backhoe testing led to the discovery of archeological materials some 20 cm below the surface. The site overlies a depositional terrace of Bluff Creek, at a location just on the margin of the present-day estimated 100-year flood level. This terrace is composed of ancient alluvial sediments, certainly pre-Middle Archaic in age, and probably much earlier, overlain by coluvial sediments derived from the bluff to the west. The estimated drainage area of Bluff Creek is 85 km², and sudden thunderstorms can cause considerable flooding of the creek and significant amounts of coluvial movement down the slopes from the west onto the lower terraces and the site area.

Scattered mesquite and live oak trees, along with various cacti such as prickly pear (*Opuntia* spp.) and tasajillo (*Opuntia leptocaulis*), are present along the creek banks and in the valley. Rather large-scale clearing of mesquite and live oak scrub has taken place to promote the use of this area as pasture. This process of chaining (clearing the vegetation with large chains and tractors) can seriously disrupt the archeological context. Large piles of dried mesquite in the immediate area of the site evidenced that this sort of clearing activity had taken place.



Figure 4.1. View of excavations at 41MK27, looking south.

Research Design and Excavation Strategy

In his consideration of archeological research design, Lewis R. Binford (1972:137) argues that:

The isolation and definition of the “content”, the “structure”, and the “range” of a cultural system, together with its ecological relationships, may be viewed as a research objective. Admittedly it is an objective which may or may not be successfully accomplished under any given research design. The research design should be aimed at the accomplishment of this isolation which, I believe, is most profitably prosecuted within a regional unit of investigation.

While this regional approach with a unified research design may well represent a valid ideal, it is one that we were precluded from reaching by the legislative mandate of the TxDOT Archeology Section. At the time of this investigation, sites chosen for excavation by the Section had to meet one basic criterion: they had to lie within a right-of-way that would be adversely affected by some departmental activity. Rather than examining regions, we were then, and still are, confined to narrow transects across them. Once a site within the right-of-way was determined to be affected, the site was dealt with regardless of its significance in the local or regional scheme of things. At that time, regional research designs did not exist, nor was the TxDOT Archeology Section given the latitude to generate them. Today, regional research documents are being developed (e.g., Kenmotsu et al. 1993), and TxDOT has incorporated regional studies (e.g., Black et al. 1997; Johnson 1994) where appropriate as an avenue to long range planning. Collins (1995:372) notes that, while a few macro-scale studies have been completed with data from Central Texas, “considerable gain could be expected from more such studies.” While the excavations at 41MK27 took place years before the implementation of regional studies, the results of the investigations can be evaluated in light of the recently completed studies, particularly Black et al.’s (1997) examination of burned rock middens in west-central Texas. In this sense, the meso-scale in-

vestigations at 41MK27 can contribute at the macro-scale.

The excavations at 41MK27 fall into the traditional category of a salvage operation. This site was not approached in the light of any local or regional scheme. In large measure the significance of this site was predicated on the fact that, at that time, there was very little even in the way of controlled excavation for the region in question. Thus, the investigation strategy was, in part, directed at providing a documented chronology for the local diagnostic projectile point types recovered. So little was actually known about this area of Central Texas that it was believed that any controlled excavation would significantly add to our knowledge. Several goals were set up for the excavation of 41MK27. Underlying these was an approach that can be called Pragmatic Empiricism. At all times, an empirical evaluation was conducted concomitant with the excavation. New data were evaluated in light of what was seen; how it was seen; what impact it had on previously determined goals; how it influenced the exigencies of temporal, fiscal, and physical limitations; and what trade-offs needed to be made to maximize recovery of significant information as these factors were perceived in the course of excavations.

Following initial testing and evaluation, the proposed goals for future excavation were to delimit the size and shape of the camp, to recognize occupational features and activity areas wherever possible, and to recover sufficient material to place the site temporally and culturally within the archeological continuum of Central Texas.

When excavations resumed in December 1979, an important discovery was made that changed and enlarged these goals. It was discovered that the site contained a major feature that had been previously unknown. A totally buried burned-rock midden was present and had to be investigated as a feature and in its relation to the remainder of the site. Areas that had previously been thought to contain scattered hearth remnants were now seen as activity areas surrounding a midden and had to be investigated more extensively than had been foreseen. We accomplished this by opening up a broad area adjacent to the midden and mapping the revealed occupation floors. At the same time,

we saw that the colluvial nature of the sediments had caused a certain amount of horizontal displacement, and possibly some vertical displacement as well. This factor had to be considered when determining to what degree fine temporal resolution would be possible at the site.

The initial investigations at this site led to observations of chert debris, burned rock, and mussel shell fragments on the surface in one small area just west of station 920+00. Backhoe testing established the presence of archeological materials some 20 cm below the surface. Significant amounts of chert flakes and a concentrated lens of mussel shell were encountered in Backhoe Test 1; Backhoe Test 2 produced more chert and shell. Backhoe Tests 3, 4, and 5 each encountered the same level of mussel shell and chert debris, although in each of these cases the backhoe trenches were extended beyond the limits of the cultural material. Hand-excavated test units established the presence of hearths or hearth remnants. Full-scale excavations during 1979 included additional backhoe trenches, stratigraphic trenches, and large areas of hand excavation.

In a 1995 article reviewing the accomplishments in Central Texas archeology since 1954, Michael Collins (1995:372) notes that:

Historically, archeological excavations in Central Texas have emphasized the vertical dimension, a direct outgrowth of the emphasis placed on the building of an archeological chronology. Growing interest in recovering evidence of human behavior has led to increasing use of wide-area excavations on “living surfaces”.

Significantly, the excavators at 41MK27 recognized the utility of horizontal excavations to investigate the midden and associated activity areas. As Collins (1995:373) observes, an advantage of horizontal exposures “is the opportunity to fully investigate entire features in their horizontal contexts.” Such exposures allow for the identification of horizontal patterning within a site. As Hester (1997:80) notes, “‘Horizontal’ information is vital to modern anthropological archaeology, providing data on site structure, behavioral

units, patterning related to social phenomena, and artifact concentrations.”

The technique, however, is best suited for short-duration, single-component exposures within sites that have been rapidly buried (Collins 1995:372). A comprehensive understanding of the geomorphology at the site is required to determine how long a surface may have remained exposed before burial. Stable surfaces may contain multiple episodes of use that obscure single components and make any visible patterning informative.

Another important component of the original research design was the examination of the soils and geology at 41MK27 in an attempt to assess the integrity of the deposits. Although a formal geomorphological study of the site was not conducted, the excavators were cognizant of the site’s position on the landscape and the potential effect this location had on the nature of the archeological materials. Collins (1995:367) notes that:

Foremost among deficiencies in the methodology by which most of the Central Texas archeological record has been built is inadequate recognition of the dynamic nature of the physical environment, and the profound implications landscape evolution has for archeological inquiry.

The colluvium at 41MK27 was a primary concern to the site’s excavators who attributed much of the disturbance of the features at the site to colluvial sediment. As a cautionary note, however, Collins (1995:370) observes that colluviation can bury sites as well as disturb them.

Methodology and Work Accomplished

Description of Excavation Procedures

Archeological work at 41MK27 was divided into two phases—an initial testing phase conducted during the summer of 1978 and an excavation phase conducted from December 1978 through February 1979. The testing phase consisted of a series of backhoe trenches

and limited hand-excavated test units; the excavation phase entailed additional backhoe trenching, Gradall stripping, and the manual excavation of large blocks.

Testing Phase

Initial testing was guided by the surface exposure of limited amounts of chert, mussel shell, and thermally altered rock. Testing began with five backhoe tests (1–5) placed within the right-of-way (Figure 4.2). These trenches contained lithic material, thermally altered rock, and mussel shell between 20–60 cmbs. Hand-excavated test units placed adjacent to Backhoe Test 2 revealed accumulations of thermally altered rock that might represent the scattered remnants of hearths. This initial testing indicated that the site area lay west of the right-of-way centerline.

Excavation Phase

Additional machine testing began in early December 1978 with six more backhoe tests (6–11) (Figure 4.2). Three backhoe tests (8, 9, and 11) were placed between the initial testing area and Bluff Creek, and three (6, 7, and 10) were placed between the testing area and the hillslope to the west. The majority of cultural materials came from the western trenches, supporting the earlier assumption that the site lay west of the centerline. Five stratigraphy trenches were also excavated by machine in the central area of the site.

Following this, a base line oriented towards true north was established, with the N50/E50 point at the highway station marker 920. An east-west line was then established 90 degrees from the north-south baseline. From these lines a grid was laid out over the site, with stakes at every 2-meter point in the area(s) considered to be the most productive, and stakes at every 4- or 8-m point in the peripheral areas. A datum pipe was then established and tied into a nearby USGS benchmark.

Excavation units were aligned to magnetic north and set up with datum reference points. Ground surface elevations were recorded for each corner of the units. Excavation proceeded in arbitrary 10-cm levels, un-

less some natural or cultural break could be discerned. Shovels, picks, trowels, and brushes were used, and all matrix was passed through ¼-in screens. Standardized level forms were recorded for each level of each unit, and included information such as provenience data, soil descriptions, approximate numbers of artifacts, artifact types, sketches, and recovery procedures. Separate notes were made for each feature in addition to the regular level notes, describing, among other things, rock type and approximate amounts, excavation procedures, and materials collected. The field director also kept a daily journal.

Profiles were drawn for trenches and test units, with standardized information such as direction and scale. Profiles highlighted individual artifacts, features, and anomalies. All materials were collected in paper bags with the site trinomial, unit and level number, date, and excavator's name recorded on each bag. Each excavation level was assigned a lot number. A photographic record was kept of the excavation procedures, with black-and-white prints, and color prints and slides. Photographs included site, unit, and feature overviews, general work views, artifacts, and wall profiles. Polaroid photographs were also taken of features and affixed to feature and level forms.

Excavation units varied in dimensions from a standard 1-x-1-m unit to 8-x-8-m blocks, with 2-x-2-m excavation blocks being the most common. Whenever a block was excavated, regardless of overall size, vertical and horizontal control was maintained with 10-cm levels and 1-x-1-m unit designations.

Soon after excavations started, it was realized that the top 20 cm of the matrix covering the site was much less productive than the underlying sediments, and three areas were chosen for the removal of this overburden by a Gradall machine. These areas were in the locations of 1) excavation block N42-44/E38-40; 2) excavation blocks N56-59/E20-22, N6-64/E24-26, and N66-68/E26-28; and 3) the large excavation block in the northeastern portion of the site which has N60/E38 as its southwest corner. It was hoped that in these areas removal of the overburden could be done in approximately 5-cm levels and in a smooth manner so that any features or artifacts encountered might be plotted. However, the relative inexperience of the ma-

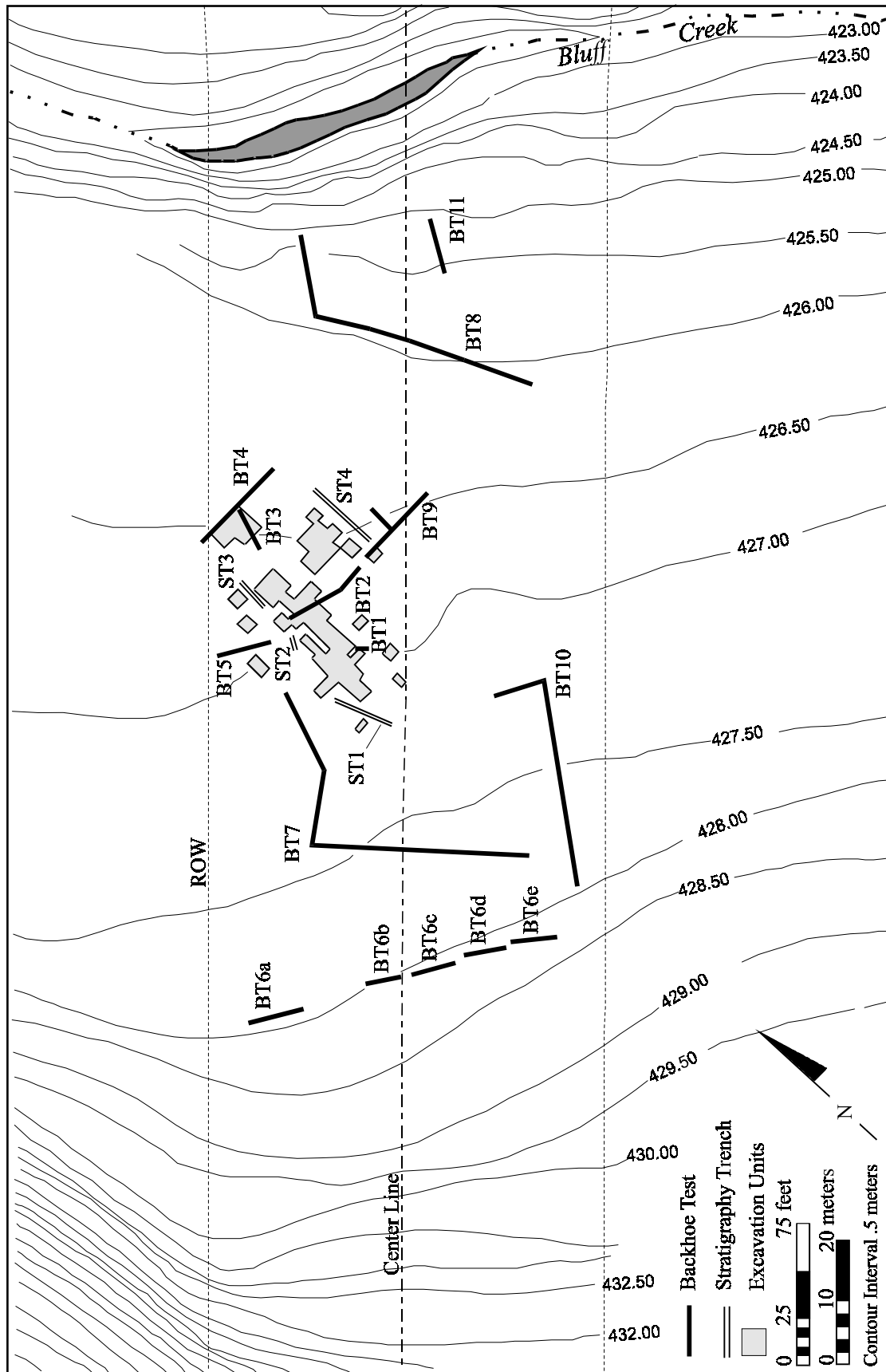


Figure 4.2. Topography and location of excavation areas at 41MK27.

chine operator, the condition of the blade, and the rocky sediments made it extremely difficult to remove thin, level slices of overburden. Instead, the depth of the cuts varied, and a corrugated or washboard effect was produced. The overburden removed by the Gradall was sorted by the monitoring personnel, and any cultural material was plotted and recovered. Although not completely sterile, the top 20 cm or so proved much less productive than the underlying deposits.

Another early development once excavations were started was the discovery of a burned rock midden deposit in the south-central portion of the site. No evidence of such a feature was apparent on the surface, as the top of the midden was approximately 10–20 cm below ground surface. This discovery altered the excavation strategy by necessitating the excavation of large open blocks to assess the horizontal extent of the feature and locate extramidden activity areas.

In total, 210 m² were excavated, or, in terms of volume, 88.8 m³. Units were concentrated in a linear, north-south arrangement (which contained most of the midden), and in two smaller excavation blocks immediately north and northeast of this area (Figure 4.2). Isolated units/blocks were also scattered around the periphery of the midden area in an attempt to identify extramidden activity areas.

Analytical Methodology

Attempts were made to obtain the exact vertical and horizontal provenience for all tools recovered from the site. An artifact card was filled out for each artifact, each lot of flakes, and each lot of mussel shell recovered. In the case of tools, a sketch was included on the artifact card. After initial type designations had been made and each artifact had been weighed and measured, this information was coded for computer entry. A number of people have written about the importance of having a systematic way in which to describe chipped stone tools, and various systems have been devised, including those of Binford (1963), Crabtree (1972), and Loy and Powell (1977). Though none of these systems completely met our needs, portions of them have been used to design a series of standard-

ized descriptive artifact modifiers for the major classes of stone tools present at the site (Appendix A).

These descriptive modifiers were designed to be computer-coded. A series of metric artifact modifiers was also used, particularly on the projectile points. These metric and descriptive modifiers can be found in the Appendix A. The metric modifiers include length, maximum blade width, blade base width, maximum blade width position, thickness at haft element juncture, haft element length, proximal haft element width, distal haft element width, basal contact width, and basal curvature. The descriptive modifiers for projectile points include tip shape, blade shape, blade margin treatment, blade face treatment, shoulder shape, barbs, notches, stem shape, stem margin treatment, stem/base face treatment, base shape, and base margin treatment. Each of these categories has a series of descriptive choices, and in some cases these are augmented by a second column of coding to indicate the degree to which a particular trait is expressed. The descriptive modifiers can also be applied to bifaces, flakes, cores, and flake tools. In addition, there are modifiers describing wear/polish, breakage, and material. This procedure allowed for the systematic examination of all material recovered from the site and a certain precision of terminology as it is applied to this body of material. It allows the reader to know with some exactitude what is meant by any descriptive term and it provides a significant degree of uniformity and consistency in the descriptive process itself. By reducing these descriptive choices to single- or double-letter codes, it is possible to use our computer capacity as appropriate.

Because projectile points seem to be the most temporally sensitive and stylistically variable artifact class, a great deal of precision is generally considered to be useful when describing them. One might even hope that by using various traits, generally metric ones, and applying certain statistical tests, projectile point types can be generated, or at least the traditionally accepted types validated. The projectile point sample from 41MK27 was subjected to factor analysis, including all metric variables and excluding certain variables such as length, blade width, blade base width, or various combinations of these masking variables. In addition, cluster and discriminant analyses were per-

formed including all variables and excluding certain of them. Probably due to the small size of the sample, particularly considering the number of types represented, none of these statistical procedures produced useful results, and the details are not recorded here. However, given an adequate sample, and even more importantly, given better temporal resolution of the types represented, these statistical techniques may prove to be very revealing. Because of the lack of adequate temporal resolution at this site, statistical comparison of well-defined components was impossible.

CHAPTER 5: RESULTS OF EXCAVATIONS AT 41MK27

Ann M. Irwin, Doug Drake, and Brett A. Houk

Introduction

This chapter describes the results of the investigations at 41MK27, beginning with an assessment of the soils at the site based on excavation information. The individual features are described in the following section. This chapter concludes with the results of the analyses of the artifacts and faunal material recovered from the site. Supporting artifact data are included in Appendix A.

Soils at 41MK27

Site 41MK27 is located on an old constructional terrace on the west side of Bluff Creek. This terrace has been covered by later colluvial deposits that grade into alluvial deposits toward the creek. In some areas colluvial and alluvial sediments are intermixed. In the immediate area of the site three soils were discerned that developed in sequentially deposited materials. The most recent of these soils, and the one present on the surface, would appear to most closely resemble the Karnes Series, Moderately Shallow Variant. The *Soil Survey of McCulloch County, Texas* indicates on the soil map that the site area lies well within the region designated as the Tarrant-Kavett association (Bynum and Coker 1974). However, the characteristics of the soil at the site do not fit with those of the published descriptions of either the Tarrant or the Kavett soils, nor do they conform to the descriptions of any of the minor soil associations listed as occurring within the Tarrant-Kavett association. In fact, the surface soil at 41MK27 resembles the Karnes Loam, Moderately Shallow Variant, a soil series that consists of well-drained, moderately deep soils that formed in sandstone and limy material, occurring on foot slopes at the base of limestone hills and on side slopes along drainage ways. These slopes are mainly convex and range from 1–5 percent (Bynum and Coker 1974:19).

A representative profile of the Karnes Loam, Moderately Shallow Variant (Bynum and Coker 1974:20) follows:

Ap-0 to 5 in., yellowish brown (10YR 5/5) loam, dark yellowish brown (10YR 4/4) moist; weak, fine granular structure; hard, friable; few small concretions of calcium carbonate; few caliche fragments on surface; calcareous; moderately alkaline; abrupt, smooth boundary.

B2-5 to 18 in., light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; moderate, very fine subangular blocky structure; hard, friable; common films and threads of lime; few calcium carbonate concretions 3 to 5 mm in diameter; few worm casts; calcareous; moderately alkaline; gradual, wavy boundary.

B3ca-18 to 30 in., very pale brown (10YR 7/4) loam, light yellowish brown (10YR 6/4) moist; weak, fine, subangular blocky structure; hard, friable; 10 to 15 percent concretions and soft masses of lime up to 2 in. in diameter; estimated calcium carbonate equivalent more than 40 percent; calcareous; moderately alkaline; clear, wavy boundary.

C-30 to 60 in., light gray (10YR 7/2), weakly cemented fine-grain sandstone; thin lime coatings in upper part and in partings.

Although the soil found at 41MK27 is not exactly equivalent to the Karnes Loam, Moderately Shallow Variant, it most closely resembles it. However, it may actually be only a variant of the Karnes Loam, or it may in fact represent a gradation between the Karnes Loam and another soil series (i.e., it may represent an

intergrade soil). It may well be that what was designated as the C horizon in our field descriptions actually represents the reddish yellow B3ca of the type description (Figure 5.1). We did not observe as much carbonate as is characteristic, but it is possible that the parent material in the area of the site is simply much more iron-rich than is normally seen. This soil association has been designated as IA, IB, and IC in the stratigraphic profiles.

The modern soil is underlain by a series of truncated paleosols of unknown association. These soils are designated by the numbers II through IV on the stratigraphic sections. The modern soil of the site area differs from these paleosols both in its color (a definite reddish brown), and in the fact that it developed in fine-grained mixed alluvial/colluvial sediments lacking the larger angular clasts typical of colluvial slope wash and characteristic of the underlying paleosols. The IA horizon has a weak subangular blocky structure and extends as much as 40 cm below the surface in some areas, although it is generally much thinner. The IB is a weak blocky to subangular blocky sandy clay loam. The IB is missing in many areas of the site. The IC is a reddish clay loam as mentioned above. It contains only rare colluvial clasts. In one area it does exhibit a colluvial aspect with a IC1 containing some scattered very small gravels, less than 5 cm in maximum diameter.

The IIA horizon has been truncated. The IIB has a moderate but small prismatic to subangular blocky structure, with carbonate stringers. The IIC1 is a mixed alluvial/colluvial deposit of sandy clay to sandy loam, with few medium (1.4-cm maximum diameter) pebbles. The IIC2 consists of alluvial deposits with beds of gravels interbedded with sands, and sands and gravels toward the bottom of the stratigraphic cut. The IIIB soil exhibits a moderately developed prismatic to subangular blocky structure and is a sandy clay loam. The IIIC is colluvium with few scattered small colluvial pebbles. Also present is a truncated IVC horizon with beds of gravels interbedded with sands and sands and gravels.

The burned-rock midden rests upon the IC materials and for the most part, the cultural material at the site is

found within the IB and to some extent the IC soil horizons. The site area represents a small depression or basin within which this modern soil development took place, and it may have been influenced by the presence of cultural debris (Figure 5.2).

Features

Eleven features were designated at 41MK27 during excavations (Figure 5.3). These include Features I through X and Feature Ia. These features varied widely in size, structure, and level of disturbance. Each feature is described below.

Feature I

Feature I was a small burned-rock midden with its center located at approximately N46.9/E30.95 on the site grid (Figure 5.4). The dimensions of this midden were 9.8 m north-south by 7.5 m east-west. The midden was completely buried and not visible from the surface. The average thickness of the burned-rock layer approximated 50 cm (426.85–426.35 m amsl); the layer contained a dark gray ashy soil in addition to the thermally altered limestone. The midden was covered by approximately 10 to 20 cm of virtually sterile soil, originating primarily as colluvium from the hill to the south and containing the IA soil horizon. The midden was somewhat thinner at the margins. Very little cultural material was recovered from within the midden proper. A large portion of the surface of the midden was exposed, and then north-south and east-west transects were excavated through it. The most common lithic items recovered were small, unmodified flakes, and there were relatively few of these. Some mussel shell was also recovered from within the midden but the quantities were considerably less than from adjacent areas, especially those to the north. Four cores, six bifaces or biface fragments, one graver, and two untyped projectile points were also associated with the midden. Although this midden did not occur on bedrock and its debris-filled central pit (Feature IA) penetrates the subsoil, it most closely fits the Burned Rock Midden Type 2 as described by Weir (1976:35–39).

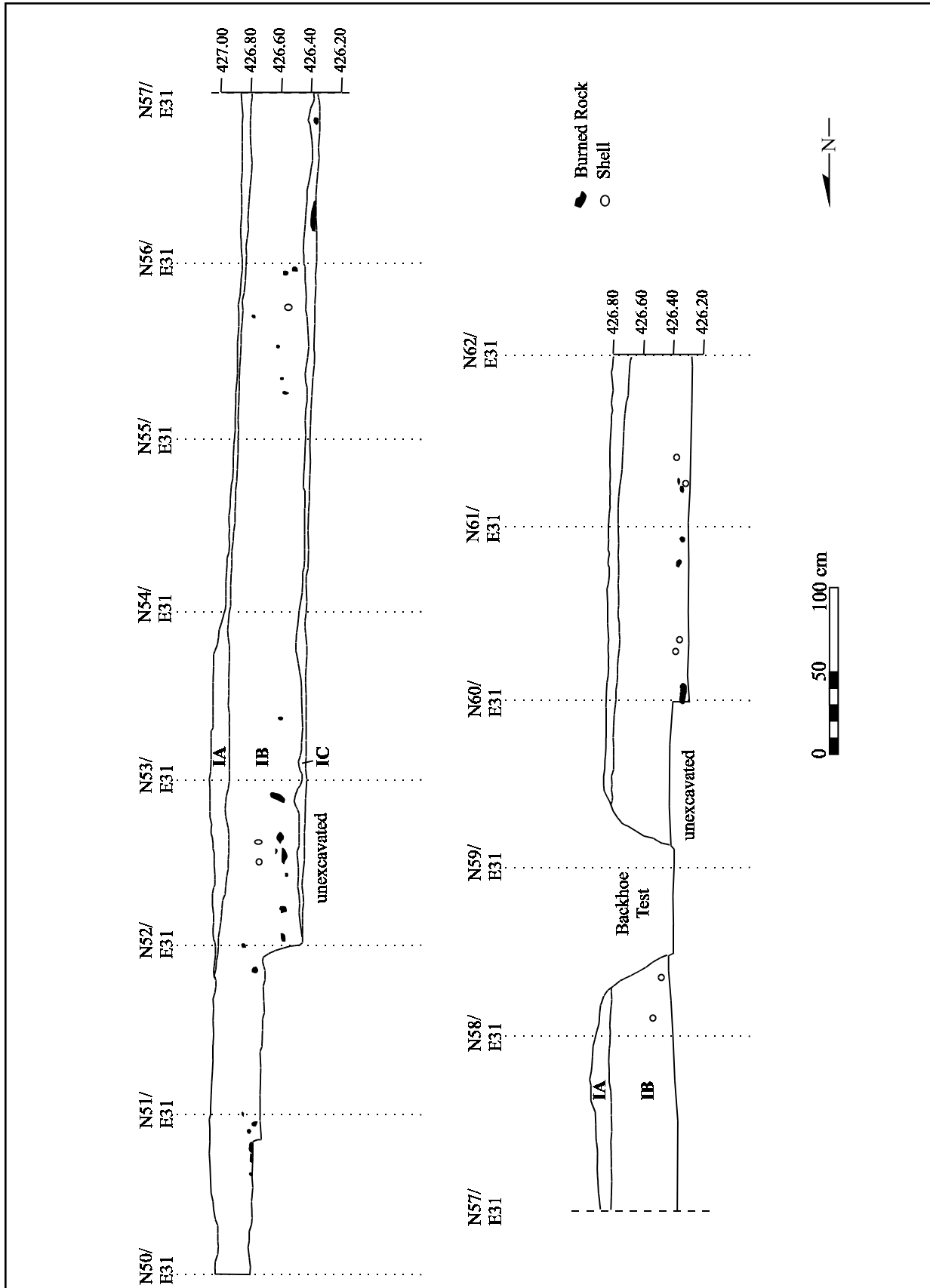


Figure 5.1. Stratigraphic profile of 41MK27 north of midden.

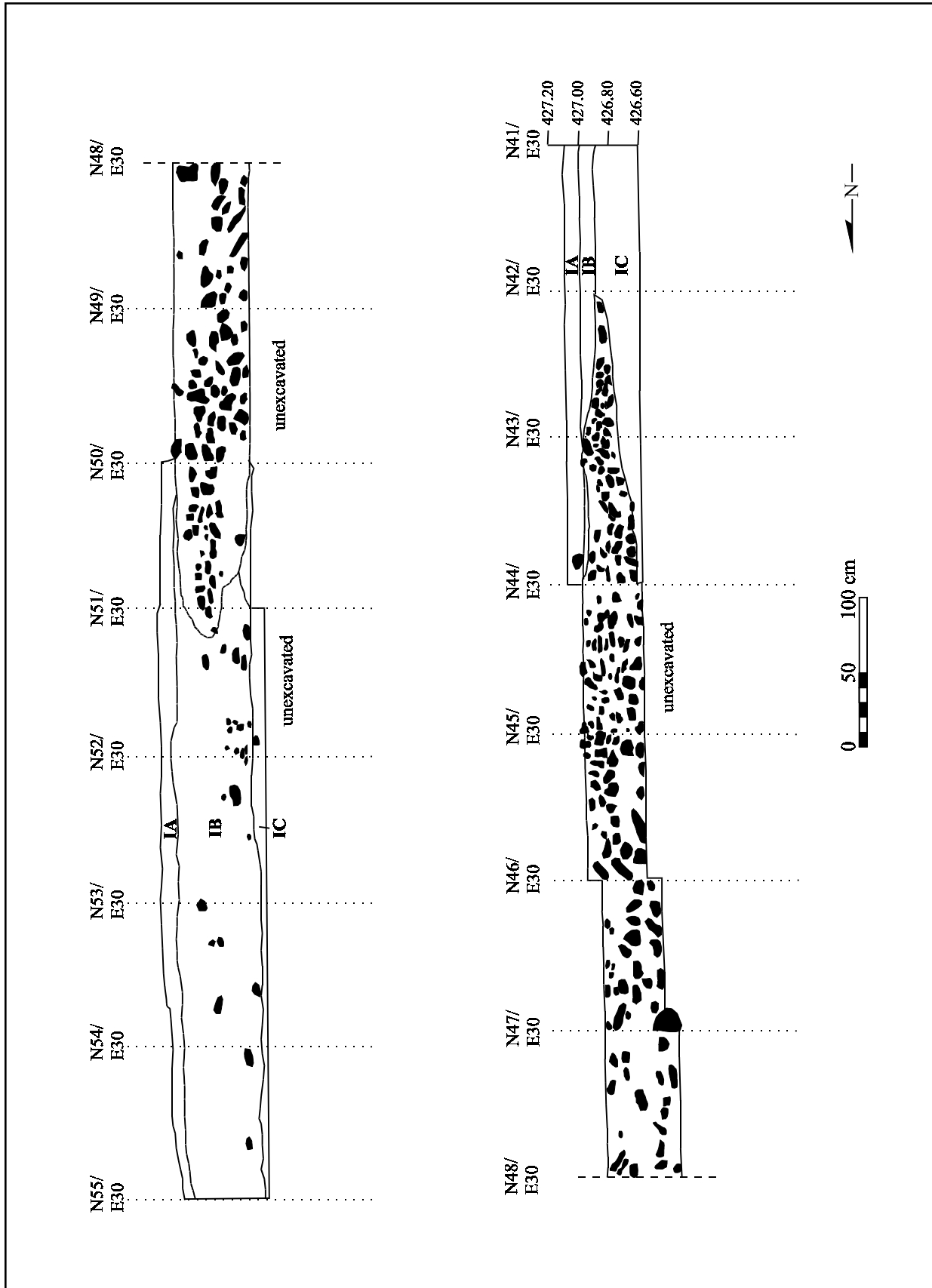


Figure 5.2. Stratigraphic profile of 41MK27 through midden.

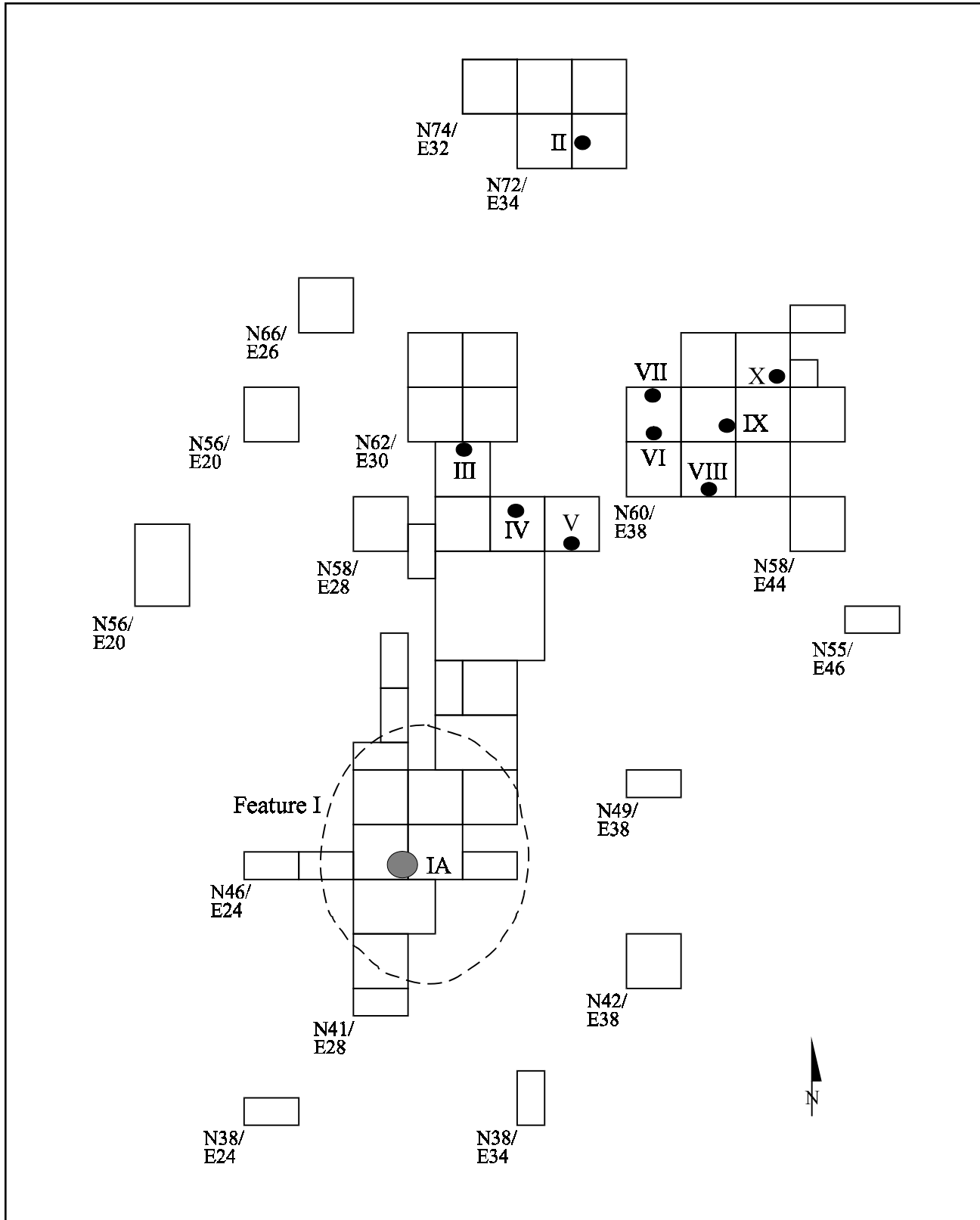


Figure 5.3. Locations of features at 41MK27. Except for Features I and IA, locations mark centers of features and do not reflect exact sizes or shapes.



Figure 5.4. Photograph of Feature I, facing south.

the remains of a central hearth or oven used throughout much of the life of the midden.

Two samples (2 and 3) from the pit were submitted by SWCA to Texas A&M University for macrobotanical analysis (Appendix C). The light fraction of Sample 2 contained a few charcoal flecks and roots, and the heavy fraction contained a few fragments of fire-cracked rock. Sample 3, however, contained charcoal fragments weighing 0.4 g, all of which were smaller than 4 mm in transverse section. Wood fragments of this small size are often difficult to identify. For this reason, the analyst was able to assign only eight charcoal fragments to a taxonomic category—*Quercus* sp. (oak) wood. Oak accounts for the majority of identified charcoal from archeological sites on and near the Edwards Plateau, primarily because it is easy to identify when the plant assemblage is very small and severely reduced, presumably by post-depositional processes. No seeds or fruit frag-

Feature IA

Discovered at the approximate center of the midden was Feature IA, the remains of a small hearth or rock-lined pit within the midden itself, located in Levels 4–6 (426.75–426.45 m amsl) at N46-47/E29-30 (Figure 5.5). A series of somewhat larger than usual slabs, oriented vertically, defined the perimeter of this feature. These included a small metate and two other possible metate fragments. The bottom dimension of this feature was approximately 30 cm by 30 cm and was located at 426.45 famsl. Based on the level notes, it was not possible to determine the top dimensions of the pit, but based on one Polaroid photo the top of the pit appears to be approximately 1 m in diameter. The pit extended some 10 cm down into the underlying IC zone, a hard yellowish clay loam clearly distinguished from the dark ashy loam fill of the midden. This feature may represent



Figure 5.5. Photograph of Feature IA.

ments were identified in either of the samples. Presumably, oak was burned as fuel while the midden was in use.

Sample 4, also from the pit, was submitted to Texas A&M for pollen and phytolith analysis (Appendix D). Both pollen and phytoliths were preserved in the sample, although the pollen taxa represent an imperfectly preserved assemblage (Appendix D). The taxa that were present represent mixed grasses, oak, and willow, suggesting that the local environment was that of a mixed-grass prairie with scattered mottes of trees. The phytoliths also reflect a mixed-grass environment, dominated by short bunch grasses and tall grass panicoids (Appendix D).

Feature II

Feature II was a small rock-lined pit that contained charcoal, ash, and small bone fragments (Figure 5.6). It was bisected by Backhoe Test 3 and only a portion of it was observed intact. It appears to have been some 20 cm deep (Levels 2 and 3; 426.45–426.25 m amsl) and 30 cm in diameter. This feature was located at N73-74/E36-37. No diagnostic artifacts were associated with this feature, and the artifact recovery in the adjacent units was less than in units located closer to the midden. Sample 1 was submitted to Texas A&M for pollen and phytolith analysis (Appendix D). The



Figure 5.6. Photograph of Feature II, facing east.

results were similar to the sample from Feature 1A, although pollen preservation was worse. A single *Cucurbita* phytolith, probably from native buffalo gourd, was identified from the sample and may indicate that the gourds were somehow associated with the feature. Alternatively, the phytolith could simply reflect the presence of buffalo gourd in the area.

Feature III

Feature III was a small, basically intact hearth located north of the burned-rock midden at N59-60/E32-33 (Figures 5.7 and 5.8). This small hearth appeared to have suffered less disturbance than others at the site. It was roughly circular, with a diameter of some 60 cm. It sat at the bottom of Level 4, at an elevation of 426.30 m amsl. The eastern half of the hearth was removed to cross-section and profile the feature. No changes in stratigraphy were noted and no stain or layer of burned clay was associated with the feature. The hearth consisted of a single layer of burned rocks (Figure 5.9). Mussel shell and numerous flakes were recovered from the unit.

Feature IV

Feature IV was a disturbed hearth or hearth remnant lying directly to the east of Feature III in Level 4 at

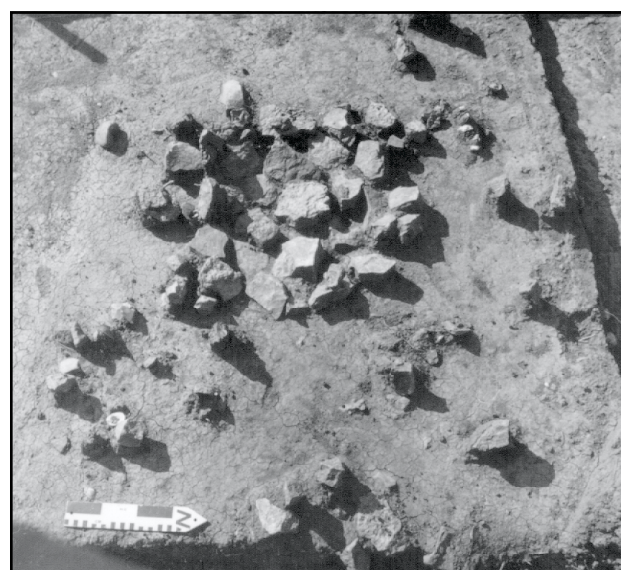


Figure 5.7. Photograph of Feature III, facing west.

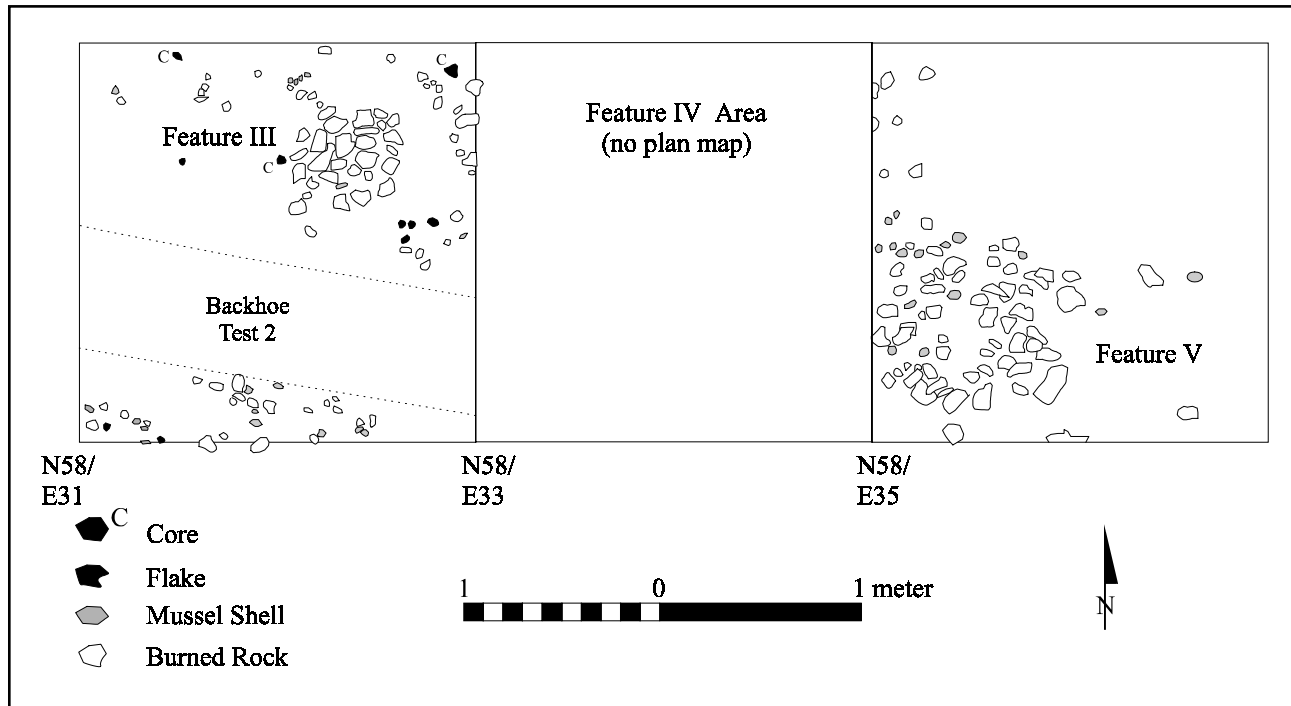


Figure 5.8. Plan map of Feature III–V area. No plan maps of Feature IV could be relocated.

N59-60/E33-34. It was uncovered during the initial test excavations, and although it was not as intact as Feature III, it probably represented the remains of another small hearth with a diameter of approximately

60 cm (see Figure 5.8). Mussel shell and flakes were recovered in association with this hearth.

Feature V

Feature V was another small, somewhat disturbed hearth located slightly to the southeast of Features III and IV at N58-59/E35-36 (see Figure 5.8). It was uncovered in Level 5 (426.30–426.20 m amsl). Roughly circular in shape, this hearth had a diameter of approximately 80 cm, with the central portion being devoid of burned rocks. Mussel shell and flakes were found in the same level as the hearth.

Feature VI

Feature VI was a possible hearth or hearth remnant located in Levels 4 and 5 (426.40–426.20 m amsl) at N62-63/E39-40 (Figure 5.10). It showed signs of disturbance and measured approximately 40 cm by 50 cm. In addition to flakes and mussel shell, a graver was found in association with this feature.



Figure 5.9. Cross-section of Feature III.

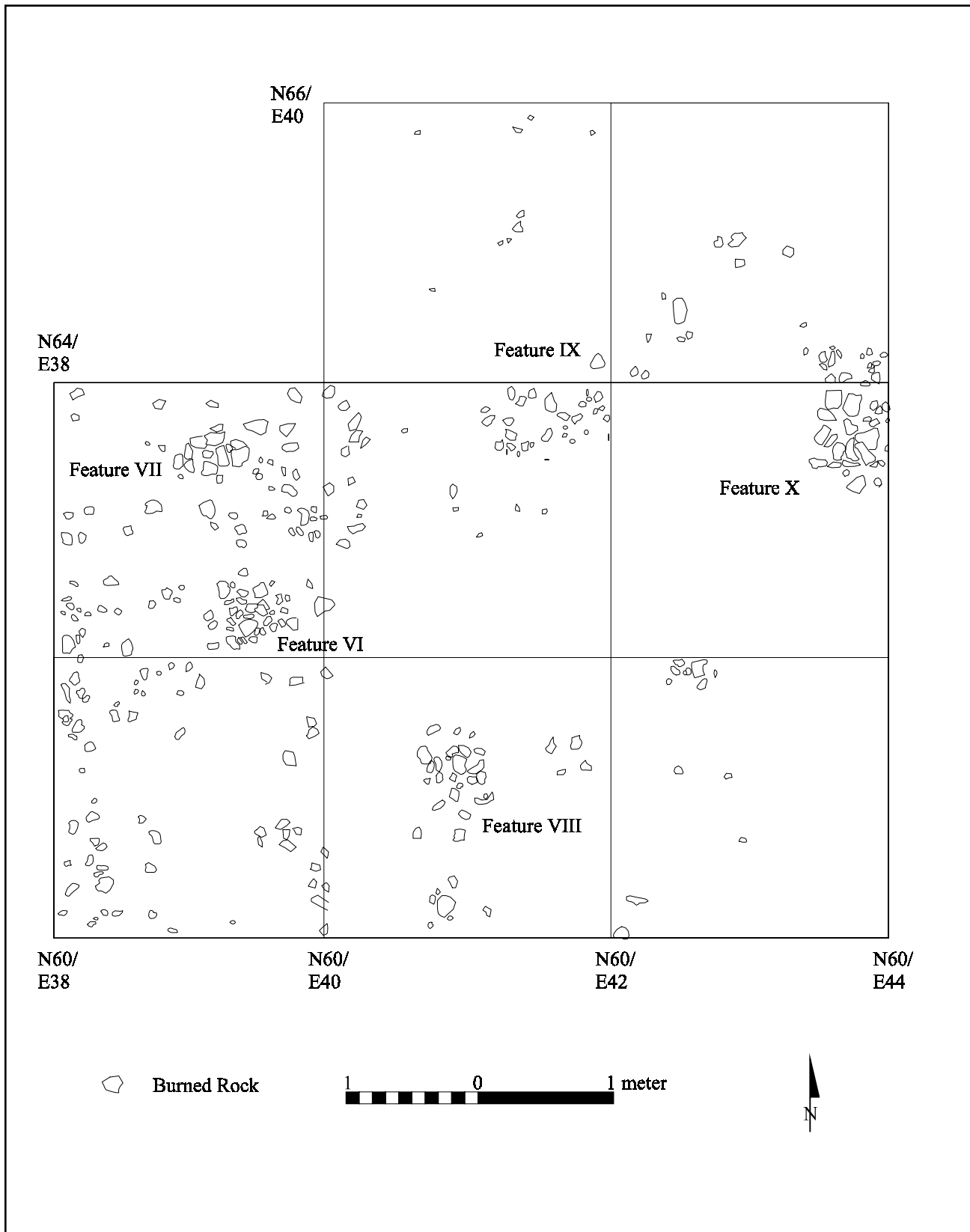


Figure 5.10. Plan map of Features VI–X.

Feature VII

Feature VII was another possible hearth showing considerable disturbance. It was located directly north of Feature VI at approximately the same elevation at N63-64/E38.9-40 (see Figure 5.10). It consisted of a number of relatively large burned rocks, and had a diameter of approximately 60 cm. A scatter of rock, probably originating from this hearth, extended to the east and slightly to the north of the feature.

Feature VIII

Feature VIII was another possible hearth, located in Level 6 (426.25–426.15 m amsl) at N60-62/E40.5-42. It also showed signs of disturbance (see Figure 5.10). The diameter was approximately 50 cm. A projectile point base representing a *Fairland* was recovered directly to the north of this feature.

Feature IX

Feature IX was a disturbed hearth remnant located in Level 5 (426.30–426.20 m amsl) at N63-64/E41-42. The diameter would appear to have been approximately 55 cm. A *Martindale*-like dart point was found in the center of this burned-rock feature. As with the other hearths, mussel shell and flakes were also recovered from the unit (see Figure 5.10).

Feature X

The last feature from 41MK27 appeared to be the disturbed remains of a somewhat larger hearth, located in Level 5 (426.30–426.20 m amsl) at N63-64/E43.5-44.5. Its dimensions were approximately 90 cm by 110 cm, though it may originally have been some 80 cm or so in diameter (see Figure 5.10). Several cores were found in association with this feature, as well as mussel shell and flakes. As with Feature IX, there appeared to be a disturbed scatter of burned rock extending toward the northeast from the hearth. This pattern of disturbance was consistent with the drainage patterns observed at the site.

Description of Materials Recovered

Artifacts

Debitage

Because the process of manufacturing stone tools from various appropriate unmodified lithic source materials is a reductive one, it results in the creation of significant amounts of lithic residue, variously called flaking debris, debitage, or waste flakes. In the early days of archaeological investigations in the United States, this portion of the lithic component of archaeological assemblages was not even recovered, and if examples of these “waste flakes” were inadvertently recovered, they were neither analyzed nor retained. Emphasis was placed on the tool types considered diagnostic, most particularly on projectile points. A primary impetus for the inclusion of debitage as a legitimate and necessary concern within the archaeological community came from the influence of J. G. D. Clark, particularly from the publication of *Prehistoric Europe: The Economic Basis* (1952) and *Excavations at Star Carr* (Clark 1954), as well as his influence as a visiting professor at universities in the United States. A second and related influence was the work conducted at various Paleolithic sites in Europe by Hallam Movius and François Bordes.

The development of lithic technology as both a replicative and an analytical endeavor, due in large part to the efforts of François Bordes and Don Crabtree and their many students and apprentices, led to an increasing acknowledgment of the potential importance of all phases of lithic analysis from a technological rather than a strictly morphological perspective, as well as an increasing emphasis on the recovery and analysis of the lithic debitage from excavated sites. Crabtree (1972:1) states that:

Reducing the initial mass of lithic material to the finished product requires many stages of manufacture, discarding waste flakes during the process. These debitage flakes are usually more diagnostic than flake scars, for their size, thickness, shape and degree of curvature can reveal several manufacturing steps. They

can indicate the technique, for they retain the bulb of applied force (platform area), show the method of platform preparation and innumerable other characteristics which indicate the technique. For this reason, a careful study of the flaking debris is a prime requisite in determining technique.

Clive J. Luke (1980:25) has pointed out that flint debitage categorized following the tradition exemplified in Texas by Shafer (1969) and Hester (1971) reflect a reduction process and is composed of 1) initial cortex flakes, 2) secondary cortex flakes, 3) interior flakes, 4) lipped flakes, and 5) fragments that cannot otherwise be categorized. LeRoy Johnson, employing a modified form of the terminology used by Honea in an unpublished manuscript, divided flakes into 1) prepared platform hammerstone flakes, 2) nonprepared platform hammerstone flakes, and 3) billet (cylindrical hammer) flakes (Johnson et al. 1962:42). Jeremiah F. Epstein (1963:28–29) distinguishes between initial cortex flakes, cortex flakes, long flakes, and billet flakes. Underlying these processes of categorization is the assumption, put forth by Crabtree, that such flakes not only reveal something about the reduction process or stages, but also something about the manufacturing techniques used and the cognitive choices made by the flintknapper.

A detailed analysis of the lithic debitage from any but the smallest of sites can be a protracted process. Debitage samples recovered from sites where ¼-in mesh is used for recovery can run from the tens of thousands of specimens into the hundreds of thousands of specimens. Examining this number of specimens, even in the most cursory manner, is time-consuming, and performing a detailed description of attributes or measurements such as those reported by Wilmsen (1970), will take an inordinate amount of time. It is, perhaps, time to consider under just what circumstances such an effort is warranted and what sort of results can reasonably be expected. Bruce Bradley (1975:6) points out that when dealing with a lithic reduction sequence, “it should be demonstrable that a valid sample of a specific assemblage is being studied. This assemblage should have an identifiable implement typology and lithic reduction sequence. Deriving this information is not always easy and in some cases virtually impossi-

ble.” Thus, if we are to follow Crabtree and derive from a collection of lithic debitage the method, the technique, and the manner of the process of manufacturing any particular group of stone tools, we must be sure that the sample or universe examined is actually representative of a valid assemblage.

David L. Clarke (1978:489) has defined the pivotal concept of an assemblage as “an associated set of contemporary artefact-types. To be distinguished rigorously from the loose physical or geographical aggregate.” Clarke (1978:245) also states that: “The important aspects of an artifact assemblage under this definition are that the artifacts may belong to more than one type and that they occur together in definite contemporary association with one another.” The importance of a precise understanding of this, and others of Clarke’s (1978:365) definitions, and the proper application of them, is underscored by his statement that:

The internal analysis of our definitions has suggested a very rough order of correlation between our archeological entities and the main social, linguistic and racial entities. A correlation that is at least partly reinforced by the evidence of the time and space distribution patterns of these entities. It is noteworthy that even this rough correlation must collapse if a precise definition and rigorous use of terminology do not underpin our taxonomy. The arbitrariness of the terms and definitions is immaterial so long as the arbitrariness is confined to an explicitly given pattern, which is always followed. Nevertheless, even if we are only saying that single assemblages are usually the product of 10s–100s of people, cultures of 100s–1,000s, culture groups of 1,000s–10,000s, and technocomplexes of 10,000s–100,000s then we are at least establishing some limits of correlation and saying something about the relative ranks of the entities concerned. In a discipline that is apt to treat the Acheulean as if it were equivalent to the Sioux, any categorization of entity, rank, and complexity is better than none.

Thus it would seem self-evident that if we are to approach an understanding of individual or group manu-

facturing processes through the study of lithic debitage, we must have debitage that “occur together in definite contemporary association.” This means that it is necessary to assess for each site, to what degree we can establish “definite contemporary association.” In other words, we must understand with precision the degree of temporal resolution any particular site situation and excavation strategy is capable of producing. Definite contemporaneity should mean that we can establish the debitage from a single occupational episode, or, even more ideally, from a single flint-working episode, as reflected in an abandoned flint-working station from which cores can be reconstructed using the associated debitage and the various stages of broken tools represented. When dealing with sites that were occupied over many tens, if not hundreds or thousands of years, and where mixing of materials has occurred by any one or more of a number of natural and cultural mechanisms, it may often be the case that we can establish no “contemporaneity” in a sense meaningful to the study of either individual flint-working techniques or even of the reduction sequences as a whole. What we will accomplish is to set up an artificial universe, represented by arbitrarily designated levels, and then perform our analytical manipulation upon the resulting data. We may well reach statistically significant results for any number of parameters studied, comparing one level with another or one site with another. What is important to recognize is that this exercise will say nothing about actual human behavior, or even about group behavior as reflected in flint-working activities. This sort of knowledge can only be acquired when the materials under study actually represent assemblages in the strict sense of the term.

There are sites which provide the sort of temporal resolution necessary: single-component, short-term occupation sites where activity areas and lithic working stations can be isolated and where what is observed reflects the life-ways of a single group of people. Such sites are rare and valuable beyond price. In the next best case we would have single-component sites with several occupational episodes represented. Here it may be difficult, but one hopes not impossible, to separate the individual occupational episodes, and to deal with each in a discrete manner. Much more difficult and less productive is the all too common situation of a site that represents repeated occupations over a con-

siderable span of time, sometimes thousands of years, by peoples using typologically distinct tool assemblages. Because of the many natural and cultural mechanisms which can and often do cause mixing of materials and thus blur the distinctions between the separate occupations, and because of excavation techniques which recover material from arbitrary levels, it is often impossible to establish any but the most broad-scale temporal resolution. This is not meant as a criticism of excavation strategies and techniques. Rather it is a recognition of the fact that most sites, no matter how sophisticated the techniques and how careful and meticulous the excavation, are incapable of providing fine temporal resolution. Using Clarke’s analogy, if all we have is the Acheulian, then we say what we can about the Acheulian, but we should not fool ourselves into thinking that we are talking about the Sioux. Techniques of analysis which would be appropriate and productive given sufficient temporal resolution and occupational control, are counter-productive, inefficient, and misleading when we are dealing with broad time spans and lumped samples.

Even in those rare cases where sufficient stratigraphic and temporal control is present and discrete occupations can be determined, these analytical techniques for studying lithic debitage should be approached with caution. Certain assumptions have been made and generally accepted by numerous investigators that may not be supported by rigorous, experimentally derived evidence. Crabtree (1972:106–107) has identified a number of factors that influence the character of the flake or blade produced including the material, the implements used to apply the force, the applied techniques, the thermal alteration or lack of alteration of the lithic material, and the degree of skill of the artisan. However, it is necessary to know more about the possibly complex interactions of these and other variables present in the flint-working process. We must be careful that what we see in the stone actually does reflect the sort of decision-making steps and motor habits that we have assumed are being reflected. Otherwise, such analysis is merely an exercise, useful perhaps in describing a body of data, but misleading in an understanding of flint-working behavior or the differences between lithic assemblages.

The Stainless Steel Indian

In discussing the use of lithic remains as a data base for isolating prehistoric cultural systems in time, Robson Bonnichsen (1977:vi–vii) postulated that the lithic craftsmen made decisions on at least four levels which are reflected on finished artifacts:

The four levels which require decision-making on the part of the tool maker are: (1) decisions regarding kinds of material; (2) decisions regarding the input variables necessary to induce a desired kind of fracture; (3) decisions regarding microstructure or the spacing between structural units; and (4) decisions regarding macrostructure or outline form perimeters.

Concerning the second of these decision levels, Bonnichsen (1977:vii) goes on to state that: “The question is raised as to whether or not the input conditions or decision sets responsible for the creation of a fracture surface can be reconstructed for classification purposes.” In order to approach this question, replicative and controlled experiments were conducted with a dynamic loading device, the “stainless steel Indian,” so that output morphology could be interpreted in light of input conditions (Bonnichsen 1977:vii). As Bonnichsen (1977:77) describes it:

The machine simulation system developed for this research is designed specifically for testing the second level of the open system model. The objectives undertaken in the experimental pilot study are to determine how and if the postulated classes of input variables of holding position, torque, force, material and impactor affect output, i.e., attribute morphology; and whether or not morphological attributes can be used to identify input variables.

Of interest here are various questions including whether or not one can differentiate between pressure and percussion flaking with precision, what the significance of materials on tool-making patterns is, and whether or not the type of impactor (i.e., soft or hard hammer) can be determined.

The experimental design are Force, Impactor, Holding Position, Material and Torque. Each class of variables was divided into levels or particular discrete units. Three levels of force were incorporated into the experiments... Originally, impactors made out of three different materials were to be incorporated into the experimental design, but it was discovered during the pilot study that the sandstone impactors consistently broke on impact rather than the specimen being struck. Consequently only moose antler impactors...and fine grained quartzite impactors...were used. Three materials were selected for use...glass, M1, obsidian, M2, and quartzite, M3. Six holding positions were chosen... Three torque levels were incorporated into the experimental design (Bonnichsen 1977:84–85).

These experiments produced some interesting results where certain aspects of flake morphology were concerned. The first of these morphological attributes is the condition of the primary flake platform. Pitting during impact occurred only once. Platform scratching did not occur at all. However, three primary flake platform alterations had a high incidence of occurrence. These are crushing, microcracking, and microflaking. In addition, the same input conditions led to the production of all three kinds of features.

The dominant variable responsible for crushing is impactor type. The hard argillite impactors were associated with the creation of platform crushing, microflaking, and microcracking, with the exception of three experiments in each variable where antler impactors led to crushing, microcracking, and microflaking. It is worth noting that the soft impactors never led to crushing, microflaking, and microcracking in quartzite materials, and are only rarely associated with the formation of three features in glass and obsidian.

The impact conditions responsible for the secondary flake platform alterations of crushing, microcracking, and microflaking are essentially the same as those for primary flake platform alterations with one major exception. Almost all secondary platform alterations are associated with holding position 2 with a few excep-

tions where holding position 4 was used. In primary flake platform alterations there is a much greater range of holding positions including positions 2, 3, 4, and 6 (Bonnichsen 1977:164).

Lipping of flakes is a feature which has traditionally received a great deal of attention, particularly in Texas. Bonnichsen (1977:165–166) has addressed this question in his controlled experiments.

Lips were experimentally produced fifty-six times and have a relative frequency of 7.5 per cent. The total combination of all impact variables is associated with the production of lips with the exception of holding position. Lips were produced only when specimens were held in holding position 2 with a single deviant experiment 64, in which a lip was created in holding position 4. Specimens held in holding in position 2 were impacted on a beveled edge which was at a 45° angle to the longitudinal axis of specimens. Consequently, it can only be concluded that angle is the critical variable responsible in the creation of lips, not the kind of material used in the impactor as commonly suggested. In other words, the experimental evidence advanced here suggests lips on primary flakes cannot be used to distinguish between the use of hard and soft impactors as has been common practice.

Lips occurred on secondary flakes twenty-one times. It is interesting to observe that the combinations of input variables responsible for the creation of lips on secondary flakes are no different than those for primary flakes. In all instances lips are associated with holding position 2, in which beveled edge specimens were used.

A third feature of flake morphology which has traditionally received considerable analytical attention and about which certain assumptions have commonly been made, is the bulb of force. Bonnichsen (1977:166) dealt with this morphological feature as well:

The formation of bulbs of force on primary flakes, variable 022, and in secondary flakes,

variable 043, are related to one dominant variable. Like lips, bulbs of force occur predominantly in holding position 2, in which beveled edge specimens were impacted at a 45° angle to the longitudinal axis of the material. In view of the evidence that bulbs were created in holding position 2, with only two exceptions, experiments 135 and 136, it can only be concluded that angle of impact relative to the longitudinal axis of the specimen is a highly critical variable in the formation of bulbs.

A rank order scale was employed for recoding bulb definition. It is interesting to note that poorly defined bulbs occurred twenty-two times, moderately defined bulbs were recorded twenty-two times and well defined bulbs were produced only twelve times. On secondary flakes nine bulbs were scaled as poorly defined, seven moderately defined, and seven well defined. No attempt has yet been made to determine if there is some sort of underlying pattern such as force level which is responsible for these differences.

In summarizing the third section of his paper, which was devoted to an analysis of the input conditions responsible for the creation of output variables in an attempt to determine the applicability of the above particularistic approach, Bonnichsen (1977) focused on the theoretical implications of the particularistic approach. Three trends were apparent from his experimental data in regard to the relationships between input decisions and output variables. The first of these, and the most important for the present discussion, is the fact that some variables, such as lips and bulbs of force, are almost always associated with a dominant input variable. In the above cases Bonnichsen discovered that this dominant variable happens to be the angle of impact, in spite of the fact that lips and to some extent bulbs of force have traditionally been interpreted as indicators of the type of impactor used. A second trend revealed is that similar or identical input conditions can result in slightly different but related output variables, as in the case of the platform alteration of primary and secondary flakes, where crushing, microflaking, and microcracking are all almost always associated with the use of non-resilient (hard) impac-

tors. The third trend noted was the fact that a particular feature may be associated with several alternative input conditions or decisions, as in the case of the production of primary half-cones in a variety of holding positions (Bonnichsen 1977:174–176).

Bonnichsen stresses the fact that his work should be considered a pilot project, and that too few experiments were conducted to provide statistically valid results, so that those results should not be used as an inferential framework for interpreting prehistoric remains. Nevertheless, Bonnichsen has opened up an avenue for further research. His results indicate that researchers should, perhaps, stop categorizing flakes on the basis of certain morphological features, such as the presence of lipping, until we have a more certain idea of just what such features indicate about input variables.

Interpretation-Free Debitage

Recognizing the drawbacks to methods using flake typologies, Sullivan and Rozen (1985) proposed an “interpretation-free” analysis. Using their method, debitage is sorted into four, non-overlapping categories: complete flakes, broken flakes (proximal flake fragments), flake fragments (medial and distal flake fragments), and debris (shatter). Because the sorting categories are distinct, other researchers can replicate the results. This is not the case with subjective or overlapping flake type categories. Their original article drew sharp criticism from other researchers (e.g., Amick and Mauldin 1989; Ensor and Roemer 1989). The primary complaint that can be leveled at the method is that although the results are replicable the categories have no behavioral relevance.

Mass Analysis

More recently, an alternative approach to debitage analysis, called *mass* or *aggregate analysis*, has been advanced by Ahler (1989) and Morrow (1997), among others. Unlike individual flake analysis which relies on distinct metric or morphological characteristics of individual flakes, *mass analysis* uses aggregates of data derived from groups of flakes of similar size (Morrow 1997:55). Individual flake analysis has several weak-

nesses first enumerated by Ahler (1989) and later restated by Morrow (1997:55):

First, it is labor intensive; recording even a basic set of metric and/or morphological attributes on flakes individually takes time. Second, due to the time-consuming nature of individual flake analysis, short-cuts may be taken. For example, specific attributes may be recorded only for the larger or more complete flakes present in an assemblage. Third, many individual flake analysis techniques involve the use of some form of flake typology. Flake types are generally polythetically defined, that is, flakes that exhibit a combination of certain features are attributed to a specific flake type category (e.g., biface thinning flake, bipolar flake, etc.). Problems with flake type approaches are exacerbated by the fact that different analysts often place varying emphasis on certain key attributes, so the flake types used in one study are typically not directly comparable to those employed in other analyses. Finally, several of the flake type categories commonly employed in analyses are not exclusively related to specific reduction practices.

Mass analysis, on the other hand is an efficient method of processing large quantities of debitage. Basically, the method relies on the assumption that different stages of tool manufacture or maintenance produce different patterns in the debitage assemblage. For example, “free-hand hard hammer percussion core reduction tends to produce proportionately fewer small flakes that average slightly more in weight than does pressure retouching a unifacial flake tool” (Morrow 1997:55).

In mass analysis, debitage is size sorted through standardized screen sizes. In both Ahler’s (1989) and Morrow’s (1997) studies, four size grades were used. The four grades were $\frac{1}{8}$ – $\frac{1}{4}$ in, $\frac{1}{4}$ – $\frac{1}{2}$ in, $\frac{1}{2}$ –1 in, and >1 in. Each category is then counted and weighed. The results can be compared to experimentally produced data sets to look for correlations (Morrow 1997). As with any approach, mass analysis has strengths and weakness as noted by Morrow (1997:56):

Mass analysis has been applied with considerable success to Great Plains debitage collections. It has been particularly effective at documenting changes in lithic raw material procurement and processing technology through time in the Knife River flint quarries. It should be kept in perspective, however, that mass analysis techniques are best suited to the interpretation of primary refuse accumulations that contain comparatively little technological sophistication or internal variation. That is, mass analysis is an ideal method for exploring trends and variation in dense lithic quarry and workshop debris.

The greatest drawbacks to the approach are the same ones that plague other methods. Technologically mixed deposits, those resulting from multiple approaches to tool production or maintenance, “would be interpreted based on the average characteristics of its constituents” because mass analysis relies on aggregated data that reduce variation to one multivariate statistic (Morrow 1997:56). Another problem arises in assemblages that have been inadvertently size sorted through natural or cultural processes. Mass analysis relies heavily on the counts and weights of the smaller size grades, and processes that remove small flakes from the assemblage can skew the results (Morrow 1997:56).

Debitage at 41MK27

Taking the above-mentioned factors into serious consideration, it was decided that a full-scale and detailed analysis of the lithic debris from 41MK27 was not appropriate. This material was recovered in the traditional manner, with an attempt to recover as many of the modified artifacts and even the larger unmodified flakes in place, so that absolute vertical and horizontal proveniences could be recorded. However, the vast majority of the lithic debris was recovered when the matrix was passed through ¼-in screens. This recovery process, as has been so well documented by Sollberger (Gunn et al. 1976), strongly biases the sample in favor of the larger flakes. Flakes from their classes six and seven, falling between 2.25 mm and 4.49 mm in size, are generally not recovered with ¼-in screens. The activity thought to be represented by flakes in classes five, six, and seven is re-sharpening

(Gunn et al. 1976:5). George Frison (1968:149–155) has demonstrated what sort of analysis is possible, given a suitable single-occupation site, when these re-sharpening flakes are recovered and properly analyzed. This point is made to emphasize that even at the level of determining what sort of recovery techniques should be used, one should keep in mind the degree of temporal resolution considered possible at the site and the type of studies envisioned.

The recovery methods also made the 41MK27 debitage sample inappropriate for mass analysis. The smallest size grade commonly used in such studies is ½–¼ in, and the use of ¼-in screens in the field effectively removed this grade from the sample. Furthermore, the site is not a quarry (the site type for which mass analysis is most effective) and the debitage assemblage is presumably mixed, resulting from multiple and technologically different reduction episodes.

In a case such as represented by Frison’s work at the Piney Creek Site (48JO312), meticulous recovery techniques are appropriate and every effort should be made to recover the smaller fraction of the lithic debitage sample, even to the extent of using very fine-meshed screen or water screening. From a site such as 41MK27, and so many other sites from central Texas, where temporal resolution is on a very broad scale, the effort to recover this fine fraction of the debitage would not produce results commensurate with the effort. However, one should keep in mind the necessarily biased nature of the sample. Of the 13,750 flakes recovered at 41MK27, 3,408 were designated decortication flakes, representing either primary or secondary decortication removals. A total of 10,342 interior flakes were recovered. These evidenced no cortex, with the possible exception of a bit of cortex on the platform area in some specimens.

In the foregoing discussion of debitage, the points made concerning a valid assemblage and the degree of temporal resolution possible at a given site apply as well to the sort of information that can be derived from the intentionally modified and shaped tools and the peoples who produced them. If a temporally valid assemblage does not exist at a site, or cannot be isolated, the information about the artifacts recovered is valid only for a much broader cultural entity, and thus less likely to be

truly representative of it. When the data represent repeated occupations during the Late to Transitional Archaic periods, but it is impossible to really identify any particular single episode of occupation, we are painting with a broad brush indeed.

Modified Flakes

Of this flake sample, relatively few examples were considered to fall into the category of modified flakes. For our purposes, a modified flake is one that exhibits some degree of marginal modification. This can vary from fine to heavy, irregular to regular, shallow to invasive. Flakes of various sizes, thicknesses, outline morphologies, and types exhibit modification. In a discussion of this tool type, if tool type it is, it should be emphasized that in many modified flakes, no determination can be made as to the agency producing the modification. Some may well have been intentionally modified to serve some specific purpose. Some may have served as expediency tools, with no or minimal intentional modification. The marginal modification observed may simply be the result of the use to which the flake has been put. However, there are other ways in which a flake margin may become modified—such as accidental chipping in the process of colluvial action or being stepped on by men or animals—which are totally unrelated to use. Although it is not uncommon to find sites where many of the flakes with suitable edges of any size show modification, that exhibited by the flakes at 41MK27 is most unimpressive, and would seem much more likely to fall into the accidental category. Only 35 flakes have been identified as having this sort of edge modification. Twenty-one of these are decortication flakes, and the remainder are interior flakes. The size and shape of these flakes shows no consistent pattern, and neither does the location of modification, with one possible exception. This exception consists of six flakes where a concave margin has been modified. These cases may actually represent intentional, though casual modification, or they may be the result of use of some type rather than of an accidental process. The modified flakes are summarized in Table 5.1 and illustrated in Figure 5.11.

Bifaces

Kelly (1988:717–734) defines two main roles for bifaces in lithic technological organization: core/variable use tools and long use-life tools. In Kelly's (1988) model, biface function is related to hunter-gatherer mobility and raw material availability. In areas where raw material is not readily available, groups may have minimized transportation weight and maximized transportable material by producing bifacial cores. Bifaces also served as long use-life tools by hunter-gatherer groups. They can be multifunctional, serving as knives or scrapers (Kelly 1988:721).

Bifacially modified artifacts have sometimes been treated as representing necessarily completed morphological or functional types such as choppers, knives, or even projectile point types with chronological or cultural significance. They might be more profitably considered as representatives of a reductive process, which begins with a usable specimen of a satisfactory lithic material and results either in the production of a completed final product or the abandonment of the item at some stage of its manufacture prior to final completion. As early as 1890, W. H. Holmes dealt with the concept of a "blank" as a basic form from which lithic artifacts are produced. In the glossary to *Ancient Man in North America*, H. M. Wormington (1957:274) defines "blank" as "a roughly shaped stone artifact, still in the process of manufacture, which has been blocked out to the approximate shape and thickness desired for a completed tool." However, in the discussion of various Paleoindian sites and assemblages, and particularly in her evaluation of the significance of E. B. Renaud's Black's Fork collection, the technological concept of a biface reduction sequence is not used to explain the discovery of "thousands of artifacts that are typologically similar to Old World Paleolithic tools of great antiquity" (Wormington 1957:219).

Guy R. Muto (1971) discusses the fact that the "blank-preform-product" continuum had gone unrecognized in his treatment of the Simon Site material. In 1975, Michael B. Collins proposed a model for the process of manufacturing stone tools. A main feature of this model is the fact that "the manufacture of chipped stone tools is a reductive technology," and "although the process is linear, it is convenient to di-

Table 5.1. Modified Flakes from 41MK27

| Specimen | L* | W* | Th* | Flake Type | Location and Nature of Modification |
|----------|-------|------|------|-------------------|---------------------------------------------------------------|
| 9 | 48.5 | 42.2 | 16.2 | Decortication | Irregular scalar & step flakes, right lateral margin |
| 26 | 43.7 | 36.4 | 17.4 | Decortication | Fine irregular removals across distal end |
| 32 | 36.8 | 54.6 | 21.6 | Decortication | Fine irregular removals across broken proximal end |
| 60 | 32.7 | 47.4 | 16 | Decortication | Invasive trimming along part of one margin of broken chunk |
| 70 | 52.3 | 38.2 | 8.5 | Interior | Irregular invasive removals along right lateral margin |
| 83 | 34.8 | 41.3 | 8.1 | Decortication | Fine irregular removals across distal end |
| 86 | 56.1 | 34.7 | 13.5 | Decortication | Irregular invasive removals along part of one margin |
| 95 | 41.2 | 31.1 | 10.6 | Interior | Fine irregular modification along part of one margin |
| 96 | 90.5 | 60.8 | 14.2 | Interior | Irregular invasive modification across distal end |
| 97 | 29.5 | 24.5 | 3.8 | Interior | Fine irregular modification along one margin |
| 98 | 26.2+ | 38.7 | 9.2 | Decortication | Fine regular modification along right lateral margin |
| 110 | 53.9 | 28.1 | 15.8 | Decortication | Irregular removals along concave distal end |
| 114 | 44.6 | 26.3 | 3.6 | Interior | Regular fine invasive modification across distal end |
| 122 | 58.3 | 49.5 | 21.4 | Decortication | Fine regular modification along portion of right margin |
| 125 | 60 | 40.7 | 17.6 | Decortication | Regular step removals along a concave margin |
| 138 | 69 | 38.8 | 7.8 | Decortication | Fine irregular removals, right lateral margin |
| 162 | 21.9 | 32.2 | 4.2 | Interior | Regular invasive modification across distal end |
| 175 | 18.1 | 11.6 | 3.2 | Interior | Very fine modification along one margin of flake fragment |
| 179 | 35.9 | 24.1 | 14.4 | Decortication | Irregular invasive modification on one margin of a chunk |
| 217 | 66.9 | 44.5 | 25.2 | Decortication | Irregular invasive modification along one margin |
| 228 | 41.6 | 26.7 | 7.1 | Interior | Regular invasive modification along concave portion of margin |
| 403 | 51.4 | 29.9 | 8.6 | Decortication | Fine irregular modification along one margin |
| 410 | 80.7 | 54.4 | 16 | Decortication | Irregular modification along one margin |
| 431 | 37.6 | 33.5 | 6.4 | Interior | Irregular invasive modification, distal end, ventral face |
| 438 | 13.4 | 20.5 | 4.5 | Interior fragment | Fine modification along one margin |
| 439 | 68.1 | 34.4 | 22.4 | Decortication | Fine invasive modification around concave distal end |
| 450 | 39.0+ | 55.6 | 13.1 | Decortication | Fine regular invasive modification across distal end |
| 454 | 33.7 | 38.4 | 15.1 | Decortication | Small area of irregular modification, left margin |
| 488 | 36.9 | 38.1 | 12.2 | Decortication | Regular invasive modification along concave margin |
| 669 | 21.8 | 28.4 | 6.9 | Interior | Fine irregular modification along one margin |
| 686 | 34.8 | 34.2 | 10.2 | Decortication | Regular invasive modification along one margin |
| 728 | 32.9 | 22.1 | 4.2 | Interior | Very fine regular modification, right margin |
| 737 | 37 | 38.8 | 3 | Interior | Regular invasive modification, reverse face, distal end |
| 747 | 26.4 | 47 | 9 | Interior | Regular fine modification across one-half of distal end |
| 1056 | 57.8 | 43.5 | 16 | Decortication | Irregular step removals along concave margin |

* All measurements are in mm.

vide it into a series of steps.” He goes on to say that “the linear relationship of the steps in the model is determined by the fact that all but the initial step are dependent upon the output qualities of the prior steps as preconditions for their initiation” (Collins 1975:16–17). Patience E. Patterson (1977:53) presented a refined model of a lithic reduction sequence “which consists of a synthesis and application of a sequence derived from the models of Sharrock (1966), Muto (1971), and Collins (1975).” Following Patterson, the

bifaces from 41MK27 have been evaluated as representing the various stages of a five-stage biface reduction sequence (Table 5.2).

Biface Reduction Stage 1: Primary Reduction Stage

The primary reduction stage is usually represented by a large flake or core biface. These may still retain

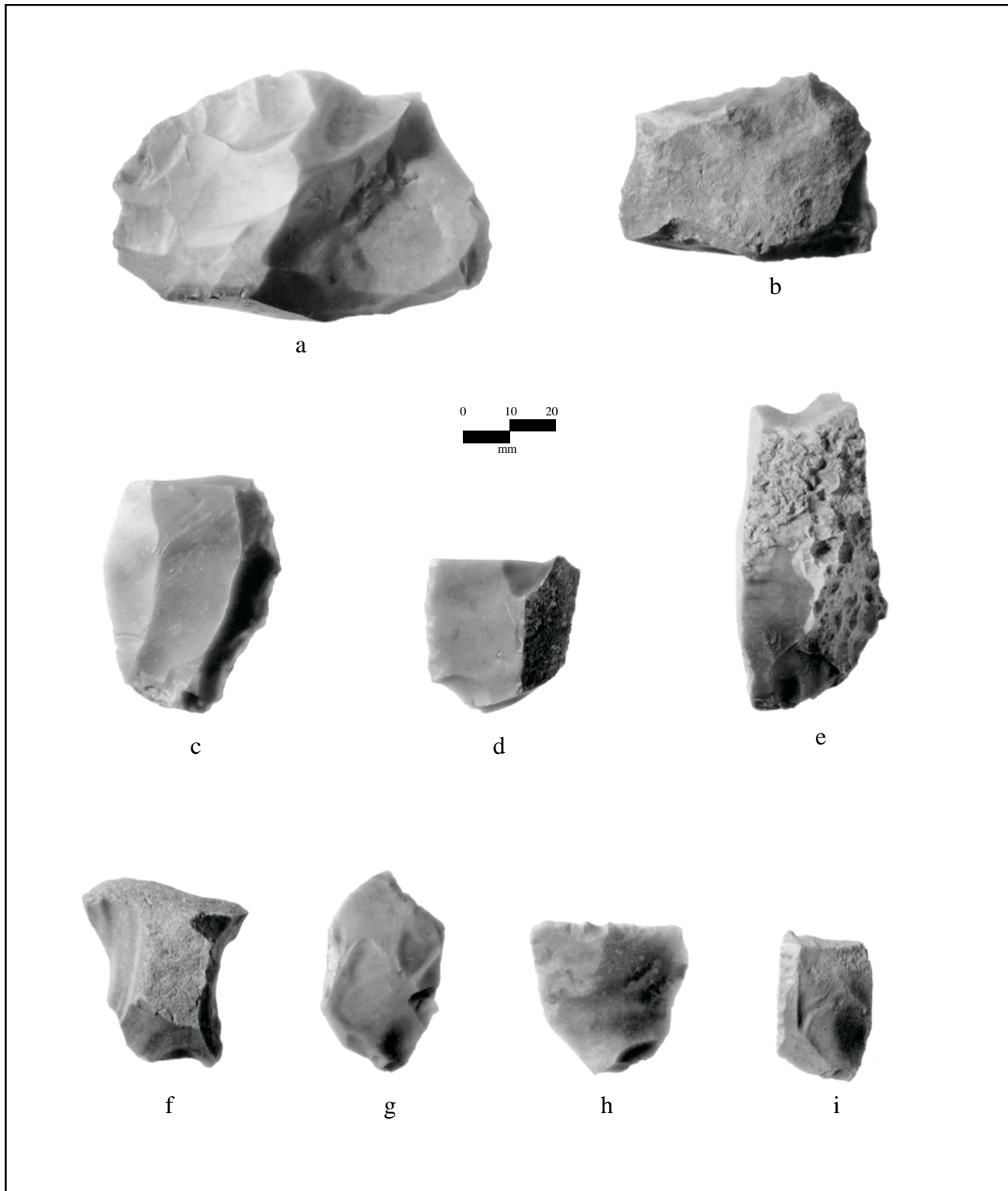


Figure 5.11. Modified flakes from 41MK27.

evidence of cortex. Evidence of flaking on at least one face is a minimum defining criterion. Intentional form is not necessarily introduced at this stage, and the reduction process is of a preliminary nature (Patterson 1977:69). There are 17 specimens from 41MK27 that are Stage 1 bifaces. Of these, 10 are complete and seven are fragmentary specimens. Those that are complete all have areas of retained cortex. Several were recovered with large areas of cortex still remaining; these were probably abandoned because of some perceived defect in the stone rather than because of a manufacturing error. In other cases it may have become apparent that it would be impossible to remove all of the cortex and proceed further with the reduction process. The broken or fragmentary specimens often reflect error on the part of the flintknapper or “technological failure.” The complete specimens range in length from 49 mm to 115 mm, in width from 45 mm to 92 mm, and in thickness from 16.5 mm to 37 mm. Flaking consists of primary reduction flaking as well as primary and secondary decortication removal. There is very little later reduction stage flaking in evidence (Figure 5.12).

Biface Reduction Stage 2: Thick Biface or Trimmed Flake

In Reduction Stage 2, the raw material has been bifacially worked to reduce the mass, usually in thickness. The artifact often has a very rough subtriangular or lanceolate form and is still quite thick relative to the finished product (Patterson 1977:70–71). Of the 31 Stage 2 bifaces, 15 are complete, and 16 are either broken or fragments. Eleven of the complete specimens exhibit at least a small area of cortex still present, and five of the broken or fragmentary specimens have areas of cortex. One of the complete specimens was broken during manufacture, but both pieces were recovered. Some specimens show marginal platform preparation, presumably in anticipation of

Table 5.2. Bifaces from 41MK27

| Spec. | Reduction Stage | Biface Shape | L* | W* | Th* |
|-------|-----------------|----------------------------------|------|------|------|
| 3 | Stage I | Triangular | ---- | 23.2 | 5.9 |
| 8 | Stage III | Triangular | ---- | 26.4 | 6.3 |
| 13 | Stage II | Fragment | ---- | 38.8 | 16.5 |
| 15 | Stage III | Parallel-sided | ---- | 31.5 | 5.5 |
| 16 | Stage II | Fragment | ---- | ---- | 11.3 |
| 17 | Stage II | Parallel-sided (fire-shattered) | ---- | ---- | ---- |
| 18 | Stage II | Fire-shattered fragment | ---- | ---- | ---- |
| 19 | Stage IV | Concave/Convex | 78 | 35.6 | 7.7 |
| 21 | Stage III | Fragment | ---- | ---- | 5.2 |
| 33 | Stage II | Fragment | ---- | 55 | 18.2 |
| 35 | Stage I | Irregular | 80 | 53.5 | 27.8 |
| 42 | Stage III | Slightly expanding basal portion | ---- | 39.4 | 8.3 |
| 48 | Stage III | Oval | 41 | 25.4 | 6.8 |
| 49 | Stage II | Fragment | ---- | 52.2 | 15.1 |
| 51 | Stage IV | Triangular | ---- | 33.6 | 5.6 |
| 52 | Stage IV | Triangular | ---- | 15.7 | 2.8 |
| 53 | Stage III | Proximal Fragment | ---- | ---- | 6.4 |
| 54 | Stage II | Oval | ---- | 35.4 | 14.4 |
| 57 | Stage I | Irregular | 73 | 60.4 | 20.1 |
| 59 | Stage III | Excurvate | ---- | 40.5 | 10.6 |
| 61 | Stage III | Slightly expanding basal portion | ---- | 40 | 6 |
| 64 | Stage III | Pointed ovate | 112 | 65.5 | 13.1 |
| 65 | Stage IV | Triangular | ---- | 17.8 | 4.6 |
| 66 | Stage IV | Excurvate | ---- | 24.5 | 6.5 |
| 67 | Stage III | Oval | 40 | 27.7 | 10.5 |
| 94 | Stage II | Oval | 60 | 37.3 | 19.7 |
| 99 | Stage III | Slightly expanding basal portion | ---- | 36.5 | 10.9 |
| 100 | Stage III | Slightly expanding basal portion | ---- | 38.3 | 8.4 |
| 106 | Stage III | Excurvate | ---- | 48.5 | 11.7 |
| 111 | Stage I | Fragment | ---- | 47.8 | 16.6 |
| 112 | Stage IV | Excurvate | ---- | 31.6 | 7.3 |
| 116 | Stage II | Oval | 140 | 87.5 | 29 |
| 119 | Stage I | Round | 77 | 73.5 | 33.5 |
| 128 | Stage II | Oval | 63 | 51.6 | 31.1 |
| 129 | Stage II | Fragment | ---- | 58.6 | 12.9 |
| 131 | Stage II | Fragment | ---- | 52 | 9.7 |
| 133 | Stage II | Excurvate | 94 | 42.3 | 12.3 |
| 135 | Stage II | Irregular | ---- | 31 | 10.2 |
| 139 | Stage II | Parallel-sided (fire-shattered) | ---- | 28.1 | ---- |
| 140 | Stage III | Parallel-sided | ---- | 41.3 | 8.3 |
| 142 | Stage IV | Triangular | ---- | 14.7 | 1.5 |
| 149 | Stage II | Oval | 68 | 53.2 | 24.6 |
| 150 | Stage I | Parallel-sided | 72 | 54.8 | 30.7 |
| 153 | Stage II | Irregular | 53 | 43.4 | 17 |
| 155 | Stage II | Oval | 71 | 39.3 | 12.9 |
| 161 | Stage II | Irregular | 83 | 51.2 | 27.1 |
| 165 | Stage III | Round | 35 | 31.9 | 9.4 |
| 168 | Stage II | Oval | 62 | 52.7 | 34 |
| 173 | Stage IV | Triangular | ---- | 35 | 6.4 |
| 177 | Stage III | Proximal fragment | ---- | 31.1 | 5.8 |

Table 5.2. Bifaces from 41MK27 (continued)

| Spec. | Reduction Stage | Biface Shape | L* | W* | Th* |
|-------|-----------------|----------------------------------|------|------|------|
| 180 | Stage III | Parallel-sided | ---- | 37.6 | 8.3 |
| 188 | Stage IV | Triangular | 86 | 36.2 | 8.6 |
| 191 | Stage I | Oval | 67 | 52.2 | 25.1 |
| 201 | Stage III | Slightly expanded basal portion | ---- | 29.1 | 5.4 |
| 212 | Stage II | Oval | 66 | 52.3 | 22.2 |
| 224 | Stage II | Fragment | ---- | 51.3 | 29.2 |
| 230 | Stage II | Pointed ovate | 72 | 42.7 | 28 |
| 235 | Stage I | Round | 55 | 51.1 | 21.2 |
| 237 | Stage IV | Parallel-sided | 83 | 28.5 | 11.1 |
| 238 | Stage III | Slightly expanding basal portion | ---- | 29.1 | 5.4 |
| 241 | Stage I | Oval | 58 | 41.1 | 17 |
| 402 | Stage III | Parallel-sided | ---- | 27.8 | 6.9 |
| 405 | Stage III | Parallel-sided | ---- | 38.9 | 9 |
| 409 | Stage I | Fragment | ---- | 38.2 | 24.3 |
| 411 | Stage I | Fragment | ---- | 38.3 | 17.2 |
| 415 | Stage II | Oval | 70 | 37.7 | 19.4 |
| 429 | Stage III | Triangular | ---- | 21.9 | 7.9 |
| 436 | Stage I | Irregular | 95 | 63 | 35.2 |
| 437 | Stage II | Fragment (fire-shattered) | ---- | ---- | ---- |
| 447 | Stage IV | Triangular | ---- | 18.7 | 4.2 |
| 449 | Stage I | Irregular | 66 | 46.9 | 15.5 |
| 451 | Stage III | Fragment | ---- | ---- | 7.4 |
| 455 | Stage II | Round | 60 | 48.6 | 22.6 |
| 470 | Stage II | Fragment | ---- | ---- | 18.5 |
| 480 | Stage IV | Distal fragment | ---- | ---- | 2.6 |
| 481 | Stage IV | Fragment | ---- | ---- | 2.3 |
| 484 | Stage I | Oval | ---- | 57.6 | 26.7 |
| 490 | Stage I | Fragment | ---- | 61.2 | 24.8 |
| 494 | Stage II | Oval | 77 | 60 | 29.8 |
| 650 | Stage IV | Triangular | ---- | 12.7 | 3.6 |
| 652 | Stage II | Oval | 110 | 76 | 25.1 |
| 657 | Stage IV | Excurvate | 82 | 28 | 7.5 |
| 666 | Stage IV | Medial fragment | ---- | ---- | 5.2 |
| 670 | Stage IV | Triangular | ---- | 11.2 | 2.2 |
| 676 | Stage IV | Excurvate | --- | 34.9 | 7.4 |
| 687 | Stage III | Triangular | 42 | 32.7 | 6.7 |
| 693 | Stage III | Excurvate | ---- | 28 | 9 |
| 694 | Stage III | Irregular fragment | ---- | 30.4 | 8.9 |
| 724 | Stage I | Irregular | 112 | 91.4 | 36.8 |
| 734 | Stage III | Distal fragment | ---- | ---- | ---- |
| 735 | Stage III | Distal fragment | ---- | ---- | 3.8 |
| 749 | Stage II | Round | 50 | 45.9 | 12.8 |
| 801 | Stage III | Medial fragment | ---- | 34.2 | 7.9 |
| 837 | Stage I | Oval | 115 | 70.4 | 33 |
| 866 | Stage IV | Excurvate | ---- | 17.6 | 4.8 |
| 870 | Stage II | Oval | 77 | 64.1 | 18 |
| 880 | Stage IV | Excurvate | ---- | 8.5 | 6.4 |
| 1163 | Stage I | Fragment | ---- | ---- | 28.4 |

* All measurements in mm.

further reduction. Others give no evidence of intentional edge modification at this stage. The lengths of the complete specimens range from 50 mm to 140 mm. Widths range from 37.3 mm to 87.5 mm and thicknesses range from 12.8 mm to 34 mm (Figure 5.13).

Biface Reduction Stage 3: Thinned Biface

Thinned, Stage 3 bifaces usually show some degree of intentional shaping or form. A reduction in thickness relative to overall size has been accomplished. As the reduction sequence proceeds, the removals become thinner and flatter (Patterson 1977:72). Of those specimens where a determination of shape was possible, three were triangular, one was round, four were parallel-sided, two were oval, one was a pointed ovate, three were excurvate, and five were proximal portions of bifaces which appear to have slightly expanding margins. Because of the incomplete nature of these specimens, the overall shape was impossible to determine, but the rectangular basal portions present were distinctive. The two oval specimens were also quite distinctive, being smaller than the other Stage 3 bifaces. They were the only complete specimens. Of the 32 specimens, 15 are proximal portions, five are distal portions, two are complete, and two are nearly complete, with one of these missing only the very distal tip and the other missing a portion of one margin. The remaining specimens were either medial portions or fragments. It is at this biface reduction stage that one might in some cases be able to determine specimens that are becoming preform stages of particular projectile point types. In this collection (Figure 5.14), given the small size of the sample, it has not been possible to match particular Stage 3 bifaces with the completed projectile point types for which they are the preforms. Where measurements are possible, lengths range from 40 mm to



Figure 5.12. *Reduction Stage 1 Bifaces from 41MK27.*

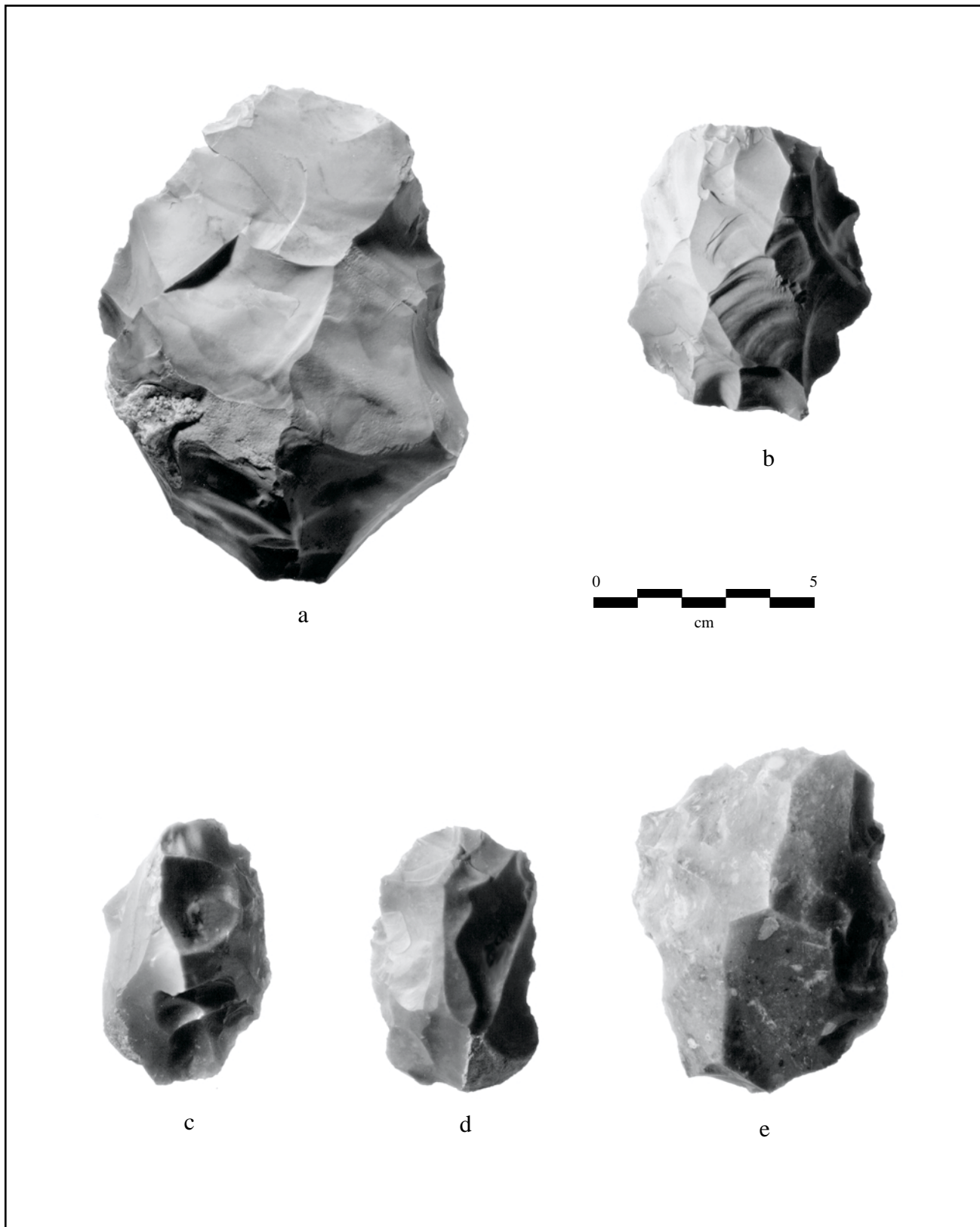


Figure 5.13. Reduction Stage 2 Bifaces from 41MK27.

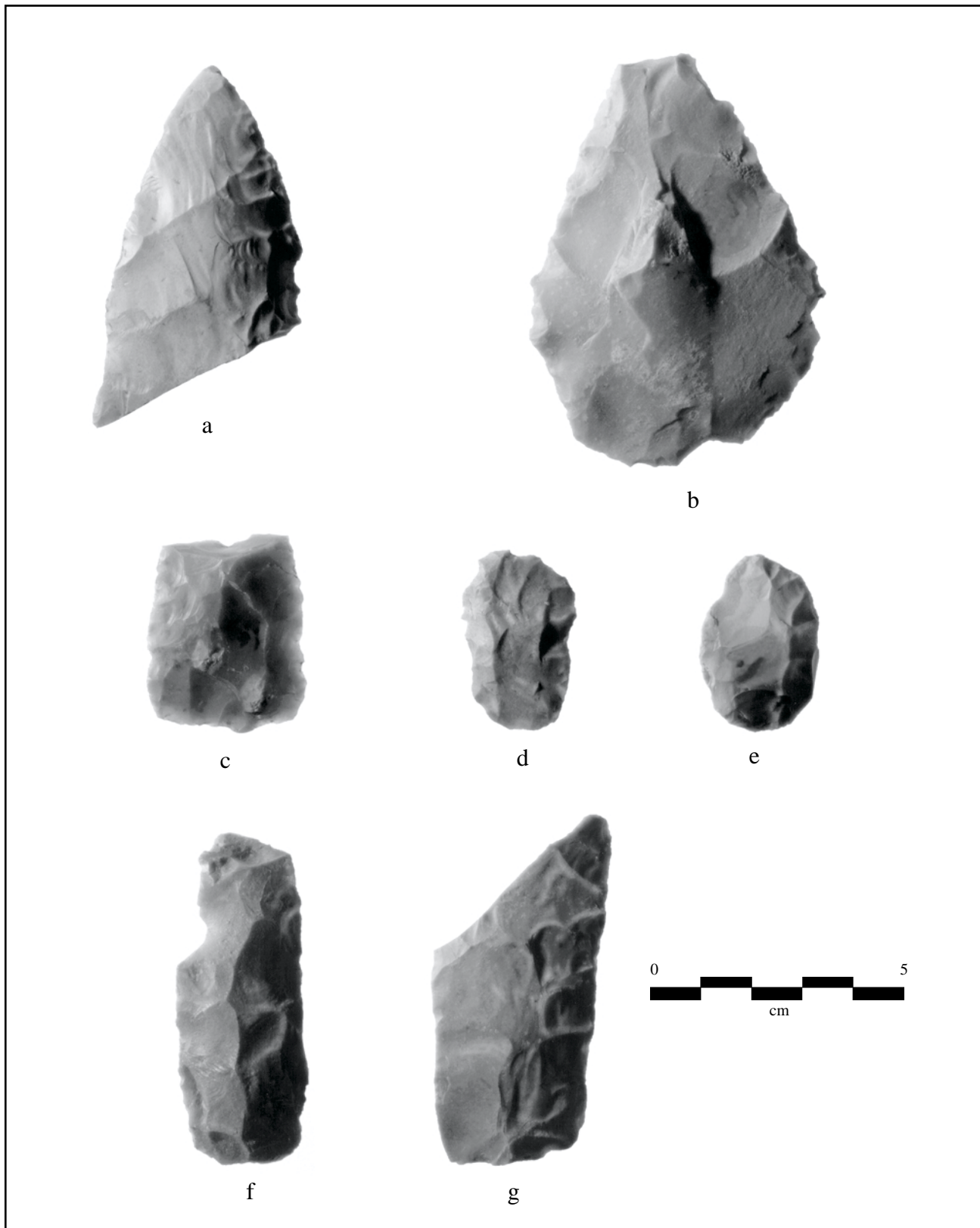


Figure 5.14. *Reduction Stage 3 Bifaces from 41MK27.*

112 mm. Widths range from 25.4 mm to 66.5 mm, and thicknesses range from 6.3 mm to 13.1 mm.

Biface Reduction Stage 4: Thinned Biface with Form

In this stage a greater degree of intentional shaping or form is evident. Shape is generally triangular or lanceolate. This is the preform stage, and reduction of mass by thinning has been accomplished (Patterson 1977:73). Where a determination of shape could be made, four specimens are excurvate, three specimens are triangular, one is a pointed-ovate, and one is concave/convex. None of the 17 specimens are complete. There are 11 distal fragments, three proximal fragments, and three medial fragments (Figure 5.15). It is obvious that at Biface Reduction Stage 4 the majority of specimens, at least as represented in this collection, have been rejected because of human error or technological error. Flaking of these specimens tends to be massive and some diminutive later reduction stage with some marginal modification. Given an adequate sample and the presence of a reduction sequence which results in distinctive preforms for certain projectile point types, it should be possible at Stage 4 to identify those preforms which are the precursors of particular point types. Unfortunately the sample from 41MK27, both of bifaces and of projectile points, is not sufficiently large to make these sorts of determinations. The nearly complete specimen measures 86 mm in length, 35.7 mm in maximum width (the proximal end), and 8.2 mm in thickness.

Biface Reduction Stage 5: Final Product

In Stage 5, the artifact has taken its completed form as a dart or arrow point (Patterson 1977:74). In considering Stage 5 or completed artifacts, several factors need to be regarded. There are several substages or conditions for a completed artifact. It may rarely be found in a pristine or unused condition. It may more commonly be found in a somewhat altered condition, due either to use, damage incurred during the useful life of the artifact, or some post-use or post-depositional factors. Another consideration is that artifacts are sometimes resharpened or rejuvenated to prolong their useful lives. This is often the case with projectile

points, and may even cause a typological paradox where the original specimen would fall into one type and a resharpened example would be considered a totally distinct and perhaps culturally different type. The majority of Stage 5 bifaces from 41MK27 are projectile points and are discussed as a separate category below. However, there are five additional bifaces that can be considered as complete and final products rather than as earlier stage bifaces.

The first of these is the distal two-thirds of a triangular biface that shows heavily beveled margins. This heavy alternate beveling is evidence that this tool has been resharpened and is not a preform (Figure 5.16a). The second is a concave/convex biface, with a convex base and beveling along the concave margin. Surface flaking consists of some massive and more diminutive later reduction stage flake scars, many of which are oriented obliquely across the face (Figure 5.16b). The extreme distal tip is missing. The third is a roughly triangular blade with one somewhat concave margin and a distinctly concave base. The distal tip is missing. Heavy beveling along one margin suggests reworking or resharpening. Both massive and diminutive later reduction stage flake scars are present on both faces (Figure 5.16c). The fourth specimen is a biface with somewhat recurved margins. Flake scars run obliquely across one face. The central ridge created by the meeting of flakes originating from each margin is off-center, suggesting once again a specimen that has been resharpened and its original shape modified in the process (Figure 5.16d). No wear patterns have been distinguished on either the margins or the faces of these specimens, but it is probable that they functioned as cutting implements.

The final Stage 5 biface is one fragmentary specimen that represents what was probably a perforator or drill (Figure 5.16e). It is missing both the complete proximal end and the distal end. This tool is bifacially worked, with some massive and some diminutive later reduction stage flake scars on both faces. Margins are irregular, although it is possible that a secondary perforating tip was worked after the proximal portion was broken away. The width is 39.8 mm and the thickness is 8.4 mm.

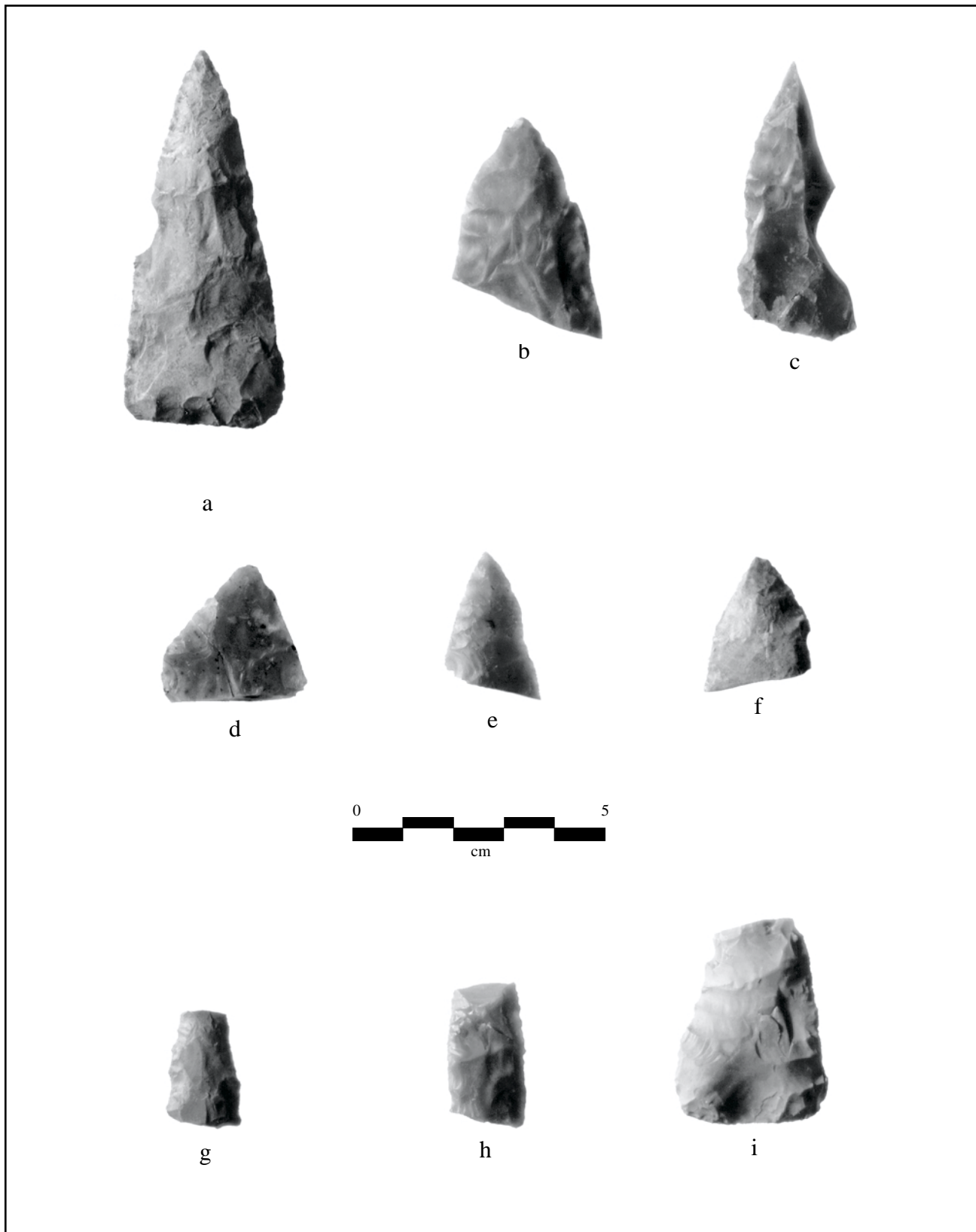


Figure 5.15. *Reduction Stage 4 Bifaces from 41MK27.*

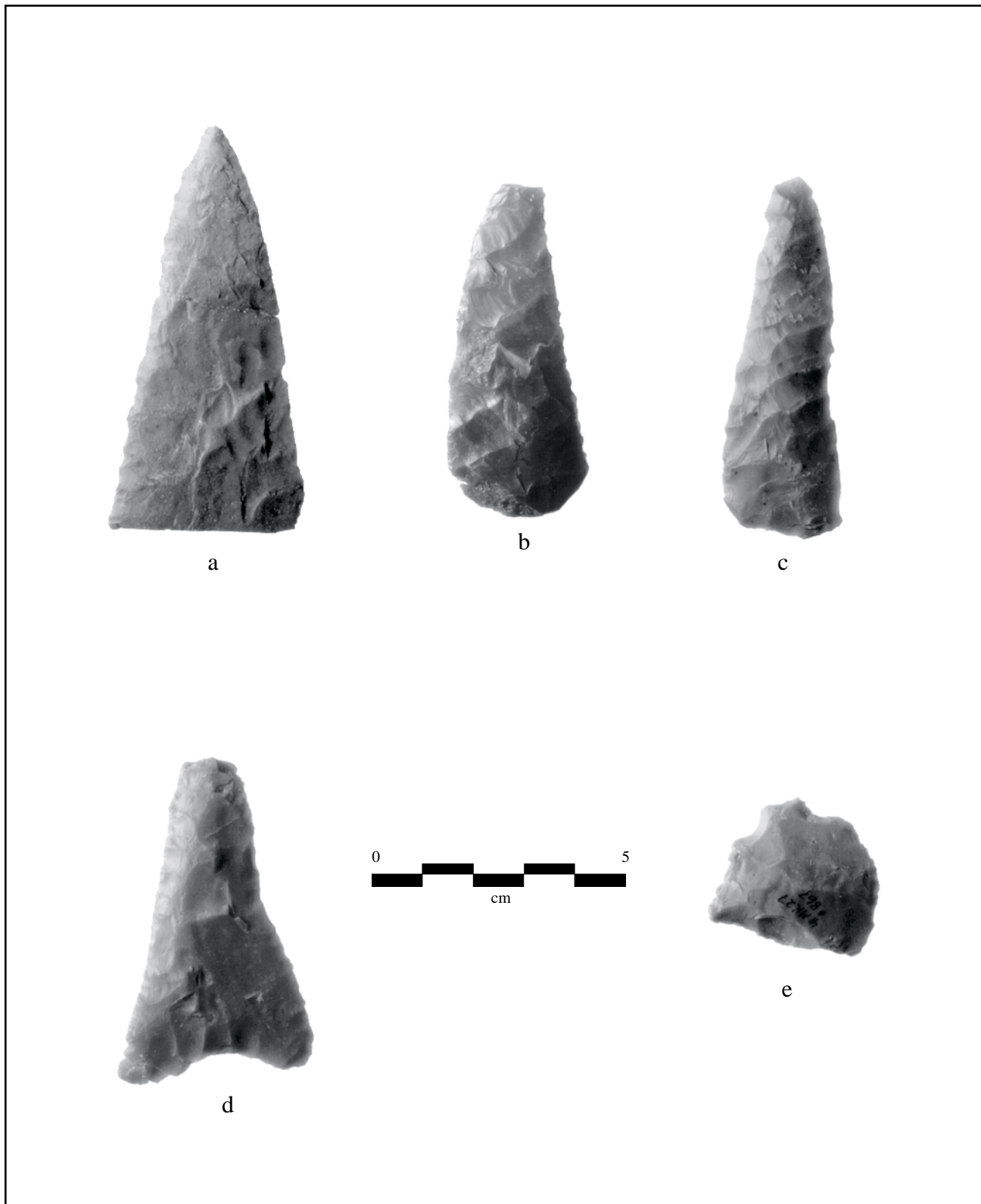


Figure 5.16. Reduction Stage 5 Bifaces from 41MK27.

Projectile Points

Excavations resulted in the recovery of 33 chert projectile points. Four are Late Prehistoric arrow points, 28 are Late/Transitional Archaic dart points, and one is likely an Early Archaic specimen. For each complete or nearly complete projectile point (n=27), a suite of objective data was generated to aid in the somewhat subjective classification of point styles. These data include length, maximum blade width, blade base width, blade width position, thickness at haft juncture, haft element length, proximal haft element width, distal haft element width, base contact width, and basal curvature (Table 5.3). These criteria and morphological/technological attributes resulted in the classification of three of the four arrow points and 18 of the 29

dart points into previously established projectile point types. Many of the dart points were extensively reworked, rendering many specimens untypeable. It is important to mention that all of these untypeable points morphologically resemble Late/Transitional Archaic types. In addition to these data, additional attributes were recorded such as raw material type and quality, beveling, serration, and evidence of burning.

Arrow Points

Four incomplete arrow points were recovered (Figure 5.17a–c). One has been classified as an *Alba* arrow point, two as *Scallorn* points, and one is untyped. All of the classifiable arrow points have been made from

Table 5.3. Measurements of Complete and Nearly Complete Projectile Points from 41MK27

| Type | Specimen | L | MBW | BBW | BWP | T at HJ | HEL | PHEL | DHEW | BCW | BC |
|-------------------------|----------|-----|-------|-------|------|---------|------|-------|-------|------|------|
| <i>Alba</i> | 117 | *35 | 18.9 | 18.9 | 0 | 3.5 | 6 | 8.5 | 7.3 | 7.6 | 0 |
| <i>Scallorn</i> | 3 | 27 | 16.2 | 26.2 | 2.1 | 3.5 | 4.5 | 13.6 | 9.2 | 6.6 | 1.1 |
| <i>Scallorn</i> | 186 | 21 | 14 | 14 | 0 | 3.6 | 5.6 | 12.4 | 7.7 | 7.5 | 1.3 |
| <i>Darl</i> -like | 446 | *72 | 27 | 27 | -1.3 | 5.5 | 10.2 | 16.4 | 12.9 | 10.3 | 0.7 |
| <i>Darl</i> -like | 487 | 84 | 26.7 | 26.7 | 0 | 6.2 | 11.5 | 19.8 | 16.9 | 14.3 | 0.8 |
| <i>Ellis</i> | 187 | 31 | 32.7 | 23.7 | 2.1 | 4.4 | 9 | 20.6 | 16.1 | 4 | 0 |
| <i>Ensor</i> | 20 | *50 | 22.9 | 22.9 | 0 | 5.1 | 10.4 | 18.9 | 12.6 | 8.3 | -2.5 |
| <i>Fairland</i> | 1 | *47 | 27.8 | 27.8 | 3.3 | 5.7 | 9.2 | 24.3 | 18.6 | 17 | 2.6 |
| <i>Fairland</i> | 105 | 58 | 25.7 | 27.7 | 0 | 5.1 | 12 | 23.2 | 16.7 | 15.2 | 2.8 |
| <i>Fairland</i> | 143 | *45 | 19.4 | 19.4 | 0 | 4.7 | 10.3 | 20.5 | 15.1 | 12.8 | 1.6 |
| <i>Fairland</i> | 211 | *52 | 23.8 | 23.8 | 0 | 5.3 | 9 | 23.6 | 14.8 | 14 | 2.6 |
| <i>Fairland</i> | 689 | *38 | *20.0 | *20.2 | 0 | 5.4 | 6.9 | 14.8 | 12.4 | 7 | 1.4 |
| <i>Frio</i> | 7 | 49 | 26.3 | 26.3 | 0 | 5.5 | 11.5 | 26.9 | 17.3 | 6 | 2.3 |
| <i>Frio</i> | 401 | *50 | 24.9 | 24.9 | 0 | 5.4 | 9.9 | 25.9 | 19.4 | 11.6 | 3 |
| <i>Frio</i> | 753 | *71 | 28.5 | 28.5 | 0 | 6.6 | 9 | *20.5 | 15.4 | 9.6 | 2.9 |
| <i>Lange</i> | 36 | 57 | 27.5 | 27.5 | 0 | 6.9 | 11 | 18.2 | 16 | 6.6 | 2 |
| <i>Lange</i> | 465 | *54 | 31.5 | 31.5 | 0 | 7.7 | 16 | 21.3 | 19.1 | 19.7 | 0 |
| <i>Martindale</i> -like | 159 | 60 | *33.0 | *33.0 | 0 | 6.1 | 10.7 | 22.5 | 15.1 | 9 | 1.2 |
| <i>Pedernales</i> | 10 | 41 | 32.6 | 23.6 | 0 | 5.8 | 14 | 19.5 | 17.8 | 7.5 | 2.4 |
| <i>Pedernales</i> | 104 | 46 | 27.2 | 27.2 | 0 | 5.5 | 14.2 | 18.8 | 18.2 | 13.9 | 3.7 |
| Untyped | 107 | *60 | 22 | 22.6 | 0 | 5.4 | 11 | 16 | 12.4 | 16 | 0 |
| Untyped | 144 | *63 | *30.0 | *30.0 | 0 | 5.6 | 10.6 | *18.0 | *16.4 | *8.0 | 1.2 |
| Untyped | 427 | 34 | 19.6 | 19.6 | 0 | 5.9 | 13.5 | 18.1 | 17.2 | 7.9 | 0 |
| Untyped | 469 | *47 | *25.1 | *25.1 | 0 | 6.3 | 11.9 | *17.1 | 14.2 | *7.8 | 1.6 |
| Untyped | 711 | *72 | 29 | 29 | 1.4 | 5.2 | ---- | ---- | 15.2 | ---- | ---- |
| Untyped | 757 | *56 | 28.2 | 28.2 | 3 | 5.9 | 10 | 14.6 | 17.1 | 4.4 | -2.1 |
| Missing | 471 | 48 | 24.4 | 24.4 | 0 | 4.7 | 7.2 | 16.1 | 14.3 | 9.6 | 1.7 |

Note: All measurements in mm. L = length, MBW = maximum blade wide; BBW = blade base width, BWP = blade width position, T at HJ = thickness at haft juncture, HEL = haft element length, PHEW = proximal haft element width, DHEW = distal haft element width, BCW = base contact width, BC = basal curvature. * = measurement estimated, assuming bilateral symmetry.

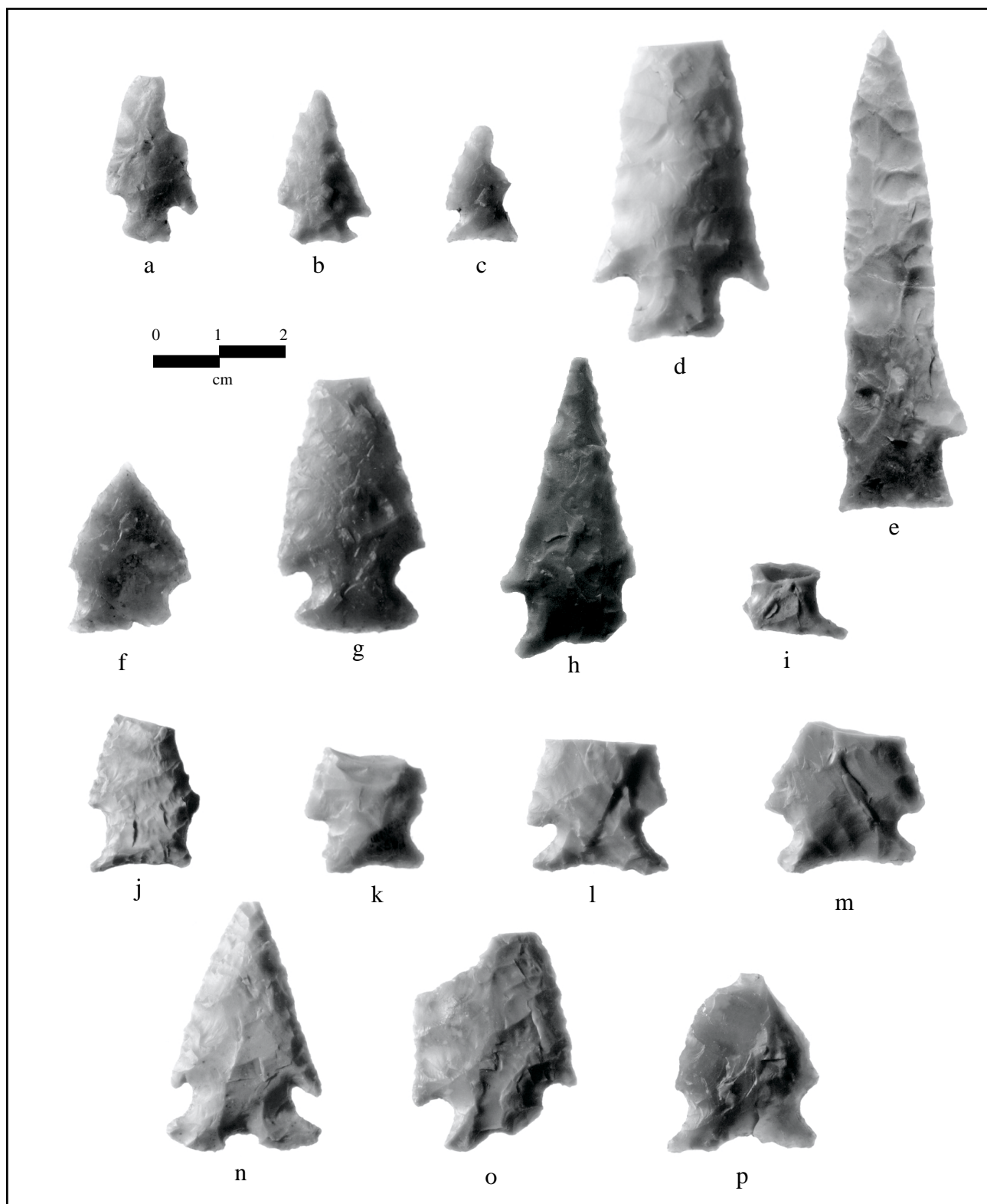


Figure 5.17. Arrow points and dart points from 41MK27. a: Alba; b, c: Scallorn; d, e: Darl-like; f: Ellis; g: Ensor; h-m: Fairland; n-p: Frio.

fine-grained, light-gray chert. The untyped point is made from a white, fine-grained chert.

Alba (1: Specimen 117; Figure 5.17a)

This nearly complete specimen (Specimen 117, Figure 5.17a) was recovered from Level 5 of excavation block N60-62/E40-42. It is biconvex with a generally collateral flaking pattern. The lateral edges are straight to slightly concave with no serrations or retouch. The distal tip is snapped with a longitudinal fracture that has removed approximately half of one lateral edge. The base is slightly convex and the stem is rectangular and slightly expanding.

Alba projectile points generally date to the Austin interval (1200–800 B.P.) of the Late Prehistoric Period, and the geographic range of this point style extends from east Texas, Louisiana, and the coastal plain to central Texas (Prewitt 1995:89; Turner and Hester 1993:200). Few examples of *Alba* projectile points are known west and northwest of the Edwards Plateau.

Scallorn (2: Specimens 3 and 186; Figure 5.17b, c)

Two nearly complete *Scallorn* arrow points were recovered. The first (Specimen 3; Figure 5.17b) was found in Level 4 of excavation block N60-62/E40-42. It is biconvex and is collaterally chipped with one convex lateral edge and one concave lateral edge. Serrations are visible on the convex edge; the concave edge appears to have been reworked. The barb on the convex edge has been broken and modified. The base is slightly concave with a wide expanding stem.

The second biconvex specimen (Specimen 186; Figure 5.17c) is from Level 5 of excavation block N52-54/E31-32. It has oblique flake scars with fine retouch on the base and the remaining convex, serrated lateral edge. The wide base is flat with a strongly expanding stem. One barb and one lateral edge are missing, due to what appears to be a break from a pick.

Scallorn points are a hallmark of the Austin interval of the Late Prehistoric Period and generally date to 1300–800 B.P. They are found nearly statewide with the exception of extreme south Texas and extreme west Texas (Turner and Hester 1993:230). *Scallorn* points

are most common along the Balcones Escarpment (Prewitt 1995:129).

Untyped (1: Specimen 146)

This biconvex medial fragment (Specimen 146) was recovered from the upper 20 cm of excavation block N44-46/E29-31. It has collateral flaking and straight lateral edges. The distal portion exhibits a snap fracture, and the base and the barbs are snapped off at the bottom of the blade.

Dart Points

Twenty-nine dart points or point fragments were recovered. One has been classified as an Early Archaic point, 17 have been classified as Late/Transitional Archaic point styles, and the untypeable points are morphologically and technologically suggestive of Late/Transitional Archaic points.

Darl-like (2: Specimens 446, 487; Figure 5.17d, e)

Two projectile points are similar in morphology and technology to *Darl* projectile points but, due to small vagaries of initial manufacture and subsequent curatorial resharpening, are not confident matches. Each point is made from fine-grained chert.

The first is a long, slender proximal projectile point fragment (Specimen 446; Figure 5.17d). It is suggestive of the *Darl* projectile point style with an expanding stem and slightly concave base, but the barbs are more massive than those typically illustrated as indicative of the type (Turner and Hester 1993:101). It was recovered from Level 5 of excavation block N59-60/E30-31. It is biconvex and made from fine-grained, light gray chert with a generally collateral flaking pattern. One lateral edge is straight and the other is concave and irregular, which suggests resharpening. Both edges are slightly serrated, and it is thickest at the haft. The distal tip is missing due to a snap fracture.

The second specimen is in two pieces (Specimen 487/710; Figure 5.17e) and was recovered from two different areas. The distal fragment was found in Level 7 of excavation block N53-55/E29-30, and the proximal fragment was found in Level 5 of excavation block N57-58.5/E30-31. The oblique break is roughly at one-

third the length of the blade from the haft and the two fragments refit perfectly. Together they form a very long, slender, biconvex projectile point with one barb missing. The stem is rectangular and expanding, and the base is straight to slightly concave, featuring both horizontal and vertical finishing flake scars. Each lateral edge of the blade has been extensively resharpened, producing greatly concave lateral edges that obscure the original morphology of the artifact. The distal tip exhibits beveling, a trait that can be indicative of *Darl* technology.

Darl points are found mainly in central Texas, but the distribution extends to south and east-central Texas as well (Prewitt 1995:100; Turner and Hester 1993:101). *Darl* points have been dated to ca. 1800-1200 B.P. (Collins 1995; Turner and Hester 1993:101).

Ellis (1: Specimen 187; Figure 5.17f)

This nearly complete plano-convex specimen (Specimen 187; Figure 5.17f) conforms to the *Ellis* point style with its “short, thick body, shallow corner-notches, barbs, and a wide, slightly expanding stem” (Turner and Hester 1993:113). Made of fine-grained translucent gray chert, it was recovered from Level 4 of excavation block N52-54/E31-32. One barb is missing, as is a corner of the base. The flaking pattern is irregular, and one lateral edge is concave while the other is convex. *Ellis* points are known from east, south, and central Texas, but their distribution extends into Louisiana, Arkansas, the Texas panhandle, and Trans-Pecos Texas (Prewitt 1995; Turner and Hester 1993:113). *Ellis* points date to ca. 4000-1300 B.P. (Turner and Hester 1993:113).

Ensor (1: Specimen 20; Figure 5.17g)

One nearly complete, biconvex *Ensor* point (Specimen 20; Figure 5.17g) was recovered from screening the backdirt of Backhoe Test 2 near the excavation block N54-58/E31-35. It was made from fine-grained, brown-gray chert and features generally oblique flake scars with slightly convex lateral edges. The distal tip has been snapped and one barb is partially missing. The remaining barb is pronounced due to the deep side notching. The base is slightly concave with an expanding stem.

Ensor points date to 2400–1400 B.P. (Turner and Hester 1993:114) and are found in central, west, and south Texas with few recoveries in east and north Texas. They are most prevalent along the Balcones Escarpment and the Lower Pecos (Prewitt 1995:103).

Fairland (6: Specimens 1, 105, 143, 211, 689, and 1165; Figure 5.17h–m)

One nearly complete and five proximal *Fairland* fragments were recovered. The complete specimen and one fragment are made from red-gray chert, and the others are made from cherts of various shades of gray. All cherts are fine-grained. All specimens are biconvex and retain the flaring concave base, shallow notches, and expanding stem that are characteristic of the type (Turner and Hester 1993:117).

The nearly complete specimen (Specimen 105; Figure 5.17h) was recovered from Level 5 of excavation block N62-64/E42-44. This specimen is obliquely flaked, and the entire length of the blade is strongly beveled. The extreme distal tip is snapped off, and the barb and basal flare on one side are missing.

One of the proximal fragments (Specimen 1165; Figure 5.17i) is snapped below the barbs, and only the stem remains. The remaining fragments exhibit straight to slightly concave lateral edges. Two proximal fragments were recovered from Levels 5 and 6 of excavation block N62-64/E32-34. One was recovered from Level 6 of excavation block N60-62/E40-42. The remaining fragments were recovered from Level 4 of the N49-50/E38-40 excavation block and Level 3/4 of N64-66/E42-44.

Fairland points date to the Transitional Archaic (ca. 1500–1200 B.P.; Collins 1995) and are found primarily in central Texas, but also are found in portions of south Texas and the Lower Pecos region (Turner and Hester 1993:117). They are most prevalent along the Balcones Escarpment (Prewitt 1995:104).

Frio (3: Specimens 7, 401, 753; Figure 5.17n–p)

One complete and two fragmentary *Frio* points were recovered. All exhibit the basal notch and side/corner notches that are characteristic of the type (Turner and Hester 1993:122).

The complete specimen (Specimen 7; Figure 5.17n) was recovered from Level 3 of excavation block N54-56/E31-35. It is made from grayish-tan, fine-grained chert. It has a biconvex cross-section with oblique flake scars and some retouch along the straight lateral edges. Side-notching has resulted in prominent barbs.

One proximal fragment (Specimen 753; Figure 5.17o) was recovered from Level 4 of excavation block N51-53/E29-30. Made of grayish-tan, very fine-grained chert, it is biconvex with generally collateral flake scars. The remnant blade is broad with straight to slightly convex lateral edges. A snap fracture has removed the proximal tip and produced a large hinge fracture on one face, and one ear is missing.

The second fragment (Specimen 401; Figure 5.17p) was recovered from Level 5 of excavation block N58-60/E35-37. It is made of translucent "rootbeer" colored, very fine-grained chert. The remaining lateral edges appear to be convex. One face exhibits a large potlid scar from thermal alteration; this appears to be responsible for much of the fragmentary condition of the point. The stem is wide, and the base extends past the short barbs.

Frio points date to the Transitional Archaic (2200–1400 B.P.; Turner and Hester 1993:122) and are found in much of south and central Texas, as well as the Lower Pecos and Trans-Pecos areas of Texas (Prewitt 1995:106). They are best represented in Val Verde County of the Lower Pecos and along the Balcones Escarpment (Prewitt 1995:106).

Lange (2: Specimens 36 and 465; Figure 5.18a, b) Two *Lange* projectile points were recovered. The first is a rather thick, biconvex point (Specimen 36; Figure 5.18a) with a straight base, expanding stem, and strong shoulders. It was recovered from the surface at Backhoe Test 2 and is made from fine-grained gray chert with a generally parallel oblique flaking pattern. The lateral edges are convex with small serrations. A large potlid is on one basal face, and has removed approximately half of the base's thickness. The intrusion of the potlid onto flake scars indicates that thermal alteration occurred after the manufacture of the artifact.

The second point (Specimen 465; Figure 5.18b) is nearly complete. It was recovered from Level 7 of excavation block N62-64/E32-34 and is made from fine-grained gray chert. The wide base is straight with a slightly expanding stem, and the shoulders are strong with short barbs. Each lateral edge is convex, and the distal tip is snapped from an impact fracture. The flaking pattern is irregular to somewhat collateral.

Lange points are found in central Texas, the Lower Pecos, and Trans-Pecos, and occasionally in northeast Texas and the Gulf coastal plain (Prewitt 1995:114; Turner and Hester 1993:141). They are dated to ca. 2200 B.P. (Collins 1995).

Martindale-like (1: Specimen 159; Figure 5.18c)

This nearly complete plano-convex specimen (Specimen 159; Figure 5.18c) resembles a *Martindale* point with its deep corner notches, short barbs, and "fish-tail" base (Turner and Hester 1993:151). It is made from fine-grained, translucent gray chert and was recovered from Level 5 of excavation block N62-64/E40-42. Long transverse flake scars extend across each face. The extreme distal tip is missing, as is one lateral edge. The entire edge and barb have been removed, most likely for use as a burin, although it is possible that this edge modification was the result of impact. The remaining lateral edge is battered, leaving a concave edge with several gouges.

Martindale points date to the Early Archaic (circa 6500 B.P.; Collins 1995; Turner and Hester 1993:151), which is much earlier than all other projectile points and radiometric assays from the site (Appendix B; see discussion in Chapter 6). One possible explanation for this anomaly is that the artifact was picked up later by an inhabitant of the site and curated for use as a burin core and/or other capacities. No burin spalls in the collection refit with this specimen. *Martindale* points are known principally from central Texas, but have been found in the Lower Pecos region, north Texas, and the Gulf coastal plain (Prewitt 1995; Turner and Hester 1993).

Pedernales (2: Specimens 10, 104; Figure 5.18d, e) Two complete *Pedernales* projectile points were recovered. Each is biconvex, is made from a grayish, fine-grained chert, and exhibits the characteristic

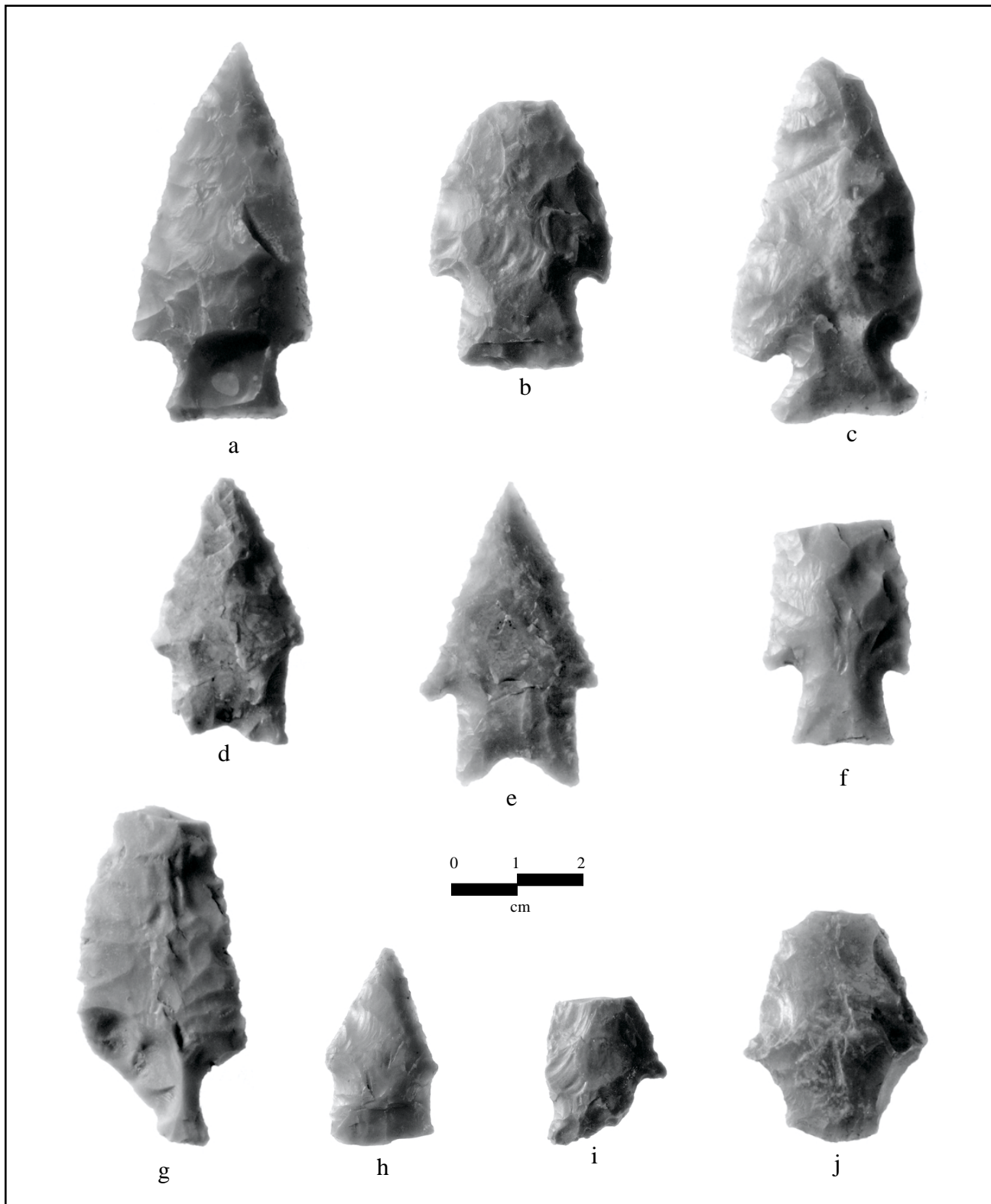


Figure 5.18. *Dart points from 41MK27. a, b: Lange; c: Martindale-like; d, e: Pedernales; f-j: Untyped.*

straight, rectangular, bifurcated stem characteristic of this point style (Turner and Hester 1993:171). Johnson (1994) argues that long, narrow *Pedernales* points are more commonly found in the eastern Edwards Plateau while flat, thin, and wide *Pedernales* specimens are more likely to be found in the southwestern Edwards Plateau. Furthermore, he contends that these wider *Pedernales* points are younger in age than their longer, slimmer counterparts, given their morphological similarities with *Montell* and *Marshall* projectile point styles. While each *Pedernales* point recovered at 41MK27 is narrow and short, extensive resharpening, as evident by the distal beveling each artifact exhibits, indicates a greater original length. Thus, it can be said that these specimens more closely approximate those *Pedernales* points which Johnson argues are earlier, eastern Edwards Plateau varieties.

The first specimen (Specimen 10; Figure 5.18d) was recovered from Level 5 of excavation block N60-62/E40-42. Vertical flute scars are visible on each side of the base, and small finishing flake scars are present on each basal edge. The basal indentation is shallow. The stem is approximately one-third of the entire length; there is no evidence of stem smoothing. The distal edges have been moderately and asymmetrically beveled, with one face at each lateral edge exhibiting resultant oblique flake scars.

The second specimen (Specimen 104; Figure 5.18e) was recovered from Level 5 of excavation block N62-64/E42-44. Multiple vertical flake scars are visible on one basal face; less so on the other. Small finishing flake scars are present on each basal edge.

The basal indentation is deep and angular. The stem has been smoothed and is approximately three-fifth of the entire length. The blade has been extensively beveled, and each lateral edge is serrated.

Pedernales points are ubiquitous in the central Texas, Lower Pecos, and south Texas regions (Prewitt 1995; Turner and Hester 1993), with the densest distribution of this point style along the Balcones Escarpment (Prewitt 1995). Believed for many years to be a hallmark of the Middle Archaic, *Pedernales* points are now considered to be Late Archaic projectile points (Collins 1995; Johnson 1995).

Untyped Dart Points (11; Figure 5.18f-j)

Eleven fragmented artifacts were recovered from 41MK27 that were identified as projectile points but could not be confidently assigned to specific styles due to fragmentation, absence of diagnostic attributes, or indistinct morphology due to resharpening and curation. These artifacts, which are all made of chert, range from basal fragments to nearly complete points lacking diagnostic bases. One (Specimen 866) was surface-collected, and the rest resulted from excavation (Table 5.4). One other dart point, Specimen 471, is missing from the collection and could not be examined. It was recovered from Level 6 of excavation unit N48-50/E28-30.

Gravers (20; Figure 5.19)

The implements which have traditionally been called gravers are a specialized tool type generally fashioned

Table 5.4. Nearly Complete Untyped Dart Points from 41MK27

| Specimen | Provenience | Remarks |
|----------|-----------------------|-------------------------------------------------------------------------|
| 107 | N62-64/E42-44 Level 5 | Proximal fragment with expanding base and serrated lateral edges |
| 144 | N50-51/E28-30 Level 5 | Very burned, distal tip and most of base missing |
| 166 | N62-64/E38-40 Level 5 | Burned, highly fragmented; seven pieces |
| 216 | N62-64/E32-34 Level 4 | Lateral fragment |
| 427 | N52-54/E32-34 Level 4 | Heavily reworked Archaic point; possibly <i>Dart</i> due to ground base |
| 469 | N52-54/E32-34 Level 6 | Proximal fragment, side-notched and barbed, possible concave base |
| 688 | N62-64/E32-34 Level 6 | Battered proximal fragment, shallow side notch, concave base |
| 711 | N53-55/E29-30 Level 7 | Nearly complete, expanding base missing below corner-notched barbs |
| 757 | N62-64/E4-46 Level 6 | Patinated medial fragment, weak-shouldered |
| 866 | BHT 1/Surface | Medial fragment |
| 1168 | N64-66/E30-32 Level 6 | Burned basal fragment, concave base, side-notching |

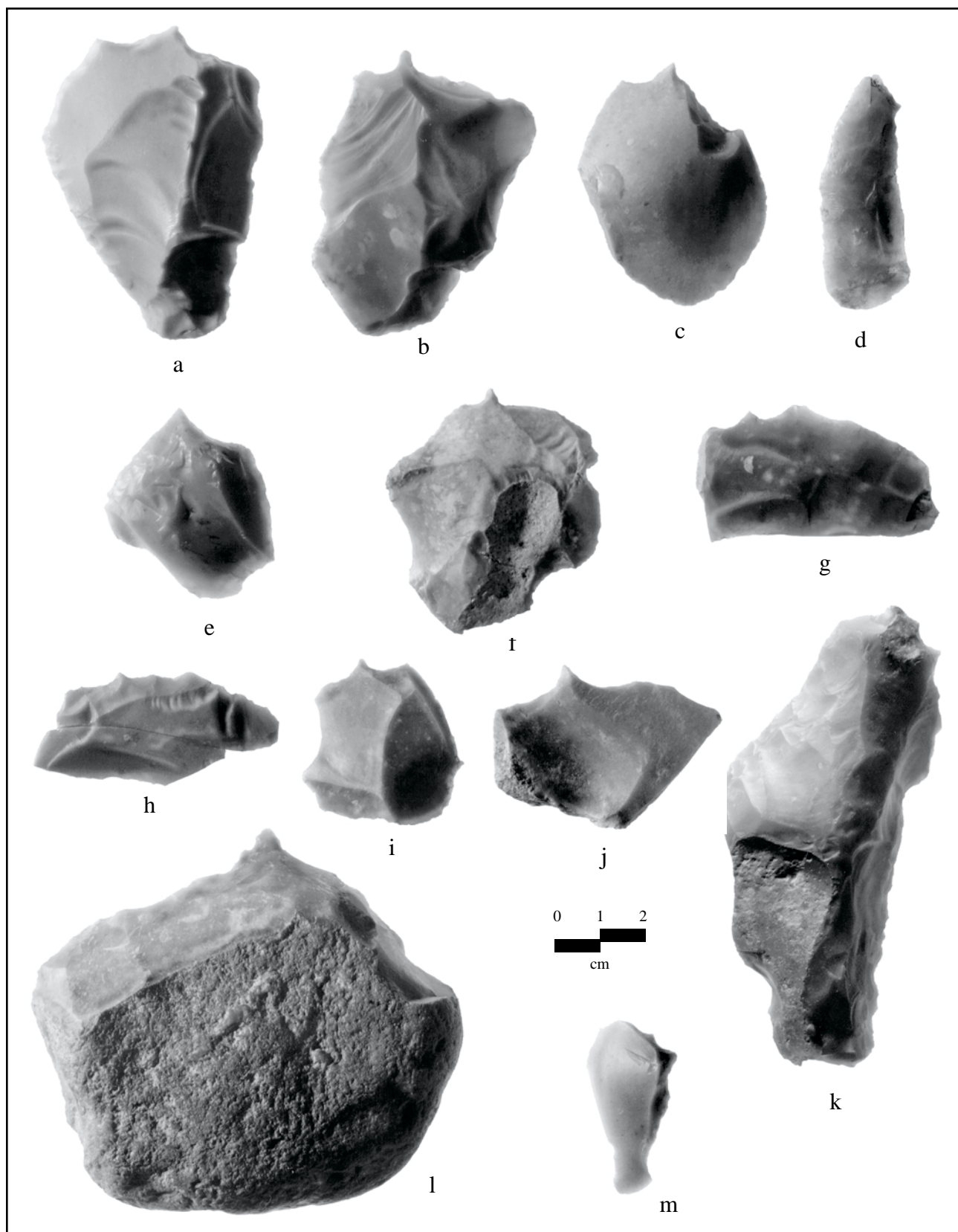


Figure 5.19. Gravers from 41MK27.

Table 5.5. Gravers from 41MK27

| Specimen | Type | Flake Type | Flaking | Additional Modification | L* | W* | Th* |
|----------|--------|--------------------------|--------------------|---------------------------------|----|------|------|
| 11 | Double | Biface thinning-interior | Unifacial-obverse | Extensive-left lateral margin | 59 | 41.7 | 10.5 |
| 25 | Single | Decortication | Unifacial-obverse | Minor area-reverse face | 59 | 61.7 | 10.1 |
| 38 | Single | Biface thinning-interior | Bifacial | Minor areas-obverse and reverse | 35 | 30.5 | 9.4 |
| 50 | Single | Biface thinning-interior | Unifacial-obverse | Minor-lateral margin | 44 | 16.5 | 2.9 |
| 55 | Single | Biface thinning-cortex | Unifacial-obverse | None | 45 | 40.5 | 9.4 |
| 58 | Single | Decortication | Some bifacial | Extensive-both lateral margins | 85 | 33.8 | 14.7 |
| 62 | Single | Biface thinning-interior | Unifacial-obverse | Fine flaking-proximal end | 54 | 36.3 | 5.9 |
| 113 | Single | Decortication | Unifacial-obverse | Fine flaking across distal end | 35 | 23 | 10.5 |
| 115 | Single | Biface thinning-interior | Unifacial-reverse | Fine flaking adjacent to tip | 32 | 46 | 8.8 |
| 123 | Single | Decortication | Unifacial-obverse | None | 39 | 43.9 | 9.7 |
| 167 | Single | Biface thinning-interior | Unifacial-obverse | Minor-one lateral margin | 46 | 25.1 | 5.6 |
| 185 | Single | Biface thinning-interior | Unifacial-obverse | None | 48 | 20.7 | 4.1 |
| 192 | Single | Biface thinning-cortex | Unifacial-platform | None | 13 | 23.1 | 6.9 |
| 193 | Single | Biface thinning-interior | Unifacial-platform | None | 17 | 33.2 | 6.4 |
| 195 | Single | Decortication | Unifacial-obverse | Minor marginal notch | 46 | 27.1 | 15.7 |
| 218 | Single | Decortication | Unifacial-obverse | Extensive-one lateral margin | 38 | 41.2 | 7.5 |
| 248 | Single | Biface thinning-interior | Unifacial-obverse | Across distal end, next to tip | 34 | 29.3 | 8.3 |
| 478 | Single | Decortication | Unifacial-obverse | Minor-across distal end | 48 | 55 | 18.8 |
| 718 | Single | Decortication | Unifacial-obverse | Minor-one side of distal tip | 70 | 76.1 | 27 |
| 838 | Single | Biface thinning-cortex | Unifacial-obverse | Extensive on margin next to tip | 44 | 32.8 | 5 |

* All measurements in mm.

on a flake, with the flake margin trimmed to produce distinct functional points or graver tips which project from it. Often the modification or trimming that fashions the graver tip is extremely fine and distinct. At times the only modification on the flake is that which forms the graver tip or tips. At other times there is additional edge modification along the flake margins. Gravers occur with single or multiple working tips or projections, and are fashioned in a wide range of sizes, from minute graving tips on very small biface thinning flakes to much larger gravers fashioned on primary decortication flakes. As the name implies, it has traditionally been thought that these implements were used to incise or engrave bone or some other material. Wormington (1957:276) defines a graver as “a small sharp-pointed implement used for engraving, incising, or marking stone, bone, antler, or ivory.” While this definition implies the function or use of this tool and seems quite reasonable, the term is used here in a strictly morphological sense. No wear pattern or other technological or replicative studies have been done which would establish the type of use to which these tools have been subjected.

A recent study by Tomenchuk and Storck (1997) identified two new tool types within a Paleoindian graver assemblage from Ontario. The first type they labeled a compass graver—a double or triple spurred graver on which one spur serves as the pilot and the other(s) as a scribe(s) (Tomenchuk and Storck 1997). Through use-wear analysis and replicative studies, they were able to demonstrate that this type of artifact was used to make circular disks with a centrally drilled perforation. The pilot spur creates a central perforation in the material being worked while the scribe spur cuts the circumference of the circle. Tomenchuk and Storck (1997) successfully produced disks out of wood and bone using replicated artifacts.

Twenty gravers were recovered from 41MK27, all of which were fashioned on flakes and all of which are unifacial tools, with two exceptions—one was made on a thick flake with some bifacial modification on the reverse face, and one was fashioned on a biface fragment. A wide range of variation exists within this tool type in this collection. Several specimens are finely fashioned on very thin flakes; others are much

less precisely worked projections on quite thick and large flakes. The gravers from 41MK27 are summarized in Table 5.5. Certain of the specimens are worthy of individual comment, however. In all cases except two, the flaking which produced the working tip originated from the obverse or dorsal surface. In one exception, Specimen 115, the obverse face is flat to concave, and the reverse or ventral face is convex. The graving tip is carefully worked where the left margin and the distal end converge (Figure 5.19c). Specimen 38 is a rather thick biface thinning flake which contains the flat, thin bifacial reduction scars on its flat obverse surface. The reverse face has been bifacially modified over approximately one-third of its length and a well-worked graver tip produced (Figure 5.19e). Specimen 11 (Figure 5.19a) is the only multiple graver, having two well-worked graving tips. It is a composite tool, with the left lateral margin modified in a regular manner and probably suitable for some cutting or slicing function, although it may have functioned as a compass graver similar to the Paleoindian examples discussed above. Specimens 55, 62, 167, 248, and 838 have prominent and well-fashioned graving tips that are well isolated from the surrounding margin by small, fine flaking (Figure 5.19b, f, g, i, j). Specimen 58, another composite tool, is a fairly large and thick flake with substantial modification along each lateral margin. These margins could have served as scrapers.

The right side of the distal end exhibits a well-made graver tip (Figure 5.19k). In two cases, Specimens 192 and 193, the small graver tip has been fashioned on the dorsal lip of the prepared platform of small and rather unsuccessful biface thinning flakes (Figure 5.19m). The dorsal face of Specimen 192 was the ventral face of a previous removal.

Scrapers (14; Figure 5.20)

The 14 specimens designated as scrapers are described in Table 5.6. Once again, these tools have been traditionally designated by a functional term. Wormington (1957:279) defines scraper as “an artifact used for rasping or cleaning hides, bone, wood, etc.... They are named by the position of their cutting edge, as end scraper, side scraper; or by their shape, turtle back (flat on bottom and rounded on top), snub-nosed or thumb scraper (thumb-shaped) and keel scraper (keel-shaped).” Because the term also carries well-known morphological connotations it has been retained here. However, its use in no way implies any statement as to the function of these artifacts. No wear patterns have been discerned on their working edges, and no replicative experiments have been done. These may well have been “scraping” implements in some sense, but they may just as easily have been cutting imple-

Table 5.6. Scrapers from 41MK27

| Spec. | L* | W* | Th* | Flake Type | Flake Shape | Type and Location of Marginal Modification |
|-------|------|------|------|-------------------------|----------------|---------------------------------------------------------------------------|
| 4 | 47 | 35.4 | 8.7 | Secondary decortication | Irregular | Nosed with steep retouch at proximal end |
| 39 | 64 | 35.5 | 21.3 | Primary decortication | Ovate | Step fractures across distal end |
| 44 | 68 | 40.2 | 17 | Secondary decortication | Contracting | Step fractures along left lateral margin |
| 101 | 54 | 45.4 | 22 | Primary decortication | Expanding | Steep "end scraper" retouch with some step fractures across distal end |
| 178 | 67 | 28.4 | 10.1 | Interior | Expanding | Steep flaking across distal end, fine edge-trimming along lateral margins |
| 196 | 67 | 36.3 | 21.6 | Secondary decortication | Irregular | Step-fractured along right (concave) margin |
| 213 | 70 | 65.4 | 27.6 | Core | Rectangular | Simple marginal edge-trimming along one |
| 222 | 87 | 36.9 | 23.1 | Secondary decortication | Concave/convex | Step fractures along both lateral margins |
| 246 | 45 | 48.6 | 17.9 | Primary decortication | Conchoidal | Steep flaking, distal end; reverse face thinned |
| 247 | ---- | ---- | ---- | Interior | Fragment | Steep flaking along one margin |
| 249 | 90 | 99 | 34.3 | Secondary decortication | conchoidal | Step-fractured along lateral margins |
| 477 | 49 | 41.9 | 7.9 | Interior/fire-shattered | | Steep and step fractures, distal end |
| 845 | 65 | 54.1 | 16.9 | Secondary decortication | Irregular | Simple edge-trimming, lateral margins |
| 1167 | 54 | 43.7 | 14.6 | Secondary decortication | Ovate | Step fractures across distal end |

* All measurements in mm.

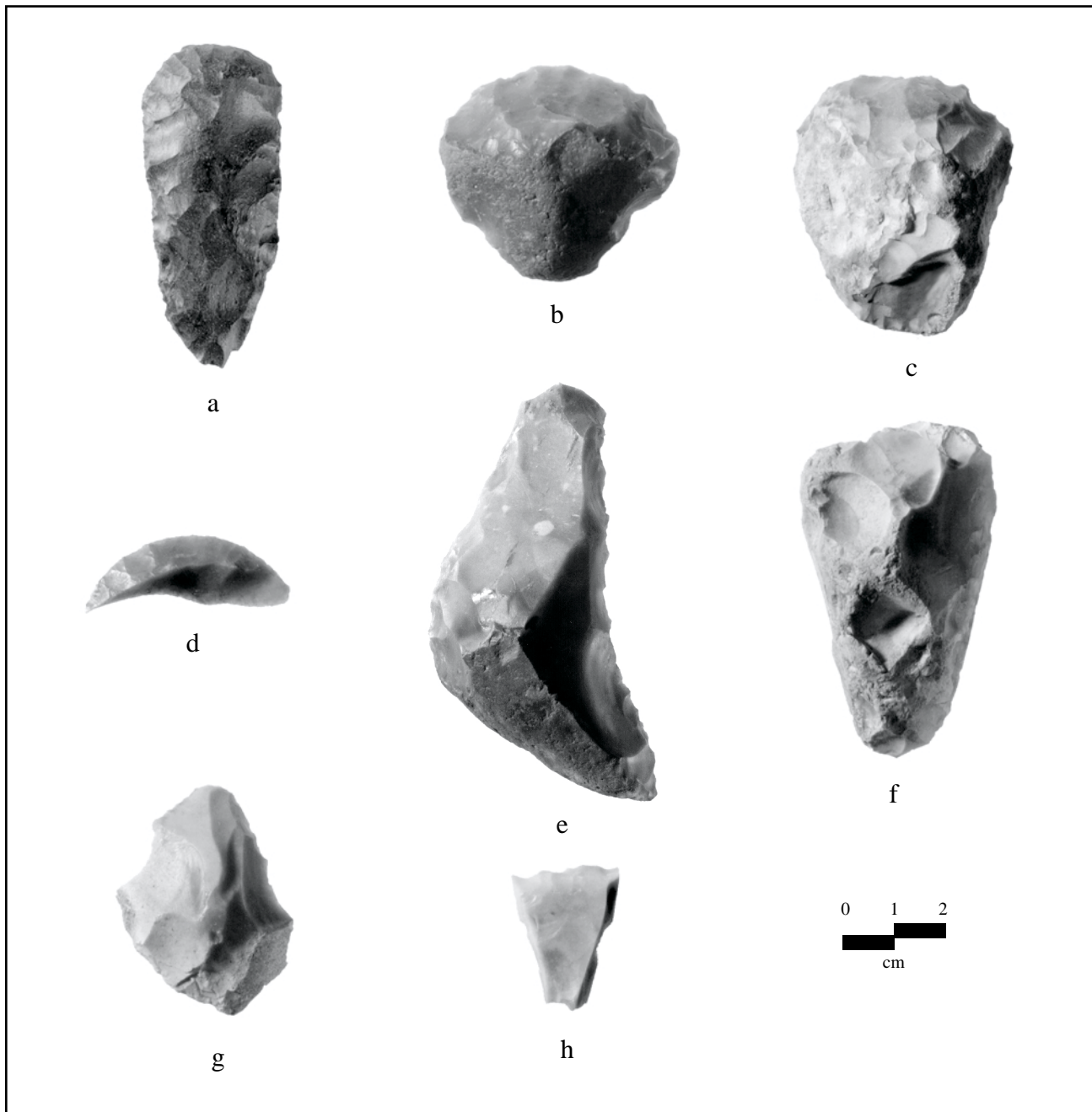


Figure 5.20. *Scrapers from 41MK27.*

ments. We have made no determination as to what material they were used to process.

The specimens recovered from 41MK27 do not form clear-cut typological categories. In many cases the working or modified margins have been casually, if not carelessly trimmed. In some cases much of the modification observed may result from the heavy use

of an originally unmodified edge rather than intentional shaping, strengthening, or sharpening of the edge. In four cases, an attempt appears to have been made to achieve a nicely convex working bit across the distal end of the tool; the flaking was done with care and purpose. Specimen 178 is extremely well made, having been bifacially worked with both massive and diminutive later reduction stage flaking on the dorsal

and ventral surfaces, as well as being carefully flaked across the distal end to produce a steep working bit, and finely edge-trimmed around the lateral margins. This degree of care and attention is unique to this specimen. Specimen 4 has a carefully worked “nosed” working bit, but the remainder of the flake is unmodified and irregular in shape. Specimens 101 and 246 show careful steep flaking across their distal working bits and the latter has been ventrally thinned, but in each case at least one-half of the flake remains unmodified. Primary or secondary decortication flakes appear to have been the favored blanks for this tool category.

Eight additional specimens should be mentioned here. They have been categorized as uniface rejuvenation flakes—flakes which have removed the exhausted or ruined working bit of a unifacial tool. This flake is often removed by a blow struck obliquely to the distal marginal edge, so that a flake is removed crosswise and at right angles to the main axis of the tool. This flake will retain the unifacial modification which characterized the original working edge. In three cases, these rejuvenation flakes retain a somewhat irregular and not very strongly modified edge. In four instances, the working bit which was removed was more carefully flaked and more heavily used. Finally, Specimen 5 presents a very interesting case. Here the working edge is very well and finely worked. It does not appear to be either exhausted or ruined. The transverse blow that removed it was struck in such a way as to leave the proximal edge sloping forward; the tool from which it was struck would have been impossible to resharpen. If this was in fact a rejuvenation flake, which would seem unlikely from the condition of the working edge, then it represents a technological failure. However, it is possible that during the actual use of this tool, stresses were introduced so that it fractured in this way, producing what appears to be, but is not, a scraper rejuvenation flake (Figure 5.20a).

Cores (47; Figure 5.21)

The cores from 41MK27 were assessed according to whether they were nodular or tabular in origin and whether the removals were uni-directional, bi-directional, or multi-directional. The status of the core was

also determined, in other words whether it is rejected-experimental, rejected-manufacturing error, exhausted, or utilized. These cores are described in Table 5.7. From the sample of 47 specimens, 32 are multi-directional and nodular. The raw material favored by the peoples who inhabited 41MK27 appears to have been cobbles eroded from ancient gravel lenses that occurred on or along the bluffs and slopes bordering Bluff Creek. There were several suitable gravel lenses exposed in the vicinity of the site at the time of excavation. The chert cobbles found in these gravels were irregularly oval to round, and poorly sorted. Those chosen to be worked were generally of medium size, approximating 100 mm in the largest dimension, although there are, of course, exceptions. A few tabular specimens were also recovered.

Cores considered to be rejected-experimental are those which show only a few removals, with the great majority of the nodule or tabular piece of stone retaining its cortex. These cores appear to have been tested with the removal of one or more flakes and rejected because of some perceived defect in the raw material, even though it might look as though it would have been an easy matter to continue to remove additional flakes. Because of the close source of raw materials, at least some nodules or cobbles were probably carried to the site before being flaked at all. It would not have been necessary to accomplish all preliminary reduction or even testing of raw materials at the acquisition locality. Other cores can be rejected because of a manufacturing error or technological failure that renders them unsuitable for further reduction. None of this type has been recognized in this collection.

Exhausted cores are those which have been reduced to the point that further removals are impractical or impossible, or no additional useful flakes can be obtained. The majority of the cores from 41MK27 are multi-directional, nodular, and exhausted. Some are quite small, and most appear to have been reduced well beyond the point that flakes suitable to be made into tools could have been removed. The flake tools from this collection are, for the most part, fashioned from larger flakes than would have been produced from most of these cores. Small flakes certainly do exist in the collection, but an admittedly cursory examination has revealed none with obvious modification. These flakes

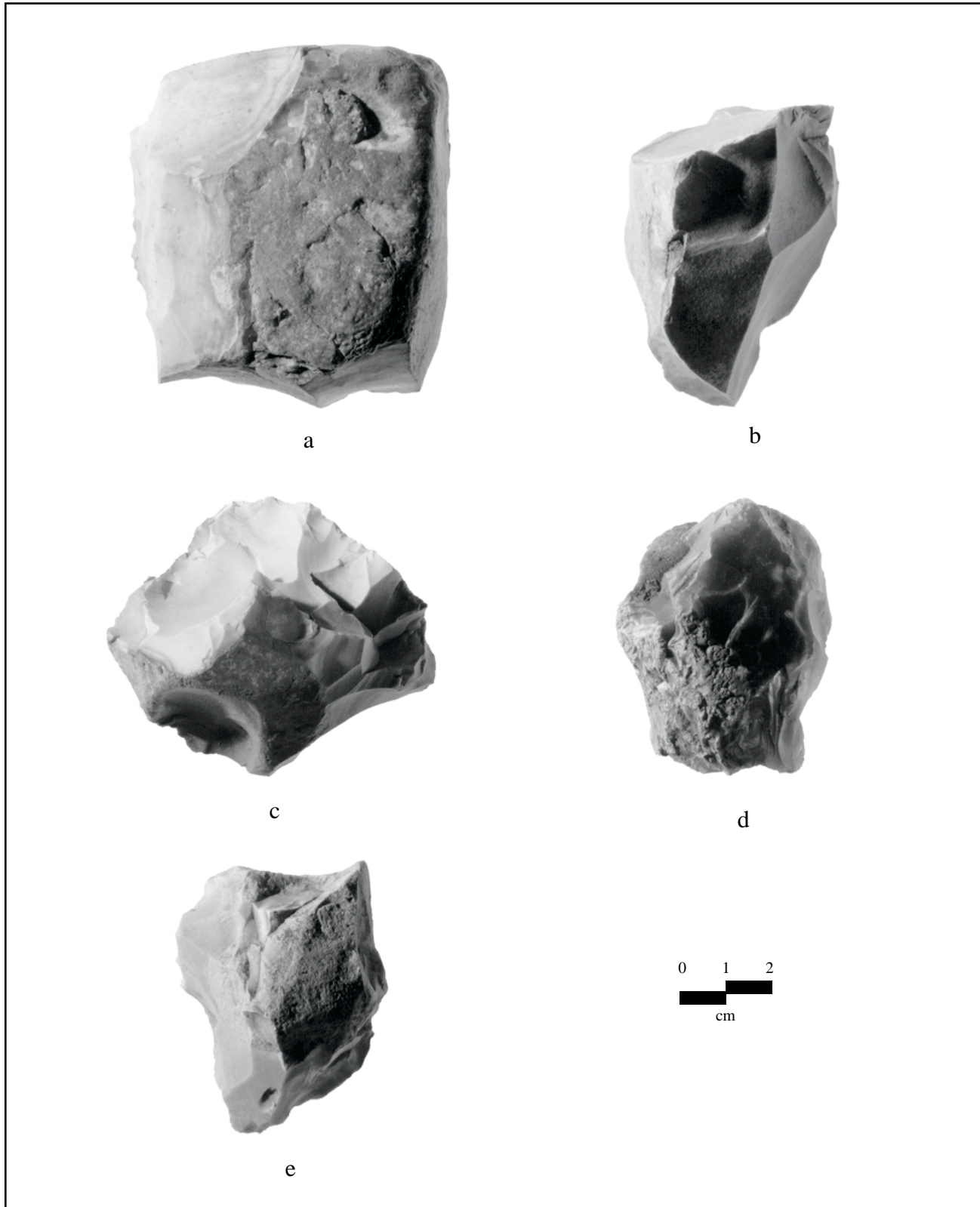


Figure 5.21. Cores from 41MK27.

Table 5.7. Cores from 41MK27

| Spec. | L* | W* | Th* | Type of Core | Status of Core |
|-------|-----|------|-------|----------------------------|------------------------|
| 24 | 56 | 61.7 | 42.2? | Multi-directional; nodular | Exhausted |
| 27 | 76 | 51.4 | 30 | Uni-directional; nodular | Rejected, experimental |
| 28 | 59 | 50.2 | 33.6 | Multi-directional; nodular | Exhausted |
| 40 | 54 | 43.3 | 29.2 | Multi-directional; nodular | Exhausted |
| 43 | 56 | 55.9 | 34.7 | Bi-directional; nodular | Exhausted |
| 47 | 79 | 70.9 | 43.1 | Uni-directional; tabular | Rejected, experimental |
| 71 | 61 | 41.9 | 35.2 | Multi-directional; nodular | Exhausted |
| 72 | 78 | 71.8 | 43.5 | Multi-directional; nodular | Exhausted |
| 103 | 79 | 51.9 | 38 | Multi-directional; nodular | Exhausted |
| 118 | 80 | 77.7 | 32.5 | Multi-directional; nodular | Rejected, experimental |
| 120 | 94 | 80 | 67 | Multi-directional; nodular | Exhausted |
| 121 | 65 | 48.4 | 45.4 | Multi-directional; nodular | Exhausted |
| 126 | 55 | 42.3 | 29.5 | Multi-directional; nodular | Exhausted |
| 127 | 86 | 50.1 | 42.9 | Multi-directional; nodular | Exhausted |
| 130 | 74 | 60.8 | 39 | Multi-directional; nodular | Exhausted |
| 151 | 83 | 45 | 33.9 | Multi-directional; nodular | Exhausted |
| 158 | 82 | 66.1 | 43.4 | Multi-directional; nodular | Exhausted |
| 163 | 54 | 48.9 | 22.6 | Bi-directional; nodular | Exhausted |
| 171 | 121 | 53.8 | 48.2 | Bi-directional; tabular | Rejected, experimental |
| 172 | 55 | 33.1 | 26.4 | Multi-directional; nodular | Exhausted |
| 174 | 63 | 48.4 | 22.6 | Multi-directional; nodular | Exhausted |
| 176 | 119 | 73.9 | 42.5 | Bi-directional; tabular | Rejected, experimental |
| 182 | 68 | 52.8 | 22.7 | Multi-directional; nodular | Exhausted |
| 183 | 86 | 70.6 | 47.1 | Bi-directional; tabular | Rejected, experimental |
| 190 | 66 | 47.6 | 29.4 | Multi-directional; nodular | Exhausted |
| 194 | 64 | 47.5 | 38.8 | Multi-directional; nodular | Exhausted |
| 203 | 72 | 56.5 | 44.6 | Bi-directional; nodular | Exhausted |
| 206 | 56 | 44.3 | 20.1 | Multi-directional; nodular | Exhausted |
| 243 | 59 | 47.6 | 33.2 | Multi-directional; nodular | Exhausted |
| 244 | 65 | 55.8 | 47.6 | Multi-directional; nodular | Exhausted |
| 413 | 58 | 50.7 | 43.8 | Multi-directional; nodular | Exhausted |
| 417 | 64 | 55.6 | 39.6 | Bi-directional; nodular | Exhausted |
| 420 | 52 | 39.7 | 16.6 | Multi-directional; nodular | Exhausted |
| 426 | 67 | 59.1 | 27.7 | Multi-directional; nodular | Exhausted |
| 428 | 56 | 49.7 | 28.3 | Uni-directional; nodular | Exhausted |
| 448 | 87 | 56.3 | 22.8 | Bi-directional; nodular | Exhausted |
| 677 | 63 | 54.7 | 24.1 | Multi-directional; nodular | Exhausted |
| 682 | 108 | 69 | 54.2 | Bi-directional; nodular | Exhausted |
| 683 | 84 | 54.5 | 38.5 | Multi-directional; nodular | Exhausted |
| 685 | 63 | 46.9 | 24.6 | Multi-directional; nodular | Exhausted |
| 708 | 47 | 51.9 | 27.2 | Multi-directional; nodular | Exhausted |
| 712 | 52 | 39.4 | 30.5 | Bi-directional; nodular | Exhausted |
| 740 | 59 | 60.3 | 23.7 | Multi-directional; nodular | Exhausted |
| 755 | 77 | 62.3 | 48.1 | Uni-directional; nodular | Rejected, experimental |
| 846 | 50 | 44.1 | 23.6 | Multi-directional; nodular | Exhausted |
| 1011 | 58 | 67.9 | 47 | Uni-directional; nodular | Rejected, experimental |
| 1035 | 78 | 47 | 34.6 | Multi-directional; nodular | Exhausted |

* All measurements in mm.

may have been produced for purposes that would require no intentional modification, and used in such a way that any edge wear would be visible only under closer inspection employing specialized techniques and greater magnification. The small exhausted cores themselves do not appear to have been used. Those cores that do show signs of use fall into the category of core-hammerstones, and will be treated with the other hammerstones.

Hammerstone (22; Figure 5.22)

Of the 22 specimens that show use as hammerstones, 10 are pebbles or cobbles with no modification other than the battering produced through their use as hammerstones (Table 5.8). Of the remainder, 10 are cores that exhibit extreme battering along at least one flake ridge. This battering appears to be far in excess of that needed for platform preparation and suggests that these cores were further used as hammerstones. The other two specimens are bifaces which were abandoned in either the first or the second biface reduction stage and then used as hammerstones. Again, the extreme battering present on the margins would seem to be in excess of that necessary or desirable for platform preparation.

The pebble and cobble-hammerstones show a range of sizes from one that is 32 mm in its largest dimension to one that is 90 mm. The core-hammerstones tend to be somewhat larger than the pebble/cobble type, ranging from 70 mm to 118 mm in the longest dimension. The hammerstones are described in Table 5.8.

Groundstone (3)

The groundstone sample recovered from 41MK27 is composed of one metate and one metate fragments, and one possible

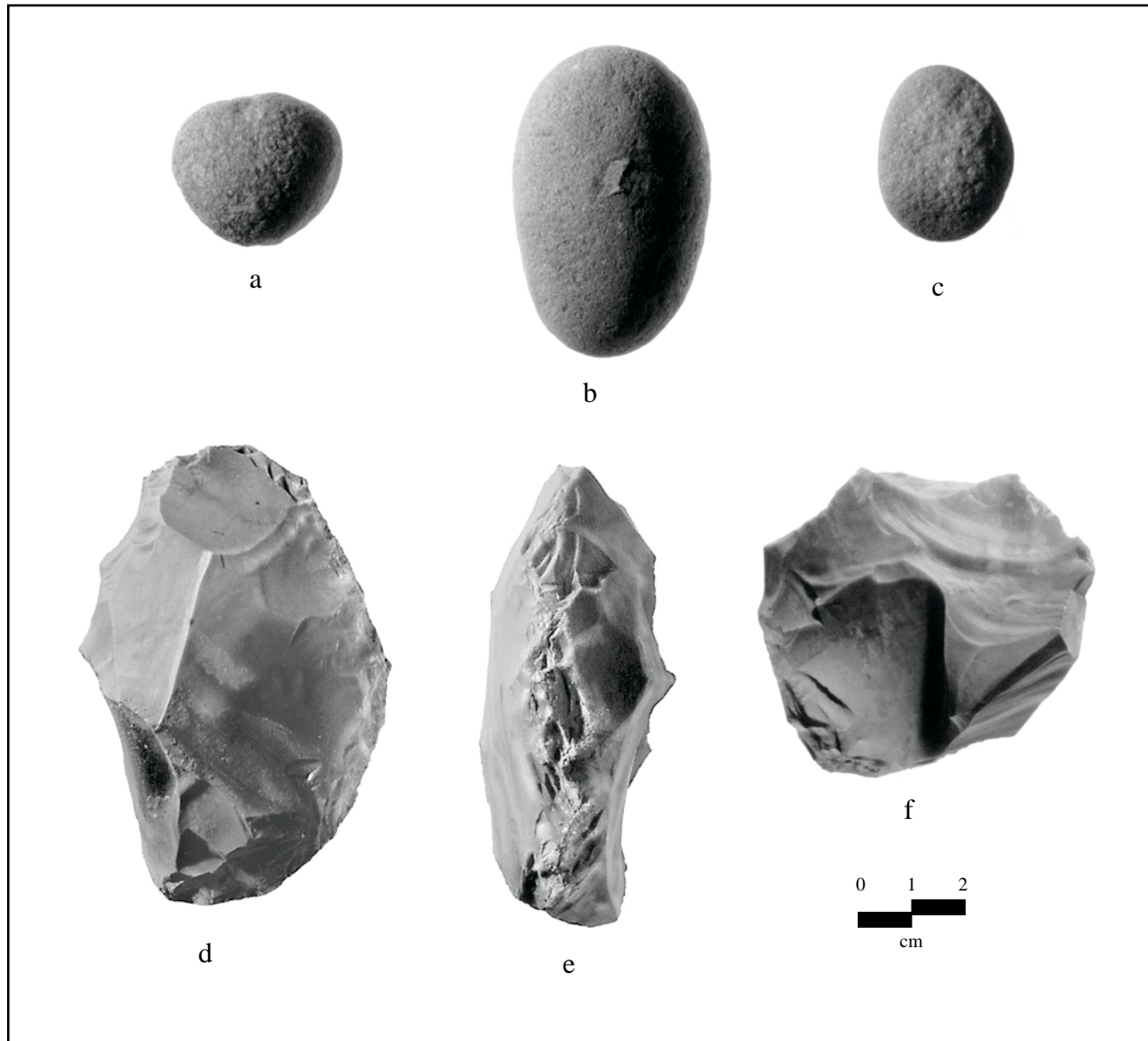


Figure 5.22. *Hammerstones from 41MK27.*

metate fragment. The complete metate, which can be seen standing on its edge and forming part of Feature IA, the hearth in the burned-rock midden (see Figure 5.5), shows evidence of grinding and pecking on one face. The metate also shows evidence of burning. The ground and pecked face is slightly concave. The dimensions of this metate are: length, 273 mm; width, 185 mm; and thickness, 79 mm.

The second specimen is a fragmentary metate that was also associated with Feature IA, forming a part of the

hearth. This metate is broken, possibly by fire as it shows evidence of burning. One surface exhibits grinding and pecking, although this face is flat rather than concave. The length of this fragment is 225 mm, the width is 112 mm, and the thickness is 65 mm. The third specimen is a fragmentary piece of ground stone, possibly a metate fragment, with evidence of grinding and pecking on both faces. One face is flat and the other is slightly concave. This ground stone fragment was also associated with Feature IA. Its length is 78 mm, its width is 69 mm, and its thickness is 30 mm.

Table 5.8. Hammerstones from 41MK27

| Specimen | L* | W* | Th* | Type of Hammerstone | Material |
|----------|------|-------|------|-----------------------------|---------------------------|
| 31 | 81 | 73.2 | 55.3 | Cobble hammerstone | Chert |
| 68 | 34 | 26.4 | 14 | Pebble hammerstone | Chert |
| 73 | 60 | 54.4 | 46.9 | Core hammerstone | Chert |
| 91 | 79 | 50 | 42.4 | Cobble hammerstone | Quartz cobble |
| 102 | ---- | ---- | ---- | Core hammerstone fragment | Chert |
| 145 | 90 | 84.3 | 71.9 | Cobble hammerstone | Chert |
| 152 | 78 | 72.5 | 48.2 | Core hammerstone | Chert |
| 156 | 58 | 79.1 | 42.4 | Cobble hammerstone | Chert |
| 181 | 85 | 64.7 | 52.1 | Core hammerstone | Chert |
| 199 | 74 | 62.2 | 35.6 | Biface hammerstone | Chert |
| 227 | 58 | 56.4 | 37.8 | Cobble hammerstone | Chert |
| 400 | 84 | 59.1 | 28.6 | Biface hammerstone | Chert |
| 418 | 71 | 34.1+ | 21.1 | Cobble hammerstone fragment | Chert |
| 442 | 32 | 29.2 | 20.6 | Pebble hammerstone | Chert |
| 462 | 77 | 61.1 | 26.2 | Core hammerstone | Quartzite, coarse-grained |
| 493 | 85 | 72.4 | 69.9 | Core hammerstone | Chert |
| 713 | 81 | 64.7 | 46.2 | Core hammerstone | Chert |
| 714 | 118 | 77.1 | 54.6 | Core hammerstone | Chert |
| 720 | 98 | 78 | 55.6 | Core hammerstone | Chert |
| 743 | 70 | 66.5 | 34.1 | Core hammerstone | Chert |
| 1023 | 59 | 37.5 | 24.4 | Cobble hammerstone | Quartzite, coarse-grained |
| 1092 | 97 | 82.7 | 67.5 | Cobble hammerstone | Quartzite, coarse-grained |

* All measurements in mm.

Faunal Material

The faunal remains recovered from 41MK27 can be placed into two categories. The first of these represents vertebrate remains, and the second consists of invertebrate remains, represented by large quantities of freshwater mussel shell. The vertebrate remains were examined by Viola Rawn-Schatzinger using standard analytical procedures for the identification of faunal remains from archaeological sites. The taxon was identified to the lowest level possible. In many cases, due to the fragmentary nature of the material, only a very general identification was possible. General categories include extra large mammal (horse, cow, bison, elk size-range); large mammal (deer, goat, human, sheep, and large carnivore such as mountain lion or wolf size-range); medium mammal (generally carnivores in the size-range of bobcat, coyote, beaver, badger, or large raccoon); and small mammal (rabbit-size animals on down, including ground squirrel and other small rodents). When it was possible to distinguish between herbivores and carnivores this was done,

and of course identifications at the generic and species level were made when possible. The element was identified when possible, and also the portion of the element present was noted. Symmetry (right/left or nonsymmetrical element) was noted. Age criteria were investigated, and age of the individual noted when possible. The condition of the specimen was also evaluated (i.e., gnawed, burned, modified, etc.). Weathering and fracture characteristics were also considered.

Most of the 114 vertebrate specimens recovered were quite fragmentary and badly weathered. These are described in Table 5.9. Nine specimens were identified as belonging to an extra large mammal, and of these five are either *Bison* or *Bos*. The other four were indeterminate. By far the largest category is that of the large mammal. Ninety-five specimens fell into this group, of which five can be identified as deer. The others are indeterminate. Medium mammals are represented by six specimens, of which three are definitely carnivores and the other three indeterminate, but also

Table 5.9. Vertebrate Remains from 41MK27

| Spec. | Taxon | No. | Element | Fracture | Modification | Age |
|-------|----------------------------|-----|---------------------------------|-----------------|---------------------|---------|
| 30 | Small mammal | 1 | Long bone, indeterminate | Indeterminate | Heavy weathering | Unknown |
| 41 | Large mammal | 1 | Lone bone, indeterminate | Indeterminate | Gnawed, burned | Unknown |
| 63 | Large mammal | 1 | Tooth fragment, indeterminate | Indeterminate | Heavy weathering | Unknown |
| 69 | Carnivore | 1 | Femur fragment, indeterminate | Indeterminate | Heavy weathering | Unknown |
| 81 | Large mammal | 3 | Fragments, indeterminate | Indeterminate | Heavy weathering | Unknown |
| 87 | Large mammal | 9 | Lone bone fragments, ind. | Indeterminate | Heavy weathering | Unknown |
| 87 | <i>Odocoileus</i> sp. | 1 | Metapodial fragment | Indeterminate | Heavy weathering | Unknown |
| 87 | Medium mammal (carnivore?) | 1 | Vertebrae fragment | Indeterminate | Heavy weathering | Unknown |
| 87 | Medium mammal (carnivore?) | 2 | Rib fragments | Indeterminate | Heavy weathering | Unknown |
| 90 | Large mammal | 7 | Indeterminate fragments | Indeterminate | Slightly charred | Unknown |
| 90 | Large mammal | 2 | Indeterminate fragments | Indeterminate | Burned black | Unknown |
| 322 | Large mammal | 1 | Indeterminate fragment | Indeterminate | Calcined | Unknown |
| 331 | <i>Bison</i> or <i>Bos</i> | 1 | Left metacarpal | None | Heavy weathering | Mature |
| 335 | Large mammal | 1 | Long bone fragment | Indeterminate | Heavy weathering | Unknown |
| 337 | Large mammal | 3 | Indeterminate fragments | Indeterminate | Heavy weathering | Unknown |
| 337 | <i>Odocoileus</i> sp. | 3 | Antler tip | Indeterminate | Antler in velvet | Mature |
| 337 | Carnivore | 2 | Jaw fragment, indeterminate | Indeterminate | Dry bone break | Unknown |
| 388 | Large mammal | 1 | Long bone fragment | Indeterminate | Heavy weathering | Unknown |
| 508 | Small mammal | 1 | Long bone fragment | Spiral fracture | Moderate weathering | Unknown |
| 631 | Large mammal | 6 | Indeterminate fragments | Indeterminate | Heavy weathering | Unknown |
| 633 | Large mammal | 8 | Indeterminate fragments | Indeterminate | Heavy weathering | Unknown |
| 633 | Large mammal | 1 | Indeterminate fragments | Indeterminate | Calcined | Unknown |
| 633 | Large mammal | 2 | Long bone fragments | Indeterminate | Burned black | Unknown |
| 634 | <i>Odocoileus</i> sp. | 1 | Distal portion, tibia | Indeterminate | Heavy weathering | Unknown |
| 635 | Large mammal | 2 | Long bone fragments | Indeterminate | Heavy weathering | Unknown |
| 636 | Large mammal | 6 | Indeterminate fragments | Indeterminate | Heavy weathering | Unknown |
| 637 | Extra large mammal | 3 | Long bone fragments | Indeterminate | Heavy weathering | Unknown |
| 638 | Large mammal | 1 | Long bone fragments | Indeterminate | Calcined | Unknown |
| 638 | Small mammal | 1 | Long bone fragment | Indeterminate | Moderate weathering | Unknown |
| 639 | <i>Bison</i> or <i>Bos</i> | 1 | Skull, mastoid process-petorsal | Indeterminate | Heavy weathering | Mature |
| 639 | <i>Bison</i> or <i>Bos</i> | 3 | Skull fragments | Indeterminate | Heavy weathering | Mature |
| 639 | Large mammal | 1 | Skull fragments | Indeterminate | Calcined | Unknown |
| 640 | Large mammal | 1 | Long bone fragments | Indeterminate | Heavy weathering | Unknown |
| 641 | <i>Bison</i> or <i>Bos</i> | 1 | Postcanine tooth fragment | Indeterminate | Heavy weathering | Mature |
| 642 | Large mammal | 7 | Indeterminate fragments | Indeterminate | Heavy weathering | Unknown |
| 642 | Fish, indeterminate | 1 | Vertebrae | Indeterminate | Moderate weathering | Unknown |
| 642 | Large mammal | 1 | Indeterminate fragments | Indeterminate | Calcined | Unknown |
| 643 | Large mammal | 21 | Indeterminate fragments | Indeterminate | Heavy weathering | Unknown |
| 644 | Large mammal | 4 | Indeterminate fragments | Indeterminate | Heavy weathering | Unknown |

probably carnivores. The small mammal class is represented by only three specimens, all indeterminate. One fish vertebrae was recovered.

Recovery techniques are probably responsible for the lack of remains from these smaller-sized animals. Because of the extremely fragmentary nature of the animal bones recovered, it is impossible to estimate number of individuals represented. Deer was probably used by the inhabitants, and there is the possibility that bison was also taken, but the identification also includes the possibility of *Bos* or cow, as cattle have been grazed in the region for many years. One specimen, the left metacarpal, is considerably less weathered than the other faunal remains and was recovered from the first level. This is almost certainly modern cow. The post-canine tooth fragment as well as three indeterminate fragments come from Level 3, and the skull fragment and three other indeterminate fragments come from Level 2. These have a better possibility of being bison, but because of the amount of disturbance and colluvial activity at the site, they may also represent the remains of modern cow.

It would appear likely that a great many of the indeterminate large mammal fragments represent deer, although it is possible that the remains of modern sheep or goat may have found their way into the site deposits. The medium mammal remains probably come from one or more of the carnivores listed as representative of this group, but the remains were too fragmentary to determine which genera or species were present. Likewise, the small mammal remains are indeterminate, and the single fish vertebra is unidentifiable as to species.

These faunal remains provide an unsatisfactory picture of the animal resources that may have been used at the site. In part this may be due to the poor conditions for preservation. Accumulation of deposits at the site was slow, allowing animal bones to remain on the surface for considerable lengths of time, thus increasing the probability that such remains would be removed by scavengers. In addition, the continual colluvial action affecting the site would help both to disintegrate the bones and to move them from their original contexts. The soils are not conducive to bone preservation. Bone that did remain buried at the site

suffered greatly from both mechanical and chemical weathering, and much of it has been destroyed. It is impossible to discern any pattern of animal use from either the horizontal or vertical distribution of faunal remains, partly due to the small size of the sample, and partly because of the indeterminate nature of most of the remains recovered.

The second general type of faunal remains recovered from 41MK27 consisted of large quantities of freshwater mussel shell. Though some of these were complete or nearly complete, a great many were recovered in fragmentary form. The complete specimens consisted of complete bivalve halves, not complete individuals still joined at the hinge. Dr. Raymond W. Neck (personal communication) identified four of the common genera present, examples of which are shown in Figure 5.23. These include the genera *Tritogonia*, *Amblema*, *Obovaria*, and *Quadrula*. Note that there is an interesting size-range represented by the *Tritogonia* specimens. In a discussion of these freshwater mussel remains, it should be noted that in general the specimens recovered from the archaeological deposits are smaller than species found living today either in the Colorado River or even in Bluff Creek adjacent to the site. These freshwater mussel shell remains are one of the very prominent factors noted at the site. A total of 47,263 g of shell was recovered during the excavations. The distribution of this shell shows a definite concentration in Levels 4, 5, and 6, with the greatest number occurring in Level 5. With all units considered, 123 g of shell were recovered from Level 1; 962 g from a combination of Levels 1 and 2, where the first level excavated was 20 cm deep; 4,131 g from Level 3; 438 g from Levels 3 and 4, where the second level excavated was 20 cm deep; 13,529 g recovered from Level 4; 22,542 g from Level 5; 12,140 g from Level 6; 2,277 g from Level 7; 850 g from Level 8; 150 g from Level 9; 34 g from Level 10; and 31 g from Level 11.

These figures are somewhat biased by the fact that not every unit was excavated through Level 11. However, every level was excavated at least through Level 1, and generally through Level 2 as well. The low number of grams of shell recovered from these upper levels truly reflects the situation. The graph in Figure 5.24 shows the distribution of mussel shell by weight

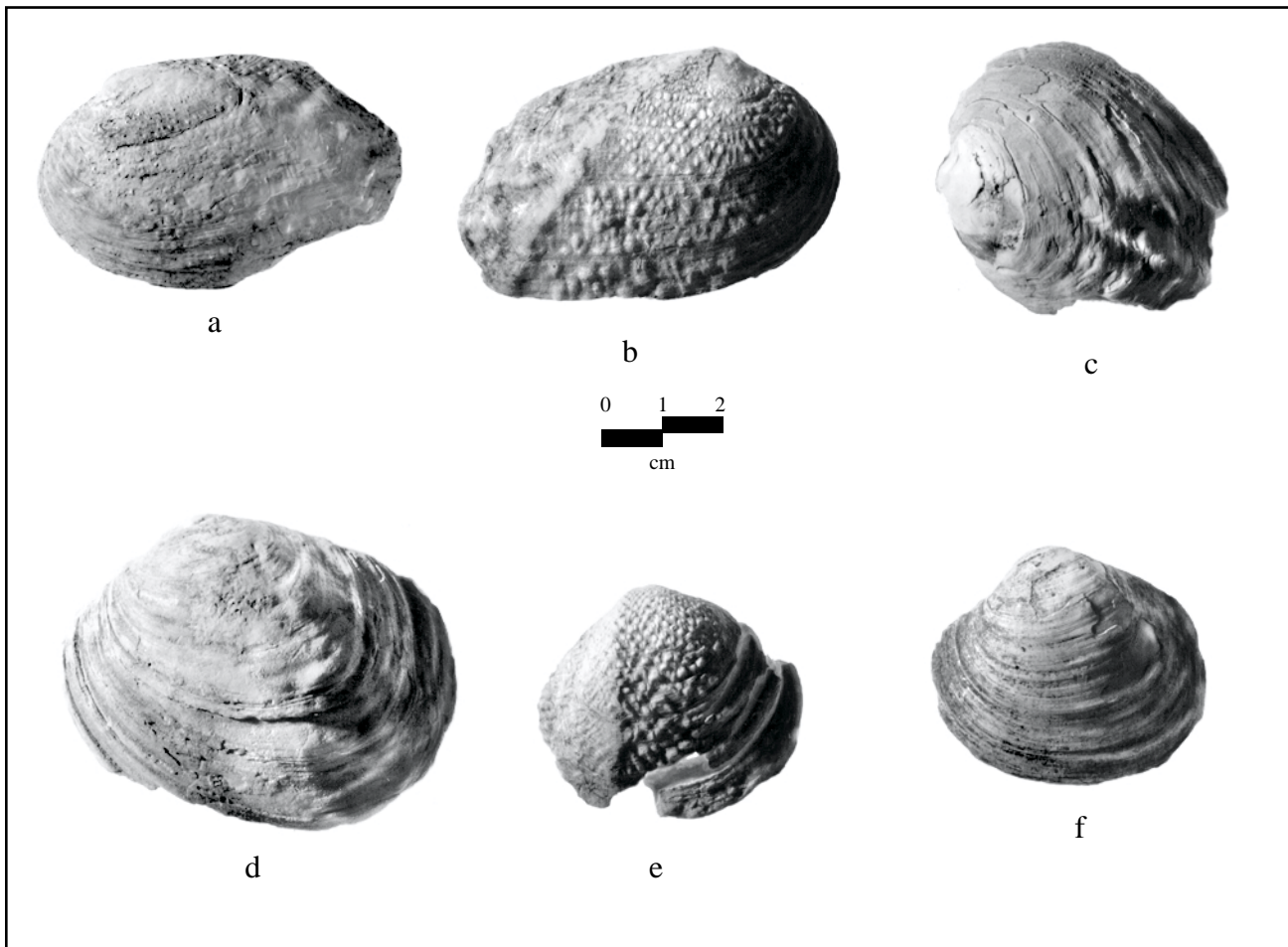


Figure 5.23. *Mussel shells*. a, b: *Tritogonia*; c, d: *Amblema*; e: *Obovaria*; f: *Quadrula* or unknown.

in grams for all levels in only those units that were excavated at least through Level 7. Not all of those units were also excavated through the lower levels, but as can be seen, for those deeper levels, the amount of shell recovered drops off sharply. Only two units were excavated through Levels 10 and 11. The amounts of mussel shell recovered from these are summarized below in Table 5.10.

Although the individual mussels represented by the shells recovered at 41MK27 are small, the amount of shell recovered would strongly suggest that they were used as a food resource. The broken and scattered nature of the remains offers little clue as to how they were prepared.

Table 5.10. Mussel Shell Weight (g) by Level at 41MK27

| Level | N60-62/E40-42 | N62-64/E32-34 |
|-------|---------------|---------------|
| 1&2 | 45 | 41 |
| 3 | 92 | 22 |
| 4 | 400 | 232 |
| 5 | 800 | 1400 |
| 6 | 800 | 800 |
| 7 | 180 | 84 |
| 8 | -- | 50 |
| 9 | 54 | 96 |
| 10 | 34 | -- |
| 11 | -- | 31 |

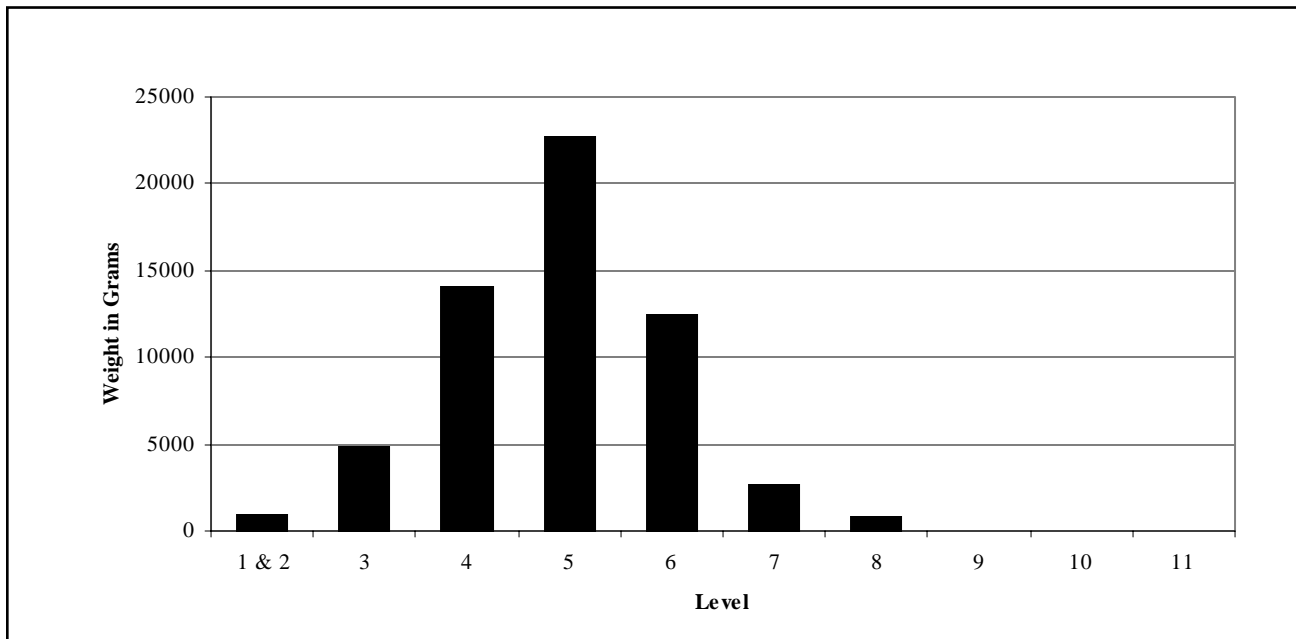


Figure 5.24. Vertical distribution of mussel shell in units excavated through Level 7.

CHAPTER 6: SUMMARY AND CONCLUSIONS FOR 41MK27

Brett A. Houk, Doug Drake, Ann M. Irwin, and Kevin A. Miller

Distribution of Recovered Materials

As has been mentioned previously, the cultural material at 41MK27, including the burned-rock midden, lay buried beneath the surface. With the exception of a small amount of lithic debris, burned rock, and mussel shell brought to the surface by some burrowing animal, the site was not visible from the surface. Because the bulk of the sediments containing the cultural material are colluvial in nature, some movement of those materials since their original deposition is to be expected. The disturbed nature of the hearths lying to the east of the midden and the resultant scatter of burned rock is probably due to the colluvial movement of sediments and runoff derived from the steep bluff to the west, as well as possible flooding action from the creek itself.

Levels 1 and 2 produced only a small portion of the materials recovered. Of the six major classes of chipped stone tools—bifaces, cores, gravers, hammerstones, projectile points, and scrapers—only some three percent of the specimens recovered came from these levels. In contrast, Level 3 produced 14 percent of these items, Level 4 accounted for 25 percent, and Level 5 produced some 31 percent. Together these three levels (3–5) produced 68 percent of the specimens from these major artifact classes (Table 6.1). In those units excavated below Level 7, the artifact yield dropped sharply. Considering the individual tool categories, 61 percent of the bifaces were recovered from these levels (Table 6.2), 68 percent of the cores (Table 6.3), 80 percent of the gravers (Table 6.4), 77 percent of the hammerstones (Table 6.5), 64 percent of the projectile points (Table 6.6), and 79 percent of

Table 6.1. Distribution of Major Artifact Classes by Level at 41MK27

| Level | Biface | Core | Graver | Hammerstone | Projectile | Scraper | Percentage of |
|---------------|--------|------|--------|-------------|------------|---------|---------------|
| Surface | 5 | 5 | | | | | 4% |
| Backhoe Tests | 13 | 2 | 1 | 2 | 2 | 2 | 10% |
| 1 | 4 | | | | | | 2% |
| 2 | 1 | 2 | 3 | | 1 | | 3% |
| 3 | 13 | 8 | 3 | 2 | 1 | 2 | 13% |
| 4 | 27 | 9 | 5 | 4 | 6 | 4 | 24% |
| 5 | 20 | 14 | 8 | 11 | 13 | 5 | 31% |
| 6 | 15 | 7 | | 3 | 3 | 1 | 13% |
| 7 | | | | | 2 | | 1% |
| 8-11 | | | | | | | 0% |

Table 6.2. Distribution of Bifaces by Level at 41MK27

| Reduction Stage | Level | | | | | | | | | | | Totals | Percentage |
|-----------------|-------|----|-----|-----|-----|-----|----|----|----|----|----|--------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| 1 | 0 | 0 | 3 | 5 | 6 | 4 | 0 | 0 | 0 | 0 | 0 | 18 | 23% |
| 2 | 2 | 0 | 3 | 11 | 6 | 4 | 0 | 0 | 0 | 0 | 0 | 26 | 33% |
| 3 | 1 | 1 | 4 | 8 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 24 | 30% |
| 4 | 1 | 0 | 3 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 12 | 15% |
| Totals | 4 | 1 | 13 | 27 | 20 | 15 | 0 | 0 | 0 | 0 | 0 | 80 | 100% |
| Percentage | 5% | 1% | 16% | 34% | 25% | 19% | 0% | 0% | 0% | 0% | 0% | 100% | |

Table 6.3. Distribution of Cores by Level at 41MK27

| Specimen | Surface | Backhoe Tests | Level | | | | | | | | | | | Total | |
|------------|---------|---------------|-------|----|-----|-----|-----|-----|----|----|----|----|----|-------|------|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| 24 | | | | | | | X | | | | | | | | |
| 27 | | | | | X | | | | | | | | | | |
| 28 | | | | | X | | | | | | | | | | |
| 40 | | | | | | | X | | | | | | | | |
| 43 | X | | | | | | | | | | | | | | |
| 47 | | | | | | | X | | | | | | | | |
| 71 | | | | | X | | | | | | | | | | |
| 72 | | | | | X | | | | | | | | | | |
| 103 | | | | | | | X | | | | | | | | |
| 118 | | | | | | | X | | | | | | | | |
| 120 | | | | | | | X | | | | | | | | |
| 121 | | | | | | | X | | | | | | | | |
| 126 | | | | | | | X | | | | | | | | |
| 127 | | | | | | | X | | | | | | | | |
| 130 | | | | | | | X | | | | | | | | |
| 151 | | | | | | | | | X | | | | | | |
| 158 | | | | | | | X | | | | | | | | |
| 163 | | | | | X | | | | | | | | | | |
| 171 | X | | | | | | | | | | | | | | |
| 172 | X | | | | | | | | | | | | | | |
| 174 | | | | | X | | | | | | | | | | |
| 176 | | X | | | | | | | | | | | | | |
| 182 | | | | | | | | | X | | | | | | |
| 183 | | | | | | | | | X | | | | | | |
| 190 | | | | | | | X | | | | | | | | |
| 194 | X | | | | | | | | | | | | | | |
| 203 | | | | | | | X | | | | | | | | |
| 205 | | | | | | | X | | | | | | | | |
| 243 | | | | | | | X | | | | | | | | |
| 244 | | | | | | | | X | | | | | | | |
| 413 | | | | | X | | | | | | | | | | |
| 417 | | | | | | | X | | | | | | | | |
| 420 | | | | | | | | X | | | | | | | |
| 426 | | | | | | | X | | | | | | | | |
| 428 | | | | | | | X | | | | | | | | |
| 448 | | | | | | | | X | | | | | | | |
| 677 | | | | | | | | X | | | | | | | |
| 682 | | | | | | | | | X | | | | | | |
| 683 | | | | | | | | | X | | | | | | |
| 685 | | | | | | | | | X | | | | | | |
| 708 | | | | | | | | | X | | | | | | |
| 712 | X | | | | | | | | | | | | | | |
| 740 | | | | | | | | X | | | | | | | |
| 755 | | | | X | | | | | | | | | | | |
| 846 | | X | | | | | | | | | | | | | |
| 1011 | | | | X | | | | | | | | | | | |
| 1035 | | | | | X | | | | | | | | | | |
| Totals | 5 | 2 | 0 | 2 | 8 | 9 | 14 | 7 | | | | | | | 47 |
| Percentage | 11% | 4% | 0% | 4% | 17% | 19% | 30% | 15% | 0% | 0% | 0% | 0% | 0% | 0% | 100% |

Table 6.4. Distribution of Gravers by Level at 41MK27

| Specimen | Backhoe Tests | Level | | | | | | | | | | | Total | |
|------------|---------------|-------|-----|-----|-----|-----|----|----|----|----|----|----|-------|------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| 11 | | | | X | | | | | | | | | | |
| 25 | | | | | | X | | | | | | | | |
| 38 | | | | | | X | | | | | | | | |
| 50 | | | | | X | | | | | | | | | |
| 55 | | | | | | X | | | | | | | | |
| 58 | X | | | | | | | | | | | | | |
| 62 | | | | X | | | | | | | | | | |
| 113 | | | X | | | | | | | | | | | |
| 115 | | | X | | | | | | | | | | | |
| 123 | | | | | X | | | | | | | | | |
| 167 | | | | | | X | | | | | | | | |
| 185 | | | | | | X | | | | | | | | |
| 192 | | | | | X | | | | | | | | | |
| 193 | | | | | X | | | | | | | | | |
| 195 | | | | X | | | | | | | | | | |
| 218 | | | | | | X | | | | | | | | |
| 248 | | | | | | X | | | | | | | | |
| 478 | | | X | | | | | | | | | | | |
| 718 | | | | | X | | | | | | | | | |
| 838 | | | | | | X | | | | | | | | |
| Total | 1 | 0 | 3 | 3 | 5 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 |
| Percentage | 5% | 0% | 15% | 15% | 25% | 40% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 100% |

Table 6.5. Distribution of Hammerstones by Level at 41MK27

| Specimen | Backhoe Tests | Level | | | | | | | | | | | Total | |
|------------|---------------|-------|----|----|-----|-----|-----|----|----|----|----|----|-------|------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| 31 | | | | | X | | | | | | | | | |
| 68 | | | | | X | | | | | | | | | |
| 73 | X | | | | | | | | | | | | | |
| 91 | | | | | X | | | | | | | | | |
| 102 | | | | | | X | | | | | | | | |
| 145 | | | | X | | | | | | | | | | |
| 152 | | | | | | | X | | | | | | | |
| 156 | | | | | | X | | | | | | | | |
| 181 | | | | | | | X | | | | | | | |
| 199 | | | | | | X | | | | | | | | |
| 227 | | | | | | X | | | | | | | | |
| 400 | | | | | | X | | | | | | | | |
| 418 | | | | | | X | | | | | | | | |
| 442 | | | | | | | X | | | | | | | |
| 462 | | | | | | X | | | | | | | | |
| 493 | | | | | | X | | | | | | | | |
| 713 | | | | | | X | | | | | | | | |
| 714 | | | | | | X | | | | | | | | |
| 720 | X | | | | | | | | | | | | | |
| 743 | | | | | | X | | | | | | | | |
| 1023 | | | | X | | | | | | | | | | |
| 1092 | | | | | X | | | | | | | | | |
| Totals | 2 | 0 | 0 | 2 | 4 | 11 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 22 |
| Percentage | 9% | 0% | 0% | 9% | 18% | 50% | 14% | 0% | 0% | 0% | 0% | 0% | 0% | 100% |

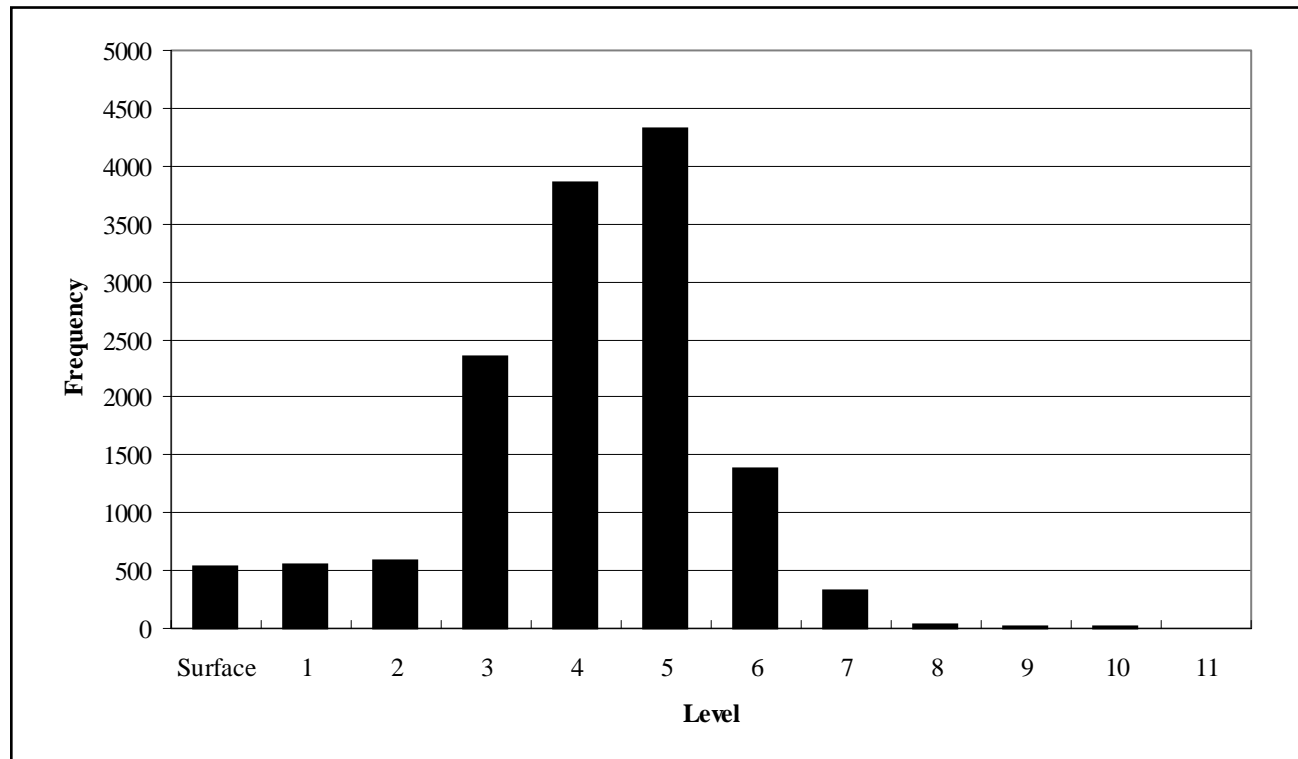


Figure 6.1. *Distribution of debitage by level at 41MK27.*

total specimens in the major tool categories recovered. The burned-rock features designated as Features III through X probably represent a living surface. However, cultural material was concentrated throughout a 30 to 40 cm vertical span; within this span, represented by Levels 3 through 6, it was not possible to isolate actual living surfaces or floors. This is probably due to the nature of the depositional process at this site and is indicative of both repeated occupations of the site and of mechanical mixing of the resulting cultural remains. Obvious activity areas were not discerned, except in the gross sense as they are represented by the burned-rock features.

Reviewing all of the artifact classes recovered at 41MK27—68 cores, 70 bifaces, 21 graters, 22 hammerstones, 18 scrapers, three groundstone, 33 projectile points, debitage, mussel shell, and bone—three general statements can be made about site activities. First, a wide variety of activities produced a heterogeneous tool assemblage. Second, many activities and/or tool types are represented by only a few specimens. Third, most activities took place away from the midden based on the distribution of artifacts.

The inferred activities at 41MK27 include the hunting, collecting, processing and cooking of animals, plant collecting and processing, tool manufacture and repair, hide preparation, and engraving. Many of these tools have been casually made, such as scrapers (only four appear to have been formally manufactured as such), and graters. Many of these activities are indicated by statistically invalid, small samples of artifacts. For instance, if all artifact classes are spatially plotted and the distribution is then standardized by cubic volume of excavated matrix, the values for projectile points, graters, scrapers, hammerstones, and bone are less than two items/m³. While it can be generally stated that these artifacts were predominantly recovered from the north-central and northeastern portions of the site, few meaningful conclusions can be reached.

The same may be stated for the distribution of cores and bifaces. Although distributions of these artifacts are typically two to three items/m³, each of these artifact types was more or less evenly distributed across the site. Notable exceptions to this distribution pattern include the absence of cores and bifaces in the

north-central portion of the midden and in most of the northernmost excavation block (N72/E34).

A closer examination of the distribution of debitage and mussel shell resulted in more informative statements about activities on and off the midden. Debitage counts and mussel shell weights were first isolated from the two levels (4 and 5) which contained both the midden deposits and the majority of artifacts. These values were then standardized by calculating the artifact density per cubic meter. The standardized values were then plotted by excavation unit across the site, with the locations of the midden and hearth features in Levels 4 and 5 also indicated (Figures 6.2 and 6.3).

Debitage ranged from 5 flakes/m³ (midden unit) to 813 flakes/m³ (Feature III and IV vicinity). The highest concentrations of debitage were at the northern limits of the midden and immediately north of the midden between it and the cluster of features (III–V) just to

the north of the midden (Figure 6.2). Slightly less dense concentrations of debitage were found north of the Feature III–V cluster and in the southwestern portion of the Feature VI–X cluster (Figure 6.2). The least dense debitage concentrations were consistently found in the midden proper. In other words, flintknapping activities, or the residue thereof, were the heaviest between the midden and the closest cluster of hearths. If the midden and hearths were contemporaneous at all, then potentially one of the most traveled areas on the site was literally carpeted with flakes. Regardless, the burned rock midden was not a chosen locale for depositing flintknapping debris, and this may reflect continuous use as a cooking facility right up to the end of site occupation.

Mussel shell weights (grams) ranged from 55g/m³ in a midden unit to 5000 g/m³ in the Feature V area (Figure 5.3). Once again, one of the two heaviest concentrations was between the midden and the Feature

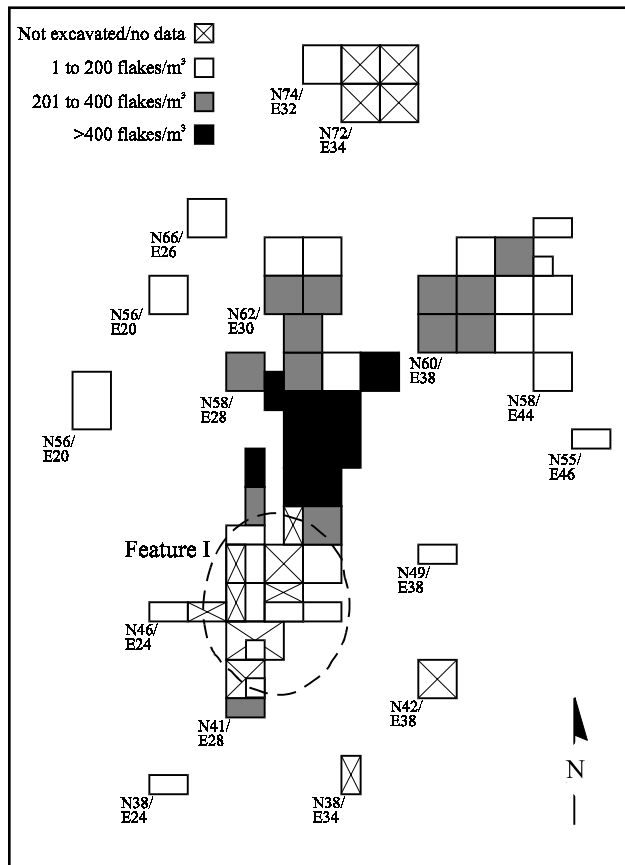


Figure 6.2. Distribution of debitage in Levels 4 and 5 at 41MK27.

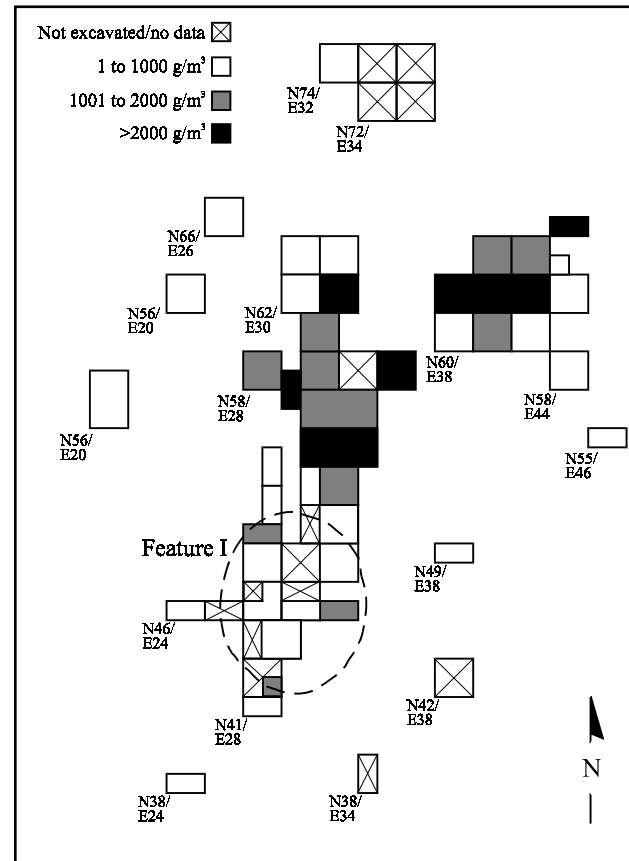


Figure 6.2. Distribution of mussel shell in Levels 4 and 5 at 41MK27.

III–V cluster, although this area was not as extensive as the debitage concentration. The second main concentration of mussel shell was located near Features VI, VII, IX, and X (Figure 6.3). Lesser concentrations were consistently located in the immediate vicinities of the hearths, which offers support to the idea that these were closely associated with the processing of shellfish. Again, the lowest densities of mussel shell were found in the midden area and in outlying excavation units that did not contain hearths.

The debitage and mussel shell data from Levels 4 and 5 indicate that most activities associated with the deposition of debitage and mussel shell took place away from the midden, but around the smaller hearths. In particular, the majority of debris was found between the midden and Feature III–V cluster. Although these features may not be contemporaneous with the midden, the central portion of the excavated site over time became the primary refuse area.

Unfortunately, the sample sizes of the major tool classes were all too small to make statistically valid statements about their distributions. The only two material classes that were represented by large samples were debitage and mussel shell. It was hypothesized that there may have been either a direct or indirect relationship between the density of the two classes, but no strong statistically correlation was found¹. The density of each artifact class and the distance from 1) the midden and 2) the center of the area of Features VI–X were examined for any correlations, but again none were detected.

Dating the Site

The two lines of evidence that are traditionally pursued to date an archaeological site are relative dating through time-sensitive diagnostic artifacts and absolute dating through radiocarbon assays. In the case of 41MK27, the only temporally sensitive artifacts recovered were projectile points.

Relative Dating

The point types represented are associated with the Early Archaic and Late Archaic through the Late Prehistoric periods. Unfortunately, the vertical distribution of projectile points does not support the presence of clearly defined and stratigraphically discrete components (see Table 6.6). Those specimens designated as arrow points occur in Levels 2, 4, and 5. The specimen from Level 2 lay directly on the surface of the burned-rock midden, and may well have been dropped by a casual visitor to the site after the time of major occupation. A second arrow point, occurring in Level 4, lay at the top of the cultural zone in that portion of the site. Two specimens were recovered from Level 5, one of which was found in association with a small *Fairland* dart point.

The burned rock midden itself is overlain by some 10 cm of essentially sterile soil. Lying on top of the uppermost rocks were a single arrow point (Specimen 146), a large concave-based biface (Specimen 132), a large Stage 1 biface (Specimen 725), and a graver (Specimen 478). From within the midden itself, a very small quantity of flint and broken mussel shell was recovered, but the numbers were considerably less than in units adjacent to the midden but outside of its boundaries. The tool count picked up immediately adjacent to the edges of the midden. One projectile point, Specimen 144, was recovered within the midden in a unit at its eastern edge. This dart could not be typed. Directly underlying the midden and atop the underlying sediments was dart point Specimen 471, a complete point originally classified as untypeable. It is now missing from the 41MK27 assemblage and could not be reassessed. These two points morphologically resemble Late or Transitional Archaic point types.

Transitional Archaic points, accounting for 39 percent of all projectile points recovered, were found in Levels 3, 4, 5, and 6 across the site. The two Late Archaic *Pedernales* points were recovered from Level 5. The Late Archaic *Lange* point, a slightly younger type than

¹ The densities of mussel shell and debitage by excavated unit were compared to one another using regression and correlation analysis. The analysis included comparing individual levels and combination of levels to look for relationships. In no case was the coefficient of variation (r^2) higher than 0.26.

Pedernales according to Collins (1995:Table 2), was recovered from Level 7. The single Early Archaic point, a modified *Martindale*-like specimen, also came from Level 5.

Seventy-eight percent of the projectile points were recovered from Levels 4–6 across the site. Unfortunately, the points overlap temporally. Transitional Archaic points were found with or below Late Archaic points, and Late Prehistoric points were found with or below Transitional Archaic points in the overall stratigraphic sequence for the site. The only two dart points recovered from the midden itself could not typed.

Radiocarbon Dating

SWCA and TxDOT submitted five samples to Beta Analytic for radiocarbon analysis (Table 6.8 and Appendix B). Three samples were associated with Feature 1, the burned rock midden, one was from Feature 2, and one was from Feature 10. Of the three from the burned rock midden, one sample was the bovid tooth fragment from Level 3, near the top of the feature's east side. Another came from Level 4, within the midden, and the final sample came from Level 6, near the bottom of the feature. The latter two samples came from the central area of the midden. None of the 2-sigma calibrated ranges overlap. From just below the feature, Beta-130458 yielded a 2-sigma range of Cal A.D. 445 to 640 (Cal. B.P. 1505 to 1310), a span of time encompassed by the latter part of the Transitional Archaic. From within the midden, Beta-130460 yielded a younger date of Cal A.D. 900 to 1030

(2-sigma Cal B.P. 1050 to 920). This would place the sample temporally within the early part of the Late Prehistoric period. The post-canine tooth (Beta-130457) returned a much younger date with a 1-sigma (68 percent probability) value of Cal A.D. 1645 to 1665 (Cal B.P. 320 to 270) within the latter part of the Late Prehistoric period. This indicates that the tooth was most likely from a bison and not a cow. Taken as a whole, the 2-sigma calibrated results from the midden span a period of over 1200 years beginning in A.D. 445 and ending in A.D. 1680. This temporal span corresponds to approximately 40 cm of stratigraphy in the area of the midden.

The remaining two dates come from samples outside of the limits of the midden. Feature 10, one of several features clustered northeast of the midden, was dated by Beta-130459 to Cal A.D. 405 to 570 (2-sigma Cal B.P. 1525 to 1410). The date for Feature 10 falls within the Late Archaic and is the earliest absolute date from the five samples that were analyzed. Of the five samples, only this one came from a unit and level from which a typeable projectile point was recovered. Specimen 104, a *Pedernales* point, came from Level 5 of excavation block N62–64/E42–44. The absolute date for Feature 10 is younger than the relative date for the *Pedernales* point type. In an adjacent unit, a Transitional Archaic *Fairland* point and a modified Early Archaic *Martindale*-like point were also recovered from Level 5.

Beta-130456 was recovered approximately 10 m north of the midden from Feature 2 and was radiocarbon dated to Cal A.D. 1300 to 1450 (2-sigma Cal B.P. 650 to

Table 6.8. Radiocarbon Samples from 41MK27

| Beta Sample | Provenience | Context | Conventional C14 Age | 2 Sigma Calibrated Result | Intercept |
|-------------|----------------------------|---------------|----------------------|-------------------------------------------------|---------------|
| 130456 | N 72-74/E 36-38, Level 3 | Feature 2 | 540+/-60 B.P. | Cal A.D. 1300 to 1450 | Cal A.D. 1410 |
| 130457 | N 48-50/E 32-34, Level 3 | Top of midden | 240+/-40 B.P. | Cal A.D. 1525 to 1560 and Cal A.D. 1630 to 1680 | Cal A.D. 1655 |
| 130458 | N 46-47/E 30-32, Level 6 | Below midden | 1500+/-40 B.P. | Cal A.D. 445 to 640 | Cal A.D. 570 |
| 130459 | N 62-64/ E 42-44, Level 5 | Feature 10 | 1580+/-40 B.P. | Cal A.D. 405 to 570 | Cal A.D. 445 |
| 130460 | N 48-50/E 29.5-30, Level 4 | Midden | 1050+/-40 B.P. | Cal A.D. 900 to 1030 | Cal A.D. 1000 |

500). Feature 2 dates to the Late Prehistoric period, approximately midway between the other two Late Prehistoric assays.

The data above suggest that the midden at 41MK27 accumulated primarily during the Late Prehistoric period. This conclusion is based on the fact that the excavation level below the midden was dated to Cal B.P. 1505 to 1310 (2-sigma) and the sample from within the feature was approximately 400 years younger. A Transitional Archaic date for the inception of the midden can not be ruled out, however. The two untyped dart points from within the midden could be associated with the use of the feature. Alternatively, they could have been incorporated into the feature inadvertently through pit dig or earth moving as Black and Creel (1997:280) and Leach and Bousman (1998:126–135) have argued took place at other middens. The young date for the bison tooth indicates that the midden may have been continuously used through the Late Prehistoric period, or the tooth, which was found near the top of the feature, could have been deposited after the midden had ceased to accumulate.

While the midden probably formed during the Late Prehistoric, the rest of the site was occupied for a longer period of time. The absolute and relative dates from non-midden areas indicate that Level 5, the level with the greatest concentrations of cultural material, contained material associated with the Early Archaic through the Late Prehistoric. Based on the predominance of Transitional Archaic points, the site was most intensively occupied between 2250–1250 B.P., but continued to be used by peoples during the Austin and Toyah intervals of the Late Prehistoric.

Summary

In a very generalized sense, 41MK27 can be divided horizontally into two primary sections: the midden and non-midden areas. The relationship between the two areas is unclear. The radiocarbon data suggest that the midden itself formed during the Late Prehistoric, and, at the earliest, during the Transitional Archaic. The area of Features VI–X yielded a single Late Archaic radiocarbon date from Level 5, suggesting that perhaps the features in that area of the site were not con-

temporaneous with the midden. The problem is compounded by the fact that the shallow stratigraphy at the site contains multiple and temporally overlapping components. The cultural material at the site that was encountered in Levels 4 and 5 represents either a palimpsest of material that was first deposited in the Late Archaic and subsequently over-printed during the Transitional Archaic and Late Prehistoric periods, or deposits that were mixed by either natural or cultural processes.

The best interpretation of the site, although somewhat handicapped by these considerations, is that 41MK27 was first occupied during the Late Archaic. The site was situated on a stable surface that was eventually buried by colluvium from the adjacent bluff. The site was revisited and used more intensively during the subsequent Transitional Archaic period. The small midden may have begun to accumulate during this period, but, more than likely, resulted from activities during the early part of the Late Prehistoric period. Feature II at the north end of the excavated area was created during the Late Prehistoric, as well. The single Toyah interval date from the top of the midden indicates that the site was in use as late as 320–270 years ago.

Paleoenvironment

The macrobotanical and pollen/phytolith samples from Features IA and II indicate that during the Late Prehistoric period, the environment at 41MK27 was a mixed-grass prairie with scattered mottes of trees. The majority of the grasses present in the samples represent warm climate types, although some cooler climate types were also present. Pollen, phytoliths, and charred wood fragments indicate that oak trees were in the immediate vicinity of the site and were being burned in the central pit of the burned rock midden as fuel.

The Excavations at 41MK27 in Light of the Burned Rock Midden Project

When trying to place the excavations at 41MK27 into perspective, the most obvious point of comparison is

the Burned Rock Midden (BRM) Project which was completed in 1997 (Black, Ellis, et al. 1997). That study is important to the present project for three important reasons. First, the BRM study produced a series of recommendations about how to excavate burned rock midden sites that can be used to evaluate the 1979 investigations at 41MK27 (Black, Creel, and Ellis 1997). Second, it included reports on two other burned rock midden sites in McCulloch County—41MK8 and 41MK9—that were excavated by TxDOT at approximately the same time as the Bluff Creek sites (Black 1997a). Third, the BRM project provides a regional framework to which to relate the data from 41MK27 (Black and Creel 1997).

Before addressing the methods used to investigate 41MK27 in light of recommendations made nearly two decades later, it is important to note again that the excavations along the right-of-way of FM 765 were essentially salvage archeology conducted without the benefit of regional research questions. That having been said, the excavators were nonetheless attempting to recover as much information about the midden *and* the adjacent non-midden features as possible using conventional methods.

BRM Project Recommendations

The BRM Project generated a series of recommendations about how burned rock middens should be investigated in the future (Black, Creel, and Ellis 1997). These ranged from pre-excavation evaluation of a site's potential to methods for systematically recording burned rock features. Rather than reiterate all of their recommendations, the following section briefly discusses the ones that are applicable to these excavations.

Evaluating Site Potential

One of the first recommendations made by the BRM Project is that, before a midden is investigated, the potential of the site to contribute meaningful data should be evaluated through an assessment of organic preservation, structural integrity, and stratification (Black, Creel, and Ellis 1997:310). According to Black, Creel,

and Ellis (1997:310), this would require “(1) a competent geoarcheological evaluation (probably involving trenching, sediment analyses, and dating efforts) and (2) assessments of the potential of a site's deposits to produce macroscopic and microscopic organic remains.” This goal was partially accomplished by TxDOT at 41MK27 in that the geomorphology of the site was examined in backhoe and stratigraphy trenches to assess the depth and structure of the deposits. It was recognized in the early stages of the investigations that there was no vertical separation of components in the stratigraphy of the site and that the colluvium from the adjacent bluff had probably disturbed the deposits. The assessment of the site's potential, however, was not more involved than those efforts.

Excavation Strategy

Black, Creel, and Ellis (1997:312) “think that an effective strategy for exploring the overall structure of a burned rock midden would be to strip off all covering vegetation, humus, and sediment, laying bare its entire upper surface.” They also state that using a Gradall may be a more efficient method of accomplishing this task than using hand-excavated units. The excavators at 41MK27 used a Gradall to remove the upper 10–20 cm of largely sterile colluvium and attempted to expose the midden and adjacent features in shallow, broad passes of the Gradall's bucket. This approach was used with more success at the Higgins site where the machine operator was more experienced (Black et al. 1998). Black, Creel, and Ellis (1997:311–312) advocate a non-traditional approach to exposing the features revealed in the mechanically stripped area by hand in which units are not used and the excavated matrix is not screened.

The excavators at 41MK27 established hand-excavation units within the stripped area as a means of maintaining horizontal control over the excavations. Unfortunately, the unit size was not standardized, creating multiple problems with artifact provenience in the field and with data analysis during the reporting stage of the project. A similar problem was encountered by the BRM Project with the data from 41MK8 and 41MK9. Black (1997a:185) notes that “it is difficult to understand a compelling rationale behind the in-

consistent unit sizes and orientations and the complicated system of unit designations.” The hand-excavated units at 41MK27 did effectively expose the internal structure of the midden, another recommendation of Black, Creel, and Ellis (1997:312). The structure was documented with photographs, plan maps, and profile drawings.

Sampling Strategy

Black, Creel, and Ellis (1997:313) argue that “burned rock middens are site features, not sites in and of themselves.” They suggest that it is impossible to understand the function of the midden unless the “wider site context is documented” (Black, Creel, and Ellis 1997:313). Partially because the midden was discovered after the rest of the site, the excavations at 41MK27 included substantial non-midden investigations. The excavators used an effective strategy of backhoe trenching to determine where cultural deposits were concentrated. Hand excavation units were then placed to sample the midden and the features to the north and northeast of the midden. Approximately 83 percent of the excavated volume at 41MK27 came from outside the midden.

On another level, Black, Creel, and Ellis (1997:313) argue that a systematic sampling strategy for collecting matrix samples for midden and non-midden areas of a site is important. As the discussions in Appendices C and D indicate, the matrix samples collected from Features IA and II provided important information about site preservation potentials. Additionally, the radiocarbon samples that were collected from feature contexts provided important chronological information that helped refine the major periods of occupation and the age of the midden.

The Corn Creek Sites

The Corn Creek sites, 41MK8 and 41MK9, were both investigated by TxDOT in the late 1970s and reported by Black (1997a) as part of the BRM Project. They are located east of 41MK27 along FM 765 (see Figure 1.1). Site 41MK8 contained three small burned rock middens, only one of which lay within the FM 765

right-of-way. Black (1997a:176–177) describes 41MK8 and Midden 1 as follows:

The burned rock middens are the major cultural features of interest at 41MK8. The absence of any visible sign of other smaller burned rock features (hearths) around the investigated midden at the south end of the site suggests that it was the focal point of the human activities there. Though extramidden sampling was limited, there was no evidence of the surrounding rock clusters (hearths) or scatters that are common at many burned rock midden sites. Also absent are the prodigious quantities of artifacts found at some sites. Because there are so few lithic artifacts and only a limited range of artifact types, all of which can be linked to subsistence activities, we infer that the midden (and the site) was used for a narrow range of functions.

The structure of Midden 1 suggests that it served as a cooking or processing locality. The primary structural evidence for this inference is the central depression, Feature 1, and its two subfeatures, Features 1A and 1B. Feature 1 was a roughly basin-shaped depression measuring about 3-x-4 m with a maximum depth of about 35 cm. The fill of this central depression was lighter in color than that of the surrounding midden and had far fewer rocks, most of which were relatively small and fragmented. Much of the central depression was probably lined by a basin-shaped layer of irregularly spaced limestone slabs, Feature 1A. Within this was a much smaller distinct slab-lined basin, Feature 1B, that measured about .75 m across.

Site 41MK9 was smaller in size than 41MK8. It contained three small burned rock middens, all of which were investigated by TxDOT (Black 1997a). The analysis of the excavated material revealed remarkable variation between middens in terms of structure and content. As Black (1997a:201) notes:

The striking differences between the artifact content of Midden A and that of Middens B

and C suggest that Midden A was the scene of a wider range of behaviors. Among the activities that we infer went on in and around Midden A are flintknapping, woodworking, plant processing, mussel steaming and consumption, and tool refitting. In contrast, Middens B and C have little evidence of any major activities beyond those associated with burned rocks. While the rock lenses of Midden C might not be expected to produce much in the way of artifacts, Midden B is roughly the same size and thickness as Midden A. The relative dearth of artifacts in Midden B suggests that this feature saw limited use and probably served strictly as a cooking facility.

Black (1997a:180, 200) believes that Midden 1 at 41MK8 and the three middens at 41MK9 date to, or were at least in use, during the Late Prehistoric period. This would make them coeval with 41MK27. All three sites share similar topographic settings, all three have small burned rock middens with central depressions, but they demonstrate remarkable variability in terms of artifact assemblages (Table 6.9). The most notable differences in artifact classes between the three sites are 1) the high percentage of bifaces at 41MK27 compared to the other sites, 2) the low percentage of modified flakes at 41MK27 compared to the other sites, 3) the presence of gravers at 41MK27, and 4) the presence of shaping disks at 41MK9. These differences reflect the fact that a variety of different activities took place at each site despite their structural similarities.

Fitting 41MK27 into the Regional Picture

One of the more important conclusions reached by the BRM project was that many middens that were previously attributed to the Archaic period based on projectile points actually formed during the Late Prehistoric period (Black and Creel 1997). Another significant realization was that burned rock midden use did not end with the Austin interval. Black and Creel (1997:282) conclude that “there is abundant evidence, some of it quite incontrovertible, that during the Toyah phase, peoples who had adopted the trappings of Toyah material culture...occupied traditional (here meaning existing and long used) burned rock midden sites and added measurably to the amalgam deposits known as middens.” At 41MK27, Toyah interval *Perdiz* points and the absolute date for the bison tooth from the upper part of the midden indicate that the site was occupied during the last part of the Late Prehistoric and that the midden itself may have been used during this time.

On a regional scale, 41MK27 fits within the pattern noted by Goode (1991) and further supported by Black and Creel (1997) in which many middens in west-central Texas date to the Late Prehistoric period. The Austin interval is increasingly being viewed as “a time of great continuity with the preceding Archaic” (Black and Creel 1997:281). There is also limited evidence to suggest that the Late Prehistoric middens were created by different ethnic groups, an idea best supported by projectile point types with very limited geographic distributions such as *Sabinal* arrow points (Black and Creel 1997:281).

Table 6.9. Comparison of Major Artifact Classes at 41MK8, 41MK9, and 41MK27

| Site | Bifaces | Cores | Projectile Points | Unifaces | Gravers | Shaping Disks | Modified Flakes | Total |
|--------|---------|-------|-------------------|----------|---------|---------------|-----------------|-------|
| 41MK8* | 21 | 19 | 11 | 1 | 0 | 0 | 88 | 140 |
| | 15% | 14% | 8% | 1% | 0% | 0% | 63% | 100% |
| 41MK9* | 52 | 53 | 30 | 11 | 0 | 52 | 287 | 485 |
| | 11% | 11% | 6% | 2% | 0% | 11% | 59% | 100% |
| 41MK27 | 102 | 47 | 33 | 14 | 20 | 0 | 35 | 251 |
| | 41% | 19% | 13% | 6% | 8% | 0% | 14% | 100% |

* Data based on Black (1997a:Tables 20 and 22).

Site Summary

Any statements that can be made about the activities that took place at the site are necessarily general in that they apply to the assemblage as a whole. The occupants were hunters and gatherers whose habitation of any site is presumed to have been intermittent. A major activity at the site involved the use of certain rock features including a small burned rock midden, Feature I. This midden was of the type originally called Burned Rock Midden Type 2 by Weir (1976) and more generally an annular midden by others—a circular accretion of fire-cracked and fractured rock with an obvious central hearth or pit. Feature I was small, about 8 m by 10 m in diameter and some 50 cm thick. A single internal feature (Feature IA) was a rock-lined pit or hearth in the approximate center and bottom of the midden. Of interest is the fact that the rocks that form this feature included an entire metate and two metate fragments. These three examples comprise the entire sample of groundstone recovered at this site.

Lying between the midden and Bluff Creek were a series of small hearths, of which eight were excavated and designated as Features III through X. These small hearths, most of which had been at least somewhat disturbed, appeared to have been simple structures composed of one or more layers of rock. Many of the individual rocks appear to have been fire-fractured in place. No real basin-shaped hearths were observed. Associated with these hearths and the accompanying scatter of living debris in the form of flint and burned rock were significant quantities of freshwater mussel shell. Although the individual specimens are relatively small, the quantities recovered suggest that they served as a source of food. Perhaps the small hearths were used in the processing of these mussels. Very little animal bone was recovered from the site. This may be explained by the poor preservation of such remains rather than the lack of use of animals at the site. The porous nature of the sediments and the movement of water through them would effect the disintegration of animal remains, and those that were found were in fragmentary condition. It is possible that a great deal more processing of animal resources took place than can be proved. One possible indication of this is the number of gravers recovered from the site. Traditionally these implements have been considered as bone-working

tools, yet practically no worked bone was recovered. Again, this is probably due to the poor preservation of bone at the site.

The number of cores, hammerstones, and unfinished bifaces in various stages of the reduction process indicate that flint-knapping activities undoubtedly took place at the site. The presence of suitable raw materials eroding from nearby gravel lenses would make this an expected activity. No clear-cut chipping stations were discerned, although considerable lithic debris was recovered. The heaviest concentrations of debitage were between the midden and the features to the north and northeast. Again, because of the colluvial nature of the sediments, it is expected that the outlines of such chipping areas would be obscured through time by the movements of materials disturbing the original associations.

Concluding Remarks

This report has dealt primarily with the description of excavations and the analyses of artifacts recovered from site 41MK27, a prehistoric campsite located along Bluff Creek in McCulloch County, Texas. Investigations conducted by TxDOT archaeologists in 1978 and 1979 have yielded a robust body of data that answers basic questions posed at the site, from chronology of occupation to potential subsistence activities and technology, and have contributed additional information to the Central Texas region as a whole. The investigations and artifacts from 41MK27 provide a glimpse of prehistoric lifeways from the important Transitional Archaic era and into the Late Prehistoric. Moreover, the study of the central site midden feature has afforded critical data in regards to midden function and technology. At the site level, the investigations produced interesting information on spatial relationships between middens and the overall site and the possible processing of large quantities of mussel shell with burned rock technology. From a regional perspective, in conjunction with results from the recent BRM Project, the 41MK27 investigations have further contributed to a growing database on midden utilization in the Late Prehistoric period of Central Texas, a new direction of thought contrary to the long held ideas of primary midden use in the Archaic.

CHAPTER 7: EXCAVATIONS AT 41MK10

Ann M. Irwin and Doug Drake

Site Description and Excavation Procedures

Site 41MK10 is located on the east side of Bluff Creek, across from Site 41MK27 (see Figure 1.2). Observation of material on the surface indicated that most of the site lies to the east of the right-of-way boundary. Adjacent to the southeastern margin of the right-of-way is a small erosional cut or intermittent tributary gully that cuts into a series of small hearths or midden areas. Areas covered with burned rock were observed along with small pieces of freshwater mussel shell and considerable amounts of chert including a number of cores, bifaces, scrapers, and flakes, and the proximal portion of a broken dart point as well as a complete dart point. This artifact scatter is found on both the eastern and western sides of the erosional gully and the major portion of the site appears to have been bisected by it. This surface scatter of cultural material may lie upon a deflated ground surface with the resulting mixture of levels. It could not be determined to what extent cultural components have been mixed in this way.

Site 41MK10 was investigated June 6–21, 1978, with additional follow-up work February 13–March 2, 1979. Excavations were carried out in anticipation of the loss of the site to the proposed construction of FM 765. To facilitate investigation of this site, vegetation was cleared from the site area and a grid was laid out within the right-of-way using highway station marker 924+00 as the N50/E50 point. The north-south base line was established with a transit using true north, and this base line extended diagonally across the centerline of the right-of-way. Site 41MK10 was contained within the northeast quadrant of the grid. Grid stakes were placed every 20 m in cardinal directions and elevations and secondary datum points were established using a benchmark cut in a rock located 172 ft to the south of

highway station marker 925+25. The elevation at this benchmark is 1404.76 ft (428.17 m) above sea level.

Once the grid was established, a series of 17 backhoe trenches was placed across the site within the right-of-way (Table 7.1; Figure 7.1). Most trenches were culturally sterile; those that were not contained minor amounts of artifacts that were not associated with one another. Following this, four blocks of test units of varying dimensions were placed within the right-of-way—their locations based on the results of the backhoe trenches and visible surface materials. These test units accounted for 10.2 m³ of excavated volume.

Material encountered during the backhoe testing was scattered and appeared to be disturbed. No material was encountered below 50 cm. Initial backhoe tests were deep, in some cases over 2.5 m. However, when nothing was recovered from the lower levels, testing was limited to the upper 1 m in subsequent trenches. The area adjacent to Bluff Creek and within the right-of-way was thoroughly tested by manual excavation (with shovels and trowels) and by backhoe trenches (see Figure 7.1). With the exception of the small hearths in Test Unit I, the area within the right-of-way yielded only occasional isolated artifacts and scattered pieces of burned rock. The hand-excavated test units, with the exception of Test Unit I, yielded very little. Examination of the slope of Bluff Creek and the potential occupation area lying within the right-of-way, combined with evidence from the backhoe tests and manually excavated test units, suggests that the matrix is basically a colluvium derived from the bluffs of the creek. In some areas the colluvium grades into overlying alluvium, and in other areas the boundary between colluvium and alluvium is more distinct. Bluff Creek has cut into its east bank at this locality and a significant layer of poorly sorted gravel seems to have been inset into the alluvium and colluvium. These gravels may be of fairly recent origin. Aboriginal oc-

Table 7.1. Backhoe Test Data from 41MK10

| Backhoe Test | Provenience | Length* | Width* | Depth* | Remarks |
|--------------|-------------------------|---------|--------|--------|------------------------------------------|
| 1 | N27.3-31.3/E64.6-68.3 | 4.2 | 1.3 | 2 | Sterile except for one burned rock |
| 2 | N36-40/E81-82 | 3.4 | 1 | 1.7 | Sterile, with pebbles in north half |
| 3 | N33.65-36.3/E14-16 | 2.7 | 0.9 | 1 | 2 mussel shells, 1 <i>Rabdotus</i> |
| 4 | N91.7-95/E50-54 | 3.3 | n/a | 0.8 | Burned rock, charcoal, <i>Polygyra</i> |
| 5 | N122.5-133.3/E60-63.3 | 2.7 | 1.3 | 1 | 1 burned rock, bedrock at 1 meter |
| 6 | N111-113.4/E56.5-59 | 2.4 | 1.4 | 0.3 | Sterile, bedrock at 0.3 m |
| 7 | N105.3-107.5/E72.5-75.4 | 2.7 | 0.7 | 0.6 | Sterile, hardpack at 0.6 m |
| 8 | N85.5-88/E78-81.9 | 3 | 0.7 | 0.89 | Sterile, hardpack at 0.89 m |
| 9 | N50-60/E50-60 | 4 | 1 | 2.16 | Sterile, 1 mussel shell |
| 10 | N43.3-46/E43.8-47.9 | 3.4 | 1.4 | 1.4 | Sterile, mussel shells on surface |
| 11 | N28.5-31.3/E53.6-56 | 3 | 1.6 | 0.82 | Sterile |
| 12 | N35.6-56.3/E41.7-63.9 | 35.5 | 0.7 | 0.8 | Core, mano, flake, burned rock |
| 13 | N36.6-66.7/E72.6-74.3 | 30.5 | 0.7 | 0.75 | Sterile, cobbles & river pebbles |
| 14 | N18-19.2/E49.8-65 | 15.4 | 0.7 | n/a | Core, flakes, FCR, charcoal, burned clay |
| 15 | N27.9-29.45/E16-32.4 | 26.4 | 0.7 | 0.7 | Sterile, 1 snail shell observed |
| 16 | N70.6-74/E26-37.5 | 17 | 0.7 | 0.75 | Sterile, river pebbles, 1 mussel shell |
| 17 | N70-82/E62-63.5 | 12.3 | 0.7 | 1.1 | Generally sterile, river pebbles |

* All measurements are maximums and are in meters

cupation within the main area of the right-of-way seems to have been disturbed by colluvial action, and much if not most of the material observed may have been displaced by slope wash. In addition, large-scale clearing of mesquite and live oak scrub in order to preserve pastureland has taken place on this property. This process of "chaining," or clearing the vegetation with large chains between tractors, destroys archaeological context.

Excavations

Test Unit 1

There was a small area along the eastern side of the right-of-way that appeared to represent a minimally disturbed portion of the site lying within the right-of-way. Small hearths, represented by accumulations of burned rock, could be seen on the surface, although there was little associated artifactual material. These features were located on the edge of a gully that has removed the eastern portion of at least one of the hearths. The distal tip of a dart point was observed on the surface, as were small pieces of burned rock, shell,

and chert flakes. These hearths were tested by hand in 5-cm levels in Test Unit 1, a 2-x-2-m unit immediately west of an erosional gully (see Figure 7.1). Two small hearths, one relatively intact and one disturbed, were encountered in this test unit (Figure 7.2).

The first hearth (Feature I) was initially tested by a 2-x-2-m unit (N62-64/E90-92), and was further exposed with a 1-x-2-m test unit immediately north (Test Unit 1A) and a 1-x-1-m test unit (Test Unit 1B) immediately east of Test Unit 1A. Each unit was excavated no more than 10 cm before the hearth was completely exposed. After mapping, the hearth fill from the central portion was collected separately and a charcoal sample was taken from the general hearth area. The remaining fill was screened through ¼-in mesh. Level 1 (0–5 cm) revealed fragments of badly broken mussel shell, burned rock, charcoal, four interior flakes, four pieces of small angular chert waste, and one bone fragment. Level 2 (5–10 cm) had more broken mussel shell, burned rock, charcoal, six interior flakes, one primary decortication flake, and one piece of angular chert waste.

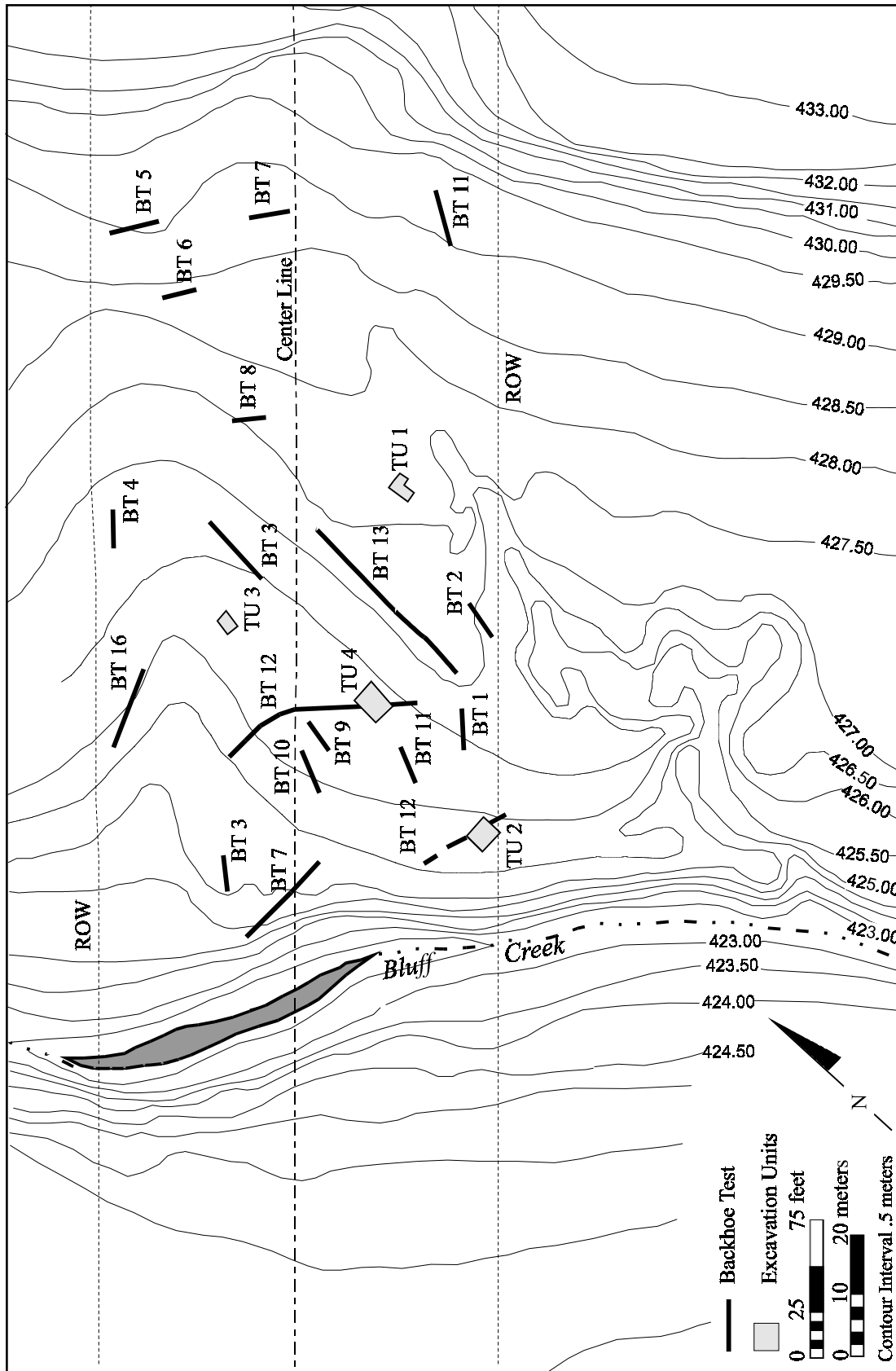


Figure 7.1. Topography and excavation units at 41MK10.

The second hearth (Feature II) was exposed on the afternoon of the last field day and, as such, excavations were hurried and limited. This disturbed hearth was exposed with trowel and brush, cleaned, mapped, and photographed. Feature fill was not collected; all matrix was instead screened through ¼-in mesh. No artifacts were recovered.

Test Unit 2

Test Unit 2 consisted of a 4-x-4-m excavation block (N13-17/E61-65). It was placed adjacent to Backhoe Test 14 after cultural materials were observed in the trench. The initial 10 cm was shovel scraped and discarded. The remaining four levels were hand excavated in 10-cm levels with all matrix screened through ¼-in mesh. Very limited quantities of debitage (burned and unburned), mussel shell, charcoal flecks, and burned limestone were recovered.

An unburned stump and a rodent hole were first uncovered in Level 3 of the southwestern corner of the block. These extended vertically approximately 10 cm and charcoal was observed in association with these disturbances. A distinct circular area (30 cm in diameter) of burned clay and charcoal was noticed in the approximate center of the excavation block. This area spread to the west and was indistinguishable from the surrounding matrix after 1-2 cm of excavation. This was not designated as a feature, and no artifacts were found in direct association with this anomaly. A smaller area (10 x 10 cm) of burned orange clay was uncovered at the bottom of Level 4 in the southern portion of the southwestern quadrant. It, too, was culturally sterile and was not given a feature number. Excavation continued for one more 10-cm level, in which were recovered scattered burned limestone (<5), and small amounts of charcoal, debitage, mussel shell, and burned clay.

Test Unit 3

Test Unit 3 was set up as a 4-x-4-m excavation block (N66-70/E50-54) placed over a linear surface concentration of burned limestone near the N68/E52 stake. Only one 1-x-2-m (N68-70/E52-53) section was actu-

ally excavated, however, and this was with shovels and trowels in 10-cm levels. All matrix was screened through ¼-in mesh. Scattered burned limestone and charcoal continued into Level 2. The burned limestone scatter was approximately 30 cm in diameter, with charcoal found predominantly on the eastern margin of the concentration. Burned and unburned debitage, mussel shell, and burned clay were recovered in Level 2. Excavation continued for one more 10-cm level, but there are no level notes.

Test Unit 4

Test Unit 4 was a partial unit set up on the southwestern face of Backhoe Test 12 after debitage and a mano were recovered. The unit was triangular, extended from the trench wall to the N42/E60 corner stake, and covered 0.25 m² of area. Three 10-cm levels were excavated with shovels and trowels, and all matrix was screened through ¼-in mesh. Recovered artifacts included one mussel shell fragment, one bifacial core, and debitage.

Features

Feature I

Feature I was a hearth located in Test Unit 1. Burned rock, apparently disturbed, was observed on the surface. Subsequent excavation revealed a moderately large hearth (approximately 120 cm in diameter) lying adjacent to a large, flat, natural boulder (see Figure 7.2). A projectile point fragment consistent with *Ensor* point morphology, a graver, debitage, mussel shell, and a broken mano were found in association with this hearth. These indicate multiple, generalized activities. A group of larger, relatively flat stones, which sloped inward toward the center of the hearth, comprised the outer margin of the feature. This led to a field assessment of a possible basin shaped hearth. Field photographs reveal smaller, more angular burned limestone in the center of the feature. The hearth stones were overlain by smaller, more fragmentary rocks. This hearth also lay along the edge of an erosional gully, and a portion of it may have been removed by erosional action.



Figure 7.2. Feature I at 41MK10.

Feature II

Feature II (Figure 7.3) is a small hearth discovered on the western end of Test Unit I on the afternoon of the last day of excavations. This hearth extended outside of the unit and lay below the level of Feature I. Because of the limited time available, this feature was not fully uncovered. A sketch map indicates a roughly semicircular concentration of burned limestone with a maximum dimension of approximately 1 m. No artifacts were recovered in association with it.



Figure 7.3. Feature II at 41MK10.

Description of Materials Recovered

Projectile Points

Castroville (1; Figure 7.4a)

This single specimen is the proximal portion of a *Castroville* dart point, and is characterized by a broad blade, large barbs formed by basal notching, and a broad stem (Turner and Hester 1993:86). The blade appears to have been triangular with even margins. The shoulder shape is very oblique, with the resultant barbs convergent. These barbs have been truncated. The specimen is basally corner-notched with intermediate notch transitions. The stem is slightly expanding with a slightly concave base. There is evidence of slight basal thinning. The blade faces show diminutive later reduction stage flake scars. This specimen was recovered from the deflated surface adjacent to the erosional gully to the east of the right-of-way and was associated with a scatter of burned rock and flint debris. *Castroville* projectile points are found predominantly in central Texas, but are not uncommon in the Lower Pecos region, south Texas, and occasionally in the Texas panhandle (Prewitt 1995:96; Turner and Hester 1993:86). *Castroville* points are dated to the Late Archaic (ca. 2400 B.P.). The incomplete length is 30.1 mm, with an estimated total length of 65 mm. Maximum blade width is 41.2 mm. Thickness at the haft juncture is 5.2 mm.

ENSOR (2; Figure 7.4b, c)

Two *Ensor* projectile point fragments were recovered at 41MK10. *Ensor* points are prevalent in the Transitional Archaic (ca. 1500 B.P.; Turner and Hester 1993:114). They are commonly found in central and south Texas, and extend west to the Lower Pecos and Trans-Pecos regions (Prewitt 1995; Turner and Hester 1993).

The first (Figure 7.4b) is a nearly complete dart point that is missing the distal tip and one corner of the base. The blade is triangular with even margins. The blade face shows diminutive later reduction stage flake scars and marginal modification. The shoulders are weakly

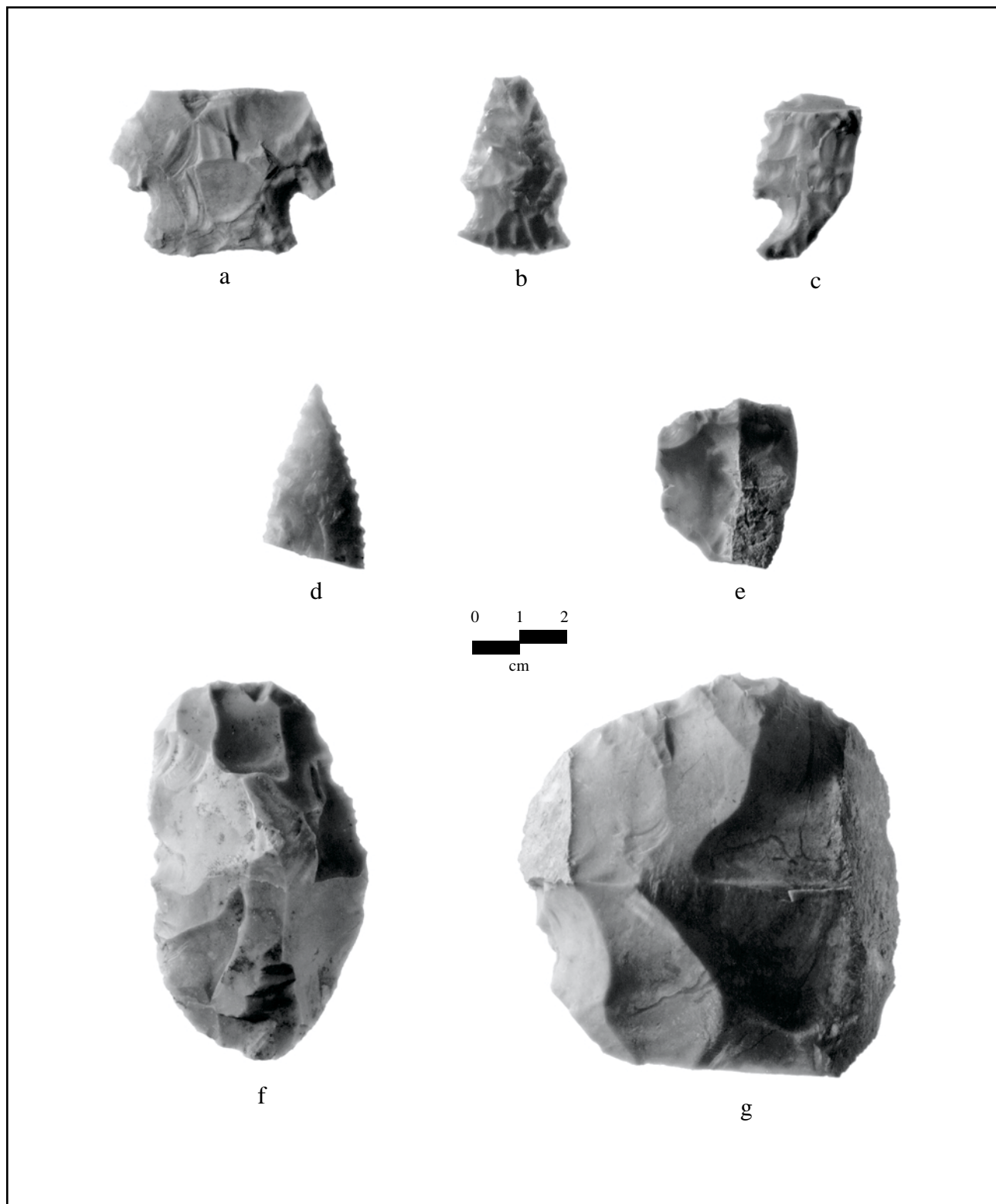


Figure 7.4. *Projectile points and other artifacts from 41MK10.* a: *Castroville* point; b, c: *Ensor* points; d: untyped distal dart point fragment; e: graver; f, g: Reduction Stage 2 bifaces.

rounded, and the specimen is side-notched with gradual notch transitions. The stem is greatly expanding and shows evidence of basal thinning. The base is convex. The cross section at the haft element is bi-convex. This specimen was recovered from the surface along the edge of the gully running along the eastern edge of the right-of-way in association with flint debris and burned rock. The length is 32.7 mm. Maximum blade width is 19.9 mm, and thickness at the haft juncture is 6.5 mm.

The second specimen (Figure 7.4c) is missing the distal tip and one lateral margin. The blade shape appears to be triangular, and the blade margin is irregular. The blade faces show diminutive later reduction stage flake scars and some marginal modification. The shoulder is abrupt. There is a corner notch with some basal narrowing. The notch transition is intermediate. The stem is moderately expanding with slight basal smoothing. This specimen was recovered in association with the northeast corner of Feature I, the hearth in Test Unit 1. The base appears to be concave. Length is 31.6 mm, and the thickness at the haft juncture is 6.2 mm.

Untyped Fragment (1; Figure 7.4d)

The very distal tip of a broken dart point or a very late reduction stage biface was recovered from the surface of Test Unit I. The most distal portion of the tip is missing. The margin is slightly irregular and the faces show diminutive later reduction stage flake scars.

Bifaces

Biface Reduction Stage 2 (2; Figure 7.4f, g)

The first representative (Figure 7.4f) of biface Reduction Stage 2 retains only one small area of cortex. The shape is roughly oval. Attempts were made to thin the piece, attempts which failed, resulting in hinge fractures and probably causing the abandonment of this specimen. Flake scars are relatively large and often deep. The length is 66.6 mm, the width is 37.8 mm, and thickness is 16.9 mm.

The second specimen (Figure 7.4g) of this reduction stage is roughly round in shape and retains two areas of cortex on the ventral surface. Flake scars are large. The length is 71.9 mm, the width is 69.7 mm, and the thickness is 24.9 mm.

Other Artifacts

Graver (1; Figure 7.4e)

This single specimen has a graver tip worked on a small secondary decortication flake. The flake has been split along one margin from the platform to the distal flake terminus. This split face, fashioned through the thickest portion of the flake, is some 14 mm wide. A small, single graver tip has been fashioned along the exterior margin of this face. This is a single-spur graver with fine to moderate marginal modification forming the graving tip. This modification is unifacial on the obverse face.

Scraper (1; Figure 7.5a)

This single specimen is worked on one half of a large split cobble that retains cortex over half of its surface. Cortex has been removed from one lateral margin and slight-to-moderate modification, including step fractures, forms the scraper edge. The length is 99.4 mm, the width is 65.2 mm, and the thickness is 33.6 mm.

Cores (5)

Five multi-directional nodular cores were recovered from 41MK10. Four of them appear to be exhausted and the fifth was rejected.

Hammerstones (2; Figure 7.5b)

Two hammerstones were recovered from 41MK10. The first hammerstone is a water-smoothed cobble that has been broken and shows evidence of battering consistent with its use as a hammerstone. The second is a core that shows extreme battering on both ends, indicating its use as a hammerstone (Figure 7.5b). This

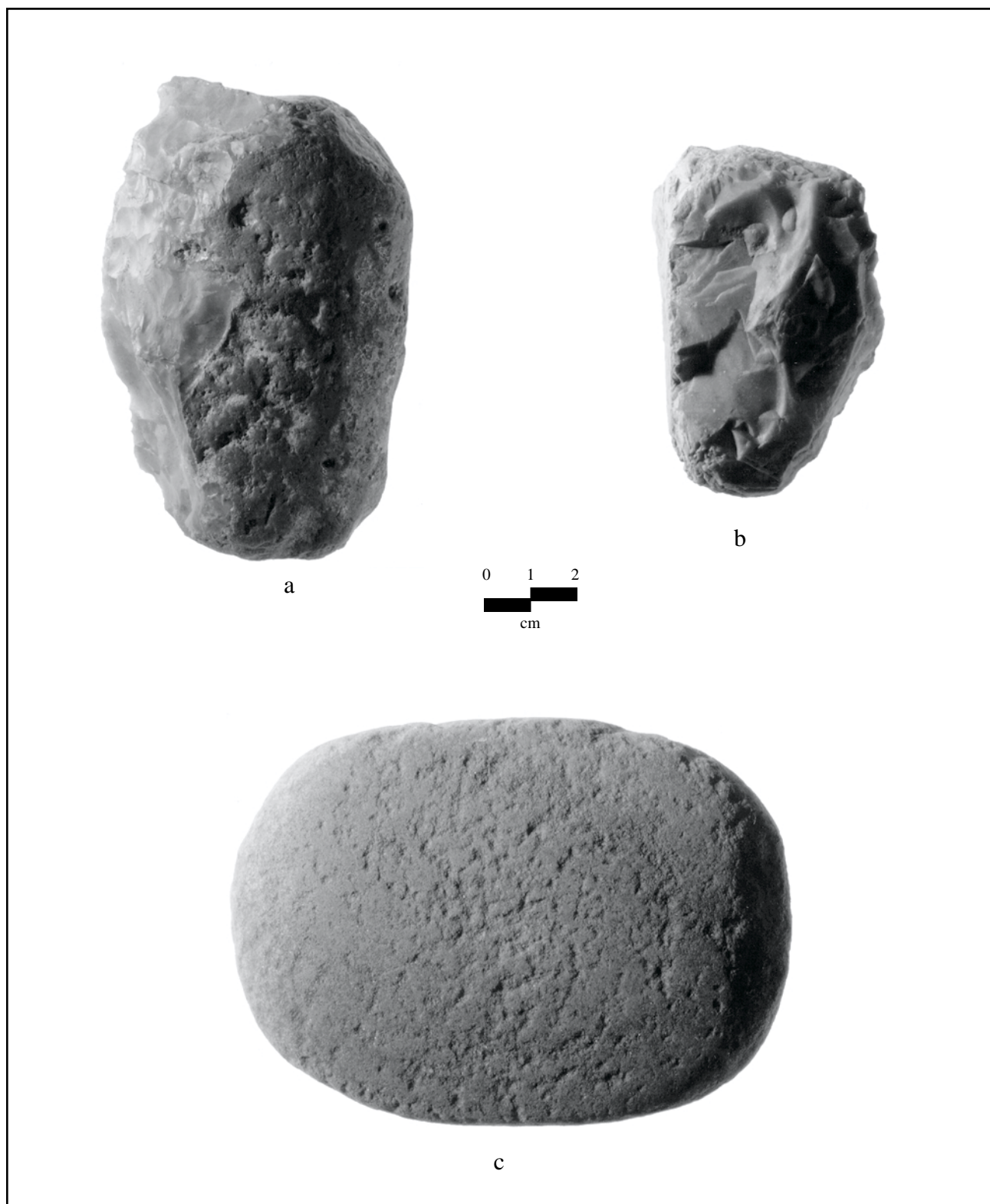


Figure 7.5. *Artifacts from 41MK10.* a: scraper; b: core used as a hammerstone; c: mano.

core was abandoned in the first stages of reduction, possibly due to internal flaws in the stone.

Groundstone

Manos (2; Figure 7.5c)

The first mano (Figure 7.5c) is a complete specimen, a rounded oval in shape. There is evidence of fairly extensive smoothing on both faces. The length is 116.4 mm, the width is 84.1 mm, and the thickness is 35.6 mm. The second specimen is broken and is somewhat less regular in shape. Evidence of grinding appears on one face and along the edges.

Metate (1)

This single specimen represents a fragment of a broken ground stone artifact, probably a metate. Slight evidence of grinding and smoothing appears on one face, and this surface is slightly concave. This specimen is 140 mm long, 71 mm wide, and 53 mm thick.

Conclusions

Because of the limited amount of material recovered from within the right-of-way at this site, relatively little can be said about 41MK10. The site was at least visited in the Late Archaic times, as is evidenced by the presence of the *Castroville* point, which was recovered on the surface and in association with burned rock scatters located along the erosional gully, and in the Transitional Archaic, indicated by the recovery of two *Ensor* projectile points. It is likely, though by no means firmly established, that these dart point types are in fact associated with the use of these features. If this is in fact the case, then we have seen at 41MK10 and 41MK27 a very long tradition of occupation involving the use of small hearths and small burned-rock middens along the banks of Bluff Creek, beginning in the Late Archaic and continuing through the Late Prehistoric.

REFERENCES CITED

- Abbott, J. T.
1993 Geomorphic Context of the Barton Site (41HY202) and the Mustang Branch Site (41HY209). In *Archaic and Late Prehistoric Human Ecology in the Middle Onion Creek Valley, Hays County, Texas*, by R.A. Ricklis and M. B. Collins, pp. 12-1–12-46. Studies in Archeology 19. Texas Archeological Research Laboratory, The University of Texas at Austin.
- Ahler, S. A.
1989 Mass Analysis of Flaking Debris: Studying the Forest Rather than the Trees. In *Alternative Approaches to Lithic Analysis*, edited by D. Henry and G. Odell, pp. 85–118. Archaeological Papers of the American Anthropological Association, No. 1.
- Amick, D. S., and R. P. Mauldin
1989 Comments on Sullivan and Rozen's "Debitage Analysis and Archaeological Interpretation." *American Antiquity* 54:166–168.
- Arbingast, S. A., L. G. Kennamer, R. H. Ryan, J. R. Buchanan, W. L. Hexlep, L. T. Ellis, T. G. Jordan, C. T. Granger, and C. P. Zlatkovick
1976 *Atlas of Texas*. Bureau of Business Research. The University of Texas at Austin.
- Bailey, V.
1905 Biological Survey of Texas. *North American Fauna* 25:1–222.
- Banks, L. D.
1990 *From Mountain Peaks to Alligator Stomachs: A Review of Lithic Sources in the Trans-Mississippi South, the Southern Plains, and Adjacent Southwest*. Memoir 4. Oklahoma Anthropological Society, Norman.
- Barker, R. A., P. W. Bush, and E. T. Baker, Jr.
1994 *Geologic History and Hydrogeologic Setting of the Edwards-Trinity Aquifer System, West-Central Texas*. Water-Resources Investigations Report 94-4039. U.S. Geological Survey, Austin, Texas.
- Bement, L.C.
1991 *Hunter-Gatherer Mortuary Practices During the Archaic in Central Texas*. Unpublished Ph.D. dissertation, The University of Texas at Austin.
- Binford, L. R.
1962 Archeology as Anthropology. *American Antiquity* 28:217–225.
1963 Proposed Attribute List for the Description and Classification of Projectile Points. In *Miscellaneous Studies in Typology and Classification*, by A. M. White, L. R. Binford, and M. L. Papworth, pp. 193–221. Anthropological Papers, No. 19. University of Michigan, Museum of Anthropology.
1972 *An Archaeological Perspective*. Seminar Press, New York.
- Black, S. L.
1989 Central Texas Plateau Prairie. In *From the Gulf to the Rio Grande: Human Adaptation in Central, South, and Lower Pecos Texas*, by T. R. Hester, S. L. Black, D. G. Steele, B. W. Olive, A. A. Fox, K. J. Reinhard, and L. C. Bement, pp. 17–36. Research Series No. 33. Arkansas Archeological Survey, Fayetteville.
1995 Introduction. In *Archeology along the Wurzbach Parkway: Module 1, Introduction, Conceptual Framework, and Contexts of Archeological Investigations in Bexar County, South-Central Texas*, by D. R. Potter, S. L. Black, and K. Jolly, pp. 1–6. Studies in Archeology 17. Texas Archeological Research Laboratory, The University of Texas at Austin.
1997a The Corn Creek Sites, 41MK8 and 41MK9. In *Hot Rock Cooking on the Greater Edwards Plateau: Four Burned Rock Middens in West Central Texas*. Volume 1, by S. L. Black, L. W. Ellis, D. G. Creel, and G. T. Goode, pp. 169–206. Studies in Archeology 22. Texas Archeological Research Laboratory, The University of Texas at Austin. Archeology Studies Program, Report 2. Texas Department of Transportation, Austin.

- 1997b The Honey Creek Site, 41MS32. In *Hot Rock Cooking on the Greater Edwards Plateau: Four Burned Rock Middens in West Central Texas*. Volume 1, by S. L. Black, L. W. Ellis, D. G. Creel, and G. T. Goode, pp. 99–168. Studies in Archeology 22. Texas Archeological Research Laboratory, The University of Texas at Austin. Archeology Studies Program, Report 2. Texas Department of Transportation, Austin.
- Black, S. L., and D. C. Creel
1997 The Central Texas Burned Rock Midden Reconsidered. In *Hot Rock Cooking on the Greater Edwards Plateau: Four Burned Rock Middens in West Central Texas*. Volume 1, by S. L. Black, L. W. Ellis, D. G. Creel, and G. T. Goode, pp. 269–306. Studies in Archeology 22. Texas Archeological Research Laboratory, The University of Texas at Austin. Archeology Studies Program, Report 2. Texas Department of Transportation, Austin.
- Black, S. L., and L. W. Ellis
1997 Introduction: A Study of Four Burned Rock Midden Sites. In *Hot Rock Cooking on the Greater Edwards Plateau: Four Burned Rock Middens in West Central Texas*. Volume 1, by S. L. Black, L. W. Ellis, D. G. Creel, and G. T. Goode, pp. 1–22. Studies in Archeology 22. Texas Archeological Research Laboratory, The University of Texas at Austin. Archeology Studies Program, Report 2. Texas Department of Transportation, Austin.
- Black, S. L., and K. Jolly
1998 Evaluating the Higgins Experiment. In *Archeology along the Wurzbach Parkway: Module 3: Investigation and Experimentation at the Higgins Site (41BX184)*, by S. L. Black, K. Jolly, C. D. Frederick, J. R. Lucas, J. W. Karbula, P. R. Takac, and D. R. Potter, pp. 229–238. Studies in Archeology 17. Texas Archeological Research Laboratory, The University of Texas at Austin.
- Black, S. L., and A. J. McGraw
1985 *The Panther Springs Creek Site: Cultural Change and Continuity within the Upper Salado Creek Watershed, South-Central Texas*. Archaeological Survey Report, No. 100. Center for Archaeological Research, The University of Texas at San Antonio.
- Black, S. L., and D. R. Potter
1995 Defining Historic Contexts for Prehistoric Sites along the Wurzbach Parkway. In *Archeology along the Wurzbach Parkway: Module 1, Introduction, Conceptual Framework, and Contexts of Archeological Investigations in Bexar County, South-Central Texas*, by D. R. Potter, S. L. Black, and K. Jolly, pp. 45–52. Studies in Archeology 17. Texas Archeological Research Laboratory, The University of Texas at Austin.
- Black, S. L., D. G. Creel, and L. W. Ellis
1997 Why Dig Another Burned Rock Midden Site? In *Hot Rock Cooking on the Greater Edwards Plateau: Four Burned Rock Middens in West Central Texas*. Volume 1, by S. L. Black, L. W. Ellis, D. G. Creel, and G. T. Goode, pp. 307–314. Studies in Archeology 22. Texas Archeological Research Laboratory, The University of Texas at Austin. Archeology Studies Program, Report 2. Texas Department of Transportation, Austin.
- Black, S. L., Linda W. E., D. G. Creel, and G. T. Goode
1997 *Hot Rock Cooking on the Greater Edwards Plateau: Four Burned Rock Midden Sites in West Central Texas*. 2 Volumes. Studies in Archeology 22. Texas Archeological Research Laboratory, The University of Texas at Austin. Archeology Studies Program, Report 2. Texas Department of Transportation, Austin.
- Black, S. L., K. Jolly, and D. R. Potter
1998 The Higgins Experiment. In *Archeology along the Wurzbach Parkway: Module 3: Investigation and Experimentation at the Higgins Site (41BX184)*, by S. L. Black, K. Jolly, C. D. Frederick, J. R. Lucas, J. W. Karbula, P. R. Takac, and D. R. Potter, pp. 39–60. Studies in Archeology 17. Texas Archeological Research Laboratory, The University of Texas at Austin.
- Blair, W. F.
1950 The Biotic Provinces of Texas. *The Texas Journal of Science* 2(1):93–117.
- Blair, W. F., and T. H. Hubbell
1938 The Biotic Districts of Oklahoma. *American Midland Naturalist* 20:425–454.

- Blum, M. D., and S. Valastro, Jr.
 1989 Response of the Pedernales River of Central Texas to Late Holocene Climatic Change. *Annals of the Association of American Geographers* 79(3):435–456.
 1992 Quaternary Stratigraphy and Geoarchaeology of the Colorado and Concho Rivers, West Texas. *Geoarchaeology* 7:419–488.
- Bomar, G. W.
 1983 *Texas Weather*. University of Texas Press, Austin.
- Bonnichsen, R.
 1977 *Models for Deriving Cultural Information from Stone Tools*. Paper No. 60. Archaeological Survey of Canada, Ottawa.
- Bousman, C. B.
 1992 Preliminary Oxygen-Isotope Evidence for Late Pleistocene-Early Holocene Climatic Change. *Current Research in the Pleistocene* 9:78–80.
 1994 The Central Texas Pollen Record: A Reinterpretation. *Current Research in the Pleistocene* 11:79–81.
 1998 Paleoenvironmental Change in Central Texas: The Palynological Evidence. *Plains Anthropologist* 43(164):201–219.
- Bousman, C. B., and D. L. Nickels
 1998 Summary, Conclusions, and Recommendations. In *Test Excavations at the Culebra Creek Site, 41BX126, Bexar County, Texas*, by D. L. Nickels, C. B. Bousman, J. D. Leach, and D. A. Cargill, pp. 215–221. Archaeological Survey Report, No. 265. Center for Archaeological Research, The University of Texas at San Antonio. Archeology Studies Program, Report 3. Environmental Affairs Division, Texas Department of Transportation, Austin.
- Bradley, B. A.
 1975 Lithic Reduction Sequences: A Glossary and Discussion. In *Lithic Technology: Making and Using Stone Tools*, edited by E. Swanson. Mouton, distributed by Aldine, Chicago.
- Bryant, V. M., Jr.
 1966 *Pollen Analysis: Its Environmental and Cultural Implications for the Amistad Reservoir Area*. Unpublished Master's thesis, Department of Anthropology, The University of Texas at Austin.
 1967 Pollen Analysis of Sediments in Arenosa Shelter. In *Excavations at Arenosa Shelter, 1965–1966*, by D. Dibble, pp. 77–85. Manuscript on file, Texas Archeological Salvage Project, the University of Texas at Austin.
 1969 *Late Full-Glacial and Postglacial Pollen Analysis of Texas Sediments*. Unpublished Ph.D. dissertation, Department of Anthropology, The University of Texas at Austin.
 1977 A 16,000 Year Pollen Record of Vegetational Change in Central Texas. *Palynology* 1:143–156.
- Bryant, V. M., Jr. and R. G. Holloway
 1985 A Late Quaternary Paleoenvironmental Record of Texas: An Overview of the Pollen Evidence. In *Pollen Records of Late Quaternary North American Sediments*, edited by V. M. Bryant, Jr. and R. G. Holloway, pp. 39–70. American Association of Stratigraphic Palynologist Foundation, Dallas.
- Bryant, V. M., Jr., and H. J. Shafer
 1977 The Late Quaternary Paleoenvironment of Texas: A Model for the Archeologist. *Bulletin of the Texas Archeological Society* 48:1–25.
- Bynum, O. W., and J. L. Coker
 1974 *Soil Survey of McCulloch County, Texas*. USDA Soil Conservation Service. U.S. Government Printing Office, Washington D.C.
- Cargill, D. A.
 1998 History of Investigations at 41BX126. In *Test Excavations at the Culebra Creek Site, 41BX126, Bexar County, Texas*, by D. L. Nickels, C. B. Bousman, J. D. Leach, and D. A. Cargill, pp. 19–25. Archaeological Survey Report, No. 265. Center for Archaeological Research, The University of Texas at San Antonio. Archeology Studies Program, Report 3. Environmental Affairs Division, Texas Department of Transportation, Austin.

- Clark, J. G. D.
 1952 *Prehistoric Europe: The Economic Basis*. Methuen. London.
 1954 *Excavations at Star Carr*. Cambridge.
- Clarke, D. L.
 1978 *Analytical Archaeology*. Columbia University Press, New York.
- Collins, M. B.
 1975 Lithic Technology as a Means of Processual Inference. In *Lithic Technology: Making and Using Stone Tools*, edited by Earl Swanson, pp. 15–34. Mouton, distributed by Aldine, Chicago.
 1994 Late Archaic Evidence in the Project Area. In *Archaic and Late Prehistoric Human Ecology in the Middle Onion Creek Valley, Hays County, Texas*, by R. A. Ricklis and M. B. Collins, pp. 101–190. Studies in Archeology 19. Texas Archeological Research Laboratory, The University of Texas at Austin.
 1995 Forty Years of Archeology in Central Texas. *Bulletin of the Texas Archeological Society* 66:361–400.
- Collins, M. B., C. B. Bousman, and T. K. Perttula
 1993 Historic Context: Quaternary Environments and Archeology in Northeastern Texas. In *Archeology in the Eastern Planning Region, Texas: A Planning Document*, edited by N. A. Kenmotsu and T. K. Perttula, pp. 49–67. Cultural Resource Management Report 3. Department of Antiquities Protection, Texas Historical Commission, Austin.
- Crabtree, Don E.
 1972 *An Introduction to Flintworking*. Occasional Papers of the Idaho State Museum 28. Pocatello.
- Crawford, D. D.
 1973 *An Archaeological Survey on Interstate Highway 10*. Publications in Archaeology 2. Texas State Department of Highways and Public Transportation, Highway Design Division, Austin.
- Creel, D. G., and G. T. Goode
 1997 The Heard Schoolhouse Site, 41UV86. In *Hot Rock Cooking on the Greater Edwards Plateau: Four Burned Rock Middens in West Central Texas*. Volume 1, by S. L. Black, L. W. Ellis, D. G. Creel, and G. T. Goode, pp. 207–234. Studies in Archeology 22. Texas Archeological Research Laboratory, The University of Texas at Austin. Archeology Studies Program, Report 2. Texas Department of Transportation, Austin.
- Dalquest, W. W., E. Roth, and F. Judd
 1969 The Mammal Fauna from Schulze Cave, Edwards County, Texas. *Bulletin of the Florida State Museum* 13:206–276.
- Davis, W. B.
 1974 *The Mammals of Texas*. Bulletin 41. Texas Parks and Wildlife Department, Austin.
- Denton, J. T.
 1976 No-Name Creek Site: A Terrace Site of the Middle and Late Archaic Period in Gillespie County, Texas, in *Archaeology on State Highways and Public Transportation*. Publications in Archaeology 7. Texas State Department of Highways and Public Transportation, Highway Design Division, Austin.
- Diamond, D. D., D. H. Riskind, and S. L. Orzell
 1987 A Framework for Plant Community Classification and Conservation in Texas. *The Texas Journal of Science* 39(3):203–221.
- Dice, L. R.
 1943 *The Biotic Provinces of North America*. University of Michigan Press, Ann Arbor.
- Dillehay, T. D.
 1974 Late Quaternary Bison Population Changes on the Southern Plains. *Plains Anthropologist* 19(65):180–196.
- Dixon, J. R.
 1987 *Amphibians and Reptiles of Texas*. Texas A&M University Press, College Station.
- Ellis, L. W., G. L. Ellis, and C. D. Frederick
 1995 Implications of Environmental Diversity in the Central Texas Archeological Region. *Bulletin of the Texas Archeological Society* 66:401–426.

- Enquist, M.
1987 *Wildflowers of the Texas Hill Country*. Lone Star Botanical, Austin.
- Ensor, H. B., and E. Roemer, Jr.
1989 Comments on Sullivan and Rozen's "Debitage Analysis and Archaeological Interpretation." *American Antiquity* 54:175–178.
- Epstein, J. F.
1963 Centipede and Damp Caves: Excavations in Val Verde County, Texas, 1958. *Bulletin of the Texas Archeological Society* 33:1–129.
- Frison, George C.
1968 A Functional Analysis of Certain Chipped Stone Tools. *American Antiquity* 33(2):149–155.
- Gould, F. W.
1969 *Texas Plants: A Checklist and Ecological Survey*. Texas Agricultural Extension Service, Texas A&M University, College Station.
- Gunn, J.
1984 *Occupation and Settlement in the Lower Fredericksburg Basin on the Edwards Plateau*. Special Report 14. Center for Archaeological Research, The University of Texas at San Antonio.
- Gunn, J., and R. A. Mahula
1977 *Hop Hill: Culture and Climatic Change in Central Texas*. Special Report 5. Center for Archaeological Research, The University of Texas at San Antonio.
- Gunn, J., R. Mahula, and J. B. Sollberger
1976 The Sollberger Distribution—Analysis and Application of a Tool Reduction Sequence. *Journal of the Southern Texas Archaeological Association* 3(4):2–8.
- Hensen, J.
1974 Wildlife. In *Soil Survey of McCulloch County, Texas*, by O. W. Bynum and J. L. Coker, pp. 57–59. U.S. Government Printing Office, Washington, D.C.
- Hester, T. R.
1971 Archeological Investigations at the La Jita Site, Uvalde County, Texas. *Bulletin of the Texas Archeological Society* 42:51–148.
1995 The Prehistory of South Texas. *Bulletin of the Texas Archeological Society* 66:427–459.
1997 Methods of Excavation. In *Field Methods in Archaeology*. Seventh Edition, edited by T. R. Hester, H. J. Shafer, and K. L. Feder; pp. 69–112. Mayfield Publishing Company, Mountain View, California.
- Holloway, R. G., L. M. Raab, and R. Stuckenrath
1987 Pollen Analysis of Late-Holocene Sediments from a Central Texas Bog. *The Texas Journal of Science* 39(1):71–79.
- Holmes, W. H.
1890 A Quarry Workshop of the Flaked-Stone Implement Makers in the District of Columbia. *American Anthropologist* 3:1–26.
- Houk, B. A., and J. C. Lohse
1993 Archeological Investigations at the Mingo Site, Bandera County, Texas. *Bulletin of the Texas Archeological Society* 61:193–247.
- Houk, B. A., C. B. Bousman, D. L. Nickels, and S. A. Tomka
1997 Analysis and Research Issues. In *Phase II Archeological Investigations at Lackland Air Force Base, San Antonio, Texas*, by B. A. Houk and D. L. Nickels, pp. 103–146. Archaeological Survey Report, No. 264. Center for Archaeological Research, The University of Texas at San Antonio.
- Huebner, J. A.
1991 Late Prehistoric Bison Populations in Central and Southern Texas. *Plains Anthropologist* 36(137):343–358.
- Huskey, V.
1935 An Archeological Survey of the Nueces Canyon of Texas. *Bulletin of the Texas Archeological and Paleontological Society* 7:104–114.

- Jarvis, R. W., and D. D. Crawford
 1974 *1971 Archaeological Excavations on Interstate Highway 10, Sutton County, Texas*. Publications in Archaeology 4. Texas State Department of Highways and Public Transportation, Highway Design Division, Austin.
- Jelks, E. B.
 1962 *The Kyle Site: A Stratified Central Texas Aspect Site in Hill County, Texas*. Archaeology Series, No. 5. Department of Anthropology, The University of Texas at Austin.
- Johnson, E. H.
 1931 *The Natural Regions of Texas*. University of Texas Bulletin 3113. Austin.
- Johnson, L., Jr.
 1967 *Toward a Statistical Overview of the Archaic Cultures of Central and Southwest Texas*. Bulletin 12. Texas Memorial Museum, The University of Texas, Austin.
 1987 A Plague of Phases: Recent Sociocultural Taxonomy in Texas Archeology. *Bulletin of the Texas Archeological Society* 57:1–26.
 1994 *The Life and Times of Toyah-Culture Folk: The Buckhollow Encampment, Site 41KM16 of Kimble County, Texas*. Office of the State Archeologist Report 40. Texas Department of Transportation and Texas Historical Commission, Austin.
 1997 *The Lion Creek Site (41BT105): Aboriginal Houses and Other Remains at a Prehistoric Ranchería in the Texas Hill Country (Burnet County)*. Archeology Studies Program, Report 1. Environmental Affairs Division, Texas Department of Transportation, Austin. Report 41, Office of the State Archeologist, Texas Historical Commission, Austin.
- Johnson, L., Jr., and G. T. Goode
 1994 A New Try at Dating and Characterizing Holocene Climates, as well as Archeological Periods, on the Eastern Edwards Plateau. *Bulletin of the Texas Archeological Society* 65:1–51.
- Johnson, L. Jr., D. A. Suhm, and C. D. Tunnell
 1962 *Salvage Archaeology of Canyon Reservoir: The Wunderlich, Footbridge, and Oblate Sites*. Bulletin 5. Texas Memorial Museum, The University of Texas, Austin.
- Keller, J. E., and J. T. Denton
 1976 *Archaeology on State Highway 16. The Crystal Rivers Site and the No-Name Creek Site*. Publications in Archaeology 6 and 7. State Department of Highways and Public Transportation, Highway Design Division, Austin.
- Kelley, J. C.
 1947 The Cultural Affiliations and Chronological Position of the Clear Fork Focus. *American Antiquity* 13:97–108.
 1959 The Desert Cultures and the Balcones Phase: Archaic Manifestations in the Southwest and Texas. *American Antiquity* 24:276–288.
- Kelly, R. L.
 1988 Three Sides of a Biface. *American Antiquity* 53:717–734.
- Kenmotsu, N. A., and T. K. Perttula
 1993 *Archeology in the Eastern Planning Region, Texas: A Planning Document*. Cultural Resource Management Report 3. Department of Antiquities Protection, Texas Historical Commission, Austin.
- Kutac, E. A., and S. C. Caran
 1994 *Birds and Other Wildlife of South Central Texas*. University of Texas Press, Austin.
- Leach, J. D., and C. B. Bousman
 1998 Cultural and Secondary Formation Processes: On the Dynamic Accumulation of Burned Rock Middens. In *Test Excavations at the Culebra Creek Site, 41BX126, Bexar County, Texas*, by D. L. Nickels, C. B. Bousman, J. D. Leach, and D. A. Cargill, pp. 119–145. Archaeological Survey Report, No. 265. Center for Archaeological Research, The University of Texas at San Antonio. Archeology Studies Program, Report 3. Environmental Affairs Division, Texas Department of Transportation, Austin.

- Lidiak, E. G., C. C. Almy, Jr., and J. J. W. Rogers
 1961 Precambrian Geology of Part of the Little Llano River Area, Llano and San Saba Counties, Texas. *Texas Journal of Science* 13(2):255–289.
- Lintz, C., M. Blum, R. Holloway, and L. Scott-Cummings
 1993 Paleoenvironmental Reconstruction. In *Cultural Resource Investigations in the O. H. Ivie Reservoir, Concho, Coleman, and Runnels Counties, Texas*, edited by C. Lintz, W. N. Trierweiler, A. C. Earls, F. M. Oglesbay, M. Blum, P. L. O'Neill, J. Kuhl, R. Holloway, L. Scott-Cummings, and D. Scurlock, pp. 261–343. Technical Report No. 346-I, Mariah and Associates, Inc.
- Lintz, C., W. N. Trierwiler, and J. J. Kuhl
 1993 Introduction. In *Cultural Resource Investigations in the O. H. Ivie Reservoir, Concho, Coleman, and Runnels Counties, Texas*, edited by C. Lintz, W. N. Trierweiler, A. C. Earls, F. M. Oglesbay, M. Blum, P. L. O'Neill, J. Kuhl, R. Holloway, L. Scott-Cummings, and D. Scurlock, pp. 1–44. Technical Report No. 346-I, Mariah and Associates, Inc.
- Loy, T. H., and G. R. Powell
 1977 Archaeological Data Recording Guide. British Columbia Provincial Museum Heritage Record No. 3. Victoria, B.C.
- Luke, C. J.
 1980 *Continuing Archaeology on State Highway 16. The Shep Site (41KR109) and the Wounded Eye Site (41KR107)*. Publications in Archaeology 16. Texas State Department of Highways and Public Transportation, Highway Design Division, Austin.
- 1981 *Test Excavations at Three Burned Rock Midden Sites in Sutton and Schleicher Counties, Texas*. Publications in Archaeology 19. Texas State Department of Highways and Public Transportation, Highway Design Division, Austin.
- Lynch, B. D.
 1981 *Native and Naturalized Woody Plants of Austin and the Hill Country*. Saint Edward's University, Austin.
- McKinney, W. W.
 1981 Early Holocene Adaptations in Central and South-western Texas: The Problem of the Paleoindian-Archaic Transition. *Bulletin of the Texas Archeological Society* 52:91–120.
- McNatt, L.
 1978 *An Archaeological Assessment of Sites 41CJ62, 41CJ69, and 41CJ71, Rush Creek Watershed Comanche County, Texas*. Report 45. Anthropology Laboratory, Texas A&M University, College Station.
- Miller, E. O., and E. B. Jelks
 1952 Archaeological Excavations at the Belton Reservoir, Coryell County, Texas. *Bulletin of the Texas Archeological and Paleontological Society* 23:168–217.
- Moore, G. L.
 1978 *Archaeological Test Excavations at Site 41WM21, Williamson County, Texas*. Report 37 (Revised). Texas A&M Research Foundation Project, College Station.
- Morrow, T.
 1997 A Chip off the Old Block. *Lithic Technology* 22:54–66.
- Muto, G. R.
 1971 *A Technological Analysis of The Early Stages in The Manufacture of Lithic Artifacts*. Unpublished Master's thesis, Idaho State University, Pocatello.
- Neck, R. W.
 1986 The Balcones Fault Zone as a Major Zoogeographic Feature. In *The Balcones Escarpment, Central Texas*, edited by P. L. Abbott and C. M. Woodruff, pp. 35–40. Geological Society of America.
- Nickels, D. L.
 1998 Introduction. In *Test Excavations at the Culebra Creek Site, 41BX126, Bexar County, Texas*, by D. L. Nickels, C. B. Bousman, J. D. Leach, and D. A. Cargill, pp. 1–3. Archaeological Survey Report No. 265. Center for Archeological Research, The University of Texas at San Antonio. Archeology Studies Program, Report 3. Environmental Affairs Division, Texas Department of Transportation, Austin.

- Nickels, D. L., C. B. Bousman, J. D. Leach, and D. A. Cargill
1998 *Test Excavations at the Culebra Creek Site, 41BX126, Bexar County, Texas*. Archaeological Survey Report No. 265. Center for Archeological Research, The University of Texas at San Antonio.
- Nickels, D. L., J. D. Leach, D. A. Cargill, K. A. McRae, and C. B. Bousman
1998 Testing Results. In *Test Excavations at the Culebra Creek Site, 41BX126, Bexar County, Texas*, by D. L. Nickels, C. B. Bousman, J. D. Leach, and D. A. Cargill, pp. 45–118. Archaeological Survey Report, No. 265. Center for Archeological Research, The University of Texas at San Antonio. Archeology Studies Program, Report 3. Environmental Affairs Division, Texas Department of Transportation, Austin.
- Nordt, L. C.
1992 *Archeological Geology of the Fort Hood Military Reservation, Ft. Hood, Texas*. Archeological Research Management Series, Research Report 25. United States Army, Fort Hood, Texas.
1993 *Additional Geoarchaeological Investigations at the Fort Hood Military Reservation, Ft. Hood, Texas*. Archeological Research Management Series, Research Report 29. United States Army, Fort Hood, Texas.
- Patterson, P. E.
1977 A Lithic Reduction Sequence: A Test Case in The North Fork Reservoir Area, Williamson County, Texas. *Bulletin of the Texas Archeological Society* 48:53–82.
1987 *Archaeological Excavations at 41LL78, the Slab Site, Llano County, Texas*. Publications in Archaeology, Report No. 34. Texas State Department of Highways and Public Transportation, Austin, Texas.
- Peter, D. E., D. Prikryl, O. McCormick, and M. A. Demuyneck
1982 Site Excavation Reports: Primary Contract. In *Archaeological Investigations at the San Gabriel Reservoir Districts, Central Texas*. Volume 1, edited by T. R. Hays, pp. 8-1–8-156. Archaeology Program, Institute of Applied Sciences, North Texas State University, Denton.
- Pertulla, T. K., M. R. Miller, R. A. Ricklis, D. J. Prikryl, and C. Lintz
1995 Prehistoric and Historic Aboriginal Ceramics in Texas. *Bulletin of the Texas Archeological Society* 66:175–235.
- Potter, D. R., and S. L. Black
1995 *Archeology Along the Wurzbach Parkway. Module 2. Initial Testing and Evaluation of Five Prehistoric Sites in the Upper Salado Watershed, Bexar County, Texas*. Studies in Archeology 18. Texas Archeological Research Laboratory, The University of Texas at Austin.
- Potter, D. R., S. L. Black, and K. Jolly
1995 *Archeology Along the Wurzbach Parkway. Module 1. Introduction, Conceptual Framework, and Contexts of Archeological Investigations in Bexar County, South-Central Texas*. Studies in Archeology 17. Texas Archeological Research Laboratory, The University of Texas at Austin.
- Prewitt, E. R.
1981 Cultural Chronology in Central Texas. *Bulletin of the Texas Archeological Society* 52:65–89.
1985 From Circleville to Toyah: Comments on Central Texas Chronology. *Bulletin of the Texas Archeological Society* 54:201–238.
- Prewitt, E. R., and R. E. Filson
1978 *An Assessment of Archeological Resources to be Affected by Floodwater Retarding Structure 6A, Southwest Laterals of the Colorado River, McCulloch County, Texas*. Technical Bulletin 23. Texas Archeological Survey, The University of Texas, Austin.
- Ricklis, R. A.
1992 The Spread of a Late Prehistoric Bison Hunting Complex: Evidence from the South-Central Coastal Prairie of Texas. *Plains Anthropologist* 37(140):261–273.

- 1994 Toyah Components: Evidence for Occupation in the Project Area during the Latter Part of the Late Prehistoric Period. In *Archaic and Late Prehistoric Human Ecology in the Middle Onion Creek Valley, Hays County, Texas*, by R. A. Ricklis and M. B. Collins, pp. 207–316. Studies in Archeology 19. Texas Archeological Research Laboratory, The University of Texas at Austin. 1994 Late Archaic Evidence in the Project Area. In *Archaic and Late Prehistoric Human Ecology in the Middle Onion Creek Valley, Hays County, Texas*, by R. A. Ricklis and M. B. Collins, pp. 101–190. Studies in Archeology 19. Texas Archeological Research Laboratory, The University of Texas at Austin.
- Ricklis, R. A., and M. B. Collins
1994 Introduction. In *Archaic and Late Prehistoric Human Ecology in the Middle Onion Creek Valley, Hays County, Texas*, by R. A. Ricklis and M. B. Collins, pp. 1–10. Studies in Archeology 19. Texas Archeological Research Laboratory, The University of Texas at Austin.
- Scheutz, M. K.
1957 A Report on Williamson County Mound Material. *Bulletin of The Texas Archeological Society* 28:135–168.
- Schmidly, D. J.
1983 *Texas Mammals East of the Balcones Fault Zone*. Texas A&M University Press, College Station.
- Sellards, E. H., W. S. Adkins, and F. B. Plummer
1981 *The Geology of Texas*. Volume 1: Stratigraphy. Bulletin 3232. The University of Texas at Austin.
- Shafer, H. J.
1967 *An Archeological Survey of Robert Lee Reservoir, Coke County, Texas*. Survey Reports 4. Texas Archeological Salvage Project, The University of Texas, Austin.
1969 *Archeological Investigations in Robert Lee Reservoir Basin West Central Texas*. Papers of the Texas Archeological Salvage Project 17. The University of Texas, Austin.
1975 Ring Shaped Burned Rock Middens in Brown and Comanche Counties, Texas. *Newsletter of the Central Texas Archaeological Society* 9(9).
- Shafer, H. J., E. P. Baxter, and T. B. Stearns
1976 *Archeological Assessment at Upper Pecan Bayou and Brownwood Laterals Watersheds Brown County, Texas*. Report 29. Anthropology Laboratory, Texas A&M University, College Station.
- Sharrock, F. W.
1966 *Prehistoric Occupation Patterns in Southwest Wyoming and Cultural Relationships with the Great Basin and Plains Culture Area*. Anthropological Papers 77. University of Utah.
- Sorrow, W. M.
1969 *Archeological Investigations at the John Ischy Site: A Burnt Rock Midden in Williamson County, Texas*. Papers of the Texas Archeological Salvage Project 18. The University of Texas, Austin.
- Sorrow, W. M., H. J. Shafer, and R. E. Ross
1967 *Excavations at Stillhouse Hollow Reservoir*. Papers of the Texas Archeological Salvage Project 11. The University of Texas, Austin.
- Spearing, D.
1991 *Roadside Geology of Texas*. Mountain Press Publishing Company, Missoula, Montana.
- Stahle, D. W., and M. K. Cleaveland
1995 Texas Paleoclimatic Data from Daily to Millennial Time Scales. In *The Changing Climate of Texas: Predictability and Implications for the Future*, edited by J. Norwine, J. R. Giardino, G. R. North, and J. B. Valdes, pp. 49–69. GeoBooks, Texas A&M University, College Station.
- Suhm, E. A.
1960 A Review of Central Texas Archeology. *Bulletin of the Texas Archeological Society* 29:63–108.
- Suhm, D. A., and E. B. Jelks
1962. *Handbook of Texas Archeology: Type Descriptions*. Bulletin 4. Texas Memorial Museum, The University of Texas, Austin.
- Suhm, D. A., A. D. Krieger, and E. B. Jelks
1954 An Introductory Handbook of Texas Archeology. *Bulletin of the Texas Archeological Society* 25.

Sullivan, A. P., III, and K. C. Rozen

- 1985 Debitage Analysis and Archaeological Interpretation. *American Antiquity* 50:755–779.

Wormington, H. M.

- 1957 *Ancient Man in North America*. The Denver Museum of Natural History, Denver.

Tomenchuk, J., and P. L. Storck

- 1997 Two Newly Recognized Paleoindian Tool Types: Single- and Double-Scribe Compass Gravers and Coring Gravers. *American Antiquity* 62: 508–522.

Toomey, R. S., III, M. D. Blum, and S. Valastro, Jr.

- 1993 Late Quaternary Climates and Environments of the Edwards Plateau, Texas. *Global and Planetary Change* 7:299–320.

Treece, A. C.

- 1993 Summary and Conclusions. In *Cultural Resource Investigations in the O. H. Ivie Reservoir, Concho, Coleman, and Runnels Counties, Texas. Volume III: Data Recovery Results from Non-Ceramic Sites*, by A. C. Treece, C. Lintz, W. N. Trierweiler, J. M. Quigg, and K. A. Miller, pp. 477–598. Technical Report No. 346-III. Mariah Associates, Inc., Austin.

Trierweiler, W. N., A. C. Earls, P. L. O'Neill, F. M. Oglesby, and C. Lintz

- 1993 Methods of Investigation. In *Cultural Resource Investigations in the O. H. Ivie Reservoir, Concho, Coleman, and Runnels Counties, Texas. Volume I: Project Introduction, Setting and Method*, by C. Lintz, W. N. Trierweiler, A. C. Earls, F. M. Oglesby, M. Blum, P. L. O'Neill, J. Kuhl, R. Holloway, L. Scott-Cummings, and D. Scurlock, pp. 111–139. Technical Report No. 346-I. Mariah Associates, Inc., Austin.

Turner, E. S., and T. R. Hester

- 1993 *A Field Guide to Stone Artifacts of Texas Indians*. Second Edition. Texas Monthly Field Guide Series. Gulf Publishing Company, Houston, Texas.

Weir, F. A.

- 1976 *The Central Texas Archaic*. Unpublished Ph.D. dissertation, Department of Anthropology, Washington State University, Pullman.

Wilmsen, E. N.

- 1970 *Lithic Analysis and Cultural Inference: A Paleo-Indian Case*. Anthropological Papers of The University of Arizona 16. Tucson.

**APPENDIX A: METRIC AND DESCRIPTIVE
ARTIFACT MODIFIERS**

Metric Artifact Modifiers

- a. Total Length (Figures A.1a and A.2a): “Measured perpendicularly from the baseline to the distal blade tip” (Ahler 1971:21).
- b. Maximum Blade Width (Figures A.1b and A.2b): the greatest distance, measured parallel to the baseline, between any two points on the blade, distal to the haft element.
- c. Blade Base Width (Figures A.1c and A.2c): “The distance between the two points, one on each lateral blade margin, nearest the baseline, measured parallel to the baseline” (Ahler 1971:22).
- d. Maximum Blade Width Position: the position of maximum blade width relative to the haft juncture. This feature is recorded as zero when the maximum blade width occurs at the point of haft juncture (Figure A.1d). When the position of maximum blade width lies distal to the haft juncture, the distance is recorded as a positive number (Figure A.2d). When the position of maximum blade width lies proximal to the point of haft juncture, this distance is recorded as a negative number.
- e. Thickness at Haft Juncture: the greatest distance, measured perpendicularly to the baseline and centerline, between any two points on the artifact at the point of haft juncture.
- f. Haft Element Length (Figures A.1f and A.2f): the average perpendicular distance from the baseline to the two points on the lateral haft element margins at the point of juncture with the blade, known as the haft element juncture.
- g. Proximal Haft Element Width (Figures A.1g and A.2g): “the distance between the two points, one on each lateral haft element margin, most proximally positioned and at which the orientation of the lateral haft element margin is most nearly parallel to the centerline, measured parallel to the baseline” (Ahler 1971:22).
- h. Distal Haft Element Width (Figures A.1h and A.2h): “the distance between two points, one on each lateral haft element margin, which are more distally located than the proximal haft element points [g], and at which the orientation of the lateral haft element margin is most nearly parallel to the centerline, measured parallel to the baseline” (Ahler 1971:22)
- i. Basal Contact Width (Figures A.1i and A.2i): “the maximum distance between points of tangency on the baseline” (Ahler 1971:22).
- j. Basal Curvature (Figures A.1j and A.2j): a measure of the degree to which the base is either concave or convex. A straight base is recorded as a zero. The degree of concavity is recorded as a positive number, and the degree of convexity is recorded as a negative number.

Descriptive Artifact Modifiers

Tip Shape

First Column (Angle formed by the distally convergent tangents and the complete lateral margins)

- a. Acicular <20°
- b. Sharp 20–40°
- c. Dull >40°

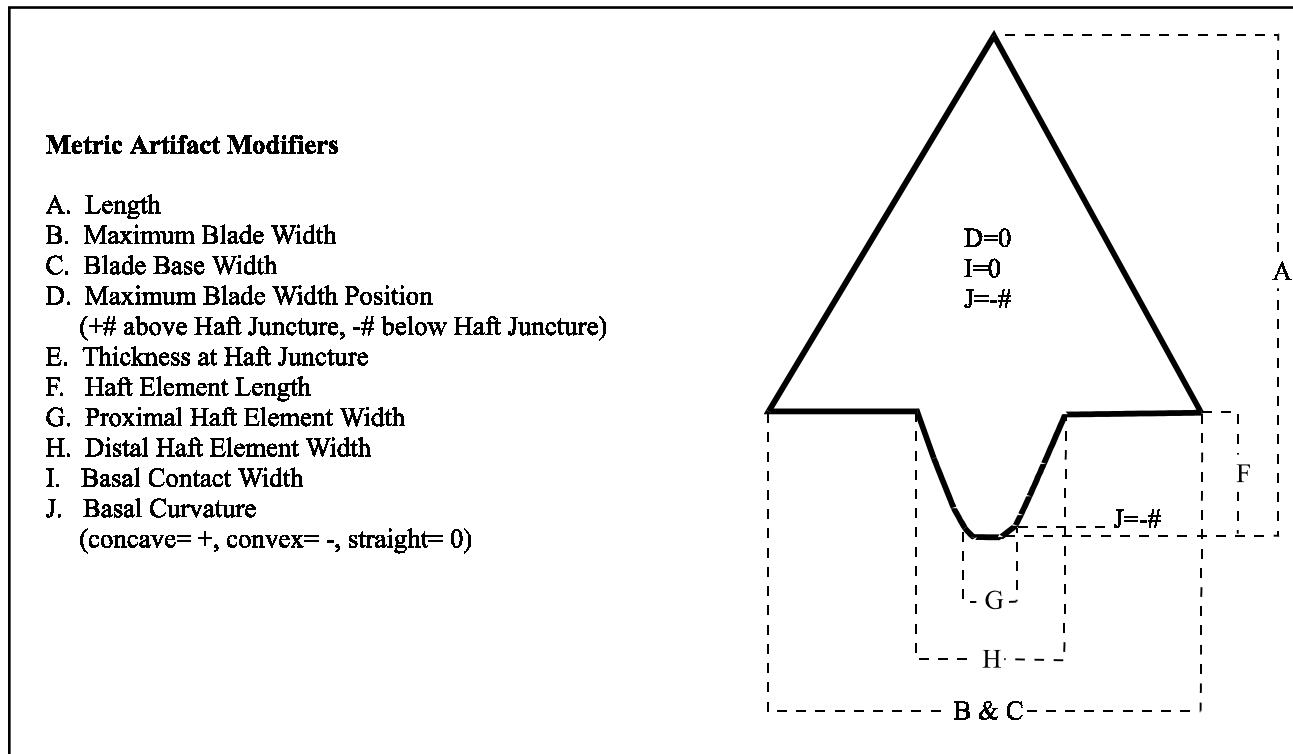


Figure A.1. Metric artifact modifiers for contracting stem projectile points.

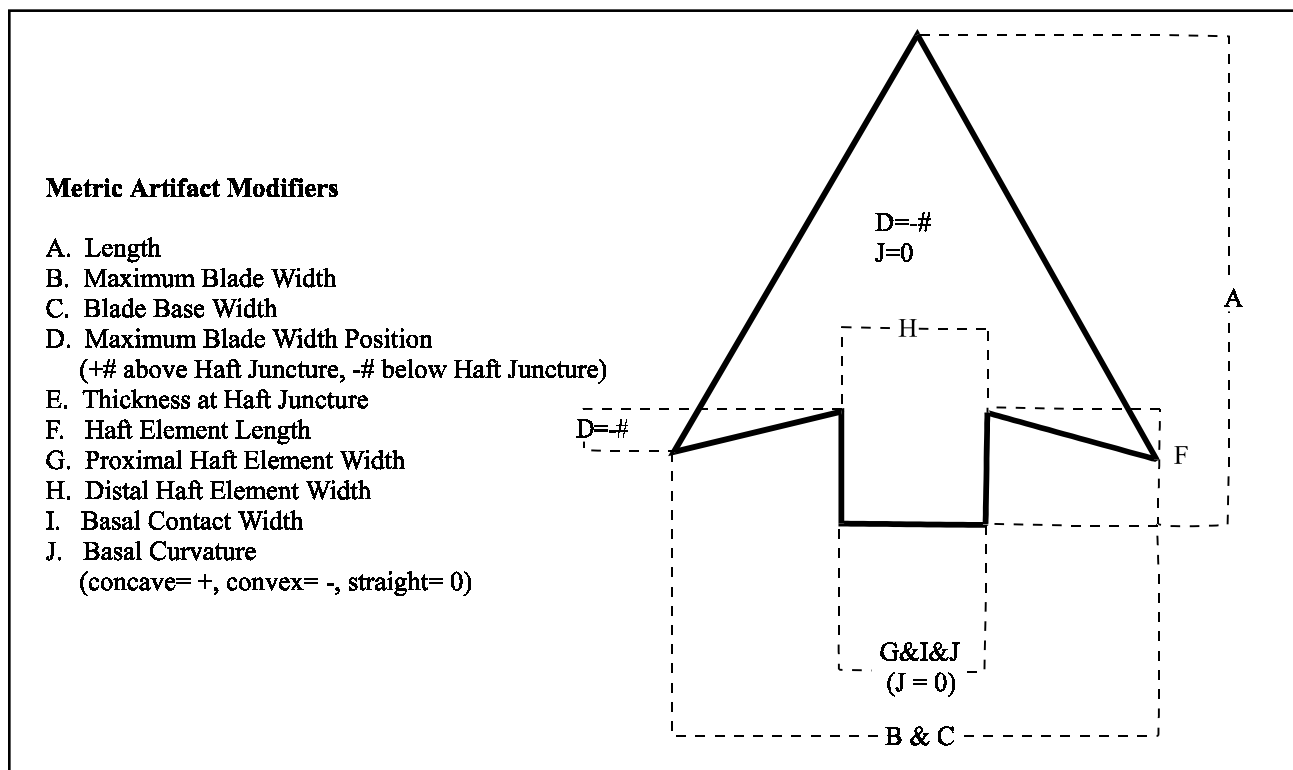


Figure A.2. Metric artifact modifiers for straight stem projectile points.

Second Column (Shape of distal terminus or tip)

- a. The angle formed by the tangents to the distal terminus is equal to the angle formed by the tangents to the complete lateral margins (i.e., a pointed tip).
- b. The angle formed by the tangents to the distal terminus is more acute than that formed by the tangents to the complete lateral margins (i.e., a recurved tip).
- c. The angle formed by the tangents to the distal terminus is more obtuse than that formed by the tangents to the complete lateral margins (i.e., a blunt tip).

Blade Shape**First Column (Shape)**

- a. Triangular: “blade...whose edges describe a straight line between the proximal defining points of the blade and the tip. The widest part of the blade is between the proximal defining points” (Binford 1963:200).
- b. Excurvate: “blades...whose edges describe convex lines between the proximal defining points of the blade and the tip. The widest part of the blade is not between the proximal defining points” (Binford 1963:200).
- c. Incurvate: “blades...whose edges describe concave lines between the proximal defining points of the blade and the tip. The widest part of the blade is between the proximal defining points” (Binford 1963:200)
- d. Recurved: “a chipped-point blade shape modifier of a combination of excurvate and incurvate blade forms on a single blade where from the apex to the shoulder an excurvate blade becomes incurvate” (Loy and Powell 1977:61).
- e. Parallel-Ovate (Parallel-Excurvate): “blades...whose edges describe convex lines diverging from the tip to intersect straight parallel lines along the lateral edge. The straight lines then pass through the proximal defining points of the blade. The widest part of the blade is between the parallel straight lines” (Binford 1963:200).
- f. Contracting-Excurvate: “a chipped-point blade modifier referring to a combination of excurvate and straight blade forms where, from the apex to the shoulder, an excurvate blade becomes straight and forms an acute angle to the longitudinal axis” (Loy and Powell 1977:45).
- g. Excurvate-Incurvate (Bicurved): “blades...whose edges describe concave-convex reverse arcs between the proximal defining points of the blade and the tip” (Binford 1963:200).
“A chipped-point blade shape modifier describing a combination of incurvate and excurvate blade forms where, from the apex to the shoulder, an incurvate blade becomes excurvate” (Loy and Powell 1977:40).
- h. Incurvate-Incurvate: “a chipped-point blade shape modifier describing a form where each blade is composed of two incurvate lines” (Loy and Powell 1977:53).
- i. Angular: blades whose edges describe straight lines diverging from the tip to intersect straight parallel lines which continue to the proximal defining points of the blade. The widest part of the blade is between the parallel straight lines.
- j. Expanding-Ovate: “blades ... whose edges describe convex lines diverging from the tip to intersect straight edges expanding from the proximal defining points to the point of intersection with the convex

lines. The widest part of the blade is at the point of intersection between the straight and convex lines” (Binford 1963:200).

- k. Contracting-Ovate: “blades...whose edges define convex lines diverging from the tip to intersect straight lines along the lateral edge of the projectile. The straight lines then continue to the proximal defining points of the blade. The widest part of the blade is between the proximal defining points of the blade” (Binford 1963:200).

Blade Margin Treatment

First Column (Type)

- a. Even: “chips removed so as to produce a regular smooth definition of the lateral edge” (Binford 1963:207).
- b. Irregular: “lateral edge lacks a clear even definition. Many scar notches occurring in a nonsymmetrical pattern” (Binford 1963:207).
- c. Serrated: “chips removed so as to produce regular notches in the lateral edge of the piece” (Binford 1963:207).
- d. Right Alternate Bevel: blade margin is beveled on the right lateral margin of the obverse face and the left lateral margin of the reverse face.
- e. Left Alternate Bevel: blade margin is beveled on the left lateral margin of the obverse face and the right lateral margin of the reverse face.
- f. Unifacial Bevel: blade margin(s) of either the obverse or reverse face show beveling.
- g. Simple Marginal Edge Trimming: the blade margin is trimmed, generally by simple percussion, so that small irregularities are removed and the edges given a more regular outline. This trimming is of limited extent and flake scars may be of varying shape and size.
- h. Pressure Edge Trimming, Shallow: blade margins exhibit fine and shallow removals, generally produced by applying a grinding pressure with a pressure tool. The resultant blade edge is strengthened and smoothed.
- i. Pressure Edge Trimming, Invasive: blade margins exhibit a series of fine removals that extend farther into the face of the artifact than in pressure edge trimming, shallow. These removals, generally produced by pressure-flaking, may show intentional orientation and may have been individually struck.

Second Column (Degree)

These degree indicators have not been metrically quantified and are somewhat subjective.

- a. Slight: indicates an expression of the trait noted in column one which ranges from barely discernible to noticeable though delicate.
- b. Moderate: an expression intermediate between slight and heavy.
- c. Heavy: an expression of the trait noted in column one that is immediately obvious as a major attribute of the blade.

Blade Face Treatment

First Column (Dorsal/Obverse Face)

- a. Early reduction stage flake scars: generally massive and deep percussion flake scars used to remove the cortex, reduce the mass and provide the initial shaping of bifaces in the first and second stages of the biface reduction sequence.
- b. Massive later reduction stage flake scars: relatively shallow flake scars representing the later stages of the biface reduction sequence (Stages III–V) and extending at least halfway across the biface. They will, in general, be considerably more shallow than early reduction stage flake scars. They are produced by pressure or percussion.
- c. Diminutive later reduction stage flake scars: shallow flake scars representing the later biface reduction stages (IV–V) and extending less than halfway across the biface. These are often but not always lamellar, ovate, or expanding in shape, and can be produced by pressure or percussion.
- d. Marginal modification: any type of intentional marginal modification including serration, beveling, intentional simple marginal edge trimming, pressure edge trimming, etc.
- e–o. various combinations of the above.
- p. Unmodified flake face: no modification present.
- q. Unmodified cortex face: no modification present.

Second Column (Ventral/Reverse Face)

Same as above

Shoulder Shape

First Column (Shape)

- a. Negative: the angle formed by the shoulder and a line parallel to the centerline and passing through the haft element juncture exceeds 180E.
- b. Straight: the angle formed by the shoulder and a line parallel to the centerline and passing through the haft element juncture equals 180E.
- c. Sloping: the shoulder lies at an angle of between 180E and 160E from a line parallel to the centerline and passing through the haft element juncture.
- d. Weak Rounded: the shoulder lies at an angle of between 160E and 120E from a line parallel to the centerline and passing through the haft element juncture.
- e. Rectangular: the shoulder lies at an angle of between 120E and 90E from a line parallel to the centerline and passing through the haft element juncture.
- f. Abrupt: the shoulder lies at an angle of 90E from a line parallel to the centerline and passing through the haft element juncture.
- g. Weakly Oblique: the shoulder lies at an angle of between 90E and 70E from a line parallel to the centerline and passing through the haft element juncture, forming a weakly oblique barb.
- h. Moderately Oblique: the shoulder lies at an angle of between 70E and 40E from a line parallel to the centerline and passing through the haft element juncture, forming a moderately oblique barb.

- i. Very Oblique: the shoulder lies at an angle of between 40E and 20E from a line parallel to the centerline and passing through the haft element juncture, forming a very oblique barb.
- j. Basally Parallel: the shoulder lies at an angle of between 20E and 0E from a line parallel to the centerline and passing through the haft element juncture, forming a basally parallel barb.

Barbs

First Column (Shape)

- a. Rectangular: the proximal terminus of the barb approximates a right-angled parallelogram.
- b. Convergent: the proximal terminus of the barb is formed by two convergent sides such that the terminus approximates a point.
- c. Divergent: the proximal terminus of the barb is formed by two divergent sides such that the greatest width of the barb occurs at its proximal terminus.

Second Column (Length)

- a. None: no barb present.
- b. Truncated: the barb is truncated by a break.
- c. Slightly extended: the barb extends no more than 30 percent of the length of the stem.
- d. Moderately extended: the barb extends from 30 percent to no more than 60 percent of the length of the stem.
- e. Very extended: the barb extends from 60 percent to no more than 90 percent of the length of the stem.
- f. Fully extended: the barb extends from 90 percent to 100 percent of the length of the stem.
- g. Hyper-extended: the barb extends to a distance greater than the total length of the stem.

Notches

First Column (Location)

- a. None: no notches present.
- b. Medial: notches occur in the distal two-thirds of the blade margin.
- c. Side: notches occur in the proximal one-third of the blade margin. There is no basal margin removal.
- d. Side with some basal narrowing: notches occur in the proximal one-third of the blade margin and there is some basal margin removal or narrowing.
- e. Laterally corner-notched: intermediate between side with some basal narrowing and apically corner-notched. There is removal of both some lateral margin and some basal margin.
- f. Apically corner-notched: notches originate from the apex of the proximal corners. They are oriented distally and toward the centerline. There is some lateral margin removal and some basal margin removal.
- g. Basally corner-notched: notches originate from the basal margin and remove the proximal corners. This is intermediate between apically corner-notched and basal with some margin removal.

- h. Basal with some margin removal: notches originate from the basal margin and remove more lateral margin than basal margin.
- i. Basal with lateral notches: notches originate from the basal margin and are oriented toward the distal end of the point. Notches are located laterally along the basal margin, though there is no removal of the lateral margins.
- j. Basal with central notch: notch originates from the basal margin and is oriented toward the distal tip. There are one or more notches located in the center of the basal margin.

Second Column (Shape)

- a. Notch transition, gradual: the notch margins describe a gradual, rounded curve.
- b. Notch transition, intermediate: the notch margins describe a transition intermediate between gradual and abrupt.
- c. Notch transition, abrupt: the notch margins approach or reach parallel.

Stem Shape

First Column (Shape)

- a. Straight: the lateral stem margins are parallel to the centerline and intersect the base at right angles.
- b. Contracting: the lateral stem margins converge toward the proximal end. The widest part of the stem is at the proximal end.
- c. Expanding: the lateral stem margins diverge toward the proximal end. The widest part of the stem is at the proximal end.
- d. Angular: the lateral stem margins diverge from the point of juncture with the blade and then converge toward the proximal end. The distal and proximal portions of the stem margins meet at an obtuse angle, with the widest portion of the stem at this angle.
- e. Rounded: the lateral stem margins describe curved lines from the point of juncture with the blade to the point of juncture with the base.

Second Column (Degree of expansion or contraction)

- a. Slight: the lateral stem margins form an angle of between 5E and 15E with a line parallel to the centerline and passing through the haft element juncture.
- b. Moderate: the lateral stem margins form an angle of between 15E and 30E with a line parallel to the centerline and passing through the haft element juncture.
- c. Great: the lateral stem margins form an angle of greater than 30E with a line parallel to the centerline and passing through the haft element juncture.

Stem Margin Treatment

First Column (Type)

- a. Even: “chips removed so as to produce a regular smooth definition of the lateral edge” (Binford 1963:207).
- b. Irregular: “lateral edge lacks a clear even definition. Many scar notches occurring in a nonsymmetrical pattern” (Binford 1963:207).

- c. Serrated: “chips removed so as to produce regular notches in the lateral edge of the piece” (Binford 1963:207).
- d. Right alternate bevel: the stem margins are beveled on the right lateral margin of the obverse face and the left lateral margin of the reverse face.
- e. Left alternate bevel: the stem margins are beveled on the left lateral margin of the obverse face and the right lateral margin of the reverse face.
- f. Double bevel: the stem margins are beveled to both the obverse and reverse faces on each side. The resultant stem cross sections range from lenticular with doubly beveled edges through bi-plano with doubly beveled edges to bi-concave with doubly beveled edges.
- g. Unifacial bevel: the stem margins of either the obverse or reverse face show beveling.
- h. c + d
- i. c + e
- j. c + f
- k. c + g
- l. Ground: the stem margins have been smoothed by rubbing with or against an abrasive object.
- m. Polished: the stem margins have been polished by use to a relatively bright luster, which may or may not extend onto the flake scars converging to the margin.
- n. Lateral thinning: the stem margin has been intentionally reduced in thickness by the removal of a series of small flakes directed toward the center.
- o. Simple marginal edge trimming: the stem margin is trimmed, generally by percussion, so that small irregularities are removed and the edges given a more regular outline.
- p. Pressure edge trimming, shallow: stem margins exhibit fine and shallow removals, generally produced by applying a grinding pressure with a pressure tool. The resultant stem edge is strengthened and smoothed.
- q. Pressure edge trimming, invasive: stem margins exhibit a series of fine removals that extend farther into the face of the stem than in shallow pressure edge trimming. This marginal trimming, generally accomplished by pressure flaking, may show intentional orientation and flakes that were individually struck.

Second Column (Degree)

- a. Slight: indicates an expression of the trait noted in the above column that ranges from barely discernible to noticeable though delicate.
- b. Moderate: an expression of the trait that is intermediate between slight and heavy.
- c. Heavy: an expression of the trait noted above that is immediately obvious as a major attribute of the stem margin.

Stem/Base Face Treatment

First Column (Dorsal/Obverse Face)

- a. Early reduction stage flake scars: generally massive and deep percussion flake scars used to remove the cortex, reduce the mass, and provide the initial shaping of bifaces in the first and second stages of the biface reduction sequence.
- b. Massive later reduction stage flake scars: relatively shallow flake scars representing the later stages of the biface reduction sequence (Stages III–V) and extending at least halfway across the biface. They will, in general, be considerably more shallow than the early reduction stage flake scars. They are produced by pressure or percussion.
- c. Diminutive later reduction stage flake scars: shallow flake scars representing the later biface reduction stages, (IV–V) and extending less than halfway across the biface. These are often but not always lamellar, ovate, or expanding in shape and can be produced by pressure or percussion.
- d. Marginal modification: any type of intentional marginal modification including serration, beveling, intentional simple marginal edge trimming, pressure edge trimming, etc.
- e. a + b
- f. a + c
- g. a + d
- h. b + c
- i. b + d
- j. c + d
- k. a + b + c
- l. a + b + d
- m. a + c + d
- n. b + c + d
- o. a + b + c + d
- p. Unmodified flake face: no modification present.
- q. Unmodified cortex face: no modification present.
- r. Early reduction stage flake scars plus fluting: flutes on one or both faces overlying early reduction stage flake scars.
- s. Later reduction stage flake scars plus fluting: flutes on one or both faces overlying later reduction stage flake scars.
- t. Early reduction stage flake scars and basal thinning: one or more longitudinal flakes removed from the proximal end of one or both faces and overlying early reduction stage flake scars.
- u. Later reduction stage flake scars and basal thinning: one or more longitudinal flakes removed from the proximal end of one or both faces and overlying later reduction stage flake scars.

- v. p + Basal Thinning: one or more longitudinal flakes removed from the proximal end of one or both faces overlying an otherwise unmodified flake face.

Second Column (Ventral/Reverse Face)

Same as above.

Base Shape

First Column (Shape)

- a. Straight: the line comprising the most proximal margin of the stem (base) describes a straight line between the two medial points of juncture with the stem margins.
- b. Straight with medial notch: the line comprising the most proximal margin of the stem (base) describes a straight line with a central notch between the two medial points of juncture with the stem margins.
- c. Concave: the line comprising the most proximal margin of the stem (base) describes a concave line between the two medial points of juncture with the stem margins.
- d. Convex: the line comprising the most proximal margin of the stem (base) describes a convex line between the two medial points of juncture with the stem margins.
- e. Convex with medial notch: the line comprising the most proximal margin of the stem (base) describes a convex line with a central notch between the two medial points of juncture with the stem margins.
- f. Cycloidal: the line comprising the most proximal margin of the stem (base) describes a cycloid.
- g. Pointed-concave: a special case of the concave base where the lines comprising the base consist of two straight lines which converge to a point at the centerline, distal to the most proximal end of the stem.
- h. Pointed-convex: a special case of the convex base where the lines comprising the base consist of two straight lines which converge to a point at the centerline proximal to the most proximal end of the stem.
- i. Bulbar: a special case of the convex base where the line comprising the base describes more than one-half of a round, circular, or ovoid form.

Second Column (Base Corner Shape)

- a. Angular: the most proximal part of the stem margins meets the basal margin at a right angle.
- b. Faceted: the most proximal part of the stem margins meets the basal margin at an obtuse angle.
- c. Slightly rounded: the most proximal part of the stem margins meets the basal margin in a slightly curvilinear arc.
- d. Moderately rounded: the most proximal part of the stem margins meets the basal margin in a curvilinear arc intermediate between slightly rounded and greatly rounded.
- e. Greatly rounded: the most proximal part of the stem margins meets the basal margin in a pronounced curvilinear arc.

Base Margin Treatment

First Column (shape)

- a. Even: "chips removed so as to produce a regular smooth definition of the (basal) edge" (Binford 1963:207).

- b. Irregular: “[basal] edge lacks a clear even definition. Many scar notches occurring in a nonsymmetrical pattern” (Binford 1963:107).
- c. Ground: the basal margin has been smoothed by rubbing with or against an abrasive object.
- d. Beveled: the basal margin has been modified so that it forms either a unifacial or a double bevel.
- e. Thinned: the basal margin has been intentionally reduced in thickness by the removal of one or more longitudinally oriented flakes.
- f. Simple edge trimming: the basal margin is trimmed, generally by percussion, so that small irregularities are removed and the edge given a more regular outline.
- g. Pressure edge trimming, shallow: basal margin exhibits fine and shallow removals, generally produced by applying a grinding pressure with a pressure tool. The resultant edge is strengthened and smoothed.
- h. Pressure edge trimming, invasive: the basal margin exhibits a series of fine removals that extend farther into the face of the base than with pressure edge trimming, shallow.

Second Column (Degree)

- a. Slight: indicates an expression of the trait noted in the above column that ranges from barely discernible to noticeable though delicate.
- b. Moderate: an expression intermediate between slight and heavy.
- c. Heavy: an expression of the trait noted in the above column that is immediately obvious as a major attribute of the basal margin.

Biface Modifiers

First Column (Shape)

- a. Pointed ovate (tear): “a biface shape modifier for an object whose widest part is below the horizontal center, one end relatively more pointed than the other” (Loy and Powell 1977:67).
- b. Triangular: a biface shape modifier for an object described by three relatively straight lines, whose widest part is at the proximal end.
- c. Leaf: a biface shape modifier for an object whose widest part is at or near the horizontal center, (i.e., double-pointed).
- d. Bi-Triangular: “A biface shape modifier of an object bounded by four straight lines and which is symmetric about the [longitudinal] axis and asymmetric about the [horizontal] axis” (Loy and Powell 1977:41).
- e. Pentagonal: “a biface shape modifier of an object bounded by five relatively straight lines” (Loy and Powell 1977:57).
- f. Rhomboidal: “a biface shape modifier of an object bounded by four straight, unequal lines” (Loy and Powell 1977:61).
- g. Excurvate: a biface shape modifier of an object bounded by two excurvate lines converging at the distal end and intersecting a third relatively straight line, forming the base.
- h. Irregular: a biface shape modifier of an object not conforming to any of the defined biface shapes.
- i. Oval: a biface shape modifier of an object bounded by lines approximating an ellipse.

- j. Round: a biface shape modifier of an object bounded by lines approximating a circle.
- k. Concave/Convex: a biface shape modifier of an object whose lateral margins describe a concave and a convex line respectively, converging distally to a rounded or pointed tip, and converging proximally to a rounded base.
- l. Parallel-sided: a biface shape modifier of an object bounded marginally by two relatively straight and parallel lines and converging proximally to a rounded base and distally to a relatively rounded tip.
- m. Slightly expanding base: a special biface modifier for proximal fragments having a relatively straight base and margins diverging from the point of juncture with the base.

Second Column (Biface Reduction Sequence Stage)

- a. Stage I: the primary reduction stage, usually represented by a large flake or core biface. These may still retain evidence of cortex. Evidence of flaking on at least one face is a minimum defining criterion. Intentional form is not necessarily introduced at this stage, and the reduction process is of a preliminary nature (Patterson 1977:69).
- b. Stage II: thick biface or trimmed flake. The stone has been bifacially worked to reduce the mass, usually in thickness. At this stage the artifact often has a very rough subtriangular or lanceolate form and is still quite thick, relative to the finished product (Patterson 1977:70–71).
- c. Stage III: thinned biface. These thinned bifaces usually show some degree of intentional shaping or form. A reduction in thickness relative to overall size has been accomplished. As the reduction sequence proceeds, the removals become thinner and flatter (Patterson 1977:72).
- d. Stage IV: thinned biface with form. A greater degree of intentional shaping or form is evident. Shape is generally triangular or lanceolate. This is the preform stage, and reduction of mass by thinning has been accomplished (Patterson 1977:73).
- e. Stage V-a: thinned biface with form and edge modification. Final thinning and edge modification are present, but the final shaping into a completed projectile point has not been accomplished.
- f. Stage V-b: final product. The artifact has taken its completed form as a dart point or an arrowpoint (Patterson 1977:74).

Core Modifiers

First Column (Type)

- a. Uni-directional, nodular: an irregular or rounded mass of raw material from which “flakes or blades were removed from one platform surface and in only one direction” (Crabtree 1972:97).
- b. Uni-directional, tabular: a flat slab of raw material from which “flakes or blades were removed from one platform surface in only one direction” (Crabtree 1972:97).
- c. Bi-directional, nodular: an irregular or rounded mass of raw material from which flakes or blades were removed from two platform surfaces in two directions.
- d. Bi-directional, tabular: a flat slab of raw material from which flakes or blades were removed from two platform surfaces in two directions.
- e. Multi-directional, nodular: an irregular or rounded mass of raw material from which flakes or blades were removed from more than two platform surfaces in more than two directions.

- f. Multi-directional, tabular: a flat slab of raw material from which flakes or blades were removed from more than two platform surfaces in more than two directions.

Second Column (Status)

- a. Rejected, experimental: a core exhibiting only one or two removals, indicating that it was rejected as being unsuitable for farther work.
- b. Rejected, manufacturing error: a core exhibiting a manufacturing error, rendering it unsuitable for farther work.
- c. Exhausted: a core that has been reduced to the point where it is no longer suitable for farther flake removal.
- d. Utilized: a core which, after being rejected or exhausted, is then utilized for some other purpose (e.g., a hammerstone or chopper).

Flake Modifiers

First Column (Shape)

- a. Lamellar: flakes often produced by pressure that are three or more times as long as their width. The margins are roughly parallel for most of their length.
- b. Ovate: flakes that are regularly or irregularly ovate in outline, and sometimes elongated several times their width. The bulbar scar is often relatively wide and flat.
- c. Conchoidal: flakes that approximate one-half of a bivalve shell in outline, having a flat, wide bulbar area. Often their length and width dimensions are nearly equal.
- d. Expanding: flakes that expand notably beyond their bulbar zone. The bulbar region is narrow and the distal end relatively wider.
- e. Contracting: flakes with a relatively wide bulbar zone that contracts to the distal end.
- f. Blade: “specialized flake with parallel or sub-parallel lateral edges; the length being equal to, or more than, twice the width. Cross sections are plano-convex, triangulate, sub-triangulate, rectangular, trapezoidal. Some have more than two crests or ridges. Associated with prepared core and blade technique; not a random flake” (Crabtree 1972:42).
- g. Side-struck:
- h. Rejuvenation, core platform: a flake which has removed the exhausted or ruined platform from a flake or blade core thereby establishing a new platform on the core. Flakes are often tabular and will retain the old platform on the dorsal surface.
- i. Rejuvenation, biface edge: a flake which has removed the exhausted or ruined edge of a biface, and will exhibit bifacial modification on its surfaces. Biface edge rejuvenation flakes are removed to facilitate the preparation of new platforms for the farther sharpening or thinning of bifaces.
- j. Rejuvenation, unifacial edge: a flake which removed the exhausted or ruined working bit of a unifacial tool. This flake is often removed by a blow struck obliquely to the distal marginal edge so that a flake is removed crosswise and at right angles to the main axis of the tool. This flake will retain the unifacial modification which characterized the original working edge.

- k. Channel: the channel flake or flute is the longitudinal removal characteristic of Clovis and Folsom point stems.
- l. Burin spall: the specialized flake removed to produce the chisel-like implement known as a burin.
- m. Irregular: a non-specialized flake with an irregular outline.
- n. Concave/Convex: a flake with one concave lateral margin and one convex lateral margin.
- o. Biface impact spall: a flake removed from a bifacially modified implement, usually a projectile point, by means of impact. These often resemble burin spalls, but have been fortuitously rather than intentionally removed.

Second Column (Type)

- a. Primary decortication: flakes which represent initial removals from the core and exhibit the presence of the cobble or nodule cortex on their entire dorsal surfaces.
- b. Secondary decortication: flakes which are partially decorticate, exhibiting cortex on only a portion of their dorsal surfaces.
- c. Interior: flakes removed from the interior of a nodule or core and exhibiting no cortex on the dorsal surface.
- d. Undetermined: incomplete flakes whose type cannot be determined.

Bulb of Force

- a. Salient: “a bulb of force having good definition of the cone part. Indicating a confined contact force” (Crabtree 1972:89).
- b. Diffuse: “a bulb of force which lacks the definition of the cone part. The bulb is disseminated, indicating a broad contact with the pressure or percussion tool. Common to billet technique. Generally lacks an enlure scar and ripple marks are much subdued” (Crabtree 1972:59).
- c. Thinned: the bulbar portion of the ventral face has been thinned by the removal of one or more flakes from the ventral surface.
- d. Removed: the bulbar portion of the ventral face has been removed entirely by one or more removals from the ventral surface.
- e. Absent: the bulbar portion of the flake is absent.

Striking Platform

- a. Unprepared cortex: the striking platform consists of unmodified cortex surface.
- b. Unprepared interior surface: the striking platform consists of an unmodified interior flake surface.
- c. Prepared-flakes: the striking platform has been prepared by the removal of one or more flakes.
- d. Prepared-ground: the striking platform has been prepared by being rubbed by or against some abrasive object.

- e. Prepared-isolated: “a platform which has been freed from the mass by the removal of flakes to isolate or cause the platform part to protrude or become prominent. Example: the platform (nib) on the base of a Folsom point on which the fabricating tool is seated prior to fluting” (Crabtree 1972:71).
- f. c + d
- g. Absent: the striking platform is missing.

Marginal Treatment (Bifaces and Flake Tools)

First Column (Type)

- a. Beveled: the margins have been modified so as to exhibit either alternate, unifacial, or double beveling.
- b. Step-fractured: “a flake or flake scar that terminates abruptly in a right-angle break at the point of truncation. Caused by a dissipation of force or the collapse of the flake” (Crabtree 1972:93).
- c. Denticulation: “Prominences resembling teeth similar to those on a saw. Tooth-like serrating on margins of artifacts” (Crabtree 1972:58).
- d. Serration: “indenting the edges by alternating the removal of flakes or the repeating of notches at regular intervals” (Crabtree 1972:90).
- e. Steep flaking (end scraper retouch): heavy, steep, and invasive modification characteristic of that found on the distal margin of those tools termed end scrapers. Sometimes called Aurignacian Retouch (Movius et al. 1968).
- f. Simple marginal edge trimming: the artifact margins are trimmed, generally by percussion, so that small irregularities are removed and the edges given a more regular outline.
- g. Pressure edge trimming, shallow: artifact margins exhibit fine and shallow removals, generally produced by applying a grinding pressure with a pressure tool. The resultant edge is straightened and smoothed.
- h. Pressure edge trimming, invasive: artifact margins exhibit a series of fine removals which extend farther into the face of the artifact than in pressure edge trimming, shallow. These removals, generally produced by pressure-flaking, may show intentional orientation and may have been individually struck.
- i. Irregular flaking: the marginal modification is of an irregular and non-patterned variety. The edges lack a clear even definition.
- j. Nosed with steep retouch: a tool trimmed so as to produce a nosed projection and modified with steep, invasive, and heavy unifacial flaking.
- k. Single graver tip: a tool trimmed so as to produce an intentional functional point projecting from the margin. In this case only a single graver tip is fashioned and there is no additional marginal modification.
- l. Double graver tip: an implement trimmed so as to produce two distinct functional points or graver tips projecting from the margin. In this case there is no additional marginal modification.
- m. Single graver tip + other marginal modification: an implement with a single graver tip or projection and some other additional areas of marginal modification.
- n. Double graver tip + other marginal modification: an implement with two graver tips or projections and some other additional areas of marginal modification.

Second Column (Degree or Location)

- a. Slight-regular: the modification noted above ranges from barely discernible to noticeable and occurs in a regular fashion producing a smooth definition of the edge.
- b. Slight-irregular: the modification noted ranges from barely discernible to noticeable and occurs in a non-symmetrical pattern.
- c. Moderate-regular: the modification noted above is intermediate between slight and heavy and occurs in a regular fashion.
- d. Moderate-irregular: the modification noted above is intermediate between slight and heavy and occurs in a non-symmetrical pattern.
- e. Heavy-regular: the modification noted is immediately obvious as a major attribute of the artifact and occurs in a regular fashion, producing a smooth definition or a patterned definition to the edge.
- f. Heavy-irregular: the modification noted is immediately obvious as a major attribute of the artifact and occurs in an irregular, non-symmetrical pattern.
- g. Right lateral margin: the modification noted is located on the right lateral margin of the artifact.
- h. Left lateral margin: the modification noted is located on the left lateral margin of the artifact.
- i. Both lateral margins: the modification noted occurs on both of the lateral margins of the artifact.
- j. Distal end: the modification noted occurs on the distal margin of the artifact.
- k. Lateral margins + distal end: the modification noted occurs on one or both lateral margins and the distal end.
- l. Proximal end: the modification noted occurs on the proximal end.
- m. Right lateral margin + ventral face: the modification noted occurs on the right lateral margin of the ventral face.
- n. Left lateral margin + ventral face: the modification noted occurs on the left lateral margin of the ventral face.
- o. Both lateral margins + ventral face: the modification noted occurs on both lateral margins of the ventral face.
- p. Distal end + ventral face: the modification noted occurs at the distal end of the ventral face.
- q. Lateral margins and distal end of ventral face: the modification noted occurs on the lateral margins and the distal end of the ventral face.
- r. Proximal end + ventral face: the modification noted occurs on the proximal end of the ventral face.
- s. Distal end and proximal end: the modification noted occurs on the distal and proximal ends.
- t. Lateral margins, distal end and proximal end: modification noted occurs on one or both lateral margins and both the distal and proximal ends.

Surface Flaking**First Column (Dorsal/Obverse Face)**

- a. Early reduction stage flake scars: generally massive and deep percussion flake scars used to remove the cortex, reduce the mass, and provide the initial reduction and shaping of bifaces and cores.
- b. Massive later reduction stage flake scars: relatively shallow flake scars representing the later stages of the biface reduction sequence or core reduction. Flakes extend at least halfway across the artifact. In general, they will be considerably more shallow than the early reduction stage flake scars.
- c. Diminutive later reduction stage flake scars: shallow flake scars representing the later biface or core reduction stages. Flakes extend less than halfway across the artifact.
- d. Marginal modification: any type of intentional marginal modification including serration, beveling, intentional simple marginal edge trimming, pressure edge trimming, etc.
- e. a + b
- f. a + c
- g. a + d
- h. b + c
- i. b + d
- j. c + d
- k. a + b + c
- l. a + b + d
- m. a + c + d
- n. b + c + d
- o. a + b + c + d
- p. Unmodified flake face: no modification present.
- q. Unmodified cortex face: no modification present.
- r. Early reduction stage flake scars + unmodified flake face: a basically unmodified flake face with one or two large early reduction stage flake scars.
- s. Marginal modification + unmodified cortex face: a basically unmodified cortex face with a small amount of marginal modification.
- t. Diminutive later reduction stage flake scars + unmodified flake face: a basically unmodified flake face with one or two diminutive flake scars.

Second Column (Ventral/Reverse Face)

Same as above.

Cross Section (at haft juncture)

- a. Plano-convex: a flat ventral face and a convex dorsal surface.

- b. Plano-triangular: a flat ventral surface and a convex dorsal surface converging to a point at the centerline.
- c. Bi-plano: a flat ventral face and a flat dorsal face.
- d. Bi-triangular: a convex ventral surface converging to a point at the centerline and a convex dorsal surface converging to a point at the centerline.
- e. Bi-convex: a convex ventral surface describing a smooth curve from margin to margin and a convex dorsal surface describing a smooth curve from margin to margin.
- f. Asymmetrically bi-convex: convex ventral and dorsal faces which are asymmetrical in relation to the longitudinal axis.
- g. Asymmetrically bi-triangular: a triangularly convex dorsal and ventral face, both being asymmetrical in relation to the longitudinal axis.
- h. Convexo-triangular: a convex ventral face describing a smooth curve from margin to margin and a convex dorsal surface which converges to a point at the centerline.

Wear/Polish

- a. Striated: the utilized edge shows tiny striae, either lines or grooves, which may be straight or curved, parallel or intersecting, continuous or interrupted.
- b. Nicked: the utilized edge shows irregular small breaks and nicks which produce an uneven margin.
- c. Battered: the utilized edge shows bruising by repeated blows, producing an uneven edge lacking surface luster.
- d. Pecked: the pecked edge shows relatively large pits and indentations that are the result of pounding. These are separated by areas that have not been subjected to pounding.
- e. Ground: the ground edge has been subjected to greater abrasion than the striated edge, and the edge itself has been modified by attrition. Striations may be relatively deep and are frequently parallel.
- f. Polished: the utilized edge shows a relatively high luster that may or may not extend onto the flake scars converging to the edge.
- g. Dulled: the utilized edge shows a considerable degree of smoothing with some modification of surface contours. The luster produced is dull rather than bright.
- h. Rounded: the utilized edge contour has been modified so that no angularity remains and the edge is rounded in cross section.
- i. Haft, hand-polished: the artifact shows polish or dulling of flake ridges on the faces rather than the edge.
- j. Micro-spalled: the utilized edge shows the removal of very small flakes in a more or less regular pattern, and these flakes may feather out at their distal ends.
- k. Silica gloss: the polish resulting from the build-up of silica molecules derived from silica-bearing plants.
- l. Nibbled: the utilized edge shows the removal of some very small flakes in a random pattern.
- m. Crushed: the utilized edge shows the results of compression between two hard bodies, one of which may be the body of the piece itself.

- n. Blade-face grinding: the piece exhibits grinding on one or both faces, which has produced wear on the surfaces, and is especially noticeable on the flake ridges of the face.
- o. Blade-face polishing: the piece exhibits polishing on one or both faces, producing a smoothing of the face and especially the flake ridges.
- p. Other

Breakage

- a. Perverse fracture: “a helical, spiral or twisting break initiated at the edge of an objective piece. Natural flaws, excessive force and mass to be removed add to the possibility of perverse fracture” (Crabtree 1972:82).
- b. End shock (lateral snap): “transverse fracture due to the stone exceeding its elastic limits. Failure of the material to rebound and recoil before fracture” (Crabtree 1972:60).
- c. Burin break: “scar left on a flake or blade resulting from the removal of a burin spall. The right angle edge or brake severed transversely from force applied to the margin” (Crabtree 1972:50).
- d. Fire-shattered: the specimen has been exploded or shattered by intense heat. The resultant fragments are blocky and angular, show no bulbs of force, and may exhibit potlids or “crenated” fractures (Purdy 1975).
- e. Fire-spalled: specimens that have been exposed to intense heat but have not shattered or exploded. They may exhibit potlid fractures on the surfaces and “crazing” or “minute surface cracks—generally cross-hatched—causing the surface to be weakened. Common to over-heated siliceous materials” (Crabtree 1972:56).
- f. Hinge: “a fracture at the distal end of a flake or blade which prevents detachment of the flake at its proposed terminal point. A hinge fracture terminates the flake at right angles to the longitudinal axis and the break is usually rounded or blunt. Not to be confused with a step fracture” (Crabtree 1972:68).
- g. *OutrepassJ*: “over and beyond the opposite margin” (Crabtree 1972:80). “Said of a flake, blade, bladelet, or burin spall whose fracture plane, normal on its proximal end, turns abruptly towards the centre of the piece and takes away part of the core—or, in the case of a burin, part of the flake, blade, or bladelet from which it is removed. The two main characteristics of a plunging piece are a very concave ventral surface, and a thickening at the distal end” (Tixier 1974:19).
- h. Snapped: “1) a method of producing a transverse fracture to sever flakes or blades. Pressure or percussion force is applied from the ventral toward the dorsal side. 2) May also be accomplished by finger pressure” (Crabtree 1972:92).
- i. Impact fracture: characteristic fracture pattern when an artifact is struck against a hard object. Common of the distal end of projectile points when they strike an animal rib, a tree, or the ground. The resulting fracture often resembles a burin scar and can produce a removal resembling and easily confused with a burin spall.
- j. Unknown: the agency and manner of the break is not known.
- k. Excavation: fractures produced during excavation by striking the object with a hard object such as a shovel or a pick. Can also be caused by the movement of heavy equipment over a site. In this case the artifacts will be newly broken in place and the adjacent pieces will be found during excavation.

- l. Other: any other causes of artifact breakage.

Material

- a. Chert: “a compact, siliceous rock. Regardless of color, formed of silica and of organic or precipitated origin which occurs as quartz particles whose outlines can be discerned either by the unaided eye or by magnification up to 14X. Most varieties of chert are opaque, although some may be semi-translucent along thin edges. Colour and texture combine to distinguish the commonly used popular names for varieties of chert: jasper, flint, etc.” (Loy and Powell 1977:43).
- b. Chalcedony: “a compact, siliceous rock (SiO₂). Regardless of colour, it is composed of quartz and is usually formed by precipitation. No graininess can be discerned even with high power magnification (14X or greater); in some cases it has a microscopically fibrous texture. The majority of chalcedony varieties are translucent. The color delimits the common or popular variety names: agate, opaline chalcedony or opal, carnelian, etc. Translucency and lack of visible graininess are diagnostic attributes in most cases” (Loy and Powell 1977:43).
- c. Quartzite, fine-grained: the fine-grained variety of a rock “formed by the siliceous cementation of sandstones under heat and pressure. The hardness is that of quartz and the surface texture can range from very coarse to very fine grained depending upon the size of the individual grains of sand in the original sandstone” (Loy and Powell 1977:60).
- d. Quartzite, coarse-grained: the coarse-grained variety of the rock defined above.
- e. Silicified wood (petrified wood): a material formed by the replacement of the organic components of wood by silica.
- f. Siltstone: “a fine grained consolidated clastic rock composed predominantly of silt-sized particles (0.625 to 0.0039 mm diameter); commonly massive with poorly developed visible bedding planes” (Loy and Powell 1977:64).
- g. Agate: a variegated chalcedony with its colors arranged in bands, clouds, etc.
- h. Sandstone: “a cemented or otherwise compacted sedimentary rock predominantly of quartz grains of sand size (0.625 mm to 2.00 mm) diameter. The binding or cementing agent(s) can be classed mineralogically as argillaceous (clay in abundance as cement); siliceous (silica as binding agent, but unlike quartzite the grains will come free of the cement); calcareous (lime cement—bubbles upon application of HCl); or ferruginous (cemented with iron oxide—typically reddish in color)” (Loy and Powell 1977:62).

References Cited

Ahler, S. A.

- 1971 *Projectile Point Form and Function at Rodgers Shelter, Missouri*. Research Series 8. Missouri Archaeological Society, Columbia.

Binford, L. R.

- 1963 Proposed Attribute List for the Description and Classification of Projectile Points. In *Miscellaneous Studies in Typology and Classification*, by A. M. White, L. R. Binford, and M. L. Papworth, pp. 193–221. Anthropological Papers, No. 19. University of Michigan, Museum of Anthropology.

Crabtree, Don E.

- 1972 *An Introduction to Flintworking*. Occasional Papers of the Idaho State Museum 28. Pocatello.

Loy, T. H., and G. R. Powell

- 1977 Archaeological Data Recording Guide. British Columbia Provincial Museum Heritage Record No. 3. Victoria, B.C.

Patterson, P. E.

- 1977 A Lithic Reduction Sequence: A Test Case in The North Fork Reservoir Area, Williamson County, Texas. *Bulletin of the Texas Archeological Society* 48:53–82.

Purdy, B. A.

- 1975 Fractures for the Archaeologist. In *Lithic Technology: Making and Using Stone Tools*, edited by E. Swanson. Chicago.

Tixier, J.

- 1974 *Glossary for the Descriptions of Stone Tools*. Translation by M. H. Newcomer. Special Publication 1. Newsletter of Lithic Technology, Pullman, Washington.

APPENDIX B: RADIOCARBON DATA FROM 41MK27

**BETA ANALYTIC INC.**

DR. M.A. TAMERS and MR. D.G. HOOD

UNIVERSITY BRANCH

4985 S.W. 74 COURT

MIAMI, FLORIDA, USA 33155

PH: 305/667-5167 FAX: 305/663-0964

E-MAIL: beta@radiocarbon.com

REPORT OF RADIOCARBON DATING ANALYSES

Dr. James Abbott

May 7, 1999

Texas Dept. of Transportation

June 16, 1999

| Sample Data | Measured C14 Age | C13/C12 Ratio | Conventional C14 Age (*) |
|------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------|--------------------------|
| Beta-130456 SAMPLE #: 768MK27FEA2 ANALYSIS: radiometric-standard MATERIAL/PRETREATMENT:(charred material): acid/alkali/acid | 540 +/- 60 BP | -24.7 o/oo | 540 +/- 60 BP |
| Beta-130457 SAMPLE #: 641MK27BRM ANALYSIS: Standard-AMS MATERIAL/PRETREATMENT:(bone collagen): collagen extraction: with alkali | 100.3 +/- 0.5 % modern | - 8.9 o/oo | 240 +/- 40 BP |
| Beta-130458 SAMPLE #: 1131MK27BRM ANALYSIS: Standard-AMS MATERIAL/PRETREATMENT:(charred material): acid/alkali/acid | 1500 +/- 40 BP | -25.3 o/oo | 1500 +/- 40 BP |
| Beta-130459 SAMPLE #: 1061MK27FEA ANALYSIS: Standard-AMS MATERIAL/PRETREATMENT:(charred material): acid/alkali/acid | 1590 +/- 40 BP | -25.7 o/oo | 1580 +/- 40 BP |
| Beta-130460 SAMPLE #: 1094MK27BRM ANALYSIS: Standard-AMS MATERIAL/PRETREATMENT:(charred material): acid/alkali/acid | 1070 +/- 40 BP | -25.9 o/oo | 1050 +/- 40 BP |

NOTE: It is important to read the calendar calibration information and to use the calendar calibrated results (reported separately) when interpreting these results in AD/BC terms.

Dates are reported as RCYBP (radiocarbon years before present, "present" = 1950A.D.). By International convention, the modern reference standard was 95% of the C14 content of the National Bureau of Standards' Oxalic Acid & calculated using the Libby C14 half life (5568 years). Quoted errors represent 1 standard deviation statistics (68% probability) & are based on combined measurements of the sample, background, and modern reference standards.

Measured C13/C12 ratios were calculated relative to the PDB-1 international standard and the RCYBP ages were normalized to -25 per mil. If the ratio and age are accompanied by an (*), then the C13/C12 value was estimated, based on values typical of the material type. The quoted results are NOT calibrated to calendar years. Calibration to calendar years should be calculated using the Conventional C14 age.

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-24.7;lab. mult=1)

Laboratory number: Beta-130456

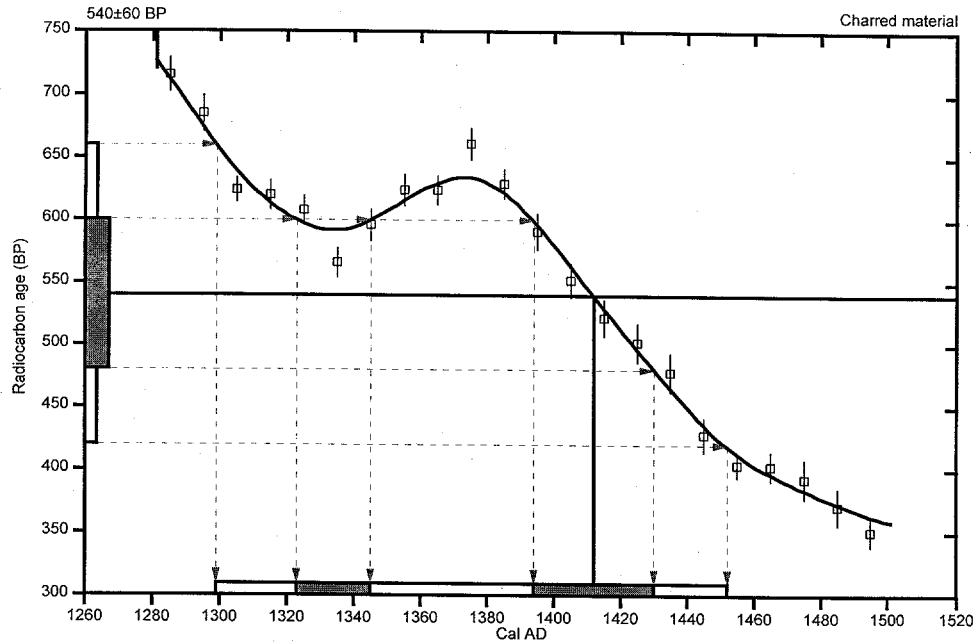
Conventional radiocarbon age: 540±60 BP

2 Sigma calibrated result: Cal AD 1300 to 1450 (Cal BP 650 to 500)
(95% probability)

Intercept data

Intercept of radiocarbon age
with calibration curve: Cal AD 1410 (Cal BP 540)

1 Sigma calibrated result: Cal AD 1325 to 1345 (Cal BP 625 to 605) and
Cal AD 1395 to 1430 (Cal BP 555 to 520)



References:

Database used

INTCAL98

Calibration Database

Editorial Comment

Stuiver, M., van der Plicht, H., 1998, *Radiocarbon* 40(3), pxii-xiii

INTCAL98 Radiocarbon Age Calibration

Stuiver, M., et al., 1998, *Radiocarbon* 40(3), p1041-1083

Mathematics

A Simplified Approach to Calibrating C14 Dates

Talma, A. S., Vogel, J. C., 1993, *Radiocarbon* 35(2), p317-322

Beta Analytic Radiocarbon Dating Laboratory

4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • E-mail: beta@radiocarbon.com

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-8.9;lab. mult=1)

Laboratory number: **Beta-130457**

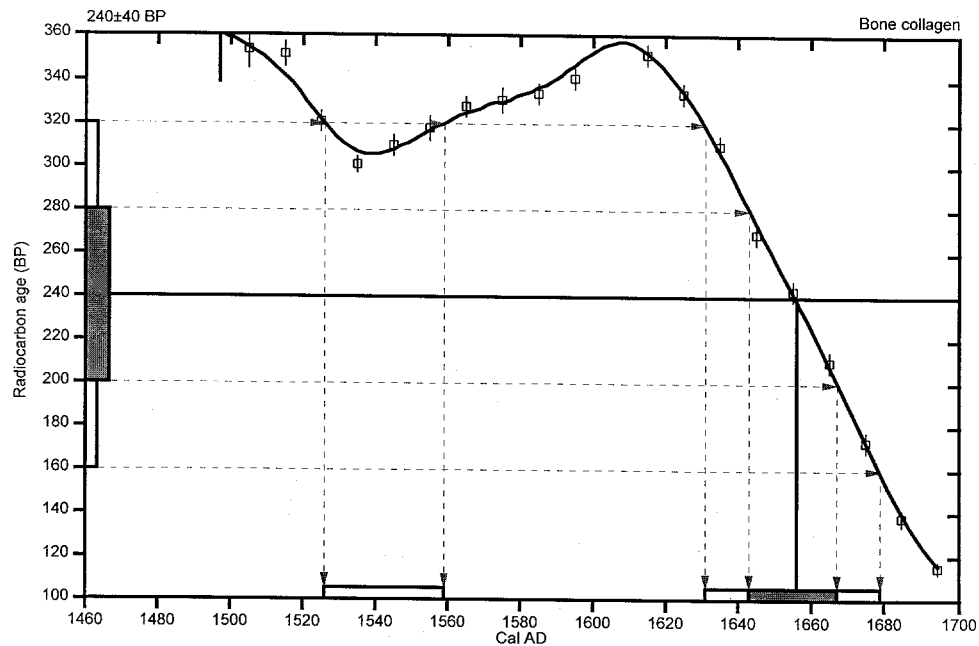
Conventional radiocarbon age: **240±40 BP**

2 Sigma calibrated results: Cal AD 1525 to 1560 (Cal BP 425 to 390) and
Cal AD 1630 to 1680 (Cal BP 320 to 270)
(95% probability)

Intercept data

Intercept of radiocarbon age
with calibration curve: Cal AD 1655 (Cal BP 295)

1 Sigma calibrated results: Cal AD 1645 to 1665 (Cal BP 305 to 285)
(68% probability)



References:

Database used

INTCAL98

Calibration Database

Editorial Comment

Stuiver, M., van der Plicht, H., 1998, *Radiocarbon* 40(3), pxii-xiii

INTCAL98 Radiocarbon Age Calibration

Stuiver, M., et. al., 1998, *Radiocarbon* 40(3), p1041-1083

Mathematics

A Simplified Approach to Calibrating C14 Dates

Talma, A. S., Vogel, J. C., 1993, *Radiocarbon* 35(2), p317-322

Beta Analytic Radiocarbon Dating Laboratory

4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • E-mail: beta@radiocarbon.com

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-25.3;lab. mult=1)

Laboratory number: **Beta-130458**

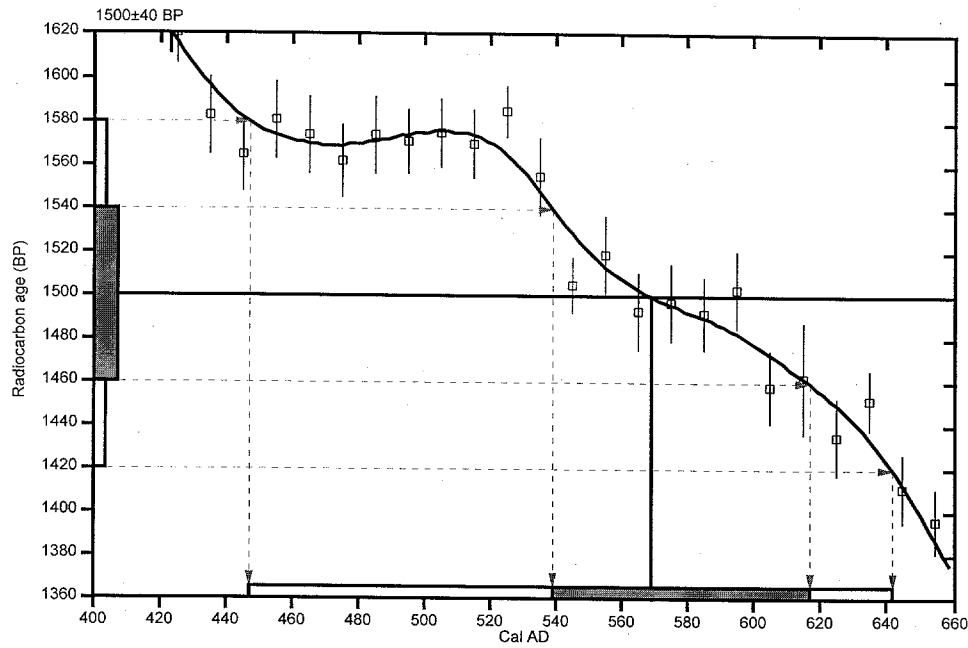
Conventional radiocarbon age: **1500±40 BP**

2 Sigma calibrated result: Cal AD 445 to 640 (Cal BP 1505 to 1310)
(95% probability)

Intercept data

Intercept of radiocarbon age
with calibration curve: Cal AD 570 (Cal BP 1380)

1 Sigma calibrated result: Cal AD 540 to 615 (Cal BP 1410 to 1335)
(68% probability)



References:

- Database used*
INTCAL98
Calibration Database
Editorial Comment
Stuiver, M., van der Plicht, H., 1998, *Radiocarbon* 40(3), pxii-xiii
INTCAL98 Radiocarbon Age Calibration
Stuiver, M., et. al., 1998, *Radiocarbon* 40(3), p1041-1083
Mathematics
A Simplified Approach to Calibrating C14 Dates
Talma, A. S., Vogel, J. C., 1993, *Radiocarbon* 35(2), p317-322

Beta Analytic Radiocarbon Dating Laboratory

4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • E-mail: beta@radiocarbon.com

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-25.7;lab. mult=1)

Laboratory number: **Beta-130459**

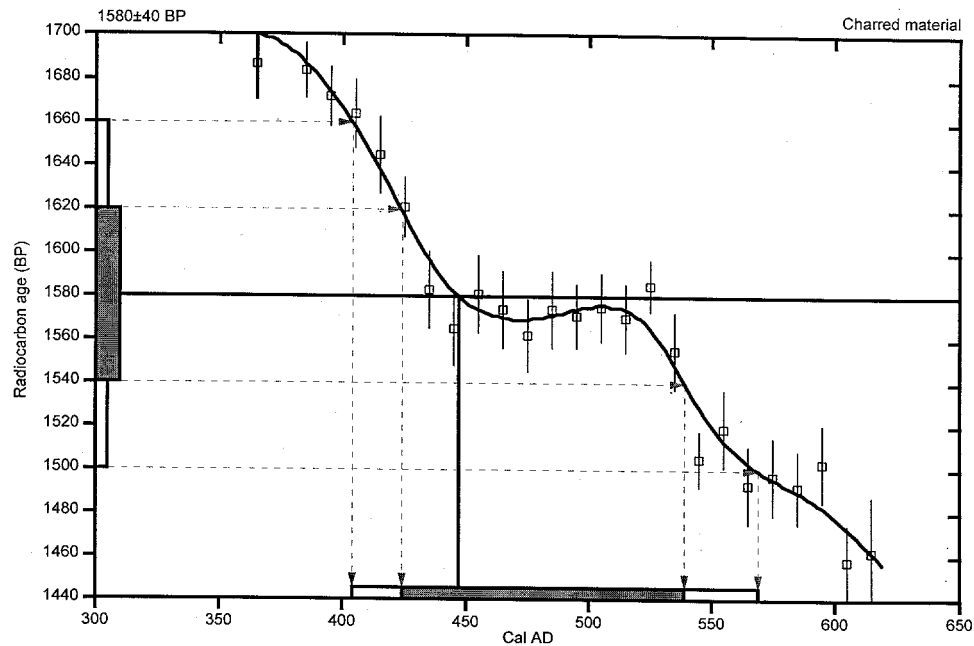
Conventional radiocarbon age: **1580±40 BP**

2 Sigma calibrated result: **Cal AD 405 to 570 (Cal BP 1545 to 1380)**
(95% probability)

Intercept data

Intercept of radiocarbon age
with calibration curve: **Cal AD 445 (Cal BP 1505)**

1 Sigma calibrated result: **Cal AD 425 to 540 (Cal BP 1525 to 1410)**
(68% probability)



References:

Database used

INTCAL98

Calibration Database

Editorial Comment

Stuiver, M., van der Plicht, H., 1998, Radiocarbon 40(3), pxi-xiii

INTCAL98 Radiocarbon Age Calibration

Stuiver, M., et. al., 1998, Radiocarbon 40(3), p1041-1083

Mathematics

A Simplified Approach to Calibrating C14 Dates

Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

Beta Analytic Radiocarbon Dating Laboratory

4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • E-mail: beta@radiocarbon.com

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-25.9;lab. mult=1)

Laboratory number: **Beta-130460**

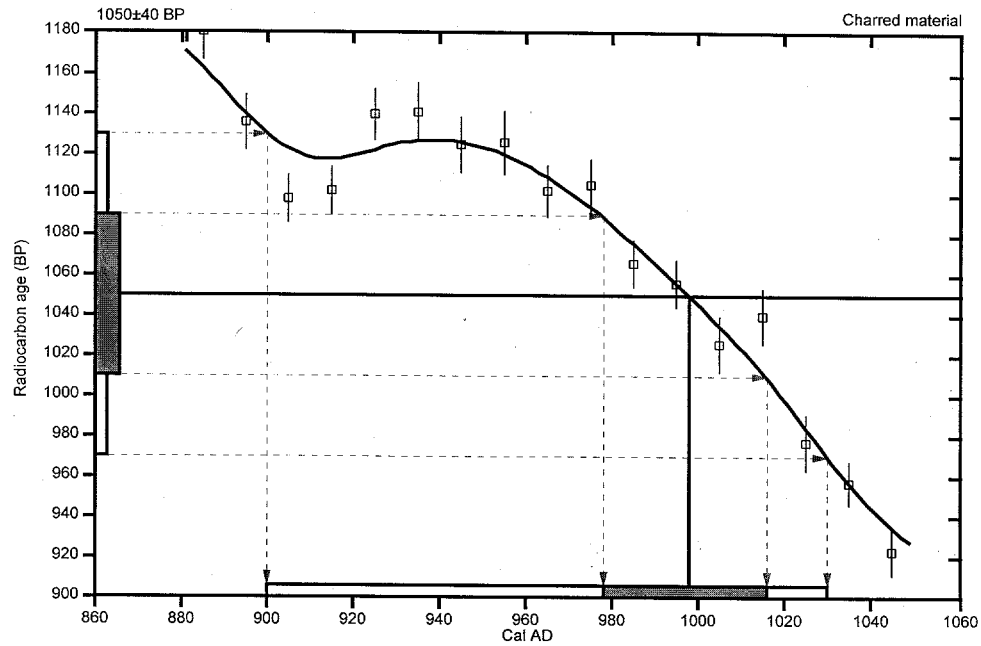
Conventional radiocarbon age: **1050±40 BP**

2 Sigma calibrated result: Cal AD 900 to 1030 (Cal BP 1050 to 920)
(95% probability)

Intercept data

Intercept of radiocarbon age
with calibration curve: Cal AD 1000 (Cal BP 950)

1 Sigma calibrated result: Cal AD 980 to 1015 (Cal BP 970 to 935)
(68% probability)



References:

Database used

INTCAL98

Calibration Database

Editorial Comment

Stuiver, M., van der Plicht, H., 1998, *Radiocarbon* 40(3), pxii-xiii

INTCAL98 Radiocarbon Age Calibration

Stuiver, M., et. al., 1998, *Radiocarbon* 40(3), p1041-1083

Mathematics

A Simplified Approach to Calibrating C14 Dates

Talma, A. S., Vogel, J. C., 1993, *Radiocarbon* 35(2), p317-322

Beta Analytic Radiocarbon Dating Laboratory

4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • E-mail: beta@radiocarbon.com

**APPENDIX C: MACROBOTANICAL ANALYSIS OF TWO
FLOTATION SAMPLES FROM 41MK27**

Phil Dering

Introduction and Method

Two flotation samples recovered from Feature IA at 41MK27 were submitted by Dr. Brett Houk of SWCA, Inc. for analysis of botanical remains. The volume of the sediment sample was first recorded, and then it was processed using a continuous-flow flotation system with 450 micrometer woven screen to eliminate backwash contamination. Each sample measured 850 ml in volume before the flotation process. All of the light fraction was captured using fine-woven chiffon cloth. The system has previously been tested by entering 100 charred poppy seeds (*Papaver* sp.) into five sediment samples, as outlined by Wagner (1982). The procedure recovered, on the average, 89.1 percent of the seeds. Both the heavy and light fractions were placed in an herbarium dryer for 48 hours before sorting.

The light and heavy fraction of the sample was sorted through a series of four nested geological screens with mesh sizes of 4 mm, 2 mm, 1 mm, 0.450 mm and a bottom catch pan. Laboratory protocol states that each size grade, including the pan, is scanned for plant seeds, fruit fragments, and other edible parts using a binocular dissecting microscope at 8 magnifications. Carbonized wood and plant remains from the 4 mm and 2 mm mesh are then separated for analysis. Material from the smaller screens is scanned for seeds or fruit fragments only. Due to post-depositional formation processes, only charred plant remains are considered to be a potential part of the archeological record (Gasser and Adams 1981; Miksicek 1987).

Seed and fruit identifications are made using reference collections at Texas A&M University. Wood is identified by examining cross-sections of the archeological material at 40X magnification and comparing it to collections housed at Texas A&M University. When

identification of wood is based on gross anatomical features viewed in cross-section at low magnification the anatomy of some woods is so similar that it is very difficult to identify to the genus level. Especially in the case of carbonized or partially deteriorated wood, many gross characteristics such as hardness, color and odor are eliminated by carbonization. For this reason I combine some taxa into wood types. All identifications in the "type" category would represent identifications to either the family or genus level.

Results and Conclusions

Examination of both the light and heavy fractions yielded the results presented in Table C.1. The light fraction of Sample 2 contained a few charcoal flecks and roots, and the heavy fraction contained a few fragments of fire-cracked rock. Sample 3, however, contained charcoal fragments weighing 0.4 g, all of which were smaller than 4 mm in transverse section. Wood fragments of this small size are often difficult to identify. For this reason, I was able to assign only eight charcoal fragments to a taxonomic category, *Quercus* sp. (oak) wood. Oak accounts for the majority of identified charcoal from archaeological sites on and near the Edwards Plateau, primarily because it is easy to identify when the plant assemblage is very small and severely reduced, presumably by post-depositional processes. No seeds or fruit fragments were identified in either of the samples.

The results may be compared to the those obtained from 41MK8 and 41MK9, at which oak, mesquite, juniper, and walnut wood types were identified. In addition, at 41MK9 prickly pear seed and walnut fragments were noted, and at 41MK8 prickly pear seeds were identified (Dering 1997). Although small float sample volumes, seldom exceeding 1 liter, were processed from these sites as well, sixteen samples were

Table C.1. Macroplant Remains and Proveniences from 41MK27

| Sample | Unit | Elevation | Taxon | Part | Count*/weight (g) |
|--------|-----------------|------------------|---------------------------------------|------|-------------------|
| 2 | N47-48/E29-29.5 | 426.75 to 426.63 | No identifiable charred plant remains | | |
| 3 | N46-48/E29-30 | 426.55 to 426.45 | <i>Quercus</i> sp. (oak) | Wood | 8/0.1 |
| | | | Indeterminate | Wood | 25+/0.3 |

* All wood fragments were smaller than 4 mm wide

examined, greatly increasing the opportunity for securing botanical data.

Previous research has demonstrated that larger flotation samples, up to 8 liters each, are much more likely to produce results (Miksicek 1987). The flotation effort, however, should be increased only when charred plant fragments or other evidence of burning can be ascertained in the plan view or profile of the excavation unit. The small amount of charcoal recovered from this sample suggests that the context from which it was taken may have some potential to generate botanical data.

References Cited

Dering, P.

- 1997 Macrobotanical Remains. In *Hot Rock Cooking on the Greater Edwards Plateau: Four Burned Rock Middens in West Central Texas*. Volume 2, by S. L. Black, L. W. Ellis, D. G. Creel, and G. T. Goode, pp. 573–600. Studies in Archeology 22. Texas Archeological Research Laboratory, The University of Texas at Austin. Archeology Studies Program, Report 2. Texas Department of Transportation, Austin.

Gasser, R., and E. C. Adams

- 1981 Aspects of Deterioration of Plant Remains in Archaeological Sites: The Walpi Archaeological Project. *Journal of Ethnobiology* 1(1):182–192.

Miksicek, C. H.

- 1987 Formation Processes of the Archaeobotanical Record. In *Advances in Archaeological Method and Theory*, vol. 10, edited by M. B. Schiffer, pp. 211–247. Academic Press, New York.

Wagner, G.

- 1982 Testing Flotation Recovery Rates. *American Antiquity* 47(1):127–132.

**APPENDIX D: ANALYSIS OF POLLEN
AND PHYTOLITHS FROM 41MK27**

John G. Jones and Lisa D. Lavold

Introduction

Two sediment samples were submitted to the Palynology Laboratory at Texas A&M University for pollen and phytolith analysis. These samples were collected from site 41MK27, in McCulloch County, Texas. Samples were selected from Feature II (Sample 1) and the charcoal-filled pit of Feature IA (Sample 4). It was anticipated that some archaeobotanical data might be recovered from these sediments offering clues to past paleoenvironmental conditions or subsistence at the site.

Generally, pollen is not well-preserved in open air sites in west-central Texas. High degrees of oxidation resulting from cycles of wetting and drying frequently lead to a near complete loss of pollen in archeological sediments. Phytoliths can also suffer from preservation problems, particularly in areas which contain both a high pH (limestone regions) and high amounts of oxidation. Considering the environmental conditions known to occur in the site area, it was acknowledged that it was possible that both fossil pollen and phytoliths might have been lost from the archeological sediments.

Methodology

Pollen

The samples were first quantified (generally 20 ml), placed in sterile beakers, and a known quantity of exotic tracer spores was added to each sample. Here, *Lycopodium* spp. spores were chosen as an exotic, because these spores are unlikely to be found in the actual fossil pollen assemblages from this region. Tracer spores are added to samples for two reasons. First, by adding a known quantity of exotic spores to a known quantity of sediment, fossil pollen concentration values can be calculated. Second, in the event that no fossil pollen is observed in the sediment sample, the presence of *Lycopodium* tracer spores verifies that processor error was not a factor in the pollen loss.

Following the addition of the tracer spores, the samples were washed with concentrated Hydrochloric Acid. This step dissolved the bonding agent in the tracer spore

tablets, and removed unwanted carbonates from the sediments. The samples were then rinsed in distilled water, sieved through 150-micron mesh screens and swirled to remove the heavier inorganic particles. Next the samples were consolidated, and 70 percent Hydrofluoric Acid was added to the residues to remove unwanted silicates. After the silicates had been removed, the residues were rinsed thoroughly, and sonicated in a Delta D-5 sonicator for 30 seconds. This step deflocculated the residues, effectively removing all colloidal material smaller than two microns.

Next, the samples were dehydrated in Glacial Acetic Acid, and were subjected to an acetolysis treatment (Erdtmann 1960) consisting of nine parts Acetic Anhydride to one part concentrated Sulfuric Acid. During this process, the samples were placed in a heating block for a period not exceeding eight minutes. This step removed most unwanted organic materials, including cellulose, hemi-cellulose, lipids and proteins, and converted these materials to water-soluble humates. The samples were then rinsed until a neutral pH was achieved.

Following this treatment, the samples were next subjected to a heavy density separation using Zinc Bromide (Sp.G. 2.00). Here, the lighter organic fraction was isolated from the heavier minerals. After this treatment, the lighter pollen and organic remains were collected, and washed in 1 percent KOH to remove any remaining humates. The residues were then dehydrated in absolute alcohol, and transferred to a glycerine medium for curation in glass vials.

Slides were prepared using glycerine, and identifications were made on a compound stereomicroscope at 400x magnification. Identifications were confirmed by using the Palynology Laboratory's extensive pollen reference collection.

A standardized technique was employed in counting the fossil pollen from site 41MK27, where a 200 or more grain count was made for each sample, as suggested by Barkley (1934). This technique is standard practice among most palynologists, and is thought to reflect past vegetation or economic plant use fairly well. Following the achievement of a 200+ grain count, the remainder of a slide was carefully scanned for eco-

nomic or other significant taxa not recorded during the actual counting.

Concentration values were calculated for all samples. Hall (1981) and Bryant and Hall (1993) note that concentration values below 2,500 grains/ml of sediment are not well-reflective of past conditions and usually record a differentially-preserved assemblage. As a result, counts with low concentration values should be viewed with caution. The presence of tracer spores in all samples, however, does confirm that pollen was not lost during processing.

Phytoliths

The samples were processed using techniques developed at the Texas A&M University Palynology Laboratory. The soil samples were initially quantified (10 grams) and placed in beakers. First, carbonates were removed with 10 percent HCl. The samples were next rinsed, screened through 150 micron mesh, and a series of "short spins" was initiated to remove residual hydrochloric acid and to facilitate the removal of clay particles and the smallest of phytoliths. This step is necessary as phytoliths smaller than 2–3 microns are rarely identifiable or valuable. Following this step, the samples were sonicated in a Delta D-5 ultrasonic generator for a period of 30 seconds, and several additional short spins were performed. These steps facilitated the removal of most of the fine clays.

The residues were next transferred to glass 100-ml tubes, and Schulze's solution (42 percent Nitric Acid and Potassium Chlorate) was added to the samples. The samples were placed in a boiling water bath for about three hours or until all organic traces had been removed. Next, the samples were centrifuged and rinsed until neutral. Following this treatment, 5 percent KOH was added to the residues to remove any additional humates. After additional rinsing in distilled water, the residue was transferred to a 300-ml glass beaker, and the samples were fractionated in a water column. Here, samples were separated into two size categories: 3–25 micron and 25–150 micron ranges. After fractionation, the residues were transferred to 15-ml tubes, and the remaining water was removed in preparation for heavy density separation.

Here, Zinc Bromide (Sp.G. 2.38) was added to the samples, which were then spun at high speeds for about 10 minutes. The lighter phytolith fraction was collected, and the heavy density separation step was repeated, again collecting the lighter phytoliths. An abundance of phytoliths was collected from all the samples.

The phytoliths were next rinsed and transferred to absolute ethanol for curation. A single drop containing phytoliths was added to a cover slip, and it was then allowed to dry. A drop of Meltmount adhesive (refractive index 1.539) was added to the cover slip, and a permanent slide was then made for each fraction of each sample.

Slides were examined at high magnification (1000–1250x) using oil immersion and differential interference contrast settings on a Jenaval compound stereomicroscope. Identifications were confirmed through the use of reference materials and published keys and descriptions. Grass phytolith types were identified based on types outlined by Fredlund and Tieszen (1994).

Among phytolith researchers, there is no established procedure as to how many phytoliths should be counted to establish a representative record of past conditions. In the case of pollen analysis, most researchers count a minimum of 200 grains as suggested by Barkley (1934). Many phytolith researchers will count a specified number of slide scans, however with this technique significant variations in phytolith numbers are frequently obtained. Rather, a minimum of 300 phytoliths from both the coarse and fine fraction was counted. As each size fraction contains different phytolith types (bulliform cells, elongates and hair cells in the coarse fraction; diagnostic grass short cells in the fine fraction), it was considered important to quantify each fraction separately.

Results

Although imperfectly preserved, fossil pollen was identified in both sediment samples from site 41MK27. Concentration values for these samples were 2312 grains/ml (Sample 1) and 7035 grains/ml (Sample 4).

Although these values, particularly Sample 1, are relatively low and probably signal that differential preservation has occurred, the preservation was good enough to allow for the positive identification of most grains, thus allowing for the production of a listing of plants likely to have been present in the site area in the past. Relatively high percentages of indeterminate grains also suggest that caution be employed when drawing paleoenvironmental interpretations from these samples. Pollen data from site 41MK27 are presented in Table D.1.

Table D.1. Pollen Types Identified in the Samples from 41MK27

| Taxa | Sample 1 | Sample 2 |
|-----------------------------------------|------------------|------------------|
| Apiaceae | 2 (0.8) | |
| Asteraceae Low-Spine | 76 (30.9) | 72 (27.9) |
| Asteraceae High-Spine | 15 (6.1) | 22 (8.5) |
| Liguliflorae-type | 6 (2.4) | |
| <i>Artemisia</i> | 3 (1.2) | |
| Cheno-Am | 10 (4.1) | 14 (5.4) |
| Fabaceae | 7 (2.8) | 3 (1.2) |
| Malvaceae | | 1 (0.4) |
| <i>Opuntia</i> | 1 (0.4) | 1 (0.4) |
| Poaceae | 19 (7.7) | 28 (10.8) |
| Solanaceae | 1 (0.4) | |
| Verbenaceae | | 1 (0.4) |
| <i>Ephedra</i> | 10 (4.1) | 3 (1.2) |
| <i>Rhus</i> | | 1 (0.4) |
| <i>Carya</i> | | 1 (0.4) |
| <i>Diospyros</i> | | 2 (0.8) |
| cf <i>Juglans</i> | 1 (0.4) | 1 (0.4) |
| <i>Juniperus</i> | 2 (0.8) | 2 (0.8) |
| <i>Pinus</i> | 3 (1.2) | 12 (4.7) |
| <i>Quercus</i> | 40 (16.3) | 28 (10.8) |
| <i>Salix</i> | 10 (4.1) | 6 (2.3) |
| <i>Ulmus</i> | | 2 (0.8) |
| Indeterminate | 40 (16.3) | 58 (22.5) |
| Total | 246 (100) | 258 (100) |
| Pollen Concentration (grains/ml) | 2312 | 7035 |

Phytoliths were well-preserved in the sediments and extended counts were made of both samples. Phytolith data are presented in Table D.2.

Table D.2. Phytoliths Identified in the Samples from 41MK27

| Phytolith Type | Sample 1 | Sample 4 |
|------------------------|------------------|------------------|
| <i>Coarse Fraction</i> | | |
| Bulliform Poaceae | 45 (14.3) | 43 (13.4) |
| Poaceae Elongate | 15 (4.8) | 23 (7.1) |
| Poaceae Hair/Edge | 26 (8.3) | 23 (7.1) |
| Bulliform | 223 (71.0) | 228 (70.8) |
| Rod | 5 (1.6) | 5 (1.6) |
| Total | 314 (100) | 322 (100) |
| <i>Fine Fraction</i> | | |
| Keeled | 10 (3.1) | 13 (4.2) |
| Conical | 8 (2.5) | 13 (4.2) |
| Pyramidal | 8 (2.5) | 8 (2.6) |
| Crenate | 8 (2.5) | 7 (2.2) |
| Saddle | 186 (58.3) | 162 (51.8) |
| <i>Stipa</i> -type | 5 (1.6) | 16 (5.1) |
| Panicoid Bilobate | 29 (9.1) | 30 (9.6) |
| Panicoid Cross | 1 (0.3) | 2 (0.6) |
| Bilobate | 63 (19.7) | 62 (19.8) |
| <i>Cucurbita</i> | 1 (0.3) | |
| Total | 319 (100) | 313 (100) |

Discussion

Pollen

Although fossil pollen was identified in both 41MK27 sediment samples, it is clear that the pollen taxa represent imperfectly preserved assemblages. Pollen concentration values are generally low indicating that many grains have been lost through natural degradation processes. Frequently, the more fragile pollen grains are lost, while durable taxa, including grasses, Cheno-Ams and Asteraceae remain. These durable taxa also possess diagnostic morphological characteristics that allow for easy recognition, even when they are in very poor shape. This results in a skewed assemblage, where several durable taxa are over-represented in the pollen spectra, while less durable types tend to be under-represented. Clearly, differentially-preserved assemblages must be examined with caution. Still, the analysis is valuable in that it provides a list of taxa likely to have been present in the site area in the past.

Both pollen samples from 41MK27 exhibit similar pollen assemblages, although there are some minor

differences between the samples. Both samples are high in Low Spine Asteraceae (ragweed type), Poaceae (grass), Chenopodiaceae (goosefoot and pigweed), *Quercus* (oak) and *Salix* (willow) pollen. These taxa tend to confirm that the area was probably a grassland area with scattered mottes of trees, and are common in the region today. Other taxa noted in the samples are also species known to occur in the site area. *Pinus* (pine) and *Ephedra* (mormon tea) are both wind-pollinated types and are known to travel great distances. It is likely that these grains were blown in from west Texas and do not represent a local occurrence of these taxa in the site area.

Phytoliths

The phytoliths identified in the 41MK27 samples were derived predominantly from grasses, and offer insights into the past grassland composition of the site area. Both samples contained nearly identical phytolith assemblages, thus providing little information on feature function.

Festucoid (cool climate C3 grasses) grass phytoliths were noted in the samples, and are represented by keeled, conical, pyramidal and crenate forms. Festucoid types are usually a minor component of most Texas phytolith assemblages (Fredlund and Tieszen 1994). Chloridoid (C4 bunch grasses; buffalo grass and grama grass) saddle phytoliths are very well represented in the 41MK27 samples. These types are more common in warmer and drier areas of south and west Texas. Panicoid (C4 warm climate grasses, including bluestem and indian grass) grasses are represented by Panicoid bilobates and cross-shaped phytoliths. These types are also well represented in central Texas. Other phytolith types encountered in the samples are less diagnostic, being found in a number of different grass groups, including bilobates and *Stipa*-type phytoliths. Because *Stipa*-type phytoliths are common in grasses in the genus *Stipa* and also occur in other genera, a generic identification cannot safely be made. The assemblages, overall, reflect a mixed grass environment, dominated by short bunch grasses and tall grass panicoids, with a fair amount of festucoid forms also present in the vicinity.

It is interesting that non-grass phytoliths were rare in the phytolith samples from 41MK27. A single *Cucurbita* phytolith was identified in Sample 1. Here, rather than representing a domesticated squash, this elongated phytolith likely derives from the native buffalo gourd (*Cucurbita foetidissima*). While this plant is fairly common in central Texas, it can also be used for food (Yanovsky 1936), and the possibility that the plant was brought into the site area by humans cannot be ruled out.

Summary

Two sediment samples from 41MK27 were examined for fossil pollen and phytolith content. Pollen was encountered in both samples, but low concentration values imply that much pollen has been lost from the assemblages. Taxa identified in the pollen samples represent species found in the site area today.

Phytoliths were well preserved in the 41MK27 samples. The assemblages were dominated by grass phytoliths, including Festucoid, Chloridoid and Panicoid types. Together, these phytoliths indicate that the past environment of the site area was probably a mixed-grass prairie. The pollen data suggests that scattered mottes of trees were also likely to have been present in the vicinity of the site.

References Cited

- Barkley, F.A.
1934 The statistical theory of pollen analysis. *Ecology* 47:439–447.
- Bryant, Vaughn M., Jr. and Steven A. Hall
1993 Archaeological Palynology in the United States: A Critique. *American Antiquity* 58:277–286.
- Erdtman, G.
1960 The Acetolysis Method: A Revised Description. *Svensk Botanisk Tidskrift* 54:561–564.
- Fredlund, Glen and Larry Tieszen
1994 Modern Phytolith Assemblages from the North American Great Plains. *Journal of Biogeography* 21:321–335.
- Hall, Steven A.
1981 Deteriorated pollen grains and the interpretation of Quaternary pollen diagrams. *Review of Paleobotany and Palynology* 32:193–206.
- Yanovsky, Elias
1936 *Food Plants of the North American Indians*. Miscellaneous Publications 237. United States Department of Agriculture, Washington, DC.

Printed and distributed by the Texas Department of Transportation

ISBN 0-9660796-5-5

**EXCAVATIONS AT THE BLUFF CREEK SITES:
41MK10 AND 41MK27, McCulloch County, Texas**

Ann M. Irwin, Brett A. Houk, and Doug Drake

ISBN 0-9660796-5-5

TxDOT
SWCA

1999