

University of Denver

Digital Commons @ DU

Electronic Theses and Dissertations

Graduate Studies

1-1-2010

Prehistoric Sandals of the Southern High Plains: Indicators of Cultural Affinity and Change

Allison N. Rexroth
University of Denver

Follow this and additional works at: <https://digitalcommons.du.edu/etd>



Part of the [Archaeological Anthropology Commons](#)

Recommended Citation

Rexroth, Allison N., "Prehistoric Sandals of the Southern High Plains: Indicators of Cultural Affinity and Change" (2010). *Electronic Theses and Dissertations*. 546.
<https://digitalcommons.du.edu/etd/546>

This Thesis is brought to you for free and open access by the Graduate Studies at Digital Commons @ DU. It has been accepted for inclusion in Electronic Theses and Dissertations by an authorized administrator of Digital Commons @ DU. For more information, please contact jennifer.cox@du.edu, dig-commons@du.edu.

Prehistoric Sandals of the Southern High Plains:

Indicators of Cultural Affinity and Change

A Thesis

Presented to

the Faculty of Social Sciences

University of Denver

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

by

Allison N. Rexroth

August 2010

Advisor: Lawrence B. Conyers

Author: Allison N. Rexroth

Title: Prehistoric Sandals of the Southern High Plains: Indicators of Cultural Affinity and Change

Advisor: Lawrence B. Conyers

Degree Date: August 2010

ABSTRACT

Perishable artifacts, such as basketry, cordage, and sandals are rare cultural materials due to the environments in which they are preserved and their inherent non-durability. Where recovered, researchers have used them to study expressed identity and trace population movements over time and space. On this premise, previously undescribed sandal assemblages from Trinchera Cave, Colorado and the Kenton Caves, Oklahoma/New Mexico were age dated, analyzed, and compared to other known sandal collections throughout North America, including Franktown Cave, Colorado. The study of the rare perishables from all three caves/rockshelters on the Southern High Plains have provided a unique opportunity for the acquisition of information regarding the technology used by and possible affiliations of prehistoric people in and immediately adjacent to this region. Specifically, the utilization of similar sandal styles at these sites at different times during the Archaic through Late Prehistoric periods suggests several population movements on the Southern High Plains.

Acknowledgments

Many thanks to the Loudon-Henritz Archaeology Museum at Trinidad State Junior College, the No Man's Land Museum, Oklahoma Historical Society, Sam Noble Museum of Oklahoma Natural History, Woolaroc Museum and Ranch, and the University of Denver, Museum of Anthropology (DUMA) and their curators, directors, and administration for opening their doors and collections for the sake of research. Thanks go to Colorado State University for awarding me the Karen S. Greiner Endowment, the Colorado Archaeological Society for awarding me multiple Alice Hamilton Scholarships, the Colorado Historical Society for awarding me a State Historical Fund Grant, the University of Arizona AMS Lab for awarding me ten free student dates, and Sarah Milledge Nelson (DU) for allowing me to use the remainder of the Franktown Cave National Science Foundation Grant to date the sandals from these three caves. Without these funds, the temporal context of these sandals would have remained a mystery. Thanks to Beta Analytic and the University of Arizona Radiocarbon Labs for their expedient and professional workmanship in dating these materials. Thanks to Sigma Xi Research Society for providing me with funds for travel.

Thanks to John Watson for the creation and adaptation of multiple maps and figures. Thanks to Christina Mann for the digitization of multiple sandal schematics and figures. You have transformed my thesis into a professional document.

Most of all, thanks go out to my support team of Dr. Sarah Milledge Nelson, Dr. Kevin Gilmore, Dr. Lawrence Conyers, Dr. J. M. Adovasio, Jeffrey Illingworth, and Ed Jolie. Many thanks for bringing these unanalyzed collections to my attention and providing me with the knowledge, means, and support to attempt and complete this work.

Table of Contents

Chapter One: Introduction.....	1
Chapter Two: Perishables.....	12
The Utilization of Artifacts and Attributes as Cultural Markers	15
Perishables Research Across North America.....	21
Sandals Research.....	29
Chapter Three: Basketry Weaves and Typologies.....	32
Basketry Weaves and Typologies Employed in the Production of Sandals.....	35
Chapter Four: Sites.....	49
Franktown Cave (5DA272; L:9:31).....	51
Location and Physiographic Setting	51
Previous Excavations.....	53
Hugh O. Capps, Jr.....	53
Arnold Withers.....	54
Gerold Thompson	56
Sarah Nelson	57
Kevin Gilmore	58
Anthony G. King.....	59
Perishables Research.....	60
Early-Middle Archaic	60
Early Ceramic	61
Summary of Previous Interpretation of the Material	61
Trincheras Cave (5LA1057).....	64
Location and Physiographic Setting	67
Previous Excavations	68
Haldon Chase	69
Dr. Herbert W. Dick.....	69
Colorado Archaeological Society, Trinidad chapter.....	70
Caryl Wood Simpson.....	70
Michael Nowak.....	74
Perishables Research.....	76
Basketry, Cordage, and Sandals.....	77
Leather and Hide.....	78
The Kenton Caves (Basketmaker Cave: 34CI50).....	79
Location and Physiographic Setting	79
Previous Excavations	83
William "Uncle Billy" Baker	83
E. B. Renaud	83
Joseph Thoburn.....	83
Perishables Research.....	85

Summary of Previous Interpretation of the Material	85
Chapter Five: Methods and Procedures	87
Methodology	90
Chapter Six: Comparative Collections: Known Sandal-making Regions	96
The Great Basin	97
Northern Great Basin	98
Western Great Basin	101
Eastern Great Basin.....	101
The Southwest.....	102
The Mogollon.....	104
Jornada Basin Mogollon	109
Colorado Plateau/Basketmaker/Ancestral Puebloan/Puebloan...	113
The Great Plains.....	118
Northern Mexico and Texas.....	120
Northern Mexico/Coahuila	120
Lower and Trans-Pecos Texas	125
Northern Coahuila (intermediate region between Coahuila and Lower and Trans-Pecos Texas).....	126
The East.....	129
Chapter Seven: Analysis and Results	135
Sandal Descriptions	135
Franktown Cave (5DA272; L:9:31).....	135
The Kenton Caves (Basketmaker Cave: 34CI-50).....	140
Trinchera Cave (5LA1057).....	175
Radiometric and Statistical Analysis	191
Internal Correlations	193
Franktown Cave (5DA272; L:9:31).....	193
The Kenton Caves (Basketmaker Cave: 34CI-50).....	198
Trinchera Cave (5LA1057).....	209
The Southern High Plains	218
External Correlations	230
Franktown Cave (5DA272; L:9:31).....	231
The Kenton Caves (Basketmaker Cave: 34CI-50).....	236
Trinchera Cave (5LA1057).....	255
The Southern High Plains	265
Chapter Eight: Interpretation	271
Technological Trajectory of the Southern High Plains Perishable Industry	272
Relation of the Developmental Sequence with Present Site Interpretations	274
Franktown Cave	274

The Kenton Caves.....	278
Trinchera Cave.....	283
Models of Population Movement and the Diffusion of Perishable Technology	289
Explanatory Scenarios	297
Chapter Nine: Conclusion.....	304
Suggested Future Work.....	312
References Cited.....	316
Appendices.....	335
Appendix A: Analysis and Recordation forms from Adovaiso 1977 (updated 2004)	335
Appendix B: Metric Data.....	350
Sandals	350
Coiled Basketry.....	364
Appendix C: Statistical Analysis	366
Franktown Cave	366
The Kenton Caves.....	367
Trinchera Cave.....	370
Southern High Plains Coiling	372
Pendejo Cave Sandal Comparison	376
Appendix D: Adovasio et al. 2005.....	377

LIST OF TABLES

Table 1: Temporal Ascription of Sandal Specimens from Franktown Cave
(adapted from Adovasio et al. 2005:Table 4).....197

Table 2: Temporal Ascription of the Sandal Types and Specimen from the
Kenton Caves.....204

Table 3: Temporal Ascription of the Sandal Types and Specimens from
Trinchera Cave.....214

Table 4: Temporal Ascription of a Rare Coiling Technique at Southern High
Plains Sites.....226

LIST OF FIGURES

Figure 1.1: Location of Franktown Cave, Colorado; Trinchera Cave, Colorado;
and the Kenton Caves, Oklahoma/New Mexico (Map created by
John C. Watson, GISP).....8

Figure 2.1: Burial wrapped in simple plaited mat (modified from Taylor 2004,
Figure 3-18).....13

Figure 2.2: Burned muddy footprints on the floor of a pit house in Pocket Cave
(Photo by Earl H. Morris; Arizona State Museum Neg. 5988, presented
in Hays-Gilpin et al. 1998, Figure 3.4).....14

Figure 2.3: Prehistoric occupant of the Kenton Caves with culturally specific
artifacts (modified from Kenton Caves display mural, Woolaroc
Museum, Oklahoma).....23

Figure 2.4: Distribution of basketry manufacturing centers: 4500-2000 B. C.
(modified from Adovasio 1974, Map 4 by John C. Watson, GISP).....26

Figure 3.1: Twining Schematic (borrowed from Adovasio 1977, Figure 6).....34

Figure 3.2: Plaiting Schematic (borrowed from Adovasio 1977, Figure 117a)....34

Figure 3.3: Schematic of coiled basketry and structural elements (borrowed
from Adovasio 1977, Figure 64).....35

Figure 3.4: Construction methods for Archaic open-twined sandals (left) and
warp-faced plain weave sandals (right) from the northern Colorado
Plateau (borrowed from Geib 2000, Figure 2).....36

Figure 3.5: Fort Rock Sandal Toe Cover Schematic (borrowed from Andrews et al. 1986, Figure 79).....	37
Figure 3.6: Sandal anatomy (adapted from McBrinn 2005: Figure 5.2 and Martin et al. 1952:261)	39
Figure 3.7: Schematic of exhausted wefts (Traction Master sandal) (adapted from Cosgrove 1947: Figure 90)	39
Figure 3.8: Examples of side selvages (borrowed from Adovasio 1977, Figure 44a & b).....	40
Figure 3.9: Classification of sandals by toe shape and heel shape (borrowed from Hays-Gilpin et al. 1998, Figure 3.6)	40
Figure 3.10: Folded (left) and Truncated (right) toe and heel constructions and selvages [borrowed from Adovasio 1977, Figures 32 (right) & 36 (left)]	41
Figure 3.11: Toe-heel and Side-loop Tie Systems (borrowed from Hays-Gilpin et al. 1998, Figure 5.14).....	42
Figure 3.12: Side-loop and Toe-heel Tie Systems (borrowed from Hays-Gilpin et al. 1998, Figure 5.29).....	43
Figure 3.13: Anasazi sandal from Bernheimer Alcove, Utah [borrowed from Kankainen 1995, Catalog no. 42SA736 (FS38.7 24080)].....	45
Figure 3.14: Anasazi sandal from Baby Mummy Cave, Arizona (borrowed from Kankainen 1995, Catalog no. 2575)	46
Figure 3.15: Fort Rock sandals (borrowed from Cressman 1962).....	48
Figure 4.1: Location of Franktown Cave, Colorado; Trinchera Cave, Colorado; and the Kenton Caves, Oklahoma/New Mexico (Map created by John C. Watson, GISP).....	51
Figure 4.2: Franktown Cave (courtesy of Sara Gale).....	52
Figure 4.3: Franktown Cave Specimen TOM-500, Type II: Close Coiling, Bundle Foundation, Non-Interlocking Stitch (borrowed from Adovasio et al. 2005, Figure 6).....	62
Figure 4.4: Trinchera Cave (Courtesy of Herb Dick).....	68

Figure 4.5: Trinchera Cave sandal specimen TR1 789 (modified from Simpson 1976, Plate 7)	71
Figure 4.6: Kenton Caves; Cave 2, Oklahoma (Courtesy of William Baker)	80
Figure 4.7: Kenton Caves; Cave 6, New Mexico (Courtesy of William Baker) ...	80
Figure 4.8: Location of Kenton Caves (Courtesy of DUMA accession records) ..	81
Figure 4.9: Kenton Caves Designations (Courtesy of DUMA accession records)	82
Figure 6.1: Basketmaking regions of North America, 4500-2000 B.C. (adapted from Adovasio 1974: Map 4 by John C. Watson, GISP).....	97
Figure 6.2: Sandal types represented in the Northern Great Basin (borrowed from Connolly and Barker 2004: Figure 1)	100
Figure 6.3: Distribution of southwestern technocomplexes, AD 1-400 (adapted from Webster 2007:Figure 2.6).....	103
Figure 6.4a: Mogollon sandal types: a) Two-warp sandal (Type 11), b) Two-warp sandal (Type 8), c) Five-warp Full-length (Type 12), d) Concentric warp (Type 14), e) Multiple Warp Cord sandal, and f) Basketmaker III twined sandal (adapted from Cosgrove 1947: Figures 91 & 92; Webster 2007:Figure 16.7).....	108
Figure 6.4b: Plaited Mogollon Sandals. Left and center: Simple Plaited; Right: Twill Plaited (Adapted from Martin et al. 1952:Figures 92 & 96).....	109
Figure 6.5: Jornada Mogollon/Pendejo Cave sandals. Clockwise from top left: Type 1 (Four-warp Scuffer Toe), Type 2 (Two-warp Scuffer Toe) with Fishtail Heel, Type 2 (Two-warp Scuffer Toe), Type 3 (Plaited with Toe Eyelet), and Type 2 (Two-warp Scuffer Toe) (adapted from Hyland 1997: Figures 43, 45, and 48-50)	112
Figure 6.6: Archaic open-twined sandals (left) and warp-faced plain weave sandals (right) from the northern Colorado Plateau (borrowed from Geib 2000, Figure 2)	115
Figure 6.7: Ancestral Puebloan/Basketmaker sandals. Counterclockwise from top left: Two-warp wickerwork, Four-warp plain weave, Twill plain weave, Composite, Twined, and Braided (adapted from Kankainen 1995: 35, 37, 40, 67, & 68)	117

Figure 6.8. Textile impressions from Graham Cave, Missouri (borrowed from Logan 1952: Plate XXI).....	119
Figure 6.9. Perishable impressions on pottery (borrowed from Logan 1952: Plate XXIII, Specimen G).....	119
Figure 6.10: Plaited sandals (Type F1a) (borrowed from Taylor 2004:Figures 5-1 and 5-3).....	121
Figure 6.11: Coahuila sandals (clockwise from top left), Twillpad (F1b), Twillpad (F1b), Checkerpad (F1c), Braided (F1e), Sewn (F1d) (adapted from Taylor 2004:Figures 6-1, 6-3, 6-5, and 6-6).....	124
Figure 6.12: V-weft Sandal (borrowed from Turpin 2003:Figure 6).....	128
Figure 6.13: Kentucky slipper sandal (Orchard 1920, Plate III).....	130
Figure 6.14: Kentucky slipper sandal with stuffed projections on both sides of the toes (Orchard 1920, Plate IV).....	130
Figure 6.15: Arnold Research Cave Sandal B, Specimen 1 (Kuttruff et al. 1998:73).....	131
Figure 6.16: Arnold Research Cave Sandal B, Specimen 5 (Kuttruff et al. 1998:73).....	132
Figure 6.17: Arnold Research Cave Specimen 21 (Kuttruff et al. 1998:74)	132
Figure 6.18: Ozark Bluffs sandals. Top row: Plaited/Interlaced; Bottom row: (L) Twined, (R) Combination (adapted from Sholtz 1975: Figures 146-148).....	133
Figure 7.1 Franktown Cave Type I Sandal, Specimen TOM-501 (Adovasio et al. 2005: Figure 16)	135
Figure 7.2. Construction schematic of the tie system employed on Specimen TOM-501 (adapted from Adovasio et al. 2005: Figure 20).....	136
Figure 7.3. Franktown Cave Type I Sandal, Specimen TOM-588, heavier variant (borrowed from Adovasio et al. 2005: Figure 30)	138
Figure 7.4. Franktown Cave moccasin (DU 3505)	140
Figure 7.5. Kenton Caves Type I Sandal, Specimen 5049 with tie mechanism schematic (schematic by C.B. Graphic).....	142

Figure 7.6. Possible Kenton Caves Type I Sandal, Specimen 5048B	143
Figure 7.7. Kenton Caves Type II Sandal, Specimens 397 (left) and 391 (right)	146
Figure 7.8. Kenton Caves Type II Sandal Schematics. Sandal profiles illustrating the bended weave (both), the creation of the tie mechanism (left), and the creation of the side selvages (schematics by C.B. Graphic and Allison Rexroth).....	146
Figure 7.9. Kenton Caves Type II Sandal Schematic. Specimen DU 397 tie mechanism (schematic by C.B. Graphic)	147
Figure 7.10. Kenton Caves Type II Sandal, Specimen DU 397 formed heel (schematic by C.B. Graphic).....	148
Figure 7.11. Possible Kenton Caves Type II Sandal, Specimen 5048H.....	149
Figure 7.12. Possible Kenton Caves Type II Sandal, Specimen Illustrated in Lintz and Zabawa 1984:Figure 7.2h	150
Figure 7.13. Kenton Caves Type III Sandal, Specimen DU 398. Note trebled weaving elements.....	152
Figure 7.14. Kenton Caves Type III Sandal, Specimen A18. Note doubled weaving elements.....	153
Figure 7.15. Kenton Caves Type III Sandal Schematic of heel finish (schematic by C.B. Graphic).....	154
Figure 7.16. Kenton Caves Type III Sandal, Specimen DU 399 with close-up of tie mechanism	155
Figure 7.17. Kenton Caves Type III Sandal Schematic, Specimen DU 399 tie mechanism (schematics by C.B. Graphic).....	156
Figure 7.18. Kenton Caves Type IV Sandals, Specimen DU 388 (above) and DU 392 (below) (schematics by C.B. Graphic).....	158
Figure 7.19. Kenton Caves Type V Sandal, Specimen DU 387 with schematic of warp configuration (schematic by C.B. Graphic).....	160
Figure 7.20. Kenton Caves Type VI Sandal, Specimen A17 with schematic (schematic by C.B. Graphic).....	162

Figure 7.21. Kenton Caves Type VII Sandals, Specimen A23 (left) and A24 (right)	165
Figure 7.22. Schematic drawings of tie mechanisms found on Cosgrove's Type 4b and 5a Two-Warp Fish-tail sandals (adapted from Cosgrove 1947: Figure 90).	166
Figure 7.23. Kenton Caves Type VII Sandal Specimen A24, schematic of knot employed in tie mechanism	166
Figure 7.24. Kenton Caves Type VIII Sandal, Specimen DU 824 (schematic by C.B. Graphic).....	170
Figure 7.25. Kenton Caves Type VIII Sandal, Specimen DU 825	172
Figure 7.26. Kenton Caves Type IX Sandal, Specimen 5119	174
Figure 7.27. Trinchera Cave Type I Sandal, Specimen 221A	177
Figure 7.28. Trinchera Cave Type II Sandals, Specimen T5-4-2 (left) and 789 (right)	179
Figure 7.29. Trinchera Cave Type II Sandal, Specimen 780.....	181
Figure 7.30. Trinchera Cave Type III Sandal, Specimen 21A.....	183
Figure 7.31. Trinchera Cave Type IV Sandals, Specimen 794 (left) and No # B (right).....	185
Figure 7.32. Trinchera Cave Type V Sandal, Specimen No # A. Moccasin	187
Figure 7.33. Trinchera Cave Type V Sandal, Specimen 41. Moccasin	187
Figure 7.34. Trinchera Cave Untyped Sandal, "Hal Chase" Specimen.....	189
Figure 7.35. Trinchera Cave Untyped Sandal, Specimen No # E.....	190
Figure 7.36. Buffalo hide legging (Gilmore 2005a)	195
Figure 7.37: The Kenton Caves Technological Sequence (based on 2 sigma calibrated ages).....	208
Figure 7.38: The Trinchera Cave Technological Sequence (based on 2 sigma calibrated ages).....	217

Figure 7.39: The Technological Sequence for Franktown Cave, the Kenton Caves, and Trinchera Cave (based on 2 sigma calibrated ages).....	225
Figure 7.40: Chamber Cave one rod and bundle basketry fragment (adapted from Nelson 1970:Figure 8).....	228
Figure 7.41. Specific sites utilized in the determination of the External Correlations of the Sandal collections from Franktown Cave, Trinchera Cave, and the Kenton Caves (adapted from Hyland 1997 by John Watson GISP).....	231
Figure 7.42: Southwestern style winter sandal, with padding. Sandal length is 130 mm. (Photo by Elizabeth Ann Morris: Arizona State Museum Neg. 6087) (adapted from Hays-Gilpin et al. 1998: Figure 4.19).....	234
Figure 7.43. Sketch of Promontory Cave (Utah) moccasins (adapted from Steward 1937a)	236
Figure 7.44: Specimen comparable to the Kenton Caves Type I sandal [left to right: Kenton Caves specimen #5049 and Cowboy Cave (Jennings 1980:59, Figure 26, specimen c) plain weave sandal	237
Figure 7.45: Dust Devil Cave “Coarse Warp Faced” sandal (Lindsay et al. 1968:118, Figure 94d) identified as being similar to a Balanced Plainweave sandal from Cowboy Cave	239
Figure 7.46: Specimen from Dust Devil and Sand Dune Caves (left: Lindsay et al. 1968:Figure 94b; right: Lindsay et al. 1968:Figure 73e)	242
Figure 7.47: Sandals from Pendejo Cave (Hyland 1997:Figure 50), Tularosa and Cordova Caves (Martin et al. 1952:Figure 92), Upper Gila Caves (Cosgrove 1947:Figure 92) and Coronado State Monument, New Mexico.....	245
Figure 7.48: Known continuous warp configurations [left: continuous outer-warp cord (Martin et al. 1952: Figure 102); center: multiple warp cord (Martin et al. 1952: Figure 100); right: multiple warp cord (Martin et al. 1952: Figure 100)]	247
Figure 7.49: Multiple warp cord sandals from Tularosa and Cordova Cave (adapted from Martin et al. 1952: Figure 99)	248
Figure 7.50: Schematic drawings of Cosgrove Type 4b and 5a Two-Warp Fish-tail sandals (Cosgrove 1947:Figure 90).....	251

Figure 7.51: Specimens comparable to the Trinchera Cave Type I Sandal [left to right: Trinchera Cave specimen #221A, Pendejo Cave Type II sandal (Hyland 1997:Figure 45), and Cosgrove Type 4b (1947: Figure 90).....	255
Figure 7.52: Specimens comparable to the Trinchera Cave Type II Sandals [left to right: Trinchera Cave Specimen #T5-4-2, Cosgrove (1947) Type 12 five warp sandal, Tularosa and Cordova Caves four warp sandal (Martin et al. 1952:Fiugre 90), and side-loop tie system on Tularosa and Cordova Caves plaited sandals (Martin et la. 1952:92)]....	257
Figure 7.53: Pendejo Cave Type I four warp scuffer toe sandal specimen G681 (Hyland 1997:Figure 43).....	258
Figure 7.54: Winter-type leather sandals with side-loop ties and grass padding from Tularosa Cave, which are similar to Trinchera Cave Type IV sandals; possible winter variants. Length of left sandal is 244 mm. (adapted from Martin et al. 1952: Figure 110).....	260
Figure 7.55: Leather sandals from Tularosa Cave (adapted from Martin et al. 1952: Figure 109).....	261
Figure 7.56: Leather sandals from Sand Dune Cave. Left: upper sides, Right: soles; specimen a:left; b:right (adapted from Lindsay et al. 1968: Figures 49 & 50).....	262
Figure 7.57: Schematic of leather sandals from Sand Dune Cave (a:left; b:right) similar to the Trinchera Cave Type V specimen No #A (adapted from Lindsay et al. 1968:Figure 51).....	263
Figure 8.1: Distribution of Southwestern Technocomplexes (top left: ca 6000 B.C.; top right: ca 5000 B.C.; bottom left: ca 3000 B.C.; bottom right: ca 1000 B.C.) (adapted from Irwin-Williams 2007:16-18)	290
Figure 8.2: Distribution of Southwestern Technocomplexes (top left: AD 1-400; top right: AD 500-900; bottom left: AD 900-1200) (adapted from Irwin- Williams 2007:18-20).....	291
Figure 8.3: Adovasio's explanatory models of the development of the known basketmaking regions. Top to Bottom: 8000-7000 B.C.; 7000-4500 B.C.; 4500-2000 B.C. (adapted from Adovasio 1974).....	294

Chapter 1: Introduction

Early Native American prehistory as told by archaeologists usually begins with a generalized and simplistic hunter-gatherer way of life. From the earliest Paleo-Indian times (11,500 B.P.), highly mobile bands relied on fairly simple stone tool and plant fiber technology to adapt to their harsh environment (Adovasio et al. 1998; Cassells 1997; Chenault 1999). They exploited megafauna using large flaked stone dart points, hide processing tools, spears, and netting, protected themselves from the elements by producing fitted clothing, footwear and matting, and transported their belongings via woven basketry and bags (Adovasio et al. 1998; Chenault 1999). Over time, with the extinction of megafauna and frequent climate changes and fluctuations (during what is termed the Archaic from about 7800-1850 B.P.) people were forced to diversify their survival strategies and broaden their resource exploitation. They began to focus on smaller game using very different artifacts such as snares and smaller projectile points, collected nuts and berries, as well as more intensively utilized groundstone tools (Cassells 1997; Chenault 1999). More rapid cultural change during the Archaic is evidenced by technological innovations in the form of more regionally diverse projectile point technology and previously unseen forms of shelter, such as pithouses (Cassells 1997). This adaptive advantage trajectory of increased change and diversity is propelled

even further with the advent of pottery and the bow and arrow, as well as the initial cultivation of maize in the Late Prehistoric (1850-225 B.P.).

Prehistoric people that inhabited what are today parts of Colorado, Kansas, Oklahoma, and New Mexico developed a number of unique and well adapted tools and clothing as an adaptation to environmental conditions on the High Plains throughout prehistory. These highly mobile hunter/gatherer bands exploited both the resources of the plains and the mountains as they migrated widely (Cassells 1997; Chenault 1999; Gilmore 2006). The exploitation of these very different ecosystems required them to develop technologies which would allow them to adapt to both types of environments during different times of the year. Evidence for the earliest occupation of both the mountains and plains dates to 11,500 B.P. during the Paleo-Indian stage (Cassells 1997; Chenault 1999). Based on the research done on lithic and ceramic data sets, it has been hypothesized that the Early Archaic occupants of eastern Colorado were highly mobile, but the Late Archaic and Early Ceramic occupants decreased mobility and increased sedentism due to increased population pressures (Gilmore 2006). The “transition from Late Archaic (1000 B.C. – A.D. 150) to Early Ceramic (A.D. 150 – 1150) on the Front Range of the Southern High Plains is defined archaeologically by the appearance of new technologies, new economies, increasing population, and new social and ritual structures” (Gilmore et al. 1999; Zier and Kalasz 1999). Whether this transition was due to factors of environmental change, increased population pressures, or outside influence, a change in lifestyle occurred at the transition between the Archaic and Ceramic periods.

There were also prehistoric groups occupying the neighboring regions, including the Southwest. Southwestern populations were culturally different than the Plains groups,

with a more permanent strategy, having considerably greater dependence on agriculture (Kantner 2004), and whose technology was more adapted for life in the Desert West. However, it has been demonstrated that these “Southwesterners” were still connected to the Plains people via trade (exotic shell and ceramics) (Gilmore 2006). The interaction between Plains and Southwest groups is evidenced by the artifacts left behind. These artifacts, such as ceramics, stone tools, architecture, and perishable technology, exhibit a sharing of technologies and interaction at the peripheral boundaries between these two environmental regions. Artifacts from the Southern High Plains, which include west Texas, New Mexico east of the Pecos River, the panhandle of Oklahoma, southeast Colorado, and southwest Kansas, that share both Plains and Southwest traits are a prime example (Nowak and Gerhart 2002; Simpson 1976).

It has been proposed that it was during this long transition between the Archaic and Ceramic periods that the manufacture of artifacts became a uniquely personal expression of identity (Dillehay 2001; Minar 2001). Regional cultural distinction and group identity were beginning to be expressed in the specific ways that these new technologies were being manufactured. Group identity was being delineated by localized variation in how the knowledge and skills related to the production, stylization, and function of tool kits were transferred from person to person (Dillehay 2001; Minar 2001). One of these highly stylized artifact types is perishables, or more specifically basketry and sandals. These artifacts are uniquely suited to questions of group identity precisely because “no two populations appear to have ever manufactured basketry [and sandals] in precisely the same fashion” (Adovasio 1977:4). This has been demonstrated ethnographically, and seems to be valid archaeologically as well (Adovasio 1977).

Therefore, in order to study the expression of identity on the Southern High Plains, I have used the only known perishable collections in the region, those of Franktown Cave and Trinchera Cave, Colorado and the Kenton Caves, Oklahoma/New Mexico. Sandals from these assemblages were compared descriptively and radiometrically in order to determine whether the identity expressed by the Southern High Plains populations displayed any similarity to identities expressed in adjacent regions, such as the Southwest.

The interaction between Plains and Southwest cultures has been an important and longstanding problem for investigators in southeastern Colorado (Simpson 1976). This is due in large part to the development and utilization of somewhat restrictive models of Southern High Plains occupation and exploitation. Unfortunately, these models tend to ignore marked similarities and interrelationships among sites in both the South Platte and Arkansas River basins of southeastern Colorado as well as in northeastern New Mexico (Zier and Kalasz 1999:141). Individuals focusing on lithic and ceramic data found at southeastern Colorado sites have suggested that the cultures of southeastern Colorado were a local in situ development with a common origin in the Ceramic/Late Prehistoric period (Zier and Kalasz 1999), as opposed to an either Plains or Southwest influenced development. Though the Sopris and Apishapa phases of the Late Prehistoric period show some Plains and Southwest influence, the precise nature of the distinctions between them has not yet been explored fully, and sites which might suggest interaction between the two have not been identified (Zier and Kalasz 1999:189). When looking at the overlapping Plains and Southwest characteristics and artifact styles at southeastern Colorado sites, it cannot be denied that there was interaction between Plains and Southwest cultures (Nowak and Gerhart 2002; Simpson 1976; Zier and Kalasz 1999).

However, the timing and intensity of this influence and interaction is up for debate. The radiocarbon dating of the sandal collections from the Southern High Plains reported in this work suggest that the earliest sandal technology present in the area is of Early Archaic (ca. 6430 cal B.C.) ascription. Plant-fiber sandals continue to be made through the Ceramic/Late Prehistoric period, after which time hide footwear is introduced. The earliest sandal technology shows considerable similarity to that produced on the northern Colorado Plateau. Later developments in Southern High Plains sandal technology show strong connections to that which dominates the Mogollon region of New Mexico.

It has been hypothesized that a spread of technology between the adjacent regions of the Plains and Southwest may have been instigated by climatic and environmental fluctuations and increased population movement (Gilmore 2006). These changes in environmental conditions would have made it desirable for groups to have larger and more varied territories available for their use, which in turn, would increase group contact. As groups expanded their traditional area of exploitation in an effort to gather more resources, previously non-overlapping spheres of exploitation would have overlapped. Peripheral zones would have been shared by very different groups. It is likely that an increase in population size (possibly due to an increase in the number of groups) in the area and a wider range of resource exploitation (as a result of climatic and environment change) led to increased interaction, intermarriage, and blending, resulting in changes in technology as an adaptational response (Gilmore 2006). Even changes in stylistic choice may have signaled an “active expression of participation in an expanded network” (Geib 2000). Meaning, a new, or newly dominant artifact attribute (or packet of attributes), may have signaled the expression of a new shared identity, a new alignment

or joining of groups. Therefore, the highly stylized attributes used in the manufacture of sandals were studied in order to determine whether a noticeable disjuncture occurred regarding the technology employed on the Southern High Plains, signaling a change in expressed identity.

Though some believe that a gradual diffusion of technology occurred, rather than an actual migration of people from the Central Plains (Gilmore 2006), the sandal technology presented here suggests otherwise. It seems more likely, that multiple co-existing populations of similar and differing cultural affiliation were present at this peripheral zone between the Rocky Mountains, Plains, and Southwest. The evidence for both Plains and Southwest influence along the Front Range by A.D. 1000 is well-established via pottery styles, projectile points, and the utilization of maize (Baugh 1994; Ireland 1970; Krieger 1946; Schroeder 1994; Simpson 1976). However, this thesis provides radiocarbon dates and newly described artifact types that support the idea that the interaction between the Plains and Southwest cultures on the Front Range was not a relatively recent development. In fact, it occurred thousands of years before previously suggested. The analysis of the perishable collections from Franktown Cave and Trincheras Cave, Colorado and the Kenton Caves, Oklahoma/New Mexico have provided new evidence regarding the direction and region from whence these individuals came, when they arrived, and what cultural influences and technology they might have brought with them.

For decades, perishable materials have been used to define, explore, and trace populations across the globe. They are uniquely designed for this type of analysis because of their population sensitive structural attributes. Because these attributes are

representative of culturally determined choices made by the craftsman, they can be used to aid in the analysis and documentation of technological change, cultural affiliation, group origin, cultural diffusion, and population movement (Adovasio 1977, 1986).

Though perishables in general include all types of plant and animal products, the focus of this study was limited to the analysis of sandals. Despite the fact that multiple and varied basketry and cordage specimens do exist in these collections, sandals were chosen as the starting point of this research and the comparison of these sites because of the paucity of sandal research in the region and the amount of evidence about group identity and cultural transmission that can be garnered from a single sandal. Basketry and cordage from these collections serve a supporting and supplementary role to the main interpretations and conclusions drawn from the sandal evidence. Much more is known and has been published about the types and distribution of basketry and sandals produced prehistorically in adjacent regions. Therefore, these publications (Adovasio 1974, 1975, 1977, 1979, 1980a, 1986, 2005; Adovasio et al. 1982; Andrews et al. 1986; Cosgrove 1947; Geib 2000; Hays-Gilpin et al. 1998; Hyland 1997; Hyland and Adovasio 2000; Kankainen 1995; Kankainen, ed. 2005; Lindsay et al. 1968; Martin et al. 1952; McBrinn 2005; Taylor 2004; Turpin 2003; Turpin and Carpenter 1994a, 1994b; Webster 2007) provide contextual information about the types of sandals and types of basketry that have been associated with one another. Basketry studies also provide examples of past research which have displayed our ability to distinguish between populations based on their basketry technology and their process of manufacture, as well as document changes in technology through time, and show how these changes have been interpreted.

Sandals used in this thesis come from only three sites, Franktown Cave, Trincheras Cave, and the Kenton Caves (Figure 1.1). Sandals were also discovered at Chamber Cave, but the recovered artifacts are in unknown private hands, and are therefore unavailable for research. These caves are found on the Southern High Plains, encompassing southeastern Colorado, northeastern New Mexico and the Oklahoma panhandle. Due to the remarkable dry, climatically stable conditions, and protection that rockshelters and caves provide, archaeologists have been able to recover a wide range of perishable cultural materials, including basketry, cordage, sandals, matting, netting, bone, feathers, wood, and leather (Gilmore 2005a). The scattered and scant amount of field notes, artifact records, and reports for the previous excavations performed at these sites made it absolutely necessary for the perishable collections not only be analyzed, but dated.

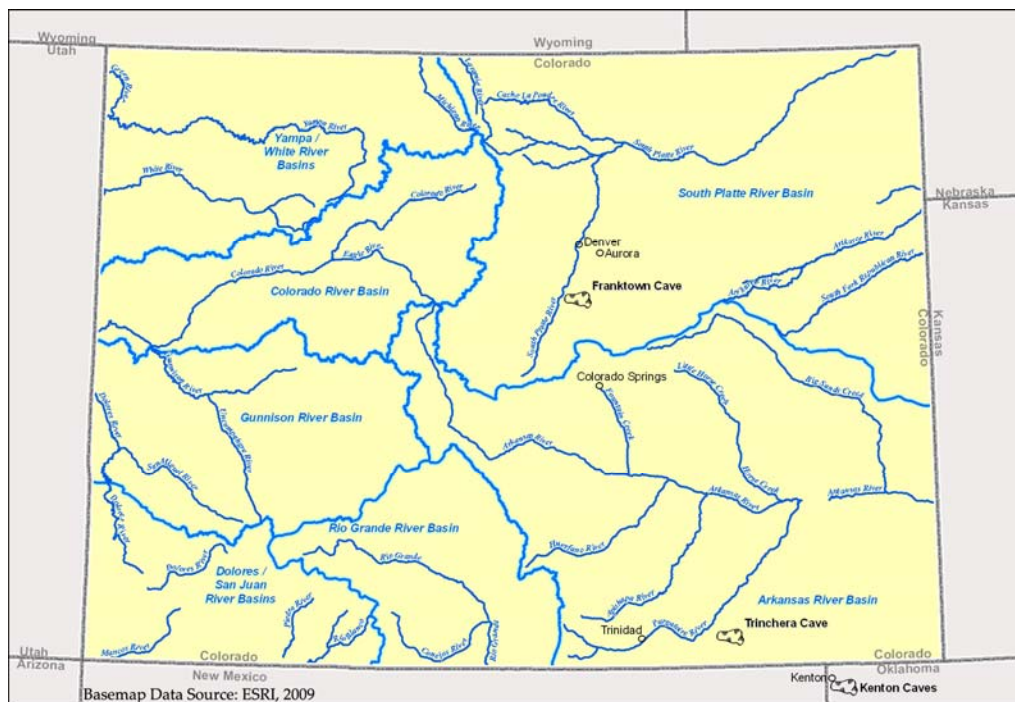


Figure 1.1. Location of Franktown Cave, Colorado; Trincheras Cave, Colorado; and the Kenton Caves, Oklahoma/New Mexico (Map created by John C. Watson, GISP).

By dating these artifacts, relatively, through sequencing and comparison to other objects of known age, or absolutely, using radiocarbon dating, we can determine which types and forms precede others. These artifacts, because they are fixed in time (age dated), can be compared by type and used to show any change in style, technique, and form over time, including the introduction or appearance of new types and forms, which suggest population movements or new cultural influences. The dating of the sandal types was necessary in order for any conclusions to be drawn regarding cultural affinity and technological change. Absolute dating (AMS) provided a means for the documentation of the temporal ranges of the utilized manufacturing techniques, the use life of each sandal type, and the appearance of new sandal types at each site in the absence of relative chronologies (detailed stratigraphic notes and artifact proveniences).

The recent analysis and age dating of the Franktown Cave perishable assemblage by J. M. Adovasio and J. S. Illingworth served as the starting point for researching these changes and cultural relationships (Adovasio et al. 2005). The Franktown Cave perishable database provided a baseline for the study of perishable technology in southeastern Colorado and on the Southern High Plains because at the start, it was the only perishable collection that had been analyzed and dated. This special status means that they could be organized into a chronological and descriptive “type” sequence for the region against which other collections could be compared. Due to the absence of rockshelters on the Plains in general, very few perishable items have survived, as most were probably discarded in areas that were unprotected on the open prairie. It was discovered that the only other perishable collections, of any size, known from the eastern

front of the Rocky Mountains were Trinchera Cave, Colorado and the Kenton Caves, Oklahoma/New Mexico, other than Chamber Cave, Colorado (whose artifacts are in unknown private hands). Neither of these sites had been dated or analyzed, and therefore, were the perfect candidates for this research based on the size of the collections, the geographic location of the sites, and the fact that little research had been completed and little information had been published about the sites.

My research began by determining the whereabouts of the collections and scattered specimens. I then journeyed to each museum in an effort to document each specimen in each collection, using analysis sheets to record all of the characteristics and pertinent measurements and describe the condition and composition of each specimen. Each specimen was also photo documented in plan view and profile, with subsequent close up views, in order to document unique attributes and to facilitate a complete and thorough description of how each was constructed. These measurements and attributes were then quantified and used to perform statistical tests. Measurements were compared between sandals in order to determine their similarity and to determine the likelihood that they were made by the same group or “community of practice.” Once these comparisons had been made within each site, the sandals were then compared between the three test sites. Finally, the sandal types and sandal attributes were compared to the known data set of sandals and sandal types for neighboring regions including the Great Basin, Southwest, Lower and Trans-Pecos Texas, and northern Mexico. This comparison showed that the perishable technology utilized on the Southern High Plains has developmental origins in both the northern Colorado Plateau and the Mogollon region of the Southwest.

The study of the rare perishables from all three caves/rockshelters on the Southern High Plains have provided a unique opportunity for the acquisition of information regarding the technology used by and possible cultural affiliations of prehistoric people in and immediately adjacent to this area. The presence of these remains indicates that Archaic and Ceramic/Late Prehistoric populations occupying the eastern margins of the Plains were “every bit a fiber-dependent as their predecessors and contemporaries on the other side of the Rockies, on the Colorado Plateau, in the Great Basin, and in the Southwest” (Adovasio et al 2005).

Chapter 2: Perishables

Perishable artifacts, such as basketry, cordage, and sandals, are rare cultural materials in archaeological sites due to the specific environmental conditions that are required for their preservation (Adovasio 1974, 1977). In contrast to lithic or ceramic artifacts, prehistoric weaving is recovered intact only under special conditions, more or less “stable environments” (Figure 2.1). These can be “extremely dry, extremely cold or extremely wet, [which] retard the decay and disintegration of basketry and other perishables by the exclusion of intermittent moisture, oxygen, bacteria or a combination of these agents of destruction” (Adovasio 1977:2). The environments which provide these conditions and under which perishables have been discovered include the waterlogged areas of North America and Europe, areas of permafrost in Alaska, Canada, and Eurasia, and dry caves and rockshelters across the globe (Adovasio 1974, 1977).



Figure 2.1. Burial wrapped in simple plaited mat (modified from Taylor 2004, Figure 3-18).

Due to the remarkable dry, climatically stable conditions, and protection that rockshelters and caves provide, it is not surprising that the basketry remains from North America (and from most other parts of the world) have been found almost exclusively in dry caves and rockshelters (Adovasio 1977). A wide range of perishable cultural materials have been recovered from these sites, including basketry, cordage, sandals, matting, netting, bone, feathers, wood, and leather (Gilmore 2005a). However, where these conditions of preservation are lacking, most notably in the Great Plains, it is still possible for perishables to be studied through indirect evidence. Evidence for perishable manufacture and use survives in the form of impressions on pottery or on floors of buildings (Figure 2.2), the presence of awls or other specialized tools employed in the production of basketry, and in ethnographic collections and/or ethnohistoric information

(Adovasio 1974, 1977; Cosgrove 1947; Drooker 2001; Hastorf 2001; Hays-Gilpin et al. 1998; Jolie 2000, 2001, 2002, 2006; Kankainen 1995; Morris 1980; Taylor 2004). Archaeological specimens are rare. The distribution of known prehistoric basketry remains is not solely a reflection of conditions of preservation, but also a reflection of the intensity of archaeological research and rigorous methods of excavation (Adovasio 1977).

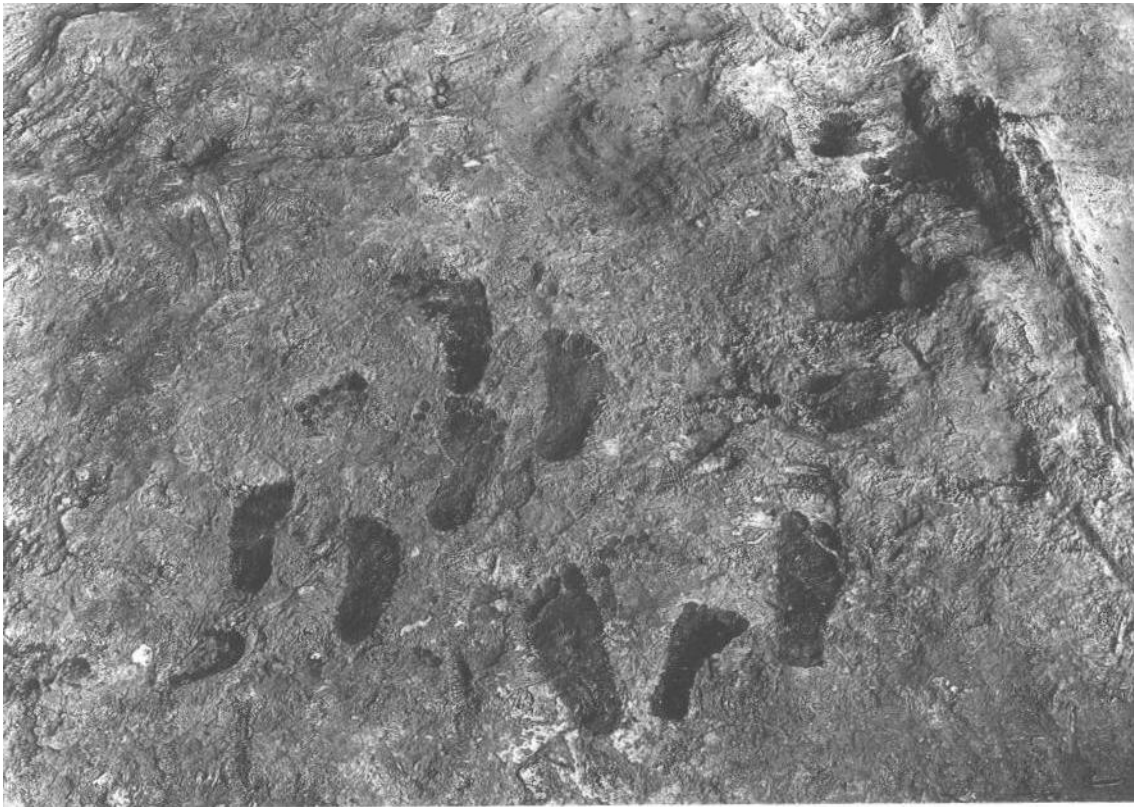


Figure 2.2. Burned muddy footprints on the floor of a pit house in Pocket Cave (Photo by Earl H. Morris; Arizona State Museum Neg. 5988, presented in Hays-Gilpin et al. 1998, Figure 3.4).

The perishable collections of Franktown Cave and Trincheras Cave, Colorado and the Kenton Caves, Oklahoma are representative of this fact. Though each of these caves and their extensive artifact assemblages have been documented in some respect, each cave or rockshelter was excavated by multiple individuals over multiple decades, leaving

a muddled site and excavation history. The majority of the site and excavation documentation has been lost for all three sites. Artifact proveniences are rare, and published reports lacking. The perishable collections of each site have been given the least amount of attention. As stated above, perishables evidence from the Plains is scarce. The majority of what we know about Plains perishables has come from historic ethnographic records. Therefore, the descriptive and radiometric study of these previously undocumented collections will add extraordinarily to the known distribution and technocultural types of prehistoric perishables for North America.

The Utilization of Artifacts and Attributes as Cultural Markers

The identification of past cultures and peoples in archaeology has, for the most part, been dependent on the assumption that bounded, monolithic cultural entities (“archaeological cultures”) correlate with past peoples, ethnic groups, tribes, and/or races (Jones 1997:106). But, there are three major critiques of/problems with this claim. The first problem has to do with the correlation of archaeological cultures with ethnic groups. This claim turns the study of chronology and typology into ends in themselves. It is necessary to undertake an analysis of the structure of archaeological assemblages, in terms of their function, within a differentiated social system; functional variations in assemblages can be mistakenly interpreted as ethnic difference. The assumption that a one-to-one relationship exists between variation in any aspect of material culture, stylistic or otherwise, and the boundaries of ethnic groups has been questioned. There is a complex relationship between material culture variation and an expression of ethnic difference. Ethnic groups are rarely a reflection of the sum total of similarities and

differences in 'objective' cultural traits. Ethnic groups are self-conscious/self-defining groups, which are based on the perception of real or assumed culture difference (Jones 1997:108).

The second problem with group-artifact correlations deals with the nature of archaeological distributions and the status of archaeological cultures as classificatory entities. Cultures and phases are defined in unidimensional and static terms on the basis of the presence or absence of a list of traits/types, which were often derived from the assemblages of a 'type site' or intuitively considered to be the most appropriate attributes in the definition of a particular culture. But, no group ever contained all of the cultural artifacts as the ideal implies; it is the repeated association of a number of types which defines the group, with some attributes being absent and some present in assemblages of other groups. A more sophisticated approach to the analysis of archaeological data reveals a much more complex structure. It has been argued that archaeological cultures can be generated out of a continuum of change, and that in many instances such entities pulled from this continuum are purely constructs devised by archaeologists. The idea that culture is a multivariate rather than a univariate phenomenon, resulting from many different factors, has been accepted by many archaeologists, and sophisticated methods of data analysis appropriate to such a theoretical stance have been developed (Jones 1997:109). By comparing perishable specimens that are representative of the same structural type, their techniques of manufacture and stylistic attributes can help determine whether they were produced by the same population or community of practice. Changes in these techniques and styles can signify population change (group composition), and when compared with other artifact assemblages (such as the more durable lithic site

component), which show similar occurrences of artifact change, they can help to reinforce an interpretation of culture change.

The third problem with group-artifact correlations is the nature of ethnicity and the existence of bounded homogeneous ethnic/cultural entities. A small minority of archaeologists have questioned the very existence of ethnic groups as fixed bounded entities. But, the recognition that ethnic groups are a dynamic and situational phenomenon has dominated research (Jones 1997:110). Studies have revealed that the boundaries of ethnic groups and the identity of individuals may change through time and from place to place, often as a result of the strategic manipulation of identity with relations to economy and political relationships (Jones 1997:110). It has also been suggested that because ethnicity is a dynamic and instrumental phenomenon, material culture has been actively used in the justification and manipulation of inter-group relations (Jones 1997:110). This is exactly why perishable attribute differences can be used to define or compare different groups. It has been argued that the intensity of ethnic consciousness, and consequently, material culture differentiation, may increase in times of economic and political stress (Jones 1997:110), as a form of integration. Stylistic variables are most fruitfully studied when questions of ethnic origin, migration, and interaction between groups are the subject of explication, “the passive product of the enculturative milieu” (Jones 1997:11).

A survey was conducted, by Minar, with respect to modern spinners, to provide insights into the cultural formation processes affecting cordage attributes and to suggest some reasons why the distribution of ceramic and cordage attributes are different (Minar 2001a:106). It was found that factors involved in the determination of final cordage twist

include the involvement of imitation in the initial learning stages (observation and instruction), the automatization of motor skills (repetitive nature of task), the pressure to conserve spinning behavior in terms of efficient production (choose and retain one way of making to ensure efficiency), and directionality, which is an important concept in terms of both symbolic and religious beliefs (strong cultural reasons for choosing) (Minar 2001a:108). In each of these factors, there is no requirement for the spinners to recognize that their behavior is leaving a signature on their product. The use of the term “community of practice” to describe the similar activities engaged in by the individuals does not necessarily imply “co-presence, [a] well-defined, identifiable group, or socially visible boundaries. It does, [however], imply participation in an activity system about which the participants share understandings concerning what they are doing and what that means in their lives and for their communities” (Minar 2001a:108). According to Minar (2001a), we may not be able to determine archaeologically the nature of this group, but, at the core, it is only important that we recognize the existence of such an entity. Other cordage attributes, such as diameter and tightness of twist, do not have the same options, pressures, and constraints on behavior that final twist direction has, with these attributes being determined more so by the constraints created by the type of form to be manufactured and its functional requirements. The limitations on diameter and tightness of twist found in impressions may well reflect both the aesthetic preferences of the makers and the physical requirements of the task of impressing ceramic surfaces (Minar 2001a:108). Final twist direction options are defined by the mechanics of yarn/cordage construction and are pressured by the social and biological factors of the learning process.

The result of these predetermined factors is the long-term conservation of final twist direction among communities of practice.

Each attribute of each artifact type has its own unique trajectory, which is affected by its own particular set of behavioral, material, functional, and stylistic options, constraints, and pressures. These factors do affect the distribution of the attribute in space and time, and thus, different artifacts, even the different attributes of the same artifact type, should be expected to distribute differently (Minar 2001a:109). Therefore, “choosing specific lines of procedures from the broad arc of alternative options and then sticking to them” is necessary for the “congruence and efficiency” that a cultural system requires to function (Sackett 1990:35 cited in Minar 2001a). A closer examination of the pressures and constraints of the choices, demonstrates the complex interaction among a variety of factors affecting the production of any given attribute. The mode of learning, the constraints and pressures of materials and methods, as well as the social pressures to conserve or innovate must be considered (Minar 2001a:109). However, Minar (2001a) argues that final twist direction may be more useful than other artifact or attribute distributions for recognizing persistent communities of practice precisely because of its motor-skill-dependence. Because of the variety and complexity of the factors affecting the process of production, culture-historical sequences derived from any given category of artifact will be somewhat different from sequences derived from any other category. But, through the analysis of multiple data sets, “reevaluation and clarification of extant culture-historical sequences is possible and offers an opportunity to strengthen the foundations upon which archaeological interpretation rests” (Minar 2001a:110). Cordage types, ceramic types, cord-marked ceramics, and individual perishable artifact types such

as coiled basketry and sandals (and their individual types), all have different distributions, spatially and temporally because each type, and each attribute of each type, represents a range in degree and kind of pressure and constraint.

Using concepts derived from “learning theory,” it can be suggested that temporal and geographic differences in attribute distributions are related to the behavioral processes involved in the transfer of knowledge and skills in some cases and to function in others (Minar 2001a:94). Archaeologists have long assumed that sociopolitical territories would show up in the record as “restricted distributions of stylistic elements on the landscape,” and that “the outer limits of the distributions would approximate the sociopolitical boundary” (Sampson 1988:14 in Minar 2001a). Change in nonperishable artifacts has been the fundamental tool used to order past time and prehistoric people, but perishable materials – just as much as nonperishable goods – were intimately tied to social and economic organization, as well as people’s knowledge of and beliefs about the natural world. With respect to the distribution of perishables compared to that of nonperishables, the work of J. M. Adovasio shows that changes in perishables parallel changes in projectile points in the Great Basin and their differences in spatial and temporal distribution in the Pacific Northwest has been explored by Croes (1989) (Minar 2001a:95).

Using these ideas of “communities or practice,” the sandal assemblages of the Southern High Plains were studied in order to determine if these artifacts types and their associated attributes indicated the presence of one or multiple “communities of practice” within the region throughout prehistory. Perishable technologies, including cordage, basketry, and sandal production, and their associated attributes tend to be culturally

conservative (Adovasio 1986; Carr and Maslowski 1995; Petersen 1996). Therefore, it was expected that the perishable (sandal) technology and associated attributes produced by related peoples would be more similar than perishable (sandal) technology produced by unrelated peoples and that this conservative technology would be demonstrated by distinct patterning both temporally and geographically.

Perishables Research Across North America

Perishables experts have conducted abundant research over the past half century which, in their opinion, has conclusively demonstrated that basketry, textiles, sandals, and cordage are far more useful for determining cultural affiliation than any other class of artifact (Adovasio 1974, 1977; King 1975; Rozaire 1969; Weltfish 1932). They believe that this unique class of artifacts has “especial (*sic*) importance in the establishment of prehistoric ‘territorial’ boundaries, as well as in the documentation of prehistoric population movements” (Adovasio 1986:45). The research of perishables as stylistic cultural markers has been employed for identifying a broad range of social aspects such as “defining prehistoric populations, examining long-term technocultural stability as well as cultural change, tracing population movements, analyzing subsistence systems and trade patterns, and even recognizing the works of individual weavers in the prehistoric past” (Adovasio 1996 in Hyland 1997:2).

One of the recurring themes in J. M. Adovasio’s research is the recognition of distinct cultural or ethnic groups in the archaeological record using textile data. A major focus of his research has been the identification of the Numic spread in the Great Basin, as well as addressing the question of the existence of the Fremont as a prehistoric culture

separate from surrounding groups (Adovasio 1975, 1979, 1980a, 1986; Adovasio et al. 1982; Andrews et al. 1986). In his exploration of group affiliation, group origin, and cultural diffusion he has demonstrated how basketry can be used to define or at least to identify prehistoric populations both “in place” (at one locale over time) and “on the move” (expanding spatially) based on the presence of unique structural attributes through space and time. He suggests that the analysis of basketry can be used for taxonomic, descriptive, chronological, and culture-historical ends. He has concluded that “the ‘what’s,’ ‘where’s,’ ‘how’s,’ and even the ‘who’s’ [are] reflected in prehistoric perishable inventories” (Adovasio 1986:84), and these “culturally sensitive behavioral products” (Adovasio 1986:84) can be used to reconstruct the activities of their owners (Figure 2.3). By determining the activities that these individuals are engaged in and with whom they corresponded, regional activities and networks can possibly be formulated. Therefore, the perishable collections of the Southern High Plains were analyzed and described to these ends. In order to determine the cultural linkages of those occupying the Front Range from the Early Archaic through Late Prehistoric periods, the rare perishable collections recovered from Franktown Cave and Trinchera Cave, Colorado and the Kenton Caves of Oklahoma/New Mexico were described, dated, and compared to one another. This analysis allowed for the documentation of the similarities and differences between the technology and populations present in this region. These collections were also compared to the known sandal collections from adjacent regions such as the Great Basin, Southwest, and Mexico in order to determine the connections between the people and technology of the Southern High Plains to those of adjacent regions.

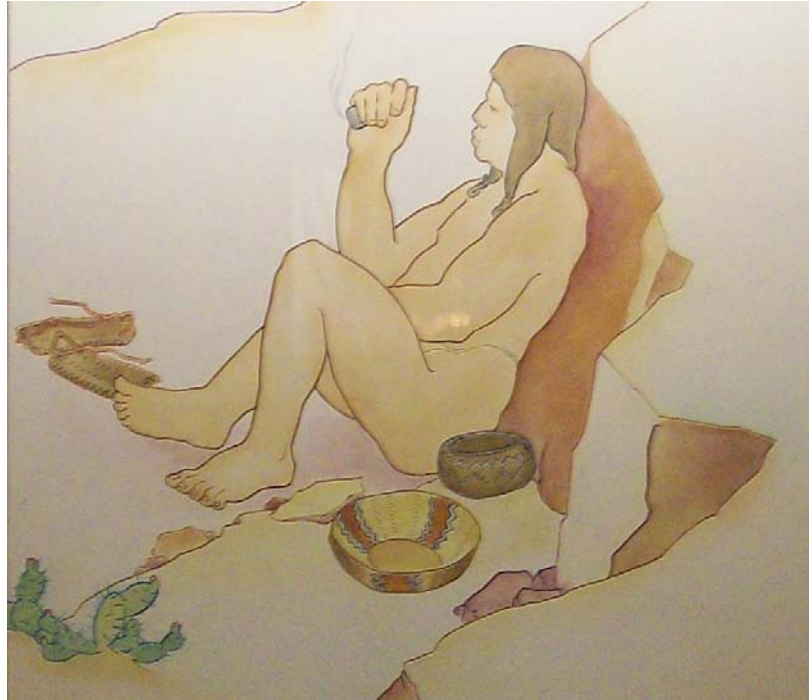


Figure 2.3. Prehistoric occupant of the Kenton Caves with culturally specific artifacts (modified from Kenton Caves display mural, Woolaroc Museum, Oklahoma).

Adovasio and Joel Gunn (1977) have used “case studies” to demonstrate that, through the systematic study of both nominal and ordinal attributes of basketry, it is possible to distinguish the work of individual ethnographic basketmakers within the same sociopolitical entity. They have also demonstrated that it is possible to isolate the products of several weavers and groups of weavers in a more or less contemporaneous archaeological assemblage and to separate the products of two culturally and linguistically disparate groups of basketmakers (Adovasio and Gunn 1977). A collection of 29 complete ethnographic Washo coiled baskets, produced by “known” individual weavers, was subjected to detailed attribute analysis. Each Washo basket was measured for four construction attributes that, though controlled to some extent by cultural preference, are highly idiosyncratic (coiling diameter, coils per cm, width of stitch, and

stitches per cm). The four measurements were then subjected to principal component analysis and canonical analysis of discriminant function. Both succeeded in separating an individual weaver, Dat-so-la-lee, from other Washo weavers and the work of Suzie from the general range of variation of the Parish collection, based on the clustering of measured attributes (Adovasio and Gunn 1977:140).

In order to ascertain whether this type of analysis was applicable to a series of archaeological basketry specimens, basketry from the three major architectural units of Antelope House in Canyon de Chelly, Arizona were tested by Adovasio and Gunn (1977) by the same means. The nominal attributes suggest the existence of distinct clusters within the Antelope House assemblage when subjected to the same tests. Actual weavers were determined in a second step of the analysis, where the most important differences were determined to be the manipulation of splices (Adovasio and Gunn 1977:140). Though the identification of individuals does not tell us how these social groups were constructed or how they operated, it nonetheless “verifies their existence in or as a part of discrete groups, and thereby adds immeasurably to a socio-economic understanding of long-term human residency at a site” (Adovasio and Illingworth 2002:7). These ideas are also elaborated upon in later works (Adovasio 1986; Adovasio et al. 1982; Adovasio and Gunn 1986; Adovasio and Illingworth 2002; Adovasio and Pedler 1994). Because of the successful application of this statistical test to archaeological collections, it was intended that the same methodology would be employed in this work, in order to determine whether individual specimens within each of the studied caves (Franktown, Trinchera, and the Kenton Caves) were made by the same weaver. However, the lack of wide variation in the nominal data for the Southern High Plains sandals inhibited the utilization

of this test. Instead, analyses of variance (ANOVA) were utilized to the same ends by comparing the interval data of the sandal types and specimens. Though principal component analysis can also be used to test interval data, the use of ANOVA tests were sufficient to identify construction attributes that were statistically the same between specimens. The small sample size of the collections and the limited number of roughly identical specimens did not warrant attempts to differentiate between their individual weavers. Nonetheless, the research completed by Adovasio and Gunn (1977) still provides a good example of the ability of perishable materials to identify these types of social groupings and style.

According to Adovasio, “one of the major consequences of recent attribute oriented, comparative studies of prehistoric basketry has been the establishment of [chronological] regional and subregional developmental sequences” (Adovasio 1974:113), which he terms “basketmaking regions” (Figure 2.4) In certain areas, “evolutionary changes in basketry production may be traced with considerable precision, while in others scarcity of data and/or lack of chronological controls allow for little more than a tentative outline of developmental trends” (Adovasio 1974:113). These basketmaking regions include the Great Basin (Northern, Western, and Eastern), northern Mexico (and its satellite center of Trans-Pecos Texas), Central Mexico, the American Southwest, California, the Plains, Eastern North American and Canada, and the Arctic (Adovasio 1974, Map 4).

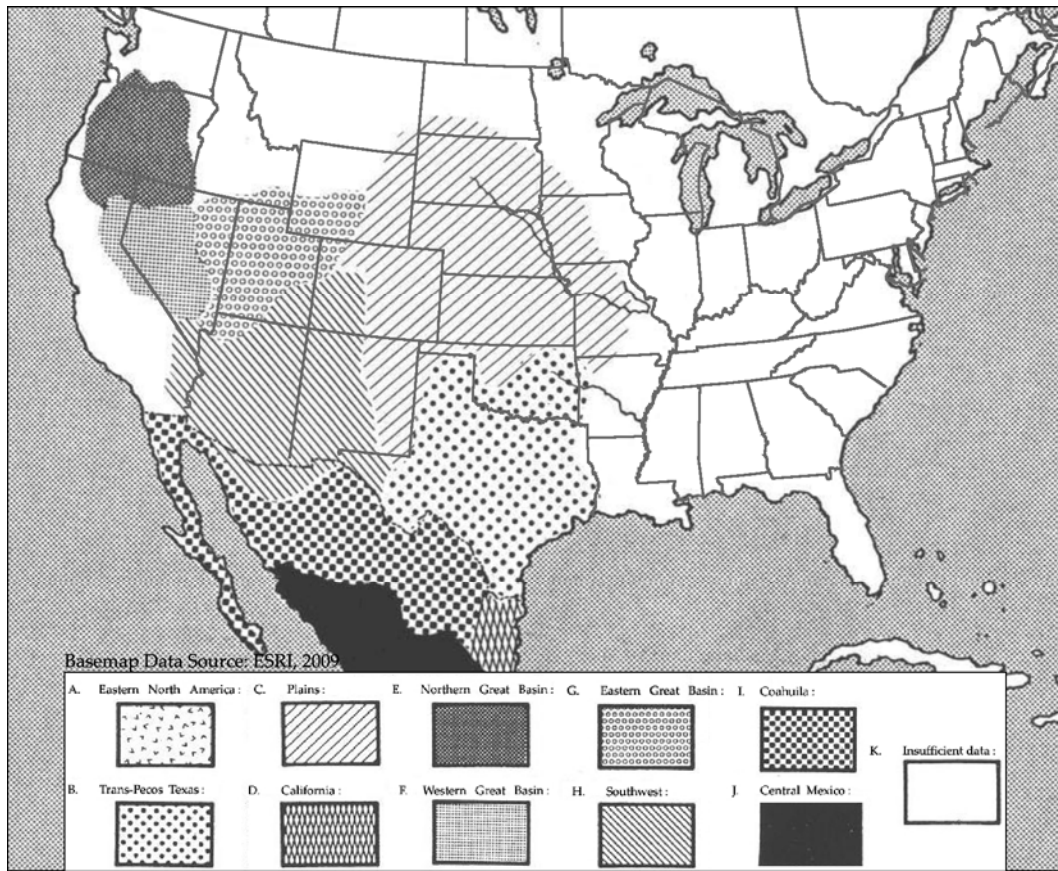


Figure 2.4. Distribution of basketry manufacturing centers: 4500-2000 B. C. (modified from Adovasio 1974, Map 4 by John C. Watson, GISP).

Similarities in basketry manufacture techniques, styles, and structural attributes represent shared technologies, presumably rooted in environmentally determined adaptive strategies that cross-cut many different ethnic units. For example, the perishable “frontiers” that separate the three Southwest traditions from each other (Anasazi, Mogollon, and Hohokam) and from other centers and traditions both north and south vary in what might be called “cultural porosity.” It appears that though the boundaries of these Southwest entities are breached or penetrated by a techno-subsistence package (of possibly Mexican origin), which initially includes corn and squash (later beans), as well as an accompanying suite of perishable artifacts including bundle foundation coiling,

twill plaiting, and in some cases certain sandal and cordage types, the penetration occurs to widely varying degrees. It appears that the further the center is from the “source,” the less evident is the Mexican stamp (Adovasio 2005:4). The idea of cultural porosity is extremely interesting when the sites in question lie on the periphery of multiple basketmaking regions. Each of the sites involved in this study lie at the meeting point of the Plains, Southwest, and Trans-Pecos Texas/Mexico basketmaking regions. The comparison of the perishable technology present at each of these Southern High Plains sites to one another and then to the technology of each of the basketmaking regions’ core has helped to explore the porosity of the peripheral boundaries of the Plains, Southwest, and Trans-Pecos Texas/Mexico basketmaking regions. These comparisons have provided a means for tracking the cultural influences of the populations occupying this peripheral area.

Perishables have also been used to trace and document the appearance of new cultures, population movements, and the interaction of cultures in wide ranging geographic and temporal associations (Adovasio 1975, 1979, 1980a, 1980b, 1986; Adovasio et al. 1982; Adovasio and Pedler 1994; Andrews et al. 1986; Bernick 1989; Croes 2001; Hays-Gilpin et al. 1998; Hyland and Adovasio 2000; Kantner 2004; McBrinn 2005; Petersen 1996; Petersen et al. 2001). Based on a detailed analysis of the large perishable artifact suite from Pendejo Cave, New Mexico and a reanalysis of many other collections from the Jornada Basin and contiguous areas, Hyland and Adovasio (Hyland 1997; Hyland and Adovasio 2000) identified a sharp disjuncture or discontinuity in the perishable artifact inventories occurring ca. 4450-1700 B.P. This sharp change is also evident in settlement pattern shifts, apparent increase in population, alterations to the

durable artifact suite, and primary modification to the subsistence system. The introduction of these items also corresponds to dramatic shifts in the cordage and sandal industries (Adovasio 2005:3). The site, its artifacts and features, demonstrates the retention of old technology and the addition of new technology, which they believe represents at least one if not multiple migration and hybridization events.

On the Uncompahgre Plateau, Alan Reed's (1996) work provides evidence for the possibility that multiple distinct populations and cultures inhabited the Southern High Plains, based on the failed alignment of Uncompahgre Plateau sites and artifacts with pre-existing cultural trait lists associated with Anasazi and Fremont peoples. This failed alignment suggests the existence of at least an alternate third culture inhabiting the area. This research has provided the means for exploring ideas of population migration on the Southern High Plains. Hyland and Adovasio's research (Hyland 1997; Hyland and Adovasio 2000) provides scenarios, based on the presence and absence of different types of perishable materials and attributes, for recognizing endogamous and exogamous cultural change. These scenarios aid in the determination of whether changes in perishable technology are due to populations movements versus the movement of ideas. In this way, the appearance of perishable technologies on the Southern High Plains can be explained by comparing similar sandal technology from adjacent regions in time and space.

Though the Franktown Cave, Trinchera Cave, and Kenton Caves perishable collections contain basketry, cordage, and sandals, they are clearly dominated by sandals. Due to the size of these sandal collections and the lack of documented sandal technology for this region, sandals were chosen as the main focus for this research. However, the

above basketry research is still applicable to the study of sandals based on their similar method of construction and shared attributes, which will be elaborated upon below.

Sandals Research

Unlike basketry, for which extensive descriptive and synthetic works exist, the archaeological literature on sandals is sparse. Apart from Andrews, Adovasio, and Carlisle's (1986) synthesis of the Great Basin sandal technology, no comparative treatment of the sandals of an entire prehistoric or ethnographic culture area exists (Hyland 1997). However, within the Southwest, the sandals of the Anasazi have been extensively studied by Ann Cordy Deegan (1993, 1995), Kathy Kankainen (1995), Kelley Hays-Gilpin, Ann Cordy Deegan, and Elizabeth Ann Morris (1998), Laurie Webster and Hays-Gilpin (1994), and Morris (1980, 1995). The footwear of the Mogollon and the Jornada Basin has been examined by C. B. Cosgrove (1947), David Hyland (1997), Elaine Bluhm (1952), R. S. MacNeish (1993), Maxine McBrinn (2005), and Laurie Webster (2007). The sandal industries of the Hohokam and Hakataya are essentially unknown. Outside the confines of the Southwest and the Great Basin, the situation is scarcely any better. Turpin, Powell, and Carpenter's (1993) and Turpin and Carpenter's (1994a, 1994b) examination of sandals from the Ocampo region and Taylor's (1966, 1988, 2004) discussion of sandals from the Cuatro Ciénegas Basin constitute the only broad-based studies of sandals in northern Mexico. Despite McGregor's (1992) recent synthesis of basketry, no similar scrutiny of sandals exists for the Lower Pecos (Hyland 1997). However, the basketmaking regions suggested by Adovasio's research (1974) also correspond to the documented sandal technology.

In addition to the aforementioned researchers, questions concerning what information perishables, more specifically sandals can offer, in terms of aiding in the explanation of past cultures and their defining characteristics, have also been researched by Phil R. Geib (2000). His research specifically concerns the comparison of the northern and southern Colorado Plateau. Geib (2000) attempts to make sense of newly recovered plain weave sandals from Chevelon Canyon, Arizona and the implications they may have on our spotty knowledge of this region and the individual cultures that interacted within its boundaries. He suggests that the distribution of lithic raw materials (obsidian), as well as rock art styles and projectile point types, might also be used to test ideas of sandal use in negotiating access to areas and social groups. These southern Colorado Plateau sandals have no known counterparts in adjoining regions. This difference in sandal technology, as well as differences in cordage and basketry technology between the Colorado Plateau and the Front Range suggests very minimal technical affinities or connections between contemporary cordage-making populations on opposite flanks of the Rockies (Andrews and Adovasio 1996). The observable trend that plain weave sandals were introduced after the use of open-twined sandals is present in the north, but it does not appear to have taken place in the south, where only plaited sandals were produced and utilized. No antecedent forms are present in the southern region, but it appears that Fort Rock open-z-twined sandals (8600-7200 B.C.) may be an antecedent to those of the northern region (Geib 2000). In addition to stressing the importance of the creation of a chronological and descriptive sequence of perishable items, Geib's article reinforces ideas about wide-ranging networks that were in place for the procurement of raw materials and patterns of cultural diffusion (Geib 2000).

This database of sandal research provided the means by which this current study could be formulated. The in-depth review of this literature and the recent analysis of the Franktown Cave perishable assemblage by J. M. Adovasio served as the starting point for exploring the cultural relationships of the groups occupying the Southern High Plains. By comparing the sandal technology found at Franktown Cave, Trinchera Cave, and the Kenton Caves, it was possible to determine the cultural affinities of the groups occupying these sites. The Kenton Caves' connections to Franktown Cave, originally posited by Adovasio were reinforced, and it became obvious that there was some relationship between the groups occupying both the Plains and Southwest at earlier times than was previously suggested.

The sandal collections from Franktown Cave and Trinchera Cave, Colorado and the Kenton Caves of Oklahoma/New Mexico have provided the means for which the previously unknown perishable technology of the Southern High Plains can now be known. The comparison of these previously unresearched assemblages of an undervalued artifact class has revealed previously unrecognized technology and underestimated interaction amongst populations living in the peripheral zone between the Rocky Mountains and the Plains. The descriptive analysis and radiocarbon dating performed on these collections has provided for the establishment of a regional developmental sequence for the sandal technology of the Southern High Plains.

Chapter 3: Basketry Weaves and Typologies

The standard descriptive terminology for perishables, namely basketry and sandals, employed here follows Adovasio (1977) and, as necessary, Emery (1995). Where discussed, cordage formulae follow Hurley (1979). The technical descriptions below follow Adovasio (1977:99-123) and Andrews et al. (1986:93-134). The term “basketry” applies to several different kinds of items, including rigid and semi-rigid containers, matting, and bags, as well as less apparent forms such as fish traps, hats, and cradles. Matting is merely a two dimensional or flat weaving, whereas baskets and many of the other forms are three dimensional. Bags are considered to be intermediate forms because they are two dimensional when empty and three dimensional when full. All forms of basketry are woven without the use of a frame or loom (Adovasio 1977:1).

Adovasio’s method of basketry classification begins with the division of an assemblage into more manageable “like” types. The basketry assemblage from any given site is first divided into major sub-classes of weaves. These mutually exclusive and taxonomically distinct sub-classes include twining, coiling, and plaiting. Each sub-class is then divided into technological types which share attributes or a particular cluster of attributes. These attributes may be defined as features of manufacture, which are “the direct product of specific manipulatory techniques that are highly standardized or culturally prescribed within any basketmaking population” (Adovasio 1977:1). It is important to note that “although many of the technical attributes by which specimens of

basketry may be distinguished are minor and seemingly inconsequential, it is precisely these details that are important because they tend to be more localized, conservative, and culturally determined” (Adovasio 1977:4).

While a variety of attributes have been and can be employed to classify basketry, Adovasio believes that sub-classes or types should be defined exclusively by attributes of wall construction (Adovasio 1977:1). Any item of basketry is assumed to have several distinct parts, the most significant of which is the “wall” or main body of the specimen. The wall of a specimen of basketry can be constructed by only three basic weaves, twining, coiling, or plaiting. In a container or basket, “the wall is easily distinguished from other parts, such as the rim, or selvage, and the center, or point of starting” (Adovasio 1977:1). In mats and other flat or atypical forms, including sandals, “the wall is the principal or major portion of the item and subsumes virtually everything that is not clearly edge or center” (Adovasio 1977:1-2).

Twining is a weave in which paired (sometimes tripled) horizontal elements (wefts) pass and engage around stationary vertical elements (warps) (Figure 3.1). In the twining process, the wefts are active while the warps are passive. Twining is employed in the production of containers, mats, and bags, as well as fish traps, cradles, hats, clothing, sandals, and a wide variety of other objects. The subdivision of twining into technological types can be based on the “spacing of weft rows, number, arrangement, and sequence of warps engaged at each weft crossing, and stitch slant of the weft rows” which make up the wall of the construction (Adovasio 1977:15).

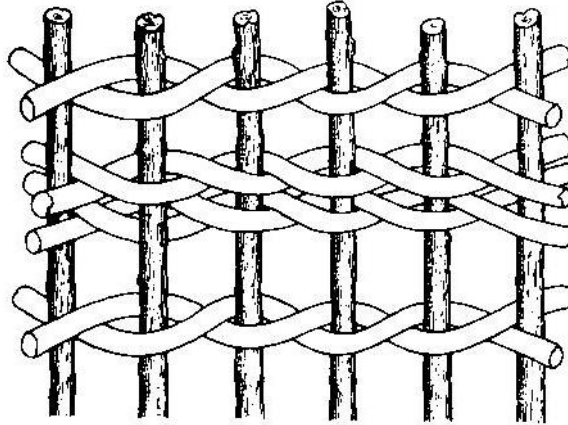


Figure 3.1. Twining Schematic (borrowed from Adovasio 1977, Figure 6).

Plaiting is a weave in which all elements are active. Single elements or sets of elements pass over and under each other at a more or less fixed angle (usually 90°), without any other form of engagement (Figure 3.2). Plaiting is employed in the production of containers, bags, mats, and a variety of other objects. The assignment of plaiting to technological types is based on a single attribute, the interval of element engagement, namely the number of elements or strips in each set that are crossed over by the strips in the other set (Adovasio 1977:99).

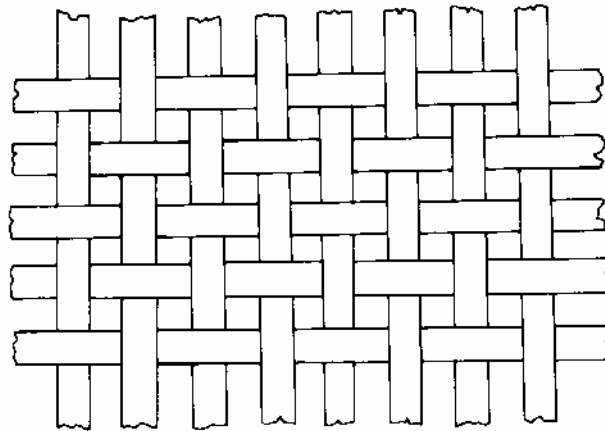


Figure 3.2. Plaiting Schematic (borrowed from Adovasio 1977, Figure 117a).

Coiling is a weave manufactured by sewing a stationary horizontal element or set of elements (the foundation), with moving vertical elements (stitches) (Figure 3.3). The stitches are active while the foundation is passive. In the strictest sense, a basket contains a single coil, continuous from center to rim. Coiling techniques are used almost exclusively for producing containers, hats, and very rarely, bags. Mats and other forms are seldom, if ever, made by coiling. The assignment of coiling to technological types is based on three attributes of wall construction: spacing of the foundation, kind, number, and arrangement of the foundation elements, and type of stitch (Adovasio 1977:53).

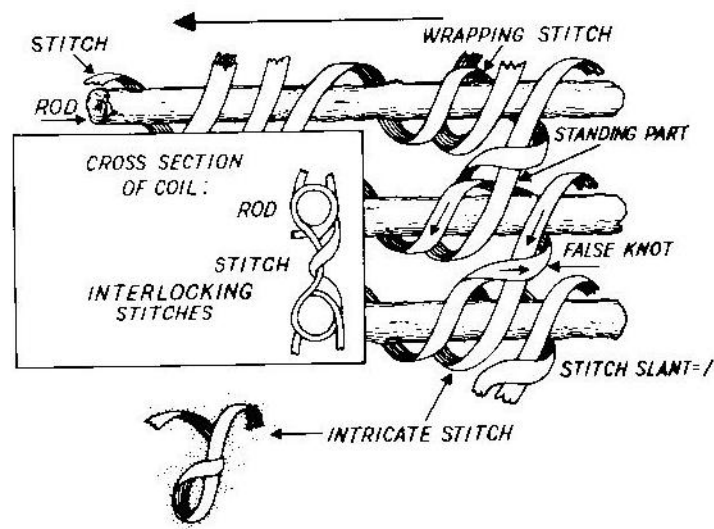


Figure 3.3. Schematic of coiled basketry and structural elements (borrowed from Adovasio 1977, Figure 64).

Basketry Weaves and Typologies Employed in the Production of Sandals

Sandals are fiber-based interwoven footwear. Sandals are an article of apparel whose forms and usage differ extensively from that of typical basketry, the most common form of which is containers. Therefore, it is warranted that sandals be given their own class apart from basketry. Sandals are ubiquitous across the western portion of North

America and represent a unique perishable category unto themselves (Deegan 1993; Hyland 1997). Sandals often exhibit a level of cultural specificity that is the equivalent of that exhibited by basketry (Andrews et al. 1986; Deegan 1995; Reyman 1980; Webster and Hays-Gilpin 1994). Therefore, given that sandals are produced by the same techniques of basketry manufacture, the application of the same classification scheme is acceptable (Hyland 1997). Sandals, like basketry specimens are first divided by sub-class of weave (Adovasio 1977; Andrews et al. 1986; Cosgrove 1947; Deegan 1993, 1995). Twining and plaiting are exclusively used in the creation of sandals (Figure 3.4). Coiling, by nature of its method of manufacture does not lend itself to the creation of two-dimensional mat-like structures such as footwear.

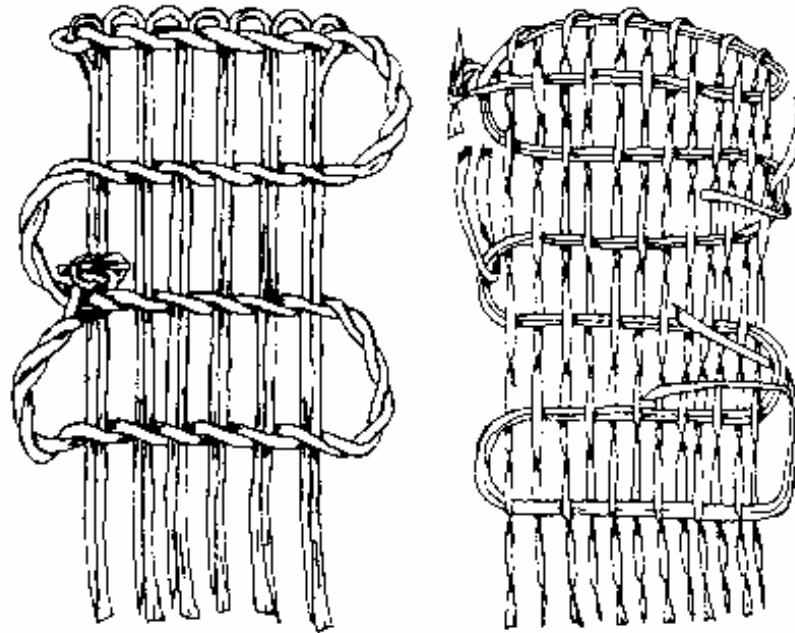


Figure 3.4. Construction methods for Archaic open-twined sandals (left) and warp-faced plain weave sandals (right) from the northern Colorado Plateau (borrowed from Geib 2000, Figure 2).

In addition to the attributes used to classify basketry, the nature of the sandal form requires the use of different and additional attributes. These supplementary criteria of classification include the overall shape and form of the sandal, the heel and toe silhouette, side and end selvages, the tie mechanism used to secure the sandal to the foot, as well as, the presence of any auxiliary components, such as toe covers (Figure 3.5) (Deegan 1993, 1995; Hyland 1997). However, because the disarticulation of sandals is no longer practiced it can be impossible to determine the exact interlacement of some tightly woven sandals. (Kankainen 1995).

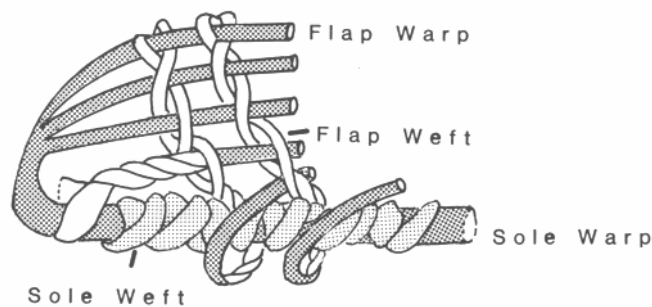


Figure 3.5. Fort Rock Sandal Toe Cover Schematic (borrowed from Andrews et al. 1986, Figure 79).

Based on these wide ranging possibilities for sandal manufacture, the designation of sandal types cannot be based solely on the type of weave employed, but also must take into consideration the unique attributes that in the end product make the sandal a unique expression of the “community of practice” that produced it (Hyland 1997:226). As previously discussed, sandal analysis begins in a similar fashion to a piece of basketry or matting, by determining the predominant weave of the wall, or in the case of sandals, the sole. It is easiest to begin analyzing the sandal according to its order of making,

determining first how the warps are laid out, followed by the wefts, and then the ties (Figure 3.6). Sandals are discerned from basketry by their shape, wear patterns, and most importantly, the presence of selvages. Sandal dimensions also help to indicate its use as a sandal. If it is still in doubt as to the use of a piece of weaving, wear patterns can be of considerable help. In sandals, wear will be present predominantly at the ball and heel of the foot, though toe depressions can also be noted. The reverse of the sandal will be severally worn with broken weft elements as well as adhered soil and other debris. The reverse of the sandal can also reveal the treatment of the exhausted wefts. In some cases, the exhausted weft and the new weft element are simply tucked behind preceding weft rows or laid-in (on top of one another). In other instances, the ends of the exhausted wefts are left to hang loose on the reverse of the sandal. These elements provide increased traction and cushioning. Sandals manufactured with this characteristic weft treatment are known as Traction Masters (Figure 3.7). Though the presence of tie mechanisms is an immediate indicator that a piece of weaving is in fact a sandal, the tie mechanism tends to give out first and therefore, does not always survive. Basic sandal analysis involves the recordation of the length, width, and thickness of the sandal, as well as its completeness, the presence of mending, and decoration. The number of warps and wefts employed in the weaving are indicated, as well as if they are made of single elements or used as a unit comprised of two or three elements. The method by which new wefts are spliced with exhausted wefts is also noted, which is an attribute that can be used to discriminate between individual weavers.

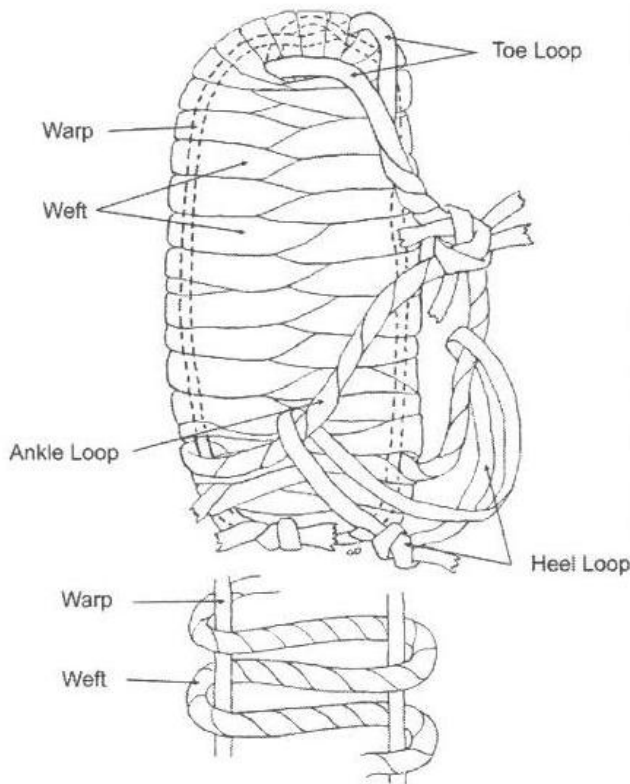


Figure 3.6. Sandal anatomy (adapted from McBrinn 2005: Figure 5.2 and Martin et al. 1952:261).

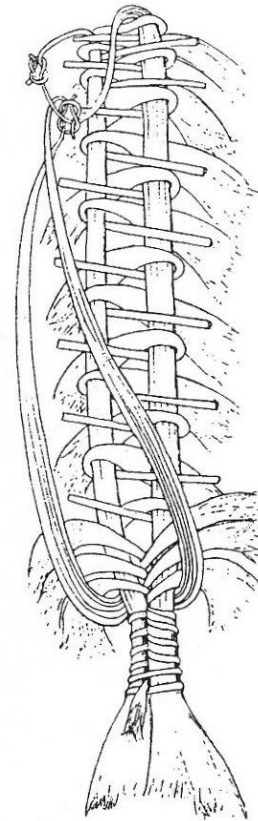


Figure 3.7 Schematic of exhausted wefts (Traction Master sandal) (adapted from Cosgrove 1947: Figure 90).

Selvages are key to the determination of whether a piece of weaving is in fact a sandal and not merely a basketry fragment. In basket weaving, the only selvage present is the rim. However, sandals have four “selvages,” specifically the toe and heel configurations and two side selvages. Side selvages are created by the reincorporation of the wefts into the body or wall of the specimen after they have woven around the outer warp element (Figure 3.8). A sandal is either begun at the toe or at the heel; sandals do not have a center. Common sandal toe silhouettes include Pointed, Round, Scalloped/Notched, and Square/Straight. Common heel silhouettes include Round,

Square, Flat, Puckered, and Cupped. Sandals can also reflect left or right foot designations (Figure 3.9) (Deegan 1993:59). Common toe constructions include Knotted, Twisted/Braided, Folded, Truncated, and Scuffer toe. Common heel constructions include Knotted, Twisted/Braided, Folded, Truncated, and Fishtail (Figure 3.10).

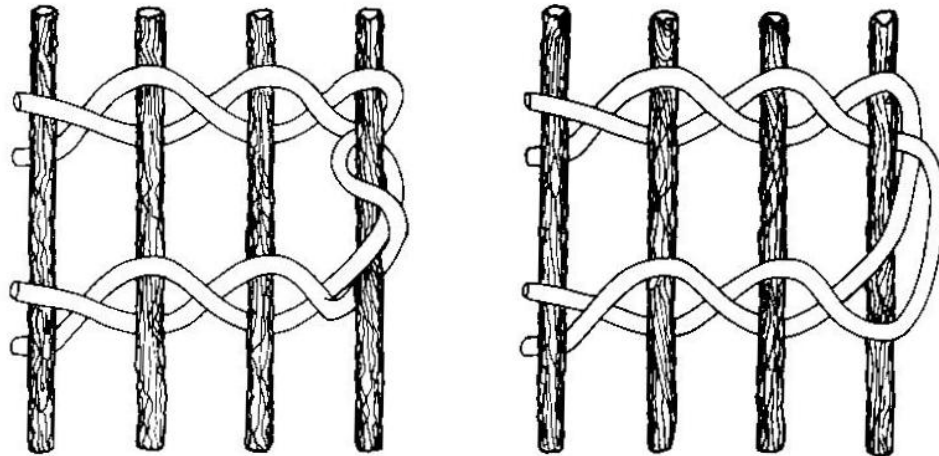


Figure 3.8. Examples of side selvages (borrowed from Adovasio 1977, Figure 44a & b).

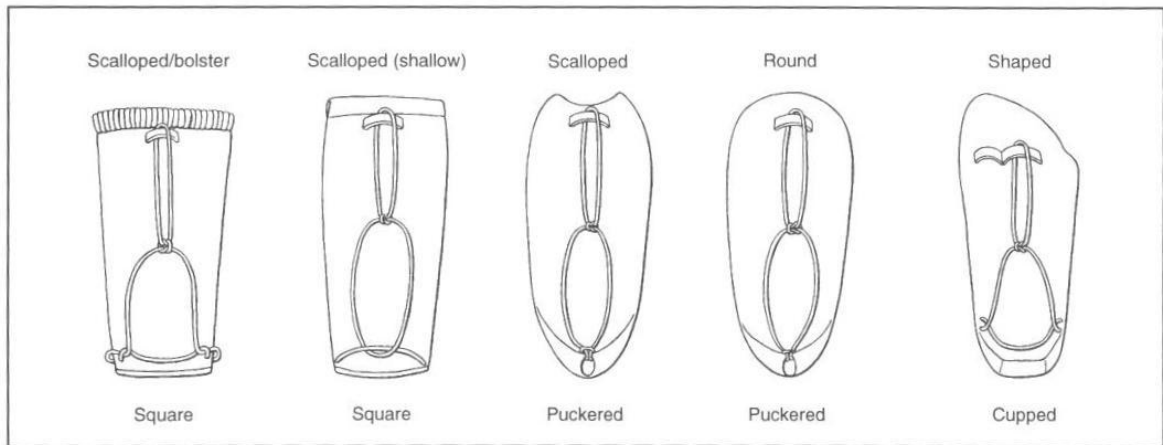


Figure 3.9. Classification of sandals by toe shape and heel shape (borrowed from Hays-Gilpin et al. 1998, Figure 3.6).

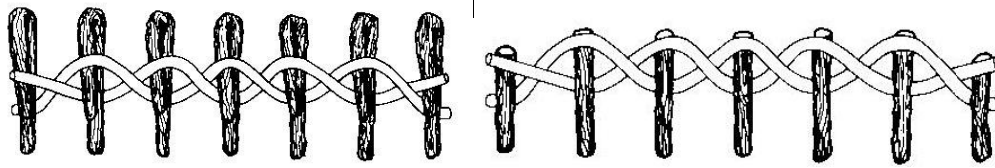


Figure 3.10. Folded (left) and Truncated (right) toe and heel constructions and selvages [borrowed from Adovasio 1977, Figures 32 (right) & 36 (left)].

Toe and heel construction and tie system may show variations that can sharpen cultural comparisons (Deegan 1995:59). Heel structures will reveal how warp ends are secured and possibly used within the tie system. The most common tie systems appear to be toe-heel, side-loop, and criss-cross (Figure 3.11) (Deegan 1993:66). Due perhaps to the vulnerable, fragile nature of these parts or to the recycling of materials, it is not uncommon that many sandals lack some or all parts of their tie systems. However, a quick study of most sandals will usually reveal some trace of a tie system, such as tufts of raw material, where toe or side loops were located (Deegan 1995:67).

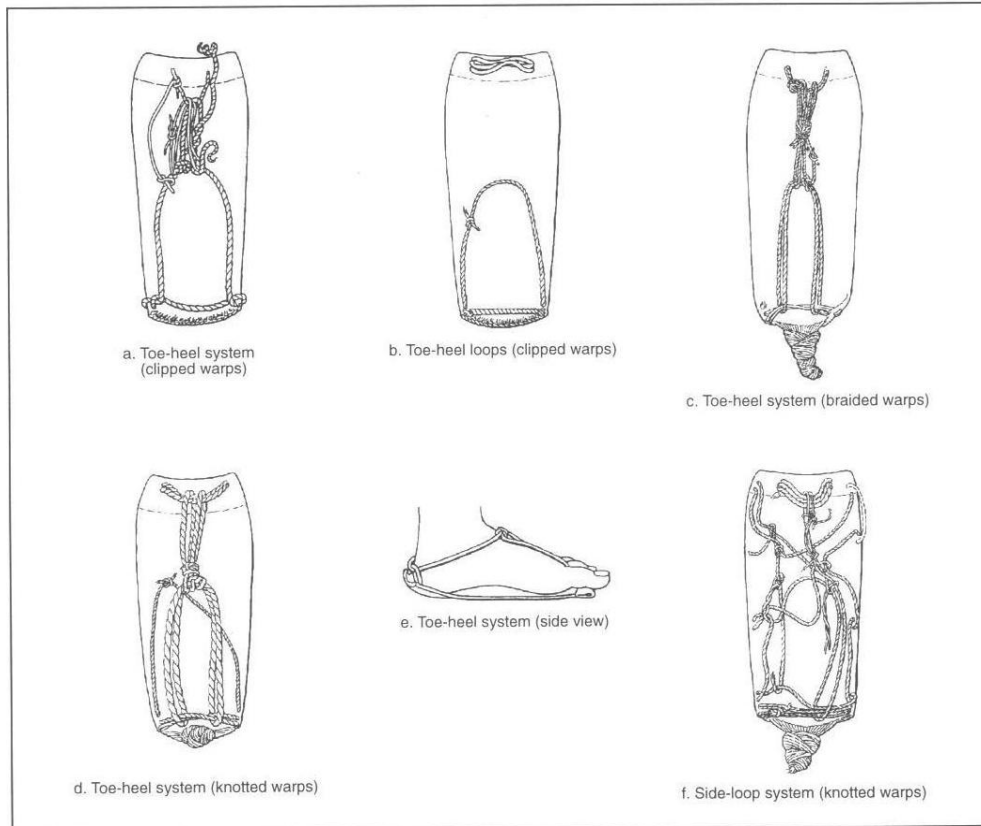


Figure 3.11. Toe-heel and Side-loop Tie Systems (borrowed from Hays-Gilpin et al. 1998, Figure 5.14).

The side-loop tie system employs varying numbers of loops along the sandal's side edges. The sandal is secured with a lacing cord that criss-crosses over the top of the foot through the side-loops (Deegan 1993:62). The toe-heel (toe-loop) tie system is a multi-component system. It requires several parts to secure the sandal to the foot. A tie-cord connects the toe loop(s) to an ankle or heel loop. Toe loops are one or more loops for one or more toes, commonly encircling the second and third toes only. An ankle loop crosses in front of the ankle usually from one sandal side edge to the other side edge. A heel loop crosses behind the heel from sandal side edge to side edge or may be comprised of two separate loops that anchor at mid-heel. Some toe-heel systems contain both ankle and heel loops (Figure 3.10) (Deegan 1993:62). The criss-cross tie system is closely

related to the toe-heel system. In these systems, the toe loop and the tie-cord are one piece and cross each other as they extend back to anchor along the sandal sides in the ankle region (Deegan 1993:62).

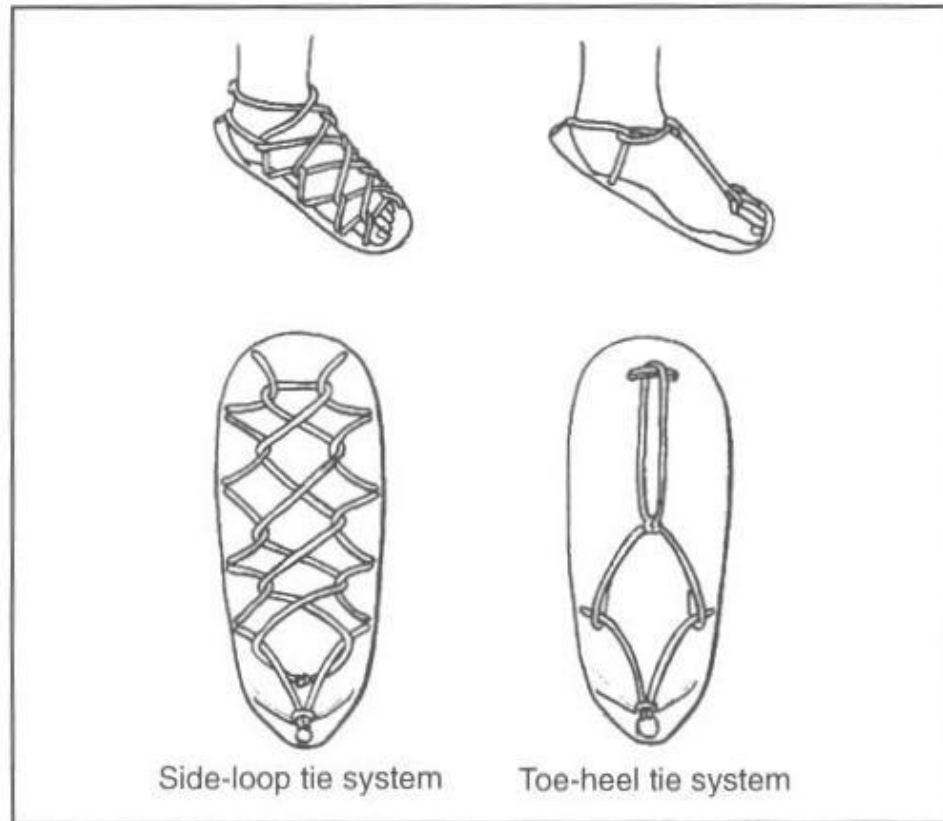


Figure 3.12. Side-loop and Toe-heel Tie Systems
(borrowed from Hays-Gilpin et al. 1998, Figure 5.29).

There are few artifacts as personal and evocative as sandals (Kankainen 1995; McBrinn 2005; Taylor 2004). Sandals convey much information about their owners. Sandals were created for an individual foot. Therefore, the size can indicate the stature, age, or sex of the wearer. Worn sandals often retain the imprint of the wearer's foot, and sometimes are caked with mud or dust from that person's travels (McBrinn 2005:61). Taylor (2004) has observed that for the modern, sandal-wearing Mexicans, both in

Coahuila and in other parts of Mexico, the sandal is both longer and wider than the foot and, it is assumed that this is to provide a kind of barrier against hazards of foot travel. He even goes as far to suggest, based on his field notes, that this barrier is most commonly about one-half inch wide (approximately 12-13 mm) around the full circumference of the sandal (Taylor 2004:71). Research done by Morris (1980, 1995) and others (Deegan 1993, 1995; Kankainen 1995) on Anasazi sandals suggest that “perhaps distinctive shoe prints were needed for group identification such as that of clan or tribe, or even for personal identification. Perhaps a person’s sandals, when observed at the entrance of a dwelling, served notice to other arrivals as to who was inside” (Morris 1995:8). Though admittedly conjectures, Morris surmises that these designs may have had “identifying characteristics of age, sex, religious society, or tribal membership” (Morris 1995:8).

Within the relatively rigid requirements of size, shape, and function, sandal makers created almost as many decorative expressions as there are recorded specimens. Although there are similarities in the details of manufacture and decoration of these fine types, no two identical specimens have been discovered so far. Each one is unique (Kankainen 1995). Not only was dyed yarn woven into complex, geometric, colored designs, there also were intricate weft wrapping techniques (Figure 3.13). With yarns wrapped around each other and tightly packed, knobs were allowed to protrude on the sandal sole, creating relief patterns. In the interest of creating beautiful textured designs on the soles of sandals, many separate decisions and executions were necessary (Morris 1995:7).

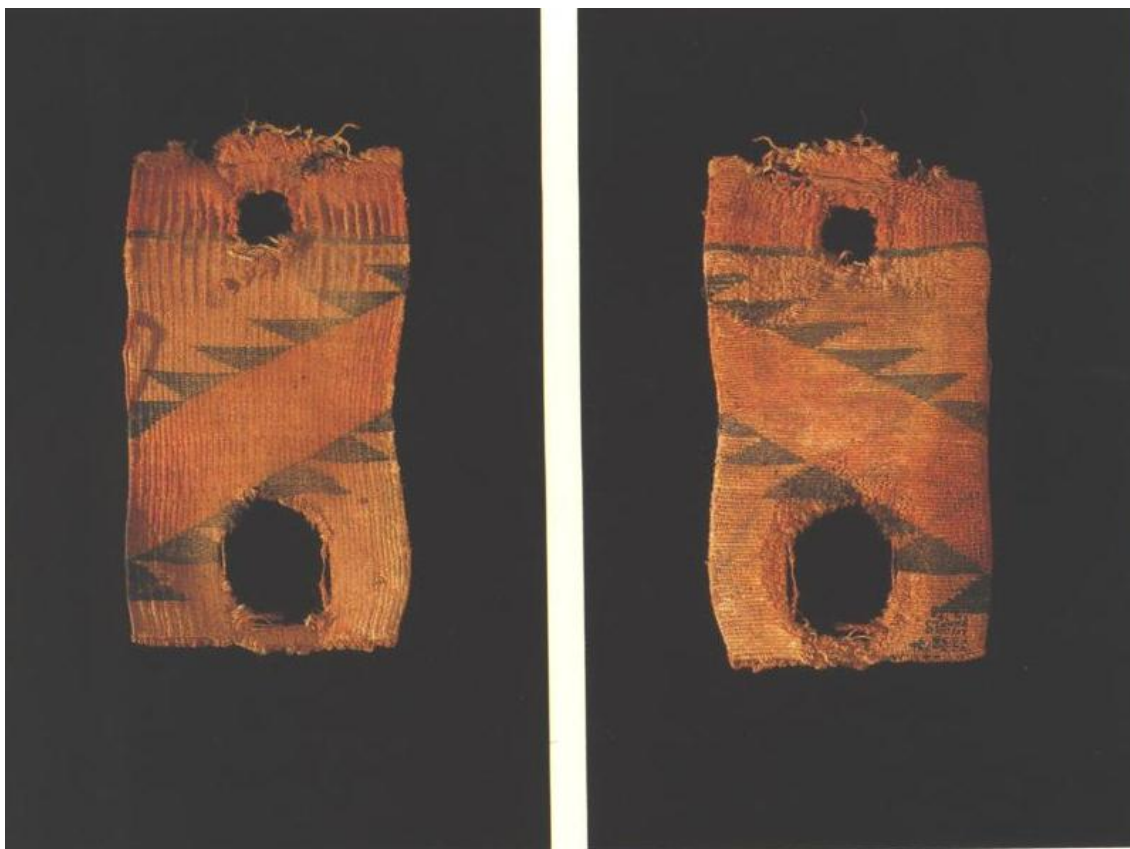


Figure 3.13. Anasazi sandal from Bernheimer Alcove, Utah
[borrowed from Kankainen, ed. 1995, Catalog no. 42SA736 (FS38.7 24080)].

Archaic sandals were easy to make and were probably seriously worn after one or two days of vigorous travel (Figure 3.12) (McBrinn 2005:61). These sandal breaks and depressions can provide clues to the foot on which they have been worn. Sandals can even be designated as right or left based on the placement of wear and breaks on the heel or at the ball of the foot, as well as due to the presence of big-toe depressions (Taylor 2004:79). Taylor suggests that the discard of more right foot sandals than left foot sandals, or vice versa, could also indicate some sort of handedness resulting in an unequal application of pressure (Taylor 2004:83). His research also indicates the practice of

sandal reuse, where sandals would have been worn on the opposite feet, worn on the reverse, or even lashing together (Taylor 2004:83).

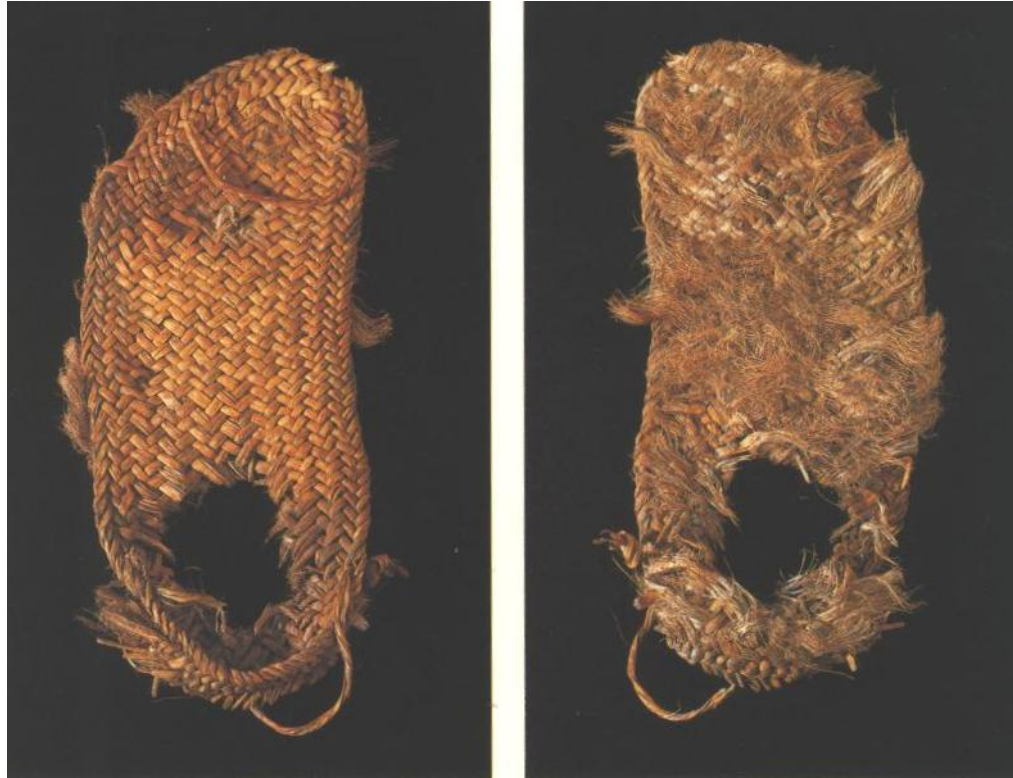


Figure 3.14. Anasazi sandal from Baby Mummy Cave, Arizona (borrowed from Kankainen, ed. 1995, Catalog no. 2575).

Unlike the other major subclasses of perishables, sandals constitute a fiber product, which, though common, is not universally manufactured across the Southwest or the Arid West, more generally. Indeed, “while there are no prehistoric populations who lived in areas with appropriate preservation who did not manufacture some form or type of cordage, netting, or basketry, oftentimes long time periods or relatively vast areas are utterly devoid of sandals” (Hyland 1997:239). Hyland proposes that there are two reasons account for the differential distribution of prehistoric and ethnographic sandal manufacture (1997:239). Firstly, many of the groups who do not produce fiber sandals do

in fact manufacture footgear in the form of hide moccasins. Secondly, some societies who do not wear sandals made no footgear at all (Hyland 1997:239). While Hyland admits that this appears incredible particularly, given the hazards of the terrain in many parts of the desert west, “the archaeological record does indicate that in certain areas at certain times, no footwear of any kind were used prehistorically” (1997:239). Using modern Mexican practice as a guide, Taylor suggests that “it may have been the aboriginal custom not to put on footgear at all until late childhood and early adolescence” (2004:71). Also, logically, a differential distribution of adult versus child sandals is not surprising. Adults would have exhausted more sandals than children. Therefore, it would statistically be rare to find a child’s sandal.

The oldest examples of footwear of any kind from anywhere in North or South America derive from Unit III at Fort Rock Cave, Oregon, and are dated to ca. 9000-6000 B.C. (10,950 – 7950 B.P.) (Figure 3.15). However, it is entirely possible that this sandal type, in particular, and sandal making, in general, extends back to the ninth or tenth millennium B.C. in the northern Great Basin (Andrews et al. 1986; Hyland 1997). It is significant that the earliest known sandal type in western North America is already highly standardized. For the entire existence of this type, the essential parameters of manufacture never change. This suggests that its manufacture, even at a remote date, was “subject to intensive ethnic overprinting” (Hyland 1997:240).



Figure 3.15. Fort Rock sandals (borrowed from Cressman 1962).

In this chapter I have attempted to educate the reader on how it is possible to analyze perishable products and use their distinguishing characteristics and attributes to determine the cultural influences of their makers. Because of the standardization of perishable technology found in prehistoric communities of practice, it is possible to differentiate between items made in the Southwest, Great Basin, Mexico, and Plains. Therefore, the uniqueness of the sandal collections from the Southern High Plains of Colorado, Oklahoma Panhandle, and northeastern New Mexico is easily recognizable.

Chapter 4: Sites

The analysis of the perishable collections found along the mountains and plains border at Franktown Cave and Trinchera Cave, Colorado and the Kenton Caves, Oklahoma/New Mexico (Figure 4.1) has offered insights into the cultural affiliations of the occupants of these sites and possibly the cultural make up of the Southern High Plains in general. Abundant research over the past half century has conclusively demonstrated that basketry, textiles, sandals, and cordage are far more useful for determining cultural affiliation than any other class of artifact and have particular importance in the establishment of prehistoric territorial boundaries, as well as in the documentation of prehistoric population movements (Adovasio 1980b, 1986, 2000, 2005; Adovasio et al. 1982; Adovasio and Gunn 1977, 1986; Adovasio and Illingworth 2002; Adovasio and Pedler 1994; Andrews and Adovasio 1980; Andrews et al. 1986; Carr and Maslowski 1995; Dillehay 2001; Hays-Gilpin et al. 1998; Hyland 1997; Hyland and Adovasio 2000; McBrinn 2005; Minar 2001; Morris and Burgh 1941; Petersen 1996; Petersen et al. 2001; Taylor 1966, 1988, 2004; Turpin 2003; Turpin and Carpenter 1994a, 1994b; Webster 2007; and Webster and Hays-Gilpin 1994). Therefore, the perishable collections from Franktown Cave, Trinchera Cave, and the Kenton Caves, occupied from the early Archaic through Late Prehistoric periods, have provided a new way of looking at the current body of evidence suggesting cultural diffusion to southeastern Colorado from the Central Plains and Southwest.

The Archaic occupants of Southern High Plains were highly mobile, with economic strategies that focused on the resources available in the foothills and mountains, which are reflected in their material culture (Gilmore 2005a, 2005b). Archaeologists consider the transition between the Late Archaic and Early Ceramic periods easily recognizable in the archaeological record of eastern Colorado because it is accompanied by obvious changes in basic technologies. These technological changes include the introduction of elongate, cord-marked ceramic vessels and smaller corner notched projectile points, “increases in population and sedentism, changes in economy (more intensive processing of natural resources and increased use of cultigens), and changes in mortuary practice that echo those associated with the Plains Woodland cultures of the Central Plains” (Gilmore 1999:7). According to Gilmore (2005a, 2005b), this probably represents a gradual diffusion of technology rather than an actual migration of people from the Central Plains. He hypothesizes that “an increase in the number of sites dating to the Early Ceramic period may indicate that population was increasing during this period, and replacement of the atlatl by the bow and arrow and the appearance...of ceramics may have occurred in response” (Gilmore 2005a:7) to this population increase. However, by studying the changes in perishable technology of this region it is soon realized that the inter-cultural interactions on the Southern High Plains was much more complicated than previously thought. The people occupying the Southern High Plains were not only influenced by the people occupying the Central Plains but were also heavily influenced by those occupying the Southwest, as well as points farther south.

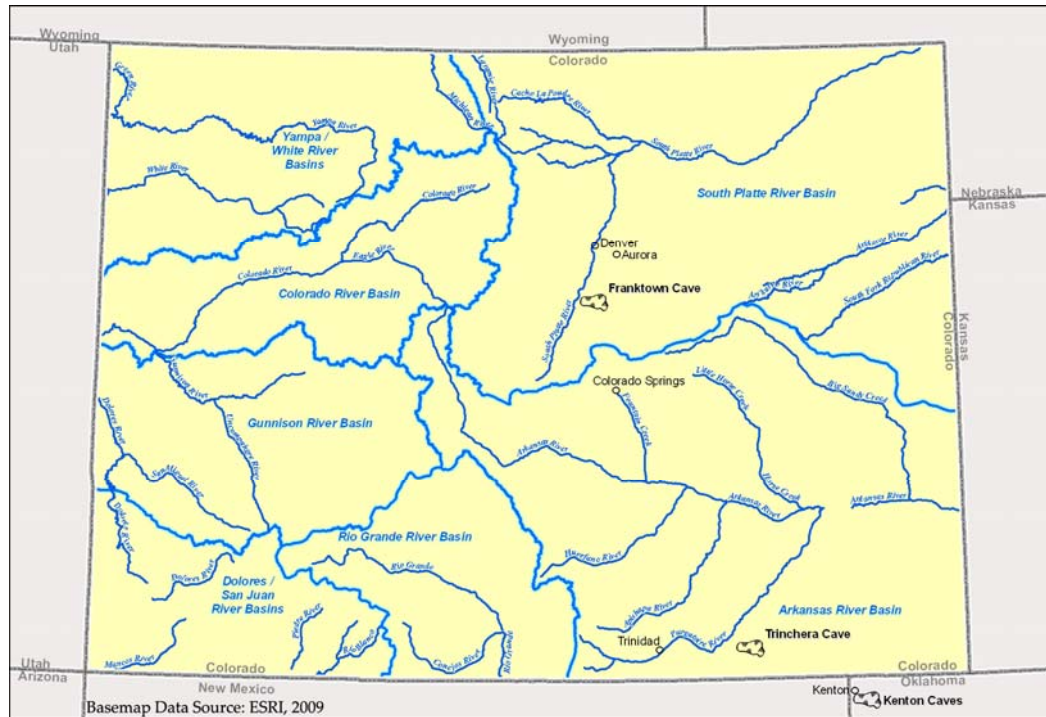


Figure 4.1. Location of Franktown Cave and Trincheras Cave, Colorado and the Kenton Caves, Oklahoma/New Mexico (Map created by John Watson, GISP).

Franktown Cave (5DA272; L:9:31)

Location and Physiographic Setting

Franktown Cave (Figure 4.2) is located 2.5 miles southwest of Franktown, Colorado, and 25 miles south of Denver, Colorado, which lies on the northern edge of the Palmer Divide at roughly more than 6000 ft in elevation. The Palmer Divide forms the drainage divide between the South Platte River to the north, and the Arkansas River to the south. Franktown Cave, an eastward facing rockshelter, is positioned 60 m above Willow Creek, a tributary of Cherry Creek, which flows north to its confluence with the South Platte River (Gilmore 2005a). This large rockshelter contains artifacts from multiple prehistoric occupations that span

nearly 5000 years. These occupations are evidenced by rare perishable constructions, such as woven yucca sandals, basketry, cordage, hide fragments, including one moccasin fragment, fragments of a possible rabbit fur robe, atlatl foreshafts, a snare, and corn (Gilmore 2005a, 2005b).



Figure 4.2. Franktown Cave (courtesy of Sara Gale).

As part of his M.A. thesis research, Anthony G. King (2006) reviewed the excavation field notes of all of the researchers who had previously conducted work at Franktown Cave and on the Franktown Cave materials. He was able to compile the first inclusive excavation history of Franktown Cave. Therefore, King's (2006) thesis, along with the University of Denver (DU) accession records, was the predominant source for the summarized excavation history below.

Previous Excavations

Four investigators and several dozen students under them have worked at Franktown Cave. However, no comprehensive report has been produced (King 2006). The most significant disagreement between the previous researchers is the reliability of the stratigraphy. Due to the variety of excavation techniques employed by each of the researchers, the temporal control at the site has been called into question. The dramatic change over time in the excavation methods of Arnold Withers reflects this. However, concerns about the reliability of the stratigraphy do not apply to the entire collection. Specifically, Capps' work appears to have been done in fine stratigraphy, as does Withers work in Stratitist I (King 2006). Furthermore, work by Pustmeuller (1977) shows that the diagnostic artifacts are not "all jumbled up" but reflect known patterns of change in projectile point technology in the area. The lowest levels contain large side-notched and stemmed projectile points of the Archaic. Corner-notched Early Ceramic points were found in the middle strata. Small side-notched and unnotched projectile points from the Middle Ceramic, associated with ceramics, were found in the upper strata (King 2006:74). Overall, the notes are adequate, if somewhat inaccessible, for explaining the nature of research done at Franktown Cave and the placement of the artifacts within the site.

Hugh O. Capps, Jr. Hugh O. Capps, Jr. was the first to conduct research at Franktown Cave. He excavated at Franktown Cave in 1942. Working at the north end of the cave, his field work recovered 208 artifacts (King 2006). His work uncovered lithic and ceramics material, as well as perishables. Diagnostic artifacts from Capps "Upper Pottery" (Stratum I) level include a corn cob dated to A.D. 1441 to 1660, seven

potsherds, and a small side-notched projectile point that is similar to other points described as “Reed,” “Washita,” or “Plains Side-Notched.” Based on recovered projectile point types, found at other dated sites, the “Upper Pottery” Level likely represents Protohistoric and Middle Ceramic times (King 2006). Diagnostic artifacts from Stratum II include one ceramic sherd and a legging and a moccasin, which have returned AMS dates of 926 +/-30 B.P. (2-sigma range cal A.D. 1025-1187), and 996 +/- 30 B.P. (2-sigma range cal A.D. 983-1157). This evidence suggests that Stratum II represents terminal Early Ceramic or early Middle Ceramic times (King 2006:129). Stratum III artifacts include 49 ceramic sherds and 45 lithic artifacts. The AMS dates and the projectile point styles suggest limited use of Franktown Cave at the beginning of the Early Ceramic (Gilmore 2004). However, the pottery concentration suggests an extensive occupation of the cave at the end of the Early Ceramic, probably starting around A.D. 900. Capps did not recover any artifacts from Stratum IV. Strata V-IX do not have any diagnostic artifacts associated, and they lack corn and pottery. Therefore, they are generally assigned to the Archaic (King 2006).

Arnold Withers. Arnold Withers excavated at Franktown Cave in 1949 and 1952. The only remaining notes associated with these excavations are a map by Gilbert Wenger that shows the locations of each “stratitest” and the test pits, and a stratigraphic profile drawn by David Breternitz (DU accession records; King 2006:52). Based on his research, Withers defines what he tentatively calls the “Franktown Focus” (Withers 1954). The Franktown Focus is based largely on the cordmarked ceramics and projectile point styles found at Franktown Cave. Withers admits that the Franktown Focus seems very similar to the Upper Republican Aspect. Therefore, the Franktown Cave materials could be

interpreted as a “transitional development from Woodland to Upper Republican in the western Plains” (Withers 1954:2). His main excavation in 1949 was Stratitest I, which included five levels. In addition to Stratitest I, Withers also dug small test pits to assess the potential of other areas in the cave. Withers returned in 1952 to excavate Stratitest II, which was an extension of Stratitest I (King 2006:132). Diagnostic artifacts from Level 1 of Stratitest I include potsherds, corn, and small side-notched and corner notched projectile points common in the Terminal Early Ceramic, Middle Ceramic contexts, and in Protohistoric contexts. Due to the commonality of artifact types during these times, this level may represent Protohistoric and Middle Ceramic times. The only diagnostic artifacts from Level 2 of Stratitest I were a large quantity of pottery sherds. Interestingly enough, this subsurface concentration of pottery is observed in other areas of the cave, and may be a marker for an extensive terminal Early Ceramic occupation. Thus this level is probably dominated by Terminal Early Ceramic deposits (King 2006:135). Stratitest I, Level 3 yielded an AMS date of 2826-2467 cal B.C. from a piece of coiled basketry (TOM-452). No other diagnostic artifacts were noted. This level likely represents Middle and Late Archaic deposits (King 2006:136). One diagnostic projectile point was recovered from Stratitest I, Level 4 and from Level 5. Both are similar to Magic Mountain type 3 (Irwin-Williams and Irwin 1966 cited in King 2006), which are associated with Middle and Early Archaic deposits. According to King (2006), like Capps’ excavation unit, Withers’ Stratitest I appears to have very good stratigraphic control. In fact, a similar pattern exists in which the upper level contains corn and a few pottery sherds, while the second level has a large quantity of pottery, which may represent a more intensive Terminal Early Ceramic occupation (King 2006:139). The

Early and Middle Archaic are represented by dated basketry and diagnostic projectile points, while the Late Archaic and Early Ceramic are ephemeral. Any occupation of Franktown Cave during these times can only be implied (King 2006).

Gerold Thompson. University of Denver graduate student Gerold “Tommy” Thompson excavated at Franktown Cave from 1956 to 1957, recording his extensive excavations in great detail. In addition to conducting his own excavations, he attempted to integrate the work of previous researchers into his notes (King 2006:58). Thompson also attempted to synthesize the artifacts from the previous excavations by Capps and Withers. He catalogued his artifacts as well as Capps’ and Withers’, a project later finished in the 1970’s by Helen Pustmeuller (King 2006:127). Thompson dug a 3’ by 54’ trench as well as laid out a grid in the central portion of the cave. Capps’ excavations and Withers’ Stratitest I suggest that the cave had excellent integrity in several areas, and Thompson’s excavations also support this notion. However, by the time of his excavations, the disturbance from Capps and Withers excavations had complicated many areas of the cave (King 2006). It was probably very difficult to distinguish between backfill and primary deposition. As a result, Thompson inadvertently excavated in areas that were probably a mix of intact cultural deposits and backfill from previous researchers and pothunters. According to King (2006), Thompson became increasingly aware of this problem as he continued to excavate the trench in the area of “large rock.” Thompson’s response was to lay out the grid in an area that was relatively less disturbed. Unfortunately, the grid was not in an area of extensive human occupation and had even more extensive roof fall than in his initial trench (King 2006).

Sarah Nelson. In 1975, Sarah Nelson, professor of Anthropology at the University of Denver, began her involvement with the Franktown Cave collection. Nelson supervised a number of student research projects and employed the assistance of multiple experts in an attempt to increase understanding of the collection. At this time, two radiocarbon dates were acquired. The first date was from a hearth 80 cm below the surface. This sample yielded a date of A.D. 195 (1755 +/- 65 B.P.), and was associated with an Archaic style projectile point (King 2006). The second date was from a charcoal sample from unit B4 Level 1 of Thompson's excavations. It yielded a date of A.D. 1060 and was found in association with pottery (King 2006). These dates gave Nelson confidence that there was some integrity to the stratigraphy of the cave. In 1976, Nelson and her students attempted to further verify the stratigraphy of the cave by scraping the sides of Thompson's trench. She also attempted to map artifact distributions to see if major activity areas or changes in artifact types could be observed. The resulting maps from this project suggest that there were areas of intensive activity at different times (King 2006:61). In the same general period, Nelson acquired the assistance of Sarah Studenmund in analyzing the Franktown Cave ceramics. Studenmund found that all the cord-marked pottery in her sample had been smoothed, and that the collection represented a fairly small number of vessels. She also attempted to analyze the cord-marks themselves to see if any meaningful patterns emerged (King 2006). Studenmund found no significant correlations in the width and depth of the cord-marks. It was concluded that the pottery from Franktown Cave could all be considered a single type. In fact, no statistical difference was found between the cord-marked and the smooth pottery, except for the presence or absence of cord marks (King 2006:62). Nelson also solicited

the assistance of Dr. James Adovasio in the analysis of the perishable collection, specifically the basketry, cordage, and sandals.

Kevin Gilmore. Kevin Gilmore began working with the Franktown Cave collection as a doctoral student at the University of Denver, Department of Geography. In collaboration with Sarah Nelson, a National Science Foundation Grant was obtained, which allowed 17 AMS samples to be taken from perishable items from the cave. This grant also allowed for samples to be taken from perishable items from the Kenton Caves collection, a portion of which is also housed at the University of Denver Museum of Anthropology (DUMA). The grant supported the acquisition of these samples due to the proposed similarity of the collections by perishables experts J. M. Adovasio and J. S. Illingworth (Adovasio et al. 2005). These calibrated radiocarbon dates suggest that Franktown Cave has five distinct temporal components: 3350-2880 B.C., 2870-2500 B.C., A.D. 670-860, A.D. 980-1190, and A.D. 1190-1280 (Gilmore 2005a; King 2006:69). Gilmore has also published the article “These Boots were Made for Walking” in the edited volume *Women and Hide Working*. In his chapter, he presents evidence for gendered activities at Franktown Cave, specifically the processed hide, stone scrapers, basketry, sandals, and rabbit fur robe. Gilmore also argues that the moccasin found in Franktown Cave is an Algonquian style from the Great Lakes Region (Gilmore 2005b). This Eastern style footwear, in addition to pottery and projectile point style evidence, suggest at least some affiliation with Eastern Woodland peoples. Based on the aforementioned AMS dating, the moccasin was discarded sometime between A.D. 980 and 1160. According to Gilmore, the moccasin may represent the material culture of

early ancestors of modern Cheyenne and Arapaho peoples from the area (Gilmore 2005b:29).

Anthony G. King. For the completion of this M. A. degree, and in order for additional research to be done, Anthony G. King deciphered the notes and stratigraphy recorded by all of the excavators of Franktown Cave. According to King, one of the most interesting patterns that emerged from his analysis of the notes was a subsurface stratum with a high concentration of pottery. This stratum seems to reflect a more intensive occupation of Franktown Cave at the end of the Early Ceramic and the beginning of the Middle Ceramic (King 2006). This evidence of more intensive occupation of the cave seems to correspond with the period between roughly A.D. 800 and A.D. 1200. Interestingly enough, this is the same period of time in which Eastern Colorado saw the highest population densities in prehistoric times (Gilmore 1999; King 2006; Zier and Kalasz et al. 1999). King focused his research on the exploration of the implications of this intensified occupation, as well as how corn affected the relative sedentism and mobility of hunter-gatherers at Franktown Cave. He explored these issues by looking at the stone tool assemblage, paying special attention to “corresponding changes in the stone tool assemblage at the appearance of corn (ca. A.D. 800-1100) that would suggest more sedentary, collector-like behavior, such as shifts in tool production patterns and raw material use that are indicative of shifting subsistence strategies and mobility patterns” (King 2006:10).

Perishables Research

Basketry, cordage, and sandals have been removed from Franktown Cave through a series of five somewhat controlled excavations (Gilmore 2005a). Perishable materials recovered from these excavations were first analyzed by Gerold Thompson in 1958. Thompson's report (1958) on the sandals and cordage from Franktown Cave focused on the technical descriptions of the specimens. His analysis showed that there were at least two types of sandals: a winter type with more complex straps and a grass sock, and a lighter summer type with less complex straps and no sock (Thompson 1958). The perishables were subjected to more in-depth analyses by J. M. Adovasio in 1972 as part of a Smithsonian Post-Doctoral Research Project, with follow-up reports being produced by Adovasio in 1999 and J. M. Adovasio and J. S. Illingworth in 2005 (DU accession records; Gilmore 2005). The most recent analysis has provided dates for the sandals and coiled basketry (whole rod foundation and bundle foundation) between 3339-2467 B.C. (4458 +/- 36 B.P. and 4028 +/- 35 B.P.) and coiled basketry (whole rod in bundle or with lateral bundle) between A.D. 677 and A.D. 860 (1267 +/- 31 B.P.). Though Thompson believed that the sandals were from the Early or Middle Ceramic, more recent radiocarbon dating, has determined that they date to the Early-Middle Archaic period (Adovasio et al. 2005).

Early-Middle Archaic. Franktown Cave is the only rockshelter site in the Palmer Divide that has been dated to the Middle Archaic, which makes the technology used and left within it very unique. Six yucca plain weave sandals, four coiled basket fragments, and a piece of rabbit fur robe from Franktown Cave have produced AMS dates from 3350-2500 B.C. (4,492 +/- 37 B.P.) through 2826-2467 B.C. (4,028 +/- 35 B.P.)

(Adovasio et al. 2005; Gilmore 2005a). Sandals TOM-501, TOM-509, TOM-546, TOM-462, and TOM-588 were found in trench B3 Level 1. Sandal TOM-858 was found in B3 Level 2. All of the sandals date to the Early-Middle Archaic. Coiled basketry specimen TOM-1140 and TOM-1137 were found in Square C3 Level 1. Coiled basketry specimens TOM-500 and TOM-452 were found in trench B3 Level 1. All but one of the coiled basketry specimens date to the Early-Middle Archaic period.

Early Ceramic. An Early Ceramic (A.D. 680-860) occupation of Franktown Cave is represented by a fragment of whole rod in bundle (or with lateral bundle) foundation coiled basketry (TOM-290, from B5 Level 1), whose technology is rather unique. According to Adovasio and Illingworth (Adovasio et al. 2005), this technique of manufacture is never common anywhere. A small bent twig and sinew net of unknown function dates to the Middle Ceramic (A.D. 1035-1290), which indicates that perishable technology was incorporated into the hunter and gatherer subsistence strategy of the Franktown Cave occupants, especially snare forms. The Franktown Cave perishable technology has provided a new approach to the analysis of the subsistence strategies and economy of the prehistoric groups of the Southern High Plains that was previously not possible.

Summary of Previous Interpretation of the Material. Although the six yucca plain weave sandals superficially resemble contemporaneous Archaic sandals from several sites in the northern Colorado Plateau (Geib 2000), preliminary examination of the Franktown Cave sandals by Adovasio, Thompson, and Illingworth (2005) suggests that they may be the product of a manufacturing sequence that, in fact, has no current analogs at any other sites. According to Adovasio and Illingworth, the only vaguely analogous

collection is that from the Kenton Caves (Adovasio et al. 2005:18). As previously stated, the most recent analysis has provided dates for the sandals and coiled basketry (whole rod foundation and bundle foundation) between 3339-2467 B.C. (4458 +/- 36 B.P. and 4028 +/- 35 B.P.) and coiled basketry (whole rod in bundle or with lateral bundle) between A.D. 677-860 (1267 +/- 31 B.P.), which appear to show that these artifacts are from the Early and Middle Archaic and Early Ceramic periods (Adovasio et al. 2005). Based on these dates, Adovasio and Illingworth have concluded that the Franktown Cave bundle foundation coiling is oldest example of this type north of Lower and Trans-Pecos Texas and northern Mexico (Figure 4.3).

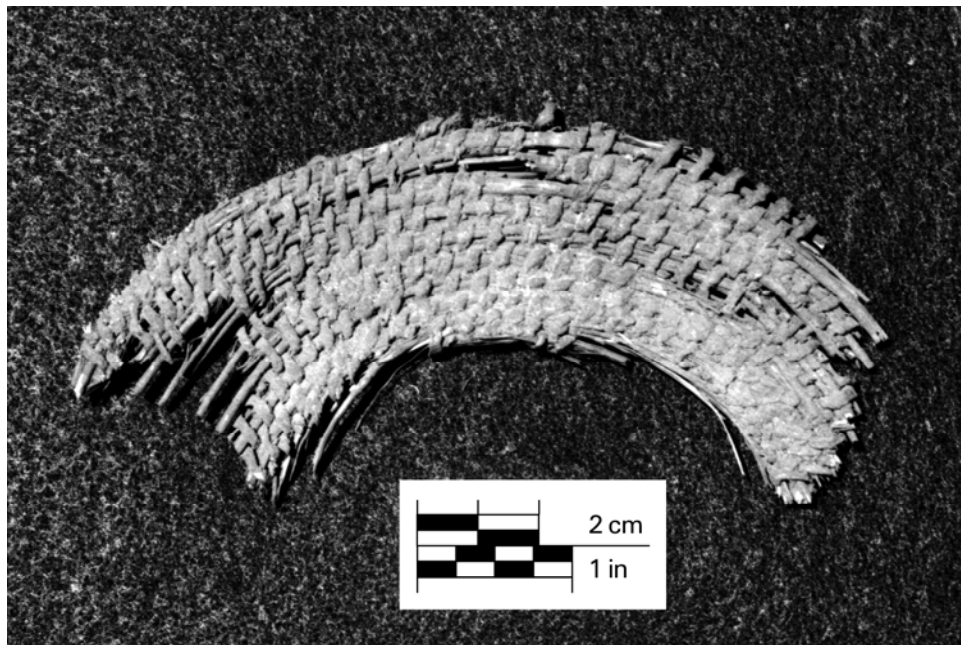


Figure 4.3. Franktown Cave Specimen TOM-500, Type II: Close Coiling, Bundle Foundation, Non-Interlocking Stitch (borrowed from Adovasio et al. 2005, Figure 6).

However, despite the antiquity of this type, the suggested association between these regions is skewed by the opposite work directions and splice techniques found on the specimens. The Mexican origin of bundle foundation coiling and its suggested

association with the arrival of domesticates, namely corn, has been confirmed by Adovasio's research (Adovasio 1974, 1975, 1980a, 1980b, 1986, and 2005). But, it's association with the corn recovered from Franktown Cave is negated because the corn samples date to much later time periods: the Middle Ceramic (A.D. 1035-1219; 892 +/- 36 B.P. through A.D. 1191-1286; 787 +/- 34 B.P.), Protohistoric (A.D. 1441-1632; 380 +/- 34 B.P. through A.D. 1489-1660; 293 +/- 36 B.P.), and Historic (A.D. 1657-1950; 170 +/- 38 B.P.). Therefore, the corn utilized at Franktown Cave is not associated with the earlier occupations and the construction of any of the plant-fiber perishable artifacts (Adovasio et al. 2005).

The sandals, cordage, and the remaining forms of coiled basketry, unfortunately, do not clarify the associations of this assemblage to other regions. According to Adovasio and Illingworth, the work direction and splice techniques of the coiled basketry, and the sole construction, tie mechanisms, and winter and spring variant forms of the sandals cannot be attributed to any of the known basketry manufacturing centers (Adovasio et al. 2005). Interestingly enough, the predominant final twist direction of the Franktown Cave cordage is the exact opposite of the predominant type in the contemporary eastern Great Basin and Colorado Plateau, which suggests very minimal technical affinities or connections between contemporaneous cordage-making populations on opposite flanks of the Rockies (Adovasio et al. 2005). According to Adovasio and Illingworth, the Kenton Caves perishable suite is the only vaguely analogous group of artifacts to those of Franktown Cave (Adovasio et al. 2005).

Of all the recorded sites in the South Platte River Basin, the Franktown Cave collection is unique in the large quantity and variety of perishable artifacts recovered. In

fact, the structural attributes contained within its perishable specimens are unique within the known basket-making populations and regions of North America. Only two other documented sites in all of eastern Colorado contained any significant amount perishables, Trinchera Cave and Chamber Cave. Both of these sites are within the nearby Arkansas River Basin in southern Colorado (Gilmore 2005a). Despite the fact that perishable materials were recovered from Chamber Cave (5PE1767), including bone, wood, and leather artifacts and a coiled basket fragment, the site was excavated by collectors and is presently held in unknown private hands. This makes it unlikely that these artifacts will ever be made available for comparative analysis (Gilmore 2005a). Fortunately, the collection of perishable artifacts recovered from Trinchera Cave (5LA1097), which approaches in variety the perishable assemblage of Franktown Cave, are available for research. The fact that this collection had not been analyzed or dated made it a perfect candidate for comparison with Franktown Cave (Gilmore 2005a).

Trinchera Cave (5LA1057)

Although no comprehensive site report that details the various excavations has been produced, Caryl Wood Simpson's (1976) thesis does provide summary descriptions that demonstrate the remarkable breadth of artifacts recovered from the site. Of special note are the diverse perishable remains, including nine basketry fragments (Black 1991), three leather sandal fragments and two moccasin fragments, and 10 yucca sandals, cordage, and ties, which are housed in the Louden-Henritz Archaeology Museum at Trinidad State Junior College (TSJC). The site seems to have been first occupied in the Archaic, starting at roughly 5000 B.P. and extending through A.D. 1700, which is similar

to the Franktown occupations. The domestic use of the site is obvious not only from the huge quantity and diversity of artifacts preserved there, but from various other features such as extensive rock art, a jacal structure, other posts, and a hearth or roasting pit (Black et al. 1998). It is interpreted as having been a possible multiple dwelling site (Black 2001). In addition, there is evidence to indicate that the occupants of Trinchera Cave participated in a regional exchange or trade system to the south and west, which has been hypothesized primarily from the presence of multiple types of non-local ceramic sherds that indicate trade with Ancestral Puebloan (Anasazi) groups. The raw material for catlinite stone pipes, probably quarried from southwestern Minnesota, provide evidence for eastern trade ties, and Olivella shell beads represent trade from coastal locales of either the Gulf of California, Gulf of Mexico, or the Pacific Ocean. Interestingly enough, these items are also represented in the Kenton Caves collection, and thus indicate the probable presence of similar trade networking on the Southern High Plains (Black 2001).

Though only limited archaeological research has been completed in southeastern Colorado, what has been done has been sufficient in helping archaeologists outline the basics of the local cultural sequence. Because a large unanalyzed perishable collection was recovered from Trinchera Cave, the site has the potential to provide important information that could question current understandings of prehistoric industry, social history, settlement, and architecture in southeastern Colorado. Specific to Trinchera Cave is an outstanding assemblage of perishable artifacts with untapped research potential that provide a means for investigating fiber arts technology, the role of plants in the local economy, stylistic relationships with neighboring prehistoric cultures, the

chronology of specific artifact classes and types, as well as changes in material culture manufacture and use (Black 2001). The perishable assemblage can also provide an understanding of the lifeways of local Native American groups in the Archaic through Protohistoric periods, specifically regarding subsistence strategies, their relationships with other groups, and the use of artifact styles as social markers.

The eastern portions of southeastern Colorado have reflected greater Plains influence, while the western half has a predominantly Southwest orientation (Black 1991; Simpson 1976; Zier and Kalasz 1999). Fortunately, the entire Trinchera Cave Archaeological District represents a possible contact zone between these two influences. A blending of the Plains and Southwest cultures has been demonstrated for all occupational levels at Trinchera Cave (Ireland and Wood 1973:188-192; Simpson 1976). The Trinchera Cave excavations as a whole also revealed that the occupational layers post-dating the Archaic period contained relatively more material than the earlier deposits, which indicates a possible increase in population through time and the addition of new types and forms of technology, including the bulk of the perishable remains (Simpson 1976).

The recent AMS dating (reported herein) of a portion of the Trinchera Cave perishable collection has provided the possibility for the creation of a larger, more complete regional perishable chronology documenting changes in perishable technology through time. Until recently, only one radiocarbon date (A.D. 430-770) (no standard deviation provided) had been recorded for the material. However, its correspondence to dates coming from Franktown Cave's Early Ceramic period (A.D. 128-421; 1755 +/- 65 B.P. through A.D. 682-879; 1,253 +/- 36 B.P.) were very promising for a successful

comparison between the two sites. According to Caryl Wood Simpson (1976), the deepest layers excavated from Trinchera Cave are undated, but the styles of artifacts described are suggestive of one or more Early or Middle Archaic period occupations. Radiocarbon data for the site acquired by Mike Nowak, Colorado College (Nowak and Gerhart 2002), suggest an occupation span of 810 B.C. through A.D. 1750. But, it is very likely that the use of Trinchera Cave extends farther. The bulk of radiocarbon dates fall into a narrow, 350 year time period (A.D. 850 to A.D. 1200). The recent radiocarbon dates for the sandals, reported in this work, fall within this range as well.

Location and Physiographic Setting

Trinchera Cave (Figure 4.4) is located on the Chaquaqua Plateau of the Raton Section in the Great Plains Province. Trinchera Cave is located 40 miles east of Trinidad, Colorado in the Arkansas River Basin. Trinchera Cave is on Trinchera Creek, a tributary of the Purgatoire River, near the mouth of the Trinchera Creek Canyon. It is actually a large rockshelter, which contains a series of four smaller shelters, but is locally known as Trinchera Cave. It is formed in the Dakota Sandstone formation situated approximately 23 feet above the stream bed. The southeasterly exposure warms the shelter in winter and cools it in summer (Simpson 1976:2). The climatic fluctuations observed in this area can be attributed to the elevation of the specific locale as well as the altitude of its various geological features (Simpson 1976:12).



Figure 4.4. Trinchera Cave (Courtesy of Herb Dick).

Previous Excavations

The consideration of which researchers excavated in each particular region of Trinchera Cave can only be discussed briefly due to the lack of records and maps. It can be said with confidence however, that it is unlikely that Herb Dick excavated in areas that Haldon Chase had previously excavated. What is likely is that Dick excavated areas that may well have been adjacent to portions that were previously excavated. Caryl Wood Simpson reports that Dick excavated shelters A and C and that Chase had previously worked in Shelter B (1976:5). However, whether those statements are completely true or not cannot be determined. Willard Loudon, who was present when both of these individuals worked at Trinchera Cave, has stated that both of the men worked “all over the place” (personal communication 2002 cited in Nowak and Gerhart 2002). Michael

Nowak has placed Simpson's excavations north of their Test A and just west of Test G. Ultimately, without the recovery of both Chases's and Dick's field notes, the question of who worked exactly where will never be known (Nowak and Gerhart 2002:16).

Haldon Chase. Archaeological investigation began at Trinchera Cave in the early 1950's by Haldon Chase who was the Trinidad State Junior College (TSJC) archaeologist from 1951 to 1953. He excavated the area designated as Shelter B (Simpson 1976). Because he was the first archaeologists to conduct research at Trinchera Cave, it is assumed that Chase was excavating in undisturbed soil (Nowak and Gerhart 2002:104). Unfortunately, the location of the majority of the records as well as some of the artifacts from that excavation is unknown at the present time. What is known is the artifact cataloguing system employed by Chase. For Compartment I, artifacts were cataloged with TA# artifact numbers. Artifacts labeled TAS are from the surface in this area. And, west and north provenience references and depths in centimeters are recorded for the artifacts. Compartment III could be the area either to the north of the fallen rock of the shelter or near the 'art gallery'. These artifacts were cataloged with T #-#-# designation (ex/ T5-4-3 designation refers to Trinchera, level 5 (60-75cm), 4 meters east, 3 meters north). Artifacts found on the surface are recorded as either TS or T S-#-# (Loretta Martin, Curator of the Loudon-Henritz Museum at TSJC, personal communication March 2007).

Dr. Herbert W. Dick. Herbert W. Dick replaced Chase in 1953 and remained the archaeologist for the college until 1962. His excavations at Trinchera Cave occurred during the 1954 through 1956 field seasons under TSJC and the Harvard Botanical Museum. His excavations occurred in Shelter A and C. All maps, photos, artifact

inventory records, and artifacts were released to the Museum, however some have been misplaced (Simpson 1976). Artifacts recovered from these excavations have proveniences designated by cave (letter), section letter and number, as well as depth range in inches. Presumably, the number and letter refer to a grid system, but it is unknown at this time what the system is. Artifacts also tend to have “TR 1” before their designated artifact number (Loretta Martin, Curator of the Loudon-Henritz Museum at TSJC, personal communication March 2007; Nowak and Gerhart 2002:104).

Colorado Archaeological Society, Trinidad chapter 1966, 1969. Unfortunately, though it is known that the Colorado Archaeological Society, Trinidad chapter conducted excavations at Trinchera Cave, no information regarding these excavations has been retained. The artifacts recovered from these excavations have no context (Nowak and Gerhart 2002:104).

Caryl Wood Simpson. Simpson attempted to make sense of the previous work based on scattered notes and drawings. She discovered a minimum of four cultural levels within Trinchera Cave. However, no correlation could be made between the levels of Area/Shelter D that she investigated and Herb Dick’s 1954-57 Area C excavations (Simpson 1976:21). The majority of the perishables she uncovered were restricted to the first occupation level and were preserved only in the rear of the shelter. Unfortunately, many of the perishables decomposed after being transported to the lab. Her greatest find was a very large sandal (TR1 789) (Figure 4.5) (Simpson 1976:154).



Figure 4.5. Trinchera Cave sandal specimen TR1 789
(modified from Simpson 1976, Plate 7).

Artifacts collected during the 1954-1956 field seasons are lacking in provenience data. The location of occupational levels could not be determined by the previous excavators, and therefore, arbitrary depths were used to denote the vertical association of artifacts. Unfortunately, the most culturally extensive portions of the cave were affected by these previous excavations (Simpson 1976:179). It was therefore not possible for Simpson to use the data in the formation of definite hypotheses concerning the cultural affiliations of the occupants of the cave. All of her conclusions were based upon her own work although Herb Dick's assemblage and notes were used periodically as

supplementary supportive data (Simpson 1976:179). Current attempts are being made to deal with this situation so that these artifacts may be placed in the proper cultural sequence (Nowak and Gerhart 2002).

Based on the work of Simpson, Dick, and Chase, Simpson has concluded that the excavations spanning 25 years at Trinchera Cave have revealed a minimum of several thousand years of extensive and intensive occupations. Based on the evidence at hand, Simpson suggests a Panhandle Aspect relationship for the first occupation level, in which shelters are noted as being the preferred habitation places when they were located near water and wood (Simpson 1976:200). Despite that fact that Trinchera Cave is a rockshelter and the Panhandle Aspect literature deals primarily with open structures of stone and/or jacal structures, similarities can be seen including stamper cordmarked pottery, Antelope Creek focus pottery, jacal-type dwellings, awls, Olivella shells, and digging sticks (Krieger 1946; Simpson 1976).

Level II is characterized by the presence of Taos Plain ceramic sherds dating to A.D. 1100-1300 and Santa Fe Black-on-White sherds which most likely date to A. D. 1200-1350. A decrease in the number of side-notched points and an increase in corner-notched points in this level are noticeable. The remaining artifacts are so similar to those found in the Panhandle and the Southwest that they do not assist in the cultural assignation of the level. Far less area was excavated to this level than in previous excavations, therefore it is premature to label this as an extension of the cultures of the Upper Rio Grande based on ceramics alone. However, it can be said that this 2nd level exhibits more of an influence from the Southwest while the first occupation level revealed a greater Plains influence (Simpson 1976:203).

Little can be said about the occupation below Level II. Although the artifact assemblage from these levels contain fewer specimens, they remain very similar to those recovered from Levels I and II. An attempt was made to date these non-ceramic levels through the obsidian hydration method. However, hydration rates for the obsidian present were unknown and the data was not believed to be applicable to hydration rates already established for the Plains area. The majority of the larger points occur in these lower levels. According to Simpson, these larger corner-notched points “resemble the Late Archaic and Early Prehistoric Ellis-type points from Texas as described by Shum, Krieger, and Jelks (1954:420)” (Simpson 1976:204). In addition, the point assemblage from Magic Mountain is very similar to these from Trinchera Cave (Simpson 1976). Zone B was assigned a questionable early basket-maker affiliation and therefore, again, a relationship between the Plains and Southwest can be seen. Despite a lack of ceramics for cross-dating, the projectile points indicate a Late Archaic through Early Prehistoric occupation within the lower levels of Trinchera Cave (Simpson 1976:204).

Based on the excavated levels and their artifact assemblages, Simpson has concluded that the Late Prehistoric and possibly Archaic cultures represented at Trinchera Cave cannot be assigned purely Plains or Southwest cultural affiliations for “they are a combination of both” (Simpson 1976:204). As one would expect, the eastern portions of southeastern Colorado reflect a greater Plains influence while the western half is predominantly Southwestern in orientation, with the entire area representing a contact zone (Black 1991; Ireland and Wood 1973: 188-192; Simpson 1976; Zier and Kalasz 1999).

Michael Nowak (1999-2001). Colorado College Professor Michael Nowak conducted undergraduate field schools at Trinchera Cave from 1999-2001. In 2001, radiocarbon dates were acquired from charcoal and matting with good association and context from areas that had escaped the effects of previous excavations and pothunting. According to Nowak, the current set of dates is encouraging because they greatly expand the time range for use of the rock shelter. The previous time range for the use of Trinchera Cave was only 350 years (A.D. 850 to A.D. 1200) (Nowak and Gerhart 2001:16). The 2001 dates now permit us to say that the age differentiation between the oldest and youngest radiocarbon dates appears to reflect a two and a half thousand-year period of use of the rock shelter, from 810 cal B.C. (2760 +/- 60 B.P.) to cal A.D. 1700 (250 +/- 60 B.P.) (Nowak and Gerhart 2002:11). In Nowak's opinion, the use of Trinchera Cave very likely extends farther, based on the recovery of Meron dart points which date to the Plains Archaic. However, the amount of disturbance present at the site may prevent this from ever being proved. A variety of occupational activities are suggested on the basis of excavations in different parts of the rock shelter (Nowak and Gerhart 2002:14). The abundance of maize ears and *Cucurbita* (squash) fragments are strong evidence for the presence of deliberately planted foods. The presence of obsidian tools and a large intact bivalve shell indicate that trade was going on. Considering trade items recovered at other southeastern Colorado sites, this does not seem to be appreciably different (Nowak and Gerhart 2002:15).

One of the aims of Dr. Nowak's research has been to locate unexcavated areas of the shelter. Along with this project has come the adventure of determining where previous excavations took place. In tandem with this endeavor, a cataloging project was

undertaken in hopes of synthesizing all available artifact information about Trinchera Cave, incorporating all the artifacts from all excavation projects that are related to 'dated' stratigraphy. While Colorado College's stratigraphy is the only absolutely dated stratigraphy (Nowak and Gerhart 2001:15; Nowak and Gerhart 2002), Simpson's stratigraphy is relatively dated by the presence of ceramics in the top three strata (1976:200-203). Most of the materials from Haldon Chase's and Herbert Dick's excavations were cataloged into the Colorado College database for Trinchera Cave by Kylie Crocket, Dr. Michael Nowak, and Heather Gerhart. The museum has both Chase's and Dick's field catalogs, but no field notes or complete database for the Trinchera Cave collection. The field catalogs provided data about the excavation unit, some provenience information, and depth for the artifacts. However, at this time, this information is not useable because there is no reference point to place the units or proveniences within the shelter (Crocket 2002:99). Due to time constraints, not all artifacts listed in the catalogs are included in the database. Some materials are missing or untraceable. However, the majority of the field books are available for comparison in order to determine what items are missing. (Crocket 2002:164).

Under the direction of Michael Nowak, Kylie Crocket attempted to establish an artifact-based stratigraphy for Trinchera Cave, to be applied to the database of Chase's and Dick's artifacts. The occupation of Trinchera was split into two temporal periods, before and after A.D. 1050 (900 B.P.). By comparing these two periods to sites that date to the same periods, she attempt to establish artifact characteristics of the two time periods for Southeastern Colorado. A.D. 1050 is the date given to the transition from the Developmental period (A.D. 100-1050) to the Diversification period (A.D. 1050-1450).

This is the date when two distinct cultures appear in Southeastern Colorado (Sopris and Apishapa) (Zier and Kalasz 1999:141). The problem of the A.D. 1050 date is that there is a possibility that this date is only significant when comparing Apishapa and Sopris sites (Crocket 2002:119). The study suggests that the A.D. 1050 transition does not influence the use of most of the artifact categories analyzed. This implies that the spheres of influences that may have been changing between the periods were not directly influencing the activities studied. The two major influences suggested to be occurring are the higher use of horticulture and the amount of trade (Zier and Kalasz 1999:195, 218, 231). Statistically speaking, before and after A.D. 1050 sites in southeastern Colorado are indistinguishable by the artifact categories analyzed (Crocket 2002:138). In fact, the sandal types and dates that are reported in this work confirm that pre- and post-A.D. 1050 artifacts are not differentiated. The same predominant sandal type (4-warp pseudo-twined) of the Trinchera Cave perishable assemblage is found both before and after A.D. 1050.

Perishables Research

Shelter A produced cordage, grass bundles, and a digging stick, as well as a grass packet that was tied with yucca and contained an unidentified species of bean.

Since it has been suggested that Hal Chase focused his efforts on the excavation of Shelter B, it can only be assumed that the artifacts which have been recorded according to his specimen designation system were found in Shelter B. These items include possible moccasin sole TA 41, grass bundle TA 269 (previously mislabeled as a sandal), and sandals T5-4-2 and No# E (TAS). A menstruation pad was also recovered.

A number of perishable artifacts were recovered from zero to 36 inches in what Dick defines as the “dry midden,” Shelter C. Wooden artifacts included a great number of wooden beads and cut, smoothed, and/or split wooden objects. Many of these have *Yucca* sp. leaves tied around one end (unknown function) {Simpson 1976:179}. Shelter C also produced a variety of grass (sp. ind.) and *Yucca* sp. bundles tied with cordage. One was soiled and its use as a menstrual pad was suggested by Dick. A feather blanket fragment constructed from twisted *Yucca* sp. and bird (sp. ind.) feathers were also recovered.

Plaited sandals No# C and 66.19.221 (A & B), moccasin toe fragment No# A, and rabbit skin sandal No# B lack provenience information and cannot be designated as being recovered from any one particular shelter.

Basketry, Cordage, and Sandals. All of the basketry was assumed to have been recovered from Shelter C (Simpson 1976:181). However, after Loretta Martin (Curator for the Loudon-Henritz Museum) explained the artifact location system employed by Herb Dick (shelter-section-depth) it became apparent that all of the basketry reported in Simpson’s Table 80 (Simpson 1976:182) were excavated from Shelter B. All of the identification numbers begin with B, for example, “B-2A-6” which would mean Shelter B, section 2A, depth 6 inches. None of the fragments had yet been analyzed to determine cultural affiliations (Simpson 1976:182). Dick noted the presence of four types of coiled basketry, all fragments basketry recovered between 6-24 inches below the surface (Simpson 1976:183).

According to Simpson, the *Yucca* sp. cordage was manufactured by using two twisted plies or by braiding three plies. Finer cordage was made from shredded *Yucca* sp. while the heavier cordage was manufactured with the use of split or whole *Yucca* sp.

leaves (Simpson 1976:180). Additionally, both cordage and otherwise unutilized leaves had been knotted. Several *Yucca* sp. needles, one with thread through the eye, were also retrieved.

Simpson (1976) also notes that an unidentified number of woven *Yucca* sp. sandals were recovered. They are described as “rectangular in outline with a four-warp frame,” with their manufacturing process consisting of “long, narrow [*Yucca* sp.] leaves [being] packed closely and woven over and under across the warp” (Simpson 1976:180). None of the specimens possessed a complete heel and toe at the time they were recorded. Only one sandal is recorded in her own research (specimen TR1 789), described as fragmented with one strap present. Based on catalogue information associated with individual sandals it can be stated with confidence that sandals TR1 28, TR1 780, 789, TR1 794 (rabbit skin sandal), 797 (missing specimen mentioned in the catalogue), and TR1 945 were found in Shelter C. Based solely on the specimen designation system used by Herb Dick (TR1), it can only be surmised that sandals TR1 EPU and TR1 EPU 21(A & B), and weft fragments TR1 375 were also found in Shelter C.

Leather and Hide. An assortment of leather strips and sinew were recovered from the Trinchera Cave, predominantly Shelter C. Many were two-ply and twisted. Dick has suggested that many may have served as straps. Several types of hide bags and bag fragments were retrieved. Additionally, strips of twisted rabbit fur were recovered, which may represent the remains of a blanket (Simpson 1976). One piece of hide had been sewn with *Yucca* sp. cordage and also revealed a patch. A variety of sewn fragments were found throughout the “dry midden.” One of these specimens may be the moccasin toe fragment, No# A. Two leather sandal fragments, rectangular in shape, were also present.

They are described as having been sewn and tied with twisted whole and split leaf *Yucca* sp. Also noticeable was grass matting that had been placed between the leather, in order to cushion the foot (Simpson 1976:183). It is possibly that these descriptions refer to the rabbit skin sandal specimens TR1 794 and No# B.

The Kenton Caves (Basketmaker Cave: 34CI50)

Location and Physiographic Setting

The Kenton Caves (Figures 4.6-4.9) are located in the Cimarron Valley of the northwestern Oklahoma panhandle. The Kenton Caves are 5-7 mi southeast of Kenton, Oklahoma, and are in the Tesesquite Creek Valley, a tributary of the Cimarron River, in the Black Mesa area of Cimarron County. The Oklahoma caves include OK 0-1, OK 0-2 (Cave 1; 34 CI 50; Basketmaker Cave I), OK 0-3, OK 0-4 (Cave 2; 34 CI 68; Wet Cave; Red Devil District; East Twin Cave), OK 0-4-5, OK 0-5 (Cave 3; 34 CI 39; Red Devil Cave; West Twin Cave; Dry Cave), OK 0-6, OK 0-7, and OK 0-8. The New Mexico caves include NM E:3:3 (NM 171; Cave 6), NM E:4:1 (NM 170; Cave 5), NM E:4:2 (NM 172; Cave 7), NM F:3:1 (NM 169A; Fumarole 5), NM F:4:2 (NM 166; Fumarole 2; Location A), NM F:4:3 (NM 167; Fumarole 2; Location B), and NM F:4:4 (NM 168; Fumarole 4) (DUMA accession records).



Figure 4.6. Kenton Caves; Cave 2, Oklahoma (Courtesy of William Baker).

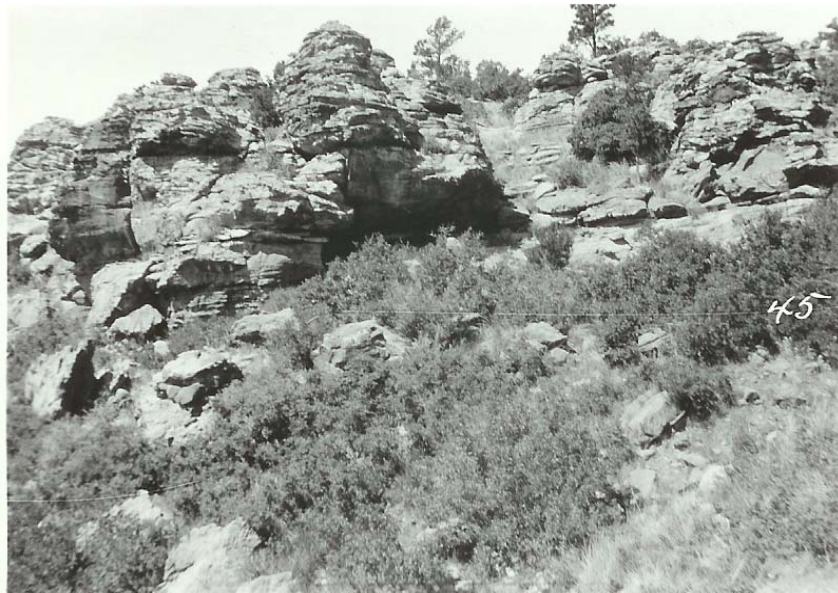


Figure 4.7. Kenton Caves; Cave 6, New Mexico (Courtesy of William Baker).

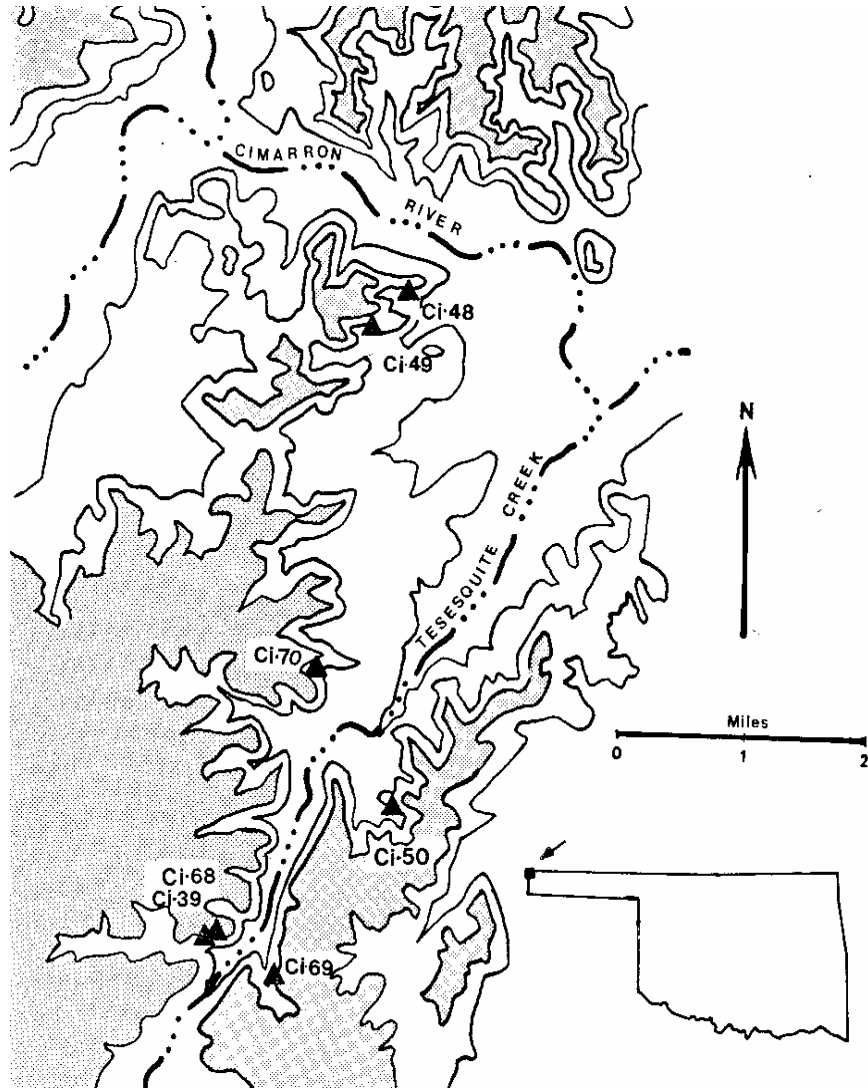


Figure 4.8. Location of Kenton Caves (Courtesy of DUMA accession records).

Site Number	Cave Name
34Ci-50	Cave No. 1 0-2 (Site Oklahoma-2) Unnamed Basket Maker Cave I Mummy Cave Ci-Ke-I
*34Ci-39 & Ci-68	Twin Caves Black Caves Labrier Site Red Devil District
*34Ci-68	East Twin Cave Cave No. 2 0-4 (Site Oklahoma-4) Wet Cave Red Devil Cave
*34Ci-39	West Twin Cave Cave No. 3 0-5 (Site Oklahoma-5) Dry Cave Black Cave Red Sun Cave
34Ci-48	Pigeon Cave
34Ci-49	Basket Maker Cave II
*34Ci-69	Bat Cave
34Ci-70	Unnamed

Figure 4.9. Kenton Caves Designations
(adapted from Lintz and Zabawa 1984:Table 7.1).

The caves produced numerous perishable materials such as basketry, sandals, cordage, maize ears and husks, squash seeds, as well as a wide variety of other floral and faunal remains. The recovered remains from the caves have been scattered, being distributed between the University of Denver, Panhandle State University, the Oklahoma Historical Society, the University of Oklahoma, and the University of Tulsa (Lintz and Zabawa 1984).

Previous Excavations

William "Uncle Billy" Baker. In 1928, a county farm agent and avid amateur archeologist named William "Uncle Billy" Baker discovered a cave in Cimarron County, Oklahoma near the border with New Mexico that had obvious signs of prehistoric human occupation. Fieldwork by the Colorado Museum of Natural History, the Oklahoma Historical Society, and the University of Oklahoma continued throughout the 1930's. Seven cave and shelter sites were eventually identified near Kenton, all with archeological remains.

E. B. Renaud. E. B. Renaud, founder of the University of Denver, Department of Anthropology, was sent by the Colorado Museum of Natural History, in 1929, to lead an expedition to search for the remains, dwellings, and artifacts of Folsom Man. The expedition covered much of the Cimarron Valley in the northeastern corner of New Mexico and the western panhandle of Oklahoma, a region speckled with caves and rockshelters. The incidental objective of E. B. Renaud's survey of northeastern New Mexico and adjacent districts in southeastern Colorado and western Oklahoma was to look for connections between the cultures of the Cimarron Valley and neighboring cultures (Plains people in the East and the Pueblos and Basket Makers in the Southwest) (Renaud 1930:115). Most of the material that Dr. Renaud collected from the surface, caves, and "fumaroles" is now housed in the University of Denver, Museum of Anthropology (DU accession records; Lintz and Zabawa 1984).

Joseph Thoburn. After Renaud's initial exploration, many other people have since excavated and collected material from the caves and rockshelters, including William Baker and Dr. Joseph Thoburn who led excavations for the State of Oklahoma.

In 1930, with grants from the Smithsonian Institute and the Oklahoma Historical Society, Dr. Thoburn directed excavations at Basketmaker Cave I, Basketmaker Cave II, and Pigeon Cave. However, little has been published and nothing is known about the work or the materials recovered. In 1933, three burials were found at Cave 1, but only limited amounts of material were recovered. With the outbreak of WWII, major excavations of the Kenton Caves ceased, with only small surveys conducted and summaries written afterwards (Lintz and Zabawa 1984).

Cultural assignment of the Kenton Cave material has been extensively debated. Renaud thought the materials represented a stage above the seminomadic hunter and below the sedentary Pueblos. He suggests that the materials were “an early, very primitive phase of the Basketmaker culture, an incipient stage preceding its more complete characterization elsewhere” (Renaud 1930:134). He suggested a date of ca. 1500 B. C. for the Kenton Caves based on the presence of basketry, painted figures, and maize, and on the absence of pottery from his 1929 excavations. In general, “cultural affiliations are tenuous because there is little stratigraphic information available to segregate the assemblages” (Lintz and Zabawa 1984:172) in addition to the complete lack of dated materials. According to researchers, “scattered artifact collections, inadequate material descriptions, poor provenience information, and a lack of specialized studies severely limits our present knowledge of the cultural resources located in the mesa and canyon lands of the northwestern Oklahoma panhandle” (Lintz and Zabawa 1984:173). Whether or not the Kenton Caves represent a single component or several occupations over a long time span was not discernable with previous data.

Perishables Research

All of the 27 Kenton Caves sandals (26 plant fiber, 1 buffalo hide) are reportedly recovered from only one of the seven caves, Basketmaker Cave (34 Ci 50). The sandals and remainder of the perishable collection, including plaited and coiled basketry, cordage, and knots, recovered from this site are housed at a multitude of museums including the University of Denver, Woolaroc Museum, No Man's Land Museum, Oklahoma Historical Society, and the University of Oklahoma's Sam Noble Museum. Cultural assignment of the Kenton Caves material has been extensively debated. E. B. Renaud initially posited that the materials represented a stage above the semi-nomadic hunter and below the sedentary Pueblos. He may be correct in this assumption due to the early dates recently awarded to these sandals and suggestions by other researchers that they represent part of the Cochise (pre-Basketmaker) culture.

Summary of Previous Interpretation of the Material. According to Adovasio and Illingworth, perhaps the only vaguely analogous assemblage of plant-fiber perishables which shows any remote generic relation to the Franktown Cave assemblage derives from the Kenton Caves, in Cimarron County, Oklahoma (Adovasio et al. 2005:18). This observation is based on Adovasio's 1972 viewing of the material as part of his post-doctoral work with the Smithsonian Institute. In May 1972, Adovasio visited the University of Denver where he analyzed and documented the attributes and method of manufacture of the sole Kenton Caves basketry specimen housed therein (DU 389). He reported that this single coiled basket resembled some from the Hueco Mountains. He also recorded his observations in regards to the sandals of the Kenton Caves, which he determined had "Mexican style edges" (Adovasio 1972).

The excavation and research histories and perishable artifact inventories for Franktown Cave, Trinchera Cave, and the Kenton Caves have thus been reviewed. The research at these sites provided the necessary contextual information regarding what is currently known about the populations occupying the Southern High Plains from the Early Archaic through Late Prehistoric periods. The previous research also points out the gaps in that knowledge. In this work, the study of the previously neglected perishable artifacts from these locations served to narrow these gaps. By identifying the similarities and differences between these collections as well as identifying their similarity and difference to known comparative collections from adjacent regions, it was possible to determine the cultural influences of the individuals occupying the Southern High Plains. These comparisons have indicated that these populations were strongly influenced by their Southwest and Mexican neighbors, much more so than previously suggested.

Chapter 5: Methods and Procedures

The Franktown Cave perishable collection includes basketry, cordage, and sandals, which have been dated, and are representative of three specific ranges of time: 3350-2880 B.C.; 2870-2500 B.C.; and A.D. 670-880. Moccasins and other leatherwork at the site are dated to two overlapping periods of time: A.D. 720-1040 and A.D. 983-1187. Based on the RC/AMS dates given for each type of specimen, a chronological sequence of items was created. Based on the individual descriptions of each specimen, their allocation into typological groupings based on their construction attributes and unique characteristics, and their temporal associations it was possible to establish a technological trajectory for Franktown Cave perishable suite. The establishment of this developmental sequence provided the means for determining of the presence or absence of trends concerning the technology of manufacture and/or any noticeable changes in technique that would indicate cultural discontinuity at the site and on the Southern High Plains. This chronological and descriptive sequence was then compared to previously established models of cultural change, based on documented perishable artifact assemblages by Hyland and Adovasio (2000), Fred Plog (1974), and Alan Reed (1996) for the Fremont, Basketmakers, and other peoples of the Southwest and Mexico in order to determine the cultural affiliations of the people that produced the perishable suite.

The Franktown Cave chronological and descriptive sequence was then utilized as a type sequence for the Southern High Plains against which the other known assemblages

could be compared in order to determine and/or gauge regional variability and/or continuity. The two assemblages that were compared to the Franktown Cave comparative collection were from Trinchera Cave, Colorado and the Kenton Caves of the Cimarron River Valley on the border of Oklahoma and New Mexico. This regional, chronological, and descriptive sequence comparison allowed for an initial exploration of whether the individuals who occupied Franktown Cave and surrounding areas represented one cultural entity that left evidence for a regional continuity or if they were representative of multiple co-existing cultural groups with distinguishable technological characteristics.

Due to received funding, AMS samples were taken from the Trinchera Cave and Kenton Caves specimens. The Trinchera Cave perishable collection is comprised of 13 plaited sandals, two rabbit skin sandals, two moccasin fragments, and numerous specimens of netting, coiled basketry, and cordage. AMS samples were taken from eleven Trinchera Cave sandals (ten plaited with side loop tie mechanisms and traction masters and one rabbit skin sandal), one coiled basketry fragment (with the same foundation, stitches, and splicing found at Franktown and the Kenton Caves), and corn kernels. However, of these, only six of the plaited sandals, one of the rabbit skin sandals, and one specimen of coiled basketry were actually dated. These items were categorized into four sandal types and one basketry type. Due to the narrow focus of this research, no additional specimens of cordage, netting, or basketry were thoroughly analyzed or typed. Therefore, the Franktown Cave perishable assemblage is no longer the only one in Colorado that has been analyzed, dated, and researched concerning potential relationships to known basketmaking centers. Previously, it had been difficult to relate the Franktown

Cave perishable inventory to any other neighboring site and/or complex. This difficulty was due not only to the rarity of the assemblage and the uniqueness of the structural attributes of its specimens, but even more importantly, because of the scarcity of perishables throughout the Southern High Plains in general.

The Kenton Caves assemblage (Cimarron County, Oklahoma) contains the same coiled basketry types and similar plaited sandals to those from Franktown Cave and Trinchera Cave. However, the Kenton Caves assemblage has its own unique type of plaited sandal, one created with elements that cross at 90° angles yet displays an unconventional “rotated” weave, in which the elements are not oriented horizontally and vertically. In March 2007, the entire Kenton Cave collection [housed at the DUMA (DU), the Oklahoma Historical Society (OHS), the Sam Noble Museum of Oklahoma Natural History (SN), the No Man’s Land Museum (NML), and the Woolaroc Museum (W)] was analyzed and AMS samples were collected. The Kenton Caves collection is comprised of 26 plaited sandals, one buffalo hide sandal, two plaited basketry fragments, two coiled basketry fragments, one twined bag fragment, and numerous pieces of cordage and fiber bundles. AMS samples were collected from 19 plaited sandals, four pieces of corn, one buffalo hide sandal, one grass bundle, one twined bag, and two basket fragments, however, of these, only 18 plaited sandals, one buffalo hide sandal, and two fragments of coiled basketry were actually dated. The collection was categorized into nine sandal types and only one type of coiling. The AMS dating of these newly analyzed specimens is extraordinary and has allowed for the temporal comparison of all three site assemblages. The analysis of the culturally sensitive construction techniques employed

in the creation of these materials has helped to elucidate the cultural relationships that existed between the Southern High Plains people that produced them.

Methodology

The Franktown Cave, Trinchera Cave, and the Kenton Caves perishable assemblages were analyzed following the protocols laid down by Adovasio (1977) for basketry and sandals, based on the determination of attributes of wall construction. Cordage and cordage attributes were analyzed and discussed following Hurley (1979). The basketry and sandal assemblages were divided into major groups or sub-classes of weaves (coiling, plaiting, and twining) and then each sub-class divided into technological types. After the wall construction technology was identified, the specimen was analyzed based on different attributes including completeness/condition, form, technological type (categorical within each type of weave), orientation and number of warp/weft elements, method of preparation of elements, texture/flexibility, splices, decoration, wear patterns, type and mechanics of mending, selvage treatment (side and end), rim finish, method of start, raw material(s), residue, and other miscellaneous attributes that attended to the uniqueness of the item. Arrangement of ties/tie system and sidedness (L/R) were recorded specifically for sandals. Measurements of the individual elements employed in the construction (element and/or element unit diameter, elements per cm, general dimensions, final twist and initial spin of incorporated cordage, and cordage angle of twist) were taken using Mitutoyo 500 series digimatic calipers (0.01mm resolution) and recorded in the metric system to aid in the comparison of specimens. It is important to note that measurements were not taken on any element that exhibited wear, which may

have skewed measurement means and additional statistical analysis (Deegan 1995). The observation of these individual attributes and these attributes as a whole allowed the investigator to distinguish between sandal and basketry fragments, specifically by focusing on the selvages/reintroduction of weft/warp elements into the body, complete/defined widths/lengths, and wear patterns. Given that the Trinchera Cave and Kenton Caves collections were not previously analyzed, several items were found to be mislabeled and misidentified as basketry fragments, when, in fact, they are sandal fragments.

Standardized analysis/recordation sheets, created and utilized by J. M. Adovasio at the Mercyhurst Archaeological Institute and R. L. Andrews Center for Perishable Analysis were used to record construction type and key attributes for each specimen, as well as all measurements and additional nominal, ordinal, and interval data (Appendix A). Supplementary diagrams and schematics were created for each specimen in order to accentuate and explain complicated or unique features. Each specimen was described in paragraph form, sketch/diagrammed, and photographed using the combination of a Kodak C633 digital camera and a Canon EOS digital camera. Gloves, a magnifying glass, probing tools, flash light/photography lamps, and Mitutoyo 500 series digimatic calipers (0.01mm resolution) were used to physically investigate each specimen with respect to details and process of manufacture. No specimens were physically destroyed and no measures were taken or attempted that would have jeopardize the stability and/or integrity of the specimen. However, it was necessary for a small undiagnostic portion/fiber strands (5-10 mg of material) of some specimens to be removed in order for

them to be dated. When possible, material that had already become detached from the specimen was used for dating, instead of removing additional material.

Once the standardized recordation sheets were completed for each specimen of the assemblage, it was possible for them to be grouped into appropriate types and compared statistically. Each sandal type was described in terms of quantity of specimens included, type of specimens (e.g., sole with and without bindings and sole with and without toe cover), number of forms represented (i.e., the minimum number of individual sandals portrayed by the recovered sandal fragments), production technology and sequence, raw material, metric measurements, and when available, provenience. Codes and abbreviations used on the recordation sheets, in the descriptive section (Chapter 7), and in the metric data tables (Appendix B) include sp. ind. for indeterminate species, n.d. for no data recorded or no data available, ind. for indeterminate measurement, and n.a. for not an applicable measurement. Artifact numbers used herein are those assigned by the museum in which they are housed.

Culturally determined attributes and sandal types can be studied and compared quantitatively in a number of ways. Three types of quantitative data exist that can be measured and manipulated: nominal, ordinal, and interval. Nominal data are data that can be categorized by named type and counted. With respect to basketry, cordage, and sandals, nominal data includes the construction types of coiling, plaiting, and twining, the number of elements utilized, the decoration, and the direction of twist. Interval data are data that can be quantitatively measured. With respect to basketry, cordage, and sandals, interval data includes twist per cm, elements per cm, width of elements, and angle of twist. Ordinal data are data that can be ranked. With respect to basketry, cordage, and

sandals, ordinal data is represented by the degree of twist (loose, medium, and tight) in cordage.

Due to the only rare use of cordage within the Trinchera Cave sandal collection and the complete lack of cordage use in the Kenton Caves sandal collection, statistical tests could not be performed on any ordinal data. In addition, due to the similarity of the nominal data for the specimens, including type of weave, number of warp elements employed, lack of decoration, and the rarity of intact tie mechanisms, variations were better represented by simple frequencies. Chi squared, binomial, and z-tests were deemed unnecessary for examining the nominal data. It was therefore also unnecessary to perform the proposed Fishers Exact Tests (FET) or principal component analysis, which utilize nominal data, used by Adovasio to test the ability to isolate the constructions of individual weavers from a population. Instead, analyses of variance (ANOVA), which compare interval data, were utilized to the same ends. Though principal component analysis can also be used to test interval data, the use of ANOVA tests were sufficient to identify construction attributes that were statistically the same between specimens. The small sample size of the collections and the limited number of roughly identical specimens did not warrant attempts to differentiate between their individual weavers. T-tests were deemed unnecessary due to the ability of the ANOVA tests to compare the metric data of multiple sites simultaneously. The ANOVA tests were also employed in order to test the viability of the typological categorization of the sandal types based on construction attributes. All of these tests allowed for the comparison of the attributes and sandal technology present in each site assemblage to the other sites on the Southern High Plains. In addition, the comparison of the attributes and the sandal technology from the

Southern High Plains to those from adjacent regions was made possible by the recorded metric data for the sandal collection from Pendejo Cave, New Mexico. These statistical tests allowed for the scientific assessment of similarity and variance within the perishable technology of the Southern High Plains and between the perishable technology of the Southern High Plains and that of adjacent regions.

By testing the quantity of unique attributes in southeastern Colorado over time, ideas of population movement and cultural diffusion could also be tested. Statistical tests were only performed within each recorded sandal type to ensure the usefulness and relevancy of the results, except when comparing tie mechanisms. For the most part, different sandal types cannot be compared directly because of the different construction methodologies employed in their making, including the presence of different attributes and even different types of elements. However, in regard to the broad categories of toe-heel, side-looped, and criss-cross tie mechanisms, similar tie systems can be present on different technological sandal types. Due to the lack of excavation notes and artifact documentation at each of the tested sites, it was impossible to perform these tests according to stratigraphic levels. Similar methods could not be used to test these ideas of culture change utilizing the recorded hideworking technology. None of the recorded hide sandals from the Southern High Plains were constructed in a similar fashion.

An index, of sorts, was created and used to compare the perishable technology present at prehistoric sites to that found at Franktown Cave and on the Southern High Plains. An assemblage's similarity to the Franktown Cave sequence was measured by determining if a site's perishable assemblage displayed chronological and descriptive data aligned with the Franktown Cave technological type sequence. Calibrated

radiocarbon designations for each specimen from the Kenton Caves and Trinchera Cave were utilized in the comparison and discussion of the temporal duration of individual types, as well as broad temporal trends in sandal production for the Southern High Plains. The radiocarbon ages were calibrated based on the INTCAL04 database. Calibrations were provided by Beta Analytic. However, radiocarbon ages provided by the University of Arizona AMS Laboratory were calibrated by the author using the CALIB 5.0 program (Stuiver et al. 2005), which is based on the INTCAL04 database.

The presence of assemblage construction attributes that do not line up with or are not present within the Franktown Cave type sequence, descriptively or temporally, demonstrated the assemblage's difference. This difference indicated either the presence of a variant cultural affiliation or a completely separate and new cultural affiliation because of the presence of different culturally determined attributes. This comparison and analysis allowed for the documentation and tracing of different cultural influences throughout the region and through time. Influences from northern Colorado Plateau and the Southwest were detected in the collections through statistical, chronological, and descriptive means.

Chapter 6: Comparative Collections: Known Sandal-Making Regions

Comparison of the small yet important sandal assemblages of the Southern High Plains is hampered by the fact that unlike basketry, for which extensive descriptive works exist, the archaeological literature on sandals is sparse. What follows is a brief description of the sandal technology found in the known basketmaking regions of the Great Basin, Southwest, Great Plains, Lower and Trans-Pecos Texas, northern Mexico, and the East (Figure 6.1). This summation is provided in order to make it more readily and visually apparent to the reader, which regional sandal technology is most similar to that found on the Southern High Plains.

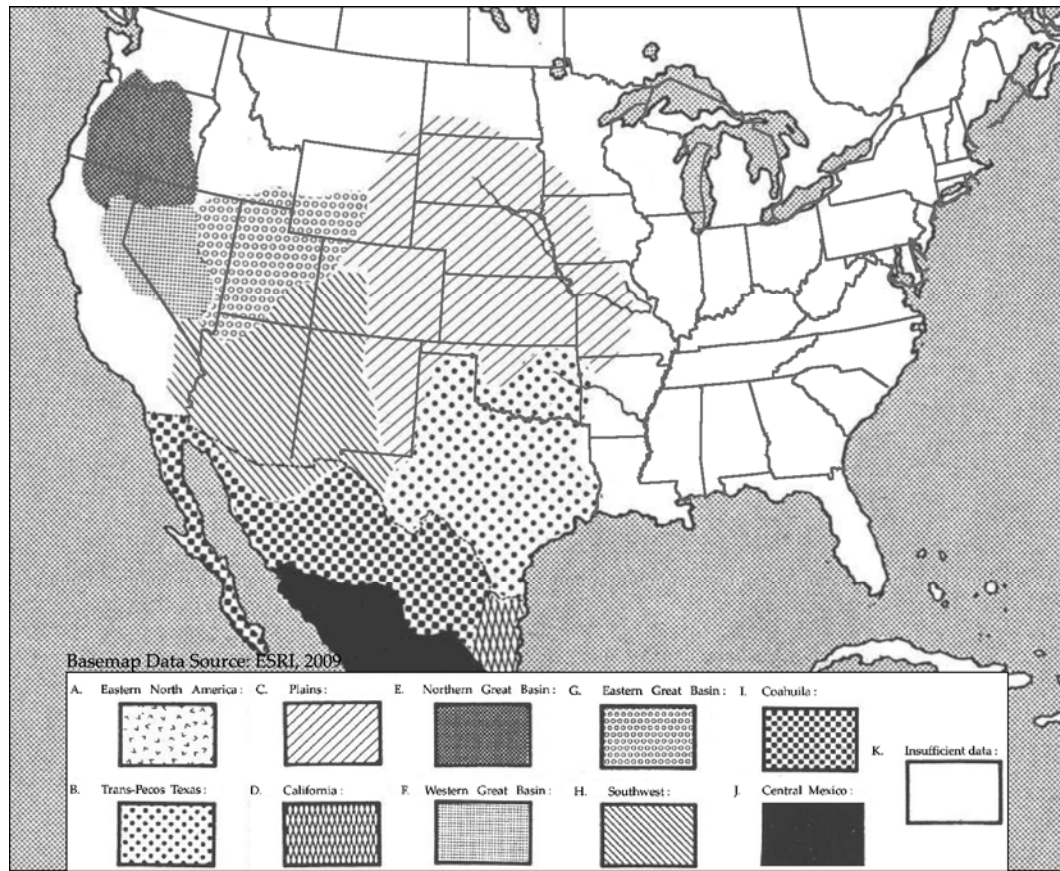


Figure 6.1. Basketmaking regions of North America, 4500-2000 B.C.
 (adapted from Adovasio 1974:Map 4 by John C. Watson, GISP)

The Great Basin

The analysis of over 5,000 specimens of coiled, plaited and twined basketry indicates the existence of three major Western Archaic textile complexes. These are the Oregon Complex (Northern Great Basin), the Western Nevada Complex (Western Great Basin), and the Eastern Great Basin. Though each has its own special characteristics and developmental sequence, all three areas of the Great Basin are related to each other in varying degrees through time (Andrews et al. 1986; Jennings 1957, 1964, 1968; Jennings and Norbeck 1955). These Western Archaic or Desert Archaic cultures had their

beginnings in the Great Basin perhaps as early as 9,000 B.C. and lasted in some areas of the West until A.D. 1850 (Adovasio 1970).

Northern Great Basin. The Northern Basin Center is located in south central Oregon and includes adjacent portions of northern California and northwestern Nevada (Adovasio 1974:113). In the Northern Great Basin in general, sandals were made of tule, although shredded sagebrush bark was used in some areas.

Within this region, three stylistically distinct sandal types have been identified, including spiral weft sandals, multiple warp sandals, and the Fort Rock-style sandals (Figure 6.2) (Cressman 1942; Andrews et al. 1986; Connolly and Barker 2004). Spiral weft sandals are made with warps running perpendicular to the axis of the foot, with wefts twined in a spiral pattern from the centerline of the foot. Spiral weft sandals have been found in Catlow Cave, Roaring Springs Cave, and Dirty Shame Rockshelter, Oregon and in Elephant Mountain Cave, Nevada (Connolly and Barker 2004:244).

Multiple warp sandals are close-twined from heel to toe (Cressman 1942:58). Loose warps are bent back to form a toe cover, but the toe cover was rarely twined. Tie loops are built into the sole, typically by extending wefts beyond the last warp and twisting them into a corded loop; a cord was then run through the loops and tied across the top of the foot. These sandals have the widest spatial distribution among all types and a well-documented temporal distribution from about 9000 to 130 B.P. (Connolly and Barker 2004:248).

Fort Rock-style sandals have a flat close twined sole, usually with five rope warps. They have been found at Fort Rock Cave, Cougar Mountain Cave, Catlow Cave, Roaring Springs Cave, and Dirty Shame Rockshelter, Oregon, as well as in Elephant

Mountain Cave in Nevada (Connolly and Barker 2004:244; Cressman 1962). In the creation of Fort Rock sandals, five pieces of rope are laid along the long axis of the foot and fastened tightly by twining. The toe ends of the warp strands, left untwisted, were folded back over the toes to form a protective pocket and fastened to the sides of the sandals by loose twining. In some sandals pine needles had been added for padding (Connolly and Barker 2004:244; Cressman 1962).

Fort Rock sandals continue to be the oldest known sandal type, predating both spiral weft and multiple warp types. Fort Rock sandals date from more than 10,000 years ago to no later than ca. 9200 years ago. Possibly the most notable feature of the age distributions is the absence of meaningful overlap between the Fort Rock and other sandal types. The oldest direct age available on multiple warp and spiral weft sandals is ca. 9400 cal B.P., approximately the minimum age of the Fort Rock sandal type (Connolly and Barker 2004:249). Reportedly, at the time of the coming of the Whites, the Klamath were wearing a winter tule sandal, wrapped well around the foot and packed with grass to keep the foot dry and warm (Cressman 1962:27).



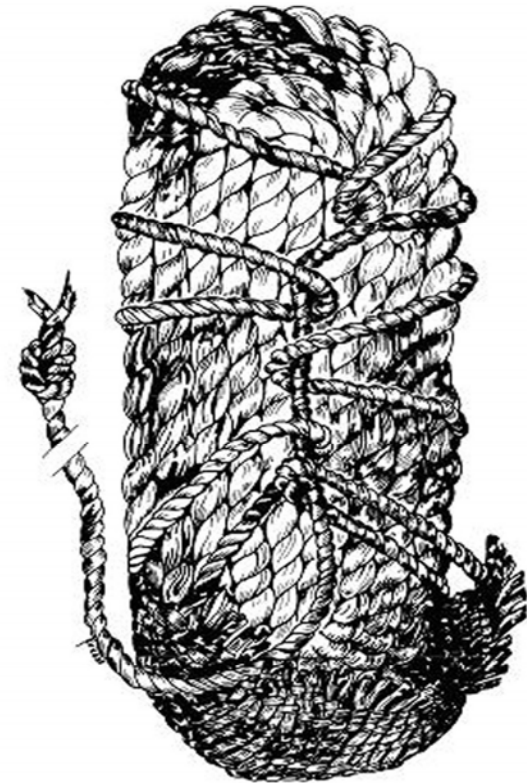
Fort Rock-style sandal

Known dates: 10,500-9,200 cal. BP
 Generally 5 robust warps
 Flat sole twined from heel to toe
 No heel pocket
 Open twined toe flap
 Most commonly sagebrush bark, rarely tule
 Ties around back of heel/ankle



Multiple Warp sandal type

Known dates: 9,400 cal. BP-Contact
 8 or more sole warps, commonly more than a dozen
 Twined from heel to toe
 Sole and heel pocket cup around foot
 Toe flap of untwined warp fibers only
 Most frequently tule, but sagebrush bark also common
 Front tie passes through a set of opposing weft loops



Spiral Weft sandal type

Known dates: 9,400-1,700 cal. BP
 Flat sole, twined in spiral from center
 Warps perpendicular to axis of foot
 Attached heel pocket (occasionally)
 No toe flap
 Tule or sagebrush bark
 Front tie passes through offset warp loops

Figure 6.2. Sandal types represented in the Northern Great Basin
 (borrowed from Connolly and Barker 2004: Figure 1)

Western Great Basin. The Western Great Basin encompasses much of west central Nevada as well as immediately continuous portions of California (Adovasio 1974:114). Western Great Basin sandals are similar in production attributes and form to the multiple warp variety of the Northern Great Basin, and are also of relatively equivalent age. Potentially, the oldest sandal from that area derives from Fishbone Cave in the Lake Winnemucca Sink area of western Nevada [9300 +/- 250 B.C. (11,250 +/- 250 B.P.) and 5880 +/- 350 B.C. (7830 +/- 350 B.P.)] (Orr 1974; Rozaire 1974). Multiple warp varieties are continuously represented almost into this century (Hyland 1997:240).

Eastern Great Basin. The Eastern Great Basin spans the state of Utah, north of the Colorado River, and adjacent portions of western Wyoming, southern Nevada, southern Idaho, and northwestern Colorado (Adovasio 1974:115). In the Eastern Great Basin, despite its well-dated and lengthy perishable and basketry sequence, is “utterly devoid of sandals and appears to represent one of those major areas where, for whatever reason, aboriginals went barefoot” (Hyland 1997:240). The extensive perishable industries at Danger Cave (Jennings 1957), Hogup Cave (Aikens 1970), the Promontory caves (Steward 1937b), as well as at more minor cave or rockshelter sites from the area there is no trace of an indigenous sandal industry from ca. 9000 B.C. (10,950 B.P.) to the Historic period (Hyland 1997:241). Evidence for prehistoric footwear lies solely in the form of various styles of moccasins. However, according to Andrews, Adovasio, and Carlisle (1986:130) moccasins were never recovered in numbers sufficient to indicate that this type of footwear was used in lieu of sandals (Adovasio, Andrews, and Carlisle 1986:130). Comparative collections in the Great Basin, and in particular the Eastern Great Basin are slight. The Fremont twining and coiling industries represent the “culmination of a long

developmental continuum localized in the Eastern Great Basin and relatively isolated from similar developments in adjacent areas. There are virtually no similarities to the industries of the Northern and Western Great Basin basketmaking centers (Adovasio 1974, 1975, 1980b; Andrews et al. 1986; Hyland 1997:241). A.D. 1300 signals the disappearance of the Fremont. The Numic populations who arrived in the Eastern Great Basin after A.D. 1300 brought with them a perishable industry with marked differences from the previous occupants.

The Southwest

The Southwest includes the Colorado Plateau, most of the states of New Mexico and Arizona as well as portions of extreme northern Mexico, southern Colorado, southern Utah, and extreme southern Nevada. Within this perishables center, additional distinctions can be made with regard to sandal production. Within the fairly restricted area of the Southwest, three major and more or less contemporary cultural traditions arose: the Mogollon, the Anasazi, and the Hohokam. Each dominated a particular area of the Southwest and each was, to varying degree, influenced by its neighbors (Figure 6.3). Furthermore, all three traditions are assumed to have evolved from a Western Archaic base through stimulus from Mexico (Adovasio 1980b:351). The sandals of the Anasazi have been extensively studied (Deegan 1993, 1995; Geib 2000; Hays-Gilpin et al 1998; Jennings 1980; Kankainen 1995; Kidder and Guernsey 1919; Morris 1919; Morris and Burgh 1941; Morris 1980, 1995; Webster and Hays-Gilpin 1994), and the footwear of the Mogollon have been broadly examined by Cosgrove (1947); Haury (1950); Hyland (1997); Hyland and Adovasio (2000); McBrinn (2002, 2005); and Webster (2007). The

sandal industries of the Hohokam and Hakataya are essentially unknown (Hyland 1997:238), though two-warp Hohokam sandals have been found at Ventana Cave (Haury 1950: Plate 44d; Webster 2007:278). The dating on these pieces probably falls in the vicinity of A.D. 800-1400, which is relatively recent (Adovasio 1980b:352). Therefore, the ancestral territories of the Ancestral Puebloan/Basketmaker people and the Mogollon are discussed separately.

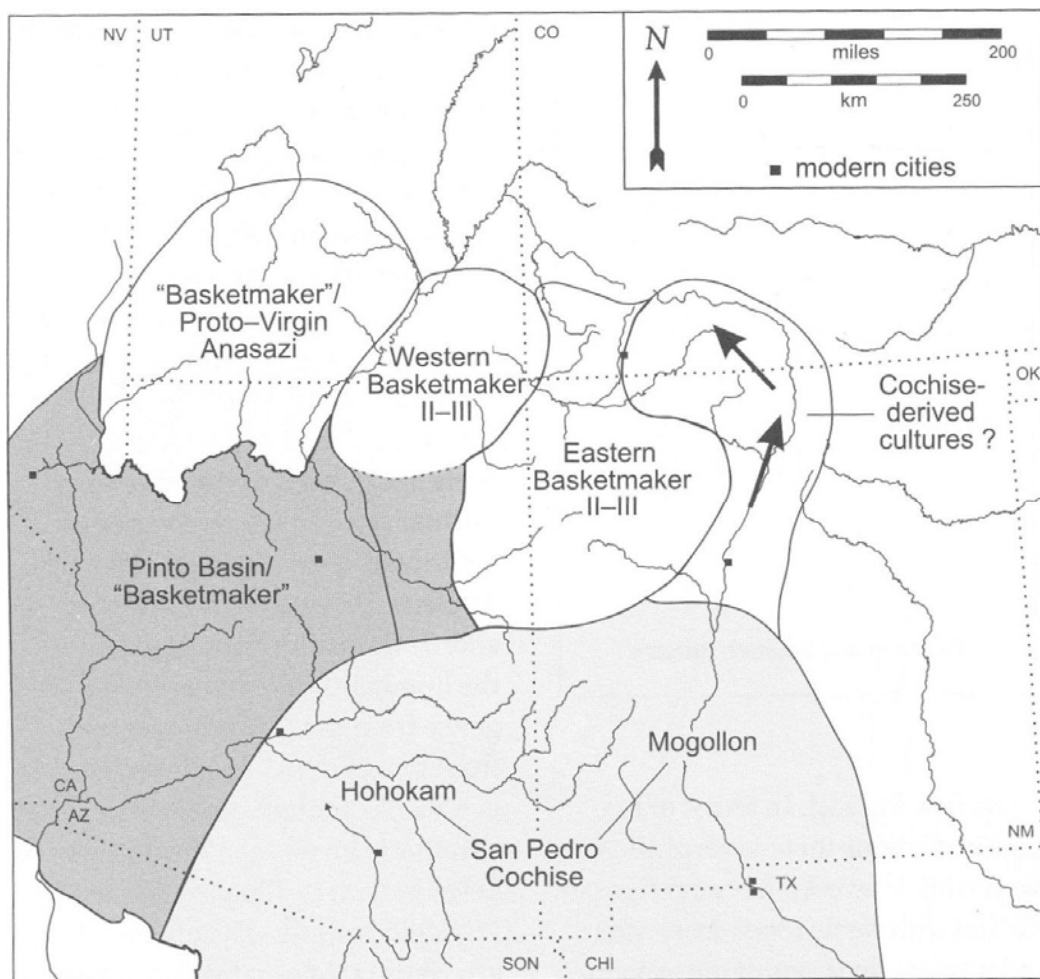


Figure 6.3. Distribution of southwestern technocomplexes, A.D. 1-400 (adapted from Webster 2007:Figure 2.6).

The Mogollon. Spatially and temporally, the Mogollon perishables database is an uneven one (Webster 2007:271). Most notably, the Mimbres, Cibola, Black River, and San Simon branches of this region contained the most uncovered perishable materials due to the presence of seasonally occupied rockshelters and caves. The Mimbres branch produced the greatest number of sites in the sample, largely due to Cosgrove's (1947) intensive survey of caves in the Upper Gila. The Cibola branch includes important "Reserve-area" sites of Tularosa and Cordova caves, as well as Bat Cave. In the San Simon branch, the western end has a strong Hohokam feel, whereas "sites to the south and east represent a blend of Mimbres, Jornada Mogollon, and northern Chihuahua influences. This region is clearly peripheral to the Mogollon heartland and exhibits strong connections to northern Mexico (Webster 2007). Direct dates are lacking for nearly all of the sandals for this region. Reported dates and phase distributions for the sandals are based on excavation levels, which in cave contexts in particular are notoriously problematic.

The Mogollon tradition derives from the Cochise culture and has its roots in the Desert Archaic tradition. Hallmarks of the Early Agricultural Mogollon tradition include two and four-warp wickerwork sandals (Webster 2007:275). According to Webster (2007), "one artifact class that appears to have served as an important boundary marker between those Early Agricultural groups utilizing the Mimbres and Reserve areas ...is the weft-faced plain-weave [wickerwork] sandal" (Webster 2007:276). During the Archaic and Early Agricultural periods "most groups in the southern Southwest appear to have used some type of wickerwork sandal, with regional differences found in form and manufacture" (Webster 2007:276). Early people in the Mogollon region, Sonoran Desert,

and eastern Great Basin shared the same ovoid style of wickerwork sandal. Early Agricultural groups in the Cibola, Mimbres, and Black River branches of the Mogollon region evidently used two-, four-, five-, and six-warp varieties of wickerwork sandals (Webster 2007:276).

Differences between groups in the Mogollon region and their eastern and western neighbors intensified during the Early and Late Pithouse periods (ca. A.D. 150-700 and A.D. 700-1000). Two new Mogollon sandal types appeared toward the end of this period, plaited sandals (Martin et al. 1952; Webster 2007: Figure 16.7g) and multiple-warp cord sandals (Martin et al. 1952; Webster 2007: Figure 16.7e). Like noncotton plainweaves, the plaited sandals show strong connections to perishable traditions in Chihuahua and Coahuila. The multiple warp cord sandals, on the other hand, share their affinities with the Colorado Plateau. Common at Tularosa Cave, the suggested appearance for this sandal style is after A.D. 500-550 (Martin et al. 1952; Webster 2007:281). After A.D. 1000 twill plaiting appears to supersede all other techniques for basketry, matting, and sandals (Webster 2007:284).

The four main sandal types outlined by Cosgrove (1947) include multiple types of two-warp sandals, full length (Cosgrove 1947:88, Fig 91, 92, Type 8 and 11) and scuffer toe (Cosgrove 1947:Type 1a, 5a, and 10), four-, five-, and six-warp sandals (Cosgrove 1947:90, Fig 91, 92, Types 12, 13), and multiple warp sandals with a concentric warp (Cosgrove 1947:91, Figure 91, 92, Type 14) (Figure 6.4a). Additional scuffer toe sandal types have been identified at Tularosa Cave (Martin et al. 1952:240). Two sandal types also found at other Mogollon sites include the multiple warp cord (Cosgrove 1947:91, Figure 91 & 92, Type 14) (Figure 6.4a) and plaited (oblique) sandals (Cosgrove 1947:89,

Figure 92, Type 9a and 9b; Martin et al. 1952:235, 268-275, Figures 91-96) (Figure 6.4b).

Cosgrove's Type 11 two-warp sandals (Cosgrove 1947:88, Fig 91, 92) occur at nearly all Mogollon sites, and is the earliest type in the region (Bat Cave, Cordova Cave, and Tularosa Cave). Sandals from Tularosa, Cordova, and examples from the Upper Gila have a warps constructed from two leaves tied together at the toe and the heel.

Cosgrove's Type 8 two-warp sandals (Cosgrove 1947:88, Fig 91, 92) occur only on the periphery of the Mogollon region and, according to Cosgrove, is not a significant Mogollon type. Additional scuffer toe sandals appear in the Hueco Mountains of New Mexico and Texas.

Some specimens from Tularosa Cave and Cordova Cave exhibit four, five, and six warps, which display the warps folded back over the toe (Cosgrove 1947:90, Fig 91, 92, Types 12, 13). A variation of this style, in which the warps are not folded over (Cosgrove Type 12) is also found in the Reserve area and resembles some Basketmaker III sandals from the Colorado Plateau (Webster 2007:Figure 16.3f).

Multiple warp sandals with a concentric warp (Cosgrove 1947:91, Fig 91, 92, Type 14) are found earliest in the Mimbres and Reserve areas. This type appears to be a Mogollon innovation. At Tularosa and Cordova caves it is reported from Pre-Pottery levels. A variation of this type also appears at Basketmaker III and Pueblo I sites on the Colorado Plateau.

Multiple warp cord sandals (Webster 2007:Figure 16.7e) were discovered at Tularosa and Cordova caves. Two and four warp varieties are contemporaneous at these sites (Martin et al. 1952:233-235). Most examples from Tularosa Cave have scalloped

toes, but round and square toes also occur, and all have puckered heels (Martin et al. 1952:237-238). These sandals appear on the northern reaches of the Mogollon region and are contemporaneous with Basketmaker III sandals. At Tularosa Cave these sandals appear ca. A.D. 500-550 and persisted until A.D. 700. However, unlike Basketmaker twined sandals, most Mogollon multiple-warp cord sandals are woven primarily in 1/1 plainweave. The Multiple warp cord sandals are also distinguished from other Mogollon plainweave sandals by their fine cordage elements and tight weave. Despite their superficial resemblance to Basketmaker twined sandals, none of the Mogollon examples exhibit the colored decoration, complex fabric structures, or knotted soles characteristic of those made in the north (Hays-Gilpin et al. 1998). For this reason, Webster (2007:306) views them as local emulations or variations of a northern sandal style.

Plaited sandals (Figure 4.6b) are usually made of three or four whole or somewhat crushed *Yucca* sp. leaves, folded at the toe, and woven in an over-two-under-one (twill plaited) or over-one-under-one (simple plaited) diagonal (oblique) pattern. The plaiting starts at the toe and extends beyond the desired finished length of the sandal. The surplus is then folded back over the heel, providing added cushioning. The sandals have square heels and round or square toes (Martin et al. 1952:235).

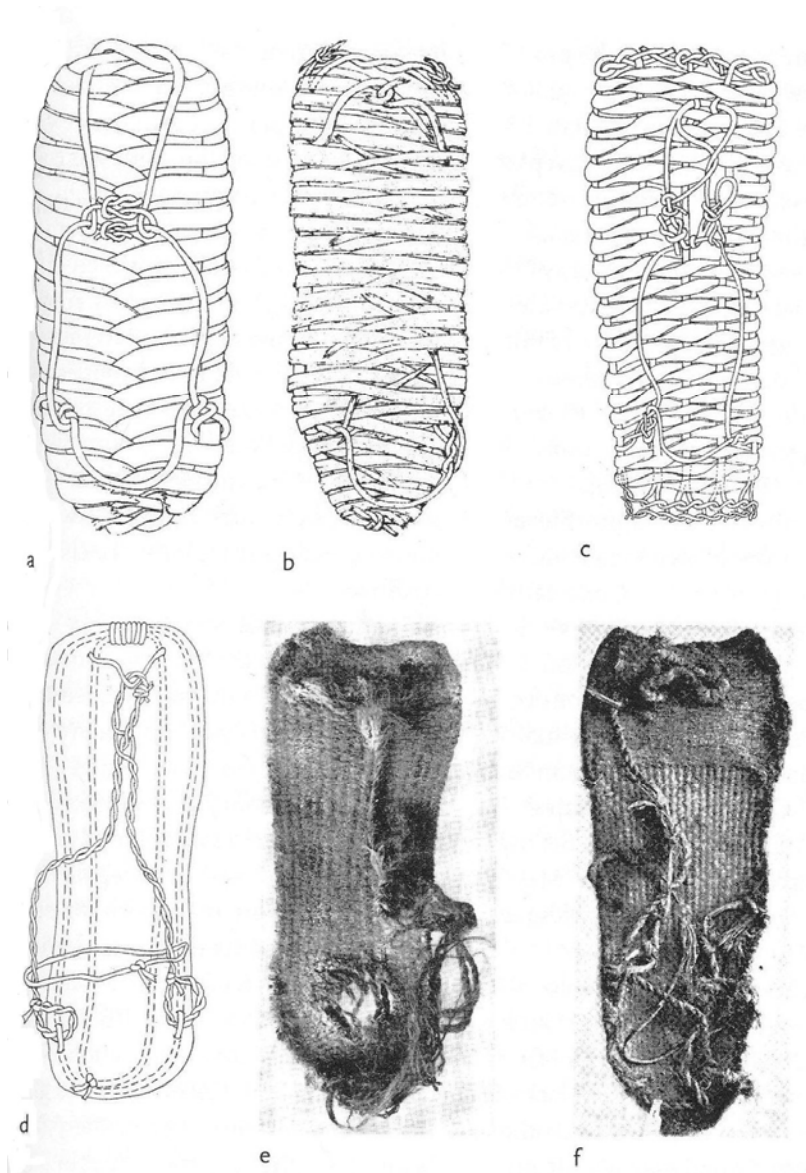


Figure 6.4a. Mogollon sandal types: a) Two-warp sandal (Type 11), b) Two-warp sandal (Type 8), c) Five-warp Full-length (Type 12), d) Concentric warp (Type 14), e) Multiple Warp Cord sandal, and f) Basketmaker III twined sandal (adapted from Cosgrove 1947: Figures 91 & 92; Webster 2007:Figure 16.7).

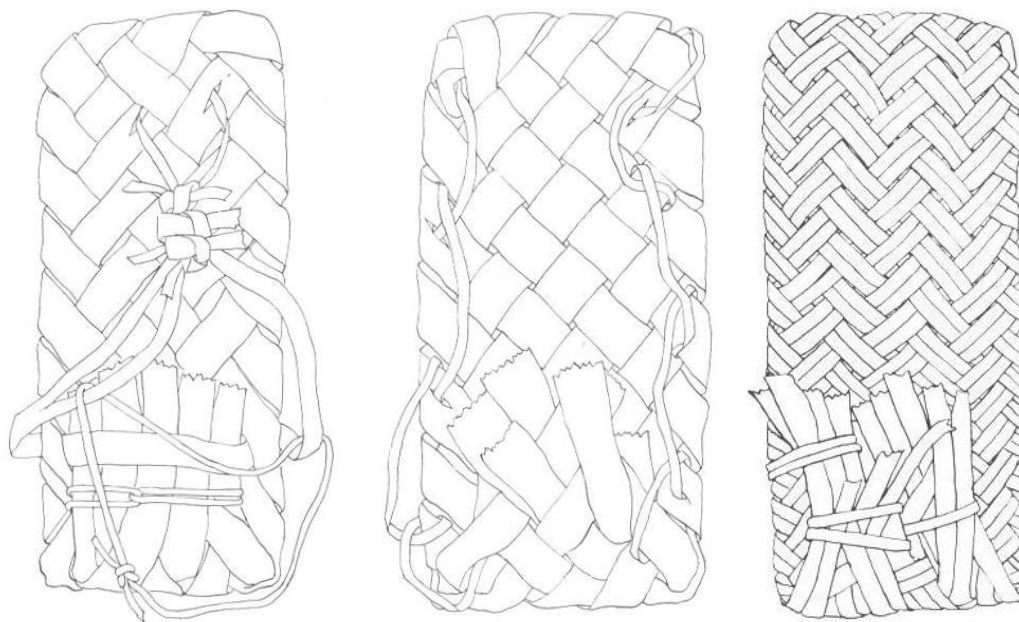


Figure 6.4b. Plaited Mogollon Sandals. Left and center: Simple Plaited; Right: Twill Plaited (Adapted from Martin et al. 1952:Figures 92 & 96).

Jornada Basin Mogollon. Pendejo Cave is the type site for the Jornada Basin, New Mexico. The technology represented at this site is wholly different from the more centralized Mogollon sandal technology and developmental trajectory. According to Hyland (1997),

none of the other Mogollon or Hueco Mountain (Texas) sandal types described by Cosgrove (1947) (see Mogollon section of this work), Dick (1965), or Bluhm (1952), nor any of the Basketmaker/Anasazi varieties illustrated by Kankainen (1995) or described and discussed by Deegan (1993, 1995) and Webster and Hays-Gilpin (1994) are reported for Pendejo Cave or occur in dated contexts anywhere in the Jornada Basin. Similarly, none of the Late or Terminal Archaic Mayran or Jora complex sandals from Coahuila are known from anywhere in the greater Mogollon area. (Hyland 1997:245)

People in the Trans-Pecos region, Jornada Basin, and northern Coahuila typically wore a short “scuffer-toe” sandal that covered just the ball and instep of the foot. Most of these sandals were finished with a “fishtail” heel, made by allowing the warps to protrude at the rear (Webster 2007:Figure 16.3a, b; Cosgrove 1947: Figures 87-90, Types 1-5). In

contrast, “groups related to the Cochise cultural tradition, including those in the Mimbres and Reserve branches, typically wore full-length wickerwork sandals lacking the fishtail heel” (Webster 2007:276). The heels of these sandals were made by tying the warp ends together and trimming them flush with the sandal body (see figure 16.3c-e; see also Cosgrove 1947: Figures 91 & 92, Type 8; Martin et al. 1952: Figures 87 & 88; McBrinn 2002)” Webster 2007:281). Both the scuffer-toe and full-length styles were used by Late Archaic and Early Agricultural groups in the Jornada Basin and areas farther north along the Rio Grande (e.g., McBrinn 2002:Tables 21 & 22) and by later populations in Chihuahua (King 1974:90; Lister 1958:85 cited in Webster 2007:281). Early Jornada Mogollon perishable assemblages also incorporate a number of Trans-Pecos and northern Mexican derived styles not usually found in contemporaneous Mogollon assemblages, including plaited baskets and mats and wickerwork sandals with fishtail heels, suggesting strong southern connections for these groups (Webster 2007).

Presently, the earliest sandal from anywhere in the Mogollon country is an example of a Type II sandal (two warp scuffer toe) (Figure 6.5) from Pendejo Cave (Hyland 1997:242). This specimen has been directly dated to 3530 +/- 60 B.C. (5480 +/- 60 B.P.). According to Hyland, this sandal type and tradition are “wholly unrelated to the multiple warp complexes on the Colorado Plateau or further afield in the Great Basin” (Hyland 1997:242). Instead, this type and its four-warp plain weave relatives are “part of a footgear tradition whose origin and center of proliferation was well to the south of the Colorado Plateau” (Hyland 1997:242). This same basic sandal type is represented in the Fresnal Shelter sequence, High Rolls Cave (Merchant and Boherer 2006), and in Fresnal Phase Level C at Tornillo Rockshelter, which MacNeish (1993:301) estimates to

date to ca. 1100 B.C. (3050 B.P.). MacNeish (1993) speculates that this type is one of the signature diagnostics for the Jornada Basin and suggests its origins may extend back to ca. 6000-4300 B.C. (7950-5650 B.P.). At Pendejo Cave, Type II sandals are last documented at A.D. 170 +/- 50 (1780 +/- 50 B.P.). However, this type (or variations thereof) is represented at Tularosa and Cordova caves throughout virtually the entire sequence (Bluhm 1952). In Cosgrove's large sandal sample (n=1016), two warp types (Type 3, 4a, 4b, 5a, 5b, 5c, 7, 8, 10, 11) collectively occur in both pre-ceramic (i.e., Basketmaker) as well as ceramic (i.e., Pueblo) contexts paralleling the situation at Tularosa, Cordova, and Bat caves (Hyland 1997:243).

The remaining two Pendejo Cave sandal types, Type I (four-warp scuffer toe) and Type III (simple plaited with tie eyelet), only occur relatively late in the sequence (Figure 6.5). Pendejo Cave Type III is the only Pendejo Cave sandal variety that does not exist on both sides of the documented cordage/basketry disjuncture at the site. It is also found in late contexts at Bat Cave and at Tularosa and Cordova caves where all forms of plaited sandals occur only in ceramic contexts (Bluhm 1952:266-276). In the Upper Gila, Mimbres, and San Francisco drainages, Pendejo Cave Type III is the equivalent of Cosgrove's Type 9a (1947:89, Figures 91-92) which again occurs only in ceramic contexts (Hyland 1997:244-245).



Figure 6.5. Jornada Mogollon/Pendejo Cave sandals. Clockwise from top left: Type I (Four-warp Scuffer Toe), Type II (Two-warp Scuffer Toe) with Fishtail Heel, Type II (Two-warp Scuffer Toe), Type III (Plaited with Toe Eyelet), and Type II (Two-warp Scuffer Toe) (adapted from Hyland 1997: Figures 43, 45, and 48-50).

Colorado Plateau/Basketmaker/Ancestral Puebloan/Puebloan. Sandals in the northern region of the Colorado Plateau exhibit two distinct styles beginning with the earlier open-twined (z-twist) sandals (8000-5400 B.C.) and followed and replaced by warp-faced plain weave sandals (5800-1450 B.C.) (Figure 6.6). Sandals from the southern region represent a uniform suite of warp-faced plain weave sandals which precede the northern produced plain weave sandals by 1,500 years. Both northern and southern types were produced utilizing whole *Yucca* sp. leaves, but it was noted that the southern plain weave sandals exhibited differentiating characteristics concerning tie methods and display a weft to warp selvage treatment not found in northern versions. The southern tie method is a criss-cross toe-heel method common in the Southwest during Basketmaker and Puebloan periods. The dated sandals were constructed between 7600 and 7200 B.C., making them contemporaneous with the northern open-twined sandals, but predating the northern plain weave sandals by 1,500 years. There appears to be no technological advantage concerning the ease in manufacture of one type over the other, but a functional advantage was observed concerning the better traction provided by the open-twined sandals on slick rock, which abounds in the northern region.

The sandal types, along with projectile point types, show stark difference between the types of artifacts found in the northern and southern regions of the Colorado Plateau, with the sandals differing prior to 5800 B.C. The earliest plain weave sandal style adopted in the north is found in Dust Devil Cave at 5800-5600 B.C., which shows the northern spread of the style at the end of the Early Archaic. However, this technological expansion has not been interpreted as a result of population replacement because of the retention of subtle distinctions such as previously used tie method and some sandals

exhibiting a combination of the two construction types (twining and plainweave). These characteristics imply in situ development. Sustained interaction and contact between northern and southern groups may have been due to the warming and drying of the period which required the expansion of foraging ranges and a need for social connectivity over wider ranges. The northern Colorado Plateau plain weave sandals provide evidence for cultural continuity from the end of the Early Archaic through the Late Archaic during a period of multiple changes in favored projectile point styles. Therefore, it is likely that there were variable and independent rates and reasons for the change exhibited in these different aspects of culture.

The well-dated collections from Cowboy Cave (Jennings 1980) and Sand Dune and Dust (Wind) Devil caves (Lindsay et al. 1968), which collectively document the Desha through Anasazi/Fremont continuum extending from ca. 7000 B.C. to A.D. 1200 (8950-750 B.P.) (Hyland 1997:3-4). The basal deposits at Sand Dune and Dust Devil caves are the type localities for the Desha complex, a Colorado Plateau cultural entity thought to be locally ancestral to Basketmaker-Anasazi (pre-Basketmaker II). The Desha complex sandals exhibit six to ten parallel warps and are exclusively open simple twined with paired, Z twist wefts (Hyland 1997:241). Several of the Sand Dune Cave sandals and grass linings were directly radiocarbon-dated producing dates of 5590 +/- 120 B.C. (7540 +/- 120 B.P.), 5750 +/- 120 B.C. (7700 +/- 120 B.P.), and 5200 +/- 120 B.C. (7150 +/- 120 B.P.) (Lindsay et al. 1968:96). Desha-style sandals from Cowboy Cave are older than those from the type localities and date to 6625 +/- 80 B.C. (8575 +/- 80 B.P.), 5265 +/- 75 B.C. (7215 +/- 75 B.P.), and 4725 +/- 75 B.C. (6675 +/- 75 B.P.) (Jennings 1980). The Desha complex apparently served as the root or progenitor of a lengthy sandal-making

tradition which included both utilitarian coarsely made specimens and exquisitely manufactured forms (Kankainen 1995). However, the Desha sandals have no counterpart in any other southwestern culture area nor in adjacent areas. Specifically, the characteristic Desha type does not occur in Hohokam, Mogollon, or north Mexican/Lower Pecos contexts. Instead, and as often stressed by Adovasio (1980b, 1986; Andrews et al.1986),

the Desha complex sandals and other perishable diagnostics, especially the coiled basketry, seem to represent distinct Great Basin derivations. Indeed, the closest general resemblance of the Desha complex sandals is as noted by Lindsay et al. (1968:91) and Andrews et al. (1986:130), to multiple warp types from the western Great Basin. These, in turn, are ultimately related to the still more ancient open twined sandals of the northern Great Basin and may reflect the very earliest Archaic sandal-making substrate which literally provided the model for Desha and related developments (Andrews et al 1986:130). (Hyland 1997:242)

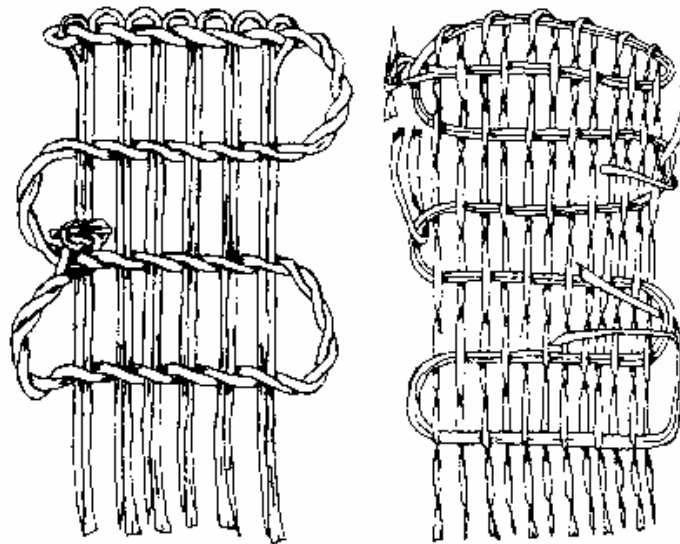


Figure 6.6. Archaic open-twined sandals (left) and warp-faced plain weave sandals (right) from the northern Colorado Plateau (borrowed from Geib 2000, Figure 2).

The earliest identifiable Ancestral Puebloan (Anasazi) sandals excavated by archaeologists are from the Basketmaker II period (A.D. 1-500). The majority of the

Anasazi sandals were recovered by Byron Cummings in the early 1900s and Jesse Jennings in the 1950s in Glen Canyon. However, additional sizeable collections have been recovered from northeastern Arizona areas including Canyon de Chelly, the Prayer Rock District, Tsegi Canyon, Tseyi-Hatsosi Canyon, and the Upper Colorado River Basin (Deegan 1993:49). These sandals have square heels and toes woven in a complex twining and wrapping technique. The most intricate and finely woven sandals come from the Basketmaker III period (A.D. 500-700). Their toes are scalloped and their heels puckered. These sandals exhibit a complex weave with a smooth, ribbed surface on the interior and a raised geometric pattern on the sole (Kankainen 1995:1). Weavers of the Pueblo I (A.D. 700-900) and Pueblo II (A.D. 900-1100) periods produced coarse cordage sandals with rounded or pointed toes. Sandals dated to the Pueblo II and Pueblo III (A.D. 1100-1300) periods were plain weave sandals woven with whole, split, or separated leaf elements for the warps and wefts (Kankainen 1995:2). One type of plain weave sandal that is abundant in the collection consists of warps that are predominantly flat leaf elements tied into knots at the toe and heel. Many are begun with a knotted start, wherein two, four, six, or more warps are aligned parallel to each other and then tied with one or more knots at the toe. In a knotted finish, warps are tied together at the heel with one or more knots (Kankainen 1995:25). Braided sandals were also manufactured, which involved only one set of elements/warps that were interlaced diagonally from one side edge to the other (Adovasio 1977; Anderson 1969; Baldwin 1938; Deegan 1995; Emery 1980; Kidder and Guernsey 1919; Elizabeth Morris 1980). The finely woven, intricate sandals, collected predominantly in northern Arizona, represent the height of complexity

in Anasazi sandals and demonstrate the genius of the weavers and their mastery of aesthetics in design (Deegan 1995:66; Kankainen 1995:29).



Figure 6.7. Ancestral Puebloan/Basketmaker sandals. Counterclockwise from top left: Two-warp wickerwork, Four-warp plain weave, Twill plain weave, Composite, Twined, and Braided (adapted from Kankainen 1995:35, 37, 40, 67, & 68).

The Great Plains

The Great Plains refers to a broad geographical region extending from the borders of the eastern Woodlands to the Rocky Mountains. On the north it extends into the western provinces of Canada, while in the south it includes portions of northern Texas and northeastern New Mexico (Adovasio 1974, 1980b). Within this vast area, basketry remains are quite rare and tend to be restricted to the peripheries of the Great Plains proper. Perishable items tend to be relatively common only in the northwestern Plains. However, small collections are known from the eastern front of the Rocky Mountains in Colorado, and the Texas and Oklahoma Panhandles (analyzed within this work). Thus they do not give a full picture of all the techniques presumed to have existed there (Adovasio 1974:122; Andrews n.d.). According to basketry evidence, twining is a relative rarity on the Plains and no early evidence of it is known. Plaiting is very rare, while coiling has been reported from the Texas panhandle, the eastern front of the Rocky Mountains, and various sites in Wyoming, Kansas, and Nebraska. The earliest basketry from anywhere on the Plains is a piece of coiled basketry from Mummy Cave, Wyoming, with an associated date of 2470 B.C. (Adovasio 1980b:355). Additional archaeological evidence for basketry on the Plains consists of secondary evidence on ceramics as early as ca. 250 B.C., and basketry impressions ca. 7500 B.C. from Graham Cave, Missouri (Figures 6.8 and 6.9) (Andrews n.d.; Logan 1952). Few basketry examples have survived, however, they do provide evidence for the necessary techniques employed in the manufacture of sandals. Though sandal evidence has been reported for the eastern Front Range of Colorado and the Oklahoma/New Mexico panhandle, the only thorough examination of these materials resides in the present study.

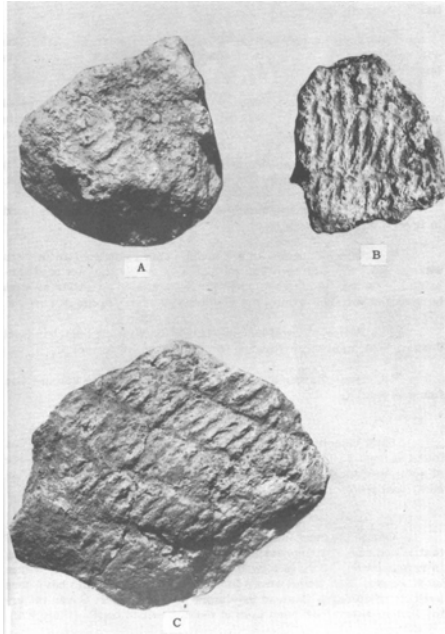


Figure 6.8. Textile impressions from Graham Cave, Missouri (borrowed from Logan 1952: Plate XXI).



Figure 6.9. Perishable impressions on pottery (borrowed from Logan 1952: Plate XXIII, Specimen G).

According to perishable experts (Adovasio 1980b; Andrews n.d.; Jolie 2000, 2001, 2002, 2006), the basketry from the Texas panhandle and from other sites on the central and southern Plains has strong affinities to developments in the Southwest and Trans-Pecos Texas. It is highly likely that basketry diffused onto the Plains at a relatively late date from neighboring areas, neighboring areas in which basketry and sandal technology was highly developed and of great antiquity. Though the sparse archaeological data from the Plains implies that there may not have been an in situ Plains basketry complex, proto-historically and historically, two types of basketry were produced on the Plains, twill plaited burden baskets and coiled gambling baskets. Information gathered by the analysis of these specimens indicates a southern origin for historic Plains coiled and plaited basketry. The diffusion of this technology from areas in northern Mexico and Trans-Pecos Texas “likely began as much as 3,000 years ago and

progressed more rapidly during the last 400 years” (Jolie 2006:17). Jolie suggests that “the spread of historic Plains basketry is related to a northward spread of agriculture with Caddoan and Siouan language speakers” (Jolie 2006:17). However, he also suggests that gambling baskets used by Eastern Shoshone groups may be the result of a “separate local basketry tradition with origins in the eastern Great Basin” (Jolie 2006:17). The functional necessity for basketry and sandals on the Plains “may have been mitigated by the availability of other types of containers, particularly those made from animal hide” (Adovasio 1980b:356). Though ethnographic accounts indicate that historic Paiute and Northern Shoshone groups and possibly proto-historic groups utilized both plant-fiber sandals (made of sagebrush bark, tule, *Yucca*, and *Jossweed*) and deerskin leggings and moccasins (one-piece or two-piece), the antiquity of these styles is indeterminate (Johnson 1975; Lowie 1924; Riddell 1960).

Northern Mexico and Texas

Northern Mexico/Coahuila. Turpin and Carpenter’s (1994a) and Turpin’s (1998, 2003) examination of sandals from the Ocampo region and Sierra de la Encantada (Turpin and Carpenter 1994b) and Taylor’s (1966, 1988) discussion of sandals from the Cuatro Ciénegas Basin constitute the only broad-based studies of sandals in Coahuila northern Mexico (Hyland 1997:239). Taylor’s (1988) typology was derived from over 1,000 sandals predominantly from Frightful Cave and Fat Burro Cave, as well as a multitude of more minor localities in the Cuatro Ciénegas Basin of southern Coahuila (Taylor 1988, 2004). Taylor defined five sandal types, including various types of plaited, twined, and sewn sandals.

Plaited sandals (Type F1a) were the most common form of footgear when the occupation of Frightful Cave began, possibly as early as 7000 B.C. In this type of footgear, warps were bent inward and crossed at the toe-end, then plaited in figure eights over-and-under around the warp-frame back toward the heel to form the wefts (Figure 6.10). Padding was added both longitudinally and transversely to form the foot-pad, and ties were installed to complete the construction (Taylor 1988:44, 2004:55). Taylor further divided this type into two-warp (F1ai) and three-warp (F1aai) subtypes, though the three-warp type appears to be a late innovation. The two-warp type from Frightful Cave ranges in use from 1600-6200 uncal. radiocarbon years ago (Turpin 2003:13).

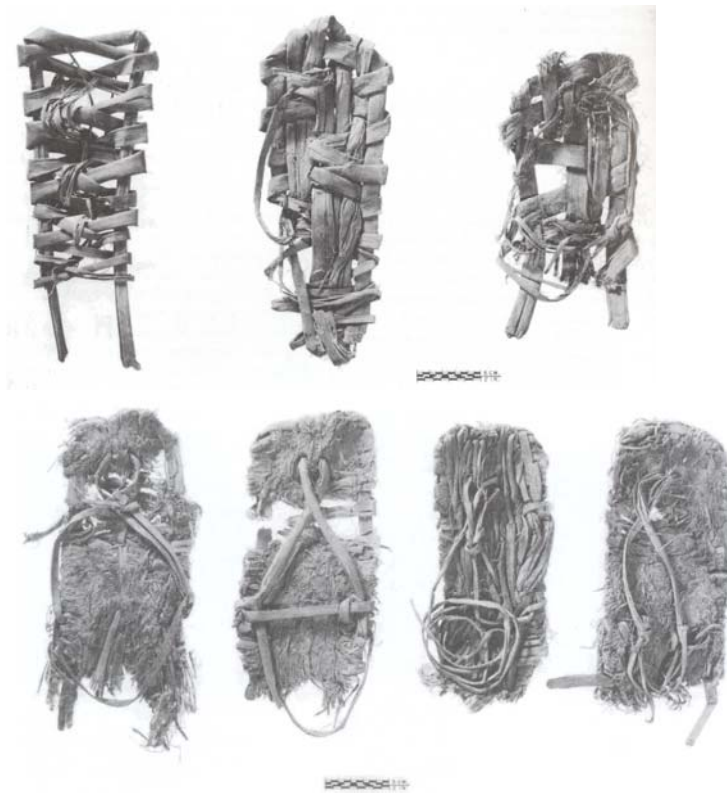


Figure 6.10. Plaited sandals (Type F1a)
(borrowed from Taylor 2004:Figures 5-1 and 5-3).

Twill pad sandals (Type F1b) were made by sewing reinforcing and padding elements through the margins of all four sides and across the underside of a basic, foot-shaped, twill-plaited fabric (Figure 6.11). Ties appear to have been installed after the padding (Taylor 2004:93, Figure 6-1). Although twill-pad and plaited sandals were found together in the Bottom Level of Frightful Cave and were thus contemporary, Taylor believes that their differences are so basic and pronounced as to suggest that they pertain to two quite distinct traditions. He therefore suggests that even at the earliest times there was more than one cultural line in Coahuila (Taylor 2004:101).

Checkerpad sandals (Type F1c) were made by sewing reinforcing and padding elements through the sides and across the ground side of a checker-plaited fabric (Figure 6.11). Fabric was often oriented on a diagonal as well as a perpendicular alignment (Taylor 1988:96, Plate 54, 2004:102, Figure 6-3; Turpin 2003:10). The geographic distribution of this type is even more restricted than that of the quite similar twill-pad sandal.

Sewn sandals (F1d) were manufactured by forming a mass of decorticated agave fiber into a foot-shaped “body” that was then sewed across its width with strands of two-ply z-twist yarn (Figure 6.11). Mending stitches have been identified as running both transverse and longitudinal. Sewn sandals appear later in time than twill-pad sandals and are generally contemporary with checker-pad sandals (Taylor 2004:106).

Braided sandals (Type F1e), as described by Taylor, were “footgear made of two bundles of fiber doubled over each other and braided from toe to heel, where they are turned over and woven back up the sandal to form padding” (Taylor 1988:103) (Figure 6.11). Braided sandals are the rarest sandal type from the Cuatro Ciénegas caves, and is

loosely temporally equivalent to the Late Archaic and Late Prehistoric periods in Texas. At Frightful Cave their documented use ranges from 1890 B.C. to A.D. 200 (Turpin 2003:8). According to Taylor, braided sandals represent a fundamental change in sandal technology from the dominant two-warp plaited style (Taylor 1988:103, 2004:107). Braided sandals consist solely of active elements that form both body and padding; there are no true warps. Thus, the two technologies are in fact different conceptualizations of the manufacturing process rather than variations on a standard template (Taylor 1988:103). Taylor (2004:107) also notes that there is no plausible way that braiding could have evolved from plaiting, implying a cultural discontinuity late in the occupation of Frightful Cave (Turpin 2003:9). This same time period, which is generally considered a time of flux in northern Coahuila and the Lower Pecos region, sees other innovations, such as the adoption of the bow and arrow (Taylor 1966).



Figure 6.11. Coahuila sandals (clockwise from top left), Twillpad (F1b), Twillpad (F1b), Checkerpad (F1c), Braided (F1e), Sewn (F1d) (adapted from Taylor 2004:Figures 6-1, 6-3, 6-5, and 6-6).

The Coahuila sandal sequence, as discussed by Taylor (1966, 1988), is probably as old as that evidenced in the classic Southwest. Like the Southwestern industries of the Colorado Plateau, the sandal technology of northern Mexico is totally different from that represented by the Mogollon. The Cuatro Ciénegas types discussed and illustrated by Taylor (1966: Figures 15-17), have no counterpart in the Mogollon area, nor do the

sandals of the Ocampo area of Coahuila described and discussed by Turpin (1985) (Hyland 1997:243).

Lower and Trans-Pecos Texas. Lower Pecos Texas includes the westernmost and southernmost portions of Texas, which lie east of the Pecos River and surrounding the Big Bend region therein. Sites with reported evidence of footgear include Hinds Cave, Moorehead Cave, Baker Cave, Bonfire Shelter, and Wroe Ranch. Three broad categories of braided, checkerpad, and plaited sandals transcend regional differences. Sandals of the Lower Pecos River region of southwest Texas have been documented and discussed by Butler 1948; King n.d.; Maslowski 1978; Schuetz 1956; Thomas 1933; Turpin 2003; and Williams-Dean n.d. Sandal typologies for Lower and Trans-Pecos Texas mirror, in some cases, the typologies established by Taylor for the Coahuila region of northern Mexico (see Figure 6.11). The predominant typology for the region was established by Schuetz (1956). Schuetz (1956:130-131) divided plaited two-warp sandals (Taylor F1a) into three subtypes depending on the configuration of the frame. In Type A, two warps converge at the toes and are bent inward and downward to form a third central warp (Taylor Type F1aii). In Type B, one element is bent into a horseshoe with the curve at the front of the foot (not described by Taylor). In Type D, warps cross at the toe and become wefts, which are woven in figure eights for the length of the sandal. This type is similar to Taylor's F1ai (2004).

Taylor's F1c (2004) is roughly equivalent to Schuetz' Type C which is also called checker weave in the Big Bend region (Smith 1933:57, 60). Only a few of Taylor's F1d sewn sandals have been noted in the Lower Pecos assemblage (King n.d.; Maslowski 1978). Taylor's F1e type, was apparently not a technique favored by Lower Pecos

shoemakers and is not a category in any of the published typologies (Turpin 2003:7). The only mention of braided sandals in the Lower Pecos region is in an unpublished inventory of the Witte Museum collection that describes two specimens from Shumla Cave (Lipkin and Mui 1999:4 cited in Turpin 2003:8).

Sandal typology for the Big Bend region of Texas, documented by Smith (1933) includes only three types: Type I: Two Opposing Warps (which was further divided into five subcategories) and Type II: Multiple Warp (which was further divided into three subcategories, one of which is a checker weave pattern similar to Schuetz's Type C) (Turpin 2003:14). Smith (1933) placed the braided sandals in his collection from the Big Bend region into a category he called Type III: Plaited.

Northern Coahuila (intermediate region between Coahuila and Lower and Trans-Pecos Texas). The degree of affinity is so great between Trans-Pecos Texas and northern Coahuila materials as to suggest that the Trans-Pecos basketry materials are in fact directly derived out of (or are an integral part of) essentially north Mexican basketry industries. The general evolution of the Trans-Pecos basketry center parallels that already described for Coahuila but with a several hundred year time lag for the introduction of specific types (Adovasio 1974:117-118). Adovasio (2004) goes so far as to say that the basic resemblance of the individual types and the overall basketry industries from both areas were so great that "they must be parts of the same developmental trajectory" (Adovasio 2004:150). Because these similarities could be tracked without significant hiatus or interruption from the late Paleo-Indian period to Historic times, Adovasio concluded that "the culture in question was the direct lineal ancestor of the ethnohistoric Coahuiltecan bands on both sides of the Rio Grande" (Adovasio 2004:150).

More recent radiocarbon assays of specimens from small shelter excavations and private collections, such as those at Sierra el Fuste and Cueva Encantada have helped to bridge the gap between the Coahuila sequence and the relative chronology assumed for the Lower and Trans-Pecos regions (Turpin 2003:1). In fact, a new sandal type was identified at both the Wroe Ranch of Lower Pecos and the Cueva Encantada site of Coahuila. V-weft two warp sandals were initially discovered and reported by Turpin and Carpenter (1994b) at both Wroe Ranch and Cueva Encantada (Turpin 1998:31). The Wroe Ranch specimens are dated at 6490-7270 b.p. The V-weft sandals are a subset of the two-warp plaited sandal types. The warp elements are split at the toe end and one-half of each element contributes to the toe loop while the other half lies across the top of the sandal. According the Turpin and Carpenter, “the most distinctive attribute of this sandal is the way in which the weft elements are twisted 180° at the latitudinal midpoint of the body and turned at a 30-45° angle to create a V-shaped pattern, opening towards the toe” (Turpin 2003:15; Turpin and Carpenter 1994b:10). In many ways, the V-weft type is a hybrid variety that combines characteristics of the fish-tail sandals that dominate in far west Texas and New Mexico (Mogollon region) and the common plaited sandals of Coahuila and the Lower Pecos. The critical difference is the lack of the characteristic heel morphology. All of the V-weft plaited sandals that retain any portion of their ties are similar in that the warps are split to form toe loops that are knotted atop the foot, then fastened to the warp midway down each side of the sandal (Figure 6.12). This toe ring is another characteristic reminiscent of the fishtail sandals of more westerly origin (Williams-Dean n.d.:28 cited in Turpin 2003:18).

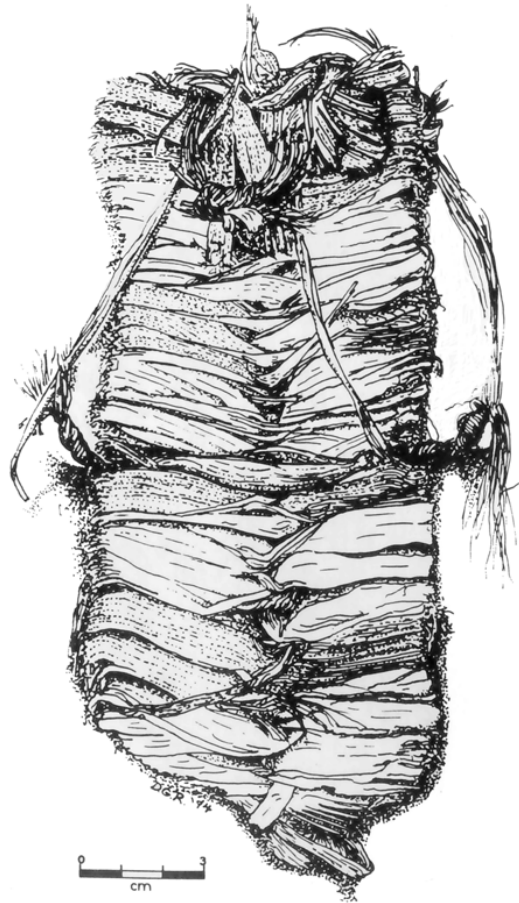


Figure 6.12. V-weft Sandal (borrowed from Turpin 2003:Figure 6).

The ubiquity of two-warp plaited sandals as a whole testifies to a strong preference that endured for millennia throughout Coahuila and southwest Texas. Checkerpad sandals contribute a consistent but small percentage of almost all inventories despite the considerable ambiguity about the age and internal consistency of this type (see Figure 6.11) (Turpin 2003:22). To date, braided sandals have been recognized in El Fuste (n=31), Cueva Encantada (n=6), the Big Bend (n=unknown), the Lower Pecos (n=2), and in proportionately low numbers in the Cuatro Ciénegas Basin (n=6) (see Figure 6.11). This distribution suggests that braiding was a late Coahuiltecan innovation

that barely reached as far east as the Lower Pecos and only infringed on the Cuatro Ciénegas fiber industry (Turpin 2003:21).

The East

What is herein referred to as the East includes all such territories east of Texas and the Great Plains. Sandal collections which represent the technology of the Eastern United States are few. The only known collections were found at Salts Cave, Kentucky (Young 1910; Orchard 1920); Arnold Research Cave, Missouri (Kuttruff et al. 1998); and the Ozark Bluffs caves of Arkansas (Harrington 1924; Scholtz 1975). Not surprisingly, given the geographic proximity, footwear from Arnold Research Cave is most similar to examples of undated footwear reported from bluff shelters in the southern Ozark Mountains of southwestern Missouri and northwestern Arkansas. Scholtz (1975) classified and described 11 examples of footwear from the Ozark rock shelters, some of which have similarities to the footwear from Arnold Research Cave. Numerous examples of footwear have been recovered from the Kentucky caves. Though a large number of twined slippers were produced at these caves, with a seam from the point of the toe to the instep, they differ from the Arnold Research Cave specimens. Interestingly enough, the twined vamps on the Fort Rock Cave shoes of the Northern Great Basin are similar stylistically to the vamps on Missouri specimens (Kuttruff et al. 1998:75).

The sandals of Salts Cave in Edmonson County, Kentucky were fabricated utilizing mainly cattail (*Typha*), or possibly of husks or stalks of corn (Orchard 1920:8). The sole techniques employed in their construction include checker weave, close-twined weave, and close-twined weave in a chevron pattern. The later style appears to have been

the predominant style based on number (Orchard 1920:10). The Kentucky cave sandals are more specifically a slip-on sandal (Figures 6.13 & 6.14) as opposed to the flat sandals manufactured in the Southwest and adjacent areas. According to Orchard, “it would be practically impossible to perform the operation without the aid of a loom of some sort to keep the warp taut” (Orchard 1920:15). The upper warp-elements were evidently drawn tight to make the sides of the sandal fit snugly to the foot. A finishing edge around the opening has been made by coil-stitching a strand of the same material as that used in making the sandal (Orchard 1920:14).

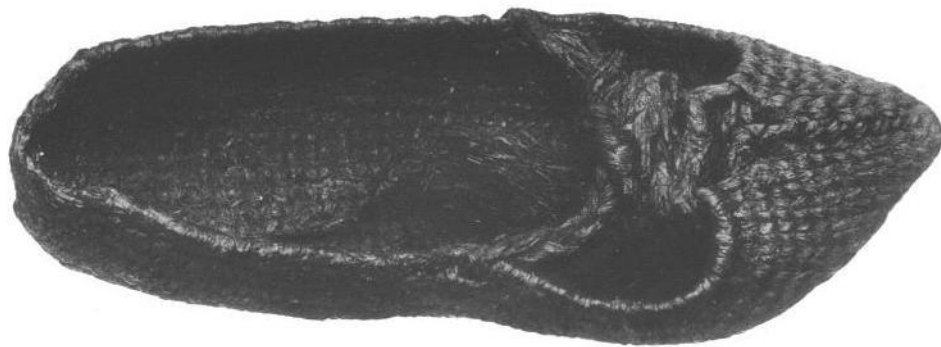


Figure 6.13. Kentucky slipper sandal (Orchard 1920, Plate III).



Figure 6.14. Kentucky slipper sandal with stuffed projections on both sides of the toes (Orchard 1920, Plate IV).

The sandals of Arnold Research Cave include both flat and slip-on sandals. The AMS dating of the assemblage of fibrous and leather footwear documents a long sequence of shoe construction by prehistoric Midwestern peoples, beginning perhaps as early as 8300 B.P. (Kuttruff et al. 1998:72). The sandals were all warp-faced with twined vamps, pointed toes and elaborate side looped tie systems. The sandals generally have no sides and are held on the foot by means of straps (Figure 6.15). The slip-ons however, were less consistent in their make. The construction technique of the slip-ons included weft-faced, balanced plaiting, twining, or a combination of twining and plaiting. Slip-ons had rounded toes and cupped/rounded heels. The slip-ons generally have sides and stay on the foot without the use of straps or fasteners (Figure 6.16) (Kuttruff et al. 1998:73). Examples of leather footwear include leather sandals with fibrous padding as opposed to leather moccasins. Plied cordage is threaded around the edge of these specimens in order to keep them tight to the foot (Figure 6.17) (Kuttruff et al. 1998:74).



Figure 6.15. Arnold Research Cave Sandal B, Specimen 1 (Kuttruff et al. 1998:73).

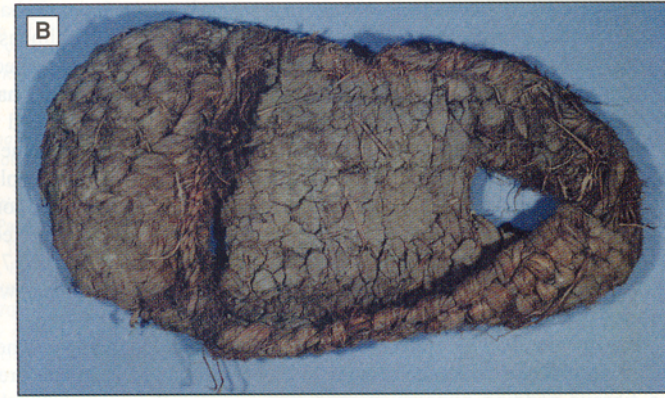


Figure 6.16. Arnold Research Cave Sandal B, Specimen 5 (Kuttruff et al. 1998:73).



Figure 6.17. Arnold Research Cave Specimen 21 (Kuttruff et al. 1998:74).

Ozark Bluffs sandal collections were gathered from a series of excavated bluff shelters of northwest Arkansas, plus one cluster of shelters in southwest Missouri (Scholtz 1975:1). Some investigators have noted the similarity between the material from the Ozark shelters and that from dry deposits in shelters of Kentucky. However, according to Scholtz (1975) comparisons were made only regarding plant materials utilized and not on technique of manufacture. The Ozark Bluffs perishable collection includes both plaited (Cat. No. SK-50, E-385, and A1-115) and twined sandals (Cat. E-625 and GB-399) as well as sandals manufactured with a combination of plaiting and twining (Figure 6.18). Two of the three plaited sandals have warp elements which have

been bent back at the toe and are secured with either one or two rows of twining (Scholtz 1975:137). Sandals and shoes with combined techniques (Cat. No. SK-47, SK-24, SK-?, E-824, AC-60, and C-16) were found to have been created with similar “toe covers” to Fort Rock sandals. Two plain weave shoes, were manufactured in a manner where the longitudinal elements were folded at the toe, folded back to form the upper portion of the shoe. However, from then on, the shoe is twined. Both have square toes and round heels (Scholtz 1975:141).



Figure 6.18. Ozark Bluffs sandals. Top row: Plaited/Interlaced; Bottom row: (L) Twined, (R) Combination (adapted from Sholtz 1975:Figures 146-148).

The previous pages serve to provide contextual information for the description of the sandal assemblages of the Southern High Plains, recovered from Franktown Cave and Trinchera Cave, Colorado, and the Kenton Caves, Oklahoma/New Mexico. The spatial and temporal distribution of the known sandal types and technological trajectories from adjacent regions provided the means for determining the cultural origins and influences of the Southern High Plains populations. Sandalmaking regions with similar sandal technology to that found on the Southern High Plains indicate that they were connected culturally to varying degrees. However, a more in-depth analysis of these areas revealed that the regional sandal technology most similar to the Southern High Plains is that of the Southwest, specifically both northern Colorado Plateau and Mogollon groups. Sandal collections recovered from Cowboy Cave and Sand Dune and Dust Devil Caves show similar construction attributes to the earliest sandal technology found on the Southern High Plains, including plain weave and oblique plaited multiple warp sandals. Sandal collections recovered from sites within the known Mogollon region including Tularosa Cave, Cordova Cave, Fresno Shelter, Pendejo Cave, and the caves of the Gila Area of New Mexico are also comprised of similar sandal types and similar construction attributes to those found on the Southern High Plains, including multiple warp, two-warp, and four-warp *Yucca* sp. sandals and hide footwear.

Chapter 7: Results

Sandal Descriptions

Franktown Cave

Type I: Simple Plaiting, 1/1 Interval Sole

Number of Specimens: 6

Types of Specimens: Sole fragments with ties, 4; Sole fragments without ties, 2

Technique and Comments:

In all six specimens, a series of split *Yucca* sp. leaves are knotted together to form a rectangular loop “frame,” roughly outlining the shape of the human foot. Onto this ‘frame,’ additional split *Yucca* sp. leaves are woven in a simple plaiting, 1/1 interval pattern. In all cases, this weaving appears to begin with “warp” elements running from toe-to-heel through which “weft” elements were interlaced from side-to-side beginning at the toe. In all cases, where extant, the side and end selvages are of the continuous self variety [Figure 7.1]. (Adovasio et al. 2005:7)



Figure 7.1. Franktown Cave Type I Sandal, Specimen TOM-501
(Adovasio et al. 2005: Figure 16)

Lateral ties were secured to the sole by a series of half-hitch knots. Two additional ties are present, including one that passed around the heel and over the instep and a tie at the toe. Both of these additional ties are connected to and looped through the lateral ties. The heel and toe ties are constructed so that the pressure on the free ends would pull the sandal snugly to the foot (Figure 7.2). According to Adovasio, “the heel ties probably rested directly on the calcaneum which would have aided in securing the sandal to the foot” (Adovasio et al. 2005:10). For a more detailed description of the sandal construction and tie mechanism see Appendix D.

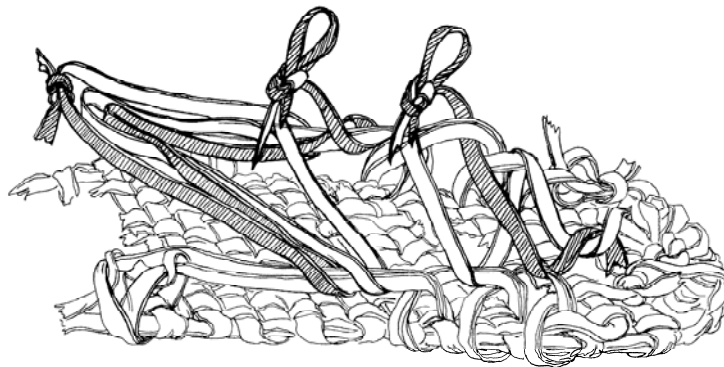


Figure 7.2. Construction schematic of the tie system employed on Specimen TOM-501 (adapted from Adovasio et al. 2005: Figure 20).

The data suggest that two variants of one basic sandal type were produced and used by the occupants of Franktown Cave. While both variants (a heavier and lighter form) share the same basic sole construction attributes and all are simple plaited, certain differences exist between them (Adovasio et al. 2005:14). The most distinctive feature of

the heavier form is the presence of a grass sock, a heel pad, and more complex toe ties used to hold the sock in place and secure it. This more substantial tie mechanism also allows the sandal to be put on or removed without the sock collapsing or losing shape. The heavier form was also constructed using paired *Yucca* sp. leaves for warps and wefts with a different frequency of those elements than in the lighter variant. Finally, the heavier form is also constructed with additional material interlaced into the contact portion of the sole to form pads, which may have enhanced traction, provided superior wear, or even extra insulation (Figure 7.3). The lighter variant (see Figure 7.1) is characterized by the absence of a grass sock and a less complex toe tie. It also lacks doubled elements and additional padding (Adovasio et al. 2005:15). The heavier variant of sandal was probably intended for winter or cold weather use, while the lighter variant was employed in warmer seasons. Only four of the Franktown Cave sandals are side-specific, including three adult rights (TOM-462, TOM-501, and TOM-588) and an adult left (TOM-858). Length and width measurements for both the complete and fragmentary sandals are presented in Adovasio et al. 2005 (Appendix D).



Figure 7.3. Franktown Cave Type I Sandal, Specimen TOM-588, heavier variant (borrowed from Adovasio et al. 2005: Figure 30).

Measurements:

Sandal Length, Range	210-243 mm
Sandal Length, Mean	227.77 mm
Sandal Width, Range	90-125 mm
Sandal Width, Mean	109.17 mm
Sandal Thickness, Range	n.d.
Sandal Thickness, Mean	n.d.
Pseudo-Warp/Weft Width, Range	3.80-7.85 mm
Pseudo-Warp/Weft Width, Mean	5.81 mm

Type II: Moccasin

No. of Specimens: 1.

Type of Specimen: complete, 1.

Specimen Numbers: 3505.

Types of forms represented: moccasin (flexible), 1.

Technique and Comments:

The specimen is a complete moccasin that was constructed by sewing multiple pieces of treated hide (sp. unknown). The Franktown Cave moccasin is a three-piece moccasin, with a U-shaped vamp, which becomes the tongue. The sole is a single piece of leather that is gathered at the toe and is stitched to the two-piece upper portion of the moccasin. The moccasin has an inverted T-shaped seam that is reportedly similar to heel closure seams of the Eastern Woodlands and some one-piece Plains moccasins. The buttonhole present on the moccasin implies closure utilizing a button or thong. The sole is worn through from use. The moccasin is an adult right (Figure 7.4.).

Dick Conn (1983), Curator at the Denver Art Museum, examined the moccasin and concluded that it was probably Late Prehistoric or Protohistoric. He noted that Native Americans used a hard sole moccasin during historic times on the plains. He believes it is a Midwestern or Eastern pattern based on the puckered toe (King 2006:66) and soft-sole design. Gilmore (2005a, 2005b) also argues that it is an Algonquian style from the Great Lakes region.



Figure 7.4. Franktown Cave moccasin (DU 3505).

The Kenton Caves

Type I: Simple Plaited (1/1), 90° angle element crossings

No. of Specimens: 1.

Type of Specimen: sole fragment with heel ties, 1.

Specimen Numbers: 5049.

Types of forms represented: sandal (semi-flexible), 1.

Technique and Comments:

The specimen is a fairly complete sandal (toe selvage absent) that was constructed by simple plaiting. The sandal was created with multiple warps, 15 total. The warps (which run toe to heel) and wefts (which run side to side) engage one another at roughly 90° angles with a 1/1 interval. Each strip is composed of *Yucca* sp. leaves, which are singular, flat, and are uniform in width. The sandal was manufactured with 180° self-selvages to secure the material at each side of the sandal. This selvage allows the wefts to be reincorporated back into the sandal, creating the next weft row, after it reaches the final warp. Despite the deteriorated toe selvage, the heel selvage, as well as part of the tie mechanism, are still intact. Based on the finishing technique, the sandal was made from toe to heel. The tie mechanism was added after the completion of the sole. The tie mechanism was created by tying a piece of *Yucca* sp. to each of the outermost warps and then tying these strands together behind the heel. An additional strand of fiber was also tied in with this elaborate knot (Figure 7.5), which most likely was part of the tie mechanism as well. However, this part of the tie mechanism was not well-preserved. This strand most likely was used to form a tie around the front of the heel. The sandal is coated in an indeterminate type of lacquer.



Figure 7.5. Kenton Caves Type I Sandal, Specimen 5049 with tie mechanism schematic (schematic by C. B. Graphic).

This type of sandal seems very similar to those recovered from Franktown Cave, and may, in fact, be one of the reasons for Adovasio's statement that the Kenton Caves collection is the only vaguely analogous collection to Franktown Cave (Adovasio 1972; Adovasio et al. 2005). It has the same number of warps and same general surficial similarities. However, the incompleteness of the toe and tie mechanism inhibit additional comparisons beyond basic weave. The differences in heel finish, however, are noticeable. Specimen 5049 does not have a complicated method of finish; the warp elements are merely frayed and not secured by any additional means. The final weft row is merely tied to the final warp strand to secure the specimen.

It is possible that specimen 5048B could also be attributed to this type (Figure 7.6). The use of balanced plain weave in its construction and its narrowing toward the heel are similar to specimen 5049. But, the lack of toe selvage on specimen 5049 and the

lack of heel ties on specimen 5048B inhibit any determination regarding the inclusion of specimen 5048B as a Type I sandal. Also, due to its small size of ~120 mm (4.7 in.) it is most likely an experimental or practice form (doodle) produced by a novice weaver or child. Though portions of ties are present at the toe, it is not likely that this specimen was ever worn or even made for that purpose. Historically, children of this size did not wear footwear. It is possibly a mimic or first attempt at the production of a Type I sandal. Because the function and typing of this specimen is indeterminate, it was not utilized in the determination of type frequency nor was its metric data utilized in the reported statistical comparisons.



Figure 7.6. Possible Kenton Caves Type I Sandal, Specimen 5048B.

Measurements:

Sandal Length, Range	210.43-212.92 mm
Sandal Length, Mean	211.68 mm
Sandal Width, Range	109.05-123.57 mm
Sandal Width, Mean	118.08 mm
Sandal Thickness, Range	3.51-8.26 mm
Sandal Thickness, Mean	6.22 mm
Pseudo-Warp/Weft Width, Range	4.90-6.62 mm
Pseudo-Warp/Weft Width, Mean	5.56 mm

Type II: Simple Plaited (1/1), 90° angle element crossings, folded toe

No. of Specimens: 5.

Type of Specimen: complete with ties, 2; toe fragment, 2;
sole fragment without ties, 1.

Specimen Numbers: 34, DU 391, DU 393, DU 397, 4051

Types of forms represented: sandal (flexible), 2; (semi-flexible), 3.

Technique and Comments:

This type includes both complete and fragmentary sandals that were constructed by simple plaiting. The sandals are created with multiple warps; though the specimens were created with 13, 15 or 21 warps, the use of 15 warps was most common. The warps and wefts engage one another at roughly 90° angles with a 1/1 interval (in an under one, over one fashion); only one specimen displays shifts of any kind (to be discussed further below). Each strip is composed of *Yucca* sp. leaves, which are singular, flat, and uniform in width. These sandals are very tightly woven. The sole of the sandal is made of one

long rectangular piece of weave, using the aforementioned simple plaiting technique, which employs 180° self-selvages (Figure 7.7). This selvage allows the wefts to be reincorporated back into the sandal after it reaches the final warp so that the next weft row can be created. This rectangular piece of weave is then folded back upon itself to create a rounded toe cover, and in doing so creates the toe selvage. The folded portion of the plaiting only extends over the front half of the foot (ending before the ankle) (Figure 7.8). Splices are laid-in, with the new material being placed behind the exhausted material but not attached to it in any fashion. Many of the sandals exhibit heavy wear in the form of missing sections (toe or heel) and broken warp/weft elements. All but one sandal is missing the heel portion. Few display an indeterminate organic residue. Three of the five sandals are coated in an indeterminate type of lacquer.

The complete sandals (34 & DU 397) are also filled with shredded and matted fibers. The foot was inserted into the sandal under the folded toe portion of the weave but above the matted cushioning. In addition to providing additional cushioning and support to the foot, the matting may have served as added insulation and protection to the foot in climatically severe conditions. The fiber filled sandals may represent a heavier or winter variant type of sandal. It is possible that the other sandal specimens of this type were merely in the process of making, and were eventually to be filled with shredded fiber. It is also possible that those lacking shredded fiber padding represent a lighter or spring variant of this type. Specimens of this type that lack the insertion of shredded fibers may have been used in warmer times of the year, when that sort of heavy protection was unnecessary (see Figure 7.6). Lighter and heavier variants are not unheard of, having been found in Southwestern collections, as well as, documented by Adovasio, Thompson,

and Illingworth in their analysis of the Franktown Cave sandals (Adovasio et al. 2005; Thompson 1958).



Figure 7.7. Kenton Caves Type II Sandal, Specimens 397 (left) and 391 (right).

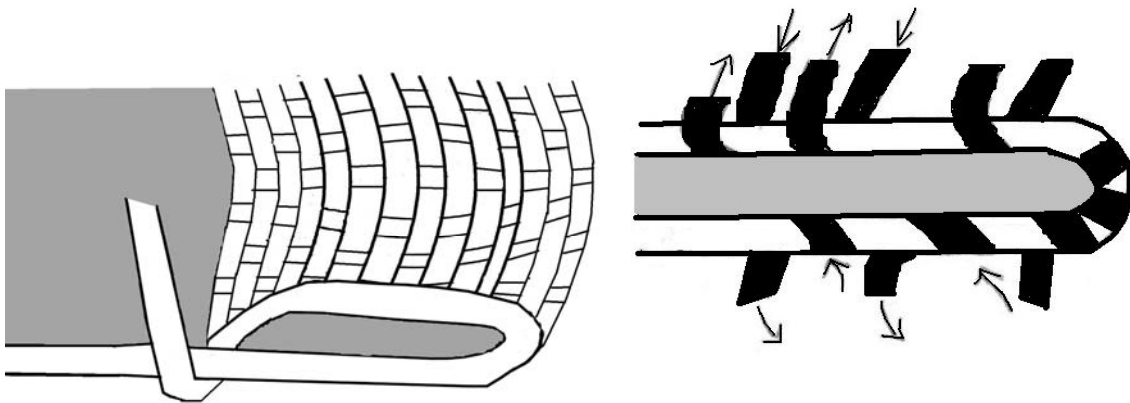


Figure 7.8. Kenton Caves Type II Sandal Schematics. Sandal profiles illustrating the bended weave (both), the creation of the tie mechanism (left), and the creation of the side selvages (right) (schematics by C.B. Graphic).

The outer warp elements of the sandals are used to create the tie mechanism. Only the two complete specimens (34 & DU 397) exhibit any evidence of a tie mechanism. Both specimens exhibit the same tie mechanism, in style and method of construction. The

loose and not yet exhausted outer warp element from each side selvage is pushed through the sole portion of the plaiting, between the final two warps. These loose strands are then tied together across the dorsal surface of the foot directly in front of the ankle [see Figure 7.8 (left) and 7.9].

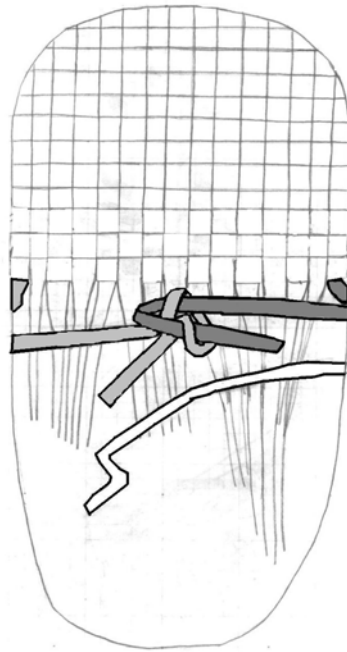


Figure 7.9. Kenton Caves Type II Sandal Schematic. Specimen DU 397 tie mechanism (schematic by C.B. Graphic).

Only one specimen (DU 397) exhibits a formed heel (Figure 7.10). As opposed to the more straight forward heel selvage found on the remaining specimens of this type, the DU 397 heel construction is very unusual and complicated. The heel portion of the weaving is used to create a “slipper” type heel, where the elements were not merely cut, tied, or folded to secure the weave of the creation as in the other specimens. The weaving creates a sort of heel lip, which cups and surrounds the heel of the wearer. It is not a true puckered heel like those found in the Southwest, but it is also not as well constructed as the heel lips recorded on Fort Rock sandals from the Pacific Northwest. The heel was

found on the under-side/reverse side of the sandal. It is probable that when the sandal was removed, the heel was turned inside-out (Figure 7.10).

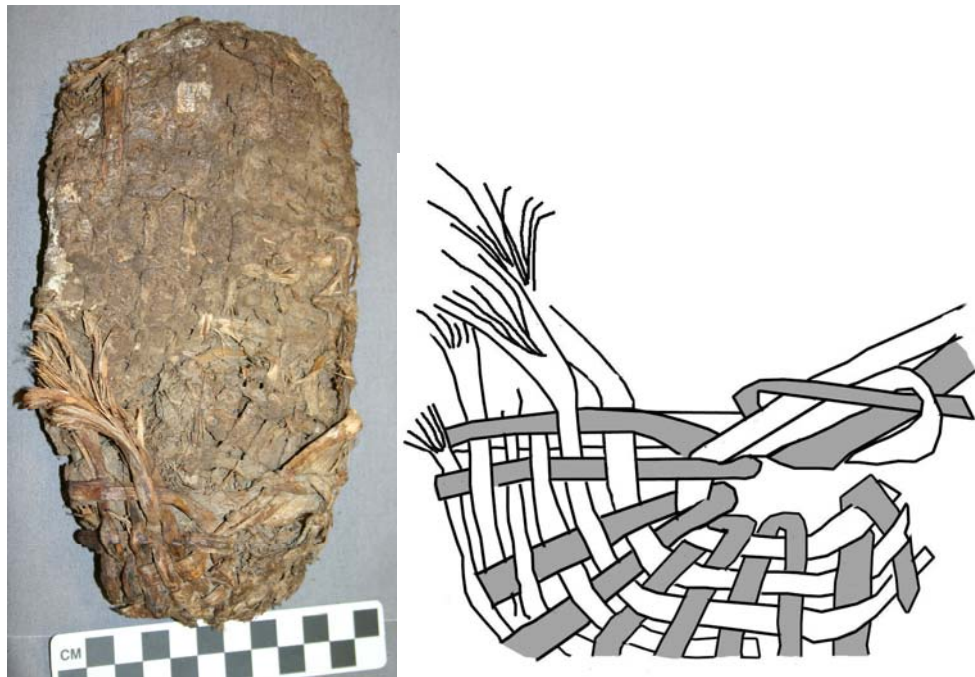


Figure 7.10. Kenton Caves Type II Sandal, Specimen DU 397 formed heel (schematic by C.B. Graphic).

Only one specimen (DU 393) exhibits any shifts in weave pattern. Every third weft row, an additional strip of fiber is added to the pre-existing weft. Therefore, every third weft row exhibits 1/2/1 shift (under one, over two, under one) because two elements are being used as one weaving unit. It is possible that this shift may only have resulted from the splicing technique utilized in the creation of this particular specimen (insertion of new materials to replace exhausted strands), but the consistent patterning of this shift suggests otherwise.

It is possible that specimen #5048H is also a sandal of this type. However, its fragmentary condition precludes absolute ascription to this type (Figure 7.11). Though weaving elements similar to those used to create the warps and wefts of the Type II

specimens are present at the surface of this specimen, their orientation is no longer intact. It is possible that this specimen is merely a fiber bundle. An additional specimen, presumably of this type, is depicted by Lintz and Zabawa (1984:Figure 7.2h). However, it is misidentified as a basketry fragment (Figure 7.12). Though the weave of this sandal appears somewhat more unbalanced than the other Type II specimens and exhibits a looser weave, the construction methodology is the same. The loose somewhat unbalanced weave may be evidence of an early more crude representation of the Type II sandals. Because the typing of these specimens (5048H and Lintz and Zabawa 1984:Figure 7.2h) is indeterminate, they were not utilized in the determination of the total number of this type present, type frequency, or metric data for the type, which were utilized in the reported statistical comparisons (Appendix C).



Figure 7.11. Possible Kenton Caves Type II Sandal, Specimen 5048H.



Figure 7.12. Possible Kenton Caves Type II Sandal, Specimen identified as a basketry fragment in Lintz and Zabawa 1984:Figure 7.2h.

Measurements:

Sandal Length, Range	208.32-214.60 mm
Sandal Length, Mean	211.93 mm
Sandal Width, Range	94.65-134.41 mm
Sandal Width, Mean	121.43 mm
Sandal Thickness, Range	4.75-8.37 mm
Sandal Thickness, Mean	6.46 mm
Sandal Thickness (with Shredded Padding), Range	21.43-30.31 mm
Sandal Thickness (with Shredded Padding), Mean	25.75 mm
Pseudo-Warp/Weft Width, Range	4.01-8.67 mm
Pseudo-Warp/Weft Width, Mean	5.96 mm

Type III: Simple Plaited (1/1), 90° angle element crossings, folded toe, oblique/
45° rotated weave.

No. of Specimens: 5.

Type of Specimen: complete with ties, 1; complete without ties, 1;
sole fragment with ties, 1; sole fragment without ties, 2.

Specimen Numbers: A18, A25, 390, 398, and 399.

Types of forms represented: sandal (semi-flexible), 5.

Technique and Comments:

The specimens are complete and fragmentary sandals that were constructed by simple plaiting. The warps and wefts engage one another at roughly 90° angles with a 1/1 interval; there are no shifts present. The elements used to create the weave are flat strips of *Yucca* sp. that are uniform width. However, multiple elements are used as one weaving unit. Predominantly, these strips are trebled (Figure 7.13) [except for A18 and A25, which are doubled (Figure 7.14)]. These sandals are very tightly woven. The sole of the sandal is made in an identical fashion to the Type II sandals; however, the weave is rotated 45°. The sandal is made of one long rectangular piece of weave, using the aforementioned simple plaiting technique, but employs 90° self-selvages. This selvage allows the wefts to be reincorporated back into the sandal after it reaches the final warp so that the next weft row can be created. This rectangular piece of weaving is then folded back upon itself to create a toe cover, and in doing so creates the toe selvage and square toe silhouette. The folded portion of the plaiting only extends over the front half of the foot (ending before the ankle). Like many of the Type II specimens, the Type III specimens do not show any evidence of being filled with shredded fiber. Therefore, they

may also represent a spring type or “lighter” variant sandal. Many of the sandals exhibit heavy wear (missing entire portions of the sandal), and some display an indeterminate organic residue. No splices are exhibited. All of the sandals are coated in an indeterminate type of lacquer.



Figure 7.13. Kenton Caves Type III Sandal, Specimen DU 398.
Note trebled weaving elements.



Figure 7.14. Kenton Caves Type III Sandal, Specimen A18.
Note doubled weaving elements.

The differences that exist between the Type II and Type III sandals are most likely a result of the choice to not use conventional “horizontal” and “vertical” elements. The Type III sandals are also created from toe to heel, which is indicated by the selvages. The toe selvage and starting point for the Type III sandals is a knot. Because of the original angle and orientation at which the individual elements are laid out, a knot is the only way that they could all be affixed together, yet maintain their angle and desired association (see Figure 7.13). The weaving continued until the desired length was reached and then the heel selvage was created. The sandal was then folded to create the toe cover, and the tie mechanism was affixed. The heel selvage was created with the use of an additional strip of raw material. This material, beginning at the obverse right of the sandal, is woven to the obverse left using simple plaiting (1/1 interval) through the

pseudowarps/pseudowefts. When this additional material reached the obverse left of the sandal, it made a 180° turn (self-selvage) and was woven back to the spot of its initial entry in the same manner. It was then affixed to itself and the furthest obverse right pseudowarp/pseudoweft using a square knot (Figure 7.15). These toe and heel finishes are present on both of the complete sandals (DU 398, & DU 399).

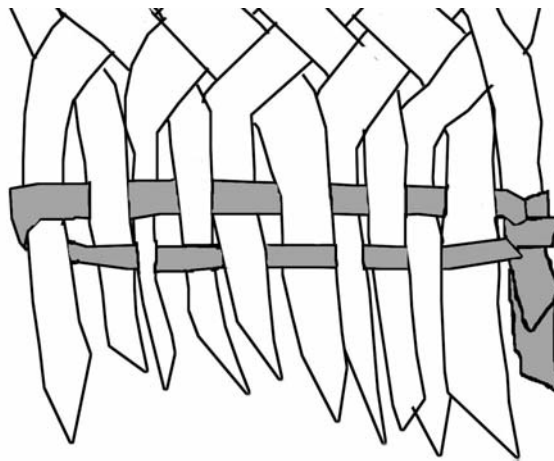


Figure 7.15. Kenton Caves Type III Sandal Schematic of heel finish (schematic by C.B. Graphic).

Only three sandals show any evidence of a tie mechanism (DU 398, 399, & A25), but only DU 399 is complete enough to warrant in-depth discussion. Evidence for some sort of tie mechanism on specimen DU 398 includes two tufts of raw material which protrude through the sandal weave on the same transverse line at the sandal toe (see Figure 7.13). Though indeterminate, it is possible that these two strands (now broken) had formed a toe loop, or these strands could have crossed in front of the ankle and been secured at the back of the heel. Evidence for some sort of tie mechanism on specimen A25 includes two loose strands of raw material that have been knotted together at the obverse left. The tie mechanism on DU 399, added after the completion of the body construction, appears only at the toe. In this style of tie, additional strands of raw material

are looped through the side selvages of the sandal and are crossed and tied together. Four pieces of material are attached to the obverse right, but only one piece remains affixed to the obverse left. It is assumed that originally, each side of the sandal had the same number of affixed pieces of material. These four loose strands of material were forced through only two holes in the weaving, produced in the creation of the side selvage. Therefore, two pieces of material were looped through each hole. The first hole is located at the uppermost portion of the toe (near the pinkie toe) and the second hole is located roughly two inches below the first. Each piece of added material is pulled through one of the holes, with equal amounts of material left on either end. Both ends of the material are then affixed to other strands of loose material on the other side of the sandal. This produces a lattice-work pattern (Figures 7.16 and 7.17).



Figure 7.16. Kenton Caves Type III Sandal, Specimen DU 399 with close-up of tie mechanism.

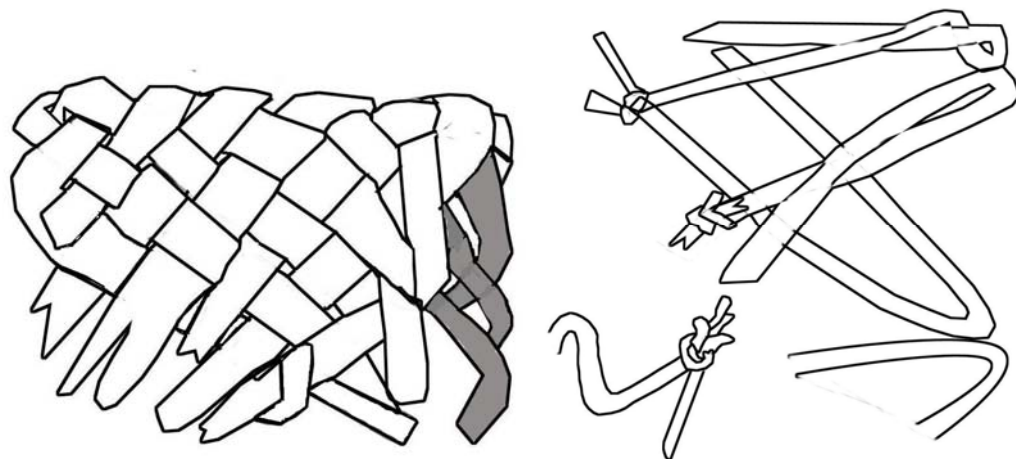


Figure 7.17. Kenton Caves Type III Sandal Schematic, Specimen DU 399 tie mechanism (schematics by C.B. Graphic).

Measurements:

Sandal Length, Range	188.27-242.72mm
Sandal Length, Mean	214.85 mm
Sandal Width, Range	74.34-111.11 mm
Sandal Width, Mean	93.19 mm
Sandal Thickness, Range	7.56-14.60 mm
Sandal Thickness, Mean	9.65 mm
Pseudo-Warp/Weft Element Width, Range	5.52-7.51 mm
Pseudo-Warp/Weft Element Width, Mean	6.31 mm
Pseudo-Warp/Weft Unit Width, Range	7.37-11.89 mm
	(2 element unit),
	7.42-12.52 mm
	(3 element unit)
Pseudo-Warp/Weft Unit Width, Mean	9.32 mm (2 element unit),
	10.08 mm (3 element unit)

Type IV: Unbalanced Simple Plaited (1/1)

No. of Specimens: 2.

Type of Specimen: toe fragment without ties, 2.

Specimen Numbers: 388 and 392.

Types of forms represented: sandal (rigid), 2.

Technique and Comments:

The specimens are extremely fragmentary, and only represent the left toe portions of two different sandals. They were constructed by simple plaiting, but in this type, the weft elements (which run from side to side) can be seen more predominantly and can altogether mask the warp elements (which run toe to heel). Therefore, the weave is considered unbalanced. However, the warps and wefts still engage one another at roughly 90° angles with a 1/1 interval. Each strip is composed of *Yucca* sp. leaves, which are singular, flat (before twisted by weaving), and are uniform in width. The self-selvages (180° variety) were used to secure the material at each side of the sandal. The sandal was created with at least six warps; if complete they would probably exhibit 8 or 10 total warps. One piece of material is used to create at least two warps. The warp material moves from heel to toe and then is bent either right or left (indeterminate based on the fragmentary condition of the specimens) and then back down toward the heel (in a “U” shape). Therefore, the toe of the sandal is created by the use of 180° self selvages. It is also possible that either of the sandals could have been created as a continuous warp variety (Type V), but the absence of a heel inhibits any clear determination (Figure 7.18). Both specimens are coated in an indeterminate type of lacquer.

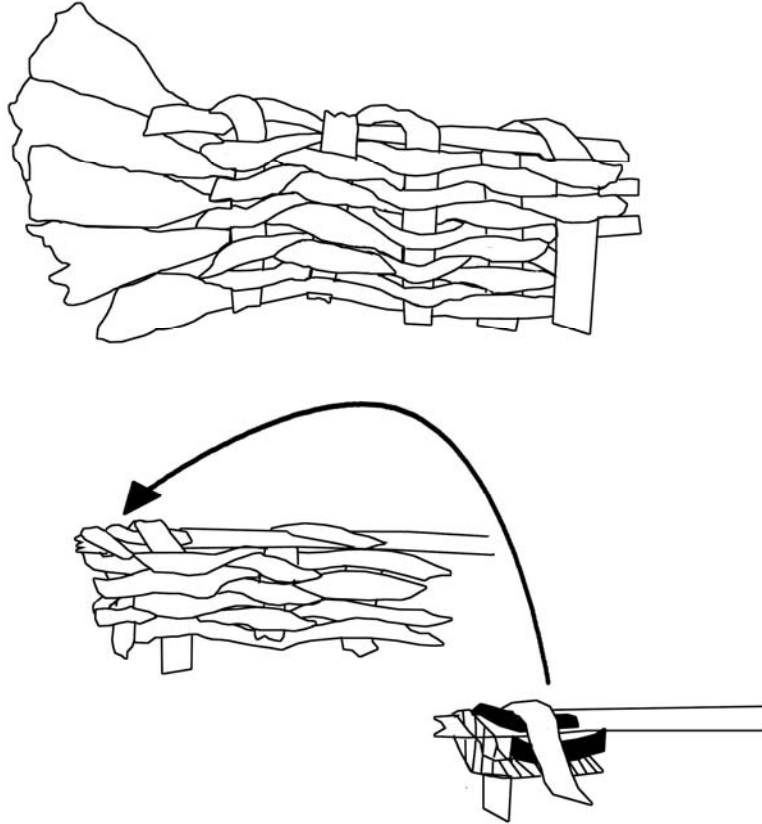


Figure 7.18. Kenton Caves Type IV Sandals, Specimen DU 388 (above) and DU 392 (below) (schematics by C.B. Graphic).

Measurements:

Sandal Length, Range	N/A
Sandal Length, Mean	N/A
Sandal Width, Range	N/A
Sandal Width, Mean	N/A
Sandal Thickness, Range	4.79-11.28 mm
Sandal Thickness, Mean	7.97 mm
Pseudo-Warp/Weft Width, Range	4.10-6.83 mm
Pseudo-Warp/Weft Width, Mean	5.08 mm

Type V: Unbalanced Simple Plaited (1/1), Continuous Warp

No. of Specimens: 1.

Type of Specimen: complete without ties, 1.

Specimen Number: DU 387.

Types of forms represented: sandal (rigid), 1.

Technique and Comments:

The solitary specimen of this type is roughly complete and is constructed by simple plaiting. The warps and wefts engage one another at roughly 90° angles with a 1/1 interval. Each strip is composed of *Yucca* sp. leaves, which are singular, flat, and very uniform in width. The sandal is actually composed of two separate pieces of woven material, which after individual creation, were knotted together with a square knot at the toe end of the sandal. The upper portion of the sandal (upon which the foot would rest directly) was manufactured by using one long strip of material (though noticeably spliced) to create all of the warps. Additional material was woven from side to side through this “frame” creating the wefts. The “frame” began at the obverse right toe end of the sandal, traveling to the obverse left, and then down the foot. After this strip reached the heel end, the material was bent back toward the toe end. This back-and-forth process was repeated until 8 warps were created and the strand returned to the original position, at the obverse right toe end of the sandal. It was then wrapped around itself to secure the “frame” (Figure 7.19). Because the bottom piece of material is so deteriorated (only present on the toe end), extremely lacquered, and tightly affixed to the upper sole, it is difficult to determine its exact construction technique. However, it is obvious that this piece has structure. It is also not possible to determine whether an additional square knot

was used to affix the two “soles” at the heel end in a similar fashion to the toe end. It is likely that the underlying piece of material was used as a pseudo-traction master, or at least to provide additional padding. Though the upper sole does not appear to be severely worn, it is not unheard of to bind two worn sandals together as opposed to fashioning a new one. Due to the presence of the affixing knot, it is not likely that the foot was placed in between these two layers. It is also interesting to note that, based on size, this specimen was most likely a child’s sandal.



Figure 7.19. Kenton Caves Type V Sandal, Specimen DU 387 with schematic of warp configuration (schematic by C.B. Graphic).

Measurements:

Sandal Length, Range	106.20-112.93 mm
Sandal Length, Mean	109.25 mm
Sandal Width, Range	53.69-79.93 mm
Sandal Width, Mean	68.96 mm
Sandal Thickness, Range	10.27-15.86 mm
Sandal Thickness, Mean	13.37 mm
Pseudo-Warp/Weft Width, Range	3.30-5.35 mm
Pseudo-Warp/Weft Width, Mean	4.40 mm

Type VI: Unbalanced Simple Plaited (1/1), Weft frame

No. of Specimens: 1.

Type of Specimen: sole fragment with ties, 1.

Specimen Number: A17.

Types of forms represented: sandal (rigid), 1.

Technique and Comments:

The specimen, though fragmentary, is so unique in its construction that it warrants its own sandal type. It was constructed by simple plaiting (1/1 interval), and the warps and wefts engage one another at roughly 90° angles. Each strip is composed of *Yucca* sp. leaves, which are singular, flat, and very uniform in width. Because the wefts exhibit a 180° self selvage, and therefore are reincorporated back into the specimen, it can be determined that the full width of the specimen is represented. The specimen has 15 warps through which additional weft material is woven. The weft material, however, is not used

as a continuous element. The weft material does not continuously weave from side to side down the entire length of the sandal to its completion. In fact, after the transverse weaving has proceeded for at least three rows, the exhausted end of the weaving element is, at the outer edge of the sandal, secured to the previous weft row by tucking the end between the weaving. Instead of splicing new material behind an exhausted weft (laying in new splices), the transverse weft row is merely abandoned. A new weft row, completely separate and discontinuous from the previous section of weaving, is begun with a new piece of weft material (Figure 7.20). Because of the fragmentary condition of the piece, the toe and heel selvages cannot be determined. Only one piece of material can be assumed to represent part of the tie mechanism, which is looped around the side selvage of one weft element. The specimen is coated in an indeterminate type of lacquer.

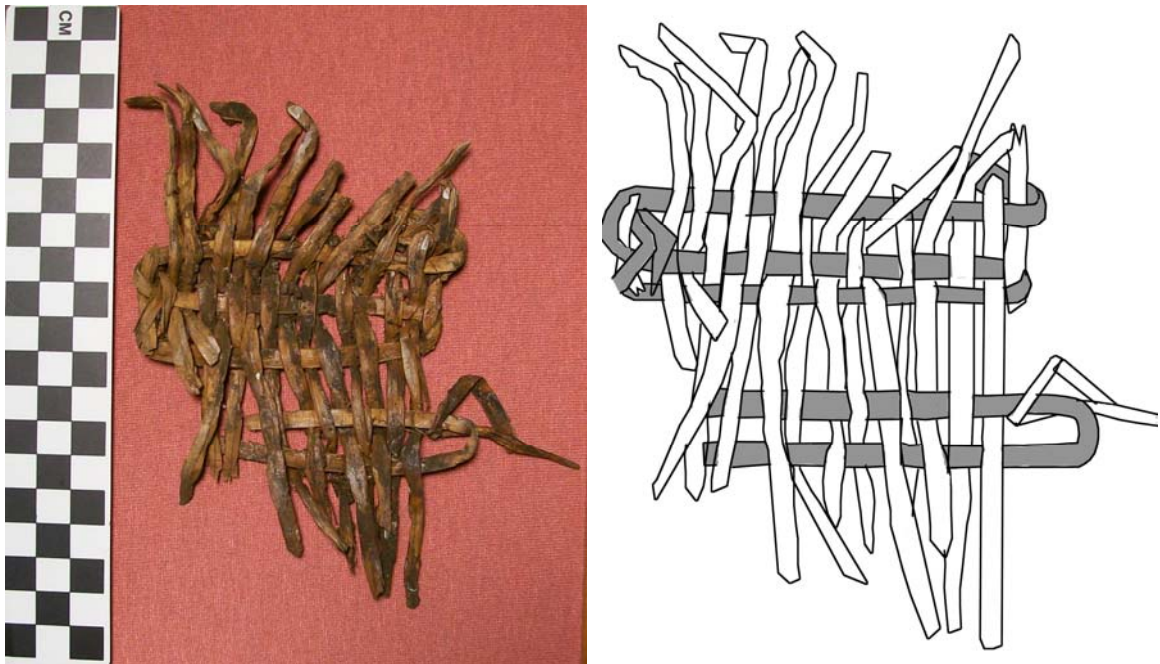


Figure 7.20. Kenton Caves Type VI Sandal, Specimen A17 with schematic (schematic by C.B. Graphic).

Measurements:

Sandal Length (incomplete), Range	121.91-130.38 mm
Sandal Length (incomplete), Mean	124.84 mm
Sandal Width, Range	81.90-120.31 mm
Sandal Width, Mean	97.99 mm
Sandal Thickness, Range	4.24-8.18 mm
Sandal Thickness, Mean	6.13 mm
Pseudo-Warp/Weft Width, Range	5.07-5.84 mm
Pseudo-Warp/Weft Width, Mean	5.58 mm

Type VII: Two-warp Pseudo-Twined

No. of Specimens: 2.

Type of Specimen: complete with ties, 2.

Specimen Numbers: A23 (child) and A24 (adult).

Types of forms represented: sandal (semi-flexible), 2.

Technique and Comments:

The specimens are complete sandals constructed by simple plaiting. The specimens were created using only two warps, around which the wefts were woven. Because only two warps were used, the wefts seem to create a figure-8 pattern as they are woven back and forth between the two stationary elements. There are no shifts in this pattern. The warps and wefts engage one another at roughly 90° angles. Each strip is composed of the same *Yucca* sp. raw material, a longitudinally split plant leaf. Technically, this process is not plaiting, as defined by Adovasio because not all of the elements are active (Adovasio 1977:99; Andrews and Adovasio 1980:27). Twining, with

its passive warps and active wefts (Adovasio 1977:15), is considered a more accurate descriptor for these sandals. However, the active elements do not engage the passive elements as in twining. Therefore, the type is referred to as pseudo-twined. Technically these specimens are plaited but appear to resemble twining. This type of plaiting is often referred to as wickerwork. The weaving of the pseudo-wefts proceeds from heel to toe and forms 180° self selvages along the sides of the sole (Figure 7.21). In this documented style, when the moving end of an individual weft element is exhausted, it is simply tucked between the immediately preceding weft rows and left to protrude beneath the sole. This characteristic trait allows for increased traction and sandal durability in rough terrain. Sandals with this feature of construction are deemed “traction masters” (Figure 7.22, right). The tie mechanism, which protrudes from each side of the sandal, was created as the sandal was created and was not added afterwards. The tie mechanism found on the Kenton Caves Type VII sandals is identical to that found on Cosgrove’s Type 4b and 5a sandals (see Figure 7.22). Towards the toe and heel ends of the sandal, the raw material that comprises the warps is divided into two sections. At the heel, one section continues to act as the warp, while the other section becomes an element of the tie mechanism. At the toe, the now loose material is knotted together to form a toe loop. The now loose material near the heel, protruding from both sides of the sandal, is affixed to this toe loop with multiple knots (Figure 7.24). Based on size and wear, it can be stated with confidence that both the child and adult versions of this type are represented. Both specimens are full length sandals as opposed to shortened scuffer toe forms, in which the sole merely covers the ball and toe of the foot. Therefore, the measurements for the adult

and child sandals have been recorded separately. Both specimens are coated with an indeterminate type of lacquer.



Figure 7.21. Kenton Caves Type VII Sandals, Specimen A23 (left) and A24 (right).

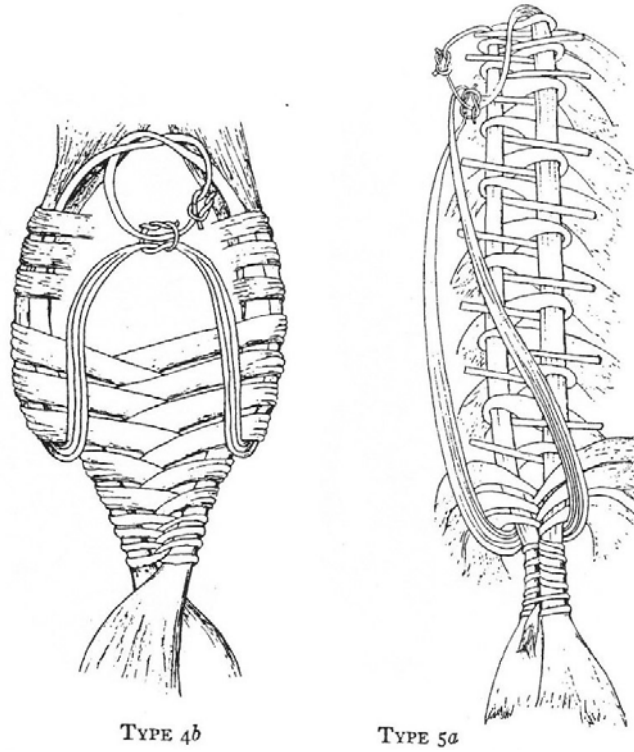


Figure 7.22. Schematic drawings of tie mechanisms and traction masters found on Cosgrove's Type 4b and 5a Two-Warp Fish-tail sandals (adapted from Cosgrove 1947: Figure 90).

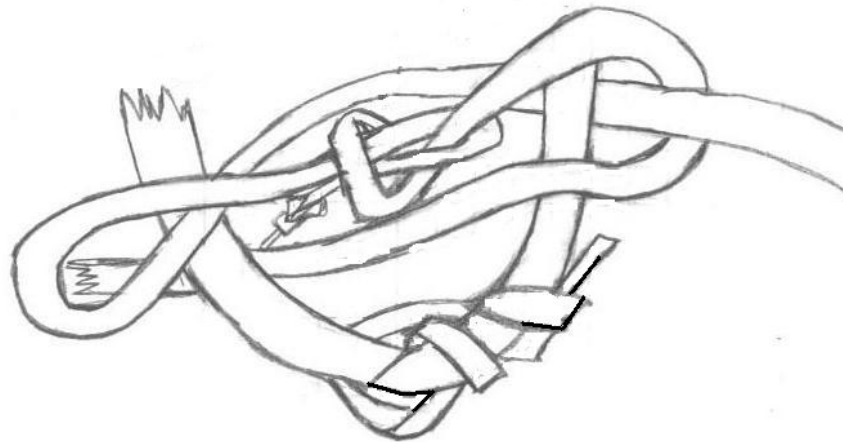


Figure 7.23. Kenton Caves Type VII Sandal Specimen A24, schematic of knot employed in tie mechanism.

Both specimens are made in a similar fashion to C. B. Cosgrove's (1947) 2c, 4b, and 5a sandal types from the Gila and Hueco Mountains. His diagrams illustrate exactly how these sandals have been constructed and, specifically, how the tie mechanism is created (Cosgrove 1947: Figure 90) (see Figure 7.22). This type is also similar to the dominant sandal type from Pendejo Cave (Hyland 1997:232). All appear to be coarse and somewhat crudely made in comparison with the similarly manufactured four-warp scuffer toe sandals of the same sites. They are also all made from heel to toe. The major differences between specimens from adjacent regions and the Kenton Caves Type VII sandals are in the form (full-length vs. scuffer toe) and the finishing technique of the toe and heel. While the Pendejo versions are reportedly finished by providing the warps with an S-twist, this characteristic is not seen in the Kenton Caves specimens. The warps of the Kenton Caves sandals are merely shredded and frayed, with no twist applied.

Measurements:

Child sandal (A23):

Sandal Length, Range	143.50-156.98 mm
Sandal Length, Mean	148.43 mm
Sandal Width, Range	64.78-71.12 mm
Sandal Width, Mean	67.19 mm
Sandal Thickness, Range	19.68-25.31 mm
Sandal Thickness, Mean	22.70 mm
Pseudo-Weft Width, Range	1.99-3.04 mm
Pseudo-Weft Width, Mean	2.51 mm

Pseudo-Weft Unit Width, Range	6.53-10.55 mm
Pseudo-Weft Unit Width, Mean	8.42 mm
Warp Width, Range	ind.
Warp Width, Mean	ind.

Adult sandal (A24):

Sandal Length, Range	240.79-267.34 mm
Sandal Length, Mean	251.02 mm
Sandal Width, Range	83.55-107.28 mm
Sandal Width, Mean	97.57 mm
Sandal Thickness, Range	12.94-21.33 mm
Sandal Thickness, Mean	16.15 mm
Pseudo-Weft Width, Range	2.85-3.40 mm
Pseudo-Weft Width, Mean	3.12 mm
Pseudo-Weft Unit Width, Range	8.92-15.08 mm
Pseudo-Weft Unit Width, Mean	12.30 mm
Warp Width, Range	ind.
Warp Width, Mean	ind.

Type VIII: Four-warp Pseudo-Twined (sub-types A and B)

No. of Specimens: 2.

Type of Specimen: toe fragment without ties, 2.

Specimen Numbers: DU 824 and DU 825.

Types of forms represented: sandal (semi-flexible), 1; sandal (flexible), 1.

Technique and Comments:

The specimens are complete sandals that are constructed by simple plaiting. The warps and wefts engage one another at roughly 90° angles. Each strip is composed of the same *Yucca* sp. raw material, a longitudinally split plant leaf. These sandals were created with the same pseudo-twined (wickerwork) sole as that discussed for the Kenton Caves Type VII sandals. However, the Kenton Caves Type VIII sandals utilize four warps instead of two warps (Type VII). The weaving of the pseudo-wefts proceeds from heel to toe and forms a 180° self selvage along the sides of the sole. However, due to the fragmentary condition of these specimens, specifically the absence of the majority of the arch and the entire heel, it can only be assumed that construction took place from heel to toe as in the Type VII specimens. Only specimen DU 824 exhibits the traction master characteristic. Because DU 825 merely consists of the upper toe portion of a sandal (at which point traction masters would not necessarily have been present), it cannot be determined whether, when complete, a traction master may have existed on the sole. It is indeterminate whether these specimens represent full-length sandals or scuffer toe sandals. Only DU 824 appears to have been coated with an indeterminate type of lacquer.

DU 824: Though not wholly dissimilar to the Cosgrove (1947:Type 1a and 1b) and Pendejo Cave (Hyland 1997) versions of the four-warp pseudo-twined sandal, the layout of the specimen's warps do deviate from previously documented specimens. In the aforementioned types, only three strands of material are used to create the warps. One strand is used to create the two outer warps (in an upside down U shape). Then two

additional strands are used to create the inner warps, each tied separately to the previously mentioned single strand (tied to the base of the U). Work proceeds heel to toe and the tie mechanism is affixed, with additional strands of material punctuating the inner two warps to create a toe loop. Additional material is then tied to either side of the sandal and knotted to the toe loop (Cosgrove 1947; Hyland 1997). However, in DU 824, four strands are used to create the warps. The inner two warps are knotted together and are not affixed to the outer warps. Once tied together, these two warps provide the material for the toe loop of the tie mechanism (Figure 7.24). Due to the fragmentary condition of this specimen, it cannot be determined whether additional material was used to affix side loops to complete the tie mechanism. The toe selvage of this specimen was created by the manipulation of the warps. The obverse left warp extends up to and across the toe and is affixed to the obverse right warp with a square knot. The final weft rows weave around this element until exhausted and are tucked into preceding rows.



Figure 7.24. Kenton Caves Type VIII Sandal, Specimen DU 824 (schematic by C.B. Graphic).

DU 825: Despite its fragmentary condition, it can be discerned, based on the uniquely embellished toe finish, that this specimen was also constructed from heel to toe. This embellishment begins at the obverse right of the sandal and is finished at the obverse left where the material is looped and affixed around the obverse outer left warp. The embellishment was most likely not added on after the creation of the entire sandal, but was created as the construction proceeded. In order to create and begin the embellishment at the obverse right side selvage, it is likely that new weft elements would have been added for each or at least every other weft row at the toe end. The addition of new material would have been necessary because the ends of the weft rows are used to create a twisted side selvage. This Z-twisted selvage does not lie above the entire construction and does not hang loose; it is completely incorporated into the tight weave of the sandal sole. At the center of the toe end, no more weft rows could be created, and therefore the material, which had previously been used in the selvage twist, hangs loose and unused. It is at this point that the weaver begins the task of affixing the embellishment to the obverse outer left warp (Figure 7.25). Unfortunately, no additional detail can be extracted from this specimen due to its extremely fragile condition.



Figure 7.25. Kenton Caves Type VIII Sandal, Specimen DU 825.

Measurements:

Sandal Length (incomplete), Range	N/A
Sandal Length (incomplete), Mean	N/A
Sandal Width, Range	98.56-116.42 mm
Sandal Width, Mean	110.31 mm
Sandal Thickness, Range	9.06-18.91 mm
Sandal Thickness, Mean	12.40 mm
Pseudo-Warp Width, Range	5.95-6.96 mm
Pseudo-Warp Width, Mean	6.38 mm
Pseudo-Weft Width, Range	3.02-6.72 mm
Pseudo-Weft Width, Mean	4.88 mm

Type IX: Buffalo hide sandal

No. of Specimens: 1.

Type of Specimen: complete with ties, 1.

Specimen Numbers: 5119.

Types of forms represented: sandal (semi-flexible), 1.

Technique and Comments:

This specimen is complete and made entirely of animal hide (buffalo). It appears to have been constructed out of only one piece of hide. No seams or sewing elements beyond the tie mechanism are apparent. The hair was only removed from one side of the hide prior to construction. This scraped side of the hide was used as the outside of the sandal. The inside of the sandal still retains buffalo hair, and, most likely, was intentionally done so to provide cushioning and insulation for the foot. Multiple holes were created in the hide (along both sides and at the toe) to create a foundation for the tie mechanism. An additional piece of hide was strung through these holes as a pseudo-drawstring. The ends of this strand were then pulled tight and tied together with a sheet bend in front of the ankle (Figure 7.26).



Figure 7.26. Kenton Caves Type IX Sandal, Specimen 5119.

Measurements:

Sandal Length, Range	N/A
Sandal Length, Mean	228.39 mm
Sandal Width, Range	120.93-132.34 mm
Sandal Width, Mean	126.09 mm
Sandal Thickness, Range	12.97-20.42 mm
Sandal Thickness, Mean	17.11 mm

Trinchera Cave

Type I: Two Warp Pseudo-Twined, scuffer toe

No. of Specimens: 1.

Type of Specimen: heel fragment without ties, 1.

Specimen Number: 221A.

Types of forms represented: sandal (rigid), 1.

Technique and Comments:

The specimen is an extremely fragmentary sandal, constructed by simple plaiting. The specimen is created using only two warps, around which the wefts are woven. Because only two warps are used, the wefts seem to create a figure-8 pattern as they are woven back and forth between the two stationary elements. There are no shifts in this pattern. The warps and wefts engage one another at roughly 90°. Each strip is composed of the same *Yucca* sp. raw material, a longitudinally split plant leaf. Technically these specimens are plaited but appear to resemble twining and are a form of wickerwork. The weaving of the pseudo-wefts proceeds from heel to toe and forms a 180° self selvage along the sides of the sole. At the heel, the two warps come to a point cross, creating a “wishbone” or Y shape. This orientation suggests the creation of a fishtail heel (Figure 7.27). It is indeterminate how the final weft elements were affixed after the fishtail was created, but based on other documented styles, the weft elements were most likely wrapped tightly around or woven between both wefts and secured by tucking them under preceding rows or affixing them with a knot. However, due to the fragmentary nature of this specimen, it can only be assumed that its construction would follow this previously documented process. It is also indeterminate whether this specimen was a traction master.

The construction of the toe can also only be suggested to follow similarly documented techniques including a twisting of the warps, merely allowing the exhausted material to lie loose, or by twisting and knotting the material into a toe loop. Though most likely worn by an adult, the sole of the sandal would have only covered the upper toe portion of the foot, which would identify this specimens as a scuffer toe sandal. Due to the fragmentary condition of the specimen, it could not be determined whether the sandal had been worn on the right or left foot. It is likely that if complete this specimen would match up nicely with both the specimens from Pendejo Cave and the caves of the Gila and Hueco Mountains, as previously discussed with regard to the Kenton Cave Type VII two-warp sandals. As with the Pendejo Cave sandals, the two-warp version appears to be coarse and somewhat crudely made in comparison with the similarly manufactured four-warp scuffer toe sandals of the same site.



Figure 7.27. Trincherá Cave Type I Sandal, Specimen 221A.

Measurements:

Sandal Length, Range	133.64-140.65 mm
Sandal Length, Mean	137.52 mm
Sandal Width (at Toe), Range	97.27-98.26 mm
Sandal Width (at Toe), Mean	97.77 mm
Sandal Width (at Heel), Range	27.51-33.11 mm
Sandal Width (at Heel), Mean	30.31 mm
Sandal Thickness, Range	3.88-9.18 mm
Sandal Thickness, Mean	6.38 mm
Pseudo-Warp Width, Range	4.06-7.41 mm

Pseudo-Warp Width, Mean	6.31 mm
Pseudo-Weft Width, Range	4.54-5.86 mm
Pseudo-Weft Width, Mean	5.14 mm

Type II: Four-Warp Pseudo-Twined

No. of Specimens: 5.

Type of Specimen: complete with ties, 2; sole fragment with ties, 2;
sole fragment without ties, 1.

Specimen Numbers: 21B, T5-4-2, 780, 789, and 945.

Types of forms represented: sandal (flexible), 3; (rigid), 2.

Technique and Comments:

The specimens consist of complete and fragmentary sandals, constructed by simple plaiting with a 1/1 interval; no shifts in this patterning are present. Four warps are utilized in the creation of these sandals. The warps and wefts engage one another at roughly 90° angles. Each strip is composed of the same *Yucca sp.* raw material, a longitudinally split plant leaf. The leaves are singular, flat, and of uniform width. Technically these specimens are plaited but appear to resemble twining. All of the specimens are traction masters. Only two sandals are complete (though 789 is heavily mended and T5-4-2 is burnt considerably at the heel) and display toe and heel finishes (Figure 7.28). T5-4-2, constructed from heel to toe, has a heel finish that was constructed by applying an S-twist to the warps. However, this can only be seen on the obverse right warp because the remainder of the heel has been burned. The toe finish was created in a similar fashion. After all of the weft rows had been created, the remaining unused warp strands are bent to the obverse right and are S-twisted together. The obverse left warp and

the left center warp begin the twist and are subsequently joined by the right center warp when the twist reaches it, and so on. After including the final warp in the twist, the group of warps was affixed to the obverse right side loop with an overhand knot. The toe and heel finish exhibited on T5-4-2 is the same as that employed on 789 for both its toe and heel (see Figure 7.28). All of the Trincheria Cave Type II specimens are adult sandals. Sidedness could only be determined for specimens 21B (Left), T5-4-2 (Right), and 789 (Right). Though only two complete full-length specimens exist, it is assumed that the remaining specimens were also full-length sandals.



Figure 7.28. Trincheria Cave Type II Sandals, Specimen T5-4-2 (left) and 789 (right).

All of the specimens exhibit tie mechanisms, and all tie systems include side loops. The most complete tie systems are found on the most complete specimens of this

type (T5-4-2 and 789) (see Figure 7.28). Both tie systems are side-loop tie systems. Three side loops are present on each side, which run the length of the entire sandal. The tie mechanism on T5-4-2 also exhibits the use of additional raw material. Some raw material strands are used to tie the uppermost side loops together to create a toe loop, while others cross over the foot, alternating from one side of the foot to the other (diagonally), connecting the side loops to create a lattice-like pattern across the foot. It is assumed that similar raw material would have also been present on specimen 789, because side loops alone would not keep the sandal on the foot. However, no remnants of the additional material exist. The tie mechanism on specimen 780 varies somewhat from that found on specimen T5-4-2 in regards to the additional material that ties the side loops together. In the tie mechanism found on specimen 780, the additional raw material crosses the foot from one side of the foot straight to the other, as opposed to diagonally (as in specimen T5-4-2) (Figure 7.29). This tie would have most likely existed at the instep and was tied directly in front of the ankle. However, it is also likely that other ties existed on this specimen, whether across the toes or around the heel.



Figure 7.29. Trinchera Cave Type II Sandal, Specimen 780.

Type II specimen #789 was the only specimen that displayed any evidence of mending. Additional pieces of raw material were inserted into the weave and were used to wrap, longitudinally, multiple sets of weft elements together and secure them. This mending is noticeable at both the toe and heel of the sandal (see Figure 7.28). This sandal shows extensively wear.

Measurements:

Sandal Length, Range	129.70-255.66 mm
Sandal Length, Mean	197.14 mm
Sandal Width, Range	85.68-143.75 mm
Sandal Width, Mean	111.76 mm

Sandal Thickness, Range	7.79-16.95 mm
Sandal Thickness, Mean	11.73 mm
Pseudo-Warp Width, Range	4.14-8.63 mm
Pseudo-Warp Width, Mean	6.25 mm
Pseudo-Weft Width, Range	2.79-7.70 mm
Pseudo-Weft Width, Mean	5.29 mm

Type III: Weft-faced/Unbalanced Plainweave

No. of Specimens: 2.

Type of Specimen: toe fragment with ties, 1; sole fragment with ties, 1.

Specimen Numbers: 21A and No # C.

Types of forms represented: sandal (semi-flexible), 2.

Technique and Comments:

The specimens are fragmentary sandals that are constructed by simple plaiting. In this type, the weft elements can be seen more predominantly and can altogether mask the warp elements. Therefore, the weave is considered unbalanced. The sandals are created with four warps. The warps and wefts engage one another at roughly 90° angles with a 1/1 interval. Each strip is composed of *Yucca* sp. leaves, which are singular, flat (before twisted by weaving), and are uniform in width. Self-selvages of the 180° variety were utilized to secure the material at each side of the sandal. As in the previous type, all of the Trincheria Cave Type III specimens are traction masters. Both specimens exhibit partial tie mechanisms in the form of tying elements. The most complete tie, found on specimen 21A exhibits both toe and side loops that are connected with untwisted raw material. The toe finish for this specimen, masked by the tie mechanism, is the same technique as that

utilized in the Trinchera Cave Type II sandals. However, the warps are S-twisted towards the obverse left. Due to the deterioration of the specimens, it is indeterminate how these twisted warps were secured (Figure 7.30). Both of the Type III specimens are adult right sandals.



Figure 7.30. Trinchera Cave Type III Sandal, Specimen 21A.

Measurements:

Sandal Length, Range	N/A
Sandal Length, Mean	N/A
Sandal Width, Range	82.94-116.94 mm
Sandal Width, Mean	98.95 mm

Sandal Thickness, Range	11.03-16.27 mm
Sandal Thickness, Mean	13.73 mm
Pseudo-Warp Width, Range	5.64-7.46 mm
Pseudo-Warp Width, Mean	6.27 mm
Pseudo-Weft Width, Range	4.17-9.42 mm
Pseudo-Weft Width, Mean	6.38 mm

Type IV: Rabbit skin sandal

No. of Specimens: 2.

Type of Specimen: complete with ties, 1; complete without ties, 1.

Specimen Numbers: 794 and No # B.

Types of forms represented: sandal (flexible), 1; sandal (rigid), 1.

Technique and Comments:

The specimens are complete sandals that are constructed with both animal and plant materials. Two pieces of rabbit hide are sewn together with Z-twist cordage to create the sole of each sandal. The sandals were then filled with loose shredded fibers. Multiple holes or eyelets are present down the length of each side of the sole to allow for side loops (made of cordage) to be inserted. These loops were created using only one long strand of cord. Untwisted plant fiber was then used to cross over the foot, alternating from one side of the foot to the other (diagonally), connecting the side loops to create a lattice-like pattern across the foot. This type of sandal most likely represents a “winter” sandal based on the large amounts of shredded fiber that are incorporated into sandal for insulation and the use of durable hide for the sole. No # B does not display as many striking sandal characteristics as specimen 794, but the presence of eyelets in the

leather, remnant sewing material (including three square knots), and a leather sole filled with shredded fibers suggest its function as a sandal (Figure 7.31). Both of the Type IV sandals are sided as adult lefts.



Figure 7.31. Trincheria Cave Type IV Sandals, Specimen 794 (left) and No # B (right).

Measurements:

Sandal Length, Range	239.57-257.44 mm
Sandal Length, Mean	247.46 mm
Sandal Width, Range	98.80-127.71 mm
Sandal Width, Mean	116.14 mm
Sandal Thickness, Range	20.14-22.78 mm
Sandal Thickness, Mean	21.46 mm
Plant Fiber Tie Element Width, Range	4.91-6.85 mm (794 only)

Plant Fiber Tie Element Width, Mean 5.44 mm (794 only)

Type V: Moccasin

No. of Specimens: 2.

Type of Specimen: toe fragment, 1; sole fragment, 1.

Specimen Numbers: 41 and No # A.

Types of forms represented: moccasin (flexible), 2.

Technique and Comments:

The specimens are fragmentary moccasins that were constructed by sewing multiple pieces of treated hide (sp. unknown). The dimensions of the final products are unknown but their use, based on material type, shape, and treatment, is undeniable. The moccasin toe (No # A) was constructed by overlaying and sewing five pieces of leather together with Z-twist cordage. Additionally, two overhand knots (one at each toe corner) were used to secure these multiple pieces (Figure 7.32). Specimen 41 is a moccasin sole fragment. Based on the clean unfrayed edges of the piece, it appears as if this sole exceeded its usefulness and was cut from the moccasin and a new sole was attached to the moccasin's upper (see Figure 7.33). Both of the Type V moccasins are sided as adult lefts.



Figure 7.32. Trinchera Cave Type V Sandal, Specimen No # A. Moccasin.



Figure 7.33. Trinchera Cave Type V Sandal, Specimen 41. Moccasin.

Untyped: Indeterminate Plaited Sandal and Probable Rabbit Skin Sole

No. of Specimens: 2.

Type of Specimen: complete sandal indet. presence of ties, 1; toe fragment with ties, 1.

Specimen Numbers: “Hal Chase sandal” and No # E

Types of forms represented: sandal (indeterminate flexibility), 2.

Technique and Comments:

Only Xeroxed photos provide evidence for the existence of these specimens. The descriptions that follow are not the result of physical examination of the specimens, but of the analysis of the images. Based on the cohesiveness of the Trinchera Cave sandal assemblage and the fact that the majority of the sandals were produced with four warps, it is likely that the plaited sandal, designated as the “Hal Chase” sandal, was constructed in a similar fashion to at least one of the previously described types. This complete specimen also appears to have a layer of padding. The padding does not appear to have any discernable patterning (oriented warps or wefts), and may merely be shredded or matted grasses (sp. indet.). Due to the nature of the black and white photograph, it is unclear whether this specimen displayed any evidence of burning or charring. No tie mechanism is discernable. The dimensions of the specimen can only be estimated (Length:220 mm; Width:115 mm) (Figure 7.34).



Figure 7.34. Trinchera Cave Untyped Sandal, “Hal Chase” Specimen.

The second untyped sandal (No # E) is a toe fragment of a probable rabbit skin sandal (Figure 7.35). There does not appear to be any horizontally, vertically, or obliquely oriented warps or wefts which would have provided a frame upon which weaving could proceed. However, the tie system provides evidence that this sandal was produced with a hide sole (most likely rabbit skin based on the Trinchera Cave Type IV sandals in the collection) and stuffed with loose frayed grasses (sp. indet.). Toe and side loops appear to have been created using untwisted plant fiber strands, which were probably similar in raw material, preparation, and dimensions to those utilized in the creation of Type IV specimen #794. Specimen No # E is unique in that it is the only other sandal in this collection that shows the use of cordage besides rabbit skin sandal (Type IV) #794. However, as opposed to sandal #794, the cordage present on this specimen is not utilized in lashing two pieces of hide together, but is incorporated into the tie system. The cordage was used as the fastening element, weaving in and out of the toe and side loops in order to secure the sandal to the foot. The sandal padding would have provided

insulation and/or cushioning, which is also present on the other Type IV rabbit skin sandals. The width of the sandal is estimated to be 120 mm; the length is indeterminate. Other than inclusion in the comparison of type frequency, this specimen was not utilized in the reported statistical comparisons and results. The “Hal Chase” sandal was also not utilized in the reported statistical comparisons and results. It could not be determined definitively whether either of the untyped sandals were worn on the left or right foot. However, specimen No #E is most likely an adult left.



Figure 7.35. Trinchera Cave Untyped Sandal, Specimen No # E.

Radiometric and Statistical Analysis

The radiometric and statistical analyses were completed in order to test the viability of the typological categorization of the sandal types and compare their technology between the three sites of the Southern High Plains and to the technology of the adjacent “basketmaking regions.” The results of the radiometric analysis provide direct evidence for the antiquity of the perishable collections from the Southern High Plains. They also provide the ability to track the developmental sequence of their perishable technology therein. The radiocarbon ages were calibrated based on the INTCAL04 database. Calibrations were provided by Beta Analytic. However, radiocarbon ages provided by the University of Arizona AMS Laboratory were calibrated by the author using the CALIB 5.0 program (Stuiver et al. 2005), which is based on the INTCAL04 database. By comparing the calibrated radiometric ages of each sandal type, noticeable changes in sandal production technology are easily identified, which may point to changes in population composition of the local “community of practice.” Age dating also provides the means for demonstrating what technology was present at each cave at the same time and over time in order to help determine the direction from which specific sandal technology and types may have spread from one area to another.

The statistical analysis provided a quantitative method for determining the similarity or difference between the collections and their similarity or difference to other known collections. By comparing the sandal technology at each individual site and the overall technological development of the Southern High Plains to those of adjacent regions, changes in technology could be attributed to influence by particular areas.

Despite the fact that the sandals had already been divided into technological types, the sandals were first analyzed statistically using ANOVA tests, as if they all belonged to a single type. This was done in order to see if the statistical groupings that were identified were different from groupings that were determined typologically and to see if any new groupings would be identified. ANOVA tests were then used within each type to determine the similarity of the sandals within each type, and the likelihood that multiple sandals were made by the same genetic population, the same family of weavers, or even the same individual weaver. Each statistical test and result is discussed within the Internal and External Correlations sections of Chapter 7 as deemed relevant, and the individual tests can be found in Appendix C.

It is important to note that the majority of sandal researchers (Connolly and Barker 2004; Cosgrove 1947; Hays-Gilpin et al. 1998; Hyland 1997; Jennings 1980; Lindsay 1968; Martin et al. 1952; McBrinn 2005; Taylor 1966, 1988; Turpin 2003; Turpin and Carpenter 1994a, 1994b; Webster 2007) whose work was utilized as valued resources for the writing of this thesis, simply report simple frequencies. In McBrinn (2005:61), for example, due to the small sample size of the sandal collections studied (185 sandals reported from Bat Cave, Tularosa Cave, Cordova Cave, and Fresnal Shelter) and the large degree of variation exhibited by those sandals, statistical techniques were not (could not be) used to test for significant trends. In comparison to their studies, in particular the 923 sandals studied by Cosgrove (1947) at Ceremonial Cave and the 959 sandals studied by Taylor (1966) at Frightful Cave, my sample size of 32 sandals (from Franktown Cave, Trinchera Cave, and the Kenton Caves) is small. However, the conclusions drawn from the statistical tests are significant. The results of the statistical

analysis provide additional support for the conclusions garnered from the typological and radiometric analyses.

Internal Correlations

Franktown Cave

Technology

Six specimens comprise the sole plant fiber sandal type from Franktown Cave. However, two variants of the basic sandal type were produced and used by the aboriginal visitors to Franktown Cave. All six specimens are constructed by adding longitudinal and transverse weaving elements to a “rectanguloid loop frame,” which are plaited in a 1/1 interval pattern and utilize continuous self selvages (Adovasio et al. 2005:7). Lateral ties were secured to the sole by a series of half-hitch knots. Two additional ties are also present, including one that passed around the heel and over the instep and a tie at the toe. Both of these additional ties are looped through the lateral ties. The heel and toe ties are constructed so that pressure on the free ends would pull the sandal snugly to the foot. According to Adovasio, “the heel ties probably rested directly on the calcaneum which would have aided in securing the sandal to the foot” (Adovasio et al. 2005:10). For a more detailed description of the sandal construction and tie mechanism creation see Appendix D.

While both plant fiber variants share the same basic sole construction attributes and both are simple plaited, certain differences do exist between these forms. The "heavier" form is represented by specimens #546, #509, #588, and #462 and the "lighter"

form is represented by specimens #501 and #858 (Adovasio et al. 2005:14; Thompson 1958:14-15).

The most distinctive feature of the heavier form is the presence of a grass sock and related attributes such as a heel pad and more complex toe ties used to hold it in place or secure it. These provisions allow for the sandal to be put on or removed without the sock collapsing or losing shape. Other unique features of the heavier form include the use of paired Yucca sp. leaves for warps and wefts with a different frequency of those elements than in the lighter variant. The heavier variant has more wefts (following Adovasio and Illingworth) or warps (following Thompson) than the lighter form and also exhibits two long loops on either side of the sole which serve to provide additional stabilization for the sock. Finally, the heavier form exhibits additional material interlaced into the contact portion of the sole to form pads which may have enhanced traction or provided superior wear or, perhaps, extra insulation.

The lighter variant is characterized by the absence of a grass sock and less complex toe ties. It also lacks doubled elements and additional padding. As the name implies, it is a less-substantial construction than its counterpart. (Adovasio et al. 2005:15)

Thompson (1958) and Adovasio and Illingworth (Adovasio et al. 2005) agree that the heavier variant was probably intended for winter or cold weather use, while the lighter variant was utilized predominantly in warmer seasons. There was no evidence of mending on any of the specimens. Though some specimens show extensive wear, there was no indications of the type of wear associated with Morton's foot (cf. Andrews et al. 1986) or any other foot pathologies. Only four of the Franktown Cave sandals can be designated or sided as having been worn on the right or left foot. The collection is comprised of three adult rights (TOM-462, TOM-501, and TOM-588) and an adult left (TOM-858). No children's sandals were recovered.

A single complete moccasin comprises the sole type of hide footwear from Franktown Cave. The specimen is a complete moccasin that was constructed by sewing three pieces of treated hide (sp. unknown). The moccasin has a reportedly similar heel closure seam to the Eastern Woodlands and some one-piece Plains moccasins (Conn

1983; Gilmore 2005a, 2005b). The buttonhole present on the moccasin implies closure utilizing a button or thong. The sole is worn through from use, but it has been determined that the moccasin is an adult right. A buffalo hide legging is also present in the Franktown Cave collection (Figure 7.36), which has a comparable date range to the moccasin [926 +/- 30 B.P. (2-sigma range A.D. 1025-1187)] (Gilmore 2005a, 2005b; King 2006).

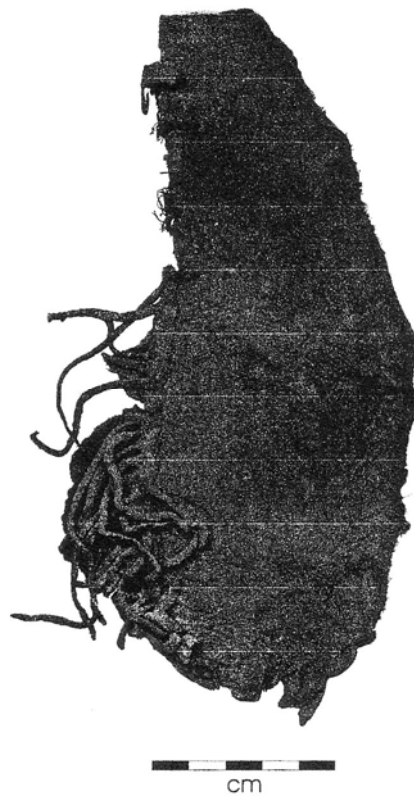


Figure 7.36. Buffalo hide legging (Gilmore 2005a).

In order to test the cohesiveness and soundness of the typological grouping, the plant fiber sandals were compared statistically. ANOVA tests were utilized in order to test the variation between the metric data reported for each sandal within the sole type

(Rowntree 2004). The results of these tests indicated that the heavier variants are statistically different from the lighter variants in regard to weft and warp diameter. These results reaffirm the typological determination that two different variations of the same sandal type exist. The statistical tests also indicated that heavier variant specimens TOM-462 and TOM-588 are more statistically similar to one another, in regard to weft and warp diameter than they are to the remaining two heavier variant forms (TOM-546 and TOM-509). Heavier variant specimens TOM-462 and TOM-588 have warp and weft diameters that are statistically the same ($\alpha=0.05$; $F=4.92 < F \text{ crit}=5.32$) (Appendix C). The differentiation between these two groups of heavier forms may be due to the more fragmentary condition of specimens TOM-546 and TOM-509, and that specimens TOM-462 and TOM-588 are portions of the sandal toe, while specimens TOM-546 and TOM-509 are sole fragments. No internal groupings could be discerned within the “lighter” variant sample.

Raw Materials

Both variants of plant fiber sandal were constructed exclusively of *Yucca* sp. leaves. The type of grass employed for the socks in the heavier form is unknown. The moccasin is composed of buffalo hide and sewn with, presumably, buffalo sinew.

Chronology

Fragments of all six Franktown Cave plant fiber sandals and the single hide moccasin were directly dated via AMS assay (Table 1). All of the dates for the plant fiber sandals overlap and cluster in the late fourth millennium cal B.C. and are essentially contemporaneous with the reported dates for the early coiled basketry (Adovasio et al.

2005: Table 2; see Appendix D). However, the moccasin dates to the Terminal Ceramic period and is the only footwear specimen attributable to later occupations of Franktown Cave (Gilmore 2005a, 2005b, King 2006). The presence of a single plant fiber sandal type at Franktown Cave and the relatively close statistical and radiometric clustering of the sandals' attributes clearly supports the proposition that the population(s) using Franktown cave for this ~200 year period were probably closely related and culturally conservative. The later appearance of the moccasin indicates a change in the cultural affiliation of the occupants of Franktown Cave.

Table 1. Temporal Ascription of Sandal Specimens from Franktown Cave (adapted from Adovasio et al. 2005:Table 4; Lab designations not provided)

Type	Type Designation	Id #	AMS years (B.P.)	Calendar Years (cal.)
I	Simple 1/1 Plaited (Lighter Variant)	TOM-501	4485+-36	3345-3033 B.C.
I	Simple 1/1 Plaited (Lighter Variant)	TOM-858	4392+-37	3260-2906 B.C.
I	Simple 1/1 Plaited (Heavier Variant)	TOM-509	4492+-37	3348-3054 B.C.
I	Simple 1/1 Plaited (Heavier Variant)	TOM-546	4465+-36	3343-3018 B.C.
I	Simple 1/1 Plaited (Heavier Variant)	TOM-462	4363+-54	3307-2882 B.C.
I	Simple 1/1 Plaited (Heavier Variant)	TOM-588	4328+-34	3020-2884 B.C.
II	Moccasin	3505	996 +/- 30	A.D. 983-1157

The Kenton Caves

Technological Pattern of Sandal Types

The Kenton Caves Type II and III sandals are the most common sandal varieties (n=5 or 25% of the sample for each type). It is intriguing that these sandal types, which have not been reported previously are the dominant types at this site. Types IV, VII, and VIII have an equal distribution as well (each with n=2; 10% of the samples). The rarest types in the Kenton Caves collection, Types I, V, VI, and IX are only represented by a single specimen (each represent 5% of the sample). Approximately half of the Kenton Caves sandals are side-specific with six adult rights (Type II [n=2]; Type III [n=2]; Type VII [n=1]; Type IX [n=1]), and four adult lefts (Type I [n=1]; Type II [n=2]; Type VIII [n=1]). The assemblage also includes a child's right (Type VII [n=1]). Nine sandals could not be designated as having been worn on the right versus left foot (Type II [n=1]; Type III [n=3]; Type IV [n=2]; Type V [n=1]; Type VI [n=1]; Type VIII [n=1]). None of the sandals exhibit wear attributable to genetic anomalies like "Morton's foot" or other foot pathologies (cf. Andrews et al. 1986:121).

While all of the plant fiber sandals are plaited in the technical sense, two different categories of plaiting are represented. Types VII and VIII are pseudo-twined with two (Type VII) or four (Type VIII) longitudinal warps, around which the transverse weft elements are woven. Though superficially similar to twining, due to the ratio of wefts to warps and the more "passive" role of the warps around which the "active" wefts are woven, the pseudo-wefts still cross over and under the pseudo-warps in simple plaiting fashion without any additional engagement (Hyland 1997:237). This form of plaiting is sometimes referred to as wickerware or wickerwork (cf. Adovasio 1977:106). In addition,

the exhausted ends of the transverse plaiting elements in the Types VII sandals and Type VIII specimen #824 are intentionally left protruding from the sole, to a greater or lesser degree. These protruding elements are typically termed a traction master. Sandal Types I, II, and III are produced by more conventional plaiting techniques in which the crossing elements are functionally equal. That is, they are of the same size, number, and appearance. However, Type III sandals are made with a rotated or oblique weave. Though the weaving elements cross one another at 90° angles, the weave does not proceed along the more common longitudinal and transverse pathways; it is rotated to a 45° angle. The weaving elements in fact, are also paired (40%) or trebled (60%). Sandal Type IV, V, and VI are produced by a plaiting technique in which one of the crossing elements is more robust than the other. That is, they are of unequal size and appearance.

The Kenton Caves sandal collection is dominated by sandal types created with multiple warps (8+ warps), though two warp and four warp sandals do exist. Multiple warp sandals are represented by Types I-VI. Type VII sandals are created with two warps, and Type VIII sandals are created with four warps. The Type IX buffalo hide sandal does not have warps or wefts or any incorporated plant fiber materials.

It is possible that the Type IV specimens are Type V specimens due to the utilization of bent warps. However, due to the fragmentary condition of the Type IV specimens it cannot be determined whether a series of bent elements (1 piece creating two warps) were used, or whether one continuous strips of material was used to create all of the warps (as in Type V).

Side selvages for the majority of the sandal types are of the 180° self type except for the Type III sandals, which have 90° self selvages. The toe and heel selvages, as well

as the toe and heel silhouettes vary greatly. Rounded toes are present on sandal Types II, VIII, and IX. Square toes are present on Types III, IV, and V. Pointed toes are present on Type VII. Rounded heels are present on Type I, II, and IX. Square heels are present on Type III and V. Fishtail heels are present on Type VII sandals.

The utilized toe selvages include clipping the warp ends (Type III and V), allowing the warp ends to hang loose (Type II), folding them over into the adjacent warp row (Type IV), twisting the warp elements along the width of the toe (or leaving them untwisted) from right-to-left or left-to-right and securing them to the final warp row (Type VIII), and wrapping the weft elements tightly around the warps and securing them behind preceding weft rows (Type VII). The utilized heel selvages include clipping the warp elements beyond the final weft row (Type I), securing the weave beyond the final engagements with two rows of transverse plaiting which are secured with a square knot (Type III), the creation of a fishtail heel (Type VII), and the affixation of the last weft row to the final warp row (Type V). The heel selvage for the Type II sandals is unclear. Only specimen DU 397 exhibits a complete heel. However, it is indeterminate whether this heel merely represents a repair, or is in fact an inverted heel.

The utilized tie systems include ties which knot in front of the ankle (Type II and IX), ankle and heel loops (and possibly toe ties) (Type I), and ties which are affixed to either side of the sandal and cross the foot in a lattice-work pattern (Type III). There are remnant portions of tie mechanisms on sandals from Type III, VII, and VIII. The Type III and VIII sandals exhibit two tufts of raw material which show through the sandal weave on the same transverse line at the sandal toe. Though indeterminate, it is possible that these two strands (now broken) had formed a toe loop, or these strands could have

crossed in front of the ankle and been secured at the back of the heel. The Type VII sandals do have complete toe loops created by twisting and tying half of each warp together. However, at the midpoint of the sandal, material is also borrowed from each warp to create some additional sort of lashing. It is indeterminate whether these additional elements were tied to the aforementioned toe loop or whether they tied in front of the ankle or behind the heel.

In order to test the cohesiveness and soundness of the typological groupings, these sandals were compared statistically. ANOVA tests were utilized in order to test the variation between the metric data reported for each sandal within each type (Rowntree 2004). The most uniform type found at the Kenton Caves is Type III. The sandal thickness and selvage treatment for both the toe and heel (length that the warps extend beyond the final weft row) of all the Type III sandals are statistically the same ($\alpha=0.05$; $F=2.22 < F \text{ crit}=2.87$; $F=1.10 < F \text{ crit}=5.32$; $F=2.49 < F \text{ crit}=5.32$) (Appendix C). The results of these comparisons are highly significant because they support the typological grouping of these sandals into the same type. The statistical cohesiveness of this type becomes even more important when considering the chronological placement of this type and the individual specimens. Though this type spans almost 3,000 years, the individual AMS dates for the five specimens are not continuous. However, the statistical similarity of these specimens indicates the conservative nature of this type over time, and that the apparent gaps in Type III sandal use may be due to preservation. Statistical testing of the weft diameter, warp diameter, and weft unit diameter determined that the Type III specimens DU 398 and DU 399 were statistically the same ($\alpha=0.05$; $F=0.99 < F \text{ crit}=5.32$; $F=0.99 < F \text{ crit}=5.32$; $F=0.30 < F \text{ crit}=4.84$) (Appendix C). The fact

that these two specimens were found to be statistically the same through all testing indicates that not only are they constructed in an identical manner (both Type III sandals), but that their construction attributes are statistically the same. Given the culturally embedded and culturally conservative construction techniques and attributes utilized in their construction, this indicates that, at the very least, these two sandals were made by the same genetic cultural population, if not the same family of weavers, or even the same individual weaver. Though their AMS dates do not overlap (DU 398: 1944-1749 cal B.C.; DU 399: 2831-2468 cal B.C.), which indicates that they were not made by the same individual, the statistical similarity of all of their measurable attributes does imply that they were made by the same “community of practice.” In this tight-knit group of conservative weavers, precise construction techniques and parameters would have been passed down from one generation to the next.

Sandals from Type IV have sandal thicknesses that are statistically the same ($\alpha=0.05$; $F=1.46 < F_{crit}=5.99$) (Appendix C). However, the fragmentary condition of these specimens may have biased this outcome. Though basic construction method of these specimens is the same, it is visually obvious that these two specimens are not identical. Therefore, though broad general similarities exist, which indicate that these sandals are of the same general type, the details of their manufacture are not similar enough to indicate that they were produced by the same “community of practice.” However, their generic similarity indicates the presence of a broad affiliation.

Additional perishable constructions of note include experimental forms (doodles) possibly created by novice weavers or even children, too small for actual use as sandals (5048B and 5048C), bundles of unspun raw material, fragmentary pieces of simple and

twill plaited basketry, cordage (fiber and sinew), plaited forms of indeterminate function (specimen # 62, 63, and 5048A), a rabbit skin pouch, antelope hide bag, and prairie dog skin bag. The analysis of these forms was beyond the scope of this project but warrant mentioning. Only the Rod with Lateral bundle coiling type is discussed herein (this chapter) due to the presence of this rare type at all three Southern High Plains sites.

Raw Materials

The plant fiber sandals were made exclusively of longitudinally split *Yucca* (sp. ind.) leaves. The buffalo hide sandal was obviously made of buffalo hide.

Chronological Pattern of Sandal Types

Of the 23 sandals (22 plaited, one buffalo hide) recovered from the Kenton Caves, 19 sandals (18 plant fiber, one buffalo hide), representing nine technological types, were directly dated. Due to suspected lacquer contamination, specimen DU 397 (Type II) was dated a second time. The second acquired date is more in-line with the remaining sandals dated from Type II, and therefore was used in the temporal comparisons. Four plant-fiber and possible plant-fiber sandals (DU 392, 5048B, 55048H, and the sandal reported in Lintz and Zabawa 1984:Figure 7.2h) are currently undated. Five technological types (Type I, IV, V, VI, and IX) contain single specimens, which provide restricted information regarding the use length of those types. Based on the calibrated date ranges for each artifact and type, it is reported that the Kenton Caves sandal assemblage spans at least 5800 years (Table 2).

Table 2. Temporal Ascription of the Sandal Types and Specimen from the Kenton Caves.

Type	Type Designation	Id #	Lab Designation	Conventional Radiocarbon Age (B.P.)	Calibrated age (2 sigma)
I	Simple 1/1 Plaited (Franktown-like)	5049 (OHS)	Beta 229387	7460 +/- 50	6430 - 6230 B.C. 8380 - 8180 B.P.
II	Simple 1/1 Plaited; 90° angle; folded toe	34 (SN)	Beta 229385	7440 +/- 50	6420-6220 B.C. 8370 - 8170 B.P.
II	Simple 1/1 Plaited; 90° angle; folded toe	391 (DU)	AA71131	7080 +/- 52	6052 - 5846 B.C. 8002 - 7796 B.P.
II	Simple 1/1 Plaited; 90° angle; folded toe	393 (DU)	AA71128	6973 +/- 43	5979 - 5746 B.C. 7929 - 7696 B.P.
II	Simple 1/1 Plaited; 90° angle; folded toe	397 (DU)	AA71132 *Beta 231172	2754 +/- 42 / * 6310 +/- 50	998 - 819 B.C. 2948 - 2769 B.P. / *5370 - 5210 B.C. 7320 - 7160 B.P.
II	Simple 1/1 Plaited; 90° angle; folded toe	4051 (NML)	AA74900	5691 +/- 44	4684 - 4407 B.C. 6634 - 6357 B.P.
III	Simple 1/1 Plaited; 45° angle rotated weave (Oblique); folded toe	A18 (W)	Beta 229380	5600 +/- 80	4600 - 4330 B.C. 6550 - 6280 B.P.
III	Simple 1/1 Plaited; 45° angle rotated weave (Oblique); folded toe	399 (DU)	AA72772	4023 +/- 37	2831 - 2468 B.C. 4781 - 4418 B.P.
III	Simple 1/1 Plaited; 45° angle rotated weave (Oblique); folded toe	390 (DU)	AA72771	4013 +/- 37	2827 -2466 B.C. 4777 - 4416 B.P.
III	Simple 1/1 Plaited; 45° angle rotated weave (Oblique); folded toe	398 (DU)	AA74903	3525 +/- 36	1944 - 1749 B.C. 3894 - 3699 B.P.

* Indicates second dating of Kenton Caves sandal DU 397. Initial date suspect due to possible lacquer contamination. Results of second dating used in temporal comparisons.

Table 2. Temporal Ascription of the Sandal Types and Specimen from the Kenton Caves (continued).

Type	Type Designation	Id #	Lab Designation	Conventional Radiocarbon Age (B.P.)	Calibrated age (2 sigma)
IV	Unbalanced Plain Weave	388 (DU)	AA71129	4148 +/- 37	2878 - 2590 B.C. 4828 - 4540 B.P.
V	Unbalanced Plain Weave, Continuous Warp	387 (DU)	AA74904	4292 +/- 38	3018 - 2875 B.C. 4968 - 4825 B.P.
VI	Unbalanced Plain Weave with double frame	A 17 (W)	AA74901	4594 +/- 42	3515 - 3107 B.C. 5465 - 5057 B.P.
VII	Pseudo-twined (2 warp)	A23 (W)	Beta 229381	2770 +/- 40	1010 - 820 B.C. 2960 - 2770 B.P.
VII	Pseudo-twined (2 warp)	A24 (W)	Beta 229382	2420 +/- 40	750 - 400 B.C. 2700 - 2350 B.P.
VIII	Pseudo-twined (4 warp)	824 (DU)	AA71134	1247 +/- 53	A.D. 665 - 889 1285 - 1061 B.P.
VIII	Pseudo-twined (4 warp)	825 (DU)	AA71133	1184 +/- 37	A.D. 717 - 968 1233 - 982 B.P.
IX	Buffalo hide sandal	5119 (OHS)	AA74908	826 +/- 33	A.D. 1159 - 1268 791 - 682 B.P.

The oldest sandals in the Kenton Caves' collection are both plaited (Type I and Type II); they share the same overlapping date range, 6430-6230 cal B.C. (8380-8180 B.P.) and 6420-6220 cal B.C. (8370-8170 B.P.) (Table 2; Figure 7.37). As previously stated, there is only one Type I specimen, which inhibits any estimation regarding the duration of use for this type. However, the five Type II specimens that were dated indicate that this method of manufacture was employed until at least 4400 cal B.C. (5647 B.P.) – a span of approximately 2,723 years. After this point in time, new sandal styles begin to appear, beginning with the oblique simple plaited sandals (Type III). However, only the Type II sandals exhibit any additional loose fiber padding to indicate the use of a

winter or heavier variant type. The change in tie mechanism is also notable. The Type II sandals only display one tie which ties across the center of the foot from outside to instep directly in front of the heel as opposed to the dual tie systems of the Type III sandals (discussed below).

The Type II and Type III sandals only overlap for a period of 200 years, from 4600 to 4407 cal B.C. After this time, Type II sandals cease to occur, and the Type III sandals become the predominant sandal type at the Kenton Caves (Figure 7.37). This fact is especially interesting because these two sandal types are the only ones known to be created from one long piece of weaving, which was then folded over the toe in order to create a toe covering. The main difference between the two types (besides the toe silhouettes that are created) is the orientation of the weave. Though both types employ simple plaiting (1/1 interval), the Type III sandals utilize paired and trebled elements to create an oblique plaiting weave as opposed to the use of singular elements to create a longitudinally oriented weave in the Type II sandals. Before 4600 cal B.C., an event of great importance would have had to occur in order to drastically alter the orientation of the predominant weave. It is also important to note that the earliest Type III sandals employed paired elements (4600-4330 cal B.C.), which preceded the creation of Type III sandals that employed trebled elements (2831 cal B.C.) by roughly 1500 years. These two variants are contemporaneous from 2800 to 2400 cal B.C. Type III sandals manufactured with trebled elements continue to be made until 1749 cal B.C. Two types of tie mechanisms are employed in the construction of the Type III sandals. Both styles of tie system appear on the trebled variety, which include lattice work ties (DU 399) and evidence for a possible toe loop and/or a criss-cross tie with the elements being tied

behind the ankle (DU 398). The lattice-work tie system (2831-2468 cal B.C.) precedes the use of the toe-loop tie system (1944-1749 cal B.C.) by roughly 500 years (Table 2).

During the predominant use of the Type III sandals, the solitary examples of the Type IV, V, and VI sandals were created. After the disappearance of these sandal types, the Type VII sandals (two warp pseudo-twined) came into use from 1010 to 400 B.C. After their disappearance, the Type VIII (four warp pseudo-twined) sandals came into use from A.D. 665-889 (roughly 1200 B.P.). The final Kenton Caves sandal type is the Type IX buffalo hide sandal, which dates from cal A.D. 1159-1268 (Figure 7.37).

In sum, three main categories of footwear are found in the Kenton Caves collection: multiple warp simple plaited plant fiber sandals, pseudo-twined (two and four warp) plant fiber sandals with traction masters, and a single buffalo hide sandal. Each of these types is mutually exclusive, as is their temporal range of utilization. The abandonment of one sandal type for the use of another unrelated sandal type signals a sharp change in sandal production technology, as well as a change in population composition, a change in cultural ideas, or both. The change from multiple warp sandals, to two and four warp pseudo-twined sandals, to hide sandals signals a change in the basic approach to sandal manufacture. However, an additional change within the utilization of multiple warp sandals is noticeable regarding the transition from the use of Type II sandals to Type III sandals, which may represent the modernization or adaptation of an older style by a different faction.

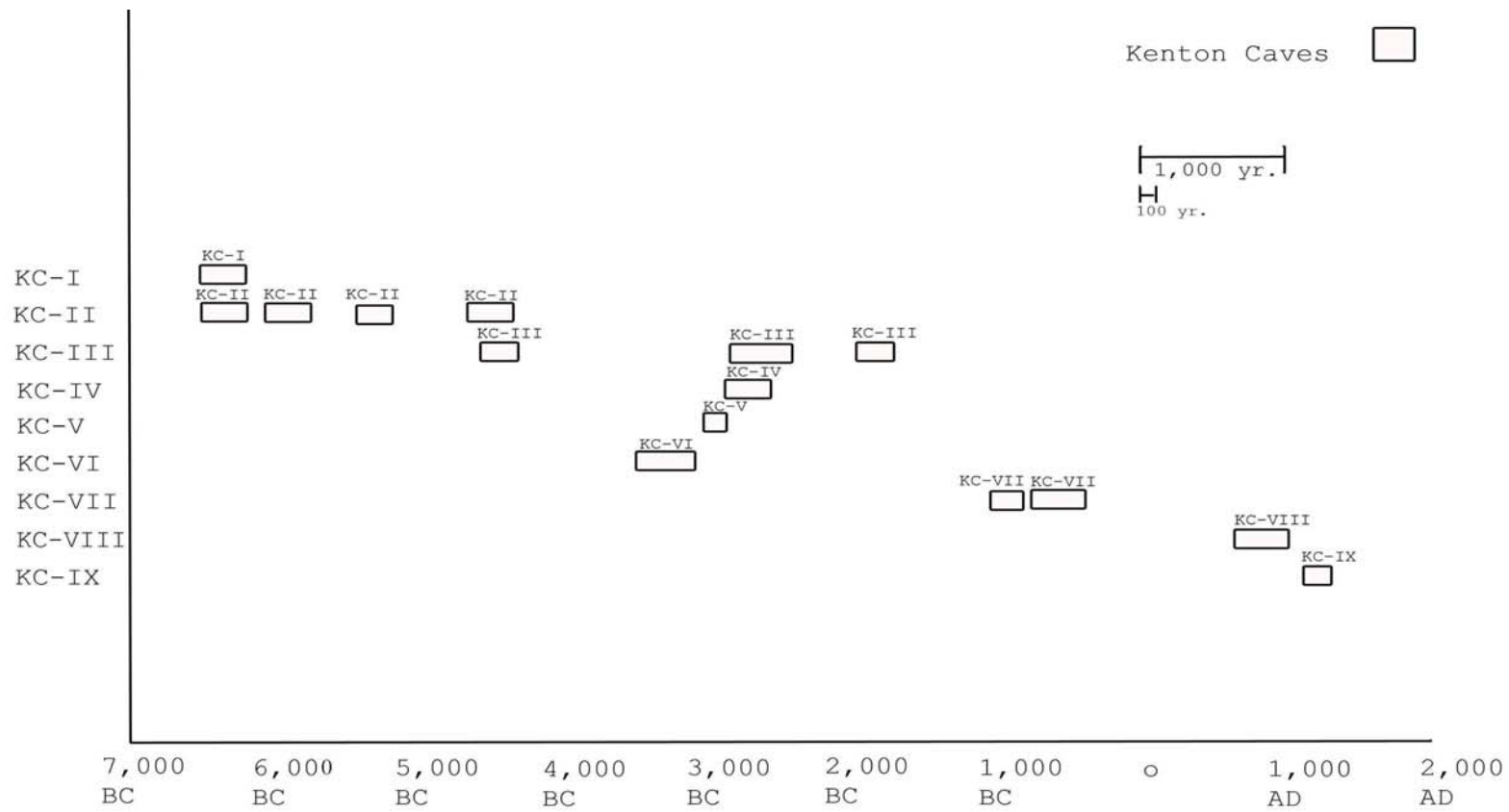


Figure 7.37 Technological Sequence for the Kenton Caves.
 (based on 2 sigma calibrated ages) (schematic by C.B. Graphic)

Trinchera Cave

Technological Pattern of Sandal Types

The Trinchera Cave Type II sandals are the most common (n=5; 36% of the sample) sandal variety. The Type III (n=2; 14%), Type IV (n=2; 14%) and Type V (n=2; 14%) sandals are equally represented. Type I sandals (n=1; 7%) are the rarest sandal type represented. The remaining sandal and sandal fragment (n=2; 14%) are untypable.

While all of the sandals are plaited in the technical sense, two different categories of plaiting are represented. Types I and II are pseudo-twined with longitudinal warps, two (Type I) or four (Type II) warps, around which the transverse weft elements are woven. Though superficially similar to twining, due to the ratio of wefts to warps and the more “passive” role of the warps around which the “active” wefts are woven, the pseudo-wefts still cross over and under the pseudo-warps in simple plaiting fashion without any additional engagement (Hyland 1997:237). This form of plaiting is sometimes referred to as wickerware or wickerwork (cf. Adovasio 1977:106). The Trinchera Cave Type III sandals are produced by more conventional plaiting techniques in which the crossing elements are functionally more equal. That is, they are of a more similar size, number, and appearance. Whatever the style of plaiting, all plant fiber sandals at Trinchera Cave are produced with either two or four warps. Multiple warp sandals (those with 5+ warps) and sandals with more rare warp orientations are completely absent from the collection. Trinchera Cave Type IV composite sandals and Type V moccasin fragments do not have warps or wefts. However, Type IV composite sandal #794 utilizes Z-twist cordage to adhere two separate pieces of hide to form the sole, and unspun plant fibers are used to

create the side-loop tie system. Untyped specimen No #E utilizes Z-twist cordage as the binding element of its side-loop tie system.

All of the plant fiber sandals, Types I, II, and III, exhibit 180° side selvages. End selvages are only present on a few specimens. Type I sandal 221A does not have an intact toe selva ge, and the toe silhouette can only be assumed to be square, as is common on other scuffer-toe specimens and as is represented in the majority of the Trinchera Cave collection. The heel silhouette of Type I specimen 221A is a fishtail, based on the orientation of the two warps at the heel. The heel selva ge can only be assumed to have been created by tightly wrapping or weaving the weft elements around the warps until affixed by tucking the wefts into the preceding row or the creation of a knot. Similar heel finishes are found in adjacent areas of the Southwest and Lower and Trans-Pecos Texas. The Type II toe and heel selvages, found on specimens 789 and T5-4-2, were created by bending the remaining portions of the warps to the obverse right and S-twisting them together. After including the final warp in the twist, the group of warps was affixed to the obverse right side-loop with an overhand knot. Both specimens have square toe and heel silhouettes. The Type III toe selva ge found on specimen 21A is very similar to that used on the Type II sandals. However, the warp elements are S-twisted to the obverse left, as opposed to the obverse right. Specimen 21A has a pointed toe silhouette. The Type IV composite sandals have square toes and specimen #794 has a puckered heel. The heel of specimen No #B is indeterminate.

The majority of the sandals have also retained some evidence of a tie system. All of the identifiable tie mechanisms consist solely of side-loop tie systems (21A, 21B, 780, 789, 794, T5-4-2, and No #C). However, the tie mechanisms found on No #C and 21A

also incorporate the use of a toe loop into their side-loop tie system. The incorporation of the binding element, which weaves through the side-loops across the foot, also varies. Specimens 794 and T5-4-2 exhibit the common lattice-work pattern, while specimen #780 utilizes an element which ties the two opposite side-loops together in a straight line across the foot. All of the tie mechanisms were created with unspun fibers.

It is also important to note that all of the Trinchera Cave plant fiber sandals have the exhausted ends of their transverse plaiting elements intentionally protruding from the sole, to a greater or lesser degree, which is termed a “traction master” (see Figure 3.7). This raised tread-like pattern, in turn, aids in prolonging sandal wearability and enhances traction. The incomplete and fragmentary Type I sandal is the only exception. However, it can be assumed that the Type I specimen also exhibited this construction technique due to its presence on all of the other Trinchera Cave plant fiber specimens, and its similarity to the other known scuffer toe, fishtail specimens with this characteristic from the Southwest and Gila and Hueco Mountains.

At Trinchera Cave, not all of the sandals exhibit use wear consistent with having been worn exclusively or near-exclusively on one foot or the other, termed side-specific. However, all of the recorded sandals were of adult size. Those that could be sided included four adult rights (Type II [n=2]; Type III [n=2]) and five adult lefts (Type II [n=1]; Type IV [n=2]; Type V [n=2]). Three sandals could not be designated as having been worn on the right versus left foot (Type I [n=1]; Type II [n=2]). None of the sandals exhibit wear attributable to genetic anomalies like “Morton’s foot” or other foot pathologies (cf. Andrews et al. 1986:121).

Trinchera Cave Type II specimen #789 was the only specimen that displayed any evidence of mending. Additional pieces of raw material were inserted into the weave and were used to longitudinally wrap multiple sets of weft elements together and secure them. This mending is noticeable at both the toe and heel of the sandal. This sandal exhibits heavy use wear. Type V specimen #41 appears to have been resoled. Based on the clean unfrayed edges of the piece, it appears as if this sole exceeded its usefulness and was cut from the moccasin and a new sole was attached to the moccasin's upper (see Figure 7.33).

In order to test the cohesiveness and soundness of the typological groupings, the Trinchera Cave sandals were also compared statistically. ANOVA tests were utilized in order to test the variation between the metric data reported for each sandal within each type (Rowntree 2004). The results of these tests reaffirmed the typological groupings of the specimens. Further, the statistical tests regarding sandal thickness, warp diameter, and weft diameter indicate that within Trinchera Cave Type II, there lies a subtype. This subtype, comprised of specimens T5-4-2, 780, and 789, though constructed with a similar weave to the remaining Type II specimens, are statistically distinct from Type II specimens 21B and 945. The subtype of Type II specimens (T5-4-2, 780, and 789) have sandal thicknesses ($\alpha=0.05$; $F=2.85 < F \text{ crit}=3.80$), warp diameters ($\alpha=0.05$; $F=0.023 < F \text{ crit}=10.13$), and weft diameters that are statistically the same ($\alpha=0.05$; $F=3.50 < F \text{ crit}=3.68$) (Appendix C). These results, however, are not surprising. These three specimens (T5-4-2, 780, and 789) are visually more similar to one another than any is to the remaining two (21B and 945), and vice versa. Though the Trinchera Cave Type II sandals were made with the same basic warp configuration (four warps), the utilization

of different construction attributes in the manufacture of the sandals indicates that it is likely that two different groups or “communities of practice” manufactured these sandals. Though these groups likely shared a more broad affiliation, each group maintained individual and conservative techniques in regards to sandal manufacture. The Trinchera Cave Type III specimens were found to have sandal thicknesses, warp diameters, and weft diameters that are statistically the same as well ($\alpha=0.05$; $F=1.45 < F_{crit}=10.13$; $F=0.45 < F_{crit}=5.59$; $F=0.28 < F_{crit}=4.96$) (Appendix C). This suggests that these sandals were made by the same genetic population, if not the same family of weavers or individual weaver. Based upon the distribution of dates, it is more likely that these sandal types were produced by the same genetic population with culturally conservative techniques with regard to sandal manufacture.

Additional perishable constructions of note include experimental forms (doodles) possibly created by novice weavers or even children, too small for actual use as sandals (specimen # TR1-28, TR1-689, and 66.19.221B), netting, bundles of unspun raw material, fragmentary pieces of plaited and coiled basketry, and cordage. The analysis of these forms was beyond the scope of this work but warrant mentioning. Only the Rod with Lateral bundle coiling type is discussed herein (this chapter) due to the presence of this rare type at all three Southern High Plains sites. However, additional types of coiling are present at each of the three Southern High Plains sites.

Raw Materials

All of the Trinchera Cave plant fiber sandals are made of longitudinally split *Yucca* sp. leaves. The composite sandals were made with a combination of rabbit hide,

Yucca sp., and grasses (sp. ind.). The moccasins were made of hide (sp. unknown, though probably either antelope or buffalo) and *Yucca* sp. cordage.

Chronological Pattern of Sandal Types

Seven of the Trincher Cave sandals were dated (6 plant fiber, 1 rabbit skin sandal), representing four technological types. Three of the Types (I, III, and IV) contain only one specimen; therefore, the estimated use length for these sandal types is extremely restricted (Table 3). Four plant-fiber sandals (945, TR1 EPU, No #C, and the “Hal Chase” sandal), two composite hide sandals (No #B and No #E), and the two moccasin fragments (41 and No #A) are currently undated.

Table 3. Temporal Ascription of the Sandal Types and Specimens from Trincher Cave.

Type	Type Designation	Id #	Lab Designation	Conventional Radiocarbon Age (BP)	Calibrated age (2 sigma)
I	Two Warp Scuffer Toe	221A	Beta 229388	1600 +/- 40	AD 390 - 550 1560 – 1400 BP
II	Pseudo-twined (4 warp)	789	Beta 229386	1090 +/- 50	AD 880 - 1020 1070 – 930 BP
II	Pseudo-twined (4 warp)	T5-4-2	Beta 229384	880 +/- 40	AD 1040 - 1240 920 – 700 BP
II	Pseudo-twined (4 warp)	21B	AA74905	1515 +/- 34	AD 433 - 619 1517 – 1331 BP
II	Pseudo-twined (4 warp)	780	AA74899	1356 +/- 33	AD 617 - 766 1333 – 1184 BP
III	Unbalanced Plainweave (4 warp)	21A	AA74906	1350 +/- 35	AD 620 - 769 1330 – 1181 BP
IV	Hide sandal	794	AA74907	934 +/- 32	AD 1023 - 1169 927 – 781 BP

The earliest sandal technology discovered at Trincher Cave is represented by the single Type I (two warp scuffer toe) sandal. The Type I sandal was constructed and

utilized at Trinchera Cave between cal A.D. 390 (1560 B.P.) and cal A.D. 550 (1400 B.P.). Shortly after the utilization of the Type I sandal at Trinchera Cave, a second sandal type begins to be constructed, Type II. These two technological types appear within only forty years from one another (Figure 7.38).

Type II sandals represent the second oldest and longest-lived sandal variety at Trinchera Cave, though the temporal duration of this type may be attributed to the fact that it is also the most numerous type at the site, with the most dated specimens. Type II sandals were initially constructed from cal A.D. 433 to AD 766 (1549-1323 B.P.) and after a brief hiatus (~120 years) reoccurs from cal A.D. 880 to 1240 (700-1070 B.P.). Type II sandals are the constant at Trinchera Cave. Through the length of their use, other sandal types come in and out of favor. Only the Type II sandals co-occur any of the other types. Types I, III, and IV were never made at the same time (Figure 7.38).

After the disappearance of the Type I sandal in cal A.D. 550, and during the utilization of the Type II sandals, the Type III sandals are constructed ca. cal A.D. 620 (1389 B.P.). These sandals are in use until at least cal A.D. 769 (1323 B.P.) (Table 3; Figure 7.38). It is interesting to note that the Type III sandals disappear at the exact time that the Type II sandals begin their ~100 year hiatus. Though this hiatus may be due to preservation issues, it is still interesting to note. The Type IV rabbit skin composite sandals have a range of utilization of cal A.D. 1023 to cal A.D. 1169 (Table 3; Figure 7.38). Though undated, it is assumed that the Type V moccasin fragments would post-date all of these styles, including the rabbit skin composite sandal. The utilization of this technology indicates a completely different way of thinking when it comes to prehistoric footwear (a paradigm shift) and is most likely due to increased Plains influence.

The Trinchera Cave collection is dominated by pseudo-twined (two and four warp) plant-fiber sandals, constructed with traction masters and side-looped tie systems. The collection of plant fiber sandals is remarkably cohesive. The appearance of composite sandals and moccasins may signal a change in the population composition or changes in the cultural ideas of the occupants. However, these may be indicative of the same phenomena. Because the Type II sandals continue to be made after the creation of the composite sandal, it cannot be said with any certainty that proto-historic and historic Plains populations (whose footwear consists of moccasins and sandals) (Johnson 1975; Lowie 1924; Riddell 1960) had replaced the preceding occupants. However, this does reaffirm that Trinchera Cave has both Southwestern and Eastern connections (Simpson 1976).

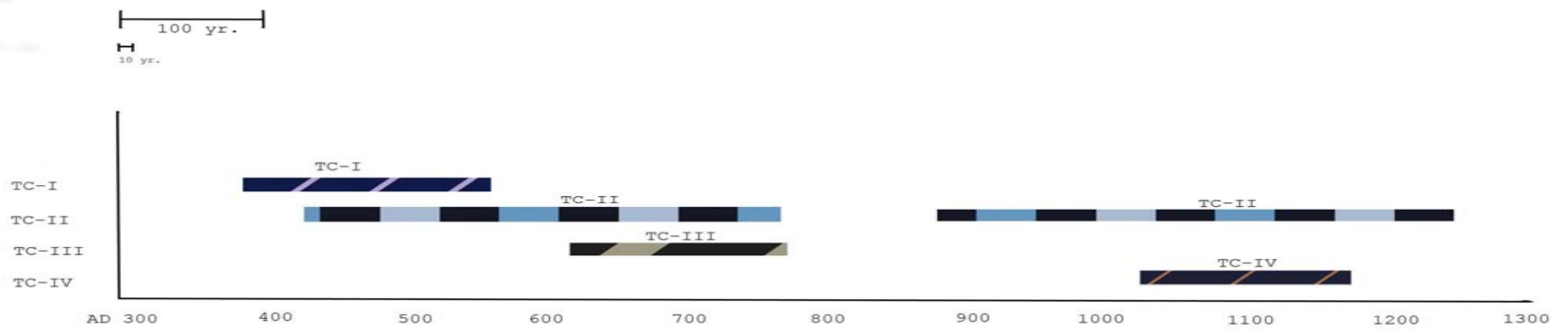


Figure 7.38 Trincheria Cave Technological Sequence
 (Based on 2 sigma calibrated ages) (schematic by C.B. Graphic)

Southern High Plains

Technological Pattern of Sandal Types

All of the plant fiber sandals found at Southern High Plains sites (Franktown Cave, Trinchera Cave, and the Kenton Caves) are plaited. Plant and hide composite sandals as well as hide moccasins were also made. The Southern High Plains footwear can be divided into eleven technological types of footwear based on site and technological characteristics, including ten sandal types (eight plant fiber, one composite, one hide), and hide moccasins. Individual types from each site are technologically conservative.

The Franktown Cave sandals only exhibit similar construction techniques and attributes to the sandals of the Kenton Caves, in particular the Kenton Caves Type I sandal. The Kenton Caves Type I specimen was shown statistically (Appendix C) to have the same warp and weft diameter as the Franktown Cave sandals. Despite the great distance between these two sites and the 3,000 year time lapse between the two collections, the fact that they share the same diameter of weaving elements indicates a general technological similarity. The similarity between the Franktown Cave Type I sandals and the Kenton Caves Type I sandal is striking. It is possible that these sandals may be of the same type. However, the absence of the toe selvage, differentiation in heel treatment and silhouette, and the tie mechanisms present in the Kenton Caves Type I sandal suggest only generic similarity. While the collections may have been produced by two different populations, it is likely that these two populations were related in some way, sharing the same overarching cultural ideas, and were part of the same conservative

technological sandal trajectory. The moccasin found at Franktown Cave and the moccasin fragments found at Trinchera Cave, however, show no similarity.

The sandals from the Kenton Caves and Trinchera Cave convey a high degree of similarity. Two warp and four warp pseudo-twined sandals were made at both sites. Though separated in time and varying in presentation, the basic weave and functional design (creation of traction masters) are the same. Though both the Kenton Caves (Type VII) and Trinchera Cave (Type I) two warp sandals both exhibit fishtail heels, their major difference lies in the toe finish and foot coverage. Though the Kenton Caves (Type VII) sandals narrow at the toe and are finished in a manner that mirrors its fishtail heel, the warp “frame” of the fragmentary Trinchera Cave (Type I) specimen remains open. The frame of the Trinchera Cave Type I sandal exhibits a wishbone or Y shape. Also, while the Kenton Caves (Type VII) sandals represent full-length forms, the Trinchera Cave (Type I) specimen is a scuffer toe sandal, which is documented as covering only the front portion of the foot. Comparisons based on tie mechanisms cannot be made. Though differences exist between the two-warp sandal from Trinchera Cave and the two-warp sandals from the Kenton Caves, both sandal forms (scuffer toe and full-length sandals) have been documented as co-occurring in adjacent regions, specifically the Southwest and Lower and Trans Pecos Texas. Despite form, the remaining shared construction attributes indicate a broad affiliation between the two types.

The Kenton Caves (Type VIII) and Trinchera Cave (Type II) four warp pseudo-twined sandals exhibit similar toe selvages, in which the exhausted warp and weft material are twisted together and affixed to an outside warp. In the Trinchera Cave sandals this proceeds from left-to-right with a S-twist and in the Kenton Caves specimen

#825 this proceeds from right-to-left with a Z-twist. The toe selvage of Kenton Caves specimen #824 proceeds in a similar manner to the Trincherera Cave specimens, however, the warp is left untwisted and the weft elements, when exhausted, are merely tucked into preceding weft rows. While the Trincherera Cave (Type II) sandals are definitively full-length sandals, the coverage of the Kenton Caves (Type VIII) sandals is indeterminate due to their fragmentary condition. However, differences in utilized tie systems are noticeable. Though only sparse evidence present on the Kenton Caves (Type VIII) specimen #824 indicates that this sandal was constructed with some sort of tie loop or toe-heel tie, the Trincherera Cave sandals (Type I-III) use side-loop tie systems exclusively. The Trincherera Cave types only vary regarding the moving element and how it weaves between or connects the side-loops. The pattern of two warp sandals preceding four warp sandals in time is found in the technological sequence of both Trincherera Cave and the Kenton Caves. In fact, the Trincherera Cave (Type I) two-warp sandal precedes the use of the Kenton Caves (Type VIII) four-warp sandals. The Trincherera Cave (Type II) four warp sandals are contemporaneous with the Kenton Caves (Type VIII) four-warp sandals. The contemporaneous use of the two-warp and four-warp sandals from each cave provides further evidence that, minimally, the occupants of these two caves shared broad regional affiliation.

Footwear constructed solely or partially of hide were found at all three caves. A buffalo hide legging and moccasin were found at Franktown Cave (Type II); a buffalo hide sandal was found at the Kenton Caves (Type IX); and moccasin fragments and composite sandals were found at Trincherera Cave (Types IV and V). Each of these types are unique, both within and between sites. In addition, winter or heavier variant sandals

were found in both the Franktown Cave collection (Type I heavier variant specimens #546, 509, 588, and 462) as well as in the Trinchera Cave collection (Type IV composite sandals). It would appear that some version of both lighter (spring/summer) and heavier (winter) variants were made and used universally along the Southern High Plains.

The Kenton Caves collection is dominated by multiple warp sandals (Types I-VI). However, the variability within this overarching category is caused by the presence of multiple types (IV-VI) that contain single specimens with rare warp orientations. The dominant Kenton Caves sandal types, in number and temporal range, are the Type II and Type III sandals. Both sandal types are created utilizing one long piece of weave, roughly a third of which is folded over the toe of the foot. The weaving elements used to create this weaving cross at 90° angles. However, the weave of the Type II sandals runs longitudinally and transversely, while the weave of the Type III sandals is more obliquely oriented, appearing to have been rotated roughly 45°. Though sandals with obliquely oriented weaves have been reported for adjacent regions (Mogollon, northern Colorado Plateau, Lower and Trans-Pecos Texas, and Coahuila, Mexico), the unique construction methodology and exact attributes of the Southern High Plains obliquely plaited sandals have not been reported previously (Cosgrove 1947; Hays-Gilpin et al. 1998; Hyland 1997; Taylor 2004; Webster 2007). The fact that these sandals were manufacture utilizing previously undocumented techniques indicates that the earliest occupants of the Kenton Caves and the Southern High Plains were not directly associated with any of the populations occupying the known basket-making regions of North America. The sandal collections from the Southern High Plains may be the result of an adaptation of pre-existing forms of sandal technology.

Raw Materials

The plant fiber sandals from the Southern High Plains were made exclusively of longitudinally split *Yucca* sp. leaves. The composite sandals were made with a combination of rabbit hide, *Yucca* sp., and grasses (sp. ind.). The Kenton Caves hide sandal and Franktown Cave legging and moccasin have been identified as being manufactured from buffalo hide. Though the hide material used to construct the Trinchera Cave moccasin fragments have yet to be identified, it is presumed to be bisonoid or antelopoid in origin.

Chronological Pattern of Sandal Types

The earliest currently documented sandal technology found in the Southern High Plains derives from the Kenton Caves of Oklahoma and New Mexico. The Kenton Caves Type I and Type II sandals share the same overlapping date range, 6430-6230 cal B.C. (8380-8180 B.P.) and 6420-6220 cal B.C. (8370-8170 B.P.). The Kenton Caves Types I, II, and III sandals predate the sandal technology found at any other Southern High Plains site by ~1,000 calendar years. The chronological sequence at the Kenton Caves represents a nearly continuous span from cal 6430 B.C. to cal A.D. 1268, roughly 7,700 years. As the longest technological sequence for sandals on the Southern High Plains, it is not surprising that these sandal types overlap those used at other sites. During the utilization of the Franktown Cave Type I sandals, Kenton Caves Type III-VI were also in use. The Kenton Caves Type III sandals actually precede the initial manufacture of the Franktown Cave sandals, and continue to be used even after the Franktown Cave sandals had been discontinued from use (Figure 7.39).

Only the Kenton Caves Type VIII and IX sandals and Franktown Cave Type II moccasin overlap chronologically with the Trincheras Cave Type II, III and IV sandals. The Trincheras Cave Type I sandals precede the Kenton Caves Type VIII sandals by a margin of ~115 years. Two warp pseudo-twined sandals from the Kenton Caves (Type VII) and Trincheras Cave (Type I) precede the four warp pseudo-twined sandals from either cave (Kenton Caves Type VIII and Trincheras Cave Type II) (Figure 7.39). This pattern of two warp pseudo-twined sandals preceding the utilization of four warp pseudo-twined sandals also appears at Pendejo Cave of the Jornada Mogollon (Hyland 1997). The Trincheras Cave Type IV rabbit skin composite sandal (cal A.D. 1023-1169; 934 +/- 32 B.P.) is penecontemporaneous with the Franktown Cave buffalo hide legging (A.D. 1025-1187) and moccasin (A.D. 983-1157) and the Kenton Caves Type IX buffalo hide sandal (cal A.D. 1159-1268; 826 +/- 33 B.P.) (Figure 7.39). It is likely that the Trincheras Cave Type V moccasins fall within the range of these dated hide footwear specimens, possibly showing the transition from purely plant-fiber footwear to hide footwear.

The sandal collections from Franktown Cave and Trincheras Cave are individually cohesive, though neither share the same type of sandal technology. The Kenton Caves sandal collection, however, displays a blending of the technology found at both of the other sites. Therefore, the Kenton Caves sandal collection is the most useful for summarizing the sandal technology and technological sequence for the Southern High Plains. The earliest sandal technology on the Southern High Plains included simple plaited multiple warp (8+ warps) plant-fiber sandals, followed by pseudo-twined (two- and four-warp) plant fiber sandals with traction masters, and ending with composite sandals, hide sandals, and hide moccasins. Each of these types is mutually exclusive, as is

their temporal range of utilization (see Figure 7.39). The conclusions drawn for the technological sequence found at the Kenton Caves are very similar to those that can be drawn for the Southern High Plains in general. The change from multiple warp sandals (Kenton Caves Types I-VI; Franktown Cave Type I), to two and four warp pseudo-twined sandals (Kenton Caves Types VII & VIII; Trinchera Cave Types I & II), to composite and hide sandals and moccasins (Franktown Cave Type II; Trinchera Cave Type IV & V; Kenton Caves Type IX) signals a change in the basic approach to sandal manufacture (Figure 7.39). The abandonment of one sandal type for the use of another unrelated sandal type not only signals a sharp change in sandal production technology, but signals a change in either population composition, change in cultural ideas, or both. Therefore, it is likely that the changes seen in the sandal technology of the Southern High Plains are the result of the migration of multiple groups into the area.

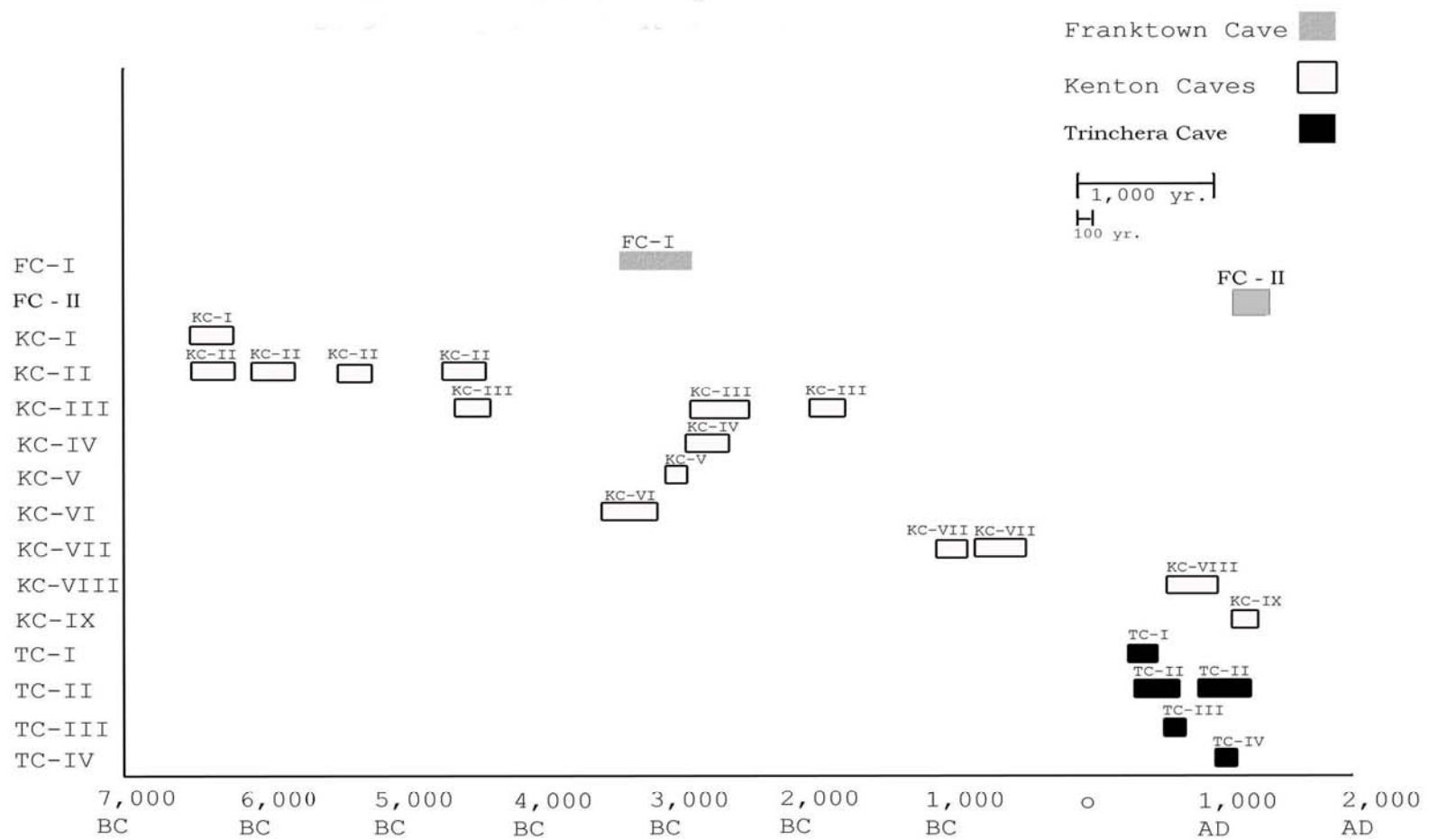


Figure 7.39 Technological Sequence for Franktown Cave, Trinchera Cave, and the Kenton Caves. (Based on 2 sigma calibrated ages) (schematic by C.B. Graphic)

A note on coiled basketry:

A rare type of coiling, rod with lateral bundle foundation coiling, is found at all three sites (Table 4). Though the Franktown Cave, Trinchera Cave, and Kenton Caves coiling specimens do not overlap chronologically, they are representative of the same rare type of coiling, produced with the same attributes, and produced by the same construction techniques.

Table 4. Temporal Ascription of a Rare Coiling Technique at Southern High Plains Sites

Site	Type	Type Designation	Id #	Lab Designation	Conventional Radiocarbon Age (BP)	Calibrated Age (2 sigma)
Kenton Caves	I	Close Coiling, Whole Rod with Lateral Bundle Foundation, Non-Interlocking Stitch	389 (DU)	AA71130	4017 +/- 47	2849 - 2370 B.C. 4799 - 4320 BP
Kenton Caves	I	Close Coiling, Whole Rod with Lateral Bundle Foundation, Non-Interlocking Stitch	A5 (W)	Beta 229379	1690 +/- 50	AD 240 - 430 1710 - 1520 BP
Franktown Cave	III	Close Coiling, Whole Rod in Bundle or with Lateral Bundle Foundation, Non-Interlocking Stitch	TOM -290	Not Reported	1267 ± 31	A.D. 677-860 1273 - 1090 BP
Trinchera Cave	I	Close Coiling, Whole Rod with Lateral Bundle Foundation, Non-Interlocking Stitch	No # D	Beta 229383	900 +/- 40	AD 1030 - 1220 920 - 730 BP

Statistical analyses were utilized in order to compare the coiling specimens of this type from each of the sites. The number of foundation units per cm are statistically the

same for all three sites ($\alpha=0.05; F=3.10 < F_{crit}=4.35$) (Appendix C). The number of stitches per cm for the Franktown Cave and Trinchera Cave specimens and Kenton Caves specimen DU 389 is statistically the same ($\alpha=0.05; F=4.38 < F_{crit}=4.74$) (Appendix C). The distance between foundation units for the Trinchera Cave and Kenton Cave specimens are statistically the same ($\alpha=0.05; F=2.65 < F_{crit}=3.98$) (Appendix C). The foundation unit diameter of the Trinchera Cave specimen and Kenton Caves specimen A5 are statistically the same ($\alpha=0.05; F=0.004 < F_{crit}=5.32$) (Appendix C). The foundation element diameter for both the rod and the bundle is statistically the same for the Kenton Caves specimens ($\alpha=0.05; F=1.76 < F_{crit}=10.13; F=0.98 < F_{crit}=10.13$) (Appendix C). The stitch width for the Kenton Caves specimens are statistically the same ($\alpha=0.05; F=3.87 < F_{crit}=4.96$) (Appendix C). The stitch width for the Franktown Cave and Kenton Caves specimens is statistically the same ($\alpha=0.05; F=3.11 < F_{crit}=3.89$) (Appendix C). The stitch gap for the Trinchera Cave specimen and Kenton Caves specimen DU 389 is statistically the same ($\alpha=0.05; F=2.29 < F_{crit}=4.96$) (Appendix C). The only major difference in the coiling types from the three sites is that the Trinchera Cave specimen exhibits intentionally split stitches, with a 100% split stitch frequency. The specimens from Franktown Cave and the Kenton Caves had roughly 25-33% split stitches, which were not deemed intentional. The multitude of statistically similar construction attributes for this rare coiling type indicates a finite similarity between the Franktown Cave, Trinchera Cave, and Kenton Caves specimens. This implies that this coiling technique, though rare throughout North America (Adovasio et al. 2005) was common and somewhat standardized on the Southern High Plains.

This coiling type may also have been utilized at Chamber Cave, Colorado (southwest of Pueblo, Colorado). Though the perishable collection from Chamber Cave resides in private hands, Charles Nelson's (1970) brief publication on the site and its contents indicates its possible use at that location. Two pieces of one rod and bundle basketry are listed in the artifact inventory (Nelson 1970:4, 9, Figure 8g) (Figure 7.40). Though the orientation of the rod and bundle are not delineated, it is possible that these basketry fragments had a rod and lateral bundle foundation, as opposed to the more common rod-in-bundle foundation. Based on the photograph, the work direction of this specimen is right-to-left, which is consistent with the specimens from Franktown Cave, Trinchera Cave, and the Kenton Caves specimen A5. Only the Kenton Caves specimen DU 389 exhibits a left-to-right work direction. The existence of this rare coiling foundation in all of the known Southern High Plains sites with perishable collections may indicate that it was a common Plains or peripheral Plains coiling foundation.

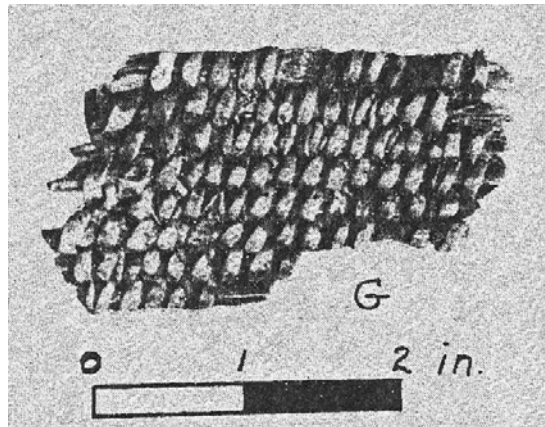


Figure 7.40. Chamber Cave one rod and bundle basketry fragment (adapted from Nelson 1970:Figure 8)

Yucca sp. sewn leather pouches and a possible bow guard or flint knapping guard are also present in the collection (Nelson 1970:7-8). According to Nelson, Chamber Cave

belongs to the Apishapa Focus based on the cord-marked pottery and side-notched projectile points. However, he also notes that in a broader sense, the material is also related to the Panhandle Aspect of Texas, Oklahoma, and New Mexico, which includes in the Antelope Creek and Optima Foci (Phases), dated around A.D. 1300-1450 (Campbell 1969) (Nelson 1970:11). These conclusions indicate the possible similarity between the artifact inventory of Chamber Cave and the remaining Southern High Plains sites discussed herein. In fact, Chamber Cave may be most similar to Trinchera Cave, due to the presence of Apishapa Focus artifacts at both sites. However, until the recovery of this collection from private hands, the similarity of the artifacts and therefore the occupants of Chamber Cave to other Southern High Plains can only be speculated.

Conclusion

The technological and chronological patterns of the sandal collections for the Southern High Plains are comprised of the individual technological and chronological patterns of the individual sandal collections from Franktown Cave, Trinchera Cave, and the Kenton Caves. The sandal collections from these site are cohesive. The earliest sandal technology found on the Southern High Plains is in the form of multiple warp sandals (Kenton Caves Types I-VI; Franktown Cave Type I) followed by two and four warp pseudo-twined sandals (Kenton Caves Types VII & VIII; Trinchera Cave Types I & II), which are then followed by composite and hide sandals and moccasins (Franktown Cave Type II; Trinchera Cave Type IV & V; Kenton Caves Type IX). However, the transition from one type of sandal technology to another signals a change in the basic approach to sandal manufacture (see Figure 7.39). These sharp changes in overall sandal construction

techniques as well as individual construction attributes signal a change in either population composition, change in cultural ideas, or both. These ideas of changing cultural affiliation and influence are examined further in the following chapter, wherein the origins of these new sandal types and construction techniques and attributes are explored based upon the reported assemblages from the surrounding regions.

External Correlations

The recent analysis and age dating (AMS radiocarbon dating) of the only three perishable collections available for research on the Southern High Plains (Franktown Cave, Trincheras Cave, and the Kenton Caves) has provided the means for the comparison of these assemblages to similar collections from surrounding regions. Perishable collections from the Great Basin, Southwest, Lower and Trans-Pecos Texas, Mexico, the Northwest Coast, and the eastern extension of the Great Plains were compared to the perishable collections of the Southern High Plains. Both spatial and temporal comparisons were made between the multiple known collections from these regions and the collections from the Southern High Plains. These comparisons were utilized to demonstrate the presence of cultural similarities within the perishable material culture of the study area and with surrounding regions. The presence of similar material culture in both the study area and the surrounding regions indicate cultural ties between the populations which occupied these regions in space and through time. The most similar sandal collections (technologically and temporally) to that of the Southern High Plains, are from southern New Mexico (Tularosa Cave, Cordova Cave, Pendejo Cave, and the

caves of the Gila and Hueco mountains) and the northern Colorado Plateau (Cowboy Cave, Sand Dune Cave, and Dust Devil Cave) (Figure 7.41).



Figure 7.41. Specific sites utilized in the determination of the External Correlations of the Sandal collections from Franktown Cave, Trinchera Cave, and the Kenton Caves (adapted from Hyland 1997 by John Watson GISP).

Franktown Cave (as reported in Adovasio et al. 2005)

According to Adovasio, Illingworth, and Thompson (Adovasio et al. 2005:16), the Franktown Cave plant fiber sandal assemblage, comprised of two variant forms of a unique plaiting type, has no direct counterparts in any of the adjacent basketmaking and sandal-making regions (see Chapter 6). The basic construction process and other details of manufacture found on the Colorado Plateau, in the Great Basin, Lower and Trans-Pecos Texas and northern Mexico are entirely different than those from Franktown Cave

(Adovasio et al. 2005:18). Adovasio and his co-authors also state that “perhaps, the only vaguely analogous assemblage of plant-fiber perishables which shows any remote generic relationships to the Franktown Cave assemblage derives from the Kenton Caves, in Cimarron County, Oklahoma” (Adovasio et al. 2005:18). Previous comparison of the Franktown Cave and Kenton Caves collections was inhibited by the lack of any firm chronological control at the Kenton Caves. Therefore, at the time of their writing, it was premature to suggest any connections between the two assemblages especially since the Kenton Caves lie approximately 480 km to the southeast of Franktown Cave in an entirely different ecological setting (Adovasio et al. 2005). However, the AMS dating of both collections (Table 1 and 2) has not solidified any connections. Despite the similar construction of the Kenton Caves Type I sandal and the Franktown Cave Type I sandals, the specimens are separated in time by roughly 3,000 years. The Kenton Caves Type I sandal is dated to between 6430-6230 cal B.C. and the earliest Franktown Cave Type I sandal is dated to between 3348-3054 cal B.C. Based on these dates, it is not likely that the same population was responsible for the creation of both types of sandals. However, as suggested in the Internal Correlations section of this chapter, their connection may lie in a common origin.

The Franktown Cave heavier variant sandals are identified by the presence of a grass sock, a heel pad, and more complex toe ties used to hold the sock in place and secure it. This more substantial tie mechanism also allows the sandal to be put on or removed without the sock collapsing or losing shape (Adovasio et al. 2005). The heavier form was also constructed using paired *Yucca* sp. leaves for warps and wefts with a different frequency of those elements than in the lighter variant. Finally, the heavier form

is also constructed with additional material interlaced into the contact portion of the sole to form pads, which may have enhanced traction, provided superior wear, or even extra insulation (Adovasio et al. 2005).

Despite dissimilarities amongst the Franktown Cave sandals and those of adjacent regions, a variety of body constructions (twined or braided) has been employed in the creation of winter-type sandals amongst populations in the Southwest (Hays-Gilpin et al. 1998:50; Kidder and Guernsey 1919; Earl Morris 1919; Elizabeth Morris 1980) and in the Northern Great Basin (Cressman 1962:27). Often, these winter-type sandals were large and perhaps were made to be worn over other sandals or to accommodate the stuffing so often found within them (Figure 7.42). The majority of the Southwestern winter-type sandals did not incorporate hide elements, which is similar to the heavier variants of the Franktown Cave collection. However, other types of winter sandals in the Klamath Highlands of the Northern Great Basin included sandals with thicker heel pads and twined shoes, though additional types of winter footwear included sandals produced with animal hide or moccasins (Cressman 1962:27). The winter variant sandals of surrounding regions do not provide conclusive evidence regarding the origin of these Franktown Cave winter or heavier variant sandals.



Figure 7.42. Southwestern style winter sandal, with padding. Sandal length is 130 mm.
(Photo by Elizabeth Ann Morris: Arizona State Museum Neg. 6087)
(adapted from Hays-Gilpin et al. 1998: Figure 4.19)

The Franktown Cave buffalo hide legging and moccasin represent the sole evidence of footwear for the later occupations of the site, specifically the Terminal Early Ceramic period. According to Gilmore (2005b), the Franktown Cave moccasin is structurally different from any form that is commonly made historically throughout the Great Plains and its periphery. Ethnographic accounts suggest both soft soles and single-piece patterns represent methods of construction that predate migration to the Plains, with a two-piece adaptation developing to deal with the harder ground and thornier plants encountered in the new environment. The Franktown Cave moccasin, however, is different from both of these types because it is a three-piece moccasin, with a U-shaped “tongue” or vamp and inverted T-shaped seam similar to heel closure seams of the

Eastern Woodlands and some one-piece Plains moccasins. The buttonhole present on the moccasin, however, which implies closure utilizing a button or thong, is not found in either the Plains or Eastern Woodlands; it is a characteristic of the Puebloan populations of the southwest. The moccasin supports what other artifacts present at Franktown Cave point to, a melding of influences from northern Colorado, the west and southwest, and the east and northeast (Gilmore 2005b:26).

Dick Conn (1983), Curator at the Denver Art Museum, examined the moccasin and concluded that it was probably Late Prehistoric or Protohistoric. He noted that Native Americans used a hard sole moccasin during historic times on the Plains. He believes it is a Midwestern or Eastern pattern based on the puckered toe (King 2006:66) and soft-sole design. Gilmore (2005a, 2005b) agrees with the previous assessment of the moccasin by Dick Conn (1983). Gilmore suggests that the moccasin is an Algonquian style from the Great Lakes Region, and ties in well with the other lines of evidence (pottery and projectile point styles) that suggest at least some affiliation with Eastern Woodland peoples. He goes as far to suggest that “we may be witnessing the initial expression of a High Plains Algonquian identity known historically as the Cheyenne and Arapahoe” (King 2006:70-71). However, Gilmore admits that three-piece moccasins from Promontory Cave, Utah also have toes similar to historic Algonquian and/or historic groups of the Northwest Coast (ca. A.D. 720-1040) (Gilmore 2005b:25). Sketches made by Steward also reinforce this determination (Figure 7.43) (Steward 1937a). However, while three-piece Fremont moccasins were made predominantly from mountain sheep, moccasins from nearby Hogup Cave were made predominantly of antelope or deer with bison patches, turned hair-side-in (Aikens 1970). Whether originating in the East or on

the northern Colorado Plateau, this moccasin style may represent an older form that was later replaced by hard sole forms better suited to the Plains environment or influenced by contact with other native Plains groups or Euro-Americans (Gilmore 2005b:29).

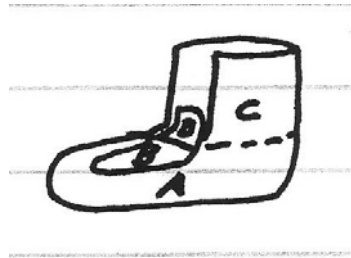


Figure 7.43. Sketch of Promontory Cave (Utah) moccasins (adapted from Steward 1937a).

The Kenton Caves

Kenton Caves Type I

The most similar specimen to the Kenton Caves Type I sandal (besides the Franktown Cave lighter variants) is a specimen from Cowboy Cave, Utah. The visual similarity between the two is surprising based on the physical distance between the two sites and the fact that the earliest sandals from the northern Colorado Plateau are dominated by open-twined sandals, followed by warp-faced plain weave sandals. However, amidst these types is a specimen designated as plain weave, appearing to be balanced plain weave as opposed to the more common warp-faced plain weave (Figure 7.44 right). Jennings (1980:61) testifies to this fact in his description that this sandal type as named did not occur elsewhere. However, he identifies an illustrated sandal, designated 'Coarse Warp Face' in Lindsay et al. (1968:118, Figure 94d) (Figure 7.45), which he deems identical to his plain-weave type. This determination appears to be mistaken. If, in fact, he was referring to the balanced plain weave sandal pictured below

(Figure 7.44 right; Jennings 1980:59, Figure 26c), he was in error. The sandal pictured in Lindsay et al. (1968: Figure 94d) (Figure 7.45), is similar in weave to the Kenton Caves Type III sandals, which are discussed below.

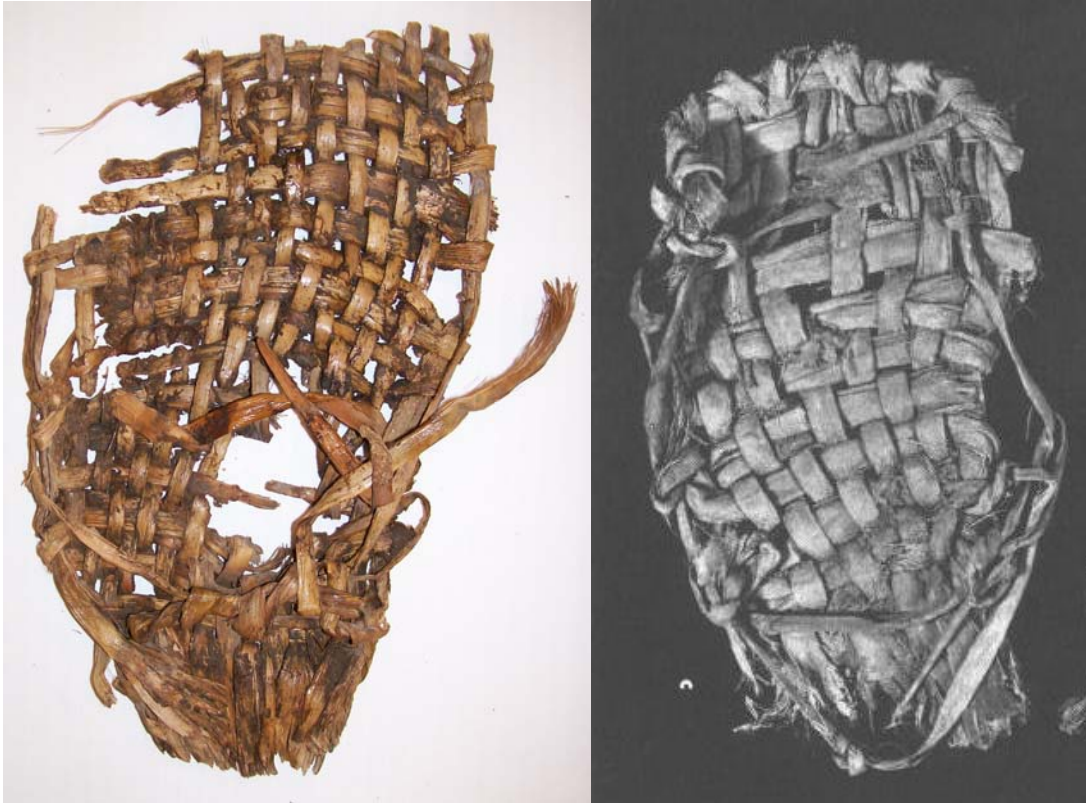


Figure 7.44. Specimen comparable to the Kenton Caves Type I sandal [left to right: Kenton Caves specimen #5049 and Cowboy Cave (Jennings 1980:59, Figure 26, specimen c) plain weave sandal.

All of the sandals recovered from Cowboy Cave were designated to be a part of the Desha complex, and according to Jennings (1980) all of the plain weave sandals occurred almost continuously through his Units III and IV, as well as appear late in Unit IV, and early in Unit V (Hewitt 1980:71 in Hyland 1997:241). Whatever the designation, according to Jennings (1980), the Stratum IIb (in Unit III) Desha-style sandals from Cowboy Cave are older than those from the type localities and date to 6625 +/- 80 B.C.

(8575 +/- 80 B.P.). The remaining Unit III sandals slightly overlap the dates from the type sites of Sand Dune and Dust Devil Caves and range in age from 5265 +/- 75 B.C. (7215 +/- 75 B.P.) to 4725 +/- 75 B.C. (6675 +/- 75 B.P.) (Hyland 1997:241). Therefore, the balanced plain weave sandal in question (Figure 7.44 right) can be assigned a date ranging from 6625 +/- 80 B.C. to 4725 +/- 75 B.C. This age matches up nicely with the antiquity of the Kenton Caves Type I sandal, which has been dated to 6430-6230 cal B.C. (8380 – 8180 B.P.) (Figure 7.44 left). The heel selvage treatment on both the Kenton Caves and Cowboy Cave specimens is identical. Loose elements are left unspun and unsecured past the final weft row. An identical knotted ankle tie is present on both specimens as well. However, it can only be assumed that the heel loops are of similar make due to the fact that only a broken element, oriented towards the heel, remains on the Kenton Caves specimen. Differences in the number of warp elements employed may vary due to differences in foot size, raw material employed, or even regional technological constraints. Also, despite Adovasio's determination that the Franktown Cave sandals have no direct counterparts in any adjacent region, I believe that, like the Kenton Caves Type I sandal, the Jennings' Figure 26c (Jennings 1980) specimen is somewhat similar to the Franktown Cave sandals.

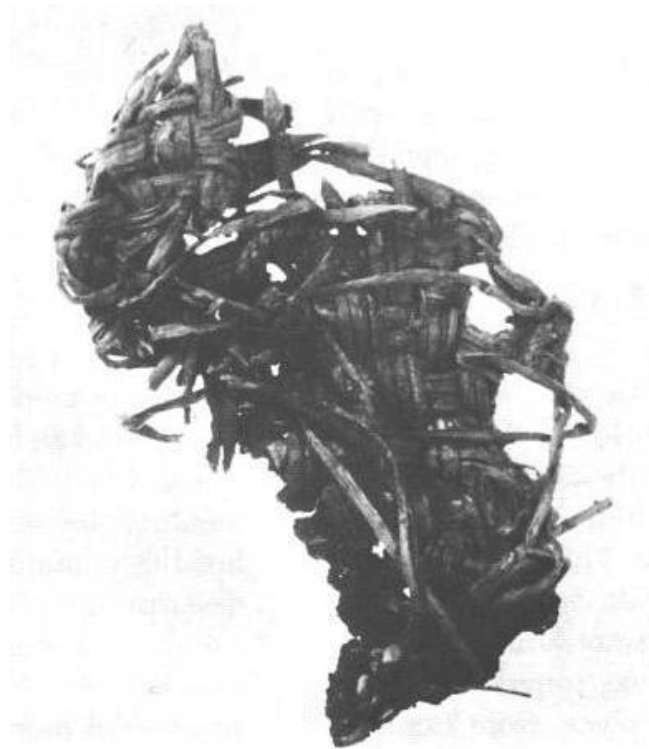


Figure 7.45. Dust Devil Cave “Coarse Warp Faced” sandal (Lindsay et al. 1968:118, Figure 94d) identified as being similar to a Balanced Plainweave sandal from Cowboy Cave.

Kenton Caves Type II

The sole of this sandal type is made of one long rectangular piece of weaving, created with a simple (1/1 interval) plaiting technique, which employs 180° self-selvages. This rectangular piece of weaving is then folded back upon itself to create a toe cover, and in doing so creates the toe selvage as well as a round toe silhouette. The folded portion of the plaiting only extends over the front half of the foot (ending before the ankle). This construction type has not been reported previously in any of the known basketmaking regions. Though sandals from Oregon and Missouri have utilized toe covers in their construction, the toe covers or vamps were created with a different weave than the sole, namely twining. The complete absence of twining in the Kenton Caves

Type II sandals and in the Kenton Caves collection in general indicates the limit of that comparison.

The Kenton Caves Type II sandals are also created with a unique tie mechanism. As opposed to the more common side-loop, toe-heel, or criss-cross tie systems, the outer warp elements are used to create the tie mechanism (see Figure 7.8). Only the two complete specimens (34 & DU 397) exhibit any evidence of a tie mechanism. The tie mechanism on both sandals is identical. The loose and not yet exhausted outer warp element from each side selvage is pushed through the sole, between the final two warps. These loose strands are then tied together across the dorsal surface of the foot directly in front of the ankle. Two of the Type II specimens (34 & DU 397) are filled with shredded or matted fibers, which suggest possible winter use. It is indeterminate whether the remaining specimens were intentionally left unfilled to be used as lighter spring sandals or whether the fragmentary condition of the specimens caused the loss of the padding. Other reported heavier or winter variant sandals are completely unlike the Type II specimens.

Due to the uniqueness of this construction type, no definitive comparisons can be made regarding the origins of this type. However, its absence from known collections from documented regions may indicate that its origin lies in areas left undocumented, such as the Plains. This previously undocumented construction type may be a purely Plains innovation or development.

Kenton Caves Type III

As mentioned above, I do not agree with Jennings' (1980) determination that the sandal illustrated in Lindsay et al. 1968: Figure 94d (see Figure 7.45) is of the same type as the sandal reported in his own work (Jennings 1980: Figure 26c) (see Figure 7.44, right). The Lindsay et al. (1968: Figure 94d) specimen appears very similar to the Kenton Caves Type III specimens with oblique plaiting. Though there is an obvious fold on Lindsay's specimen, it is indeterminate whether the fold is at the toe or heel of the specimen. Additionally, it is possible that Lindsay's Figure 94d specimen exhibits a remnant tie mechanism. It is obvious that additional material was added to the sole or body of the specimen. Though indeterminate without physical examination, it is possible that the loose, knotted pieces of raw material which extend the length/width (ind.) of the specimen were once a part of a lattice-work tie system similar to that found on Kenton Caves Type III sandal specimen DU 399 (see Figures 7.16 and 7.17). Lindsay's (Lindsay et al. 1968) Figure 94b, as well as, Lindsay's (Lindsay et al. 1968) Figure 73e (Figure 7.46) are also similar to the Kenton Caves Type III sandals because the weaving incorporates trebled and doubled element units. However, Lindsay's (Lindsay et al. 1968) Fig 94b and Lindsay's (Lindsay et al. 1968) Figure 73e specimens do not portray the same oblique plaiting. Based on the selvage of Lindsay's (Lindsay et al. 1968) Figure 73e (Figure 7.46), where the pseudo-weft element leaves and reenters the weave (180° selvage), it is obvious that the specimen has longitudinal and transverse elements. The Kenton Caves Type III items have 90° selvages, as does Lindsay's (Lindsay et al. 1968) Figure 94d (see Figure 7.45).

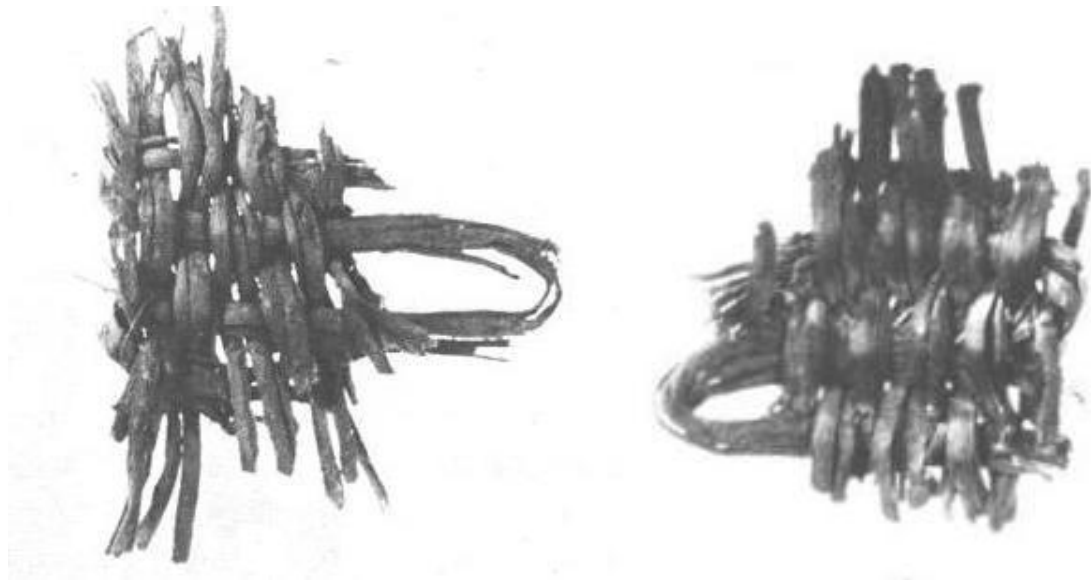


Figure 7.46. Specimen from Dust Devil and Sand Dune Caves (left: Lindsay et al. 1968:Figure 94b; right: Lindsay et al. 1968:Figure 73e)

According to Lindsay (Lindsay et al. 1968), the Navajo Mountain plain weave sandals, which include those illustrated in Lindsay's (Lindsay et al. 1968) Figures 73e, 94b, and 94d, are of the same age as the open-twined sandals which were used to define the Desha complex. Therefore, it can be assumed that these specimens date to between 5000 and 6000 B.C. (Lindsay et al. 1968:96). It is indeterminate whether the double weft element type precedes the trebled weft type of plain weave sandals. However, these Desha complex plain weave sandals (with double and treble weft elements) precede similar forms found at the Kenton Caves by a minimum of 400 years. The earliest example of the Kenton Caves Type III sandals happens to be made with doubled weaving elements and dates to 4600-4330 cal B.C., preceding the trebled variety by roughly 1500 years. The two forms of the Kenton Caves Type III sandals, one made with doubled weaving elements and the other with trebled weaving elements, are contemporaneous from 2800-2400 cal B.C.

Similar and much more recent oblique plaiting sandals than the Kenton Caves Type III specimens are also found at Tularosa Cave, Pendejo Cave, and the caves of the Upper Gila area (Figure 7.47). Though the oblique plaited sandals found at Tularosa Cave, which date to the Georgetown and San Francisco phases from A.D. 500 to A.D. 900 (Martin et al. 1952:237), are similar to that found at the Kenton Caves, the method of start on the two collections is completely different. The Kenton Caves examples begin with a knotted start, a Southwestern method (Anasazi or Mogollon), while the Tularosa examples begin with the weaving elements folded at the toe, wherein each end of the weaving element is incorporated into the sandal. However, the Kenton Caves Type III sandals appear to be a blend of the two Southwestern styles, incorporating both a knotted start and then a fold at the toe. The Pendejo Cave Type III sandal is also similar to the Kenton Cave Type III sandals and has a post-A.D. 800 temporal ascription. It is most similar, however, to the Tularosa Cave sandals and Cosgrove's Type 9a (1947:89, Figure 91 & 92) sandals from the Upper Gila area, in that the weaving elements are folded in half at the toe before weaving proceeds. The Kenton Caves Type III sandals are unique in that they are created as one long piece of weaving, which is then folded to cover the toe portion only.

An additional sandal of this type was also found in the museum display at the Coronado State Monument in Bernalillo, New Mexico. With a reported temporal ascription of A.D. 600, this specimen exhibits a complete tie mechanism and is similar to the plaited sandals from Tularosa Cave (Figure 7.47). However, the excess weaving elements are not folded at the heel and secured with additional raw material as in other Tularosa Cave specimens. After the desired sandal length was accomplished, the

exhausted weaving elements of the Bernalillo specimen were plaited underneath preceding weaving rows creating a 90° selvage. Though these exhausted elements point toward the toe and lay on the obverse heel, they were not folded and there is no evidence that they were secured by additional raw material elements.

Though the knotted start found on the Kenton Caves specimens is a nod to Anasazi associations, interestingly enough, the Anasazi Basketmakers are not defined as an entity until A.D. 1. The early dates of the Kenton Caves sandals pre-date any previously published descriptions about the Basketmaker peoples and even the pre-Basketmaker Cochise culture. The knotted start that appears on the Kenton Caves Type III sandals is found as early as 4600 cal B.C. This knotted start does not appear on the earlier Kenton Caves Type II sandals, but may have been utilized on the Type III specimens due to the orientation of the weaving elements. Knotting the elements may have been the only way to secure them. Though the construction method of utilizing a folded toe was retained from the Type II sandals, the original sandal style was deviated from in regard to orientation of weave, tie mechanism, and heel selvage, changes that may have been influenced by or adapted from a different group of individuals.

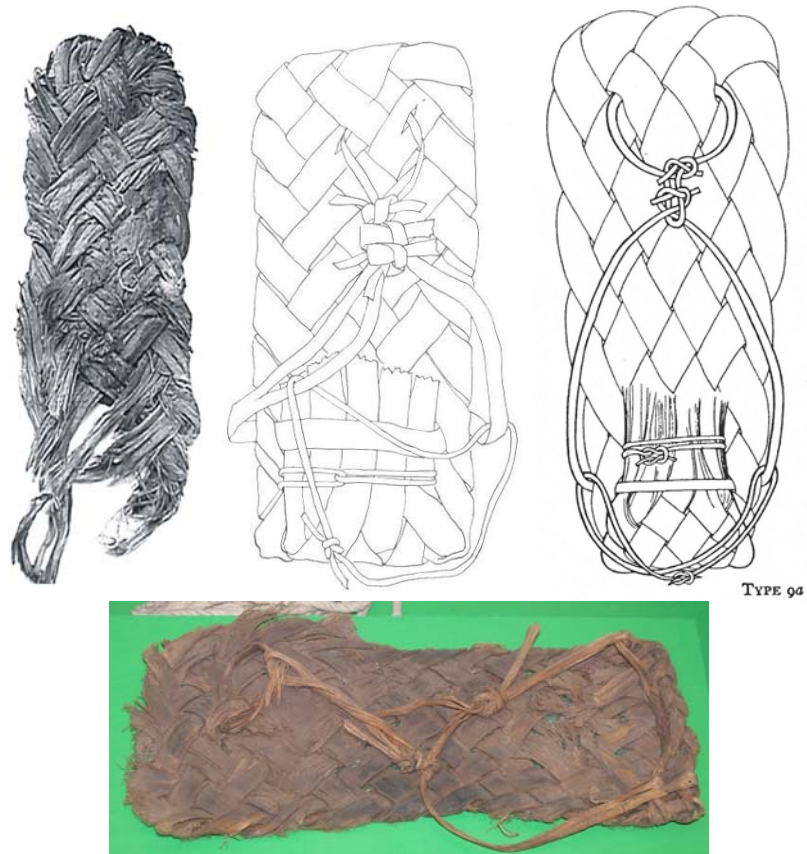


Figure 7.47. Sandals from Pendejo Cave (Hyland 1997:Figure 50), Tularosa and Cordova Caves (Martin et al. 1952:Figure 92), Upper Gila caves (Cosgrove 1947:Figure 92) and Coronado State Monument, New Mexico.

Kenton Caves Type IV

Due to the fragmentary condition of the Kenton Caves Type IV specimens, many aspects of their original construction are indeterminate. The total number of warp elements employed, presence of traction masters, tie mechanism, heel selvage, and heel silhouette are indeterminate. Therefore, these unknowns impose limitations on any attempt to compare their construction methodology to that of adjacent regions. Unbalanced plain weave sandals, as well as weft-faced and warp-faced sandals have been documented in surrounding areas, however, none are particularly more similar to the Kenton Caves Type IV specimen than any other. They provide no assistance in the

determination of the cultural affiliation of the occupants of the Kenton Caves and the Southern High Plains. The construction attributes utilized in the manufacture of these specimens are not unique to any particular region.

Kenton Caves Type V

Sandals known as continuous warp sandals normally have one continuous loop around the edge of the sandal to which additional warp elements are fastened. These sandals are either twined or sewn. Sandals made with one long piece of raw material (warp), which runs back and forth longitudinally up and down the length of the sandal, have been previously unknown. It is much more common for one long piece of raw material to be bent and utilized as two warps, as in two warp sandals and multiple-warp cord sandals, as opposed to the six warps created in the Kenton Caves Type V sandal. The only known sandals that have been created with a continuous warp are continuous outer-warp cord sandals (Figure 7.48). Examples of continuous outer-warp cord sandal types are present at Tularosa Cave, produced during both the Pine Lawn Phase (100 B.C.-A.D. 500) and San Francisco Phase (A.D. 700-900). However, "it is also possible that both variations were experiments at blending Mogollon wickerwork techniques and Anasazi multiple-warp techniques" (Martin et al. 1952:239). Eleven multiple-warp cord sandals were also found at Tularosa Cave (Figure 7.49), which resemble types found in Basketmaker sites. Both warps and wefts are usually of two-yarn cord. These sandals are woven by simple plaiting with puckered heels and the ends of the warps (at the heel) forming an ankle tie. Ties resemble those on wickerwork sandals (Martin et al. 1952:238). Multiple-warp cord sandals are characteristic of Basketmaker II (A.D. 1-500)

and III (A.D. 500-700) sites and Pueblo III (A.D. 1100-1300) sites. However, the Mogollon sandals, which appear during the Georgetown Phase (A.D. 500-700) lack the knotted soles and colored decorations present in Anasazi sandals. Multiple-warp cord sandals seem to be an Anasazi development, a type that is more abundant and more complicated in weave and decoration at Anasazi sites. The construction attributes utilized in the manufacture of the Kenton Caves Type V specimen are unique and have not been reported previously from any adjacent region. Because the Kenton Caves Type V sandals have no known counterparts in regards to construction technology, they provide no assistance in the determination of the cultural affiliation of the occupants of the Kenton Caves and the Southern High Plains.

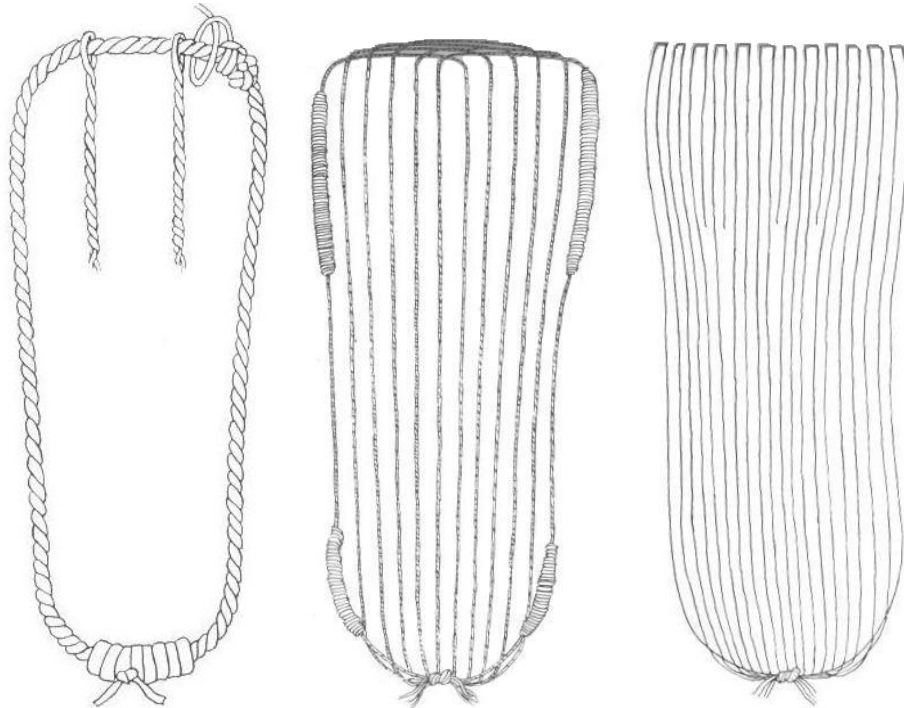


Figure 7.48. Known continuous warp configurations [left: continuous outer-warp cord (Martin et al. 1952: Figure 102); center: multiple warp cord (Martin et al. 1952: Figure 100); right: multiple warp cord (Martin et al. 1952: Figure 100)].

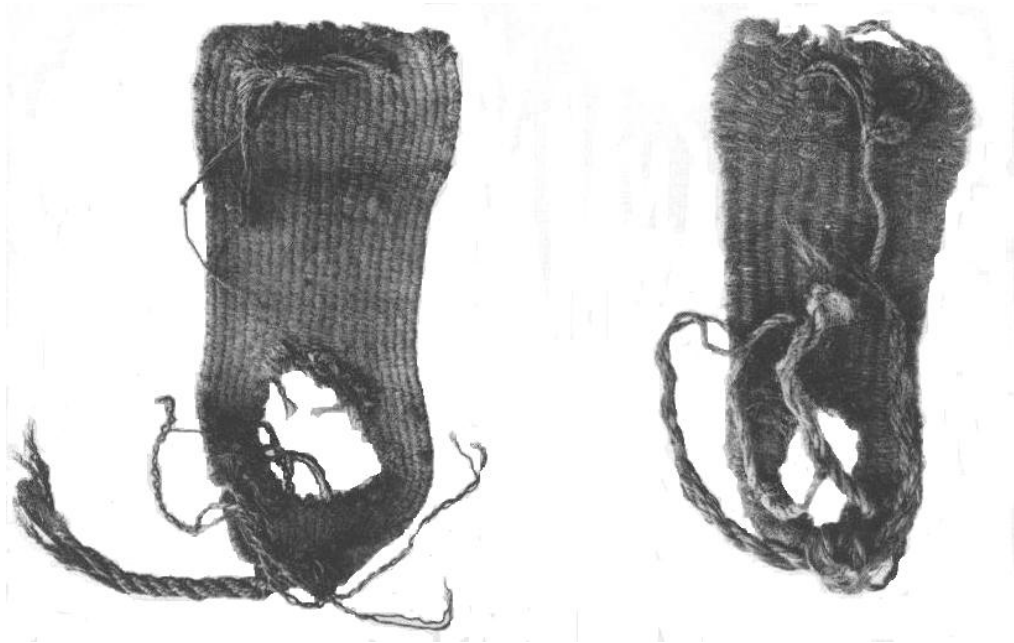


Figure 7.49. Multiple warp cord sandals (adapted from Martin et al. 1952: Figure 99).

Kenton Type VI

The Kenton Caves Type VI sandals have no known counterparts. Most sandals identified as having a “frame” normally refer to the continuous warp sandals mentioned in discussions of the Kenton Caves Type V sandal. However, the frame present on the Type VI specimen is created by the wefts as opposed to the warps. The narrowest part of this sandal is assumed to be the sandal width; this is also based on the 180° selvages created by the weft frame. Because the Kenton Cave Type VI sandals have no known counterparts, they provide no assistance in the determination of the cultural affiliation of the occupants of the Kenton Caves and the Southern High Plains.

Kenton Caves Type VII

Two warp wickerwork sandals are the earliest sandal type utilized in the Mogollon area and are the predominant type from pre-pottery times through ca. A.D. 750-900 (1200-1050 B.P.), the end of the San Francisco phase (Bluhm 1952; Hyland 1997). This type (or variations thereof) is represented at Tularosa and Cordova caves throughout virtually the entire sequence (100 B.C. through A.D. 1200) (Bluhm 1952; Hyland 1997). In Cosgrove's large sandal sample (n=1016), two warp types (Type 3, 4a, 4b, 5a, 5b, 5c, 7, 8, 10, 11) collectively occur in both preceramic (i.e., Basketmaker) as well as ceramic (i.e., Pueblo) contexts, which parallels the situation at Tularosa, Cordova, and Bat caves (Hyland 1997). Outside the Mogollon area, two warp plaited or plain weave sandals occur very rarely in Late Anasazi contexts (Kankainen 1995) as well as in the Lower and Trans-Pecos Texas. Two warp plaited sandals also occur sporadically throughout northern Mexico with the notable exception of central Coahuila and Tamaulipas. However, the Cuatro Ciénegas types discussed and illustrated by Taylor (1966: Figures 15-17; 2004), have no counterpart in the Mogollon area nor do the sandals of the Ocampo area of Coahuila (Hyland 1997:243; Turpin 1985).

The Kenton Caves Type VII sandals are similar to other scuffer toe sandals with fishtail heels from the Gila and Hueco Mountains and Pendejo Cave (Cosgrove 1947; Hyland 1997). They are the most similar to and seem to be a combination of Cosgrove's (1947) Type 4b (Two-warp fish-tail toe sandal) and Type 5a (Two-warp Fishtail Scuffer Toe sandal) (Cosgrove 1947:85-86, Figure 89 & 90) (Figure 7.50). The Kenton Caves Type VII sandals are similar to Cosgrove's Type 4b sandals because of the tight wickerwork weave, which proceeds from heel to toe, and in which the ends of the leaves

protrude from the sole, creating traction masters (Figure 7.22, right). They are also similar based on the construction of the tie mechanism. Portions of the warps emerge from the side selvages at the ball of the foot and tie to the toe loop, which is created by the opposite ends of the warps. Though this tie mechanism is documented for sure on the Cosgrove Type 4b specimens, only remnant portions of the tie mechanisms remain on the Kenton Caves Type VII sandals. However, the placement and orientation of the tie mechanism elements suggest that they are identical. It is important to note that Cosgrove's Type 4b sandals also have a fishtail toe that is also present on the Kenton Caves Type VII sandals. The Kenton Caves Type VII sandals are also similar to Cosgrove's Type 5a sandals (Figure 7.50) in which the first weft leaf at the heel usually encircles the warps 2 or 3 times with the broad end of this leaf forming part of the tail. Cosgrove's Type 5a sandals also display the same tie mechanism as that found on the Type 4b sandals, with portions of the warp material emerging from the selvage and tying to the toe loop. They are dissimilar to the remaining Type 5 specimens (b-f) reported by Cosgrove (1947), which in their descriptions include mention of tension straps. According to Cosgrove, in all the sandals except Type 5a, "the so-called tension straps, composed of a single leaf, lie on either side on top of the selvage and parallel with the warps ... and whose pull has a tendency noticeably to curl the compact bundles of warps upward at the toe, giving the frame a characteristic sled-like appearance" (Cosgrove 1947:86).

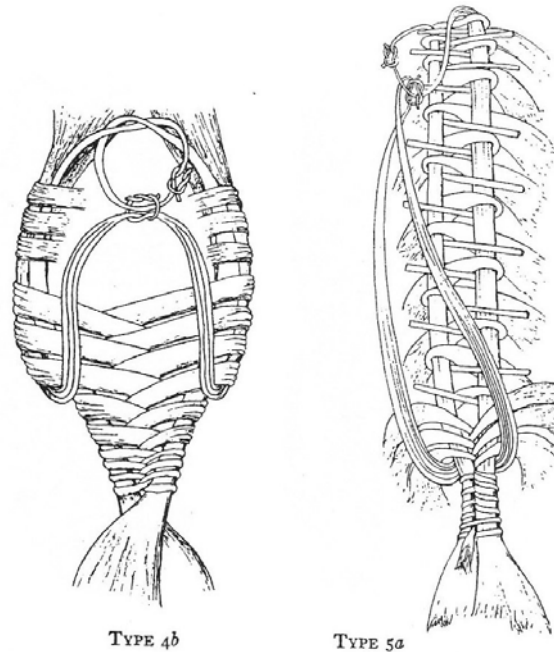


Figure 7.50. Schematic drawings of Cosgrove Type 4b and 5a Two-Warp Fish-tail sandals (Cosgrove 1947: Figure 90).

Kenton Type VIII

In the Jornada Basin of the Mogollon region, the Pendejo Cave four warp scuffer toe sandals (Pendejo Cave Type I) are restricted to a solitary occurrence, bounded by a radiocarbon determination of cal A.D. 800 \pm 100 (1150 \pm 100 B.P.) and cal A.D. 1000 (950 B.P.) (Hyland 1997:244). Elsewhere, the four warp variety occasionally appears somewhat earlier than at Pendejo Cave and persists for an even longer time. At Tularosa and Cordova Caves, so-called four warp wickerwork sandals appear in the pre-pottery levels through mixed San Francisco/Tularosa and Late Phase levels (100 B.C.-A.D. 1200) (Bluhm 1952:262-263; Martin et al. 1952:233-235). However, the excess warp material that is folded at the toe and secured with additional rows of plaiting is completely different from how the Kenton Caves Type VIII sandals are constructed. Cosgrove (1947:82-83) assigns four warp plaited sandals to three variations (Types 1a,

1b, 1c) based principally on toe loop and side strap manipulations. According to Cosgrove (1947:93, Table 1), all three of these variations are most common in the Hueco Mountain area though they also occur in the Upper Gila region. While the type is quite common in preceramic contexts, it does persist, like its two warp counterpart, into the pre-ceramic period (Hyland 1997:244).

Though the Kenton Caves Type VIII sandals are similar to four-warp sandals from the Upper Gila and Hueco Mountains (Type 1a-1b) (Cosgrove 1947:82-83, Figure 87 and 88) and Pendejo cave (Type I), the layout of the specimen's warps do deviate from previously documented specimens. In the aforementioned types, only three strands of material are used to create the warps. One strand is used to create the two outer warps (in an upside down U shape). Then two additional strands are used to create the inner warps, each tied separately to the previously mentioned single strand (tied to the base of the U). Work proceeds heel to toe and the tie mechanism is affixed with additional strands of material punctuating the inner two warps to create a toe loop. Additional material is then tied to either side of the sandal and knotted to the toe loop. However, in DU 824, four strands are used to create the warps (see Figure 7.24). The inner two warps are knotted together and are not affixed to the outer warps. Once tied together, these two warps actually provide the material for the toe loop of the tie mechanism, for which additional material is no longer necessary. Due to the fragmentary nature of this specimen, it cannot be determined whether additional material was used to affix side loops to complete the tie mechanism, though it is likely this was so. The toe selvage of this specimen is created by the orientation of the warps. The obverse left warp extends up to and across the toe and is affixed to the obverse right warp with a square knot. The final

weft rows weave around this element until exhausted and tucked into preceding rows. Traction masters are also present on the Kenton Caves Type VIII specimens, which are also found on specimens from the Upper Gila and Hueco Mountains and Pendejo Cave. All of the sandal similarities reported above regarding the construction techniques and attributes utilized in the manufacture of the Kenton Caves Type VIII sandals and other four-warp pseudo-twined sandals reported for the Mogollon region (Cosgrove 1947; Hyland 1997) provide evidence for the shared cultural affiliation of the people that occupied these two areas.

Kenton Caves Type IX

The Kenton Caves Type IX buffalo hide sandal is unique. No similar sandal descriptions or photographs have been published. More common in adjacent areas are rabbit skin sole sandals stuffed with plant fiber or calf-high antelope moccasins are more common in adjacent areas such as the Mogollon region of the Southwest, the northern Colorado Plateau, and Great Basin.

The Kenton Caves Sandal Collection

The Kenton Caves sandal collection is comprised of three sets or general styles of sandal. The earliest type of sandal is manufactured with multiple warps, which are replaced by two-warp and four-warp pseudo-twined sandals, which are then replaced by buffalo hide sandals. All of these general sandal styles are mutually exclusive in regards to construction methodology and temporal ascription. No two groups of sandals with different warp orientations or sole constructions (multiple warp, two-warp, four-warp, or buffalo hide) are manufactured at the same time at the Kenton Caves. Each of these

groupings is also influenced by different populations that reside in different basketmaking regions. The early appearance and dominance of multiple warp varieties suggest affiliations to the southern Great Basin and the northern Colorado Plateau. However, both regions utilize twining in their constructions as well as an open weave. Sandals from Cowboy Cave are the only exception. The two-warp and four-warp varieties are most similar to those of the Mogollon region (Tularosa Cave, Cordova Cave, the Upper Gila area and Hueco Mountains) and Jornada Mogollon region (Pendejo Cave). The buffalo hide sandal technology was most likely derived from Plains influence.

The deviations in manufacture between the Kenton Caves Type II and Type III multiple warp sandals may signal some form of change, or the presence of a different group, though a part of the same regional network. The construction of the Type III sandals may represent a possible modernization of an old style by a different faction. Many groups in the Anasazi Southwest use different types of sandals to signify group identity within such a regional network of association. This may be another example of such individuality or group statement. A knotted start is a clue to Anasazi associations, but interestingly enough, the Anasazi Basketmakers are not defined as an entity until A.D. 1. The early dates of the Kenton Caves sandals pre-date any previously published descriptions about the Basketmaker peoples and even the pre-Basketmaker Cochise culture. The knotted start that appears on the Type III sandals is found as early as 4600 B.C. This knotted start does not appear on the earlier Type II sandals, and may be another indication that the original sandal style was deviated from and may have been influenced by more southwestern individuals. Balanced plainweave sandals are not completely

unknown, and are actually abundant in New Mexico and northern Mexico. However, the folded toe found on the Kenton Caves Type II and Type III specimens is unique.

Trinchera Cave

Trinchera Cave Type I

The Trinchera Cave Type I sandal most closely resembles the Pendejo Cave Type II (two warp scuffer toe) sandals. Not only are they visually the most similar, but the results of ANOVA comparison of their sandal thicknesses indicate that their sandal thicknesses are statistically the same ($\alpha=0.05$; $F=3.35 < F_{crit}=3.97$) (Appendix C). However, sandal types such as Cosgrove's Type 4b (Cosgrove 1947:Figure 90) sandals from the Hueco mountains are also vaguely similar based on the utilization of a fishtail heel and warp orientation (Figure 7.51).



Figure 7.51. Specimens comparable to the Trinchera Cave Type I Sandal [left to right: Trinchera Cave specimen #221A, Pendejo Cave Type II sandal (Hyland 1997:Figure 45), and Cosgrove Type 4b (1947:Figure 90).

Trinchera Cave Type II

Though no documented four warp pseudo-twined sandals from adjacent regions match perfectly with the Trinchera Cave Type II specimens, those that are most similar come from the Mogollon sites of Tularosa Cave and Cordova Cave and the Upper Gila caves. The four warp sandals have twisted toe and heel selvages similar to those found on the Trinchera Cave specimens, however, a portion of the warps are folded over and secured by additional rows of plaiting. The Mogollon five-warp varieties are also similar to the Trinchera Cave four-warp sandals because of the inclusion of twisted warps in the complex toe and heel selvages of the sandals; however, these selvage types are much more complex than those found on the Trinchera Cave specimens. While the four-warp and five-warp wickerwork sandals from Tularosa and Cordova Caves share the same basic sole construction as the Trinchera Cave Type II sandals, only the obliquely plaited sandals from Tularosa and Cordova Caves share the same side-loop tie system as that found on all of the Trinchera Cave sandal types. The four- and five-warp wickerwork sandals from Tularosa and Cordova caves are created exclusively with toe-heel tie systems. It is possible that the four-warp Trinchera Cave (Type II) specimens represent an amalgamation of the four-warp wickerwork and obliquely plaited sandals found at the Tularosa and Cordova Caves (Figure 7.52).



Figure 7.52. Specimens comparable to the Type II Trincherera Cave sandals [left to right: Trincherera Cave Specimen #T5-4-2, Cosgrove (1947) Type 12 five warp sandal, Tularosa and Cordova Caves four warp sandal (Martin et al. 1952:Fiugre 90), and side-loop tie system on Tularosa and Cordova Caves plaited sandals (Martin et la. 1952:92)].

In addition to similarities between the Trincherera Cave Type II sandals and other four-warp sandals from Tularosa and Cordova Caves, the Trincherera Cave Type II sandals also share statistical similarity with sandals from the Mogollon site of Pendejo Cave, New Mexico. Specifically, a subtype of the Trincherera Cave Type II specimens, consisting of specimens #780 and #789, show the most similarity. The warp diameters of the Trincherera Cave Type II (four warp) sandal specimens #780 and #789 and Pendejo Cave Type I (four warp scuffer toe) sandal specimen G681 are statistically the same ($\alpha=0.05$; $F=0.26 < F \text{ crit}=5.79$) (Figure 7.53) (Appendix C). Though the Trincherera Cave Type II subtype is shown to be statistically similar to the Pendejo Cave specimen in regard to this one construction attribute, the orientation of the warps is different. The warps of the Pendejo Cave specimens were created with three to four whole *Yucca* sp. leaves, while the warps of the Trincherera Cave specimens utilized only one to two leaves. In fact, additional construction differences exist between these two types. The Pendejo

Cave Type I specimen is a scuffer toe sandal which only provides protection for the front portion of the foot, exhibits a tapered heel, and though no evidence for a tie mechanism is present, due to its scuffer toe configuration, it is likely that the exhausted pseudo-warps were tied around the toe or ankle (Hyland 1997:231; Martin et la. 1952:263-267). These characteristics are in sharp contrast to the characteristics of the Trinchera Cave Type II subtype specimens which are full length, square toe, square heel sandals that exhibit a side-loop tie system. Though the warp diameter of the four-warp sandals from Trinchera Cave and Pendejo Cave are statistically the same, major differences exist between these two types, as indicated by the remaining construction attributes. While generic similarity regarding warp configuration and general plaiting technique may indicate broad cultural similarities, the sandals from these sites were likely produced by two different “communities of practice” who utilized very different culturally conservative sandal techniques and attributes.



Figure 7.53. Pendejo Cave Type I four warp scuffer toe sandal specimen G681 (Hyland 1997:Figure 43)

Trinchera Cave Type III

Due to the fragmentary condition of the Trinchera Cave Type III specimens, many aspects of their original construction are indeterminate, including heel selvage and heel silhouette. Therefore, these unknowns impose limitations on any attempt to compare their construction methodology to that of adjacent regions. Unbalanced plain weave sandals, as well as weft-faced and warp-faced have been documented in surrounding areas, however, none are particularly more similar to the Trinchera Cave Type III specimens than any other. They provide no assistance in the determination of the cultural affiliation of the occupants of Trinchera Cave and the Southern High Plains.

Trinchera Cave Type IV

Nine examples of a winter-type sandals very similar to the Trinchera Cave Type IV sandals were recovered from Tularosa Cave (Martin et al. 1952:242). The Tularosa Cave sandals were manufactured from an oval-shaped piece of antelope hide, which is pulled up around the foot by a series of side-loop ties. Grass padding (sp. ind.) also lines the majority of the specimens (Figure 7.54). Reportedly, the sandals were found in Pre-Pottery (300 -150 B.C.), Pine Lawn (150 B.C.-A.D. 500), San Francisco (A.D. 700-900), and San Francisco through Tularosa Phases (A.D. 900-1200), but were more popular in the earlier period. The majority of the phases during which these sandals have been found at Tularosa Cave predate the Trinchera Cave specimens (cal A.D. 1023-1169). The similarity between the two collections of these composite sandals is striking. Side-loop winter sandals have also been reported from the Great Basin at Promontory Cave/Promontory Point by Steward (1937b:53 Fig. 23f), however this unique type was

described as being derived from the prehistoric Southwest. Therefore, based on the radiometric and technological descriptive data, it is possible that the Mogollon composite sandals from Tularosa Cave are the precedent forms of the Trincherera Cave specimens.

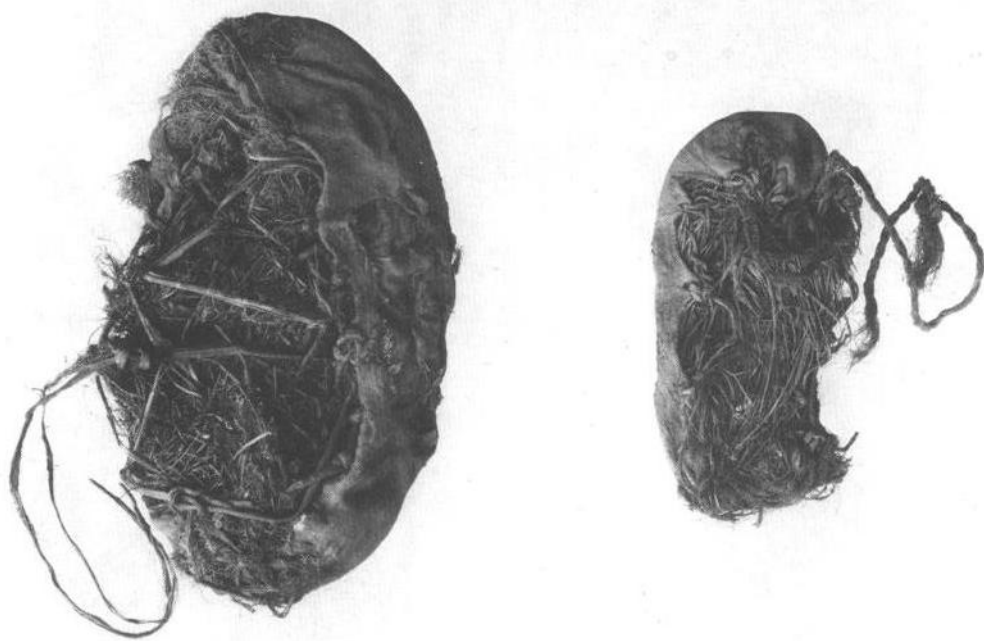


Figure 7.54. Winter-type leather sandals with side-loop ties and grass padding from Tularosa Cave, which are similar to Trincherera Cave Type IV sandals; possible winter variants. Length of left sandal is 244 mm. (adapted from Martin et al. 1952: Figure 110)

Twelve leather sandals, all made of antelope hide, were also found in Tularosa Cave. Three were modeled after cloth sandals. Leather pieces were cut in foot-shaped patterns with rounded toe and heel, wider at the toe than at the heel (Figure 7.55). The ties found on these specimens also resemble those of the fabric sandals (Martin et al. 1952:242). Plain leather sandals have been found in the Papago level of Ventana Cave (Haury 1950:427) and in a Basketmaker II site in northeastern Arizona (Kidder and Guernsey 1919:160). However, so few of this type have been reported in the Southwest that no definite conclusions can be drawn from their analysis. The sandals probably

occurred in both areas at the same time (Martin et al. 1952:242). Though none of the reported Trinchera Cave hide sandals resemble these specific examples, they are representative of the established hide tradition at Tularosa Cave, and strengthen the argument of connection and shared affiliation between these two sites and regions.

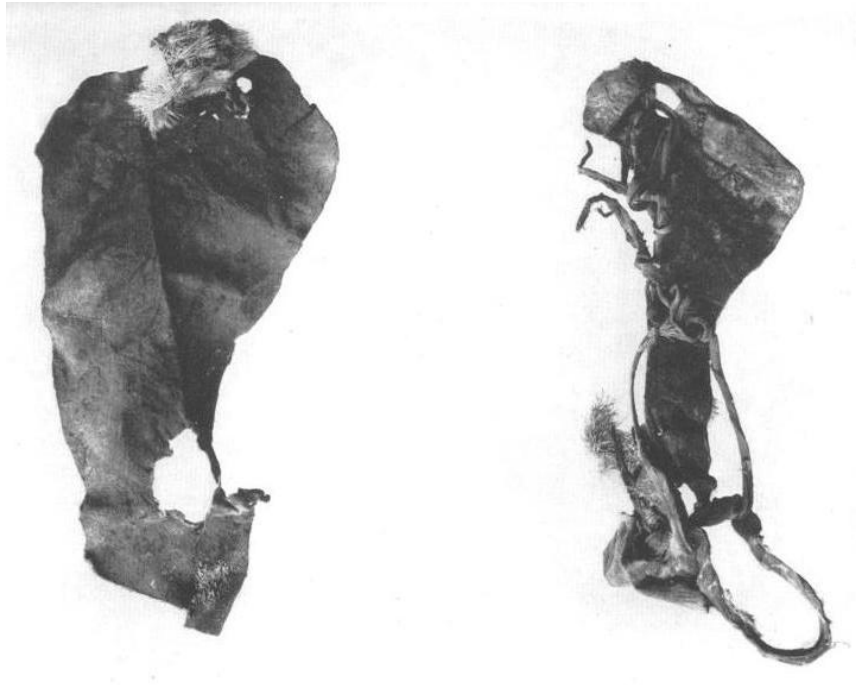


Figure 7.55. Leather (antelope hide) sandals from Tularosa Cave (adapted from Martin et al. 1952: Figure 109)

Trinchera Cave Type V

Trinchera Cave Type V specimen No #A is most closely aligned with the moccasin specimens from Sand Dune Cave (Figure 7.56). Despite the fact that specimen No #A is merely a moccasin toe, the toes of the moccasins from Sand Dune Cave are constructed in a similar fashion (Figure 7.57). It is not stated whether multiple pieces of hide were utilized in the construction of the toes, however, the use of cordage (twist

unidentified) indicates the combination of at least two pieces. However, the use of knotting is not discussed. The principal ties, comprised of heavy 2-yarn, Z-twist *Yucca* (sp. unreported) cordage, are attached to the heels (Lindsay et al. 1968:76). Moccasins from Sand Dune Cave (NA7523) are reportedly very similar to modern Pueblo and Navajo moccasins. All sewing was done with simple running stitches, and the soles are flat, rather than being turned up at the edges. They were constructed of deer (?) hide with the hair left on. The hair side was placed to the outside, or downward (Lindsay et al. 1968:74). The description of the sole of these moccasins is also similar to Trincheria Cave Type V specimen 41. It is possible that specimen 41 was cut from a flat sole as opposed to soles with “turned up” edges. The hair side of specimen 41 was also placed to the outside.

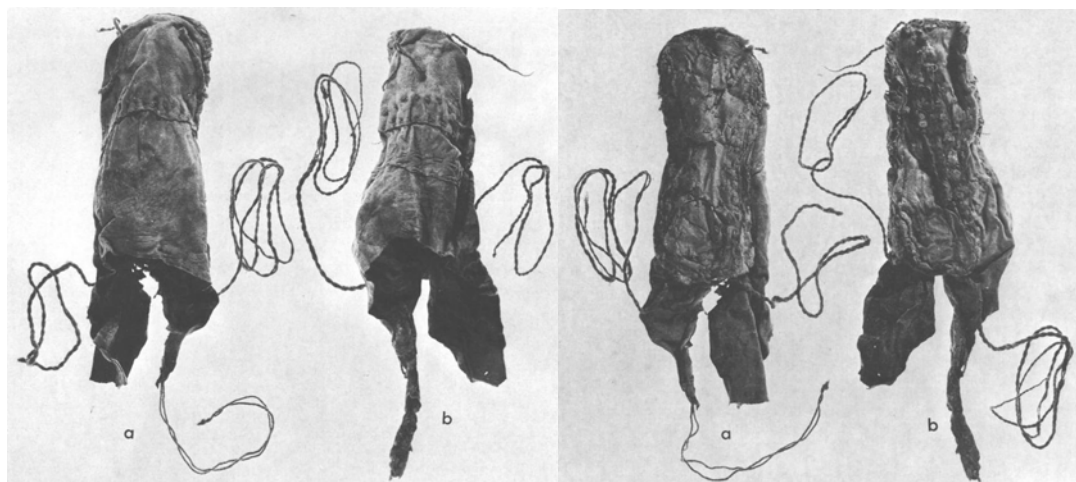


Figure 7.56. Leather sandals from Sand Dune Cave. Left: upper sides, Right: soles; specimen a:left; b:right (adapted from Lindsay et al. 1968:Figures 49 & 50)

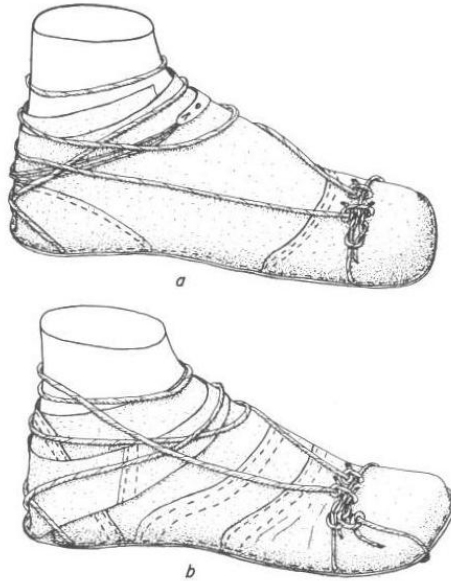


Figure 7.57. Schematic of leather sandals from Sand Dune Cave (a:left; b:right) similar to the Trinchera Cave Type V specimen No #A (adapted from Lindsay et al. 1968:Figure 51).

Moccasins are rare in the Southwest, where sandals are the principal type of footgear. Leather sandals also appear in early Southwest assemblages, but rarely. A few leather sandals are reported from a Basketmaker II site and Pueblo III sites in southern Utah, northern Arizona, and southwestern Colorado. Southwestern people, then, knew how to make leather moccasins, leather sandals, and fibrous sandals, but the overwhelming proportion of fibrous sandals show this is the footgear they favored (Hays-Gilpin et al. 1998:37). One moccasin fragment was reported from the Pre-Pottery level of Tularosa Cave (ca. 300 B.C.). However, a full description of the object was inhibited by the fragmentary condition of the specimen. The reportedly crimped edge of the piece and the leather thongs used in its sewing led researchers to believe it was a toe fragment (Martin et al. 1952:242). In the Great Basin moccasins are a more important type of footgear. The most notable collections have been found in Promontory Cave, Hogup

Cave, the Fremont River area, and Lovelock Cave (Martin et al. 1952:244), each with their own unique style. Three-piece Fremont moccasins were made predominantly from mountain sheep, while Hogup moccasins were made predominantly of antelope or deer with bison patches, turned hair-side-in. Based on the similarity of different aspects of the Trincheras Cave moccasin fragments to hide footwear found on the Plains, northern Colorado Plateau, and the Mogollon region of the Southwest, the origin and cultural affiliation of the Trincheras Cave moccasin fragments is currently indeterminate.

Trincheras Cave Sandal Collection

The Trincheras Cave sandal collection is comprised of four sets or general styles of sandal. The earliest type of sandal is a two-warp pseudo-twined sandal, which is replaced by four-warp pseudo-twined sandals, which are then replaced by composite (hide sole and grass padding) sandals. Though hide moccasins are present in the collection, they were not dated and cannot be assigned temporal ascription. However, based on the later appearance of buffalo hide sandals at the Kenton Caves and the early predominance of plant fiber sandals at the site, it is assumed that the moccasins appear penecontemporaneously if not post-date the composite sandals at Trincheras Cave. All of these general sandal styles are mutually exclusive in regards to construction methodology, however they were utilized penecontemporaneously. The four-warp pseudo-twined sandals are the most predominant sandal type utilized at Trincheras Cave. They have the longest length of use, during which sandal types I, III, and IV come in and out of favor. It is likely, based on previously recorded perishable collections, that all of the plant fiber sandals and composite footwear have the same origin, that of the Mogollon

region. Only the hide footwear has an indeterminate origin, possibly arising from the Plains, northern Colorado Plateau, or even the Mogollon region.

The Southern High Plains

It is not surprising that such a cavalcade of different sandals types have been found in this area. The Kenton Caves, Trinchera Cave, and Franktown Cave are geographically located at the center of where multiple basketmaking regions (each with a unique style of basketry, cordage, and sandal manufacture that can be differentiated from the styles of other regions) meet, as documented and reported by Adovasio (1974). Southeastern Colorado and the Oklahoma Panhandle were a natural meeting place for populations from the Great Basin, Plains, Southwest, and Trans-Pecos Texas/Mexico.

The early appearance and dominance of multiple warp varieties suggest affiliations to the northern Colorado Plateau. However, technological characteristics employed in the construction of the majority of the sandals found in this region, namely twining and the utilization of an open weave, are not found on the Southern High Plains. Many of the Kenton Caves sandal types have no known counterparts, including those created by folding one long piece of weaving (Kenton Caves Types II and III) as well as those with previously unrecorded warp and weft orientations and configurations (Kenton Caves Types V and VI). Two- and four-warp sandals with traction masters indicate Southwestern influence at both the Kenton Caves and Trinchera Cave (which is much earlier at Trinchera Cave than previously suggested). Both the two-warp and four-warp sandals from the Kenton Caves and Trinchera Cave indicate influence specifically from the Mogollon region. The two-warp sandals from both sites appear earlier in time than the four-warp sandals from both sites, a pattern which is mirrored at Pendejo Cave, New

Mexico. It is important to note that the Mogollon-like sandals from both sites are temporally coeval. Statistical comparisons between the sandal collections from the Southern High Plains and the Pendejo Cave site from the Jornada Basin, New Mexico show great similarity. More specifically the Pendejo Cave sandals are closely aligned with the Trincheras Cave two warp (Type I) and four warp (Type II) sandals and the Kenton Caves Type III oblique plaited sandals. It is also interesting to note that in the comparison of the four-warp sandals from Pendejo Cave and Trincheras Cave, the statistical tests (ANOVA) identified the Trincheras Cave Type II subtype discussed in the Internal Correlations section. Only the Type II subtype is similar to one of the Pendejo Cave four-warp sandals.

In contrast to the uniform utilization of plant-fiber sandals at all three Southern High Plains sites, composite sandals were only recovered from Trincheras Cave. They are closely aligned with those found at Tularosa Cave. The utilization of composite sandals from ca. 300 B.C.-A.D. 1200 at Tularosa Cave and cal A.D. 1023-1169 at Trincheras Cave reinforces the proposed affiliation between these collections based on plant-fiber sandal technology. The moccasin fragments from Trincheras Cave, moccasin and legging from Franktown Cave, and the buffalo hide sandal from the Kenton Caves may be the only true lead regarding Plains influenced footwear. However, the utilization of bison hide in the Great Basin limits the definitive designation of the buffalo hide items purely on the basis of raw material. Though the buffalo hide sandal from the Kenton Caves and the buffalo hide moccasin and legging from Franktown Cave have overlapping date ranges (ca. cal A.D. 983-1268), the moccasin fragments from Trincheras Cave have not been dated. However, it is likely that these specimens are also penecontemporaneous.

A Note on Animal Hide Footwear

The moccasin fragments from Trinchera Cave, the buffalo hide sandal from the Kenton Caves, and buffalo hide legging and moccasin from Franktown Cave do not provide any definitive lead regarding the origins of the footwear. However, animal hide composite sandals very similar to those recovered from Trinchera Cave have been found at Tularosa Cave. The winter-types are created using oval-shaped pieces of leather which are then pulled up around the foot by a series of side-loop ties, which resemble those on the fabric sandals. Grass padding and in some cases “socks” line most of these. Side-loop winter sandals have also been reported from the Great Basin by Steward (1937b:53 Fig. 23f), though in very low quantity.

Moccasins generally are rare in the Southwest, where sandals are the principal type of footgear. However, in the Great Basin moccasins are a more important type of footgear. The predominant hock and three piece varieties (Fremont and Hogup styles) have been found in notable quantity at the Promontory cave, the Fremont River area, Hogup Cave, and Lovelock Cave (Aikens 1970; Martin et al. 1952:244; Steward 1937b). The moccasins from Sand Dune Cave on the Colorado Plateau are very similar to Trinchera Cave specimen No # A, the toe portion of a deteriorated moccasin. Moccasin schematics by Lindsay et al. (1968 Fig. 51) illustrate how the toe was attached to the remaining sole and footcovering material. The Trinchera Cave No # A specimen exhibits the same cordage material and technological construction attributes. The Trinchera Cave specimen 41 can be warranted a similar description to those from Sand Dune Cave: “The soles of both are flat, rather than being turned up at the edges. They were constructed of

deer (?) hide with the hair left on. The hair side was placed to the outside, or downward” (Lindsay et al. 1968:74).

While the composite animal hide sandals from Trinchera Cave have associations with the Mogollon region of the Southwest, specifically Tularosa Cave, it is likely that the moccasins from Trinchera Cave have associations with the northern Colorado Plateau. However, Plains ascription cannot be ruled out. The buffalo hide sandal from the Kenton Caves has likely Plains ascription. It is made entirely of animal hide, including the tie mechanism. Nothing thus far has been reported from the Southwest or any other adjacent region that shows any similarity to this buffalo hide specimen. The use of buffalo hide alone hints at Plains origin. Though, as previously stated, some Great Basin moccasins were created with bison hide, the Kenton Caves collection does not show any similarity to other specimens of Great Basin footwear. Though the group(s) that made it may have gone barefoot in the summer time, this specimen indicates that at one point in the year, it was necessary to fashion footwear with a thick hair insole to insulate, protect, and cushion the foot. The Franktown Cave buffalo hide legging and moccasin have reportedly Midwestern and Eastern origin, based on the presence of a puckered toe and soft sole (Conn 1983). However, the moccasin shows similarity to three-piece moccasins from the Great Basin (Steward 1937a, 1937b).

According to Hyland (1997:245), the disappearance of fiber sandal making in New Mexico can be ascribed to non-European influences. His research suggests that “prolonged contact with southern Plains Indians profoundly changed local Pueblo culture and apparently this interplay between habitual moccasin wearing hunters and traditional sandal wearing farmers resulted in the preferred footwear of 5000 plus years being

supplanted by the latest leather styles from the Plains” (Hyland 1997:245). The phenomenon of the plant fiber sandal industry being replaced by new buffalo hide sandals and/or buffalo or antelope hide moccasins in New Mexico appears to have been mirrored by and extended to include the Southern High Plains. The transition from the exclusive use of plant fiber sandals to the utilization of composite (ca. cal A.D. 1023) and hide footwear (ca. cal A.D. 1159) is clearly witnessed in the technological trajectory of the Southern High Plains (see Figures 7.39). However, as previously stated, it is indeterminate whether the appearance of these new hide forms are the result to Plains influence, as opposed to influence from the northern Colorado Plateau, Great Basin, or continued influence from the Mogollon region.

A Note on Coiled Basketry

Only one type of coiled basketry was found in the Kenton Caves collection, Close Coiled Rod with Lateral Bundle (A5 and DU 389). This type of coiling was also found in the Trinchera Cave (No # D) and Franktown Cave (TOM 290) assemblages amongst additional types of close coiling. The Close Coiled Rod with Lateral Bundle basketry from all three caves is statistically the same (Appendix C). Unlike other coiling foundation types which are a ubiquitous signature of Anasazi and Mogollon coiling techniques, rod with lateral bundle is never common anywhere. The technique occurs very sporadically in the Southwest as a minority element in post-Archaic contexts (Morris and Burgh 1941) and also in the Upper Gila and Hueco areas of eastern New Mexico and west Texas (Cosgrove 1947). Perhaps, significantly, the technique is most common east of the Rocky Mountain Front Range and its outlier's and is rarer to the west

(Adovasio et al. 2005:17-18). The late appearance of the majority of the specimens of this coiling type, following the appearance of the two-warp and four-warp sandal types may provide additional evidence that the populations occupying the region at this time were of Southwestern origin. However, even deeper antiquity is suggested by specimen DU 389. This type has an initial appearance at roughly 2800-2300 cal B.C. and was made contemporaneously with Kenton Caves Types III and IV multiple warp sandals. Though the cultural origin of the Kenton Caves Type IV sandals is indeterminate, the Type III sandals have a possible northern Colorado Plateau (Sand Dune and Dust Devil Caves) or Mogollon origin (Tularosa Cave, Pendejo Cave, and the caves of the Upper Gila area).

Chapter 8: Interpretation

Based exclusively on the modified fiber perishable assemblage recovered from the Southern High Plains, specifically that from Franktown Cave, Trinchera Cave, and the Kenton Caves, it is possible to make certain observations about the populations that occupied this area in and through time. Due to the general lack of field notes, records, and artifact proveniences for all three sites, the conclusions that follow are based only on the dated materials from these sites, of which the radiocarbon dates are assumed to be accurate, being based on 2-sigma calibrations (see Tables 1-4). Comparative dates for sandal types and industries from adjacent areas used in discussions of technological origins are also calibrated (designated as B.C.). Based on the data presented in the Internal and External Correlations of Chapter 7, it is possible to broadly outline the chronological and technological progression of perishable manufacture on the Southern High Plains. The present effort represents the first attempt to report and synthesize the perishable evidence for the Southern High Plains, and the implications of that evidence in regards to its occupants and their influences. While the individual assemblages indicate the origin of influences of the populations which occupied each site, they, in combination, provide evidence for broad trends of population movement and influences across the region. Alternative reconstructions are offered based on different possible interpretations of the data with respect to previously documented linguistic,

archaeological, and ethnographic models of population movement and hypotheses regarding exogamous social interaction and economic networks.

Technological Trajectory of the Southern High Plains Perishable Industry

The early utilization and dominance of multiple warp sandal technology on the Southern High Plains (ca. 6430 cal B.C. at the Kenton Caves and 3348 cal B.C. at Franktown Cave) suggests that the earliest inhabitants of the Southern High Plains had affiliations to the northern Colorado Plateau. Though technological characteristics employed in the construction of the majority of the sandals found in this region, namely twining and the utilization of an open weave, are not found on the Southern High Plains, strong similarities exist between these collections. Though the Desha complex sandals of the northern Colorado Plateau exhibit six to ten parallel warps and are exclusively open simple twined, the more rare sandals from these collections, including a 15-warp balanced plainweave sandal from Cowboy Cave (Jennings 1980: Figure 26, specimen c) and obliquely plaited sandals with paired and trebled pseudowarps/pseudowefts from Sand Dune and Dust Devil Caves (Lindsay 1968: Figures 73e, 94b, and 94d) are very similar to the multiple warp Kenton Caves Types I and III (see Figure 7.44 and Figure 7.45). Many of the Kenton Caves sandal types have no known counterparts, including those created by folding one long piece of weaving (Kenton Caves Types II and III) as well as those with previously unrecorded warp and weft orientations and configurations (Kenton Caves Types V and VI). However, based on the determined northern Colorado Plateau affiliations of the Kenton Caves Type I and III sandal technology and the overlapping and contemporaneous use of the Kenton Caves Type I-VI sandals, it can be

stated with confidence that all of the groups that produced these sandal types on the Southern High Plains shared the same northern Colorado Plateau affiliation.

The manufacture of two- and four-warp sandals with traction masters ca. 1010 cal B.C. at the Kenton Caves indicate the presence of a new group of people on the Southern High Plains. These individuals had definite affiliations to the Southwest. The presence of these people, and this technology, on the Southern High Plains appears to have occurred much earlier than previously suggested. Both the two-warp and four-warp sandals from the Kenton Caves and Trinchera Cave indicate technological influence specifically from the Mogollon region. The utilization of two-warp sandals at both sites occurs earlier in time than the four-warp sandals from both sites, a pattern which is mirrored at Pendejo Cave, which is occupied by the Jornada Mogollon (Hyland 1997). It is important to note that the Mogollon-like sandals from both Trinchera Cave and the Kenton Caves are temporally coeval (see Figure 7.39). Statistical comparisons between the sandal collections from the Southern High Plains and the Pendejo Cave site from the Jornada Basin, New Mexico show great similarity (Appendix C). As stated previously, though obliquely plaited sandals were recovered from Mogollon sites in post-A.D. 500 contexts (Hyland 1997; Martin et al. 1952; McBrinn 2005), the earliest example of the technology employed in the construction of the Kenton Caves Type III sandal soles comes from Dust Devil Cave on the northern Colorado Plateau ca. 5000-6000 cal B.C. (Lindsay et al. 1968). Despite this early utilization, the form and stylistic construction attributes found on the Kenton Caves Type III obliquely plaited sandals exhibit construction attributes that are aligned with both northern Colorado Plateau and Mogollon groups. The Kenton Caves Type III sandals appear to be a blend of the two Southwestern styles, incorporating

both a knotted start and then a fold at the toe. However, the Kenton Caves Type III sandals are unique in that they are created as one long piece of weaving. The composite sandals recovered from Trincheria Cave are also indicators of Mogollon affiliation. They are closely aligned with composite sandal technology found at Tularosa Cave. The utilization of composite sandals from ca. 300 cal B.C. to cal A.D. 1200 at Tularosa Cave and cal A.D. 1023 to 1169 at Trincheria Cave reinforces the proposed affiliation between these collections (Martin et al. 1952).

The moccasin fragments from Trincheria Cave, buffalo hide legging and moccasin from Franktown Cave, and the buffalo hide sandal from the Kenton Caves may be the only true lead regarding Plains influenced footwear. Though the buffalo hide sandal from the Kenton Caves dates to cal A.D. 1159-1268, and the buffalo hide legging and moccasin date to the same general time period cal A.D. 983-1187, the moccasin fragments from Trincheria Cave have not been dated. Despite the late manufacture of these specimens at peripheral Southern High Plains sites and the coeval arrival of this technology with other Plains attributed artifacts, it must be noted that the Trincheria Cave moccasin fragments also exhibit visual similarity to specimens from the northern Colorado Plateau.

Relation of the Developmental Sequence with Present Site Interpretations

Franktown Cave

The majority of the artifacts recovered from Franktown Cave come from Early/Middle Ceramic contexts. At the transition between the Archaic and the Ceramic/Late Prehistoric period (ca. A.D. 1-400), a transition toward a more sedentary

lifestyle is indicated by the increased utilization of expedient lithic technology (King 2006). This intense occupation of Franktown Cave as a residential base is a reflection of a regional population peak for the northeastern Colorado area (Gilmore 1999). This longer, more intensive occupation of Franktown Cave is indicated by more extensive exploitation of local raw material sources and utilization of corn as part of their subsistence strategy. However, in preceding periods, during the time that the Franktown Cave sandals were produced (ca. 3500 cal B.C.), more regional diversity is apparent in the projectile point technology and other aspects of material culture. This, in turn, suggests that populations were becoming more diverse and regionally distinct (King 2006). More intensive occupation of the region during the Archaic is also suggested by the construction of pithouses (i.e. Yarmony Pithouse) and pithouse villages (Bawaya 2005 cited in King 2006; Cassells 1997:102). Some archaeologists argue that Archaic populations on the Plains originated in the Great Basin and Rocky Mountains to the west (Black 1991; Kalasz et al. 2003) and that they participated in a “seasonal transhumance subsistence pattern of movement between foothills, montane, and subalpine areas” (Black 1991).

According to Adovasio, Thompson, and Ilingworth (2005), it is very difficult to relate the Franktown Cave perishable inventory to any specific neighboring site or complex. Though the solitary plant-fiber sandal type from this site appears similar to the Kenton Caves Type I sandal and the plainweave example from Cowboy Cave (Jennings 1980:Figure 26, Specimen c) (see Figure 7.44), “the only affinities that can be delineated are on the most basic and broadest technological levels” (Adovasio et al. 2005:18). Possible affiliations with northern Colorado Plateau populations based on the plant-fiber

sandals are in stark contrast to Midwestern and Eastern affiliations suggested by the buffalo hide legging and moccasin (Conn 1983). The coiled basketry from the site, specifically the whole rod (Type I), bundle (Type II), and rod with lateral bundle (Type III) foundation coiling, does not help to clarify associations. The construction attributes used in the creation of the specimens are in opposition to those utilized in surrounding regions (Adovasio 1970, 1974, 1980; Adovasio et al. 2005; Adovasio and Gunn 1986; Andrews and Adovasio 1980; Andrews et al. 1986; McGregor 1992; Morris and Burgh 1941). Though the whole rod (Type I) foundation coiling is present in the Arid West in the 7th millenium B.C. and has the same work direction as that found at Franktown Cave, the stitch type is completely different (Adovasio et al. 2005). Whole and half rod foundations are used by the Fremont in the Eastern Great Basin and on the Colorado Plateau until cal A.D. 1000 and persists among bunched foundation-dominated Anasazi and Mogollon populations until Pueblo IV times (cal A.D. 1690-1790) (Adovasio 1970, 1974). Bundle foundation technology is unknown during the Archaic of the Eastern Great Basin and later Fremont contexts, and is relatively unknown in the Southwest. Bundle foundation coiling, along with twill plaited basketry and cultigens, have ancient Mexican origins and are thought to have been introduced into the Southwest ca. 1200-1000 cal B.C. (Adovasio 1970, 1974, 1980, 2005; Adovasio et al. 2005; Andrews et al. 1986; Hyland et al. 2003; Morris and Burgh 1941). However, the Franktown Cave Type II (bundle foundation coiling) is older than any known Mogollon examples and is not associated temporally with any of the corn recovered from the site. The most intriguing coiling type from Franktown Cave is the Type III (rod with lateral bundle foundation) coiling. Reportedly, this coiling type is never common anywhere. The technology is in

the minority among post-Archaic Southwest and Upper Gila and Hueco Mountain sites, but is more common east of the Rocky Mountains (Adovasio et al. 2005; Morris and Burgh 1941; Cosgrove 1947). In fact, this coiling type is found at all three Southern High Plains sites (Franktown Cave: Type III; Trinchera Cave: Type I; the Kenton Caves: Type I). Though the specimens from all three sites utilize the same construction techniques and attributes (see Appendix C), as a whole, they display different work directions and splice mechanics than examples from points south and east (Adovasio et al. 2005).

In many ways, this inability to "fit" or "place" the Franktown Cave perishable suite in time and space should not be surprising. Perishable plant-fiber artifacts of any age are remarkably scarce not simply in the Denver area but along virtually the entire eastern front of the Rockies (Adovasio et al. 2005:18). The unique types and attributes identified within the perishable assemblage of Franktown Cave hints at possible Plains affiliations or possibly Plains adaptation. However, due to poor preservation on the Plains, this cannot be proven conclusively. The appearance of previously undocumented technology along with previously undocumented variations of technology from adjacent regions, hints that the Franktown Cave perishable collection may represent the previously undocumented and reportedly non-existent ancient Plains basketmaking region. Though the sparse archaeological data from the Plains implies that there may not have been an in situ Plains basketry complex, the production of proto-historic and historic twill plaited burden baskets and coiled gambling baskets on the Plains are indicative of a southern origin as early as 3,000 years ago (Jolie 2006).

The Kenton Caves

Cultural assignment of the Kenton Caves material has been extensively debated. Renaud hypothesized that the materials represented a stage above the seminomadic hunter and below the sedentary Pueblos. He suggested that the materials were “an early, very primitive phase of the Basketmaker culture, an incipient stage preceding its more complete characterization elsewhere” (Renaud 1930:134). He proposed a date of ca. 1500 B. C. for the Kenton Caves based on the presence of basketry, painted figures, maize, and on the absence of pottery from his 1929 excavations. In general, “cultural affiliations for the site and its occupants are tenuous because there is little stratigraphic [or radiometric] information available to segregate the assemblages” (Lintz and Zabawa 1984:172). The caves are only a “small part of a larger settlement system within the valley and thus, the regional prehistory should also concentrate on studying other site situations within a broader area base” (Lintz and Zabawa 1984:173). According to researchers, “scattered artifact collections, inadequate material descriptions, poor provenience information, and a lack of specialized studies severely limits our present knowledge of the cultural resources located in the mesa and canyon lands of the northwestern Oklahoma panhandle” (Lintz and Zabawa 1984:173).

Only three sites in western Oklahoma dating to between 7000 B.C. and A.D. 500 have been extensively excavated: the Boat Dock site (Bell 1958), the Gore Pit site (Bastian 1964; Hammatt 1976), and the Summers site (Leonhardy 1966) (cited in Hughes 1984:109). Archaic sites that have been intensively surveyed, collected, and reported but not tested include the Pumpkin Creek site (Wyckoff and Taylor 1971), the Clay and Roberts sites (Saunders 1974), the Ross site (Hofman 1971), Cd-177 (Hofman 1973), and

the Nall site (Baker et al. 1957) (Hughes 1984:109). From this data, two complexes have been identified for the Archaic of western Oklahoma, the Lawton aspect and the Summers complex. However, no radiocarbon dates were obtained for sites attributable to the Lawton aspect, so precise temporal boundaries cannot be drawn between the phases of this complex, and the sole date obtained for the Summers Complex (968 +/- 160 B.C.) is considered its oldest limit (Hughes 1984:111-116). Unfortunately, little work has been done on the settlement technology of the Archaic foragers of western Oklahoma. The majority of sites studied were short-term multipurpose sites which focused on lithic reduction and tool production. Less is known about the Archaic of western Oklahoma than almost any other time period and region in the state. There was trade going on with the peoples of the Texas panhandle and the Edwards Plateau, indicated by the presence of lithics from these areas. Large marine-shell disc beads and Olivella shell beads indicate that the people were also part of an exchange system extending to the Gulf of Mexico, the Gulf of California, or the Pacific Ocean. However, the nature, importance, and duration of this trade have not been determined by previous research (Hughes 1984:116).

The prehistoric occupants of the Kenton Caves were hunters of bison, deer, antelope, and rabbit and gatherers of wild vegetal food, but they also cultivated maize and had squash, but no beans. Awls, wads of vegetal material (possible bedding material), and crude stone artifacts were also recovered (Renaud 1930:122). In this culture, Renaud recognized features of primitive stages of Basket Maker culture (cave art, a single kind of Indian corn, irregularly shaped metates, and one-hand manos). The material recovered reveals a stage somewhat above the semi-nomadic hunters, but inferior to the sedentary, skillful potter, mason, and advanced agricultural Pueblo. Despite the presence of

numerous sandals and coiled basketry fragments, Renaud identified this group as below the full development of the Basket Maker culture, with its cists for storage and burial, and its fine basketry and weaving. It is the opinion of Renaud (1930) that the finds from the Oklahoma caves must belong to an early, very primitive phase of Basket Maker culture. However, due to the proof of the beginnings of agriculture and basketry, he believed that the occupants of the Kenton Caves were more advanced than the Fumarole Culture found in other portions of the Cimarron Valley who were probably nomadic hunters and who would have used the shelter more as a hunting lodge as need required (Renaud 1930:134).

The recovery of an unfluted “fishtail” point from 34Ci-50 (Basketmaker Cave) may indicate some late Paleoindian or early Archaic use of the Kenton Caves. The large corner-notched points, wooden atlatl, and pod-corn may be indicative of later Archaic occupations; these items, however, are rare and could well coincide with subsequent use of the caves (Lintz and Zabawa 1984). Although projectiles and pottery were not abundant, most of the styles are post-Archaic. The many Scallorn and, to a lesser extent, Washita, Harell, and Fresno points, along with the long bow, suggest occupations by both Woodland and Plains Village stage groups. In addition, numerous Woodland and Plains Village sites have been recorded in the adjacent Black Mesa State Park on South Carrizo Creek (Saunders 1978), and in the environmentally similar Chaquaqua Plateau in Southeastern Colorado (Campbell 1969, 1976) (cited in Lintz and Zabawa 1984:172-173). The projectile point technology found at the Kenton Caves was made predominantly of local quartzite materials. This point technology does not change with the appearance of the northern Colorado Plateau influenced sandal technology. It is

possible that either the perishable technology diffused to this area and did not impact the lithic technology, or that the perishable technology arrived with new people who continued producing Archaic lithic technology with available local resources. Similar exploitation of local resources occurred at Franktown Cave, where local rhyolite and petrified wood resources were utilized on the Palmer Divide (Gilmore 1999; King 2006).

Though cultivated maize, beans, and pumpkin seeds were recovered from the Kenton Caves, none have been directly dated, and the lack of stratigraphic data and excavation notes inhibits even relative dating for these items (Baker 1929; Lintz and Zabawa 1984; Renaud 1930; Thoburn 1930). Small and large ears of corn, cornhusks, and shelled kernels of 8-, 10-, 12-, and 14-row varieties are present (Cutler 1959; J. C. Winters 1975 cited in Lintz and Zabawa 1984:167). However, none of these items can be definitely associated with any particular period of occupation or inhabitants. Though grinding stones were also found, it cannot be determined whether they were used to grind wild grass seeds, roots, and dried meat as opposed to corn. However, they do “imply a certain stability of the dwellers that made and used them” (Renaud 1930:121).

It was not previously discernable whether or not the Kenton Caves represented a single component or several occupations over a long time span. However, due to the descriptive, radiometric, and statistical analysis of the structural attributes of the sandals from this site, a clearer understanding of the cultural sequence, its development and influences, has been achieved. The sandal collection recovered from the Kenton Caves (Basketmaker Cave, 34Ci50) indicates that two cohesive perishable suites exist at the site. The first collection is comprised of varieties of multiple warp (8-15 warps) sandals with a temporal range of 6430 to 1749 cal B.C. This collection reflects influence from and

affiliation with the northern Colorado Plateau. The second collection is comprised of two- and four-warp wickerwork sandals with a temporal range of 1010 cal B.C. to cal A.D. 968 (see Figure 7.37). This collection reflects influence from and affiliation with the Mogollon of the Southwest. A sole buffalo hide sandal represents the only evidence of Plains influence within the sandal collection from the Kenton Caves. It post-dates all other reported types of footwear at the site, dating to cal A.D. 1159-1268.

Though Renaud (1930) was not completely wrong in his designation of the Kenton Caves remains as pre-Basketmaker, it appears more accurate based on the sandal technology that the caves were occupied by both pre-Basketmaker and pre-Mogollon/Mogollon populations. The majority of the artifacts collected from the caves could easily be representative of either population due to the common Cochise origins of both the Basketmaker and Mogollon populations and lack of stratigraphic data and radiometric analysis for the majority of the collection. However, the radiometric, statistical, and descriptive analysis of the Kenton Caves sandal collection has provided the means for the identification of these two different populations within the Southern High Plains.

Renaud (1930) was correct in his identification of these populations as representing a primitive phase of Basketmaker and Mogollon culture never before known to exist in northeastern New Mexico and Western Oklahoma. However, he was in error regarding the temporal position of this technology. Though peripheral from what is now known to be the center of Basketmaker/Mogollon culture, the Kenton Caves materials do not represent the survival of outdated technology obtained from a more advanced cultural center (a.k.a. the Basketmakers). The technology present at the Kenton Caves precedes

the full-blown development of the Basketmaker and Mogollon traditions by thousands of years and is co-eval with other pre-Basketmaker cultures such as the Desha Complex ca. 6500 cal B.C. from Sand Dune and Dust Devil Caves (Lindsay et al. 1968). Instead of a marginal representation of a fully developed Basketmaker culture, the Kenton Caves remains represent a surprisingly early and ancient cultural stage as well as transitional stages between nomadic and sedentary habits. Renaud cannot be faulted for his misidentification of the age of this collection. Though noting the possibility that the remains could be ancient (Renaud 1930), he erred on the side of caution and based his assertions of a 2000-1500 B. C. occupation on the spatial distance of other similar prehistoric sites from this admittedly peripheral location and the evidence he could gather from undated diagnostic materials.

Trinchera Cave

What is most interesting and important about the Trinchera Cave sandal collection is its cohesiveness. However, in stark contrast to this observation are the conclusions that have been drawn about the site and its occupants. Previous researchers who have focused on alternative artifact types (stone tools and pottery) and architecture have indicated that “a blending of the Plains and Southwest cultures has been demonstrated for all occupational levels at Trinchera Cave” (Simpson 1976:205). The earliest levels show greater Southwestern influence and the later levels show greater Plains influence. Trinchera Cave and the Trinchera Cave Archaeological district appear to be the meeting place between Southwestern and Plains affiliated populations.

The presence of obsidian tools and *Olivella* shell indicate that trade was occurring on the Southern High Plains. Considering trade items recovered at other southeastern

Colorado sites, this does not seem to be “appreciably different” (Nowak and Gerhart 2002:14). Trade is not surprising at the site because it is located in a “cultural convergence zone” along the Front Range. Nowak and Gerhart (2002:104) term this area the “‘New York City’ of the prehistoric world” because it is a virtual “melting pot” of peoples. Both Plains and Southwestern influences are found in Southeastern Colorado (Campbell 1976; Gunnerson 1989; Simpson 1976; Wood and Bair 1980; Zier and Kalasz 1999). However, though addressed to minor degree, populations from southeastern Colorado, and Trinchera Cave specifically, were not isolated from populations occupying areas farther north and the Rockies and their influences (Nowak and Gerhart 2002). The presence of a rare coiling type found at both Trinchera Cave and Franktown Cave is evidence of this fact.

Middle Archaic habitation was geographically widespread both within and beyond the borders of the Southern High Plains. Early Archaic sites were still utilized, with reuse of specific site locations in some cases. However, “the sheer number and sudden widespread distribution of Middle Archaic sites strongly suggests that the significant changes in the archaeological record are best explained in terms of demographic processes” (Zier and Kalasz 1999:116). The apparently region-wide population expansion, though possibly internally generated, most likely reflects the outward spread of people via immigration from one or more core areas. Late Archaic population increases were probably “internally generated” as suggested by the widespread, in situ population already present in the area at the beginning of the period. This is also reinforced by the fact that Late Archaic lithic industries are virtually

indistinguishable from those of the Middle Archaic (Kalasz et al. 1993; Zier and Kalasz 1999:130-131).

Similarly, there is no evidence that new populations arrived in eastern Colorado and northeastern New Mexico during the beginning of the Late Prehistoric period, termed the Developmental period (A.D. 100-1050) (Zier and Kalasz 1999:171). However, a region-wide demographic expansion seems to have occurred during this period. Though it is possible that the increased number of identified Developmental period sites may be a result of the increased visibility of Late Prehistoric versus Archaic sites, the situation is mirrored for the Cimarron district in northeastern New Mexico (Glassow 1980). Glassow (1980) also identifies formal artifact attributes that suggest regional cultural continuity and suggests that artifactual and architectural variability in the district might be attributable to small population units continually expanding into the region, which “represents an adaptation very similar to that of the Early Basketmakers of the San Juan River basin” (Glassow 1980:103; Zier and Kalasz 1999:171).

At its commencement, the Late Prehistoric stage was characterized by new technologies superimposed on a well-established Archaic stage way of life. As the Late Prehistoric stage progressed, the Southern High Plains witnessed important changes in settlement, subsistence, technology, trade, and demographics (Zier and Kalasz 1999:141). In addition to the initial appearance of bow-and-arrow and ceramic technologies, sandal and basketry technology are also introduced during this initial Late Prehistoric period. Because Southwestern influence was identified at the earliest levels of Trinchera Cave, the appearance of this technology is not surprising. As stated above, the appearance of this technology during the Developmental period (A.D. 100-1050) may be due to the

expansion of the pre-existing Mogollon-influenced populations already present on the Southern High Plains, specifically those occupying the nearby Kenton Caves.

Unlike the preceding Developmental period (A.D. 100-1050), no new technologies were introduced during the Diversification period (A.D. 1050-1450). Technological trends in regards to lithic artifacts, ceramics, and bone tools or ornaments continue with minimal modification in the Diversification period (Zier and Kalasz 1999:193). The cohesiveness of the Trinchera Cave sandal collection supports this technological continuity. Though the Diversification period (A.D. 1050-1450) is marked by the appearance of two new in situ developments, the Sopris and the Apishapa (Zier and Kalasz 1999), the Southwestern/Mogollon influenced sandal technology is more aligned with the Southwestern influenced Sopris. Moccasin fragments were recovered from Trinchera Cave, which may be indicative of the presence of the Plains influenced Apishapa. However, these specimens are currently undated.

The Trinchera Cave excavations as a whole also revealed that the occupational layers post-dating the Archaic period contained relatively more material than the earlier deposits, which indicates a possible increase in population size and the addition of new types and forms of technology, including the bulk of the perishable remains (Simpson 1976). Radiocarbon data for the site acquired by Mike Nowak (Nowak and Gerhart 2002), suggest an occupation span of 810 cal B.C. through cal A.D. 1750. It is very likely that the use of Trinchera Cave extends farther. The bulk of the radiocarbon dates fall into a narrow, 350 year time period (cal A.D. 850 to cal A.D. 1200) (Nowak and Gerhart 2002:14). Based on the excavated levels and their artifact assemblages, Simpson (1976) has concluded that the Prehistoric and possibly Archaic cultures represented at Trinchera

Cave cannot be assigned purely Plains or Southwest cultural affiliations for “they are a combination of both” (Simpson 1976:204). As one would expect, the eastern portions of southeastern Colorado reflect a greater Plains influence while the western half is predominantly Southwestern in orientation, with the entire area representing a contact zone (Black 1991; Ireland and Wood 1973: 188-192; Simpson 1976; Zier and Kalasz 1999).

The plant fiber sandals from Trinchera Cave display only Southwestern affiliations, specifically from the Mogollon. The Trinchera Cave Type II (four-warp pseudo-twined) sandals are the predominant type of footwear manufactured at the site during cal A.D. 433-1240 and show strong continuous influence from the Mogollon region of the Southwest. Though additional types of plant-fiber sandals (Types I and III) were constructed, they all indicate influence and origin from the same region. The presence of composite footwear at Trinchera Cave (Type IV) (cal A.D. 1023-1169) reinforces the presence of Mogollon influence, showing the greatest similarity to specimens from Tularosa and Cordova Caves (Martin et al. 1952). It is possible that the later sandal forms constructed from A.D. 1050-1200 represent footwear utilized by the Southwestern-influenced Sopris phase people that were present in southeastern Colorado at that time. Only the Trinchera Cave moccasin fragments provide evidence for possible influx of footwear technology from the Plains. However, they have not been dated and also show some similar characteristics to moccasin types from the northern Colorado Plateau (Lindsay et al. 1968). It is possible that the later forms constructed from A.D. 1050-1450 may represent footwear utilized by the Plains-influenced Apishapa phase people that were present in southeastern Colorado at that time.

The in situ development of the Sopris phase populations is supported by the uniformity of the Trinchera Cave sandal collection. Because these sandal forms are affiliated with Mogollon constructions, reportedly Middle Archaic migrations into the area (Cassells 1997; Chenault 1999; Gilmore et al. 1999; Zier and Kalasz 1999) reinforce the possibility that Mogollon technology diffused onto the Southern High Plains and continued to be utilized through the development of the Sopris ca. A.D. 1050. The presence of this technology is also seen at another Southern High Plains site, the Kenton Caves, in the form of two-warp and four-warp wickerwork sandals (Kenton Caves Types VII and VIII). The Kenton Caves sandals reinforce the presence of Mogollon people on the Southern High Plains. In fact, the Kenton Caves sandals demonstrate an even greater antiquity of Mogollon influence with the arrival of two-warp pseudotwined sandals at cal. 1010 B.C., 1,500 years prior to their appearance at Trinchera Cave (see Figure 7.39). The order of appearance of the sandal types, with two-warp wickerwork sandals preceding the arrival or use of four-warp wickerwork sandals is also a reflection of Southwestern, specifically Mogollon, influence, if not origin (Hyland 1997). It is likely that the individuals that occupied Trinchera Cave in the early A.D.'s were related regionally to the individuals that had been occupying the Kenton Caves to the east and were part of the same broad economic network if not the same genetic population. Despite the reported presence of both Southwestern and Plains influence in all of the levels of Trinchera Cave, only two hide moccasin fragments provide potential evidence for the presence of Plains influenced groups at Trinchera Cave. These admittedly undated materials make it difficult to make a case for the in situ development of the Apishapa populations.

Models of Population Movement and the Diffusion of Perishable Technology

Based on the compilation of archaeological, ethnographic, and linguistic data, models have been put forth in order to illustrate the development of demographic patterns of the American Southwest from early through modern times (Adovasio 1974; Irwin-Williams 2007). According to Irwin-Williams, the characteristic long-term trend is toward “continued withdrawal of the bison-hunting-oriented Plano cultures from the eastern Southwest and their replacement by economically eclectic groups from the west and south” (Irwin-Williams 2007:15). Though, admittedly, the purpose of these models is to explain the development and expansion of groups occupying the Southwest, it is important to note where the physical boundary between the Plains and Southwestern cultures is identified and how it is shown to change or not change through time (Figure 8.1 and 8.2).

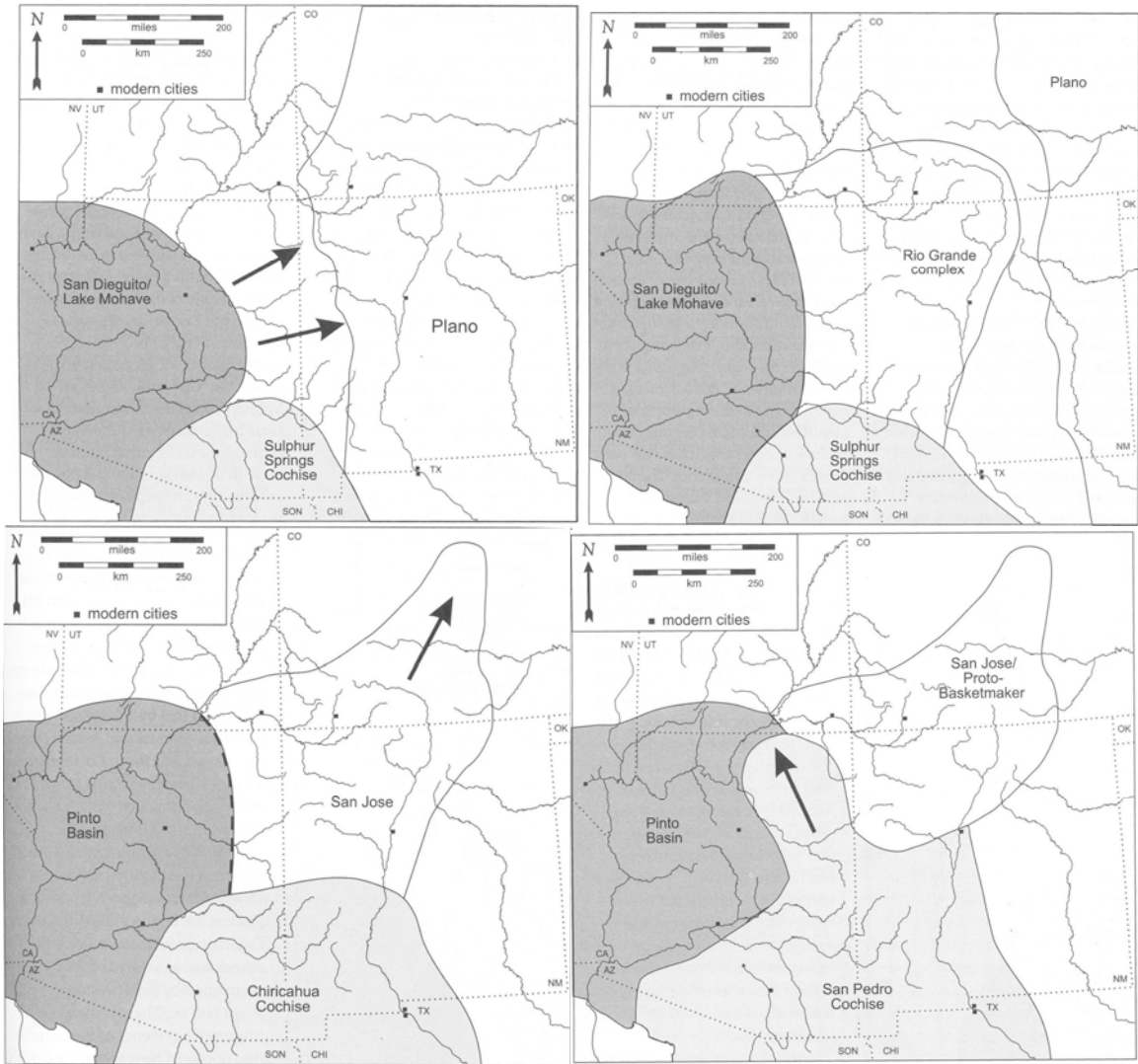


Figure 8.1. Distribution of Southwestern Technocomplexes (top left: ca. 6000 B.C.; top right: ca. 5000 B.C.; bottom left: ca. 3000 B.C.; bottom right: ca. 1000 B.C.) (adapted from Irwin-Williams 2007:16-18).



Figure 8.2. Distribution of Southwestern Technocomplexes (top left: A.D. 1-400; top right: A.D. 500-900; bottom left: A.D. 900-1200) (adapted from Irwin-Williams 2007:18-20).

The people that occupied the Southern High Plains were greatly influenced by groups occupying the greater Southwestern region. Though located in a peripheral region to this developmental core, the transfer of technology and culturally significant ideas is evident in their perishable technology. The early occurrence and maintained strength of these ties, at least at the Kenton Caves, suggest frequent interaction. Not surprisingly, due to the lack of radiocarbon dates, poor preservation and site visibility, and sparse reporting

for the Southern High Plains, the timing of the initial migration and expansion of Southwestern groups onto the Southern High Plains has been debated. Adovasio (1974) suggests that the presence of the Southwestern perishable tradition encompasses the southern majority of both present-day Arizona and New Mexico at ca. 7000-4500 B.C. (Figure 8.3). However, according to Irwin-Williams (2007), this coverage or expansion of the Cochise does not occur until ca. 3000 B.C. (see Figure 8.1).

The utilization of plant fiber sandals at the Kenton Caves at a very early date (ca. cal 6430 B.C.) requires the reconsideration of older models of the expansion of Southwestern groups and their sphere of influence. Because no previous evidence existed to suggest that the influence of these cultures extended that much farther east at such an early time, no previously suggested models included the Oklahoma panhandle and the southeastern Colorado as being within that sphere of influence. Research in these areas has been slim and poorly documented, resulting in a lack of concrete explanatory models of population movement, linguistic development, or even culture-historical sequence of development. No models currently exist to explain the similarities between the multiple warp sandals of the northern Colorado Plateau and the Oklahoma panhandle/Southern High Plains. Models of Lake Mohave, Rio Grande, and San Jose expansion do not extend to these areas (Irwin-Williams 2007). Similarly, models for the expansion of Cochise-derived Mogollon populations also do not include and extend far enough to reach Trincheras Cave and the Kenton Caves localities. The movement of groups suggested by Irwin-Williams (2007) does not account for the early occupation of the Oklahoma panhandle by populations with affiliations to the northern Colorado Plateau. Though linguistic data suggests northern Colorado Plateau movement towards Franktown Cave

ca. 3000 B.C., it does not account for the coeval appearance of Desha complex technology at the Kenton Caves ca. 6000 cal B.C. (Figures 8.1-8.3).

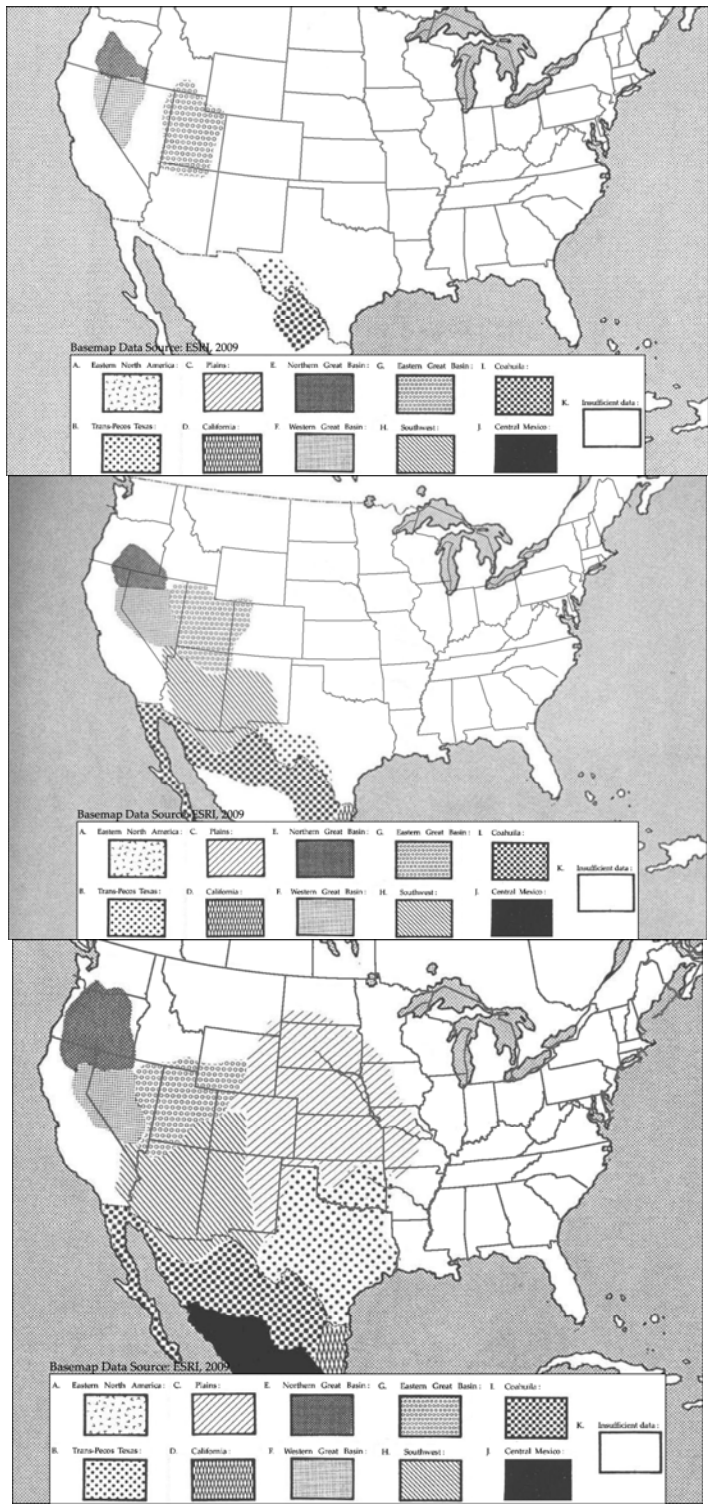


Figure 8.3. Adovasio’s explanatory models of the development of the known basketmaking regions. Top to Bottom: 8000-7000 B.C.; 7000-4500 B.C.; 4500-2000 B.C. (adapted from Adovasio 1974)

However, Webster (2007) indicates that the “ancestors of the Mogollon appear to have participated in a widespread Late Archaic hunting and gathering tradition that extended from the Eastern Great Basin to central and northern Arizona and across southern Arizona and New Mexico to the Trans-Pecos region of Texas, western Oklahoma, and inland northern Mexico (e.g., Baker and Kidder 1937; Guernsey and Kidder 1921; Haury 1957; Howard 1932, 1935; Kelly 1937; Kidder and Guernsey 1919; Mera 1938; Moreno 2000; Schroeder 1983)” (cited in Webster 2007:275).

Archaeological correlates of this tradition include the use of

caves as burial sites, temporary camps, and storage facilities; the internment of the dead in baskets or twined bags; and a distinctive suit of perishable material culture, including twined rabbit-fur robes, nets, coiled baskets, twined and looped bags, grooved wooden clubs (fending sticks), and atlatls. (Webster 2007:276)

Between 1000 and 500 B.C. this widespread pattern appears to become more localized across the southern Southwest (Webster 2007:276). Based on similar recovered evidence, the Kenton Caves Southern High Plains site was heavily involved in this lifestyle. Geib (2000) postulates that environmental stress caused by the warming and drying of the early Holocene made it desirable for groups to have larger and more varied territories available for their use. These expansions could have been accomplished by increased communication between groups and the allowance of access to new areas during times of shortage, necessitating a relaxation of “social boundary defense.” Thus, the participation

of northern and southern Colorado Plateau groups in an “expanded network of forager bands” (Geib 2000; McBrinn 2005:21) seems to have been mirrored by Mogollon groups who expanded their territories to include the Southern High Plains sites of Trinchera Cave and the Kenton Caves.

Population movements between the mountains and the plains show increased visibility throughout the Archaic and Ceramic periods (Nelson 2001), which is represented by the increased number of sites reported, the occupation of all of the environment subregions (Black Forest, Hogback, Mountains, and Plains), as well as the increased duration or intensive occupation of sites, and the introduction of new and different technologies, including mortuary practices, the bow and arrow, ceramics, and corn, that appear in the region at this time (Gilmore 1999; Gilmore et al 1999; Nelson 2001). Numerous ecotones are present in this important yet small and constricted area due to the fact that the terrain is composed of multiple elevations and contains multiple types of resources. Adaptations that are required for survival in this area are very different from and more extensive than adaptations required for a single type of landscape (plains or desert only) (Gilmore 1999; Gilmore et al 1999; Nelson 2001). Indications of an influx of populations from adjacent regions are visible in the archaeological record in the form of changing technology and the integration of new aspects/attributes into the old technology, specifically from either desert (Southwest, Great Basin, Lower and Trans-Pecos Texas) or plains environments, or both. In the region of southeastern Colorado, it has been deduced (Kevin Gilmore personal communication 2005) that due to the varied and abundant resources it provides, the local populations may not have needed to migrate as often as people who may have been

restricted to one environmental zone which produced only one or very few types of resources at one time. People who occupied an area that produces multiple types of animal and plant resources year-round have the luxury of not being extensively governed by the movements of animals or relocating to areas of increased plant growth on a seasonal basis. In fact, the multiple elevation zones and resources that exist in southeastern Colorado may have been what drew people from adjoining regions, whose presence is indicated by the appearance of new technology and a sharp increase in the number and distribution of utilize/occupied sites (Kevin Gilmore personal communication 2005).

According to Kevin Gilmore (personal communication 2005), there appears to have been a “see-saw” in the sizes of populations across the landscape between the Arkansas River Basin, the South Platte River Basin, and the Palmer Divide during the Late Prehistoric, which is also supported by increased site density within both regions. It is likely that these interpretations can also be extended to include the nearby Oklahoma panhandle. Prehistoric groups were either seasonally moving back and forth from the Palmer Divide to either of the two river basins, the populations were making a permanent move to the Palmer Divide from one of the two river basins, or a combination of the two aforementioned ideas.

Explanatory Scenarios

Though the affiliations of the Southern High Plains occupants, who produced the sandals recovered from Franktown Cave, Trinchera Cave, and the Kenton Caves, have been established, multiple hypotheses and alternative scenarios can be suggested to

explain these affiliations. The occurrence of multiple warp (8+ warps) sandal technology has three interpretations: (1) Plains innovation; (2) Plains adaptation (or diffusion and adaptation); and (3) migration of northern Colorado Plateau populations. The utilization of Mogollon affiliated footwear on the Southern High Plains is likely the result of the migration of nomadic pre-Mogollon/Mogollon populations, first at the Kenton Caves (ca. 1010 cal B.C.) and later at Trinchera Cave (ca. 390 cal A.D.).

Plains innovation is the least likely of the possible explanations for the appearance of multiple warp sandal technology on the Southern High Plains. Though only sparse perishable data exists from the Plains region, what has been found, suggests that there is no ancient Plains basketry complex or complexes in the sense of indigenous groups of techniques that evolved in and are uniquely characteristic of various areas in the Plains. According to previous research, basketry diffused onto the Plains at a relatively late date from neighboring areas in which it was highly developed and possessed a great antiquity (Adovasio 1980b:356). The diffusion of basketry technology, in the form of twill plaited and coiled basketry from areas in northern Mexico and Trans-Pecos Texas “likely began as much as 3,000 years ago and progressed more rapidly during the last 400 years” (Jolie 2006:17). However, this relatively late diffusion of basketry construction techniques could not explain to the utilization of multiple warp sandals on the Southern High Plains ca. 6430 cal B.C.

The second and third explanations for the development of the sandal technology on the Southern High Plains are on somewhat equal footing. Neither can be proven conclusively to be more correct than the other based on the poor preservation, poor excavation and documentation of Archaic Southern High Plains sites with perishables,

the low visibility of Archaic sites for comparative purposes, and the utilization of a generalized regional Archaic lithic toolkit. Though the perishables from the Southern High Plains reinforce the idea that basketry diffused onto the Plains, by suggesting the adaptation of more uncommon northern Colorado Plateau technology (i.e. balanced plainweave and oblique plaiting) this adaptation may have been implemented by either Plains or northern Colorado Plateau groups. Either way, this adaptation resulted in the regional variation of plainweave and obliquely plaited sandals as early as ca. 6400 cal B.C. at the Kenton Caves. The explanation of population migration from the northern Colorado Plateau, despite the great distance of this emigration, seems somewhat more likely based on previous determinations that the artifacts from the Kenton Caves are of pre-Basketmaker affiliation and the coeval use of these weaves in the northern Colorado Plateau (Jennings 1980; Lindsay et al. 1968). However, Plains adaptation cannot be discounted based on the shared utilization of a generalized Archaic toolkit in both regions, which included the exploitation of local raw material resources. Possible evidence for Plains adaptation include the presence of previously undocumented sandal technology including the creation of unique Kenton Caves toe covers and warp orientations. In addition, the Kenton Caves sandal technology lacks some of the other main northern Colorado Plateau sandal construction techniques, such as twining and the utilization of an open weave. It is, therefore, possible that Plains groups are responsible for the creation of these sandals.

In regards to the sharp disjuncture in sandal technology on the Southern High Plains, and the Kenton Caves specifically, ca. 1010 cal B.C., the sandal collection indicates, at the very least, a Mogollon population migration and intrusion. Though poor

excavation and stratigraphic records and the lack of radiocarbon and relative dates for the remainder of the more durable collection inhibits determinations of complete population replacement versus hybridization (Carr and Maslowski 1995:326), the sandal technology indicates that no hybridization occurred. It is likely that a situation of exodus and replacement took place at the Kenton Caves, in which an abandonment of this region by the northern Colorado Plateau affiliated groups was followed by an influx of a new (Mogollon affiliated) group into the area. In this scenario, after the departure of the original group, the perishable as well as other industries of the newly and later arriving immigrants would appear (Hyland 1997:332). This scenario is supported by the 700 year absence of perishable technology following the disappearance of the northern Colorado Plateau influenced sandal technology (Kenton Caves Type III sandals) ca. 1749 cal B.C. Mogollon-influenced sandal technology does not appear at the site until (Kenton Caves Type VII sandals) ca. 1010 cal B.C. There is no evidence to support a catastrophic migration, which would involve the violent incursion or invasion of one dominant group into the area, causing the removal and displacement of the indigenous population (Hyland 1997:332). Due to the poor stratigraphy, scarce dating, and scattered reporting, it cannot be stated whether the other industries support this notion conclusively. Regardless, this phenomenon is usually restricted to the domination of hunter-gatherer bands by a more highly organized society as opposed to between hunter-gatherer bands (Hyland 1997:332). Migration via recruitment is also not supported by the perishable tradition. In this scenario, generally, females are moving between neighboring groups or marrying into distant unaffiliated villages. However, the sandal industry on the Southern High Plains indicates that the entire group of people was involved in the initial move. If only

women were moving, it would be visible in the perishable record. Because women, ethnographically and historically were responsible for 90% of perishable production, the movement of females would be denoted by the appearance of alien construction methodologies and attributes in new areas (Hyland 1997:332). The two systems of manufacture would clash. Though the new “recruit” would be forced to learn the basketry styles of the new group some of the old traits could have/would have been retained and hidden from view, as is recorded in populations and from sites in the Southwest (Croes 2001:374). Therefore, despite attempts at assimilation, enculturated basket makers can continue to construct portions of their products in their original, culturally determined manner, even if only in the form of unconscious automatic initial spin and/or final twist direction of cordage. This sometimes automatic and unconscious retention of technology allows researchers to differentiate weavers and even suggest the origin of particular styles, specifically in regard to distance and direction (Croes 2001). The influx of Mogollon sandal technology does not show that any techniques of the previous technology were borrowed or adopted in any fashion. All of the sandal techniques utilized on the Southern High Plains have been demonstrated from other known Mogollon sites (Hyland 1997; Martin et al. 1952; McBrinn 2005).

The situation at Trinchera Cave is complicated by the presence of both Plains and Southwestern influenced artifacts in every recorded stratigraphic level of the site. Carr and Maslowski (1995:326) suggest that “settlements near the boundary between two regional bands or tribes that recruit persons from each other may have mixed proportions of artifacts, in contrast to more interior settlements that are more homogeneous.” However, despite the presence of both Southwestern and Plains influence in all levels at

Trinchera Cave (Simpson 1976), the sandal collection is homogeneous in its indication of Southwestern (Mogollon) origin. Therefore, it is difficult to interpret the occupation of Trinchera Cave. If both Plains and Mogollon-influenced populations occupied Trinchera Cave in overlapping settlement systems, they either used it as a base camp or merely as a site for the logistic extraction of resources alternately through time, or these local bands joined together temporarily at a logistic-aggregation site (Carr and Maslowski 1995:327). The dual presence of Southwestern and Plains artifacts could be used to argue for either of these explanations. While the Southwestern footwear from Trinchera Cave is clearly represented through time, the undated possibly Plains associated moccasins inhibit further comparison. While it is possible that the moccasins were constructed at the same time as the Mogollon-influenced plant fiber sandals, all of the sandal techniques employed in the manufacture of the sandals have been demonstrated at other known Mogollon sites. The sole utilization of Mogollon construction techniques indicates that hybridization or migration via recruitment between the Southwestern and Plains influenced groups occupying Trinchera Cave is not supported by the perishable tradition.

Based on the information presented above, which synthesizes that data presented in the Internal and External Correlations of Chapter 7, the technological trajectory of the Southern High Plains appears to be the result of the occupation of the area by multiple groups of differing regional affiliation. Whether the appearance of this technology is purely the result of technological diffusion or the actual migration of populations remains to be seen. However, it is possible that it is a combination of both, in the form of diffused technology onto the Plains, the migration of Northern Colorado Plateau or Plains groups who adapted this technology, and, later, the migration of Mogollon groups. Changes in

basketry like changes in other artifact classes reflect responses to varying internal and external stimuli that affected all prehistoric populations (Adovasio 1974:126). Though reasons for the migration of populations onto the Southern High Plains can only be hypothesized, their early appearance calls into question previous ideas about the distribution, relation, and movement of early North American populations.

Chapter 9: Conclusion

The perishable sandal collections of Franktown Cave and Trinchera Cave, Colorado and the Kenton Caves, Oklahoma/New Mexico were analyzed in order to study the expression of group cohesion and affiliation on the Southern High Plains. Sandals from these assemblages were compared descriptively, statistically, and chronometrically in order to determine whether the groups that manufactured these artifacts utilized the same sandal technology, technological trajectory of sandal use, and participated in the same “community of practice.” By determining whether groups from the Southern High Plains and adjacent regions were participating in the same “community of practice” in regard to conservative sandal technology, ideas of possible shared affiliation between the Southern High Plains and the adjacent regions could be explored.

It has been theorized that a spread of technology between the Southwest and the Plains may have been instigated by climatic and environmental fluctuations and increased population movement (Gilmore 2006). These changes in environmental conditions would have made it desirable for groups to have larger and more varied territories available for their use, which in turn, would increase group contact. This modification could have been accomplished by increased communication between groups and permitted access to new areas during times of shortage, necessitating a relaxation of “social boundary defense” (Geib 2000). As groups expanded their traditional area of exploitation in an

effort to gather more resources, previously non-overlapping spheres of exploitation would have overlapped and peripheral zones would have been shared by various non-affiliated groups. Based on these assertions, Geib (2000) has suggested that for the neighboring regions of the northern and southern Colorado Plateau, groups began to participate in an “expanded network of forager bands” (Geib 2000; McBrinn 2005). It is likely, based on the sandal collections from Franktown Cave, Trinchera Cave, and the Kenton Caves, that a similar development occurred on the Southern High Plains. An increase in population in the area (either by growth of local populations or migration of new groups from adjacent areas) possibly led to increased interaction (Gilmore 2006). Changes in stylistic choice may have signaled an “active expression” of identity in this newly altered world. New artifact attributes (or packet of attributes) may have signaled the expression of a new shared affiliation with immigrant groups, retention of old technology and practices in opposition to immigrant groups, or simply indicate the expansion of group territory into previously unoccupied areas. The analysis of prehistoric sandals is uniquely attuned to utilization in identifying prehistoric populations both “in place” (at one locale over time) and “on the move” (expanding spatially) based on the presence of unique and culturally conservative structural attributes through space and time.

Population movements between the mountains and the plains show increased visibility throughout the Archaic and Ceramic/Late Prehistoric periods (Nelson 2001), which is represented by the increased number of sites reported, as well as the increased duration or intensive occupation of sites, and the introduction of new and different technologies, including mortuary practices, the bow and arrow, ceramics, and corn, and

the integration of new aspects/attributes into the old technology (Gilmore 1999, 2005b, 2006; Gilmore et al. 1999; Nelson 2001). Changes in artifact characteristics are linked to physically constructed and historically changing circumstances. No doubt, the meanings and choices of many artifacts changed with changing political and economic conditions (Dillehay 2001:18). The people who exploited the varied and abundant resources provided on the Southern High Plains may not have needed to migrate as often as people who may have been restricted to one environmental zone which produced only one or very few types of resources at one time (Kevin Gilmore personal communication 2005). However, the multiple environmental zones and year-round resources of the Southern High Plains may have been what drew different groups from the adjacent regions. The presence of new people on the Southern High Plains is indicated by the appearance of new technology and a sharp increase in the number and distribution of utilized/occupied sites (Kevin Gilmore personal communication 2005). Though the majority of recent paleoenvironmental reconstructions have focused on the Palmer Divide and the South Platte and Arkansas River basin, it is likely that these interpretations can also be extended to include the nearby Oklahoma panhandle, which also lies in the Southern High Plains.

The early utilization and dominance of multiple warp sandal technology on the Southern High Plains (ca. 6430 cal B.C. at the Kenton Caves and 3348 cal B.C. at Franktown Cave) suggests that the earliest inhabitants of the Southern High Plains had affiliations to the northern Colorado Plateau. The arrival of new people onto the Southern High Plains is signaled by a change in this sandal technology. The manufacture of two- and four-warp sandals with traction masters ca. 1010 cal B.C. at the Kenton Caves and ca. cal A.D. 390 at Trinchera Cave indicate the presence of a new group of people with

affiliations to the Mogollon region of the Southwest. The presence of these people, and this technology, on the Southern High Plains appears to have occurred much earlier than previously suggested. The fact that the sandal trajectory of the Southern High Plains mirrors that of the Mogollon region, in which the use of two-warp sandals precedes the use of four-warp sandals (Hyland 1997), is yet another indicator that these new groups had Mogollon affiliation. Mogollon affiliation is also indicated by the presence of composite sandal technology at Trinchera Cave. This technology is closely aligned with and temporally coeval with that found at the Mogollon site of Tularosa Cave (Martin et al. 1952).

The moccasin fragments from Trinchera Cave, buffalo hide legging and moccasin from Franktown Cave, and the buffalo hide sandal from the Kenton Caves may be the only true lead regarding Plains influenced footwear. Though the buffalo hide sandal from the Kenton Caves and the buffalo hide legging and moccasin from Franktown Cave were utilized contemporaneously, the moccasin fragments from Trinchera Cave have not been dated. Despite the generally late appearance of these specimens at Southern High Plains sites (~1100 cal A.D.), and their coeval arrival with other Plains attributed artifacts, the interpretation of these items are muddled by the visual similarity of the Trinchera Cave moccasin fragments to specimens manufactured by northern Colorado Plateau groups.

Though some believe that a gradual diffusion of technology occurred between the Southwest and the Plains, rather than an actual migration of people (Gilmore 2006), the sandal technology presented herein suggests otherwise. Many of the climatic, environmental, and cultural developments and changes apparent during the Archaic period in the Greater Southwest specifically are now being thought of as time

transgressive and do not fit into a “pan-regional package of in situ and gradualistic change” (Hyland 1997:331). It appears as if this may be the case for the Southern High Plains as well. In nearly direct opposition to models of in situ and/or gradualistic change are various models of migration. Migration, as another form of patterned behavior, can be identified and traced in the archaeological record. However, while the causes of migration may differ in space and through time, and may not be regularly identifiable due to poor preservation, excavation, or interpretation, “migration has been continuously operational both prehistorically and historically” (Hyland 1997:331).

Because cultures as a whole include “the total pattern of human behavior and its products embodied in thought, speech, action, and artifact and are dependent upon human capacity for learning and transmitting knowledge to succeeding generations through the use of tools, language, and systems of abstract thought” (Gove 1964 cited in Minar 2001b), it is difficult to identify cultures or ethnic groups by only a portion of these defined parameters. However, the identification of the patterns and distribution of particular artifacts and attributes, such as sandal technology, have been utilized in order to identify certain “communities of practice” which show conservative use of and the creation of items over time and space. In addition to the production of similar artifacts, these “communities of practice” show similarities in how they hand down technology from one generation to the next. These similar “communities of practice” can be identified by their similar or difference to adjacent “communities of practice.” Within the archaeological record, “groups with common origins and shared learning networks are more likely to demonstrate similar patterns [in perishable technology] than unrelated groups...[and]...groups with significantly different patterns [in perishable technology]

are not likely to be related” (Minar 2001b:397). At the very least, they do not share a common origin or technological tradition (Minar 2001b:397). Therefore, the cavalcade of styles present on the Southern High Plains (multiple-warp sandals, two- and four-warp wickerwork sandals, composite sandals, buffalo hide sandals, and moccasins) can be explained by the presence of multiple unaffiliated groups (northern Colorado Plateau, Mogollon, and Plains). While previous research has focused on and relied on projectile point technology to identify cultural groups, it is perishable technology, and the stylistic choices preserved within that technology, that allows for the identification of smaller cultural units through “communities of practice.” Different aspects of sandal manufacture and their visibility to group members and non-members indicate conscious and unconscious choices of identity, or at least inclusion within a broader group. Changes in basketry, like changes in other artifact classes, reflect group responses to varying internal and external stimuli that affected all prehistoric populations (Adovasio 1974).

Alternative endogamous and exogamous scenarios can be proposed in order to explain the appearance of the different sandal technologies present on the Southern High Plains. Though migration is the most likely explanation for these two waves of different sandal technology (multiple warp sandals followed by two- and four-warp wickerwork sandals), the possibility of Plains adaptation (or diffusion and adaptation) cannot be discounted. Neither Plains adaptation or the migration of northern Colorado Plateau populations can be proven conclusively to be more correct than the other based on the poor preservation, poor excavation and documentation of Archaic Southern High Plains sites with perishables, the low visibility of Archaic sites for comparative purposes in general, and the utilization of a generalized regional Archaic toolkit. Though the

perishables from the Southern High Plains reinforce the idea that basketry diffused onto the Plains, by suggesting an adaptation of more uncommon northern Colorado Plateau technology (i.e. balanced plain weave and oblique plaiting) this adaptation may have been implemented by either Plains or northern Colorado Plateau groups. The explanation of population migration from the northern Colorado Plateau, despite the great distance of this emigration, seems somewhat more likely based on previous determinations that the artifacts from the Kenton Caves are of pre-Basketmaker affiliation, to which northern Colorado Plateau groups are locally ancestral. The temporally coeval use of balanced plain weave and oblique plaiting on the Southern High Plains and the northern Colorado Plateau reinforces this interpretation. No matter the progenitor, this adaptation resulted in the regional variation of plain weave and obliquely plaited sandals as early as ca. 6430 cal B.C. at the Kenton Caves.

In regards to the sharp disjuncture in sandal technology on the Southern High Plains, and the Kenton Caves specifically, the sandal collections indicate a Mogollon population migration and intrusion. Despite poor excavation and stratigraphic records and a lack of radiocarbon and relative dates for the remainder of the more durable collection, the sandal technology indicates the presence of Mogollon influence ca. 1010 cal B.C. Because only Mogollon construction techniques were utilized in the construction of these sandals, it is obvious that no hybridization occurred between this new population and the previous occupants. It is likely that a situation of exodus and replacement took place at the Kenton Caves, in which an abandonment of this region by the northern Colorado Plateau affiliated groups was followed by an influx of a new (Mogollon affiliated) group into the area. This scenario is supported by the 700 year absence of perishable technology

at the Kenton Caves following the disappearance of the northern Colorado Plateau influenced sandal technology and before the appearance of Mogollon-influenced sandal technology.

The situation at Trinchera Cave is complicated by the presence of both Plains and Southwestern influenced artifacts in every recorded stratigraphic level of the site (Simpson 1976). However, the plant fiber sandal collection is similar to the Kenton Caves collection in regard to its homogeneous Southwestern (Mogollon) origin. The Southwestern influenced footwear from Trinchera Cave is clearly represented through time. Unfortunately, the undated possibly Plains associated moccasins inhibit further comparison. However, again, the sole utilization of Mogollon construction techniques indicates that hybridization or even intermarriage, which would introduce new construction techniques and attributes, between the Southwestern and Plains influenced groups occupying Trinchera Cave is not supported by the perishable tradition. The lack of significant changes or adaptation to this technology indicates the presence of a similar genetic population to that occupying the Mogollon region. In fact, the homogenous Mogollon-influenced plant-fiber sandal collection provides supporting evidence for the interpretation that Sopris populations occupying the Arkansas River Basin from A.D. 1050-1200 were an in situ development from previous periods of occupation.

The evidence for both Plains and Southwest influence along the Southern High Plains by A.D. 1000 is well-established via pottery styles, projectile points, and the utilization of maize (Baugh 1994; Ireland 1970; Krieger 1946; Schroeder 1994; Simpson 1976). However, the descriptive, statistical, and chronometric analysis of the Southern High Plains sandal technology supports the idea that the interaction between the Plains

and Southwest cultures in this peripheral area was not a relatively recent development. In fact, the sandal collections (from Franktown Cave and the Kenton Caves) suggest that northern Colorado Plateau pre-Basketmaker technology arrived on the Southern High Plains (ca. 6430 cal B.C.) thousands of years before the suggested contact between the Southwest and Plains. The analysis of the perishable collections from Franktown Cave and Trinchera Cave, Colorado and the Kenton Caves, Oklahoma/New Mexico indicates that the technological trajectory of plant-fiber sandals on the Southern High Plains appears to be the result of the occupation of the area by multiple groups of differing regional affiliation. Though reasons for the migration of populations onto the Southern High Plains can only be hypothesized, the early appearance of unique sandal technology calls into question previous ideas about the distribution, relation, and movement of early North American peoples.

Suggested Future work

Only the sandals, moccasins, and a few specific coiled basketry fragments from Franktown Cave, Trinchera Cave, and the Kenton Caves have been reported within this text. However, the complete perishable collections from these sites also include many examples of cordage, sandal “doodles”/miniatures/toys (produced by children or novice weavers), additional types of basketry fragments (plaited and coiled), and even a twined bag and containers manufactured utilizing whole animal remains (prairie dog). The analysis and reporting of these items could be used to strengthen cultural comparisons within the region. By comparing other sites throughout the region to the Southern High Plains technological trajectory, it can be determined which sites’ assemblage data

suggests or discredits ideas concerning cultural continuity and/or cultural change via population influx/movement or cultural diffusion. In addition, ideas of learning and the conservative parameters of perishable production can be explored further via the study of the crafts produced by the child and novice weavers. Children begin to learn a variety of cultural practices including craft production at an early age. As this happens, they may leave traces of their activities in the archaeological record. These traces are “the means by which archaeologists can begin to reconstruct the sequences by which crafts are learned in prehistoric societies” (Wenger 1998). Kamp (2001) and Crown (2001) have attempted to discern the presence of children and/or novices in craft production as a means of understanding the processes by which communities of practice reproduce themselves. A further examination of the “doodle” forms found in the Southern High Plains collections should be conducted in order to examine similar issues.

Awarded funds and time could not provide sufficient support for an expanded regional comparison beyond published resources and personal communications regarding similar and singular finds. Future research must be focused on expanding this preliminary research from New Mexico/Mexico to Wyoming and from the Nebraska/Kansas region to eastern Utah. Funds were also not available to date all of the plant-fiber, composite sandal specimens, or the hide moccasins. The dating of the Trincheria Cave moccasins would allow for comparisons to be made regarding the temporal association of these items with that of the moccasin and buffalo hide legging from Franktown Cave and the buffalo hide sandal from the Kenton Caves. Dating the Trincheria Cave moccasin fragments would allow researchers to determine whether this

possibly Plains affiliated footwear was produced along-side the Mogollon plant fiber sandal technology.

Measurements of cordage utilized in the manufacture of the sandals were unnecessary because cordage was not used in the construction of the sandals or basketry. Therefore, no comparison of cordage types used in different forms or footwear was possible. Though it was hoped that the recordation of cordage types and attribute information would increase sample size and give the conclusions drawn from their statistical differentiation more weight and increase the mathematical accuracy of the study, as previously stated, they could only have been compared with cordage collections from other sites and not cordage used in sandal manufacture.

As research proceeded, it became evident that the previously proposed analysis of cord-marked ceramics would no longer be necessary or useful. In the future, however, this type of analysis could be utilized as a means for recording more data about the types of cordage used and the range of variability in the types of cordage produced by these people. Positive casts of the Franktown Cave cord-marked ceramics were made however, as a part of the Franktown Cave NSF Grant research, and are available for use in future studies. They currently reside in the hands of Erik Gantt, a Project Supervisor for Centennial Archaeology, Inc. The clay casts were made using blue and red Crayola brand modeling clay in order to ease the analysis and measurement of the individual cordage attributes on the sherds. In the future, positive casts could also be made for the Trincheria Cave and Kenton Caves ceramics. Casts of yarn, fabric, and basketry impressions on clay or pottery from many time periods and parts of the world have been analyzed and are available for comparison (Drooker 2001:172). Usually, a diversity of fabric types, with

many instances of wear and damage, were designed and produced to serve a variety of functions, only later being recycled for use in pottery manufacture. Often, it is possible to measure the yarn elements, analyze the fabric structure and yarn construction, and even make an educated guess at the type of fiber from which the original textile was made (Drooker 2001). Preliminary analysis of these casts indicate that a variety of weaving types were used in pottery finishing techniques, including twining, cord wrapped sticks, and cord wrapped paddles.

The study of the rare perishables from all three caves/rockshelters on the Colorado High Plains have provided a unique opportunity for the acquisition of information regarding the technology used by and possible cultural affiliations of the prehistoric people in and immediately adjacent to southeastern Colorado and the Oklahoma panhandle. By completing additional work on the perishable collections, and continuing to research the site collections as a whole, a clearer picture of life on the Southern High Plains can be formulated. Previously, the Southern High Plains represented a gap in the knowledge of the perishable technology employed by prehistoric North American populations. However, the information revealed by the analysis of the perishable materials utilized on the Southern High Plains indicates that what archaeologists know about the occupation of this region may require reexamination.

References Cited

- Adovasio, J. M.
- 1970 The Origin, Development, and Distribution of Western Archaic Textiles. *Tebiwa* 13(2):? Pocatello.
- 1972 Notes taken on the Kenton Caves materials.
- 1974 Prehistoric North American Basketry. *The Nevada State Museum Anthropological Papers* 16:98-148.
- 1975 Fremont Basketry. *Tebiwa: Miscellaneous Papers of the Idaho State University Museum of Natural History* 17(2):67-76.
- 1977 *Basketry Technology: A Guide to Identification and Analysis*. Chicago: Aldine Publishing.
- 1979 Comment on The Fremont and the Sevier: Defining Prehistoric Agriculturalists North of the Anasazi, by David B. Madsen. *American Antiquity* 44(4):723-731.
- 1980a The Evolution of Basketry Manufacture in Northeastern Mexico, Lower and Trans-Pecos Texas. In *Papers on the Prehistory of Northeastern Mexico*, edited by J. F. Epstein, T. R. Hester, and C. Graves, pp. 93-102. Center for Archaeological Research Special Report 9, The University of Texas at San Antonio.
- 1980b Prehistoric Basketry of Western North America and Mexico. In *Early Native Americans: Prehistoric Demography, Economy and Technology*, edited by David L. Bowman, pp 341-362. Mouton, The Hague.
- 1986 Artifacts and Ethnicity: Basketry as an Indicator of Territoriality and Population Movements in the Prehistoric Great Basin. In *Anthropology of the Desert West: Essays in Honor of Jesse D. Jennings*, edited by D.J. Condie and D.D. Fowler, pp. 43-89. Anthropological Paper No. 110. University of Utah Press, Salt Lake City.
- 1996 Textiles. In *The Oxford Companion to Archaeology*, edited by B. M. Fagan, pp. 709-710. Oxford University Press, New York.
- 2000 Style, Basketry, and Basket Makers: Agency Concretized in a Perishable Medium. Paper Prepared for "Art for Archaeology's Sake: Material Culture and Style Across the Disciplines," 33rd Annual Chacmool Conference, 8-12 November 2000.

2004 Some Thoughts on the Chronology of Cueva Esponentosa and the Cuatro Ciénegas Basin. In Sandals From Coahuila Caves. In *Pre-Columbian Art and Archaeology* No. 35, Appendix D. Dumbarton Oaks Research Library and Collection, Washington, D.C.

2005 The Mexican Connection: Another Look at “Perishable” Relationships Between Mexico and Points North. Presented at the Symposium “Unraveling the Boundary: Perishable Technologies Across and Between the Prehistoric Great Basin and Southwest,” 70th Annual Meeting of the Society for American Archaeology, 30 March – 3 April 2005, Salt Lake City, Utah.

Adovasio, J. M., R. L. Andrews, and C. S. Fowler

1982 Some Observations on the Putative Fremont Presence in Southern Idaho. *Plains Anthropologist* 27(95):19-27.

Adovasio, J. M. and Joel Gunn

1977 Style, Basketry, and Basketmakers. In *The Individual in Prehistory: Studies of Variability in Style in Prehistoric Technologies*, edited by James N. Hill and Joel Gunn, pp.137-152. Academic Press, New York.

1986 The Antelope House Basketry Industry. In *Archaeological Investigations at Antelope House*, edited by D. P. Morris, pp. 306-397. Publications in Archaeology No. 19. National Park Service, Washington, D.C.

Adovasio, J. M., D. C. Hyland, and O. Soffer

1998 Perishable Technology and Early Human Populations in the New World. Paper Prepared for the 31st Annual Chacmool Conference “On Being First: Cultural Innovation and Environmental Consequences of First Peoplings,” 12-15 November 1998, Calgary, Alberta.

Adovasio, J. M. and J. S. Illingworth

2002 Style, Basketry, and Basket Makers Redux: Looking at Individuals Through a “Perishable” Prism. Paper Presented at the Symposium “Twenty-Five Years after *The Individual in Prehistory*,” 101st Annual Meeting of the American Anthropological Association, 20-24 November 2002, New Orleans, Louisiana.

Adovasio, J. M. and D. R. Pedler

1994 A Tisket, a Tasket: Looking at the Numic Speakers through the “Lens” of a Basket. In *Across the West: Human Population Movement and the Expansion of the Numa*, edited by D. B. Madsen and D. Rhode, pp. 114-123. University of Utah Press, Salt Lake City.

- Adovasio, J. M., G. M. Thompson, and J. S. Illingworth
2005 Overview of the Perishable Assemblage from Franktown Cave (5DA272;L:9:31), Douglas County, Colorado. Report Prepared by Mercyhurst Archaeological Institute, Mercyhurst College, Erie, Pennsylvania, for the Department of Anthropology and the Archaeological Research Institute, University of Denver, Denver, Colorado.
- Aikens, C. Melvin
1970 Hogup Cave. University of Utah Anthropological Papers No. 93. University of Utah: Salt Lake City.
- Anderson, Keith M.
1969 Tsegi Phase Technology. MS, Doctoral dissertation, Department of Anthropology, University of Washington, Seattle.
- Andrews, R. L.
n.d. Plains Perishables. Unpublished manuscript originally intended for publication in *A Most Indispensable Art: Native Fiber Industries from Eastern North America* by James B. Peterson.
- Andrews, R. L. and J. M. Adovasio
1980 *Perishable Industries from Hinds Cave, Val Verde County, Texas*. Ethnology Monographs No. 5. Department of Anthropology, University of Pittsburgh, Pittsburgh.
- 1996 The Origins of Fiber Perishables Production East of the Rockies. In *Fiber Perishables East of the Rockies*. University of Tennessee Press: Knoxville.
- Andrews, R. L., J. M. Adovasio, and R. C. Carlisle
1986 Perishable Industries from Dirty Shame Rockshelter, Malheur County, Oregon.
- Baker, William E.
1929 The First of the Plainsmen, Chapter II. Southwest Wilds and Waters, December: 16-19, 44.
- Baker, William E., T. N. Campbell, and G. L. Evans
1957 The Nall Site: Evidence of Early Man in the Oklahoma Panhandle. *Bulletin of the Oklahoma Anthropological Society* 5:1-20.
- Baldwin, G. C.
1938 An Analysis of Basket Maker III Sandals from Northeastern Arizona. *American Anthropologist* 40:465-485.

Bastian, Tyler

1964 Radiocarbon Date from an Archaic Site in Southwest Oklahoma. *Oklahoma Anthropological Society Newsletter*, 12(9):1-4.

Baugh, Timothy G.

1994 Holocene Adaptations in the Southern High Plains. In *Plains Indians, A.D. 500-1500: The Archaeological Past of Historic Groups*, edited by Karl H. Schlesier, pp. 264-289. University of Oklahoma Press, Norman.

Bell, Robert E.

1958 Archaeological Investigations at the Boast Dock Site, Ma-1, in the Lake Texoma Area, Marshall County, Oklahoma. *Bulletin of the Oklahoma Anthropological Society* 6:37-47.

Bernick, Kathryn

1989 The Potential of Basketry for Reconstruction Cultural Diversity on the Northwest Coast. In *Ethnicity and Culture*, edited by Reginald Auger, Margaret F. Glass, Scott MacEachern, and Peter H. McCartney, pp. 251-257. University of Calgary Archaeology Association, Calgary.

Black, Kevin

1991 Archaic Continuity in the Colorado Rockies: The Mountain Tradition. *Plains Anthropologist* 36(133):1-29.

2001 Registration Form: Trinchera Cave Archaeological District (5LA9555). National Register of Historic Places. United States Department of the Interior. National Park Service, 2/2001.

Black, Kevin, Gary, Moreschini, Sylvia Moreschini, Bruce Wahle, Robert Rushforth, and Jill Starceovich

1998 Site or Property Reevaluation Form: Trinchera Cave (5LA1057). Colorado Cultural Resource Survey. Colorado Office of Archaeological and Historic Preservation, 8/23/98.

Bluhm, E.

1952 Clothing and Textiles. In *Mogollon Cultural Continuity and Change: The Stratigraphic Analysis of Tularosa and Cordova Caves*, edited by P. S. Martin, John B. Rinaldo, Elaine Bluhm, Hugh C. Cutler, and Roger Grange, Jr. *Fieldiana: Anthropology* 40:231-330. Chicago Natural History Museum.

Butler, Charles T.

1948 *A West Texas Rock Shelter*. Unpublished Master's thesis. The University of Texas, Austin.

Cambell, Robert Gordon

1969 Prehistoric Panhandle Culture on the Chaquaqua Plateau, Southeast Colorado. University of Microfilms International. Ann Arbor, Michigan.

1976 The Panhandle Aspect of the Chautauqua Plateau. *Texas Tech University Graduate Studies*, No. 11.

Carr, Christopher, and Robert F. Maslowski

1995 Cordage and Fabrics: Relating Form, Technology, and Social Processes. In *Style, Society, and Person: Archaeological and Ethnological Perspectives*, edited by Christopher Carr and Jill E. Neitzel, pp. 297-344. Interdisciplinary Contributions to Archaeology. Plenum Press, New York.

Cassells, E. Steve

1997 The Archaeology of Colorado, revised edition. Johnson Books: Boulder.

Chenault, Mark L.

1999 Paleoindian Stage. In *Colorado Prehistory: A Context for the Platte River Basin*, pp. 51-90. Colorado Council of Professional Archaeologists, Denver.

Conn, Dick

1983 Dick Conn on 3505, CO L:9:31, Moccasin. Ms. on file, Museum of Anthropology, University of Denver.

Connolly, Thomas J. and Pat Barker

2004 Basketry Chronology of the Early Holocene in the Northern Great Basin. In *Early and Middle Holocene Archaeology of the Northern Great Basin*, edited by D. L. Jenkins, T. J. Connolly, and C. M. Aikens, pp. 241-250. University of Oregon Anthropological Papers 62.

Cosgrove, C.B.

1947 Caves of the Upper Gila and Hueco Areas in New Mexico and Texas. Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard University Vol. XXIV, No. 2. Published by the Museum: Cambridge, Massachusetts.

Cressman, L. D.

1942 *Archaeological Researches in the Northern Great Basin*. Carnegie Institution of Washington Publications No. 538. Washington, D.C.

Cressman, L. S.

1962 The Sandal and the Cave: The Indians of Oregon. Beaver Books: Portland.

Crocket, Kylie

- 2002 Temporal Characteristics of Southeastern Colorado and Trinchera Rockshelter. In *Archaeological Investigations in Southeastern Colorado* by Michael Nowak and Heather J. Gerhart. Department of Anthropology at Colorado College. Colorado College Publications in Archaeology No. 22.

Croes, Dale R.

- 2001 Northwestern Coast Wet Sites: Using Perishables to Reveal Patterns of Resource Procurement, Storage, Management, and Exchange. In *Fleeting Identities: Perishable Material Culture in Archaeological Research*, edited by Penelope Ballard Drooker, pp. 357-385. Occasional Paper No. 28. Center for Archaeological Investigations, Southern Illinois University Press, Carbondale.

Crown, Patricia L.

- 2001 Learning to Make Pottery in the Prehispanic American Southwest. *Journal of Anthropological Research* 57(4):451-469.

Deegan, Ann Cordy

- 1993 Anasazi Fibrous Sandal Terminology. *Kiva* 59(1):49-64.

- 1995 Anasazi Sandal Features: Their Research Value and Identification. *Kiva* 61(1): 57-69.

Dick, H. W.

- 1965 *Bat Cave*. Monograph No. 27. School of American Research, Sante Fe, New Mexico.

Dillehay, Tom D.

- 2001 Reflection on Material Culture and Identity. In *Fleeting Identities: Perishable Material Culture in Archaeological Research*, edited by Penelope Ballard Drooker, pp. 16-24. Occasional Paper No. 28. Center for Archaeological Investigations, Southern Illinois University Press, Carbondale.

Drooker, Penelope Ballard

- 2001 Leaving No Stone Unturned: Making the Most of Secondary Evidence for Perishable Material Culture. In *Fleeting Identities: Perishable Material Culture in Archaeological Research*, edited by Penelope Ballard Drooker, pp. 170-186. Occasional Paper No. 28. Center for Archaeological Investigations, Southern Illinois University Press, Carbondale.

Emery, Irene

- 1980 *The Primary Structures of Fabrics: An Illustrated Classification*. Washington: The Textile Museum. (Originally published 1966).

- 1995 The Primary Structures of Fabrics: An Illustrated Classification. Revised 1980. The Textile Museum, Washington, D. C. Reprinted by Watson-Guption Publications, the Whitney Library of Design, and the Textile Museum, Washington, D. C.
- Geib, Phil R.
- 1996 AMS Dating of Plain-Weave Sandals from the Central Colorado Plateau. *Utah Archaeology* 9:35-53.
- 2000 Sandal Types and Archaic Prehistory on the Colorado Plateau. *American Antiquity* 65(3):509-524.
- Gilmore, Kevin
- 1999 The Late Prehistoric Stage. In *Colorado Prehistory: A Context for the Platte River Basin*, by Kevin Gilmore, Marcia Tate, Mark Chenault, Bonnie Clark, Terri McBride and Margaret Wood, pp. 175-308. Colorado Council of Professional Archaeologists, Denver.
- 2004 *National Register of Historic Places Registration Form for Franktown Cave (5DA272)*.
- 2005a Registration Form: Franktown Cave (5DA272). National Register of Historic Places. United States Department of the Interior. National Park Service, 1/31/05.
- 2005b These Boots were Made for Walking: Moccasin Production, Gender, and the Late Prehistoric Hideworking Sequence on the High Plains of Colorado. In *Gender and Hideworking*, edited by Lisa Frink and K Weedman, pp. 13-35. Altimira, Berkley.
- 2006 Ritual Landscapes, Population, and Changing Sense of Place During the Late Prehistoric Transition in Eastern Colorado. In *Landscape Perspectives on the Archaeology of the High Plains*, edited by Laura Scheiker and Bonnie Clark. University Press of Colorado, Boulder.
- Gilmore, Kevin and Sean Larmore
- 2004 Seventeen First Dates: Implications of AMS dates from Perishable Artifacts from Franktown Cave, Colorado. Paper presented at the annual meeting of the Colorado Council of Professional Archaeologists, Colorado Springs.
- Gilmore, Kevin, Marcia Tate, Mark Chenault, Bonnie Clark, Terri McBride and Margaret Wood
- 1999 *Colorado Prehistory: A Context for the Platte River Basin*. Colorado Council of Professional Archaeologists, Denver.

Glassow, Michael A.

1980 Prehistoric Agricultural Development in the Northern Southwest: A Study in Changing Patterns of Land Use. *Ballena Press Anthropological Papers* No. 16. Ballena Press: Socorro, NM.

Guernsey, Samuel J.

1931 Explorations in Northeastern Arizona. *Papers of the Peabody Museum of American Archaeology and Ethnology* 12(1). Cambridge: Harvard University.

Guernsey, S. J. and A.V. Kidder

1921 *Basketmaker Caves of Northeastern Arizona*. Papers of the Peabody Museum of American Archaeology and Ethnology, No. 8.

Gunnerson, James H.

1989 Apishapa Canyon Archaeology: Excavations at the Cramer, Snake Blakeslee and Nearby Sites. Reprints in Anthropology Volume 41. J & L Reprint Company, Lincoln, Nebraska.

Hammatt, Hallett H.

1976 The Gore Pit site: An Archaic Occupation in Southwestern Oklahoma and a Review of the Archaic Stage in the Southern Plains. *Plains Anthropologist* 21(74):245-277.

Harrington, Mark R.

1924 The Ozark Bluff-Dwellers. *American Anthropologist* 26:1-21.

Hastorf, Christine A.

2001 Making the Invisible Visible: The Hidden Jewels of Archaeology. In *Fleeting Identities: Perishable Material Culture in Archaeological Research*, edited by Penelope Ballard Drooker, pp. 27-42. Occasional Paper No. 28. Center for Archaeological Investigations, Southern Illinois University Press, Carbondale.

Haury, Emil W.

1950 The stratigraphy and archeology of Ventana Cave, Arizona. University of Arizona Press, Tucson.

1957 An Alluvial Site on the San Carlos Indian Reservation, Arizona. *American Antiquity* (23)1

Hays-Gilpin, Kelley, Ann Cordy Deegan, and Elizabeth Ann Morris

1998 Prehistoric Sandals from Northeastern Arizona: The Earl H. Morris and Ann Axtell Morris Research. *Anthropological Papers of the University of Arizona* No. 62. University of Arizona Press: Tucson.

Hewitt, N. J.

1980 Fiber Artifacts. In *Cowboy Cave*, by J. D. Jennings, pp. 49-74. Anthropological Papers Number 104. University of Utah, Salt Lake City.

Hofman, Jack L.

1971 A Surface Survey of the Ross Site, Cd-59, Caddo County, Oklahoma. *Bulletin of the Oklahoma Anthropological Society* 20:101-114.

1973 Cd-177: A Small Archaic Camp in West-Central Oklahoma. *Bulletin of the Oklahoma Anthropological Society* 22:171-206.

Hughes, David T.

1984 The Foragers: Western Oklahoma. In *Prehistory of Oklahoma*, edited by Robert E. Bell, pp. 109-117. Academic Press.

Hurley, William M.

1979 *Prehistoric Cordage: Identification of Impressions on Pottery*. Chicago: Aldine Publishing.

Hyland, David C.

1997 Perishable Industries from the Jornada Basin, South-Central, New Mexico. Doctoral Thesis; University of Pittsburgh.

Hyland, D. C. and J. M. Adovasio

2000 The Mexican Connection: A Study of Sociotechnical Change in Perishable Manufacture and Food Production in Prehistoric New Mexico. In *Beyond Cloth and Cordage: Archaeological Textile Research in the Americas*, edited by Penelope Ballard Droker and Laurie D. Webster, pp. 141-159. University of Utah Press, Salt Lake City.

Hyland, D. C., J. M. Adovasio, and J. S. Illingworth

2003 The Perishable Artifacts. In *Pendejo Cave*, edited by Richard S. MacNeish and Jane G. Libby, pp. 297-416. University of New Mexico Press, Albuquerque.

INTCAL04 Radiocarbon Age Calibration; IntCal04: Calibration Issue of Radiocarbon (Volume 46, nr 3, 2004).

Ireland, Stephen K.

1970 Purgatoire River Reservoir Salvage Archaeology, 1969: Sites TC:C9:4 and TC:C9:9. National Park Service Contract No. 14-10-2:920:133. Department of Anthropology, Trinidad State Junior College; Trinidad, Colorado.

Ireland, Stephen K. and Caryl E. Wood

1973 *Trinidad Reservoir Salvage Archaeology, 1970: Sites TC:C9:9B, TC:C9:23, TC:C9:24, TC:C9:302*. Department of Anthropology, Trinidad State Junior College, Trinidad, Colorado.

Irwin-Williams, Cynthia

2007 Prehistoric Cultural and Linguistic Patterns in the Southwest since 5000 BC. In *Zuni Origins: Toward a New Synthesis of Southwestern Archaeology*, edited by David A. Gregory and David R. Wilcox, pp. 14-21. The University of Arizona Press, Tucson.

Irwin-Williams, Cynthia C. and Henry J. Irwin

1966 *Excavations at Magic Mountain: A Diachronic Study of Plains-Southwest Relations*. Denver Museum of Natural History Proceedings 12, Denver, CO.

Jennings, Jesse D.

1957 *Danger Cave*. Anthropological Papers No. 27. Department of Anthropology, University of Utah, Salt Lake City.

1964 The Desert West. In *Prehistoric Man in the New World*, edited by Jesse D. Jennings and Edward Norbeck, pp. 149-174. University of Chicago Press.

1980 Cowboy Cave. University of Utah Anthropological Papers No. 104. University of Utah: Salt Lake City.

Jennings, Jesse D. and Edward Norbeck

1955 Great Basin Prehistory: A Review. *American Antiquity* 21:1-11.

Johnson, Edward C.

1975 *Walker River Paiutes: A Tribal History*. University of Utah Printing Service: Salt Lake City, Utah.

Jolie, Edward A.

2000 Two Ethnographic Cheyenne Gambling Baskets. Report prepared for D. G. Harding, Carnegie Museum of Natural History, Pittsburgh, Pennsylvania. Manuscript on file at the R. L. Andrews Center for Perishable Analysis, Mercyhurst Archaeological Institute, Erie, Pennsylvania.

2001 Two Ethnographic Sioux Twined Gambling Baskets. Report prepared for J. Landmann, South Dakota State Historical Society Cultural Heritage Museum, Pierre, South Dakota. Manuscript on file at the R. L. Andrews Center for Perishable Analysis, Mercyhurst Archaeological Institute, Erie, Pennsylvania.

- 2002 An Ethnographic Perspective on Plains Indian Textile Arts. Paper prepared for the 67th Annual Meeting of the Society for American Archaeology, Denver, Colorado 20-24 March 2002.
- 2006 The Technomechanics of Plains Indian Coiled Gambling Baskets. *Plains Anthropologist* 51(197): 17-49.
- Jones, Siân
1997 The Archaeology of Ethnicity: Constructing Identities in the Past and Present. Routledge, New York.
- Kalasz, Stephen M., Christopher C. Kinneer, John D. Kennedy, Michael D. McFaul, Jennifer W. Gish and Mary E. Malainey
2003 *Mitigative Excavations at the East Plum Creek Site (5DA1008) in Castle Rock, Douglas County, Colorado*. Prepared by Centennial Archaeology. Copies available from Colorado Department of Transportation, Project IM 0252-360, I-25 Railroad Overpass.
- Kamp, Kathryn A.
2001 Prehistoric Children Working and Playing: A Southwestern Case Study in Learning Ceramics. *Journal of Anthropological Research* 57(4):427-440.
- Kankainen, Kathy
1995 Sandal Styles, Materials, and Techniques. In *Treading in the Past: Sandals of the Anasazi*, edited by Kathy Kankainen, pp. 21-30. Utah Museum of Natural History in association with the University of Utah Press, Salt Lake City.
- Kankainen, Kathy, ed.
1995 *Treading in the Past: Sandals of the Anasazi*. Utah Museum of Natural History in association with the University of Utah Press, Salt Lake City.
- Kantner, John
2004 *Ancient Puebloan Southwest: Case Studies in Early Societies*. Cambridge University Press.
- Kidder, Alfred V. and Samuel J. Guernsey
1919 Archaeological Explorations in Northeastern Arizona. *Bureau of American Ethnology Bulletin* 65. Smithsonian Institution. Washington.
- King, Anthony G.
2006 Subsistence Dynamics and Stone Tools at Franktown Cave, Colorado. Unpublished M.A. Thesis, Department of Anthropology, University of Denver, Denver.

King, M. E.

n.d. Sandals from Hinds Cave. Unpublished manuscript on file at the Texas Archaeological Research Laboratory, The University of Texas at Austin.

1975 Archaeological Textiles. In *Irene Emery Roundtable on Museum Textiles 1974 Proceedings*, edited by P. L. Fiske, pp. 9-16. The Textile Museum, Washington, D. C.

Krieger, Alex D.

1946 *Culture Complexes and Chronology in Northern Texas*. University of Texas Publication No. 4640. Austin.

Kuttruff, Jenna T., S. Gail DeHart, Michael J. O'Brien

1998 7500 Years of Prehistoric Footwear from Arnold Research Cave, Missouri. *Science* vol. 281, 3 July 1998, p. 72-75.

Leonhardy, Frank C.

1966 Test Excavations in the Mangum Reservoir Area of Southwestern Oklahoma. *Contributions of the Museum of the Great Plains*, No. 2.

Lindsay, Alexander J., J. Richard Ambler, Mary Anne Stein, and Philip M. Hobler

1968 Survey and Excavations North and East of Navajo Mountain, Utah, 1959-1962. The Northern Arizona Society of Science and Art, Inc.: Flagstaff.

Lintz, Christopher and Leon George Zabawa

1984 The Kenton Caves of Western Oklahoma. In *Prehistory of Oklahoma*, edited by Robert E. Bell, pp. 161-174. Academic Press.

Lowie, Robert H.

1924 Notes on Shoshonean Ethnography. *Anthropological Papers of the American Museum* vol. XX, Part III, pp. 185-314. American Museum Press: New York.

Logan, Wilfred D.

1952 Graham Cave: An Archaic Site in Montgomery County, Missouri. Missouri Archaeological Society Memoir No. 2. Columbia.

MacNeish, R. S., ed.

1993 Preliminary Investigations of the Archaic in the Region of Las Cruces, New Mexico. Historic and Natural Resources Report No. 9. Cultural Resources Management Program. Directorate of Environment, United States Army Air Defense Artillery Center, Fort Bliss, Texas.

- Martin, Paul S., John B. Rinaldo, Elaine Bluhm, Hugh C. Cutler, and Roger Grange, Jr.
 1952 Mogollon Cultural Continuity and Change: The Stratigraphic Analysis of Tularosa and Cordova Caves. *Fieldiana: Anthropology* vol. 40. Chicago Natural History Museum.
- Maslowski, Robert F.
 1978 The Archaeology of Moorehead Cave: Val Verde County, Texas. Doctoral dissertation, University of Pittsburgh. University Microfilms, Ann Arbor, Michigan.
- McBrinn, Maxine
 2005 Social Identities Among Archaic Mobile Hunters and Gatherers in the American Southwest. Arizona State Museum Archaeological Series no. 197. Arizona State Museum. The University of Arizona: Tucson.
- McGregor, R.
 1992 *Prehistoric Basketry of the Lower Pecos, Texas*. Monographs in World Archaeology No. 6. Prehistory Press, Madison, Wisconsin.
- Merchant, Jan and Vorsila Bohrer
 2006 High Rolls Sandals. In *High Rolls Cave: Insectos, Burritos, y Frajos: Archaic Subsistence in Southern New Mexico*, pp. 153-158, edited by Stephen C. Lentz. Office of Archaeological Studies, Museum of New Mexico, Archaeology Notes 345, Santa Fe.
- Minar, C. Jill
 1995 The Development of Archaeological Textile Analysis in the New World with a Discussion of Attribute Analysis. Unpublished Undergraduate Senior Thesis, Mercyhurst College.
- 2001a Material Culture and the Identification of Prehistoric Cultural Groups. In *Fleeting Identities: Perishable Material Culture in Archaeological Research*, edited by Penelope Ballard Drooker, pp. 94-113. Occasional Paper No. 28. Center for Archaeological Investigations, Southern Illinois University Press, Carbondale.
- 2001b Motor Skills and the Learning Process: The Conservation of Cordage Final Twist Direction in Communities of Practice. *Journal of Anthropological Research* 57(4):381-405.
- Minar, Jill and Patricia L. Crown
 2001 Learning and Craft Production: An Introduction. *Journal of Anthropological Research* 57(4):369-380.

- Morris, Earl H.
1919 The Aztec Ruin. *Anthropological Papers of the American Museum of Natural History* 26(1). American Museum of Natural History, New York.
- Morris, Earl H. and Robert F. Burgh
1941 Anasazi Basketry, Basket Maker II Through Pueblo III: A Study Based on Specimens from the San Juan River Country. *Carnegie Institution of Washington Publication* 604. Washington.
- Morris, Elizabeth A.
1980 *Basketmaker Caves in the Prayer Rock District, Northeastern Arizona*. Anthropological Papers of the University of Arizona 35. Tucson: University of Arizona Press.

1995 Anasazi Textiles. In *Treading in the Past: Sandals of the Anasazi*, edited by Kathy Kankainen, pp. 5-10. Utah Museum of Natural History in association with the University of Utah Press, Salt Lake City.
- Nelson, Charles
1970 Chamber Cave. *Southwestern Lore* 36 (1):1-11.
- Nelson, Sarah M.
2001 Prehistoric Sites. In *Denver: An Archaeological History*, pp. 61-109. University of Pennsylvania Press, Philadelphia.
- Nowak, Michael and Heather J. Gerhart
2002 Archaeological Investigations in Southeastern Colorado. Department of Anthropology at Colorado College. Colorado College Publications in Archaeology No. 22.
- Orchard, William C.
1920 Sandals and Other Fabrics from Kentucky Caves. *Indian Notes and Monographs, Miscellaneous No. 4*. Museum of the American Indian: New York.
- Orr, P. C.
1974 Notes on the Archaeology of the Winnemucca Caves. In *Collected Papers on Aboriginal Basketry*, edited by D. R. Tuohy and D. L. Rendall, pp. 47-59. Nevada State Museum Anthropological Papers Number 16, Carson City.
- Petersen, James B.
1996 Fiber Industries from Northern New England: Ethnicity and Technological Traditions during the Woodland Period. In *A Most Indispensable Art: Native Fiber Industries from North America*, edited by James B. Petersen. University of Tennessee Press, Knoxville.

- Petersen, James B., Michael J. Heckenberger, and Jack A. Wolford
 2001 Spin, Twist, and Twine: An Ethnoarchaeological Examination of Group Identity and Native Fiber Industries from Greater Amazonia. In *Fleeting Identities: Perishable Material Culture in Archaeological Research*, edited by Penelope Ballard Drooker, pp. 226-253. Occasional Paper No. 28. Center for Archaeological Investigations, Southern Illinois University Press, Carbondale.
- Plog, Fred T.
 1974 *The Study of Prehistoric Change*. Academic Press, New York.
- Pustmeuller, Helen M.
 1977 *Notched Projectile Points from Franktown Cave: Classification and Traditional and Statistical Analysis*. Unpublished Masters Thesis, University of Denver.
- Reed, Alan D.
 1996 The Gateway Tradition: A Formative Stage Culture Unit for East-Central Utah and West-Central Colorado. *Southwestern Lore* 63 (2):19-26.
- Renaud, E. B.
 1930 Prehistoric Cultures of the Cimarron Valley, Northeastern New Mexico and Western Oklahoma. *Colorado Scientific Society Proceedings Vol. 12, No. 5*. Colorado Scientific Society, Denver.
- Reyman, J. E.
 1980 *Plaited Matting from Cave Sites in Coahuila, Mexico*. Ms. On file, Mercyhurst Archaeological Institute, Erie, Pennsylvania.
- Riddell, Francis A.
 1960 Honey Lake Paiute Ethnography. *Nevada State Museum Anthropological Papers No. 4*. Nevada State Museum: Carson City, Nevada.
- Rowntree, Derek
 2004 *Statistics Without Tears: A Primer for Non-Mathematicians*. Allyn and Bacon, Inc.
- Rozaire, C. E.
 1969 The Chronology of Woven Materials from Seven Caves at Falcon Hill, Washoe County, Nevada. *The Nevada State Museum Anthropological Papers* 14:181-186.
- 1974 Analysis of Woven Materials from Seven Caves in the Lake Winnemucca Area, Pershing County, Nevada. In *Collected Papers on Aboriginal Basketry*, edited by D. R. Tuohy and D. L. Rendall, pp. 60-97. Nevada State Museum Anthropological Papers Number 16, Carson City.

Saunders, Roger S.

1974 The Clay and Roberts Site, Two Lithic Workshop Sites in Western Oklahoma. In Reports of the ARKLA Salvage Project, Oklahoma Archaeological Survey, Contract Archaeology Survey 1:73-112.

1978 Archaeological Resources of Black Mesa State Park, Cimarron County, Oklahoma. *Oklahoma Archaeological Survey, Archaeological Resource Survey Report*, No. 7.

Scholtz, Sandra Clements

1975 Prehistoric Plies: A Structural and Comparative Analysis of Cordage, Netting, Basketry, and Fabric from Ozark Bluff Shelters. Arkansas Archaeological Survey Research Series No. 9.

Schroeder, Albert H.

1994 Development in the Southwest and Relations with the Plains. In *Plains Indians, A.D. 500-1500: The Archaeological Past of Historic Groups*, edited by Karl H. Schlesier, pp. 290-307. University of Oklahoma Press, Norman.

Schuetz, Mardith

1956 An Analysis of Val Verde County Cave Material. *Bulletin of the Texas Archaeological Society* 27:129-160.

Simpson, Caryl Wood

1976 Trinchera Cave: A rockshelter in Southeastern Colorado. Unpublished M.A. Thesis, Department of Anthropology, University of Wyoming, Laramie.

Smith, Victor J.

1933 Sandals of the Big Bend Culture with Additional Notes Concerning Basketmaker Evidence. *Bulletin of the Texas Archaeological and Paleontological Society* 5:57-65).

Steward, J. H.

1937a Notes on moccasins found at Promontory Cave #1. Notes for the later published *Ancient Caves of the Great Salt Lake Region*. Bureau of American Ethnology Bulletin 116. Washington, D. C.

1937b *Ancient Caves of the Great Salt Lake Region*. Bureau of American Ethnology Bulletin 116. Washington, D. C.

Stuvier, Minze, Paula Reimer, and Ron Reimer

2005 CALIB 5.0 Calibration Program. www.calib.qub.ac.uk.

- Taylor, Walt W.
 1966 Archaic Cultures Adjacent to the Northeastern Frontier of Mesoamerica in Archaeological Frontiers and External Connections, edited by G.F. Ekholm and G.R. Willey, pp 59-94. *Handbook of Middle American Indians*, Vol. 4, edited by Robert Wauchope. University of Texas Press, Austin.
- 1988 *Contributions to Coahuila Archaeology*. Research Paper 52, Southern Illinois University at Carbondale.
- 2004 *Sandals from Coahuila Caves*. Studies in Pre-Columbian Art and Archaeology No. 35. Dumbarton Oaks Research Library and Collection, Washington, D.C.
- Thoburn, J. B.
 1930 Professor Thoburn Still Digging. *The Oklahoma Engineer* 1:6-7.
- Thomas, Sidney J.
 1933 The Archaeological Investigation of Fate Bell Shelter, Seminole Canyon, Val Verde County, Texas. Master's thesis, University of Texas, Austin.
- Thompson, Gerald M.
 1958 An Analysis of Prehistoric Woven Materials from Eastern Colorado. Manuscript on file, Department of Anthropology, University of Denver, Denver, Colorado.
- Turpin, Solveig A.
 1985 *Seminole Sink: Excavation of a Vertical Shaft Tomb, Val Verde County, Texas*. Texas Archaeological Survey Research Report 93. University of Texas, Austin.
- 1998 *Wroe Ranch: Small Shelter Occupancy on the Edge of the Trans-Pecos*. Borderlands Archeological Research Unit Report 3, The University of Texas at Austin.
- 2003 Sandal Chronology for Coahuila and Southwestern Texas. *Journal of Big Bend Studies* 15:27-53.
- Turpin, Solveig A. and Stephen M. Carpenter
 1994a Prehistoric Sandals from the Ocampo Region of Coahuila, Northern Mexico. *Bulletin of the Texas Archeological Society* 65:110-123.
- 1994b Prehistoric Sandals from the Sierra de la Encantada, Coahuila, Mexico. *La Tierra* 21(2):7-14.
- Turpin, Solveig A., J. F. Powell, and S. M. Carpenter
 1993 A Collection of Prehistoric Artifacts from the Ocampo Region of Coahuila, Northern Mexico. *La Tierra* 20:6-17.

Wallaert-Pêtre, H  l  ne

2001 Learning How to Make the Right Pots: Apprenticeship Strategies and Material Culture, a Case Study in Handmade Pottery from Cameroon. *Journal of Anthropological Research* 57(4):471-493.

Webster, Laurie

1995 From Relics to Resources: Using Older Museum Collections to Assess Textile Change in the Northern Southwest. *Museum Anthropology* (19)3:30-36.

2007 Mogollon and Zuni Perishable Traditions and the Question of Zuni Origins. In *Zuni Origins: Toward a New Synthesis of Southwestern Archaeology*, edited by David A. Gregory and David R. Wilcox, pp. 270-317. The University of Arizona Press, Tucson.

Webster, Laurie and Kelley Hays-Gilpin

1994 New Trails for Old Shoes: Sandals, Textiles, and Baskets in Basketmaker Culture. *Kiva* 60(2):313-327.

Wenger, E.

1998 *Communities of Practice*. Cambridge University Press: Cambridge.

Weltfish, G.

1932 Problems in the Study of Ancient and Modern Basket Makers. *American Anthropologist* 34:108-117.

Williams-Dean, Glenna

n.d. Technological Study of Archaic Sandals from the Lower Pecos Region of Texas. Unpublished manuscript on file at the Texas Archeological Research Laboratory, The University of Texas at Austin.

Withers, Arnold M.

1954 University of Denver Archaeological Fieldwork. *Southwestern Lore* 19(4):1-3.

Wood, Caryl E. and Garald A. Bair

1980 *Trinidad Lake cultural Resource Study Part II: The Prehistoric Occupation of the Upper Purgatoire River Valley, Southeastern Colorado*. Laboratory of Contract Archeology, Trinidad State Junior College: Trinidad, Colorado.

Wyckoff, Don G. and Lyonel Taylor

1971 The Pumpkin Creek Site, and Early Archaic Site in the Southern Plains Border. *Plains Anthropologist* 16(51):20-50.

Young, Bennett H.

1910 *The Prehistoric Men of Kentucky*. J. Morton & Co. Louisville, Kentucky.

Zier, Christian J., and Stephen M. Kalasz
1999 *Colorado Prehistory: A Context for the Arkansas River Basin*. Colorado Council
of Professional Archaeologists, Denver.

APPENDICES

APPENDIX A: Analysis and Recordation forms from Adovasio 1977 (updated 2004)

Form 1: Coiling

RLA _____

Initials: _____

Date: _____

COILED BASKETRY ANALYSIS FORM

(present all metric data in millimeters unless otherwise stated)

GENERAL DATA

1. *Site Number:* _____

Type Name: _____

2. *Site Name:* _____

3. *Cultural Affiliation:* _____

4. *Specimen I.D. Number:* _____

5. *Provenience:* _____

ANALYTICAL DATA (BODY)

6. *General Appearance:* Complete
 Incomplete

Flexible
 Semi-flexible
 Rigid

Decorated
 Undecorated
 Mended
 Unmended

7. *Form:* Constricted mouth bowl
 Wide mouth bowl
 Parching Tray
 Other: _____

With rim
 Without rim
 With center
 Without center

8. *Dimensions and Sketch:*

Form 1: Coiling (continued)

9. *Foundation Spacing:* Close Foundation Units per Centimeter: _____
 Open
 Close and Open Frequency of Close and Open Sections: _____

10. *Distance Between Foundation Units:* _____ ; _____ ; _____ ; _____ ; _____
Range: _____ to _____
Mean: _____

11. *Foundation Type:* _____ Rod Single
 _____ Bundle Horizontal
 _____ Rod in Bundle Stacked
 _____ Welt Bunched
 _____ Other: _____ Other: _____

Foundation Name: _____

12. *Foundation Unit Diameter:* _____ ; _____ ; _____ ; _____ ; _____ ; _____ ; _____
Range: _____ to _____
Mean: _____

13. *Foundation Element Diameter (mean):* Rod: _____
 Bundle: _____
 Rod in Bundle: _____
 Welt: _____
 Other: _____

14. *Foundation Element Material and Preparation:* Rod: _____
 Bundle: _____
 Welt: _____
 Other: _____

15. *Foundation Splicing Technique and Comments:*

Form 1: Coiling (continued)

24. *Stitch Splices* (con't.): Moving End: _____
Length: _____ ; _____ ; _____
Range: _____ ; _____
Mean: _____
Angle: _____ ; _____ ; _____
Range: _____ ; _____
Mean: _____

25. *Use Related Wear*:
Work Surface: () Sheen () Stained () Organic Residue
 () Pitched () Inorganic Residue
 () Other: _____
Non-Work Surface: () Sheen () Stained () Organic Residue
 () Pitched () Inorganic Residue
 () Other: _____

ANALYTICAL DATA (RIM)

26. *Rim Type*: () Self Rim
 () Wrapped () Same direction of work as body
 () Unwrapped () Different direction of work
 () False Braid
 Direction: _____ Number of elements: _____
 Braid interval: _____
 () Combination
 Explain: _____

27. *General Rim Comments*:

Form 1: Coiling (continued)

ANALYTICAL DATA (CENTER)

28. *Type of Center:*
- | | |
|---|---|
| <input type="checkbox"/> Normal | <input type="checkbox"/> Oval |
| <input type="checkbox"/> Reinforced | <input type="checkbox"/> Reinforced |
| <input type="checkbox"/> Un-reinforced | <input type="checkbox"/> Un-reinforced |
| <input type="checkbox"/> Knotted: _____ | <input type="checkbox"/> Plaited: _____ |
| <input type="checkbox"/> Reinforced | <input type="checkbox"/> Reinforced |
| <input type="checkbox"/> Un-reinforced | <input type="checkbox"/> Un-reinforced |

29. *General Center Comments:*

ANALYTICAL DATA (MENDING AND DECORATION)

30. *Comments on Mending Technique:*

31. *Comments on Decoration Technique:*

COMMENTS

Form 2: Plaiting

Textile Identification Sheet: Plaiting, Main Body (Attach appropriate center, rim, and mend-decoration form as needed.)

1. SITE NUMBER _____
2. SITE NAME _____
3. CULTURAL AFFILIATION _____
4. SPECIMEN UNIQUE NUMBER _____
5. COMPLETENESS OF SPECIMEN AND DEGREE OF FLEXIBILITY
 - a. Complete Incomplete
 - b. Rigid Semi-flexible Flexible
 - c. Decorated Undecorated Mended Not mended
6. FORM _____ Profile (if Complete Specimen)
 - a. Mat Ring basket Basket Other (specify) _____
 - b. Without selvage With selvage With Center Without Center
7. PLAITING TYPE
 - a. Simple plaiting (1/1): Number of individual elements acting as a unit _____
 - b. Twill plaiting: Number of elements acting as a unit _____
 - 2/2 Unknown
 - 3/3 Other _____
8. SHIFTS
 - a. Intentional-nature, interval and design (specify) _____
 - b. Accidental (specify) _____
9. STRIP
 - a. Shape Flattened Cordage _____ Braided _____
(No. of elements)
 - b. Number Single Trebled Other _____
 - c. Orientation Superimposed Overlap (partially exposed) Side by side Other (specify) _____
 - d. Width Equal _____ Unequal, range _____ Mean _____ No. of meas. _____
 - e. Angle of crossing 45° 90° Other (specify) _____

Form 2: Plaiting (continued)

12. SPLICES

- New elements laid in
- Other (specify) _____

13. WEAR PATTERNS, STAINS, ETC.

	Obverse	Reverse
Carbonized	<input type="checkbox"/>	<input type="checkbox"/>
Wear from utilization	<input type="checkbox"/>	<input type="checkbox"/>
Sheen _____	<input type="checkbox"/>	<input type="checkbox"/>
Stain _____	<input type="checkbox"/>	<input type="checkbox"/>
Organic residue _____	<input type="checkbox"/>	<input type="checkbox"/>
Inorganic residue _____	<input type="checkbox"/>	<input type="checkbox"/>
Pitched _____	<input type="checkbox"/>	<input type="checkbox"/>
Other (specify) _____	<input type="checkbox"/>	<input type="checkbox"/>

14. STRIP PREPARATION

		Genus/Species
a. <input type="checkbox"/> Plant leaf	b. <input type="checkbox"/> Split	_____
<input type="checkbox"/> Stem	longitudinally	_____
<input type="checkbox"/> Root	<input type="checkbox"/> Quartered	_____
<input type="checkbox"/> Twigs	<input type="checkbox"/> Decorticated	_____
<input type="checkbox"/> Bark	<input type="checkbox"/> Cortex intact	_____
<input type="checkbox"/> Seed hair	<input type="checkbox"/> Rhetted and spun	_____
<input type="checkbox"/> Other (specify)	<input type="checkbox"/> Other (specify)	_____

15. MISCELLANEOUS ATTRIBUTES

Describe (where possible) straps, handles, etc. and measurements found on the specimen which are not covered in this form.

Plaited Centers

(Append to Main Analysis Form where necessary)

1. NUMBER OF ELEMENTS PRESENT IN CENTER _____

2. ORIENTATION OF ELEMENTS

- Spiral plaiting with _____ interval
- Spiral plaiting, interval unknown
- Other (specify) _____

3. WIDTH OF ELEMENTS AND ANGLES OF CROSSING

	a. Width of elements	b. Angle of crossing
Equal	_____	_____
Unequal	_____ to _____	_____ to _____
Mean	_____	_____
No. of meas.	_____	_____

4. NOTE BELOW ANY WAYS IN WHICH THE ELEMENTS IN THE CENTER DIFFER IN OTHER MEASUREMENTS AND/OR TECHNIQUE OF MANIPULATION FROM THOSE IN THE BODY OF THE SPECIMEN.

Form 2: Plaiting (continued)

Plaited Selvages

(Append to Main Analysis Form where necessary)

1. SELVAGE LOCATION

Side End

2. SELVAGE TYPE

a. Simple selvages

1. Clipped

Extends beyond body of specimen:

Equal _____

Unequal _____

Mean _____

No. of meas. _____

2. Reinforced by twining

No. of courses of weft rows _____

Stitch slant _____

Weft composition (specify) _____

3. Self selvage

90° Braided 90°

Double 90° 180°

a. Ring basket

Clipped end extends beyond fold:

Equal _____

Unequal _____

Mean _____

No. of meas. _____

Tapered twilling present Yes No

Wooden ring present Yes No

Diameter _____

Decorticated Cortex Intact

b. Mat fragment

Reinforced by twining Yes No

No. of courses of weft rows _____

Stitch slant _____

Weft composition (specify) _____

Separate plaited band added

Width _____

4. MULTIPLE SELF SELVAGE

Plaiting and folding pattern from apex fold to terminal clip _____

Reinforced by twining Yes No

No. of courses of weft rows _____

Stitch slant _____

Weft composition _____

Record all angles of folding and final clip angle

Apex fold _____ clip

5. COILED SELVAGE

Append Coiling Rim Form where appropriate.

Form 2: Plaiting (continued)

Plaited Basketry: Mends and Decoration

1. TECHNIQUES OF MENDING

- () Patching (specify) _____
- () Cordage binding or twining (specify) _____
- () Other (specify) _____

2. TECHNIQUES OF DECORATION

- () Shift manipulations of monochromatic strips
- () Different colored strips
- () Shift manipulation with different colored strips
- () Painting

Specify the exact nature, composition, color and shift sequence, etc., employed in the decoration of the specimen.

Form 3: Plaited Sandal

Initials _____
Date _____

Plaited Sandal Analysis Sheet

PRIMARY DATA:

- 1. Site Number: _____
- 2. Site Name: _____
- 3. Cultural Affiliation: _____
- 4. FS Number: _____
- 5. Provenience: _____
 Square: _____
 Feature: _____
 Level: _____

ANALYSIS DATA:

- 6. Complete Fragmentary
- 7. Decorated Undecorated
- 8. Traction Masters:
 Present Not Present

Comments: _____

- 9. Length: _____; _____; _____
 Range: _____ to _____
 Number of Measurements: _____
 Mean: _____

- 10. Width:
 Ball: _____
 Arch: _____
 Heel: _____
 Range: _____ to _____
 Number of Measurements: _____
 Mean: _____

- 11. Thickness:
 Ball: _____
 Arch: _____
 Heel: _____
 Range: _____ to _____
 Number of Measurements: _____
 Mean: _____

- 12. Number of Warps: _____

- 13. Toe Configuration: scuffer toe other: _____

A. Selvage Type:

- a. Truncated beyond final weft row
 Angle of truncation: _____
 Extension of warps beyond final weft row: _____; _____;
 _____;
 Range: _____ to _____
 Number of Measurements: _____
 Mean: _____
- b. Warps knotted
 on themselves with _____ knot
 to adjacent warp rows with _____ knot.

Form 3: Plaited Sandal (continued)

- c. Warps twisted or braided
Specify twist: _____
Length of twist beyond final weft row: _____
Number of elements in braid: _____
Length of braid beyond final weft row: _____
- d. Warps folded
 Into final weft row
 Into adjacent weft row at _____ angle
Stub of warp
 Not visible
 Visible, passes beneath _____ weft rows at a length of _____
- B. Shape:
 Pointed
 Round
 Scalloped, notched
 Square, straight
- C. Type:
 Left
 Right
 Unknown
Comments: _____

14. Heel Configuration: Fishtail Other: _____

- A. Selvage Type:
- a. Truncated beyond final weft row
Angle of truncation: _____
Extension of warps beyond final weft row: _____; _____;
_____;
Range: _____ to _____
Number of Measurements: _____
Mean: _____
- b. Warps knotted
 on themselves with _____ knot
 to adjacent warp rows with _____ knot
- c. Warps twisted or braided
Specify twist: _____
Length of twist beyond final weft row: _____
Number of elements in braid: _____
Length of braid beyond final weft row: _____
- d. Warps folded
 Into final weft row
 Into adjacent weft row at _____ angle
Stub of warp
 Not visible
 Visible, passes beneath _____ weft rows a length of _____
- B. Shape:
I. Round
 Square
II. Flat
 Cupped
- Comments: _____

Form 3: Plaited Sandal (continued)

15. Selvage exhibited by sides
a. Both ends of weft row knotted with _____ knots
b. Self selvage (~~specify knot type~~) _____
c. Continuous side selvage
Terminated with _____ knot
Number of twists between weft rows _____
Number of twists per centimeter _____

16. Ties: () present () not present
Type: () side loop
() toe loop
() heel loop
() toe-heel loop

Preparation and raw material (if different from rest of sandal): _____

WEAR

17. () carbonized () wear _____ light or _____ heavy
() sheen () stained () organic residue
() inorganic residue () pitch () other: _____

18. Mends and decoration

Describe below the technique and materials used in mending the specimen. Note the location mend and any pertinent measurements:

19. Possible foot anomalies: _____

RAW MATERIALS

20. Genus: _____
Species: _____

21. Method of Identification: _____

22. Plant part used: () leaves () stem () root () branches/twigs () bark
() flowers () unknown

23. Preparation: _____

24. Comments: _____

Form 3: Plaited Sandal (continued)

25. Form:
 With selvage Without selvage
 With center Without center
26. Plaiting type:
a. Simple plaiting (1/1): Number of individual elements acting as a unit: _____
b. Twill plaiting: Number of elements acting as a unit: _____
 2/2
 3/3
 Other: _____
 Unknown
27. Shifts
a. Intentional-nature, interval, and design: _____

- b. Accidental: _____

28. Strip
a. Shape: flattened Cordage: _____ Braided: _____
b. Number: single trebled Other: _____
c. Orientation: superimposed overlap (partially exposed) side by side
 Other: _____
d. Width: _____; _____;
Range: _____ to _____
Number of Measurements: _____
Mean: _____
e. Angle of crossing
 45
 90
 Other: _____
29. Splices
 new elements laid in
 other: _____
30. Strip Preparation
a. Plant leaf
 Stem
 Root
 Twigs
 Bark
 Other: _____
b. Split: _____
 Quartered
 Decordicated
 Context intact
 Other: _____
31. Plaited Selvages
A. Selvage Location
 Side End
B. Selvage Type
a. Simple selvages
1. Clipped
Extends beyond body of specimen:
Length: _____; _____;
Range: _____ to _____

Form 3: Plaited Sandal (continued)

Number of Measurements: _____

Mean: _____

2. () Reinforced by twining
Number of courses of weft rows: _____
Stitch slant: _____
Weft composition: _____

3. () Self Selvage
() 90 () Braided 90
() Double 90 () 180

4. () Multiple self selvage
Plaiting and folding pattern from apex fold to terminal clip: _____

Reinforced by twining: () Yes () No

Number of courses of weft rows: _____

Stitch slant: _____

Weft composition: _____

Record all angles of folding and final clip angle

Apex fold _____ clip.

32. Techniques of Mending

() Patching (specify) _____

() Cordage binding or twisting (specify) _____

() Other (specify) _____

33. Techniques of Decoration

() Shift manipulates of monochromatic strips

() Different colored strips

() Shift manipulation with different colored strips

() Painting

Specify the exact nature, composition, color and shift sequence, etc., employed in the decoration of the specimen.

Form 4: Knotting

KLA _____

Initials: _____

Date: _____

KNOT ANALYSIS FORM

(present all metric data in millimeters unless otherwise stated)

GENERAL DATA

1. Site Number: _____ () Single Knotted
2. Site Name: _____ () Netting
3. Cultural Affiliation: _____ () Other: _____
4. Specimen I.D. Number: _____
5. Provenience: _____

ANALYTICAL DATA

6. Type of Knot: _____
7. Nature of Affixation: () Fixed: _____ () Suspended: _____
() self engaging: _____ () self engaging: _____
() rigid element: _____ () rigid element: _____
() flexible element: _____ () flexible element: _____
() other: _____ () other: _____
8. Number of Elements Engaged: _____ 9. Method of Tying: _____
10. Appearance of Knot Face:
Front to back: _____
Top to bottom: _____
11. Distance Between Knots and Ends of Cordage: _____ ; _____ ; _____ ; _____ ; _____ ; _____
12. Longest End: _____
13. Use Related Wear: () Carbonized: _____ () Organic Residue: _____ () Inorganic Residue: _____
() Sheen () Pitched () Stain () Other: _____

GENERAL COMMENTS

APPENDIX B: Metric Data

Sandals

Site	Specimen	Provenience	Type	Type Description	Sandal L, Range	Sandal L, Mean	Sandal W, Range
Franktown Cave	TOM-462	B3 L1	I	Simple Plaiting, 1/1 Interval Sole	n.d.	(I) 90	n.d.
Franktown Cave	TOM-501	B3 L1	I	Simple Plaiting, 1/1 Interval Sole	n.d.	210	n.d.
Franktown Cave	TOM-509	B3 L1	I	Simple Plaiting, 1/1 Interval Sole	n.d.	(I) 130	n.d.
Franktown Cave	TOM-546	B3 L1	I	Simple Plaiting, 1/1 Interval Sole	n.d.	(I) 130	n.d.
Franktown Cave	TOM-588	B3 L1	I	Simple Plaiting, 1/1 Interval Sole	n.d.	243	n.d.
Franktown Cave	TOM-858	B3 L2	I	Simple Plaiting, 1/1 Interval Sole	n.d.	230	n.d.
The Kenton Caves	5049	34Ci50; Basketmaker Cave	I	Simple Plaited (1/1), 90° angle element crossings	210.43-212.92	211.68	109.05-123.57
The Kenton Caves	34	34Ci50; Basketmaker Cave	II	Simple Plaited (1/1), 90° angle element crossings, folded toe	(I) 129.30-179.40	(I) 151.50	113.89-116.15
The Kenton Caves	DU 391	34Ci50; Basketmaker Cave	II	Simple Plaited (1/1), 90° angle element crossings, folded toe	(I)	(I)	121.21-134.41

Site	Specimen	Sandal W, Mean (mm)	Sandal TH, Range (mm)	Sandal TH, Mean (mm)	Warp/ Pseudo- Warp Dia, Range (mm)	Warp/ Pseudo- Warp Dia, Mean (mm)	Weft/ Pseudo- Weft Dia, Range (mm)
Franktown Cave	TOM-462	(I) 115	n.d.	n.d.	3.79-7.38	5.31	3.79-7.38
Franktown Cave	TOM-501	60 (Toe) 90 (Heel)	n.d.	n.d.	5.87-6.94	6.28	5.65-6.62
Franktown Cave	TOM-509	(I) 105	n.d.	n.d.	4.05-6.23	5.44	4.05-6.23
Franktown Cave	TOM-546	(I) 100	n.d.	n.d.	5.72-7.18	6.31	5.72-7.18
Franktown Cave	TOM-588	87 (Toe) 110 (Heel)	n.d.	n.d.	2.93-4.44	3.8	2.93-4.44
Franktown Cave	TOM-858	100 (Toe) 120 (Heel)	n.d.	n.d.	4.10-6.07	5.13	7.15-8.23
The Kenton Caves	5049	118.08	3.51-8.26	6.22	4.90-6.62	5.56	4.90-6.62
The Kenton Caves	34	115.28	23.37-29.73	25.7	4.01-6.25	5.5	4.01-6.25
The Kenton Caves	DU 391	125.18	4.75-7.29	6.07	4.35-5.61	5.02	4.35-5.61

Site	Specimen	Weft/ Pseudo-Weft Dia, Mean (mm)	Weft/ Pseudo-Weft Unit Dia, Range (mm)	Weft/ Pseudo- Weft Unit Dia, Mean (mm)	Warp L beyond final weft row, mean (mm)
Franktown Cave	TOM-462	5.31	n.a.	n.a.	n.a.
Franktown Cave	TOM-501	6.12	n.a.	n.a.	n.a.
Franktown Cave	TOM-509	5.44	n.a.	n.a.	n.a.
Franktown Cave	TOM-546	6.31	n.a.	n.a.	n.a.
Franktown Cave	TOM-588	3.8	n.a.	n.a.	n.a.
Franktown Cave	TOM-858	7.85	n.a.	n.a.	n.a.
The Kenton Caves	5049	5.56	n.a.	n.a.	35.91 (Heel)
The Kenton Caves	34	5.5	n.a.	n.a.	n.a.
The Kenton Caves	DU 391	5.02	n.a.	n.a.	n.a.

Site	Specimen	Provenience	Type	Type Description	Sandal L, Range	Sandal L, Mean	Sandal W, Range
The Kenton Caves	4051	34Ci50; Basketmaker Cave	II	Simple Plaited (1/1), 90° angle element crossings, folded toe	(I)	(I)	130.59-130.98
The Kenton Caves	DU 393	34Ci50; Basketmaker Cave	II	Simple Plaited (1/1), 90° angle element crossings, folded toe	(I)	(I)	123.90-131.87
The Kenton Caves	DU 397	34Ci50; Basketmaker Cave	II	Simple Plaited (1/1), 90° angle element crossings, folded toe	208.32-214.60	211.93	94.65-115.29
The Kenton Caves	A 18	34Ci50; Basketmaker Cave	III	Simple Plaited (1/1), 90° angle element crossings, folded toe, 45° rotated weave	(I)	(I)	(I)
The Kenton Caves	A 25	34Ci50; Basketmaker Cave	III	Simple Plaited (1/1), 90° angle element crossings, folded toe, 45° rotated weave	(I)	(I)	(I)
The Kenton Caves	DU 390	34Ci50; Basketmaker Cave	III	Simple Plaited (1/1), 90° angle element crossings, folded toe, 45° rotated weave	(I)	(I)	(I)

Site	Specimen	Sandal W, Mean	Sandal TH, Range	Sandal TH, Mean	Warp/ Pseudo- Warp Dia, Range	Warp/ Pseudo- Warp Dia, Mean	Weft/ Pseudo- Weft Dia, Range
The Kenton Caves	4051	130.79	7.04-8.37	7.71	4.38-6.92	6.02	4.38-6.92
The Kenton Caves	DU 393	126.63	5.06-6.18	5.59	5.56-6.99	6.11	5.56-6.99
The Kenton Caves	DU 397	109.27	21.43-30.31	25.8	5.84-8.67	7.13	5.84-8.67
The Kenton Caves	A 18	(I)	7.56-12.30	9.61	5.52-6.65	6.31	5.52-6.65
The Kenton Caves	A 25	(I)	11.45-14.60	13.03	5.53-7.51	6.3	5.53-7.51
The Kenton Caves	DU 390	(I)	4.89-7.17	6.31	2.56-4.08	3.11	2.56-4.08

Site	Specimen	Weft/ Pseudo-Weft Dia, Mean	Weft/ Pseudo-Weft Unit Dia, Range	Weft/ Pseudo- Weft Unit Dia, Mean	Warp L beyond final weft row, mean
The Kenton Caves	4051	6.02	n.a.	n.a.	n.a.
The Kenton Caves	DU 393	6.11	8.19-12.34 (double/shift)	10.04 (double/shift)	n.a.
The Kenton Caves	DU 397	7.13	n.a.	n.a.	7.43
The Kenton Caves	A 18	6.31	8.30-11.89 (doubled)	10.32 (doubled)	20.25 (Toe)
The Kenton Caves	A 25	6.3	7.37-9.23 (doubled)	8.33 (doubled)	n.a.
The Kenton Caves	DU 390	3.11	7.42-10.08 (trebled)	8.60 (trebled)	n.a.

Site	Specimen	Provenience	Type	Type Description	Sandal L, Range	Sandal L, Mean	Sandal W, Range
The Kenton Caves	DU 398	34Ci50; Basketmaker Cave	III	Simple Plaited (1/1), 90° angle element crossings, folded toe, 45° rotated weave	188.27-200.47	193.83	76.37-111.11
The Kenton Caves	DU 399	34Ci50; Basketmaker Cave	III	Simple Plaited (1/1), 90° angle element crossings, folded toe, 45° rotated weave	222.37-242.72	235.86	87.54-100.28 (Toe) 74.34-84.32 (Heel)
The Kenton Caves	DU 392	34Ci50; Basketmaker Cave	IV	Unbalanced Simple Plaited (1/1)	(I)	(I)	(I)
The Kenton Caves	DU 388	34Ci50; Basketmaker Cave	IV	Unbalanced Simple Plaited (1/1)	(I)	(I)	(I)
The Kenton Caves	DU 387 (Child)	34Ci50; Basketmaker Cave	V	Unbalanced Simple Plaited (1/1), Continuous Warp	106.20-112.93	109.25	53.69-79.93
The Kenton Caves	A 17	34Ci50; Basketmaker Cave	VI	Unbalanced Simple Plaited (1/1), Weft frame	(I) 121.91-130.38	(I) 124.84	81.90-120.31
The Kenton Caves	A 23 (Child)	34Ci50; Basketmaker Cave	VII	Two-warp Pseudo-Twined	143.50-156.98	148.43	64.78-71.12
The Kenton Caves	A 24 (Adult)	34Ci50; Basketmaker Cave	VII	Two-warp Pseudo-Twined	240.79-267.34	251.02	101.35-107.28 (Toe) 83.55-86.90 (Heel)

Site	Specimen	Sandal W, Mean	Sandal TH, Range	Sandal TH, Mean	Warp/ Pseudo- Warp Dia, Range	Warp/ Pseudo- Warp Dia, Mean	Weft/ Pseudo- Weft Dia, Range
The Kenton Caves	DU 398	97.61	5.44-8.31 (Toe) 9.62- 14.95 (Heel)	6.52 (Toe) 12.58 (Heel)	4.39-7.66	5.75	4.39-7.66
The Kenton Caves	DU 399	93.93 (Toe) 78.45 (Heel)	6.65-11.85	8.28	4.85-5.64	5.15	4.85-5.64
The Kenton Caves	DU 392	(I)	4.70-9.14	6.87	4.72-6.83	5.53	4.72-6.83
The Kenton Caves	DU 388	(I)	5.38-11.28	9.06	7.96-12.35	10.21	4.10-5.06
The Kenton Caves	DU 387 (Child)	68.96	3.52-5.55 (Toe) 10.27-15.86 (Heel)	4.58 (Toe) 13.37 (Heel)	3.30-5.35	4.4	3.30-5.35
The Kenton Caves	A 17	97.99	4.24-8.18	6.13	5.07-5.84	5.58	5.07-5.84
The Kenton Caves	A 23 (Child)	67.19	19.68-25.31	22.7	ind.	ind.	1.99-3.04
The Kenton Caves	A 24 (Adult)	103.74(Toe) 85.23 (Heel)	12.94-21.33	16.15	ind.	ind.	2.85-3.40

Site	Specimen	Weft/ Pseudo-Weft Dia, Mean	Weft/ Pseudo-Weft Unit Dia, Range	Weft/ Pseudo- Weft Unit Dia, Mean	Warp L beyond final weft row, mean
The Kenton Caves	DU 398	5.75	9.43-12.00 (trebled)	10.66 (trebled)	29.33 (Toe) 67.68 (Heel)
The Kenton Caves	DU 399	5.15	9.61-12.52 (trebled)	10.98 (trebled)	23.23 (Toe) 77.66 (Heel)
The Kenton Caves	DU 392	5.53	n.a.	n.a.	n.a.
The Kenton Caves	DU 388	4.63	n.a.	n.a.	n.a.
The Kenton Caves	DU 387 (Child)	4.4	n.a.	n.a.	n.a.
The Kenton Caves	A 17	5.58	n.a.	n.a.	n.a.
The Kenton Caves	A 23 (Child)	2.51	6.53-10.55	8.42	n.a.
The Kenton Caves	A 24 (Adult)	3.12	8.92-15.08	12.3	19.39 (Toe) 39.85 (Heel)

Site	Specimen	Provenience	Type	Type Description	Sandal L, Range	Sandal L, Mean	Sandal W, Range
The Kenton Caves	DU 824	34Ci50; Basketmaker Cave	VIII	Four-warp Pseudo-Twined	(I)	(I)	98.56-111.14
The Kenton Caves	DU 825	34Ci50; Basketmaker Cave	VIII	Four-warp Pseudo-Twined	(I)	(I)	114.18-116.42
Trinchera Cave	66.19.221A	n.d.	I	Two Warp Pseudo-Twined, scuffer toe	133.64-140.65	137.52	97.27-98.26 (Toe) 27.51-33.11 (Heel)
Trinchera Cave	TR1 EPU	n.d.	II	Four-Warp Pseudo-Twined	(I) 95.63-109.53	(I) 100.98	n.a.
Trinchera Cave	TR1-D/C-EPU-21B	n.d.	II	Four-Warp Pseudo-Twined	129.70-129.90	129.8	(I) 59.92-100.58
Trinchera Cave	T5-4-2	Lv 5, 4 m E, 3 m N	II	Four-Warp Pseudo-Twined	208.83-213.02	210.38	116.83-118.74 (Toe) 103.77-104.48 (Heel)
Trinchera Cave	780	Shelter C, Sec. 1A, Depth 7.5"	II	Four-Warp Pseudo-Twined	(I)	(I)	119.53-143.75
Trinchera Cave	789	Shelter C, Sec. 10C, Depth 0-6"	II	Four-Warp Pseudo-Twined	248.30-255.66	251.23	107.75-109.10 (Toe) 85.68-109.56 (Heel)
Trinchera Cave	945	Shelter C, Sec. 8B, Depth 10"	II	Four-Warp Pseudo-Twined	(I) 111.88-120.24	(I) 117.13	(I) 76.18-98.42

Site	Specimen	Sandal W, Mean	Sandal TH, Range	Sandal TH, Mean	Warp/ Pseudo- Warp Dia, Range	Warp/ Pseudo- Warp Dia, Mean	Weft/ Pseudo- Weft Dia, Range
The Kenton Caves	DU 824	105.25	9.06-12.11	10.28	5.95-6.96	6.38	4.61-6.72
The Kenton Caves	DU 825	115.36	11.85-18.91	14.51	3.02-4.87	3.96	3.02-4.87
Trincher Cave	66.19.221A	97.77 (Toe) 30.31 (Heel)	8.46-9.18	8.82	4.06-7.41	6.31	4.54-5.86
Trincher Cave	TR1 EPU	n.a.	6.40-7.56	6.98	4.27-5.89	4.98	4.27-5.89
Trincher Cave	TR1-D/C-EPU- 21B	(I) 78.24	9.76-11.31	10.57	5.67-8.08	7.08	5.57-7.03
Trincher Cave	T5-4-2	117.79 (Toe) 104.13 (Heel)	12.20-15.22	13.61	ind.	ind.	3.38-6.87
Trincher Cave	780	133.07	10.23-16.95	14.59	5.88-8.63	7.65	4.34-6.78
Trincher Cave	789	108.43 (Toe) 97.62 (Heel)	9.64-14.07	11.69	5.95-6.24	6.1	5.48-7.70
Trincher Cave	945	(I) 87.30	7.79-8.60	8.2	4.14-4.20	4.17	2.79-5.19

Site	Specimen	Weft/ Pseudo-Weft Dia, Mean	Weft/ Pseudo-Weft Unit Dia, Range	Weft/ Pseudo- Weft Unit Dia, Mean	Warp L beyond final weft row, mean
The Kenton Caves	DU 824	5.79	n.a.	n.a.	n.a.
The Kenton Caves	DU 825	3.96	n.a.	n.a.	n.a.
Trinchera Cave	66.19.221A	5.14	n.a.	n.a.	n.a.
Trinchera Cave	TR1 EPU	4.98	n.a.	n.a.	n.a.
Trinchera Cave	TR1-D/C-EPU- 21B	6.27	n.a.	n.a.	n.a.
Trinchera Cave	T5-4-2	4.74	n.a.	n.a.	7.33 (Toe) 3.37 (Heel)
Trinchera Cave	780	5.45	n.a.	n.a.	n.a.
Trinchera Cave	789	6.33	n.a.	n.a.	n.a.
Trinchera Cave	945	3.67	n.a.	n.a.	n.a.

Site	Specimen	Provenience	Type	Type Description	Sandal L, Range	Sandal L, Mean	Sandal W, Range
Trinchera Cave	TR1-D/C-EPU-21A	n.d.	III	Weft-faced/Unbalanced Plainweave	(I) 128.77-141.72	(I) 135.64	108.76-114.75 (Ball) 116.40-116.94 (Arch)
Trinchera Cave	No # C	n.d.	III	Weft-faced/Unbalanced Plainweave	58.09-69.22	63.24	82.94-83.55
	5119 is a buffalo hide sandal; measurements not included						
	TR1-28 & 66.19.221B are doodles; measurements not included						
	TR1-794 & No #B are rabbit skin sandals; measurements not included						
	No #A and 41 are hide fragments; measurements not included						
	(I) = Incomplete	Ind.= Indeterminate		n.d. = No data		n.a. = Not applicable	

Site	Specimen	Sandal W, Mean	Sandal TH, Range	Sandal TH, Mean	Warp/ Pseudo- Warp Dia, Range	Warp/ Pseudo- Warp Dia, Mean	Weft/ Pseudo- Weft Dia, Range
Trinchera Cave	TR1-D/C-EPU- 21A	111.76 (Ball) 116.59 (Arch)	12.44-16.27	14.91	5.64-7.46	6.27	5.74-9.42
Trinchera Cave	No # C	83.245	11.03-14.07	12.55	ind.	ind.	4.17-6.10

Site	Specimen	Weft/ Pseudo-Weft Dia, Mean	Weft/ Pseudo-Weft Unit Dia, Range	Weft/ Pseudo- Weft Unit Dia, Mean	Warp L beyond final weft row, mean
Trinchera Cave	TR1-D/C-EPU- 21A	7.43	n.a.	n.a.	n.a.
Trinchera Cave	No # C	5.32	n.a.	n.a.	n.a.

Coiled Basketry

Site	Specimen	Provenience	Type	Thickness (mm)	Foundation units/cm	Dist btw Foundation units (mm)	Found Unit Diam (mm)
Franktown Cave	TOM-290	B5 L1	Close Coiling - Whole Rod in bundle or with lateral bundle, non-interlocking stitch with accidentally split stitches	n.d.	1.5	1.26	6.78
Trinchera Cave	No #D	n.d.	Close Coiling - Rod with lateral bundle, non-interlocking stitch with intentional split stitches	6.65	2.38	1.19	3.32
The Kenton Caves	A5	34Ci50; Basketmaker Cave	Close Coiling - Bundle or welt with lateral bundle, non-interlocking stitch with intentional split stitches	n.d.	2	1.26	3.31
The Kenton Caves	389	34Ci50; Basketmaker Cave	Close Coiling - Rod in bundle or rod with lateral bundle, non-interlocking stitch with intentional split stitches	n.d.	2.2	1.7	4.45

Site	Specimen	Found Element Diam (mm)	Work Direction	Stitch Width (mm)	Stitch Gap (mm)	Stitches per cm	Stitch Splice Length (mm)	Split stitch freq
Franktown Cave	TOM-290	1.96 (Rod) 2.86 (Bundle)	R-L	2.69	2.6	3	ind.	20-30%
Trinchera Cave	No #D	2.84 (Rod) 1.21 (Bundle)	R-L	3.37	1.07	2.5	2.65 (Fag end) 3.11 (Moving end)	100%
The Kenton Caves	A5	3.19 (Rod) 2.80 (Bundle)	R-L	2.05	0.57	4	ind.	35.55% (16/45)
The Kenton Caves	389	3.77 (Rod) 2.48 (Bundle)	L-R	2.6	1.48	3	ind.	12% (21/176)

APPENDIX C: Statistical Analysis

Franktown Cave

Anova: Single Factor **Franktown Cave (462 & 588)**
warp diameter

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Column 1	5	24.45	4.89	0.7184
Column 2	5	19.01	3.802	0.48557

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	2.95936	1	2.95936	4.9160029	0.0574319	5.317655
Within Groups	4.81588	8	0.601985			
Total	7.77524	9				

Anova: Single Factor **Franktown Cave (462 & 588)**
weft diameter

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Column 1	5	24.45	4.89	0.7184
Column 2	5	19.01	3.802	0.48557

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	2.95936	1	2.95936	4.916003	0.057432	5.317655
Within Groups	4.81588	8	0.601985			
Total	7.77524	9				
Total	49.47853	14				

The Kenton Caves

Anova: Single Factor **Kenton Caves**
Type III
 Sandal Thickness

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Column 1	5	48.07	9.614	2.93628
Column 2	2	26.05	13.025	4.96125
Column 3	3	18.94	6.313333	1.540433
Column 4	9	76.85	8.538889	11.96826
Column 5	6	49.68	8.28	3.85576

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	59.79405	4	14.94851	2.217681	0.103655	2.866081
Within Groups	134.8121	20	6.740606			
Total	194.6062	24				

Anova: Single Factor **Kenton Caves Type III (Toe)**
 Warp length beyond final weft row

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Column 1	5	127.57	25.514	37.53698
Column 2	5	146.67	29.334	28.77598

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	36.481	1	36.481	1.100268	0.32486	5.317655
Within Groups	265.2518	8	33.15648			
Total	301.7328	9				

Anova: Single Factor

Kenton Caves Type III (Heel)

Warp length beyond final weft row

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Column 1	5	33.83	6.766	0.62358
Column 2	5	38.84	7.768	1.38897

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	2.51001	1	2.51001	2.494358	0.152909	5.317655
Within Groups	8.0502	8	1.006275			
Total	10.56021	9				

Anova: Single Factor

Kenton Caves Type III (398 & 399)

Weft diameter

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Column 1	5	28.73	5.746	1.70808
Column 2	5	25.75	5.15	0.08585

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.88804	1	0.88804	0.990049779	0.348869579	5.317655
Within Groups	7.17572	8	0.896965			
Total	8.06376	9				

Anova: Single Factor

Kenton Caves Type III

(DU 398 & 399) Warp Diameter

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Column 1	5	28.73	5.746	1.70808
Column 2	5	25.75	5.15	0.08585

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.88804	1	0.88804	0.99005	0.34887	5.317655
Within Groups	7.17572	8	0.896965			
Total	8.06376	9				

Anova: Single Factor

**Kenton Caves Type III:
DU 398 & 399 only**
Weft Unit Diameter

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Column 1	6	63.96	10.66	0.98844
Column 2	7	76.86	10.98	1.185467

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.330831	1	0.330831	0.301878	0.593686	4.844336
Within Groups	12.055	11	1.095909			
Total	12.38583	12				

Anova: Single Factor

**Kenton Caves
Type IV**
Sandal Thickness

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Column 1	5	45.32	9.064	6.77733
Column 2	3	20.61	6.87	4.9359

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	9.025567	1	9.025567	1.464353	0.271744876	5.987378
Within Groups	36.98112	6	6.16352			
Total	46.00669	7				

Trinchera Cave

Anova: Single Factor

Trinchera Type II (T5-4-2, 780 & 789)

Sandal Thickness

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Column 1	6	81.63	13.605	1.29011
Column 2	4	58.34	14.585	9.2315
Column 3	6	70.13	11.68833	3.353977

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	22.29224	2	11.14612	2.845915	0.094383	3.805565
Within Groups	50.91493	13	3.916533			
Total	73.20718	15				

Anova: Single Factor

Trinchera Type II (780 & 789)

Warp Diameter

T5-4-2 could not be measured

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Column 1	2	14.32	7.16	3.2768
Column 2	3	20.82	6.94	2.1631

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.05808	1	0.05808	0.022917	0.889279	10.12796
Within Groups	7.603	3	2.534333			
Total	7.66108	4				

Anova: Single Factor

Trinchera Type II (T5-4-2, 780 & 789)

Weft Diameter

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Column 1	6	28.46	4.743333	1.557227
Column 2	6	32.67	5.445	0.89379
Column 3	6	37.99	6.331667	0.803897

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	7.602633	2	3.801317	3.503611	0.056422	3.68232
Within Groups	16.27457	15	1.084971			
Total	23.8772	17				

Anova: Single Factor

Trinchera Type III

Sandal Thickness

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Column 1	3	44.72	14.906667	4.580233
Column 2	2	25.1	12.55	4.6208

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	6.6646533	1	6.6646533	1.450807	0.314757	10.12796
Within Groups	13.781267	3	4.5937556			
Total	20.44592	4				

Anova: Single Factor

Trinchera Type III

Warp Diameter

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Column 1	4	25.09	6.2725	0.698092
Column 2	5	29.28	5.856	0.97013

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.385494	1	0.385494	0.45164	0.523111	5.591448
Within Groups	5.974795	7	0.853542			
Total	6.360289	8				

Anova: Single Factor

Trinchera Type III
Weft Diameter

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Column 1	6	45.46	7.576667	3.207947
Column 2	6	42.71	7.118333	1.289377

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.630208	1	0.630208	0.280259	0.608082	4.964603
Within Groups	22.48662	10	2.248662			
Total	23.11683	11				

Southern High Plains Coiling

Anova: Single Factor

All specimens from all three caves
Foundation units/cm

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Column 1	1	1.5	1.5	#DIV/0!
Column 2	4	9.5	2.375	0.0625
Column 3	1	2	2	#DIV/0!
Column 4	5	11	2.2	0.075

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.6488636	3	0.216288	3.105672	0.098128	4.346831
Within Groups	0.4875	7	0.069643			
Total	1.1363636	10				

Anova: Single Factor **Franktown, Trinchera, and the Kenton Caves #389**
Stitches/cm

SUMMARY

Groups	Count	Sum	Average	Variance
Column 1	4	12	3	0
Column 2	1	3	3	#DIV/0!
Column 3	5	12.5	2.5	0.125

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	0.625	2	0.3125	4.375	0.058528	4.737414
Within Groups	0.5	7	0.071429			
Total	1.125	9				

Anova: Single Factor **Trinchera and the Kenton Caves**
Distance between foundation units

SUMMARY

Groups	Count	Sum	Average	Variance
Column 1	5	5.97	1.194	0.05528
Column 2	4	5.03	1.2575	0.006025
Column 3	5	8.5	1.7	0.325

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	0.742691	2	0.3713454	2.653854	0.114683	3.982298
Within Groups	1.539195	11	0.1399268			
Total	2.281886	13				

Anova: Single Factor **Trinchera and the Kenton Caves #A5**
Foundation unit diameter

SUMMARY

Groups	Count	Sum	Average	Variance
Column 1	5	16.59	3.318	0.04457
Column 2	5	16.54	3.308	0.06842

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	0.00025	1	0.00025	0.004425	0.948595	5.317655
Within Groups	0.45196	8	0.056495			
Total	0.45221	9				

Anova: Single Factor

**Kenton Caves
specimens**
Foundation element diameter (rod)

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Column 1	1	3.19	3.19	#DIV/0!
Column 2	4	15.06	3.765	0.149967

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.2645	1	0.2645	1.763725	0.27616	10.12796
Within Groups	0.4499	3	0.149967			
Total	0.7144	4				

Anova: Single Factor

**Kenton Caves
specimens**
Foundation element diameter (bundle)

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Column 1	1	2.8	2.8	#DIV/0!
Column 2	4	9.9	2.475	0.086033

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.0845	1	0.0845	0.982177	0.39472	10.12796
Within Groups	0.2581	3	0.086033			
Total	0.3426	4				

Anova: Single Factor

Kenton Caves specimens
Stitch width

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Column 1	6	12.29	2.048333	0.028977
Column 2	6	15.6	2.6	0.44284

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.913008	1	0.913008	3.870183	0.077494	4.9646027
Within Groups	2.359083	10	0.235908			
Total	3.272092	11				

Anova: Single Factor **Franktown Cave and Kenton
Caves specimens**
Stitch width

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Column 1	6	12.29	2.048333	0.028977
Column 2	6	15.6	2.6	0.44284
Column 3	3	8.07	2.69	0.0093

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	1.23421	2	0.617105	3.114485	0.081379	3.88529383
Within Groups	2.377683	12	0.19814			
Total	3.611893	14				

Anova: Single Factor **Trinchera Cave and Kenton
Caves #389**
Stitch
Gap

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Column 1	6	8.88	1.48	0.27872
Column 2	6	6.39	1.065	0.17275

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.516675	1	0.516675	2.288856	0.161249	4.964603
Within Groups	2.25735	10	0.225735			
Total	2.774025	11				

Pendejo Cave Sandal Comparison

Anova: Single Factor

**Pendejo Cave and Trinchera Cave
(two warp sandals)**
Sandal Thickness

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Column 1	3	86.35	28.78333	38.80333
Column 2	2	20.82	10.41	10.6722
Column 3	3	56.49	18.83	1.8849
Column 4	1	14.05	14.05	#DIV/0!
Column 5	2	50.8	25.4	220.5
Column 6	2	17.64	8.82	0.2592

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	748.4355	5	149.6871	3.349691	0.073135	3.971523
Within Groups	312.8079	7	44.68684			
Total	1061.243	12				

Anova: Single Factor

Pendejo #681 and Trinchera Cave #780 & 789
Warp Diameter

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Column 1	3	23.25	7.75	1.2675
Column 2	2	14.32	7.16	3.2768
Column 3	3	20.82	6.94	2.1631

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	1.035488	2	0.517744	0.255348	0.784168	5.786135
Within Groups	10.138	5	2.0276			
Total	11.17349	7				

APPENDIX D

**OVERVIEW OF THE PERISHABLE ASSEMBLAGE FROM
FRANKTOWN CAVE (5DA272; L:9:31),
DOUGLAS COUNTY, COLORADO**

J. M. Adovasio, G. M. Thompson, and J. S. Illingworth

Report Prepared by
Mercyhurst Archaeological Institute,
Mercyhurst College, Erie, Pennsylvania,
for
the Department of Anthropology and
the Archaeological Research Institute,
University of Denver, Denver, Colorado

List of Tables

Table 1. Cordage Formula Schematic Diagrams for Types Identified in Cordage from Franktown Cave, by Cordage Type.

Table 2. Provenience and Temporal Ascription of Coiled Basketry Specimens from Franktown Cave, by Specimen Number (Following Mercyhurst Archaeological Institute [MAI] and University of Denver Museum of Anthropology [DUMA] Catalog Numbers).

Table 3. Provenience and Temporal Ascription of Cordage Specimens from Franktown Cave, by Specimen Number (Following Mercyhurst Archaeological Institute [MAI] and University of Denver Museum of Anthropology [DUMA] Catalog Numbers).

Table 4. Temporal Ascription of Sandal Specimens from Franktown Cave, by Specimen Number (Following University of Denver Museum of Anthropology [DUMA] Catalog Numbers).

List of Figures

Figure 1. Coiled basketry Specimen RLA20041-103/TOM-1140, an example of Type I: Close Coiling, Whole Rod Foundation, Non-Interlocking Stitch. Note, this is the work surface.

Figure 2. Coiled basketry Specimen RLA20041-103/TOM-1140, an example of Type I: Close Coiling, Whole Rod Foundation, Non-Interlocking Stitch. Note, this is the non-work surface.

Figure 3. Coiled basketry Specimen RLA20041-101/TOM-1137, an example of Type II: Close Coiling, Bundle Foundation, Non-Interlocking Stitch. Note, this is the work surface.

Figure 4. Coiled basketry Specimen RLA20041-101/TOM-1137, an example of Type II: Close Coiling, Bundle Foundation, Non-Interlocking Stitch. Note, this is the non-work surface.

Figure 5. Coiled basketry Specimen RLA20041-102/TOM-500, an example of Type II: Close Coiling, Bundle Foundation, Non-Interlocking Stitch. Note, this is the work surface.

Figure 6. Coiled basketry Specimen RLA20041-102/TOM-500, an example of Type II: Close Coiling, Bundle Foundation, Non-Interlocking Stitch. Note, this is the non-work surface.

Figure 7. Coiled basketry Specimen RLA20041-104/TOM-452, an example of Type II: Close Coiling, Bundle Foundation, Non-Interlocking Stitch. Note, this is the work surface.

Figure 8. Coiled basketry Specimen RLA20041-104/TOM-452, an example of Type II: Close Coiling, Bundle Foundation, Non-Interlocking Stitch. Note, this is the non-work surface.

Figure 9. Coiled basketry Specimen RLA20041-100/TOM-290, an example of Type III: Close Coiling, Whole Rod in Bundle or with Lateral Bundle, Non-Interlocking Stitch. Note, this is the work surface.

Figure 10. Coiled basketry Specimen RLA20041-100/TOM-290, an example of Type III: Close Coiling, Whole Rod in Bundle or with Lateral Bundle, Non-Interlocking Stitch. Note, this is the non-work surface.

Figure 11. Cordage Specimen RLA20041-4.1a-b/TOM-850, an example of Type II: Two Ply, S-Spun, Z-Twist. Note, this specimen exhibits a square knot as well as wear indicative of other knots having been tied on it. This specimen may have once been part of a net.

Figure 12. Cordage Specimen RLA20041-20.1a-b/TOM-589, an example of Type II: Two Ply, S-Spun, Z-Twist which has been square knotted to a piece of Type III: Two Ply, Z-Spun, S-Twist cordage.

Figure 13. Cordage Specimen RLA20041-27.1/TOM-460, an example of Type III: Two Ply, Z-Spun, S-Twist. Note that this specimen is clearly a snare component and still has an intact trigger (the small twig to which the cord is knotted).

Figure 14. Cordage Specimen RLA20041-34.1/TOM-2145, an example of Type IV: Compound, Two Ply, S-Spun, Z-Twist. Note the folded end of this specimen which demonstrates that the specimen was probably produced by re-plying a single piece of Type III cordage back onto itself.

Figure 15. Cordage Specimen RLA20041-36.1/TOM-3617, an example of Type IV: Compound, Two Ply, S-Spun, Z-Twist.

Figure 16. Sandal Specimen TOM-501, an example of Type I: Simple Plaiting, 1/1 Interval Sole. Note, this is the dorsal surface.

Figure 17. Sandal Specimen TOM-501, an example of Type I: Simple Plaiting, 1/1 Interval Sole. Note, this is the plantar surface.

Figure 18. Detailed construction schematic of the sole of sandal Specimen TOM-501 (adapted from Thompson 1958).

Figure 19. Detailed construction schematic of lateral binding ties of Specimen TOM-501 (adapted from Thompson 1958).

Figure 20. Detailed construction schematic of the tie system employed on Specimen TOM-501 (adapted from Thompson 1958).

Figure 21. Sandal Specimen TOM-858, an example of Type I: Simple Plaiting, 1/1 Interval Sole. Note this is the dorsal surface.

Figure 22. Sandal Specimen TOM-858, an example of Type I: Simple Plaiting, 1/1 Interval Sole. Note this is the plantar surface.

Figure 23. Reverse view of the "sock" associated with sandal Specimen TOM-858.

Figure 24. Sandal Specimen TOM-509, an example of Type I: Simple Plaiting, 1/1 Interval Sole. Note this is the dorsal surface.

Figure 25. Sandal Specimen TOM-509, an example of Type I: Simple Plaiting, 1/1 Interval Sole. Note this is the plantar surface.

Figure 26. Sandal Specimen TOM-546, an example of Type I: Simple Plaiting, 1/1 Interval Sole. Note this is the dorsal surface.

Figure 27. Sandal Specimen TOM-546, an example of Type I: Simple Plaiting, 1/1 Interval Sole. Note this is the plantar surface.

Figure 28. Sandal Specimen TOM-462, an example of Type I: Simple Plaiting, 1/1 Interval Sole. Note this is the dorsal surface.

Figure 29. Sandal Specimen TOM-462, an example of Type I: Simple Plaiting, 1/1 Interval Sole. Note this is the plantar surface.

Figure 30. Sandal Specimen TOM-588, an example of Type I: Simple Plaiting, 1/1 Interval Sole. Note this is the dorsal surface.

Figure 31. Sandal Specimen TOM-588, an example of Type I: Simple Plaiting, 1/1 Interval Sole. Note this is the plantar surface.

Figure 32. Detailed construction schematic of the sole of sandal Specimen TOM-588 (adapted from Thompson 1958).

Figure 33. Detailed construction schematic of the lateral binding ties of sandal Specimen TOM-588 (adapted from Thompson 1958).

Figure 34. Detailed construction schematic of the tie system of sandal Specimen TOM-588. (adapted from Thompson 1958).

Figure 35. Detailed construction schematic of the heel tie system of sandal Specimen TOM-588 (adapted from Thompson 1958).

Introduction

The Franktown Cave (5DA272; L:9:31) perishable assemblage has been extensively studied and analyzed, in whole or in part, on three separate occasions. It was originally inventoried and described in what was, for that time, incredible detail by Gerold M. Thompson in 1958. Subsequently, the five coiled basketry samples were studied by J. M. Adovasio as part of his Smithsonian Post-Doctoral Research Project in May of 1972. An overview report on these five specimens was provided by Adovasio to the University of Denver in 1999. Finally, the coiling, cordage, and sandals were re-analyzed by Adovasio and J. S. Illingworth in the summer of 2004 as part of an NSF sponsored re-examination and AMS dating of the cave's material culture. The synthesized results of all three of these study events are presented below. It should be noted that this report *only* discusses cordage, sandals, and basketry. No discussion is presented of the knotted and unknotted fiber, sticks and twigs, fur (including possible rabbit-fur robe fragments), or any other miscellaneous perishable material in this collection.

Analytical Procedures

At the time of the 1972 and 2004 analyses, all of the artifacts had been cleaned of adhering sediment. All specimens were initially scrutinized with the unaided eye and, when necessary, visual inspection was aided with a hand-lens. All metric data were obtained with Helios needle-nosed calipers and recorded in the metric system. All data from cordage and coiled specimens were recorded on standardized analysis forms. In the case of sandals, a copy of G. M. Thompson's manuscript (Thompson 1958), containing

descriptions of these sandals, was used to record metric data and to add any corrections to his original descriptions.

Criteria of Classification

The perishable plant-fiber artifacts from Franktown Cave include specimens of basketry, cordage, and sandals.

Coiled basketry specimens are allocated to three structural types based on the kind of basket wall or foundation technique and the type of stitch employed. These specimens were also assessed for type of rim finish, method of starting, work direction, decorative patterns and mechanics, type and mechanics of mending, form, wear patterns, function, method and preparation of foundation and sewing elements, and type of splice. All analysis, terminology, and descriptive protocols follow Adovasio (1977).

Cordage specimens are allocated to four structural types based on the number and composition of plies, direction of initial "spin", and direction of final "twist." Each specimen was also analyzed for splices, knots, angle of final twist, twists per centimeter, decorative treatments, and wear. Cordage terminology and analysis protocols follow Emery (1966) and Hurley (1979). Knot typology follows Budworth (2003).

Sandal specimens are allocated to a single structural type based on the technique used to construct the sole. Sandals were also analyzed for toe treatment, heel treatment, sole reinforcement, tie arrangement, mending, wear, and decoration. Terminology protocols for the sandals follow Adovasio (1977) and Andrews et al. (1986).

Results

A total of 66 perishable plant-fiber artifacts from Franktown Cave are described below. These items include 5 coiled basketry specimens (ascribing to 3 types), 55 pieces of cordage (ascribing to 4 types [Table 1]), and 6 sandal specimens.

Coiling

TYPE I: CLOSE COILING, WHOLE ROD FOUNDATION, NON-INTERLOCKING STITCH

Number of Specimens: 1

Type of Specimens: Wall fragment, 1

Number of Individual Forms Represented: 1

Type of Form Represented: Parching tray, 1

Work Direction: Right-to-Left, 1

Technique and Comments: A single, whole, undecorticated rod is sewn with non-interlocking stitches which regularly pierce and split the rod (Figures 1 and 2). Stitches are vertically stacked and spaced so as to partially expose the foundation. The work surface also exhibits double stitches used as expansion elements. There is some accidental (<2%) stitch splitting on the non-work surface. The frequency of split stitches is not detectable on the work surface due to extensive carbonization and heavy organic residue. The work surface is concave. The texture is rigid. The specimen is undecorated, unmended, unpitched, and not naturally watertight. The specimen does not exhibit a center or rim. Splices are present with moving ends bound under (average length=30.35 mm), but fag end treatment is indeterminate due to charring. The work surface is heavily carbonized and exhibits organic residue presumed to be mush or gruel while the non-

work surface is lightly carbonized and abraded The rod is constructed of *Salix* sp. wands and the stitches are constructed from split *Yucca* sp. leaves. Provenience data are presented in Table 2.

Measurements:

Range in diameter of coils: 8.06–8.35 mm

Mean diameter of coils: 8.24 mm

Range in width of stitch: 4.80–5.36 mm

Mean width of stitch: 5.01 mm

Range in gap between stitches: 4.23–7.60 mm

Mean gap between stitches: 5.61 mm

Range and mean coils per cm: 1.5

Range and mean stitches per cm: 1.5

TYPE II: CLOSE COILING, BUNDLE FOUNDATION, NON-INTERLOCKING STITCH

Number of Specimens: 3

Type of Specimens: Wall Fragments, 3

Number of Individual Forms Represented: Parching Tray or Steep-Sided Bowl, 3

Work Direction: Right-to-Left, 3

Technique and Comments: A fibrous bundle foundation is sewn with non-interlocking stitches which pierce the foundation (Figures 3-8). Specimen RLA20041-101 exhibits vertically oriented stitches which are unsplit on both surfaces. Specimen RLA20041-102 exhibits randomly oriented stitches which are unsplit on the non-work surface while the degree of splitting is not detectable on the work surface due to charring.

Specimen RLA20041-104 exhibits randomly oriented stitches which are accidentally (40%) split on the non-work surface while the degree of splitting on the work surface is indeterminate due to charring. In all three cases, the stitches are spaced so as to expose the foundation. Work surface is concave and texture is semi-flexible. The work surface on all three specimens is concave and the texture is semi-flexible. All specimens are undecorated, unmended, unpitched, and not naturally watertight. None of the specimens exhibit centers or rims. Specimen RLA20041-101 exhibits splices with the moving and fag ends bound under and concealed. Specimen RLA20041-104 exhibits splices with the moving end bound under but with fag end treatment obscured due to heavy carbonization. Specimen RLA20041-102 exhibits splices with the moving end clipped flush but with fag end treatment obscured due to heavy carbonization. All three specimens exhibit light to moderate charring on the work surface and light abrasion on the non-work surface. Specimen RLA20041-104 also exhibits light charring on the non-work surface. Specimen RLA20041-101 uses shredded *Yucca* sp. leaves for foundation construction while the RLA20041-102 and 104 use an untyped grass species for the foundation. All three specimens use split *Yucca* sp. leaves for stitches. Provenience data are presented in Table 2.

Measurements:

Range in diameter of coils: 4.57–7.02 mm

Mean diameter of coils: 5.79 mm

Range in width of stitch: 2.75–4.30 mm

Mean width of stitch: 3.56 mm

Range in gap between stitches: 2.62–4.95 mm

Mean gap between stitches: 3.60 mm

Range in coils per cm: 1.5–2.5

Mean coils per cm: 1.8

Range in stitches per cm: 1.5–3

Mean stitches per cm: 2

TYPE III: CLOSE COILING, WHOLE ROD IN BUNDLE OR WITH LATERAL BUNDLE, NON-INTERLOCKING STITCH

Number of Specimens: 1

Type of Specimens: Wall Fragment, 1

Number of Individual Forms Represented: 1

Type of Form Represented: Parching Tray or Steep-Sided Bowl, 1

Work Direction: Right-to-Left, 1

Technique and Comments: A whole, decorticated rod which is either in a bundle of retted fibers or lateral to the bundle is sewn with non-interlocking stitches which pierce the foundation (Figures 9 and 10). The stitches are randomly arranged and are spaced so as to expose the foundation. Stitches are accidentally (20-30%) split on the non-work surface. Frequency of stitch splitting on the work surface is indeterminate due to extensive charring. The work surface is concave and the texture is semi-flexible. The work surface does exhibit double stitches which act as an expansion element. Moving end splices are clipped short and flush with the basket surface while fag-end treatment is indeterminate due to extensive charring. The specimen is undecorated, unmended, and unpitched. The specimen does not exhibit a center or rim. The specimen may be naturally

watertight. The specimen is heavily charred on the work surface, possibly from parching, and exhibits moderate abrasion on the non-work surface. The specimen uses decorticated *Salix* sp. wands for the foundation rod and shredded *Yucca* sp. leaves for the foundation bundle. The stitches are composed of split *Yucca* sp. leaves. Provenience data are presented in Table 2. It should be noted that this specimen was originally misidentified by Adovasio (1972, 1999) as Close Coiling, Two Rod and Bundle Bunched Foundation, Non-Interlocking Stitch.

Measurements:

Range in diameter of coils: 6.55–6.94 mm

Mean diameter of coils: 6.78 mm

Range in width of stitch: 2.65–2.80 mm

Mean width of stitch: 2.69 mm

Range in gap between stitches: 1.55–3.49 mm

Mean gap between stitches: 2.60 mm

Range and mean coils per cm: 1.5

Range and mean stitches per cm: 3

Cordage

TYPE I: SINGLE PLY, S-TWIST

Number of Specimens: 2

Type of Specimens: "Loose" cords, 2

Technique and Comments: A single bunch of fibrous material is S-twisted.

Neither specimen exhibits splices, knots, crepe-twisting, or rat-tailing. Based on regularly

spaced indentations on these items, both specimens appear to be single-ply components of TYPE II: TWO PLY, S-SPUN, Z-TWIST Cordage and are presumed to be degraded segments of that type which is described below. If these are *not* parts of a larger cordage construction, their function is unknown. Both specimens are constructed of *Apocynum* sp. fiber. Provenience data are presented in Table 3.

Measurements:

Range in Length of Construction: 35.00–103.75 mm

Mean Length of Construction: 69.38 mm

Range and Mean in Angle of Twist: 12.25°

Range and Mean in Twist per Centimeter: 1

Range and Mean in Ply Diameter: n/a

Range in Cord Diameter: 1.48–2.36 mm

Mean Cord Diameter: 1.92 mm

TYPE II: TWO PLY, S-SPUN, Z-TWIST

Number of Specimens: 44

Type of Specimens: "Loose" cords, 26; Knotted cords, 18

Technique and Comments: Two bunches of fibrous material are initially S-spun and then Z-twisted together (Figures 11 and 12). None of the specimens exhibits crepe-twisting or rat-tailing. Eighteen of the specimens (RLA20041-1.1, 4.1a, 6.1, 15.1, 17.1, 21.2, 22.1a-b, 23.1, 24.1, 25.1-2, 29.1, 31.1, 32.1, 33.1, 35.2, 40.1) exhibit ply splices in which S-spun fiber bundles are S-twisted into exhausted ply elements. No other splice technique is evident. Seventeen of the specimens exhibit knots. Specifically, RLA20041-

8.1 is square knotted on itself, RLA20041-18.1 exhibits a square knot on a bight, RLA20041-20.1b is square knotted to a piece of Type III cord, while RLA20041-4.1a-b; 12.1a-c; 16.1a-b; and 22.1a-b are square knotted together in pairs. Specimens RLA20041-2.1, 9.1, 14.1a-b, and 41.1 exhibit single overhand knots. Specimen RLA20041-40.1 exhibits a half-hitch. Specimens RLA20041-11.1, 21.2, and 30.1 exhibit heavy wear and are highly frayed and friable. Specimens RLA20041-22.1b and 35.4 are partially carbonized. Specimens RLA20041-1.1, 2.1, 3.1, 4.1b, 23.1, 25.1, 31.1, and 33.1 exhibit wear typical of having been knotted. Specimens RLA20041-4.1a, 5.1, 8.1, and 10.1 exhibit moderate general use wear. Specimen RLA20041-6.1 exhibits what appear to be urine crystals. Specimens RLA20041-4.1a-b and 22.1a-b appear to be segments of netting. If these are parts of nets, specimen 4.1a-b has an estimated mesh gage of 159.81mm and specimen 22.1a-b has an estimated mesh gage of 152.4mm. Specimens RLA20041-31.1 and 40.1 appear to be parts of snare constructions. All of the specimens, except for RLA20041-2.1 and 7.1 are constructed of *Apocynum* sp. fibers. Specimens RLA20041-2.1 and 7.1 are constructed of an untyped grass-like plant fiber. Provenience data are presented in Table 3.

Measurements:

Range in Length of Construction: 17.55–329.55 mm

Mean Length of Construction: 119.57 mm

Range in Angle of Twist: 21–47.5°

Mean Angle of Twist: 34.6°

Range in Twist per Centimeter: 1–5

Mean Twist per Centimeter: 2.9

Range in Ply Diameter: 0.88–2.70 mm

Mean Ply Diameter: 1.80 mm

Range in Cord Diameter: 1.20–4.20 mm

Mean Cord Diameter: 2.63 mm

TYPE III: TWO PLY, Z-SPUN, S-TWIST

Number of Specimens: 3

Type of Specimens: Snare, 2; Knotted cordage 1

Technique and Comments: Two bunches of fibrous material are initially Z-spun and then S-twisted together (Figure 13 and see Figure 12). None of the specimens is crepe-twisted and none of exhibits splicing. Specimen RLA20041-27.1 exhibits moderate rat-tailing at both ends. Specimen RLA2004-20.1a exhibits a square knot which connects it to a piece of Type II Cordage. Specimen RLA20041-28.1, which is presumed to represent a snare, exhibits an overhand knot on one end of the cord and an slipknot/overhand noose on the opposite end. Specimen RLA20041-27.1 exhibits a half-hitch tied around a *Rhus* sp. twig (12.10 mm long and 2.20 mm wide), a granny knot which results in a loop 7.75 mm in diameter, and an overhand with an auxiliary loop. This specimen is presumed to be a snare with the trigger intact. Only specimen RLA20041-28.1 exhibits wear in the form of a heavy patch of wear approximately 21 mm from the knot. All specimens are constructed of *Apocynum* sp. fibers. Provenience data are presented in Table 3.

Measurements:

Range in Length of Construction: 81.55–468.15 mm

Mean Length of Construction: 240.97 mm

Range in Angle of Twist: 27.5–33.5°

Mean Angle of Twist: 29.5°

Range in Twist per Centimeter: 3–3.5

Mean Twist per Centimeter: 3.4

Range in Ply Diameter: 1.29–1.33 mm

Mean Ply Diameter: 1.32 mm

Range in Cord Diameter: 1.57–2.02 mm

Mean Cord Diameter: 1.79 mm

TYPE IV: COMPOUND TWO-PLY, S-SPUN, Z-TWIST

Number of Specimens: 6

Type of Specimens: "Loose" cordage, 6

Technique and Comments: Two pieces of Type III Cordage are Z-twisted together (Figures 14 and 15). None of the specimens exhibits crepe-twisting, rat-tailing, knots, or discernible wear. Specimen RLA20041-36.1 is produced by re-plying a single piece of Type III Cordage back onto itself. Specimen RLA20041-13.1 exhibits a single splice wherein a bundle of Z-spun fibers are Z-twisted into one of the original plies. Specimen RLA20041-34.1 is constructed of *Apocynum* sp. fibers while all of the remaining specimens are constructed of *Asclepias* sp. fibers. Provenience data are presented in Table 3.

Measurements:

Range in Length of Construction: 27.60–69.85 mm

Mean Length of Construction: 48.83 mm

Range in Angle of Twist: 37–48.5°

Mean Angle of Twist: 43.5°

Range in Twist per Centimeter: 1.5–4

Mean Twist per Centimeter: 3.1

Range in Ply Diameter: 1.33–4.30 mm

Mean Ply Diameter: 2.12 mm

Range in Cord Diameter: 2.33–5.58 mm

Mean Cord Diameter: 3.12 mm

Sandals

TYPE I: SIMPLE PLAITING, 1/1 INTERVAL SOLE

Number of Specimens: 6

Types of Specimens: Sole fragments with ties, 4; Sole fragments without ties, 2

Number of Individual Forms Represented: 6

Technique and Comments: In all six specimens, a series of split *Yucca* sp. leaves are knotted together to form a rectanugloid loop "frame," roughly outlining the shape of the human foot. Onto this "frame," additional split *Yucca* sp. leaves are woven in a simple plaiting, 1/1 interval pattern. In all cases, this weaving appears to begin with "warp" elements running from toe-to-heel (see below) through which "weft" elements were interlaced from side-to-side beginning at the toe. In all cases, where extant, the side and end selvages are of the continuous self variety. Of these six sandals and sandal fragments, Specimens 501, 858, 462, and 588 still exhibit ties.

The specific descriptions which follow are primarily based on the 2004 re-analysis of the Franktown Cave sandals *and* the original analysis conducted by Thompson (1958). Where discrepancies in interpretation exists, they are duly noted.

Specimen 501 is a nearly complete left sandal, with the exception of portions of the heel, which are frayed (Figures 16 and 17). The specimen is 21 cm long and 9 cm wide along the length of the sandal except for the toe area where the width narrows to 6 cm. Like all examples of this type, the sandal was constructed on a foundation of *Yucca* sp. leaves which serves as the "frame" of the item. The construction sequence for this sandal is shown in Figure 18. As indicated, the sandal frame is composed of whole *Yucca* sp. leaves labeled A, B1, and B2. Leaf A was carried around the outside of the sandal from the little toe area (see Figure 18, point 1) to the big toe area (see Figure 18, point 2). Leaves B1 and B2 were then paired and added to form the outer rim or edge of the toe area. B1 was then tied with a square knot (or Marlin hitch) at point 1. Leaves B1 and B2 were then carried to point 2, where they were temporarily secured to Leaf A. Leaf B2 apparently hung unsecured at point 1 until after the sandal sole was finished.

The next steps in the construction process are subject to different interpretations. According to Thompson (1958:3-6), who based his reconstruction on a "replication" of Specimen 501, the next step was the insertion of "lateral" foundation elements which he called warps. The distal end of the first warp was bent around Leaf A at the right side of the heel (see Figure 18, point 3). The free end was then carried transversely across the long axis of the sole to the opposite side of the heel (see Figure 18, point 4) crossing over and around frame Leaf A and then returning to the right side of the heel. After being carried back to the left side, the proximal end of the leaf was secured at point 5 (see

Figure 18). In Thompson's reconstruction, a total of five whole leaves were used to form 15 warps, with one short additional leaf inserted to make a total of 16. Additional leaves were then woven in from heel-to-toe in an over-one, under-one interval. (Thompson called this "checker-weave," but this manipulation is usually referred to as simple plaiting, 1/1 interval [cf. Adovasio 1977:Figure 117a]). Thompson labeled the heel-to-toe elements wefts and indicated that they could have been inserted in any one of the following ways.

Method 1: The initial weft (#19) was inserted at the right side of the sole at the toe, this weft passed under and around Leaves B1-B2 and was secured by wrapping it twice around Leaf A (see Figure 18, point 6). Six more leaves were subsequently woven in, each starting at and then returning to the heel. This process produced a total of 12 wefts (#1, 3, 4, 6, 7, 9, 10, 12, 13, 15, 16, and 18). According to Thompson, each leaf passed over-and-under the same warps on its passage to the heel and back. The ends of the leaves were secured at the heel by bending over or under Leaf A (see Figure 18, point 7). Six additional wefts were then inserted (#2, 5, 8, 11, 14, and 17). Each was drawn in between two wefts which had been produced by the passage of a single leaf from toe-to-heel and back (i.e., 1-3, 4-6, etc.). The weaving sequence employed in drawing in each single weft was exactly opposite that followed by the flanking wefts.

These wefts crossed over the toe foundation (B1 and B2), then passed under the loops formed at the toe by the first wefts (see Figure 18, point 8). the six wefts were then tied in a square knot located over the big toe on the anterior side of the sandal (see Figure 18).

Method 2: One leaf may have been folded at its midpoint over frame Leaves B1 and B2. The ends were then woven in as a pair in an over-one, under-one interval to the heel. A whole leaf may then have been woven in at the center of the paired wefts as described for Method 1.

Method 3: A leaf (#1) was woven in from heel-to-toe and the end was left hanging free at B, while the second weft was woven in. Leaf #1 was then looped over Leaf #2 and frame Leaf B and carried back to the heel. This process was repeated along wefts #2-5-8-11-14 and 17 to hang free at the toe until the weaving of the sandal sole was completed.

Based on ethnographic analogy and other detailed prehistoric sandal research (cf. Andrews et al. 1986; Cosgrove 1947), Adovasio and Illingworth suggest a different sole construction sequence for Specimen 501 and the rest of the Franktown Cave sandals.

While Thompson unquestionably has the position of the construction elements in the sandal sole accurately recorded, their role in the construction process is probably the exact *opposite* of his reconstruction. Specifically, the items which he designates as wefts are actually warps and vice versa. Herein, it should be stressed that, technically, *all* of these items are plaiting strips or elements not actual warps or wefts as those terms are restricted to twined basketry and certain textile elements. However, as noted by Adovasio (1977:106, 110), in some types of plaiting, sets of elements may function as pseudo-warps or pseudo-wefts as in actual twining though without the engagement evidenced in that sub-class of perishables. This is the case with the Franktown sandals though the "warps" and "wefts" are in the view of Adovasio and Illingworth mislabeled. In this

perspective, the items which run lengthwise along the sandal sole are the warps while the items which engage them across the sole are the wefts.

The warps are emplaced first then engaged by the wefts in a process which is nearly the mirror image of that depicted by Thompson. Put most simply, in Thompson's reconstruction, the active weaving element or weft runs up and down the sole over-and-under the passive horizontal or transverse elements which, in that scenario, are warps. In the alternate interpretation, which is strongly supported in the ethnographic and archaeological literature, the reverse situation obtains.

Whatever basic sole construction scenario is correct, there are additional details of manufacture. Lateral binding ties consisting of paired leaves C1 and C2 (Figure 19), compose the right tie and leaves D1 and D2 compose the left tie. The tie was formed heel-first. There are leaves passed through a hole made by splitting the nineteenth warp (following Adovasio and Illingworth) or weft (following Thompson) between the third and fourth weft rows (following Adovasio and Illingworth) or warp rows (following Thompson). These leaves looped from the inside around Frame Leaf A and are tied in an overhand knot (see Figure 19, point 3). The free ends were then carried toward the toe, forming a half-hitch between the seventh and eighth weft (following Adovasio and Illingworth) or warp (following Thompson), again, splitting the nineteenth warp (following Adovasio and Illingworth) or weft (following Thompson). This step was repeated two more times between wefts (following Adovasio and Illingworth) or warps (following Thompson) #15 and #16, splitting warp (following Adovasio and Illingworth) or weft (following Thompson) #19 both times. This process basically produces a series of half-hitches which secure the lateral ties to the sandal sole.

Frame leaves B1 and B2 were then untied and secured in final position as follows: the free end of leaf C2 was secured to frame Leaf A by a square knot. Leaf C1 was then carried toward the center of the sandal, passing over Leaf A, then under the nineteenth and eighteenth elements, over the seventeenth, and then under the fifteenth to the twelfth. At this point, Leaf C1 was brought to the surface of the sole and crossed over the eleventh to the seventh elements to the underside of the sole where it is, in turn, carried toward the center of the sandal, passing over Leaf A, then under the nineteenth and eighteenth elements, over the seventeenth, and then under the sixteenth to the twelfth. At this point, Leaf C1 was brought to the surface of the sole and crossed over the eleventh to the seventh element, then passed between the sixth and seventh elements to the underside of the sole where it is, in turn, carried to its terminus at the twelfth element. Depending on interpretation, all of the elements noted above are either warps (following Thompson) or wefts (following Adovasio and Illingworth). Leaf B1 (Figure 20, point 2) was carried under Leaf A over element 19, under the eighteenth to the sixteenth. Leaf B1 then split the sixteenth element, passed through it and continued over the eleventh, under the tenth, to the second element, crossed over the seventh, then under the eighth to the eleventh. Leaf B1 then passed between the eleventh and twelfth elements where the leaf end terminated. Once again, the elements cited either warps (following Adovasio and Illingworth) or wefts (following Thompson).

Leaf B2 was carried over Leaf A then under the nineteenth element continuing to the fifteenth. It passed between the fifteenth and fourteenth then was carried over the fourteenth crossing under the thirteenth to the twelfth. Leaf B2 then passed between the eleventh and tenth element continuing to the first where it passed under the loops around

Leaf A on the left margin (see Figure 18, point 1). Leaf B2 was then carried over and tucked under itself at the seventh element. The elements cited are either warps (following Adovasio and Illingworth) or wefts (following Thompson).

Lateral tie D1 and D2 on the left side of the sole (see Figure 19, point 4) was initiated at the heel, split and passed through warp (following Adovasio and Illingworth) or weft (following Thompson) #1. A series of half hitches were then made along the left edge of the sandal to the toe. D1 and D2 were tied in a square knot, one end of D1 protruding from this knot was then inserted in the square knot which secured Leaf B1 with Frame Leaf A (see Figure 19, point 1). Leaf B2 was secured at the left side of the sandal by being wrapped twice around Frame Leaf A.

The sandal was secured to the foot by two additional ties, one passing around the heel and over the instep, the other at the toe.

The heel tie involves the distal ends of two whole yucca leaves, E1 and E2, being tied in a square knot (see Figure 20, point 3). This knot lay above the heel at the back of the foot. The free ends of the leaves were carried one to the left, the other to the right, of the foot to meet the lateral ties (see Figure 20, points 4a and 4b). Each looped around the lateral tie, was carried back around the heel to the opposite side of the foot and looped around the lateral tie again. They were fastened in a bow knot over the instep.

The toe tie involves two whole yucca leaves (F1 and F2) which were bent at their distal ends and interlocked with one another (see Figure 20, point 5). The free ends, one left, one right, were passed under and around the lateral ties and carried toward the heel. The leaves were crossed to the opposite lateral ties, passed under, and around them, and tied over the metatarsal arch in a bow knot.

The heel and toe ties are so constructed that pressure on the free ends would pull the sandal snugly to the foot. The heel ties probably rested directly on the calcaneum which would have aided in securing the sandal to the foot.

Specimen #858 is a relatively complete sandal with extensive wear to the toe area (Figures 21-23). The specimen is 23 cm long, 12 cm wide at the heel and narrows to 10 cm at the toe. The method of construction is essentially similar to Specimen #501 with some generally minor differences. Specimen #858 was manufactured with 16 warps (following Adovasio and Illingworth) or wefts (following Thompson) which are interlaced with 18 wefts (following Adovasio and Illingworth) or warps (following Thompson). Additionally, five doubled elements are crossed over the toe and tied in a square knot centered over the arch of the foot. Depending on perspective, these doubled elements are either wefts (following Adovasio and Illingworth) or warps (following Thompson). The doubling of elements at the toe is paralleled in the sole and was probably done to increase sole thickness and, hence, longevity.

Although fragmentary, the heel area of Specimen #858 is sufficiently intact to permit identification of the construction sequence in this area. A heel pad was formed at the base of the heel by inserting short segments of *Yucca* sp. leaves. These leaf elements were then carried from the heel toward the toe for approximately 4 cm, then passed between a weft (following Adovasio and Illingworth) or a warp (following Thompson) and carried back to the underside of the heel. Beginning at the left side of the heel, an additional leaf was secured to Frame Leaf A with a square knot, then interlaced across the base of the heel to the right side. At this juncture, the leaf was wrapped twice around Frame Leaf A then interlaced across to the left side where it was again secured with Leaf A. This process

secured the additional leaves and thus formed the heel pad. Because of the knotting and wrapping on the right and left margins, the heel pad is thicker in these areas.

The lateral and heel ties were produced in the same fashion as Specimen #501. The toe tie is essentially the same as Specimen #501 except that two separate sets of leaves were tied at the distal ends with the free or proximal ends passing to the left and right (see below). Specimen #858 exhibits the very fragmentary remains of a grass sock similar to that which is much better preserved in Specimen #588 (see below).

Specimen #509 is fragmentary and measures 13 cm in length with a maximum width of 10.5 cm (Figures 24 and 25). The method of construction is basically the same as Specimen #501 except that this item contains 20 warps (following Adovasio and Illingworth) or wefts (following Thompson). Additional leaves have been added to the sole in a manner similar to Specimen #858. No other attributes are available.

Specimens #546 (Figures 26 and 27) and #462 (Figures 28 and 29) are fragmentary and measure 13 cm in length by 10 cm in width and 9 cm in length and 11.5 cm in width, respectively. Specimen #546 was apparently produced in a manner similar to Specimen #501 while the construction of specimen #462 is similar to Specimen #509. Data on ties and socks are available only from Specimen #509. The toe tie of Specimen #462 is basically the same as Specimen #858 with one difference. In specimen #462, only one set of *Yucca* sp. leaves were tied at the distal ends in a square knot.

Specimen #588 is a relatively complete sandal with a maximum length of 24.3 cm and a maximum width of 12.5 cm (Figures 30 and 31). The specimen measures 11 cm at the heel; 11.2 cm at the instep; and 8.7 cm at the toe. The basic weave of Specimen #588 is similar to Specimen #501 with specific exceptions. The edges of Specimen #588 are

built up by wrapping with a double thickness of whole *Yucca* sp. leaves (Figure 32, point 1). This was apparently designed to facilitate the fastening of a grass "sock" to the sole of the sandal. Transverse plaiting elements (wefts [following Adovasio and Illingworth] or warps [following Thompson]) in this specimen extend to the toe unlike in Specimen #501. The specimen contains 15 warps (following Adovasio and Illingworth) or wefts (following Thompson) and 26 wefts (following Adovasio and Illingworth) or warps (following Thompson). Five elements (warps [following Adovasio and Illingworth] or wefts [following Thompson]) cross over the toe foundation leaves, four of which are tied in a square knot located over the big toe. The remaining element extended to and was possibly secured by a toe tie over the arch (Figure 33, point 1). Additional *Yucca* sp. leaves are woven into the sole, perhaps to facilitate anchoring the grass sock. Leaf 6 on the left side splits warp (following Adovasio and Illingworth) or weft (following Thompson) #3 passing between weft (following Adovasio and Illingworth) or warp (following Thompson) #21 emerging on the opposite side of the sole. The leaf end is then carried toward the toe and splits warp (following Adovasio and Illingworth) or weft (following Thompson) #5 and weft (following Adovasio and Illingworth) or warp (following Thompson) #11 (see Figure 33, point 3). The leaf is then looped around and re-enters through the same aperture. The free end is then carried toward the toe for a short distance (approximately 1.25 cm) then possibly secured. What *appears* to be a continuation of this leaf is carried toward the toe to weft (following Adovasio and Illingworth) or warp (following Thompson) #16 and warp (following Adovasio and Illingworth) or weft (following Thompson) #2 (see Figure 33, point 4). At this locus it passes through the sole and ends on the base as a pad leaf on the right side (see Figure 33,

point 5), splits warp (following Adovasio and Illingworth) or weft (following Thompson) #14 and passes between wefts (following Adovasio and Illingworth) or warps (following Thompson) #8 and #9 emerging on the surface. This leaf is then carried toward the heel and splits weft (following Adovasio and Illingworth) or warp (following Thompson) #18 and weft (following Adovasio and Illingworth) or warp (following Thompson) #2 (see Figure 33, point 6). This leaf then passes through and continues on the underside of the sole toward the toe. At that point, the leaf splits weft (following Adovasio and Illingworth) or warp (following Thompson) #8 and warp (following Adovasio and Illingworth) or weft (following Thompson) #12 and emerges on the surface of the sole. The leaf element is then carried toward the heel and splits weft (following Adovasio and Illingworth) or warp (following Thompson) #18 and warp (following Adovasio and Illingworth) or weft (following Thompson) #2 before passing through. The leaf is next carried on the underside to warp (following Adovasio and Illingworth) or weft (following Thompson) #4 and weft (following Adovasio and Illingworth) or warp (following Thompson) #9 which it splits before emerging on the surface (see Figure 33, point 4). From here, the leaf is carried toward the toe to weft (following Adovasio and Illingworth) or warp (following Thompson) #1 where it is truncated.

Lateral ties differ somewhat from the pattern evidenced in Specimen #501. In Specimen #588, an additional leaf was inserted in the right side of the sole (Figure 34, point 1). One end is secured to Frame Leaf C1 in a square knot while the opposite end is carried toward the toe and splits warp (following Adovasio and Illingworth) or weft (following Thompson) #15 between weft (following Adovasio and Illingworth) or warps (following Thompson) #5 and #6. The leaf element passes through the sole and the end

forms a pad on the sole (see Figure 34, point 2). A small loop is then formed from a short section of *Yucca* sp. leaf and is tied in a square knot. This loop connects Frame Leaves B and C. A small piece of *Yucca* sp. is used to bind Frame Leaf B after the short section was secured.

The heel tie of Specimen #588 is the same as that on Specimen #501 but the toe tie of #588 is more complex. This tie is composed of three *Yucca* sp. leaves labeled W, X, and Y (Figure 35, point 1). The distal ends of these leaves are conjoined with a square knot, then the free end of Leaf X is looped around the internal tie then under Leaf Y crossing to pass under the opposite lateral tie. Here, Leaf X passes under, then over, and is carried toward the center of the sandal in the direction of the heel.

At the center of the sandal, Leaf X is secured with leaves W and Z in a square knot (see Figure 33, point 3). The free end of Leaf W is carried from (see Figure 33, point 1) to the opposite lateral tie looping under, then over, and is carried across to the opposite side. Here the leaf passes under, then over, the lateral tie and is carried to the center of the sandal in the direction of the heel and secured (see Figure 33, point 3). The free end of leaf Z is carried from point 3 to and passes under, then over, the right lateral tie. The leaf is then carried toward the heel where it has been secured. Possibly this end of Leaf Z may have been secured at (see Figure 33, point 3).

This specimen is provided with a grass lining that has the characteristics of a sock. Long stems of grass (genus/species unknown) were folded back and forth and shaped to fit the sandal. The grass sock was kept in place by a double strand of grass cord. This cord was laced along the edge of the grass sock securing the upper and lower parts in this manner; the cord is looped under Leaf G and is woven in along the edge of the sock

toward the toe. Here the cord is looped under warp (following Adovasio and Illingworth) or weft (following Thompson) #3 and is then woven into the body of the sock. The free end of the cord is looped around the toe tie and then carried to and looped under warp (following Adovasio and Illingworth) or weft (following Thompson) #13. The free end is then carried toward the heel in the same manner as described for the opposite side. The free end of the cord element is then looped over, then under, Leaf H (Point 3) and continues toward the center of the sandal at which point the cord has been severed. From the location of this cord, it may be that the cord was tied at this point. It should be noted that this cord does not appear in Figure 30 or 31, nor was it evident when the sandal was re-analyzed in 2004. The heel pad of Specimen #588 is completely missing but was probably similar to that evidenced on Specimen #858.

Provenience data and temporal ascription for all sandal specimens are presented in Table 4.

Internal Correlations

Basketry

Technology

The Franktown Cave basketry assemblage consists entirely of coiling. The collection is typologically circumscribed and is dominated by single-element foundations (whole rods, bundles, whole rod in or next to a bundle) with no stacked or bunched foundations represented. Similarly, only non-interlocking stitches are present. All of the specimens are relatively well made with moderate (less than 40%) to no accidental splitting of the stitches on either surface. Work direction is right-to-left on all specimens

and work surface is consistently concave. Method of starting and rim finish are unknown. None of the specimens is pitched, decorated, or mended. The solitary Type III specimen may be naturally watertight though this characteristic does not apply to any of the other coiled specimens.

There is a slight preference for bound-under moving end splice treatments (n=3 [60%]) over clipped-short moving end treatment (n=2 [40%]), though there is no consistent splice treatment in the most numerous of coiling types, Type II. Due to wear or adherent residue, no data are available on fag end splice treatment.

Raw Materials

Only two raw materials are represented in the Franktown Cave coiling collection. Split *Yucca* sp. leaves are the consistent choice for stitches, shredded *Yucca* sp. leaves are chosen for bundles, and willow (*Salix* sp.) twigs are chosen for rigid foundation elements.

Form and Function

The Franktown Cave basketry assemblage consists entirely of tray or wide-mouth bowl forms. These were apparently used for food preparation and/or consumption based on the nature of wear, carbonization patterns, and extensive food-based residues adherent to most of the specimens.

Cordage

Technology

Like the basketry suite, the Franktown Cave cordage assemblage is quite homogeneous. The most numerous type represented is Type II, which accounts for 80% (n=44) of the cordage assemblage. If the Type I cordage, in fact, represents decayed and/or disassociated elements of Type II, then final Z-twist is by far the most common cordage finishing technique, accounting for approximately 94% of the assemblage. Unlike coiling, the extant cordage splices are uniform. In all cases, a spun bundle of fibers is simply added to replace the exhausted bundle.

In terms of execution the cordage assemblage is relatively standardized, particularly as regards metric traits within typological categories. With the exception of the Type I cordage, which, as mentioned above, is most likely decayed parts of more complex cordage types, all of the cordage falls into Hurley's (1979:5-6) medium-to-tight or medium-to-hard angle of twist.

Raw Material

As with the basketry, the cordage assemblage evidences a highly circumscribed selection of raw materials. All of the Type I Cordage specimens are composed of *Apocynum* sp. fibers, as are all of the Type III specimens, and all but two of the Type II specimens. Interestingly, only one of the Type IV specimens is composed of *Apocynum* sp. fibers, while the remaining five specimens (83%) are composed of *Asclepias* sp. fibers.

Form and Function

While much of the cordage from Franktown Cave could have served a wide variety of unknown lashing, binding, and wrapping functions, in those instances where specimens are intact enough to determine probable use, the Franktown Cave cordage appears to be heavily dedicated to snare forms. While it is possible that some of these specimens were also used in net construction and it is almost a certain fact that they were used for many of the sundry lashing and binding tasks common in any culture, there is no direct evidence for any of these uses.

Sandals

Technology

As originally suggested by Thompson (1958:14-15), the analytical data suggest that two variants of one basic sandal type were produced and used by the aboriginal visitors to Franktown Cave. These include a "heavier" form represented by specimens #546, #509, #588, and #462 and a "lighter" form represented by specimens #501 and #858. While both variants share the same basic sole construction attributes and all are simple plaited, certain differences exist between these forms.

The most distinctive feature of the heavier form is the presence of a grass sock and related attributes such as a heel pad and more complex toe ties used to hold it in place or secure it. These provisions allow for the sandal to be put on or removed without the sock collapsing or losing shape. Other unique features of the heavier form include the use of paired *Yucca* sp. leaves for warps and wefts with a different frequency of those elements than in the lighter variant. The heavier variant has more wefts (following

Adovasio and Illingworth) or warps (following Thompson) than the lighter form and also exhibits two long loops on either side of the sole which serve to provide additional stabilization for the sock. Finally, the heavier form exhibits additional material interlaced into the contact portion of the sole to form pads which may have enhanced traction or provided superior wear or, perhaps, extra insulation.

The lighter variant is characterized by the absence of a grass sock and less complex toe ties. It also lacks doubled elements and additional padding. As the name implies, it is a less-substantial construction than its counterpart.

Raw Materials

Both variants of sandal were constructed exclusively of *Yucca* sp. leaves. The type of grass employed for the socks in the heavier form is unknown.

Form and Function

As the term implies, these items are designed to be and were used as footwear. This is supported not only by the construction attributes cited above but also by the highly diagnostic wear patterns in the areas of the ball of the foot and the heel. Interestingly, in this regard there are no indications of the type of wear associated with Morton's foot (cf. Andrews et al. 1986).

Thompson suggested—and Adovasio and Illingworth concur—that the heavier variant of sandal was probably intended for winter or cold weather use, while the lighter variant was employed in warmer seasons.

Chronology

Basketry

After analysis and photodocumentation, small segments of all five of the Franktown Cave coiled baskets were directly dated by AMS assay. The results are presented in Table 2. As that table indicates, three of the specimens cluster tightly in the later fourth millennium B.C. (cal.) and include the solitary example of Type I: Close Coiling, Whole Rod Foundation, Non-Interlocking Stitch and two examples of Type II: Close Coiling, Bundle Foundation, Non-Interlocking Stitch. The final example of Type II is attributable to an apparently large occupation in the early third millennium B.C. (cal.) while the lone example of Type III: Close Coiling, Whole Rod in Bundle or with Lateral Bundle, Non-Interlocking Stitch is dated to the mid to late first millennium A.D. (cal.).

Though the dated sample is admittedly small, the results suggest that both whole rod and bundle foundation coiling were produced during the early Middle Archaic while only bundle foundations are represented later in the same general time frame. The solitary, quasi-exotic, single-element type, Type III is represented only during the Ceramic Period occupation of Franktown Cave. The implications of these dates are addressed in External Correlations.

Cordage

None of the Franktown Cave cordage samples was directly dated. Based on provenience data, however, some cordage specimens appear to be associated with directly dated basketry samples. As is presented in Table 3, all of the apparently associated cordage specimens cluster in the later fourth millennium B.C. (cal.).

Sandals

Fragments of all six Franktown Cave sandals were directly dated via AMS assay, the results of which are presented in Table 4. All of the dates cluster in the late fourth millennium B.C. (cal.) and are essentially contemporaneous with the suite of early coiled basketry dates. None of the analyzed sandals yielded dates attributable to later occupations/utilizations of Franktown Cave.

External Correlations

At the time of the two earlier studies of the perishable-fiber artifacts from Franktown Cave (Adovasio 1999; Thompson 1958), the chronological placement of this assemblage was very ambiguous. Now, however, with the benefit of the AMS dates cited above, as well as others not reported here, the temporal ascription of the Franktown Cave material comes into much sharper relief. Paradoxically, this level of chronological resolution clouds, in some ways, the possible external affinities of this collection.

Of the various classes of perishable artifacts described and discussed above, the two "most" sensitive for comparative purposes are the coiled baskets and the sandals, though cordage is not uninformative in these matters.

Two of the coiling types represented at Franktown Cave, Type I: Close Coiling, Whole Rod Foundation, Non-Interlocking Stitch and Type II: Close Coiling, Bundle Foundation, Non-Interlocking Stitch enjoy relatively widespread, if spatially, sporadic, and temporally discontinuous distribution in the so-called Greater American Southwest (Adovasio and Gunn 1986; Hyland et al. 2003; Kent 1983; Morris and Burgh 1941; Tanner 1976), the immediately contiguous eastern Great Basin (Adovasio 1970, 1974;

Andrews et al. 1986) and, rather further afield, in Lower and Trans-Pecos Texas, adjacent New Mexico and northern Mexico (Adovasio 1980; Andrews and Adovasio 1980; McGregor 1992).

Whole as well as half rod single element foundations are very early seventh millennium B.C. developments in all these areas and effectively constitute the earliest coiled basketry types in the Arid West (Adovasio 1970, 1974). In the eastern Great Basin, as well as in the Southwest, the stitch type associated with whole or half rod foundation is usually interlocking while in the dry reaches of lower and Trans-Pecos Texas and adjacent northern Mexico non-interlocking stitches occur on this foundation (Andrews and Adovasio 1980). In the Southwest and the eastern Great Basin, work direction corresponds to the Franktown Cave specimens (right-to-left) while the opposite work direction prevails in Texas and northern Mexico. Significantly, virtually all of the early single element coiling is in the form of parching trays, a use for which even earlier twining is ill-suited (Adovasio 1970, 1974). Thereafter, whole or half rod coiling persists for varying periods of time usually as a minority technique within the context of later Archaic or Formative perishable industries. Single element, whole or half rod coiling foundations remain in use among the Fremont of the eastern Great Basin and Colorado Plateau until ca. A.D. 1000 (950 B.P.) and likewise persist among the bunched foundation-dominated Anasazi and Mogollon basketry industries until at least Pueblo IV times ca. A.D. 1690–1790 (260–160 B.P. [Adovasio and Andrews 1985]).

Unlike whole or half-rod foundation coiling, bundle foundation coiling does not have a relatively wider distribution and venerable antiquity in regions immediately adjacent to the greater Franktown Cave study area. Bundle foundation coiling is virtually

unknown in the Archaic of the eastern Great Basin (Adovasio 1970, 1974) and also in later Fremont contexts (Adovasio et al. 2002) and is relatively uncommon in the Southwest until earliest Formative times (Adovasio 2005; Hyland et al. 2003; Morris and Burgh 1941). Indeed, as suggested by Adovasio (1970, 1974) and apparently confirmed by recent research, it appears that this highly diagnostic coiling type along with twill plaited basketry have an ancient Mexican origin (Adovasio 1980; Andrews et al. 1986). Furthermore, given the dates of its initial appearance in most parts of the Southwest, which seems to occur no later than 1200-1000 B.C., it may well be that this type was introduced into the Southwest along with, or as an integral part of, a techno-subsistence package that specifically involves Mexican-derived cultigens (Adovasio 2005; Hyland et al. 1995, 2003).

At the time of his earlier study, Adovasio suggested that bundle foundation coiling and domesticates may have reached the Franktown Cave area as part of this Formative diffusion process. This interpretation seemed to be supported by the presence of corn (*Zea mays*) in the Franktown Cave assemblage. In this scenario, the obvious "ties" of the Franktown Cave coiled suite would lie to the south and west, toward Mogollon country.

Unfortunately, this attractive interpretation is terminally compromised by the AMS dates of the Franktown Cave bundle foundation coiling as well as the corn remains from that site. As the AMS dates conclusively show, the bundle foundation fragments *are not* temporally associated with the corn but, surprisingly, *are* older than *any* bundle foundation coiling from the Mogollon area or *any* other part of the Southwest. In fact, the Franktown Cave bundle foundation coiling is by far the oldest example of this type north of Lower and Trans-Pecos Texas or northern Mexico. Significantly, in the latter areas,

this technique extends back to the eighth and seventh millennia B.C. and thereafter persists until historic contact, though unaccompanied by *any* domesticates.

The deep antiquity of bundle foundation coiling in the Lower and Trans-Pecos region may suggest another point of possible origin for the numerically dominant Franktown Cave coiling type—still south, but east, not west! Possibly confounding this scenario is the fact that several of the ethnically sensitive or population-specific coiling construction attributes are different in both areas. At Franktown Cave, as in the eastern Great Basin and American Southwest, the principal coiled work direction is right-to-left, while in Lower and Trans-Pecos Texas it is generally the reverse. Likewise, splice treatment is different in both areas.

If the possible external relationships of the Franktown Cave coiling assemblage are masked by the unexpectedly early dates on bundle foundation coiling, they are rendered even more opaque by the presence of a relatively rare coiling foundation, rod in or adjacent to a bundle (also called rod with lateral bundle), as evidenced in Coiling Type III. Originally identified as close-coiling, two rod and bundle bunched foundation by Adovasio (1999), re-analysis indicates that assignment was in error. Unlike two rod and bundle bunched foundation which is *the* ubiquitous, signature Anasazi and Mogollon coiling technique, rod in or adjacent to a bundle is *never* common anywhere. The technique occurs very sporadically in the Southwest as a minority element in post-Archaic contexts (Morris and Burgh 1941) and also in the Upper Gila and Hueco areas of eastern New Mexico and west Texas (Cosgrove 1947). Perhaps, significantly, the technique is most common east of the Rocky Mountain Front and its outlier's and is rarer to the west. However, once again, the Franktown Cave specimen evidences a different

work direction and splice mechanics than those encountered in baskets of this foundation type from points south and east.

With one possible and intriguing exception, the issue of possible relationships is, unfortunately, not clarified by the Franktown Cave sandal suite. This assemblage contains a unique plaiting type or, more accurately, two variants of a type, which have no direct counterparts in *any* of the areas discussed above.

Prehistoric populations across the Rockies in the northern part of the eastern Great Basin never made sandals while those recovered further south on the Colorado Plateau are twined (Jennings 1980; Lindsey et al. 1968). Plaited sandals *were* produced by both the Mogollon (Kent 1983; Martin et al. 1952; Tanner 1976) and the Anasazi (Kankainen 1995) and were quite common in Lower and Trans-Pecos Texas (McGregor 1992) as well as northern Mexico (Taylor 2004), but the basic construction process and other details of manufacture are entirely different than those from Franktown Cave.

Finally, while it is clear that terminal cordage twist can often be an important indicator of population or ethnic affinities (Adovasio 1986; Adovasio and Pedler 1994; Johnson and Meyers 2004; Petersen and Wolford 2000; Petersen et al. 2001), the cordage suite from Franktown Cave is too small and local comparative assemblages too rare to provide any useful insights from this vantage point. Suffice to note that the final Z twist observed on the majority of the Franktown Cave cordage is the exact opposite of the predominant type in the contemporary eastern Great Basin and Colorado Plateau. This suggests minimal technical affinities or connections between contemporary cordage-making populations on opposite flanks of the Rockies.

Perhaps, the only vaguely analogous assemblage of plant-fiber perishables which shows any remote generic relationships to the Franktown Cave assemblage derives from the Kenton Caves, in Cimarron County, Oklahoma. Originally discovered by W. Baker or, perhaps by E. B. Renaud (or one of his associates) and subsequently studied, published, or commented upon by Clements (1943), Haury (1982), Lintz and Zabawa (1984), Lopez and Saunders (1973), and Saunders (1978) and most recently visited by D. Meltzer in 1997 (D. Melzer, personal communication 2005), the Kenton Caves contain a small perishable suite that was examined by the senior author as part of a Smithsonian Post-Doctoral Research Project. Though largely undated but apparently of mid- to late Archaic ascription, the Kenton Cave perishable inventory includes close coiling on a rod with lateral bundle foundation and simple plaited sandal fragments, several of which are vaguely reminiscent of the those recovered from Franktown Cave. Without any firm chronological control, it is certainly premature to suggest any "connections" between the two assemblages especially since the Kenton Caves lie approximately 480 km to the southeast of Franktown Cave in an entirely different ecological setting.

At this juncture, it should be clear that it is very difficult to relate the Franktown Cave perishable inventory to any specific neighboring site and/or complex. Indeed, the only "affinities" that can be delineated are on the most basic and broadest technological levels. In many ways, this inability to "fit" or "place" the Franktown Cave perishable suite in time and space should not be surprising. Perishable plant-fiber artifacts of any age are remarkably scarce not simply in the Denver area but along virtually the entire eastern front of the Rockies. In fact, it is this very rarity which makes the Franktown Cave collection so valuable.

Unlike the much more common lithic remains from the site, the Franktown Cave baskets, sandals, and cordage provide singular insights into a craft milieu which, based on data from other areas, doubtless played a critical role in the economy of the aboriginal populations who lived in or passed through this region. These remains also indicate by their attributes that Middle Archaic populations occupying the eastern margins of the Plains were deeply involved in a broad spectrum techno-subsistence strategy every bit as fiber-dependent as their predecessors and contemporaries on the other side of the Rockies in the Great Basin and on the Colorado Plateau.

At an altogether different level of abstraction, again unlike the durable artifact suite recovered from Franktown Cave, the plant-fiber inventory provides us with a fleeting glimpse of the handiwork of women, an otherwise nearly invisible part of the aboriginal Archaic and early Formative technological suite in the Greater Denver area.

Overview

The salient aspects of the Franktown Cave plant-fiber artifact assemblage are as follows:

1. The basketry assemblage is dominated by coiling to the total exclusion of twining and plaiting.
2. All coiling is close; no open coiling is present.
3. Despite the small size of the coiled collection (n=5), three different foundation types are represented. All are single element variations (whole rod, bundle, rod in or adjacent to a bundle). No stacked or bunched foundations are represented.

4. Whatever the foundation, all stitches are non-interlocking with both randomly arranged and intentionally stacked stitch manipulations represented.
5. Work surface, where discernable, is concave and work direction is exclusively right-to-left
6. Most specimens appear to be portions of trays or wide-mouthed, steep-sided bowls.
7. With the exception of Type III, none of the vessels appear to be naturally watertight by virtue of the tightness of the weave nor are any pitched to render them impermeable.
8. All of the coiled baskets appear to have been employed in the preparation or consumption of food.
9. None of the specimens is decorated or mended and no data is available on rims, centers, and fag end splice manipulations. Wear patterns are generally undiagnostic.
10. The cordage assemblage is small (n=55), and is dominated by final Z-twist specimens (n=50).
11. The cordage suite probably served a wide variety of binding and lashing functions with some indications of use in snares and nets.
12. The sandal inventory contains a single simple plaited type which employs multiple elements interlaced in a pseudo-twined fashion.
13. Two variants of this basic sandal type exist and probably represent seasonal "styles." A potential "cold season" form has a lining and sock while the "warm season" variety lacks these features.
14. A remarkably narrow range of plant fibers was exploited in the production of the Franktown Cave perishable inventory. *Yucca* sp. leaves were used for coiled stitches,

at least two of the coiled bundle foundations, and all of the sandal plaiting elements. *Salix* sp. wands were used for rigid coiled foundation elements. *Apocynum* sp. and *Asclepias* sp. were used to produce cordage and an unknown species of grass was employed for the remaining coiled bundle foundations and the grass sandal socks.

15. Based on the AMS dates, the Franktown Cave perishable plant-fiber artifact assemblage is minimally ascribed to the Middle Archaic and early Cermaic periods.
16. Despite certain broad congruences to perishable artifact suites in neighboring areas, no clear-cut ties to *any* extant sites, "cultures," or complexes can be established for the Franktown Cave perishable suite.
17. Given the ethnographic association of many plant-fiber related crafts with women, the Franktown Cave collection affords a unique opportunity to engender the prehistory of this part of the eastern Rocky Mountain flanks.

Table 1. Cordage Formula Schematic Diagrams for Types Identified in Cordage from Franktown Cave, by Cordage Type.

Cordage Type	Cordage Formula Schematic Diagram
Type I: Single Ply, S-Twist	S
Type II: Two Ply, S-Spun, Z-Twist	Z^S_S
Type III: Two Ply, Z-Spun, S-Twist	S^Z_Z
Type IV: Compound, Two Ply, S-Spun, Z-Twist	Z^{S^Z_Z}_{S^Z_Z}

Table 2. Provenience and Temporal Ascription of Coiled Basketry Specimens from Franktown Cave, by Specimen Number (Following Mercyhurst Archaeological Institute [MAI] and University of Denver Museum of Anthropology [DUMA] Catalog Numbers).

Specimen Number		Provenience	Age		Temporal/ Cultural Component
MAI Catalog (RLA 20041-)	DUMA Catalog		AMS Assay (Years B.P.)	Calendar Years (A.D./B.C. [cal.])	
Type I: Close Coiling, Whole Rod Foundation, Non-Interlocking Stitch					
103	TOM-1140	C3-LI	4431 ± 36	3328–2921 B.C.	Early-Middle Archaic
Type II: Close Coiling, Bundle Foundation, Non-Interlocking Stitch					
101	TOM-1137	C3-LI	4458 ± 36	3339–2931 B.C.	Early-Middle Archaic
102	TOM-500	B3-LI	4455 ± 35	3337–2929 B.C.	Early-Middle Archaic
104	TOM-452	B3-LI	4028 ± 35	2826–2467 B.C.	Early-Middle Archaic
Type III: Close Coiling, Whole Rod in Bundle or with Lateral Bundle, Non-Interlocking Stitch					
100	TOM-290	B5-LI	1267 ± 31	A.D. 677–860	Early Ceramic

Table 3. Provenience and Temporal Ascription of Cordage Specimens from Franktown Cave, by Specimen Number (Following Mercyhurst Archaeological Institute [MAI] and University of Denver Museum of Anthropology [DUMA] Catalog Numbers).

Specimen Number		DUMA Catalog	Provenience	Age ^a (Calendar Years [cal.])
MAI Catalog (RLA 20041-)				
Type I: Single Ply, S-Twist				
35.1		TOM-5713	—	—
26.1		TOM-456	B3-LI	3337–2467 B.C.
Type II: Two Ply, S-Spun, Z-Twist				
40.1		TOM-3616	—	—
41.1		TOM-348	A3-LI	—
22.1a-b		TOM-481	B3-LI	3337–2467 B.C.
14.1aa-b		TOM-601	B3-L1	3337–2467 B.C.
16.1a-b		TOM-552	B3-LI	3337–2467 B.C.
18.1		TOM-592	B3-LI	3337–2467 B.C.
2.1		TOM-872	B3-LII	—
4.1a-b		TOM-850	B3-LII	—
8.1		TOM-847	B3-LII	—
9.1		TOM-863	B3-LII	—
12.1a-c		TOM-1085	B3	—
11.1		TOM-1088	B3	—
10.1		TOM-865	B3-LII	—
7.1		TOM-856	B3-LII	—
6.1		TOM-878	B3-LII	—
5.1		TOM-857	B3-LII	—
3.1		TOM-1074	B3-LII	—
1.1		TOM-864	B3-LII	—

Table 3 (continued). Provenience and Temporal Ascription of Cordage Specimens from Franktown Cave, by Specimen Number (Following Mercyhurst Archaeological Institute [MAI] and University of Denver Museum of Anthropology [DUMA] Catalog Numbers).

Specimen Number		DUMA Catalog	Provenience	Age ^a (Calendar Years [cal.])
MAI Catalog (RLA 20041-)				
Type II: Two Ply, S-Spun, Z-Twist				
19.1		TOM-575	B3-LI	3337–2467 B.C.
17.1		TOM-590	B3-LI	3337–2467 B.C.
15.1		TOM-553	B3-LI	3337–2467 B.C.
25.1		TOM-473-A	B3-LI	3337–2467 B.C.
25.2		TOM-473-B	B3-LI	3337–2467 B.C.
24.1		TOM-461	B3-LI	3337–2467 B.C.
23.1		TOM-480	B3-LI	3337–2467 B.C.
20.1b		TOM-589	B3-LI	3337–2467 B.C.
21.1		TOM-494	B3-LI	3337–2467 B.C.
21.2		TOM-494	B3-LI	3337–2467 B.C.
33.1		TOM-5712	Surface	—
32.1		TOM-1066	B3-LIII	—
31.1		TOM-1148	C3-LI	3328–2921 B.C.
39.1		TOM-5716	—	—
38.1		TOM-5715	—	—
35.2		TOM-5713	—	—
35.3		TOM-5713	—	—
35.4		TOM-5713	—	—
29.1		TOM-1128	C3-LI	3328–2921 B.C.
30.1		TOM-1147	C3-LI	3328–2921 B.C.

Table 3 (continued). Provenience and Temporal Ascription of Cordage Specimens from Franktown Cave, by Specimen Number (Following Mercyhurst Archaeological Institute [MAI] and University of Denver Museum of Anthropology [DUMA] Catalog Numbers).

Specimen Number		DUMA Catalog	Provenience	Age ^a (Calendar Years [cal.])
MAI Catalog (RLA 20041-)				
Type III: Two Ply, Z-Spun, S-Twist				
20.1a		TOM-589	B3-LI	3337–2467 B.C.
28.1		TOM-1139	C3-LI	3328–2921 B.C.
27.1		TOM-460	B3-LI	3337–2467 B.C.
Type IV: Compound, Two Ply, S-Spun, Z-Twist				
34.1		TOM-2145	Area 3 BD	—
37.1		TOM-5714	—	—
13.1-3		TOM-1087	B3	—
36.1		TOM-3617	—	—
<p>a Ages presented for cordage specimens are derived from coiled basketry samples that have been directly dated and appear to share the same provenience (see Table 2) as some cordage specimens.</p>				

Table 4. Temporal Ascription of Sandal Specimens from Franktown Cave, by Specimen Number (Following University of Denver Museum of Anthropology [DUMA] Catalog Numbers).

DUMA Catalog Specimen Number	Age		Temporal/Cultural Component
	AMS Years (B.P.)	Calendar Years (cal.)	
TOM-501	4485 ± 36	3345–3033 B.C.	Early-Middle Archaic
TOM-858	4392 ± 37	3260–2906 B.C.	Early-Middle Archaic
TOM-509	4492 ± 37	3348–30354 B.C.	Early-Middle Archaic
TOM-546	4465 ± 36	3343–3018 B.C.	Early-Middle Archaic
TOM-462	4363 ± 54	3307–2882 B.C.	Early-Middle Archaic
TOM-588	4328 ± 34	3020–2884 B.C.	Early-Middle Archaic

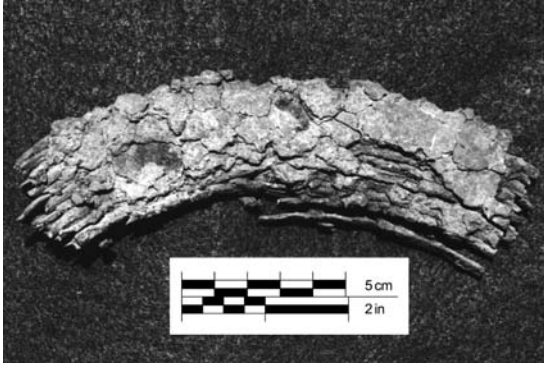


Figure 1

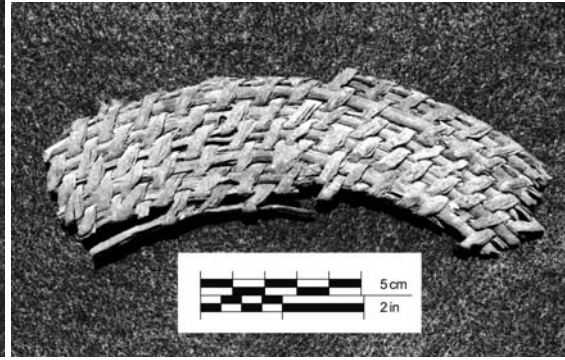


Figure 2

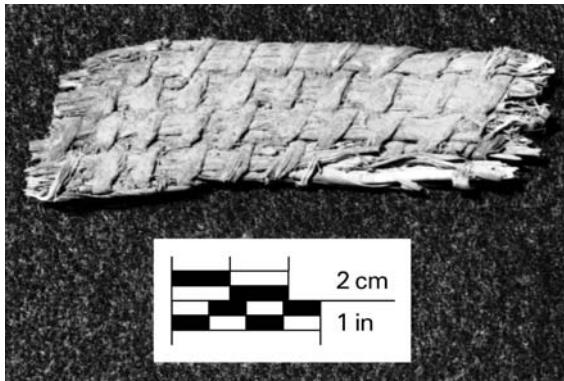


Figure 3

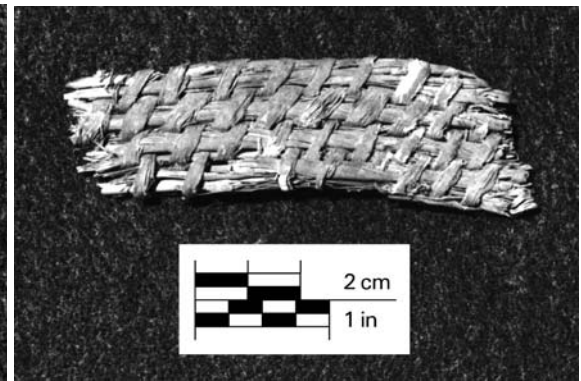


Figure 4

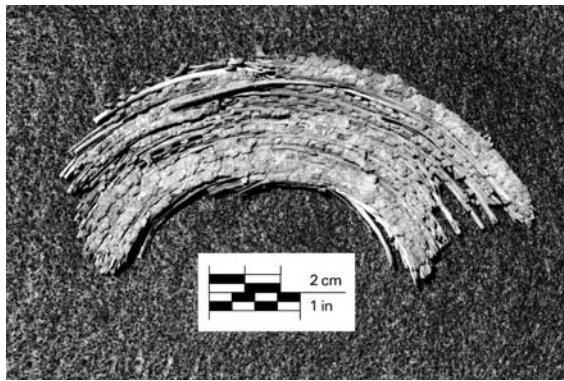


Figure 5

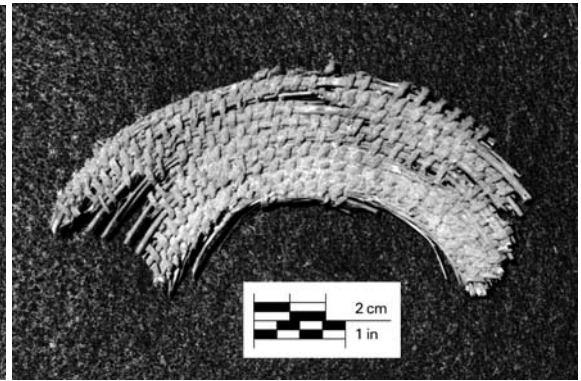


Figure 6

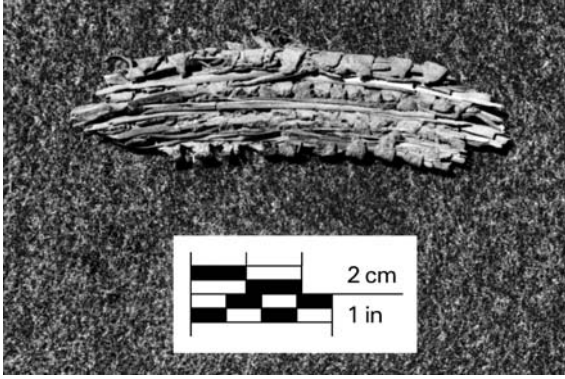


Figure 7

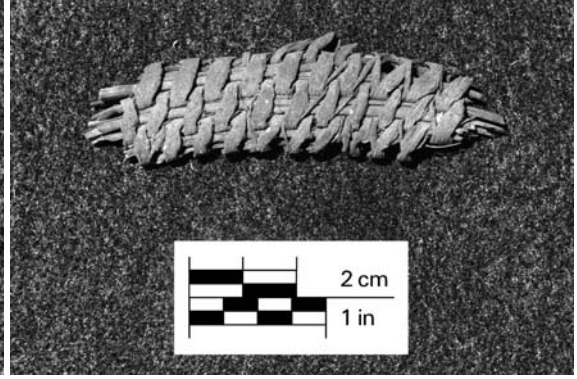


Figure 8

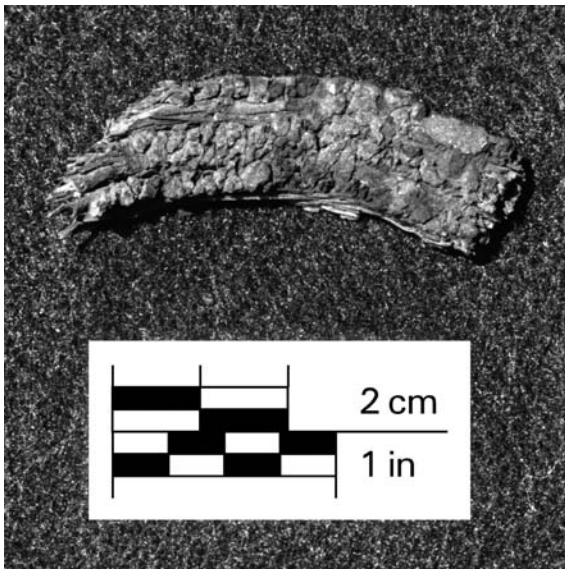


Figure 9

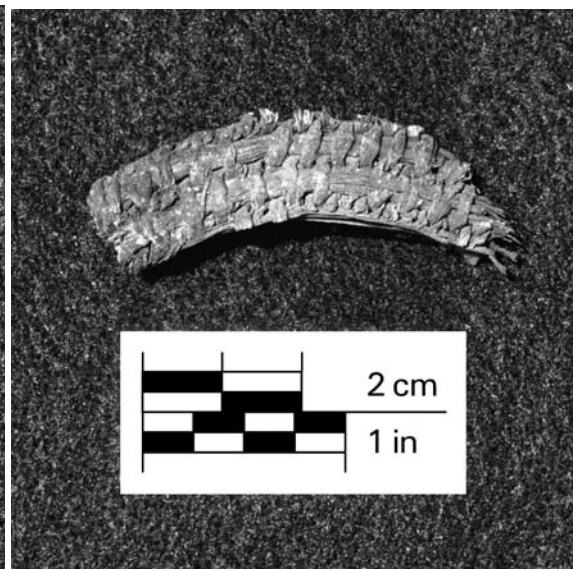


Figure 10

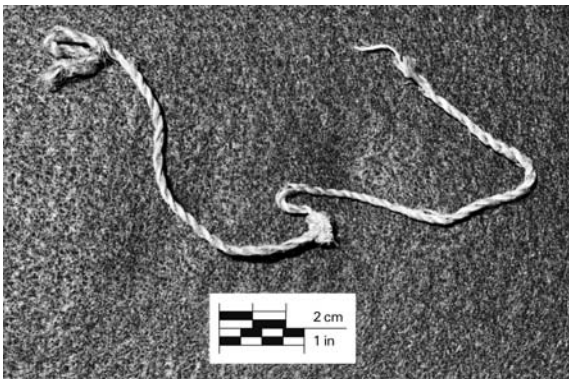


Figure 11

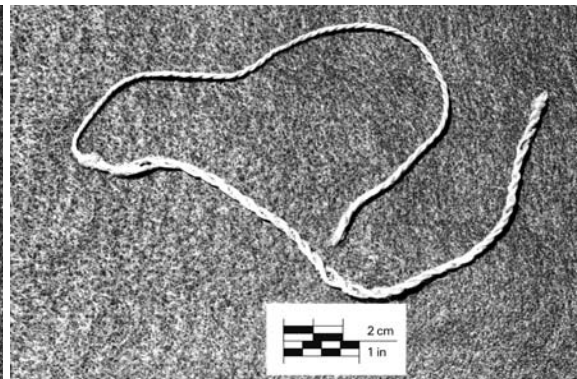


Figure 12

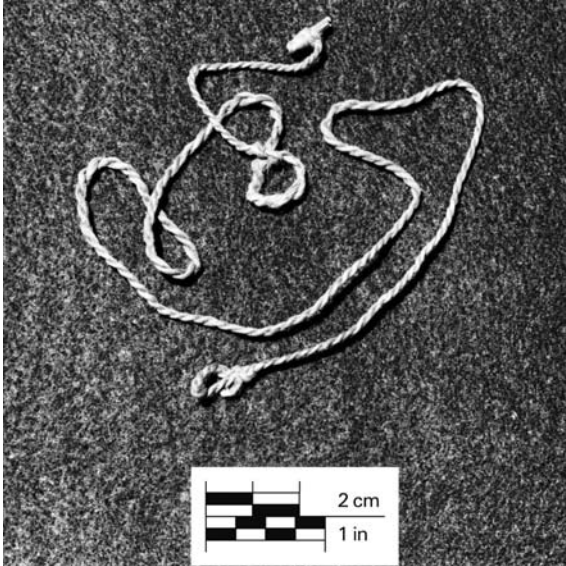


Figure 13

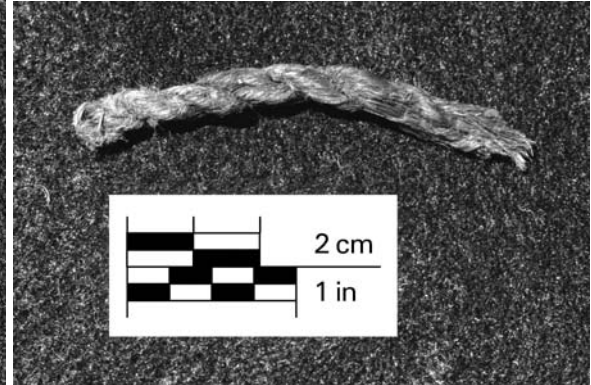


Figure 14

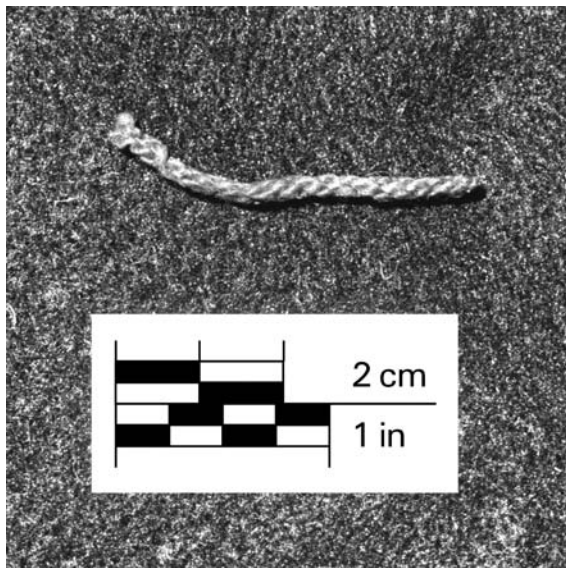


Figure 15

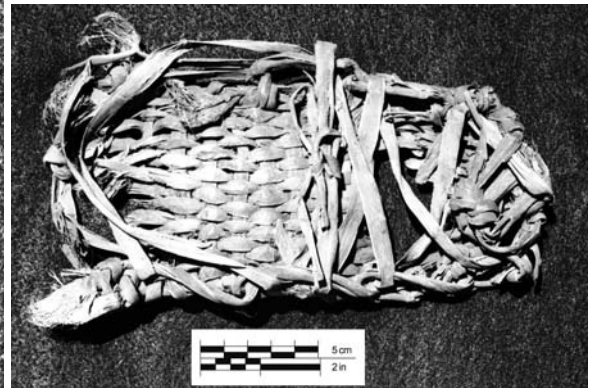


Figure 16



Figure 17

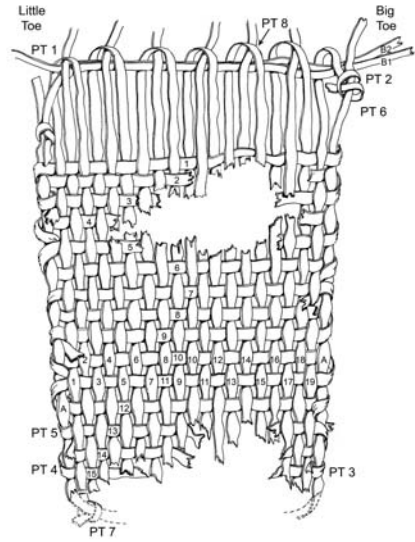


Figure 18

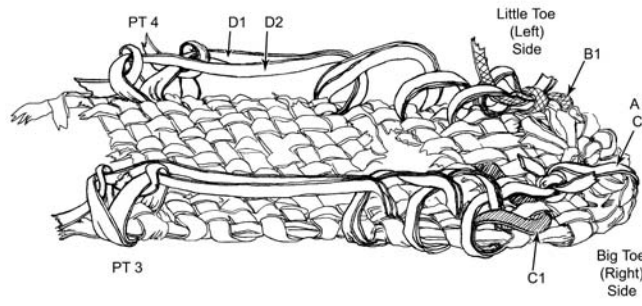


Figure 19

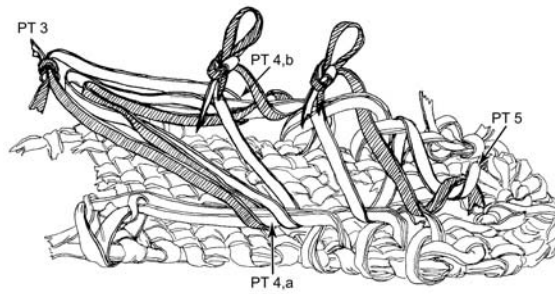


Figure 20



Figure 21

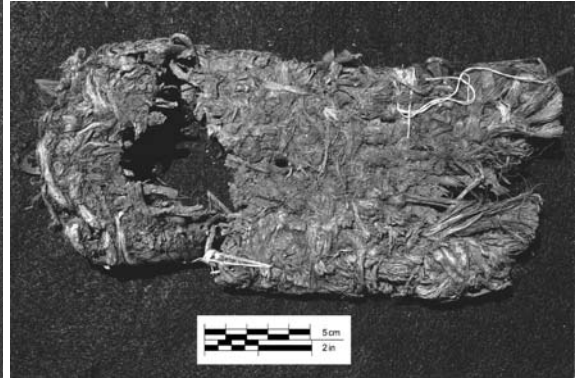


Figure 22

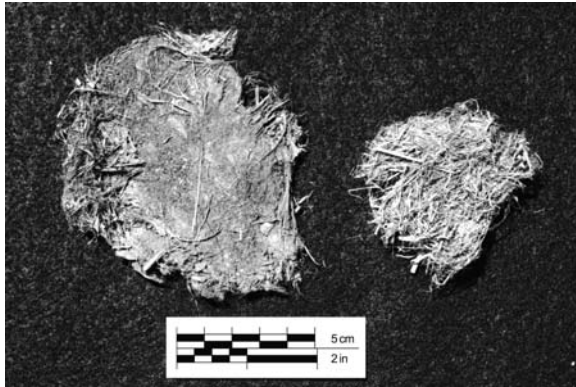


Figure 23

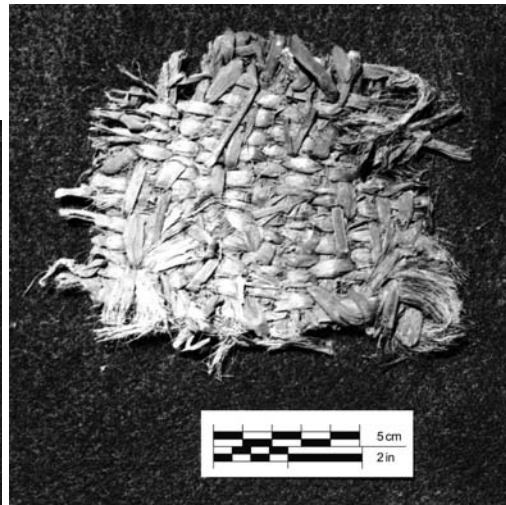


Figure 24

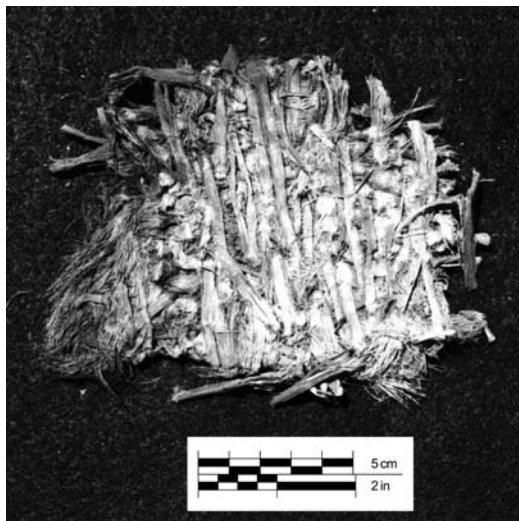


Figure 25

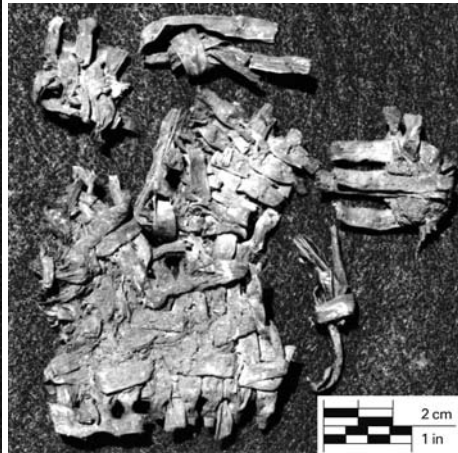


Figure 26



Figure 27



Figure 28

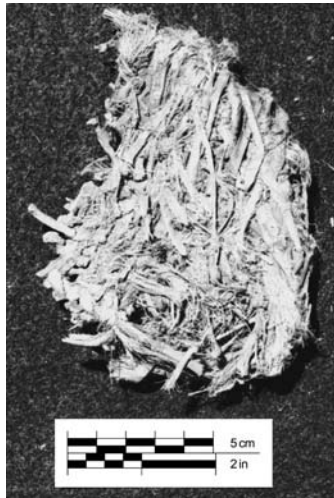


Figure 29



Figure 30



Figure 31
430

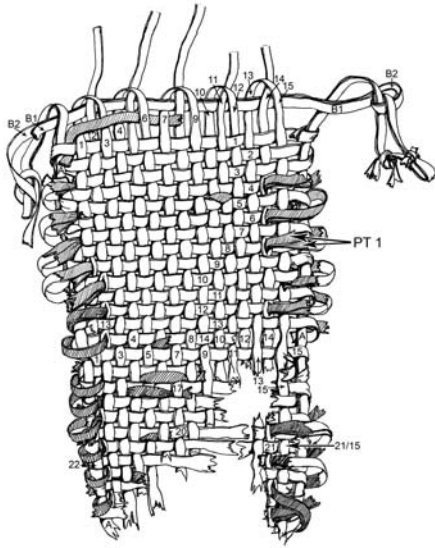


Figure 32

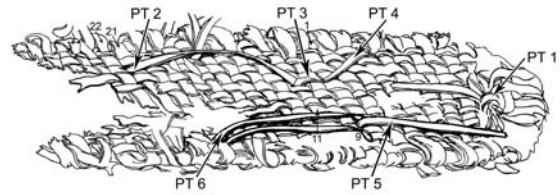


Figure 33

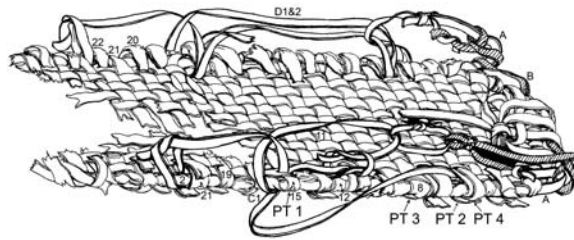


Figure 34

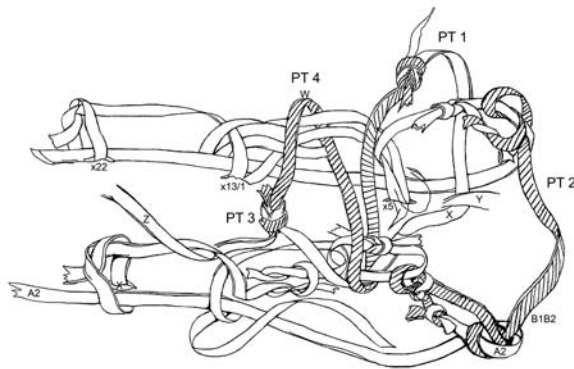


Figure 35

References Cited

Adovasio, J. M.

- 1970 The Origin, Development, and Distribution of Western Archaic Textiles. *Tebiwa* 13:1-40.
- 1972 Notes on the Analysis of Franktown Cave (L:9:31) Baskets. Manuscript on file, Department of Anthropology, University of Denver, Denver, Colorado.
- 1974 Prehistoric North American Basketry. *Nevada State Museum Anthropological Papers* 16:100-145.
- 1977 *Basketry Technology: A Guide to Identification and Analysis*. Aldine Publishing Co., Chicago.
- 1980 The Evolution of Basketry Manufacture in Northeastern Mexico, Lower and Trans-Pecos Texas. In *Early Native Americans: Prehistoric Demography, Economy, and Technology*, edited by David L. Browman, pp. 341-362. Mouton, The Hague.
- 1986 Prehistoric Basketry. In *Great Basin*, edited W. L. d' Azevedo, pp. 194-214. Handbook of North American Indians, vol. 11, W. C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.
- 1999 Basketry from Franktown Cave (L:9:31), Douglas County, Colorado. Manuscript on file, Department of Anthropology, University of Denver, Denver, Colorado, and Department of Anthropology, Mercyhurst College, Erie, Pennsylvania.
- 2005 The Mexican Connection: Another Look at "Perishable" Relationships Between Mexico and Points North. Paper presented at the 70th Annual Meeting of the Society for American Archaeology, Salt Lake City.

Adovasio, J. M., and R. L. Andrews

- 1985 Basketry and Miscellaneous Perishable Artifacts from Walpi Pueblo, Arizona. In *Basketry and Miscellaneous Perishable Artifacts from Walpi Pueblo, Arizona with an Introduction to the Walpi Archaeological Project*, edited by R. C. Carlisle, pp 35-112. Ethnology Monographs 7. Department of Anthropology, University of Pittsburgh, Pittsburgh.

Adovasio, J. M., and J. D. Gunn

- 1986 The Antelope House Basketry Industry. In *Archaeological Investigations at Antelope House*, edited by Don P. Morris, pp. 306-397. National Park Service, United States Department of the Interior, Washington, D.C.

Adovasio, J. M., and D. R. Pedler

- 1994 A Tisket, A Tasket: Looking at the Numic Speakers through the "Lens" of a Basket. In *Across the West: Human Population Movement and the Expansion of the Numic*, edited by D. B. Madsen and D. Rhode, pp. 114-123. The University of Utah Press, Salt Lake City.

- Adovasio, J. M., D. R. Pedler, and J. S. Illingworth
2002 *Fremont Basketry*. Utah Archaeology 15(1):5–25.
- Andrews, R. L., and J. M. Adovasio
1980 *Perishable Industries from Hinds Cave*. Ethnology Monographs 5. Department of Anthropology, University of Pittsburgh, Pittsburgh.
- Andrews, R. L., J. M. Adovasio, and R. C. Carlisle
1986 *Perishable Industries from Dirty Shame Rockshelter, Malheur County, Oregon*. Issued jointly as Ethnology Monographs No. 9 and University of Oregon Anthropological Papers No. 34. Department of Anthropology, University of Pittsburgh, Pittsburgh, and Department of Anthropology, university of Oregon, Eugene.
- Budworth, G.
2003 *The Ultimate Encyclopedia of Knots & Ropework*. Hermes House, London.
- Clements, F. E.
1943 Basketmaker Culture In The Oklahoma Panhandle. In *Geology And Ground Water Resources Of Cimarron County, Oklahoma*, by S.L. Schoff, pp. 122-124. Bulletin No. 64. Oklahoma Geological Survey, Norman.
- Cosgrove, C. B.
1947 *Caves of the Upper Gila and Hueco Areas in New Mexico and Texas*. Papers of the Peabody Museum of American Archaeology and Ethnology Vol. 42. Harvard University, Cambridge.
- Emery, I.
1966 *The Primary Structure of Fabrics*. The Textile Museum, Washington, D.C.
- Haury, C. E.
1982 *The prehistory and paleoenvironment of the Black Mesa Locality, Cimarron County, Oklahoma*. University of Tulsa, Tulsa, Oklahoma.
- Hurley, W. M.
1979 *Prehistoric Cordage: Identification of Impressions on Pottery*. Aldine Publishing Co., Chicago.
- Hyland, D. C., J. M. Adovasio, and J. S. Illingworth
1995 Perishable Industries from Pendejo Cave, New Mexico Paper presented at the 60th Annual Meeting of the Society for American Archaeology, Minneapolis, Minnesota.
2003 The Perishable Artifacts. In *Pendejo Cave*, edited by Richard S. MacNeish and Jane G. Libby, pp. 297-416. University of New Mexico Press, Albuquerque.

- Jennings, J. D.
 1980 *Cowboy Cave*. Anthropological Papers 104. University of Utah Press, Salt Lake City.
- Johnson, W. C., and A. J. Myers
 2004 Population Continuity and Dispersal: Cordage Twist Analysis and the Late Woodland in the Glaciated Allegheny Plateau of Northwestern Pennsylvania. In *Perishable Material Culture in the Northeast*, edited by P. B. Drooker, pp. 87–128. New York State Museum Bulletin 500, Albany.
- Kankainen, K. (editor)
 1995 *Treading in the Past: Sandals of the Anasazi*. University of Utah Press, Salt Lake City.
- Kent, K. P.
 1983 *Prehistoric Textiles of the Southwest*. School of American Research Press, Santa Fe.
- Lindsey, A. J., Jr., J. R. Ambler, M. A. Stein, and P. M. Hobler
 1968 *Survey and Excavations North and East of Navajo Mountain, Utah, 1959-1962*. Bulletin 45, Glen Canyon Series 8. Museum of Northern Arizona, Flagstaff.
- Lintz, C. and L. G. Zabawa
 1984 The Kenton Caves of Western Oklahoma. In *Prehistory of Oklahoma*, edited by R. Bell, pp. 161-174. Academic Press, New York.
- Lopez, D. R. and R. S. Saunders
 1973 Current Lithic Studies In Oklahoma. *Oklahoma Anthropological Society Newsletter* 21(9):1-4.
- McGregor, R.
 1992 *Prehistoric Basketry of the Lower Pecos, Texas*. Monographs in World Archaeology No. 6. Prehistory Press, Madison, Wisconsin.
- Martin, P. S., J. B. Rinaldo, E. Bluhm, H. C., Cutler, and R. Grange, Jr.
 1952 *Mogollon Cultural Continuity and Change; A Stratigraphic Analysis of Tularosa and Cordoba Caves*. Fieldiana: Anthropology, Volume 40:1-227. Field Museum of Natural History, Chicago.
- Morris, E. H., and R. F. Burgh
 1941 *Anasazi Basketry: Basket Maker II Through Pueblo II, A Study Based on Specimens from the San Juan River Country*. Publication No. 533. Carnegie Institution of Washington, Washington, D.C.

- Petersen, J. B., M. J. Heckenberger, and J. A. Wolford
2001 Spin, Twist and Twine: An Ethnoarchaeological Examination of Group Identity in Native Fiber Industries from Greater Amazonia. In *Fleeting Identities: Perishable Material Culture in Archaeological Research*, edited by P. B. Drooker, pp. 226-253. Occasional paper No. 28. Center for Archaeological Investigations, Southern Illinois University, Carbondale.
- Petersen, J. B., and J. A. Wolford
2000 Spin and Twist as Cultural markers: A new England Perspective on Native Fiber Industries. In *Beyond Cloth and Cordage: Archaeological Textile Research in the Americas*, edited by P. B. Drooker and L. D. Webster, pp. 101-118. University of Utah Press, Salt Lake City.
- Saunders, R.S.
1978 *Archeological Resources of Black Mesa State Park, Cimarron County, Oklahoma*. Archeological Resource Survey Report No. 7. Oklahoma Archeological Survey, Norman.
- Tanner, C. L.
1976 *Prehistoric Southwestern Craft Arts*. University of Arizona Press, Tucson.
- Taylor, W. W.
2004 *Sandals from Coahuila Caves*, edited by N. J. Demerath, M. C. Kennedy, and P. J. Watson. Studies in Pre-Columbian Art and Archaeology No. 35. Dumbarton Oaks Research Library and Collection, Washington, D.C.
- Thompson, Gerald M.
1958 An Analysis of Prehistoric Woven Materials from Eastern Colorado. Manuscript on file, Department of Anthropology, University of Denver, Denver, Colorado.