

INFORMATION TO USERS

This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.

**Bell & Howell Information and Learning
300 North Zeeb Road, Ann Arbor, MI 48106-1346 USA**

UMI[®]
800-521-0600

**Settlement Change Documentation and Analysis:
A Case Study from the Mogollon Region
of the American Southwest**

Angela Rae Linse

A dissertation submitted in partial fulfillment of the
requirements for the degree of

Doctor of Philosophy

University of Washington

1999

Program Authorized to Offer Degree: Department of Anthropology

UMI Number: 9952863

**Copyright 1999 by
Linse, Angela Rae**

All rights reserved.

UMI[®]

UMI Microform 9952863

Copyright 2000 by Bell & Howell Information and Learning Company.

**All rights reserved. This microform edition is protected against
unauthorized copying under Title 17, United States Code.**

**Bell & Howell Information and Learning Company
300 North Zeeb Road
P.O. Box 1346
Ann Arbor, MI 48106-1346**

©Copyright 1999

Angela Rae Linse

In presenting this dissertation in partial fulfillment of the requirements for the Doctoral degree at the University of Washington, I agree that the Library shall make its copies freely available for inspection. I further agree that extensive copying of the dissertation is allowable only for scholarly purposes, consistent with "fair use" as prescribed in the U.S. Copyright Law. Requests for copying or reproduction of this dissertation may be referred to Bell and Howell Information and Learning, 300 North Zeeb Road, P.O. Box 1346, Ann Arbor, MI 48106-1346, to whom the author has granted "the right to reproduce and sell (a) copies of the manuscript in microform and/or (b) printed copies of the manuscript made from microform."

Signature Angela R. Jense

Date December 15, 1999

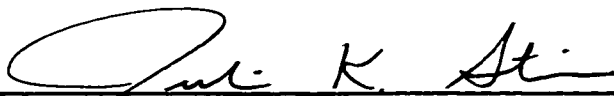
University of Washington
Graduate School

This is to certify that I have examined this copy of a doctoral dissertation by

Angela Rae Linse


and have found that it is complete and satisfactory in all respects,
and that any and all revisions required by the final
examining committee have been made.

Chair of Supervisory Committee:

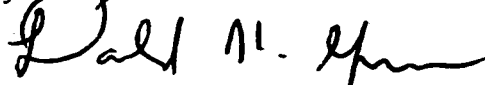


Julie K. Stein

Reading Committee:



Julie K. Stein



Donald K. Grayson



Nicholas R. Chrisman

Date: December 15, 1999

University of Washington

Abstract

Settlement Change Documentation and Analysis:

A Case Study from the Mogollon Region

of the American Southwest

Angela Rae Linse

Chairperson of the Supervisory Committee:

Professor Julie K. Stein
Department of Anthropology

American archaeologists have been interested in changing patterns of prehistoric settlement for more than 50 years. Despite this interest, many settlement patterns remain poorly documented and unexplained. Adherence to the concepts of site and phase restrict the scales at which change is observed and explanations are sought. In this dissertation, I devise an alternative system for chronicling changes in prehistoric settlement. To justify the need for a new approach, I conduct an historical analysis of settlement research in a particular region, part of the Mogollon territory in New Mexico.

The alternative strategy for settlement analysis differs from traditional approaches in three important ways. First, I alter the spatial scale of the unit of observation to the structure, the smallest unit of settlement in the area. Second, I examine data from a large area, which increases the sample size of available data and permits documentation of intraregional settlement variability. Third, I assign age-ranges to structures rather than sites, which improves the chronological resolution and makes possible identification of incremental, gradual, or short-term settlement change.

This system for documenting settlement change permits me to use and make sense of settlement data from disparate sources for over 2000 excavated Mogollon structures. The utility of the approach is demonstrated when I use a portion of the newly compiled database to evaluate one of the most widely accepted settlement patterns in the study area—the abandonment of inaccessible landforms for accessible landforms at around A.D. 550.

I evaluate whether the settlement shift occurred as proposed and investigate variables implicit in the definitions of accessible and inaccessible landforms. Although the settlement pattern is not supported by available data, two other settlement changes occur later in the temporal sequence. Additional analyses show that accessibility is a multivariate that includes relative elevation, distance to water, and possibly additional geomorphic variables.

This research has implications for explanation of settlement changes within the Mogollon region and elsewhere settlement patterns are identified using a phase chronology and site-scale data collection. The approach is applicable in any area with discrete and archaeologically visible units of settlement.

TABLE OF CONTENTS

List of Figures		iv
List of Tables		vii
Chapter 1	Mogollon Settlement Analysis: Introduction.....	1
Chapter 2	Mogollon Culture: Historical and Developmental Analysis.....	16
	Introduction	
	The Mogollon Phase Sequence: A Brief Overview	19
	Mogollon Culture: History	25
	History of Mogollon Research.....	26
	Culture History and the Influence of the "Mogollon Problem"	
	New Conceptions of Mogollon Archaeology	
	The Mogollon Sequence Reviewed and Assessed	34
	Mogollon Culture History Inventories: Sources and Format	
	Case Study: The San Francisco Phase	
	Summary	46
Chapter 3	Mogollon Settlement Patterns: Descriptions and Proposed Explanations.....	48
	Introduction	
	The Significance of Settlement Studies	50
	Mogollon Settlement Reviewed	52
	Settlement Change One: Early Pit Structures.....	53
	Settlement Change Two: Movement from "Isolated" to "Accessible" Landforms	63
	Settlement Change Three: Rounded Pithouses versus Quadrangular Pithouses.....	67
	Settlement Change Four: The Pithouse-to-Pueblo Transition.....	79
	Settlement Change Five: The Shift to Adobe Wall Construction	88
	Summary	91
Chapter 4	Settlement Change: Data Collection and Identification.....	93
	Introduction	
	Settlement Scale.....	96
	Settlement Validity	99
	Sites and Structures	
	Periods, Phases, and Chronometric Dates	

	Settlement Reliability	115
	Spatial Scale	
	Sample Size	
	Comparability	
	Boundary Effects	
	Variables	119
	Identification Variables	121
	Location Variables	125
	Geographic Variables	
	Environmental Variables	
	Chronological Variables	
	Structure Variables	129
	Structure Form	
	Structure Type	
	Structure Materials	
	Reference	135
	Study Area	136
	Summary.....	139
Chapter 5	Mogollon Settlement Change: Pithouse Period Movement from Isolated to Accessible Landforms.....	141
	Introduction	
	Pithouse Period Settlement.....	146
	Inaccessible and Accessible Defined	147
	Settlement Pattern Analysis	150
	Early Pithouse-to-Georgetown Settlement Change?	151
	Unassigned Structures	
	Summary	
	Pithouse Period Landform Variability.....	161
	Comparability of Chronometric and Phase-Dated Samples	
	Defining Accessible and Inaccessible Landforms	177
	Elevation	177
	Relative Elevation	
	Summary: Elevation	
	Distance To Water	200
	Summary: Distance to Water	
	Substrate	207
	Summary: Substrate	
	Landform Aspect	211
	Summary: Aspect	
	Summary and Future Research.....	220
Chapter 6	Summary and Implications	227
	Settlement Change Implications	230
	Implications: Inaccessible and Accessible Structures	
	Implications: Mogollon Settlement	
	Implications: Settlement Change Research	

Bibliography	245
Appendix A: Mogollon Culture History Inventory:	
All Reported Traits	269
Pinelawn/Cumbre Phase (Early Pithouse period).....	270
Georgetown Phase	272
San Francisco Phase	273
Three Circle Phase.....	275
Pithouse-to-Pueblo Transition	277
Mimbres Classic Phase	278
Reserve Phase	279
Tularosa Phase.....	280
Black Mountain/ Animas/El Paso Phase	281
Cliff/Salado Phase	282
Appendix B: Mogollon Culture History Inventory:	
Only Newly Reported Traits	283
Pinelawn/Cumbre Phase (Early Pithouse period).....	284
Georgetown Phase	286
San Francisco Phase	287
Three Circle Phase.....	288
Pithouse-to-Pueblo Transition	290
Mimbres Classic Phase	291
Reserve Phase	292
Tularosa Phase.....	293
Black Mountain/ Animas/El Paso Phase	294
Cliff/Salado Phase	295
References Cited in Appendices A and B	296
Appendix C: Excavated Mogollon Structures Database.....	
Radiocarbon Notes	1224
References.....	1225

LIST OF FIGURES

Number	Page
1.1 Traditional southwestern culture areas (modified from Cordell 1997: 24, Figure 1.7)	2
1.2 New Mexico with the study area in the west-central and southwestern part of the state	10
2.1 San Francisco phase pithouses from Mogollon Village (LA11568); a) House 2, a rectangular domestic pit structure (after Haury 1936a, Figure 6); b) House 5A, a rounded pit structure labeled "ceremonial(?)" (after Haury 1936a: 16 and Figure 5)	43
3.1 Reconstruction of a typical pit structure (after Martin 1940: 86, Figure 39)	55
3.2 Mogollon pithouse reconstructions (after Haury 1936a, Figure 26). The change in pithouse shape from c to b marks the transition from the Georgetown to the San Francisco phase	68
3.3. Superimposed pithouses 142, 143, and 143A and other structures at Cameron Creek Village (Bradfield 1929)	69
3.4 Superimposed pithouses at the Ridout Locus of the Wind Mountain site (LA127260; after Woosley and McIntyre 1996, Figure 4.122)	72
3.5 Pithouse reconstructions; a) pit structure with a radial roof construction pattern (after Martin 1943: 139, Figure 43), b) pit structure with a conical roof construction pattern (modified from Martin 1943: 139, Figure 43)	77
4.1 Study area defined by geodetic coordinates with USGS 7.5 minute topographic quadrangle names	98
4.2 Apache Creek Pueblo, Rooms 1-5. The numbering sequence of Rooms 3, 3A, and 3B exemplifies the way structures with multiple settlements are labeled by archaeologists working in the study area. Redrafted from Martin et al. (1957)	102
4.3 Site occupancy by phase	104
4.4 Structure occupancy by phase	105

4.5	Phase and period age-ranges for excavated structures at the Old Town site (LA1113).....	111
4.6	Chronometric age-ranges for excavated structures at the Mogollon Village site (LA11568).....	113
4.7	Study area with topography and major drainage systems	117
5.1	The age distributions of inaccessible and accessible structures chronometrically dated to the Early Pithouse period.....	163
5.2	Structure frequency by age-range midpoint; located on a) inaccessible landforms, and b) accessible landforms	165
5.3	Structure frequency by phase; located on a) inaccessible landforms, and b) accessible landforms	167
5.4	Percentage of chronometrically dated structures located on inaccessible landforms, grouped by age range midpoint	171
5.5	Percentage of structures located on inaccessible landforms; a) chronometrically dated structures grouped, by age range midpoint, into phase-equivalent time periods, and b) structures grouped by phase	172
5.6	Elevation frequency for structures with chronometric dates; a) inaccessible landforms, and b) accessible landforms	180
5.7	Elevation frequency for phase-dated structures; a) inaccessible landforms, and b) accessible landforms.....	181
5.8	Landforms occupied during the Pithouse period with excavated structures	186
5.9	Landforms occupied during the Pithouse period sites with excavated structures situated on terraces or benches.....	188
5.10	Elevation as a function of latitude for terraces and benches in the Mimbres valley with excavated structures dating to the Pithouse period.....	189
5.11	Histogram of residuals from regressing elevation on latitude for landforms occupied during the Pithouse period in the Mimbres River drainage.....	193

5.12	Boxplots of residuals from regressing elevation on latitude for occupied landforms in the Mimbres River valley.....	195
5.13	Latitude by elevation for all occupied landforms in the Mimbres valley with excavated structures dating to the Pithouse period	196
5.14	Regressions of elevation on latitude for inaccessible and accessible landforms in the Mimbres valley	198
5.15	Distance to water for the a) chronometric sample, and b) phase-dated sample	202
5.16	Landform orientation of chronometrically dated structures; a) inaccessible landforms, and b) accessible landforms	213
5.17	Landform orientation of phase-dated structures; a) inaccessible landforms, and b) accessible landforms.....	214
5.18	Distribution of landform orientation for the chronometric sample by 100-year increments.....	216
5.19	Distribution of landform orientation for the chronometric sample by phase-equivalent increments.....	217
5.20	Distribution of landform orientation for the phase-dated sample	219

LIST OF TABLES

Number	Page
2.1	21
2.2	37
2.3	41–42
3.1	61
4.1	106–108
4.2	123–124
4.3	138
5.1	148
5.2	153
5.3	155
5.4	157
5.5	160

5.6	Chi-square test of independence between landform class and age using the chronometric sample divided into a) 100-year increments, and b) phase-equivalent temporal categories	169
5.7	Chi-square test of independence between landform class and age using the phase-dated sample	174
5.8	Chi-square test to determine whether the proportion of observations that fall into each age class are the same for the chronometric and phase-dates samples; a) accessible structures and b) inaccessible structures.....	176
5.9	Elevation statistics for chronometric and phase-dated samples.....	179
5.10	Chi-square test of independence between landform class and elevation using the chronometric sample.....	183
5.11	Chi-square test of independence between landform class and elevation using the phase-dated sample.....	184
5.12	Mimbres valley regression of elevation on latitude. Analysis of variance (ANOVA) testing the significance of the regression	192
5.13	Results of Kruskal-Wallis tests for temporal changes in distance to water	203
5.14	Dunn multiple comparison test of distance to water for paired temporal classes; a) chronometric sample divided into 100-year increments, b) chronometric sample divided into phase-equivalent classes, and c) phase-dated sample	205
5.15	Substrate frequencies for Pithouse period structures.....	209
5.16	Chi-square results for the tests of independence between substrate and age; a) three substrate categories (alluvium, colluvium, and volcanic), b) two substrate categories (alluvium and other).....	210

ACKNOWLEDGEMENTS

I would like to thank the members of my committee, Dr. Julie Stein, Dr. Donald Grayson, and Dr. Karl Hutterer for their sage counsel and constructive criticism on my research, my reasoning, and this dissertation. Don helped me to strengthen my reasoning and clarify my arguments. Karl provided crucial commentary and context for larger issues of settlement pattern research. Dr. Nicholas Chrisman deserves special thanks for agreeing to be on my reading committee as well as serving as my graduate faculty representative. Nick gave more time and attention than I could have expected and he helped me to see my research in a larger cross-disciplinary perspective. Thank you for asking the hard questions.

I am, of course, most indebted to Julie for her unfailing support throughout my graduate career. Julie saw the possibilities for me and helped me to turn them into reality. I have always known that I was fortunate to have her as a research advisor, but the more I learn, the more grateful I am. She has taught me about far more than archaeology—she has been my advisor, teacher, mentor, and colleague. She pushed and provoked me when my motivation flagged, but because she took the time to know me, she also knew when to give me the freedom and encouragement to develop my own ideas. Because of her mentoring, I have learned what it means to be a professional and to make strides in developing my own philosophy of advising, mentoring, and teaching. If not for your respect and your perception, I would surely not be where I am today. We did it!

Julie also has my profound thanks for introducing me to my other mentor, Dr. Kathleen Noble. Kate's wisdom and encouragement got me through the most difficult part of this life-long learning journey. She helped me hone my observational and perceptive skills to the point that my view of the world is irrevocably altered (and thank goodness)! With Kate and Julie as champions, anything seems possible. Their unfailing enthusiasm, knowledge, and support have been more influential than they will ever know.

My next big thank you goes to the archaeologists in my writing guild, Lisa Nagaoka, Fran Hamilton, Susan Hughes, Betsy Scharf, Larkin Hood, and Kris Bovy. Lisa ("our leader") had the insight to activate the guild and was its first success. Although she has gone on to join the professoriate, she continues to influence and amaze the rest of us. Fran has been an inspiration to me for many years and deserves thanks for pointing out how important the guild has been for all of us to recognize and acknowledge our strengths and successes. Susan, Betsy, Kris, and Larkin each gave me endless advice and support—they kept asking those difficult questions until I came up with answers! I simply cannot thank you enough to listening, challenging, and valuing me and my contributions.

I owe Dr. Raymond Mauldin a debt of gratitude for the countless stimulating email and phone conversations. What a relief it was to talk to him about the intricacies of Mogollon archaeology! Raymond has impeccable timing. He showed up at just the right time—the first time and the most recent. Raymond helped make this process fun and exciting, particularly at the point when it would have become tedious. I thought about asking him to type this dissertation, but figured it was just too much to ask after he answered every last

question, gave me endless feedback on numerous drafts, and listened, listened, listened.

Of course, many other archaeologists have also helped and influenced me. I particularly want to thank Dr. Patricia Gilman. Pat provided unpublished data from her manuscript on the Mimbres Foundation excavations at the Mattocks site. But more importantly, she shared with me her view that no one is “just a grad student.” I have adopted her perspective that grads are also professionals with skills—knowing that helped me get through these last long years of hard work. Cherie Scheick deserves my thanks for always challenging me to expand my perspectives and for being a great role model. I also want to thank Michael Etnier and Mike Cannon for always being there to talk about archaeology or anything else. Dr. Emily Silverman, quantitative ecologist and teacher extraordinaire, also has my thanks for her friendship, conversations, and for answering every last statistical question I put to her! Vance Holliday deserves special thanks for all of his encouragement and advice. Kari Schmidt and Steve Swanson, who began their archaeology careers on my field school, have given me many reasons for pride and helped me more than they know.

For the past few years I have been fortunate to find myself working with an amazing group of people at the UW Center for Instructional Development and Research and the Graduate School. I tell people that when I first started working at CIDR, I felt like I was walking around with one of those cartoon “idea” lightbulbs over my head! They have all taught me so very much about teaching and learning. In particular, they taught me the true meaning of collaboration and life-long learning. Through my work at CIDR, I was able to take advantage of a wonderful opportunity to work with Elizabeth Feetham,

Associate Dean of the Graduate School. I have already learned so much from Betty that I can only imagine what I will be able to accomplish after working with her for the next year. Thank you Betty, for the many times you simply said "just get it done."

Finally, but most importantly, I want to thank my family for their unwavering support and love. Not one of them ever asked me why on earth I would want to spend so many years striving for such a singular goal! I realize how lucky I am to have a family that is so proud of me. My parents, Carole and David, taught me to value education and knowledge. My grandparents, Clarence and Lydia Johnson, introduced me to the wonders of the natural world. My sisters Jo and Susanna, brother John and his family, Carole Ann and Gabriella, and aunt Stephanie—they all helped give me balance and perspective, even in the last intense throes of the dissertation.

To my grandmother

Lydia Pauline Johnson

and the women of her generation who
helped create new opportunities for the women of future generations.

Chapter 1

MOGOLLON SETTLEMENT ANALYSIS:

INTRODUCTION

The archaeological literature of the Southwest of the United States is astonishingly unproductive on the general problem of settlement patterns and interpretations of settlement data in cultural terms. (Haury 1956:3)

In the more than 40 years since Haury wrote these words, archaeologists working throughout the American Southwest have been productive in accumulating data about prehistoric settlement. In the Mogollon region, however, Haury's statement still strikes a chord in the 1990s. Although a number of settlement shifts have been identified in the occupational history of the region, they have not received a great deal of attention from archaeologists working in the area.

The Mogollon territory is one of four major subdivisions of the American Southwest (Figure 1.1). The Mogollon territory includes the mountainous area south of the Colorado Plateau, as well as the northernmost reaches of the Chihuahuan Desert. The other archaeological subdivisions of the southwest are the Anasazi, the Hohokam, and the Patayan. The Anasazi territory is located in the northern Southwest, on the Colorado Plateau and in the southern Rocky Mountains. The Hohokam area is located in the Sonoran

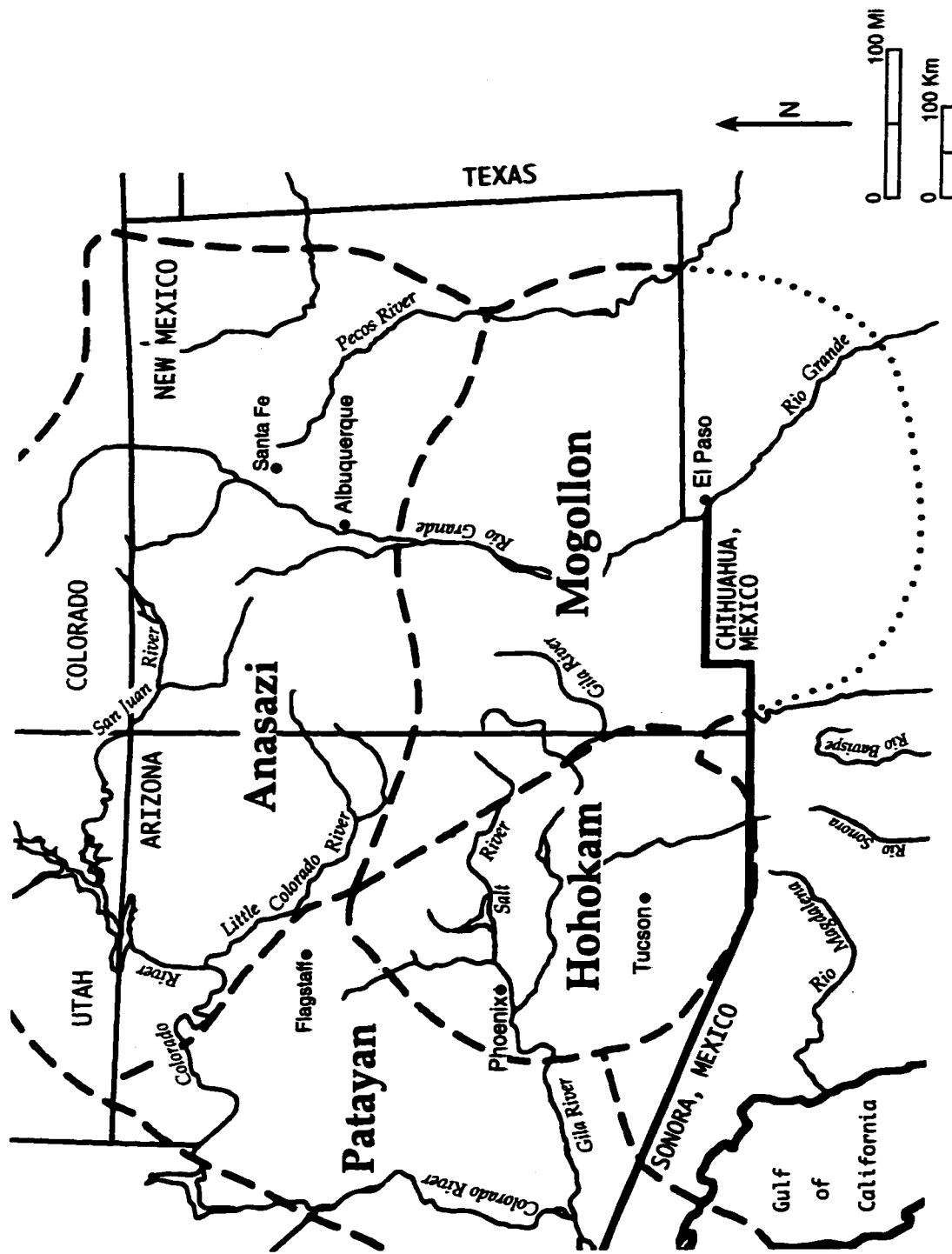


Figure 1.1 Traditional southwestern culture areas (modified from Cordell 1997: 24, Figure 1.7).

Desert of southern Arizona south of the Colorado Plateau. The Patayan territory is relatively poorly defined, but is centered on the Colorado River valley of western Arizona and far eastern California. As originally defined, each area was considered to reflect the territory of different prehistoric people with a shared culture. Today, these areas are used as geographic units that reflect the distribution of archaeological materials with similar characteristics. They are distinguished based primarily on differences in prehistoric ceramics and architecture (Cordell 1997).

In the late 1920s, the archaeological material of the American Southwest was classified under a single system originally referred to as Basketmaker-Pueblo. This sequence was formalized at the Pecos Conference convened by one of the founders of Southwest archaeology Alfred V. Kidder (1927). The Basketmaker-Pueblo chronological sequence is referred to as the Pecos Classification and is now used only in the Anasazi territory. In 1931, archaeologists from the Gila Pueblo Archaeological Foundation proposed the Hohokam as a separate entity (Gladwin and Gladwin 1933, 1934, 1935; cf. Woodbury 1993). The Gladwins (1934, 1935) mention the Mogollon Branch, but do not present it as a separate culture. Kidder defined the term Anasazi to refer to "non-Hohokam" material (Kidder 1936: 589-590). At that time, he does not recognize a separate Mogollon territory and considers the Little Colorado, Upper Gila, and Mimbres valleys (all of which are now included in

the Mogollon territory) as part of the Anasazi pueblo range (Kidder 1936: 593-594).

In the same year that Kidder named the Anasazi, Emil Haury formally defined the Mogollon cultural tradition (Haury 1936a). The Mogollon culture was defined based on Haury's excavations at Harris Village (LA1867) in the Mimbres River valley and Mogollon Village (LA11568) along the San Francisco River. Haury and Russell Hastings found these two sites in 1931 during a survey of west-central New Mexico sponsored by the Gila Pueblo Foundation for the purpose of defining the eastern boundary of the Hohokam area (Haury 1936a).

Haury identified a number of characteristics that set the archaeological material of the Mogollon area apart from the Anasazi to the north and the Hohokam to the east. Early Mogollon ceramic assemblages are characterized by polished brownware, polished and slipped redware, and brownware with red painted designs. In contrast, Hohokam ceramics were known to be red-on-buff painted pottery, while Anasazi ceramics are graywares. Early Mogollon architecture, although similar to early Anasazi architecture, lacked attributes characteristic in the latter such as deflectors, ventilator shafts, sipapus, and partition walls (Haury 1936a). Later, Haury (1986: 453) suggests that the most distinguishing Mogollon characteristic is "a preference for a mountain habitat." Subsequent research documented the occurrence of

Mogollon archaeological traits, particularly brownware ceramics, over a broad region (Haury 1986).

The Mogollon area currently extends south from the Mogollon Rim of the Colorado Plateau and the Little Colorado River in eastern Arizona into northern Chihuahua, Mexico. In New Mexico, the northern boundary is more diffuse than in Arizona. The boundary begins approximately around the town of Quemado, ranging through the mountainous Mogollon Highlands, and southward into the Chihuahuan Desert of Mexico. Material classified as Mogollon extends an unknown distance into Mexico (Cordell 1997). The territory reaches eastward from the San Simon area of southwestern Arizona, past the Rio Grande, and into west Texas. The area east of the Rio Grande, in New Mexico, west Texas, and northern Chihuahua is referred to as the Jornada Mogollon (Lehmer 1948).

MOGOLLON SETTLEMENT RESEARCH

Research on prehistoric Mogollon settlement has only recently reached a critical convergence of data, technology, and archaeologists. I suggest that there are reasons why settlement change has not been a conspicuous focus for archaeologists working in the Mogollon territory. First, until recently, analytic technology served to restrict the scale of settlement research. The available technology limited the size of databases that could be managed by archaeologists. Thus, most research was restricted to relatively small areas, short time spans, and/or a limited number of variables (Benson and Upham

1986). Analytic and data storage technology have developed to a point where analysis of a large database covering 1000 years of prehistory and more than 24,000 square kilometers is now feasible.

A second factor that may have constrained research on Mogollon settlement is the number of archaeology projects the area. For many years, the number of archaeologists working on Mogollon prehistory was small relative to those working in the Anasazi and Hohokam archaeological territories. I suggest that that the range of questions has been limited, to some extent, by the number of archaeologists specializing in the Mogollon region. A small number of archaeologists can research a finite number of questions and sponsor just so many graduate student projects. Mogollon research is now in its fourth and fifth generations of archaeologists¹, and the variety of questions has expanded accordingly. Earlier generations accumulated sufficient data that the current generation now have the luxury to reassess earlier conclusions.

Interestingly, although modern archaeological research has increased the level of detail and expanded the Mogollon database, these data have had limited influence on interpretations of Mogollon settlement change. This situation is understandable given that the culture history framework was

¹ The Cosgroves, Bradfield, Nesbitt, and their contemporaries comprise the first generation of Mogollon archaeologists. Haury, Martin and their colleagues make up the second, while the Mimbres Foundation, Fitting and his students, and those involved in the NAN Ranch projects are the third generation. Their students, my contemporaries, are the fourth.

developed to define differences and address questions of relatedness and origins, not to address issues of settlement change. Much of the research conducted since Haury's initial identification of a Mogollon culture history sequence has understandably focused on filling gaps in the sequence, not on reassessing it.

Settlement Change Research

The most important aspect of the research presented in this dissertation is that it emphasizes the effects of scale on archaeological interpretations. In particular, this research highlights the impact that changing the scale of data collection, and the scale of the classificatory framework, has on perceptions of settlement patterns and settlement change. As in many areas with an extant culture history classification, Mogollon settlement changes are recorded at the boundaries between temporal phases using data at the spatial scale of the archaeological site. Although modern research questions differ from those asked by culture historians, the analytic scales are rarely questioned or modified.

The data collection framework used here demonstrates that the account of settlement in an area can be altered significantly by changing the scale of observation from the site to a smaller unit of space. Limiting the unit of analysis to the archaeological site determines which patterns are observable and which explanations may be considered. Processes that result in settlement changes for portions of sites can neither be documented nor

explained. Only settlement processes that affect the occupation of whole sites can be recorded and interpreted. Although settlement changes that occur across a large area may be observed in data recorded at the site scale, explanations for such patterns are still restricted to processes that affect the occupation of entire sites.

The shift in scale to a smaller unit of analysis also permits change to be observed at a different temporal resolution. When sites are divided into smaller spatial units, they are also more easily divided into shorter occupational age ranges. In most areas where sites are the focus of research, the classificatory framework is typically a culture history phase sequence (or an analogous system). Phase-based chronological systems divide the archaeological record into blocks of time, often several hundred years, each of which is associated with lists of characteristic traits. Sites that have been extensively occupied are typically associated with a lengthy period of settlement that spans more than one phase.

Improvement of the temporal resolution changes the shape of the distribution of settlement through time. In a phase-based system, all change is condensed into the lines that separate the phases, making obtrusive change inevitable. The analyses conducted here demonstrate that dependence on a phase-based system distorts the distribution of settlement change by allowing it only at phase boundaries. Use of smaller time intervals permits

recognition of incremental change rather than limiting change to simple differences between lengthy time periods.

The Current Study

The goal of my research is to understand prehistoric settlement in a portion of the central Mogollon territory (Figure 1.2). This region includes areas where some of the most extensive and intensive Mogollon archaeological research has been conducted. The study area is large enough to encompass much of the topographic and environmental variability in the larger Mogollon territory. The area is located entirely within New Mexico to preclude logistical complications that would arise from incompatible state databases as well as avoiding the difficulty of obtaining data from excavations conducted in northern Mexico. However, the research is structured so that data from these sources may eventually be incorporated.

I define settlement in terms of the natural and artificial environments in which people live. A natural environment is settled when people arrive and create an artificial environment. This artificial environment is created when people construct or modify the environment in which they live.

The geomorphology, climate, and ecology of a locale condition the natural environment. In general, people do not live completely exposed to the elements of the natural environment. They typically occupy some form of shelter, which is defined as "something that provides cover and protection" (*American Heritage Dictionary*, 3rd ed., s.v.). All attributes of

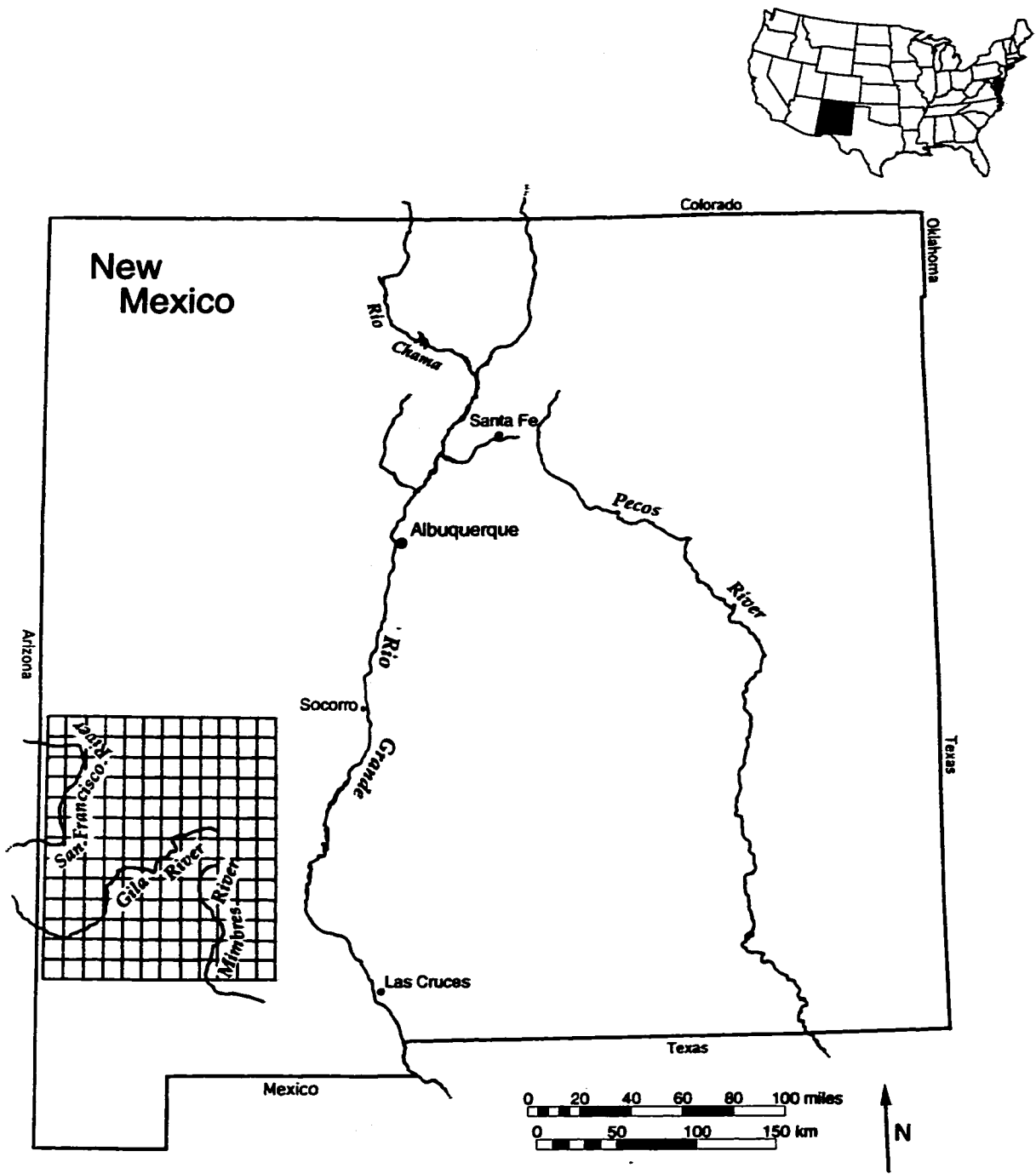


Figure 1.2 New Mexico with the study area in west-central and southwestern part of the state; the area is $1^{\circ} 37.5'$ latitude by $1^{\circ} 30'$ longitude and is divided into 156 grid units each $7.5'$ on a side.

shelters that are constructed or modified are part of the artificial environment.

People create an artificial environment by modifying a natural shelter (e.g. cliff dwelling) or by wholly constructing a shelter. All constructed shelters are "structures," defined as anything "made up of parts put together in a particular way" (*American Heritage Dictionary*, 3rd ed., s.v.). Here, I restrict the definition of structures to include only shelters constructed by people (e.g. masonry rooms, pithouses, and tents). This definition does not necessarily exclude culturally modified caves and rockshelters, but some alterations of natural shelters may be difficult to identify in the archaeological record.

The artificial environment within a structure is similar, but not identical, to the surrounding area. Therefore, structures and the enclosed environment are the primary mediating factor between people and the natural environment. Any alteration in the location, form, materials, or construction methods of a shelter or a structure constitutes a settlement change.

OVERVIEW AND ORGANIZATION

Understanding the historical context of previous Mogollon research and the data that previous researchers have accumulated is a crucial first step in my investigation of Mogollon settlement change. My evaluation and

reassessment of Mogollon settlement is dependent upon current perspectives of Mogollon culture history and the data upon which it is based.

This dissertation is divided into six chapters. Chapter 2 provides a historical analysis of the development of the Mogollon culture history sequence and evaluates its reliability for studying settlement patterns. My evaluation is based on an analysis of the empirical foundations for the Mogollon phase sequence. It begins with a brief overview of the Mogollon phase sequence that serves as a framework for the remainder of the chapter.

I next review the history of archaeological research, with a specific focus on the research conducted in the culture history and culture process eras of Mogollon archaeology. This review provides an historical context for a developmental analysis of the current conceptions of Mogollon culture history phases. The developmental analysis is accomplished through the compilation of cultural inventories of the traits archaeologists have used to define each phase. Most synopses of Mogollon culture history are in a narrative form, which sometimes makes the empirical bases of each phase difficult to discern. The inventories included in this dissertation provide similar information in a concise, but extensive form.

The cultural inventories are unique because they include, in a single document, trait lists for each of ten phases of the Pithouse and Pueblo periods used in the study area instead of including only a limited time range or subregional temporal sequence. They are also unique because the

publications from which the trait lists were compiled span more than five decades of research in the Mogollon territory. Finally, and perhaps most importantly, the inventories provide a historiography of the Mogollon sequence that documents the evolution of each phase by listing, separately and in chronological order, the traits identified by individual authors.

Chapter 3 focuses on the five major settlement patterns identified by culture historians. I discuss each settlement pattern in four parts, beginning with a definition of each settlement pattern. I then review the explanations proposed for each pattern and discuss related current research on the topic. Next, I identify the challenges and problems facing investigators of each settlement pattern. And finally, I make suggestions for future research on the settlement changes.

In Chapter 4, I present my approach to the investigation of settlement change and describe a method for creating a comprehensive database that can be used to evaluate previously identified settlement patterns. In the first part of the chapter, I identify issues of settlement validity and reliability and propose a number of changes in data collection procedures that help resolve these issues. I specify the structure (typically individual pithouses or pueblo rooms), rather than the site, as the primary unit of observation. The large size of the study area helps to resolve the problems of the small sample size and spatial variability that have impeded earlier investigations of Mogollon settlement change. In the final section of Chapter 4, I identify a series of

settlement variables and describe how the data were collected for all excavated structures in the study area.

The framework presented in Chapter 4 has significance for the way we use extant archaeological data. The framework used here integrates data from different sources and offers a way to make sense of cumulative data.

Although the data was gathered by archaeologists with different theoretical perspectives and some of it is considered out-of-date, it is far from useless. I argue that reorganization and reanalysis of previously collected data can provide new insights on the prehistory of a region.

This kind of archival meta-analysis may prompt others to conduct research using previously collected archaeological data; meta-analysis is a method for combining information from independent studies to evaluate previous explanations or form a foundation for new research. Reanalysis of curated collections is accepted as original research, but meta-analysis in archaeology is still relatively rare. This kind of research will become more important with the continued escalation of the rate at which the archaeological record is being destroyed. Increased destruction puts pressure on the archaeological community to develop methods of analysis that preserve what remains.

Chapter 5 serves as a case study of how the alternative approach to settlement analysis presented in Chapter 4 can be applied to a particular settlement pattern. In this chapter, I reevaluate one of the most widely

accepted settlement patterns in the Mogollon territory, the proposed shift from isolated to accessible landforms. I investigate two primary aspects of this settlement change. First, I investigate whether the shift from isolated to accessible locales occurs as specified at the boundary between the Early Pithouse period and the Georgetown phase. I ask whether the data show that the change occurs, and if so, does it occur at around A.D. 550? The results of my analyses indicate that although a settlement change occurs, the nature and timing of the change do not agree with the pattern as originally proposed. Based on those results, I proceed to the second part of my investigation, the definition of accessible and inaccessible landforms. I suggest that many settlement change analyses are confounded by settlement criteria presented as attributes of a single, simple variable, when they are in fact attributes of composite variables. I suggest that the accessible and inaccessible categories reflect attributes of a number of different geomorphic variables and I evaluate those variables individually to determine whether their attributes change through time.

Chapter 6 provides a summary of my research and analyses. I conclude the chapter with a discussion of the significance of my research at different research scales. I first discuss the implications for the specific settlement pattern. I then discuss how my work could affect future research into the other settlement patterns identified in the study area. Finally, I discuss the implications for investigation of prehistoric settlement change in other areas.

Chapter 2

MOGOLLON CULTURE:

HISTORICAL AND DEVELOPMENTAL ANALYSIS

Before the settlement patterns for any area may be plotted from archaeological evidence, three things must be done: (1) the area must be surveyed intensively to locate the majority of the sites; (2) some sites must be excavated; and (3) the chronological framework of the area must be outlined. (Bluhm 1960: 538)

INTRODUCTION

The two primary goals of this chapter are an historical review of Mogollon archaeology and a developmental analysis of the Mogollon archaeological sequence. Review of how the Mogollon culture history sequence developed is important because modern archaeological views of settlement change continue to be conceptualized within the traditional culture history sequence. I begin with a brief introductory overview of the traditional phase sequence for the sole purpose of providing a simple chronological framework within which the historical review and developmental analysis are conducted.

The purpose of the historical analysis is to show that the traits diagnostic of the Mogollon were selected to differentiate the area from the Anasazi and Hohokam. I suggest that those traits are not necessarily

appropriate for describing Mogollon settlement. The historical review is divided into two sections that reflect the two research perspectives most influential on the evolution of the Mogollon sequence: culture history and new archaeology. I find that the development of the Mogollon sequence was influenced as much by historical contingency, in terms of the archaeological personae and the timing of their publications, as by the archaeological data.

In the developmental analysis, I evaluate the empirical basis for the culture history sequence, and consequently, the foundations of most interpretations of Mogollon settlement. The purpose of this analysis is to demonstrate that the Mogollon sequence is based on limited archaeological data and has changed relatively little despite decades of additional research. I propose that the small sample size and lack of change has hindered explanation of identified settlement patterns and I argue that a new approach is needed to resolve questions about Mogollon settlement change.

One outcome of the developmental analysis is an extensive inventory of the data on which Mogollon culture history is founded (Appendix A). The inventory is a compilation of diagnostic phase traits identified by prominent archaeologists working in the study area. The chronological order of their publications is maintained in the inventory to show how the culture history sequence in use today developed primarily from archaeological excavations conducted early in the 20th century.

Although many narrative accounts of Mogollon culture history exist, this culture history inventory is unique because the data in it are presented concisely and in a format that is comparable for each of ten traditional phases. Appendix A lists all of the traits identified as diagnostic by the authors. Appendix B includes only those traits that are newly identified by each author; traits previously identified by other archaeologists and repeated in later publications are eliminated from the inventory. Appendix B was compiled to reveal the extent to which phases are the reservoirs of cumulative archaeological knowledge they are perceived to be.

I use the San Francisco phase as a case study, which exemplifies the trends seen for all phases in the sequence, rather than use the inventories as the basis for a narrative account of the entire Mogollon culture history sequence. The trends of phase formation include definitions based on a small number of sites, descriptions that remain static after their initial definition, and settlement patterns that remain unexplained. New, and sometimes contradictory, data have had little effect on the current phase definitions and settlement patterns. Instead, new data appear to be shaped to fit the established culture history framework.

THE MOGOLLON PHASE SEQUENCE: A Brief Overview

It is apparent that many archaeologists have been trying to oversimplify the problem. Just as every human being differs from every other, so every house will vary from every other in some of its details... Recognizing this fact, it remains a useful procedure to attempt a simplified organization of the data into some sort of workable order. (Danson 1957: 80)

Archaeologists working in the Mogollon region use a traditional culture history phase sequence to identify and classify materials. Most archaeologists divide the sequence into five periods, each of which is associated with one or more phases. These periods are the Paleoindian, Archaic, Early Pithouse, Late Pithouse, and Pueblo. As Lekson notes, however, "culture history, or historiography, in southwestern New Mexico begins with the Early Pit House period" (Lekson 1992a: 59). The level of detail for the Pithouse and Pueblo periods far exceeds that of the Paleoindian and Archaic periods in the study area. In the following paragraphs, I briefly describe the five periods and the phases of each.

The Paleoindian and Archaic periods have received relatively little attention from archaeologists working in the Mogollon territory of New Mexico. In fact, no Paleoindian sites have been excavated in the study area and I do not consider this period further.

The Archaic period is subdivided into the Early, Middle, and Late Archaic. Seven sites with materials that date to the Archaic, or that appear to pre-date the occurrence of ceramics, have been excavated in the study area.

The most renowned and best documented of these Archaic sites is Bat Cave (LA4935; Dick 1965; Wills 1988, 1989) and the immediately adjacent North Shelter (LA44182; Wills 1988). Martin and his colleagues' work at Tularosa (LA4427) and Cordova Caves (Martin et al. 1952) is also well known, but the documentation is difficult to interpret because the complex stratigraphy of the caves was excavated in arbitrary levels. A similar situation holds for Fitting's excavations at the Cave of the Ollas (LA88762; Fitting et al. 1972).

Documentation is also scarce for Fitting's Eaton (LA34800; Fitting 1973a; Hemphill 1983) and Winn Canyon (LA34813; Fitting 1973b) sites. Although the available data for these sites are recorded in the database, I do not discuss them further in this dissertation.

As noted earlier, the documentation for the latest periods far exceeds that available for the early periods. Archaeologists generally agree on the sequence of phases in the Pithouse and Pueblo periods, although they disagree over the placement of some phase boundaries (Table 2.1). Note that some of the phases overlap in time, but apply to different parts of the region. For example, Reserve and Classic Mimbres are roughly equivalent in chronological terms, but have different spatial distributions. The following abbreviated descriptions of pithouse and pueblo phases are based on more detailed data contained in Appendix A; how the appendix was constructed is discussed later in this chapter.

Table 2.1 Select Mogollon chronological sequences.

Date	Lekson (1992)	Anyon et. al (1981, LeBlanc (1980)	Bullard (1962)	Danson (1957)	Wheat (1955)	Martin et al. (1952)	Haury (1936a)
A.D. 1400	Animas & Salado ¹	Cliff (Salado)		PIV			
A.D. 1300	El Paso (Blk. Mtn.) ²	Black Mountain (Animas)		PIII (Mimbres & Tularosa)	Mogollon 5	Tularosa	
A.D. 1200	Tularosa ³			Pueblo II (Mangas & Reserve)		Reserve	Mimbres
A.D. 1100	Mimbres Classic Reserve	Mimbres Classic		Pueblo I (Three Circle & San Francisco)	Mogollon 4	Three Circle	Three Circle
A.D. 1000	Mangas	Three Circle	Three Circle				
A.D. 800	Late Pithouse	San Francisco	San Francisco		Mogollon 3 (Three Circle)	San Francisco	San Francisco
A.D. 700		Georgetown	Georgetown Pine Lawn (Mimbres Pine Lawn area)	Pre-Pueblo I (Georgetown & Pinelawn)		Georgetown	Georgetown
A.D. 600	Early Pithouse	Cumbre			Mogollon 2 (San Lorenzo)		
A.D. 500							
A.D. 400							
A.D. 300							
A.D. 200	Late Archaic				Mogollon 1 (Georgetown & Pine Lawn)	Pine Lawn	
A.D. 100							
A.D. 0							
100 B.C.							
200 B.C.							

¹ Animas and Salado (Cliff) are probably contemporaneous, both beginning in the AD 1300s (Lekson 1992: 89-90).

² El Paso (Black Mountain), AD 1200-1400, but lacking Gila Polychrome, it should date to early part of the range, AD 1200-1300 (Lekson 1992:89).

³ Tularosa phase, late AD 1100s-1300s, (Lekson 1992:92).

The Early Pithouse period is associated with two different phase names, each of which has a distinct spatial distribution and includes the entire period. In the northern part of the study area, the Early Pithouse period is referred to as the Pinelawn (or Pine Lawn) phase (Martin 1940, 1943; Martin and Rinaldo 1947). In the southern part of the region, specifically in the Mimbres River valley, the Early Pithouse period is referred to as the Cumbre phase (LeBlanc 1986). Throughout the remainder of this dissertation, I use only the period designation. The distinguishing traits of the Early Pithouse period are its rounded pit structures and plain brownware pottery. Early Pithouse sites appear to be preferentially situated on hilltops, mesas, and other high, steep-sided landforms.

The Late Pithouse period is divided into three phases, Georgetown, San Francisco, and Three Circle, that are generally viewed as consecutive (see Table 2.1). Some archaeologists consider that the Georgetown phase is the southern equivalent of the Pinelawn phase in the northern part of the study area (e.g. Bullard 1962; Danson 1957). The Georgetown phase is marked by the first appearance of San Francisco Red, a polished and slipped redware pottery. Georgetown pit structures are rounded, as in the Early Pithouse period, but they appear to be located on landforms such as benches and terraces considered accessible relative to earlier site locations.

San Francisco phase pit structures are quadrangular with rounded corners and situated on the same accessible landforms as Georgetown

structures. San Francisco phase structures are associated with the first painted ceramics, most notably, Mogollon Red-on-Brown and Mimbres Boldface Black-on-White (also referred to as Mimbres Style I B/w).

The Three Circle phase is characterized by sharp-cornered quadrangular pit structures, again, located on accessible benches and terraces. Sites assigned to this phase are typically associated with Three Circle Red-on-White, Mimbres Boldface Black-on-White, and Mimbres Transitional Black-on-White (also called Mimbres Style II B/w) pottery.

Throughout the study area, the Pueblo period is distinguished by the first appearance of surface masonry architecture, typically quadrangular rooms or clusters of rooms whose floors are not excavated below the ground surface. Pueblo period phase names differ in the northern and southern parts of the study area. In the north, the Pueblo period is divided into the Reserve and Tularosa phases (see Table 2.1); both characterized by cobble and adobe masonry structures and black-on-white ceramics of the same name. Reserve sites are typically small, generally with fewer than 15 contiguous rooms. Tularosa sites tend to be much larger, sometimes with hundreds of rooms and multiple roomblocks (clusters of contiguous rooms).

In the southern part of the study area, the Pueblo period is divided into, at most, the Mangas, Classic Mimbres, Black Mountain (or Animas, or El Paso), and Cliff (or Salado) phases. Archaeologists strongly disagree on the status of the Mangas phase (also referred to as the Early Mimbres phase or

Transitional phase). Some archaeologists consider this phase to be the earliest manifestation of surface architecture (small, ≤ 10 room pueblos; Cosgrove and Cosgrove 1932; Danson 1957; Lekson 1988, 1990, 1999), while others argue that the phase does not exist (LeBlanc 1986; LeBlanc and Whalen 1980; Minnis 1980). Mangas phase sites are typified by Mimbres Transitional (Style II) Black-on-White ceramics.

The Classic Mimbres phase is characterized by large multiroom cobble masonry and adobe pueblos associated with Mimbres Classic Black-on-White pottery (also referred to as Mimbres Style III B/w). Classic B/w is probably best known for the anthropomorphic and zoomorphic figurines painted on bowl interiors, although geometric designs are also common for this pottery type.

In the southern part of the study area, the "post-Classic" era is divided into two phases, Black Mountain and Cliff (Anyon and LeBlanc 1984, Nelson and LeBlanc 1986). When LeBlanc first defined the Black Mountain phase, he considered it the Mimbres valley manifestation of the Animas phase, which is the term assigned to late pueblos in the Animas valley south of the southwest corner of the study area. Animas phase sites appear to post-date the Mimbres Classic, although the phase is poorly dated (LeBlanc 1980b). Adobe pueblos and Chihuahuan polychrome pottery characterize these sites (DeAtley 1980; DeAtley and Findlow 1982). No sites of the Animas phase are identified in the study area. Lekson (1992a) suggests that the Black Mountain

phase is most similar to the El Paso phase, a designation used in the southern Rio Grande and Jornada Mogollon areas, to the east and southeast of the study area; the El Paso phase is also characterized by adobe pueblos and Chihuahuan pottery.

The Cliff phase is generally inferred to be a southwestern New Mexico manifestation of the southern Arizona Salado, although different meaning is assigned to the term "Salado" throughout the large area where Salado ceramics are found (cf. Nelson and LeBlanc 1986). Adobe-walled pueblos also typify Cliff/Salado sites, but these sites are associated with Gila, Pinto, and Tonto polychrome pottery.

MOGOLLON CULTURE: HISTORY

We cannot fully interpret the narratives of Southwest prehistory without knowing the historical context in which they were produced. (Reid 1990: 318)

In most archaeological regions, the traditional culture history provides the principal foundation for subsequent research, particularly in chronological terms. Although a culture history chronology is not a required first step, culture historical research is probably the most common source of basic chronological information about a region. If the chronological sequence is reliable, then other, more complex questions may be asked about the processes responsible for formation of the archaeological record in an area. In the Mogollon region, the culture history sequence not only serves as the

principal chronological tool, it is also the primary source for questions about settlement change.

As typically depicted, culture historians collect data to build an account of the sequence and distribution of cultural events in prehistory. They use chronological and spatial variables to differentiate culture areas through time and across space (Trigger 1989; Willey and Phillips 1958; Willey and Sabloff 1980). In culture historical research, differences are most commonly explained by reference to the processes of diffusion, migration, and independent invention.

HISTORY OF MOGOLLON RESEARCH

In this section, I briefly review the history of Mogollon archaeology in the study area. The review is divided into two sections that reflect the different goals of culture historians and processual archaeologists.

Archaeologists have been working in the Mogollon area since the late 1800s. Hough's work near Luna, New Mexico is included in some of the earliest publications about the area (Hough 1907, 1914). Although widely cited, Hough's archaeology had relatively little impact on the development of the Mogollon culture history sequence. The best known of the early archaeological work is probably that of Burt and Hattie Cosgrove who excavated at the Swarts site (LA1691) in the Mimbres River valley from 1924 to 1927 (Cosgrove and Cosgrove 1932). The excavations at the Galaz site (LA635) in 1927 by the Southwest Museum of Los Angeles (Bryan 1927a,

1927b, 1931a, 1931b, 1931c; Cosgrove and Felts 1927) and by the University of Minnesota (Jenks 1928a, 1928b) from 1929-1931 spread interest in Mogollon Mimbres archaeology well beyond the bounds of the Southwest. Other early Mimbres archaeology includes Nesbitt's work at the Mattocks Ruin (LA676; Nesbitt 1931) and Bradfield's excavations at Cameron Creek (LA190; Bradfield 1931) and the Three Circle Ranch (LA53; Everett 1992). Bradfield died soon after completing the report of his work at LA190 and his work at LA53 remained unpublished for more than 60 years (Everett 1992).

Given that these are some of the earliest large scale excavation projects conducted in the area, the reports are understandably limited in scope and not regionally synthetic. These early excavations were conducted at large cobble and adobe pueblo sites with dozens of rooms, and from which spectacular collections of Mimbres Black-on-White pottery were recovered for museum display. Although earlier structures underlay these pueblos, differences from early Anasazi structures were not emphasized in the excavation reports (LeBlanc 1992). Not until the Gila Pueblo Archaeological Foundation published Haury's (1936a) treatise on Mogollon Culture did the area receive much attention from the archaeological community.

Culture History and the Influence of the "Mogollon Problem"

The Mogollon appears to be an illegitimate whose paternity is still under scrutiny. (Judd 1940: 433)

Mogollon culture was an undeveloped, unsophisticated, unalloyed, unvarnished, homespun kind of culture with no striking or dramatic features. The general Mogollon cultural pattern was unadorned and lowly and based on almost minimal requirements. (Martin 1943: 124)

The statements above reflect that controversy accompanied Haury's publication and the inception of the Culture History era in the Mogollon territory. Haury faced strong resistance to his conception of the Mogollon as a culture area distinct from, and of equal status to, the Anasazi and Hohokam traditions (Diafuku 1952; Judd 1940; Martin 1954; Martin and Rinaldo 1954; Reed 1950; Rinaldo 1941; Wendorf 1956; cf. Reid 1986). The debate over the status of the Mogollon, soon dubbed the "Mogollon problem" (Martin 1940: 10), was so contentious that Wormington (1947: 148) likens interpreting Mogollon Culture to "dealing with a time bomb."

Disagreements were centered on classification and chronology (Rinaldo 1941), which reflect the theoretical perspectives about how and why cultures change. Following the lead of Alfred Kidder (1924), most southwestern archaeologists considered the area with the most highly developed and characteristic traits to be the center of dispersion and the location of the source population. At the time, the San Juan River valley was perceived to have the most abundant, sophisticated, and ancient traits, therefore it was considered the heartland of Southwest and Puebloan culture (Kidder 1924). The

Mogollon area was included in the sphere of Anasazi diffusion because the known material conformed to the northern puebloan pattern, contiguous rectangular masonry structures and Black-on-White and corrugated pottery.

Proponents of elevating the Mogollon Branch (Gladwin and Gladwin 1933, 1934) to a higher taxonomic level argued that distinctly Mogollon material (e.g. brownware pottery) might predate the earliest evidence for Anasazi influence in the area. Reid (1989: 65) suggests that some archaeologists were "annoyed by the suggestion that the Mogollon possessed ceramics earlier than their own Anasazi."

Initially, Haury (1936a) had little data to support his suggestion that the Georgetown phase predated A.D. 800. The matter became more complicated when Martin (1940) proposed that the SU site, which had only plain brownware ceramics, dated to A.D. 500 or earlier, before Haury's Georgetown phase. By the mid-1940s supporters had used the presence of Anasazi ceramics on Mogollon sites, and vice-versa, to demonstrate that the Pinelawn and Georgetown phases predated Anasazi puebloan material.

Again, my purpose in discussing the Mogollon Problem is to note that early data collection efforts were heavily focused on legitimizing (or challenging) the Mogollon concept. Mogollon traits were selected because they helped to differentiate Mogollon material from other regions of the Southwest. Given this focus, the chronology and interphase differences of the sequence received less attention than they might have in an undisputed

culture area. The question of Mogollon "paternity" (Judd 1940: 433) diverted attention away from building a detailed description of intraregional chronological and spatial artifact distributions.

Authors of early synthetic publications for the Mogollon area (e.g. Haury 1936a; Wheat 1955; Danson 1957) use a traditional framework of phases, which implies that the traits discussed are spatially homogeneous and chronologically significant (cf. Willey and Phillips 1958). The traits appear to be spatially significant on a pan-Southwest scale because they serve to distinguish the Mogollon from Anasazi and Hohokam areas. However, they may not have been good intraregional chronological markers.

Chronological data are limited for many parts of the Mogollon culture history sequence and some of the primary differences between phases are poorly documented. For example, the ages of the earliest formal pit structures and the earliest surface structures are still ambiguous (Lekson 1992a). Archaeologists also disagree about the timing and distribution of the early painted wares. Mogollon R/b, Three Circle R/w, Mimbres Boldface (Style I) B/w, Transitional (Style II) B/w, and Mimbres Classic (Style III) B/w may represent an evolutionary sequence of ceramic development (LeBlanc 1982a) or the earliest three types may be contemporary (Lekson 1992a).

Disagreement over Haury's (1936a) Mogollon Concept continued into the 1950s, but as the number of Mogollon research projects decreased, the animosity of the disagreements also diminished. Haury and Martin both

shifted to work on research projects in Arizona during the 1950s. The primary excavations in the southern reaches of the territory soon became those of looters destroying Mimbres sites to obtain burial ceramics (Lekson 1992a).

Professional archaeological data collection did continue on a reduced scale in some areas, but with a different purpose. The Museum of New Mexico began its Highway Salvage Archaeology program in the late 1950s. The program recorded and excavated a large number of sites along major roadways around the towns of Glenwood, Reserve, Luna, and Apache Creek (Wendorf 1954, 1957, 1963; Peckham 1957, 1958, 1963; Peckham et al. 1956). In the late 1960s and early 1970s, the Laboratory of Anthropology conducted additional highway salvage projects near Apache Creek, Cliff, and Gila Cliff Dwellings National Monument (Bussey 1972, 1975; Hammack 1966; Hammack et al. 1966; Ice 1968). Temporally, these salvage archaeology projects mark the transition from the culture history era to the New Archaeology. The sites were excavated using traditional methods, but the analyses were conducted by archaeologists influenced by changes in the impetus for archaeological work and by changes in the theoretical perspectives of the discipline.

New Conceptions of Mogollon Archaeology

The Mogollon Cultural tradition is still not accepted as an independent entity by all researchers in the area, and even its advocates must admit that it is not well defined and dated, particularly in its earlier stages. (Fitting 1973b: 70)

Although the Mogollon concept was no longer debated in the literature after the advent of the New Archaeology in the 1960s, the comments above show that the Mogollon Problem and the associated difficulties with the Mogollon chronology were never resolved. Nonetheless, the foundation laid by culture historians was comprehensive enough for archaeologists to shift from asking questions of origin and difference to asking questions of process. Archaeologists began to ask about the processes responsible for creation of the archaeological record, with the attendant goal of understanding variability in the record.

The focus on variability prompted archaeologists to look beyond single-site excavation projects. For the first time, archaeologists attempted to assess the distribution of different kinds of sites over large areas using survey techniques (e.g. University of Michigan Mimbres Area Survey [Lekson 1992a]; Fitting 1972; Graybill 1973; Herrington 1979; LeBlanc 1976; Mimbres Foundation 1978). Prior to this time, surveys were relatively haphazard (e.g. Arnold 1943) and/or covered a limited area. For example, Danson (1957) generally limited his survey to river valleys and tributary drainages.

Some of the most significant research of this era was conducted by Mimbres Foundation archaeologists (Anyon and LeBlanc 1984; LeBlanc 1975,

1976, 1977, 1983; Nelson and LeBlanc 1986; LeBlanc and Whalen 1980). The Mimbres Foundation sample-surveyed a large part of the Mimbres Valley and excavated at 14 sites of varying ages and kinds (LeBlanc and Whalen 1980). Although the work of the Foundation ceased by the early 1980s, its research program continues to influence the direction and scope of Mimbres area research (e.g. Gilman 1990; Nelson 1999).

Also significant are the excavations and surveys of the Texas A & M University NAN Ranch Project. The project conducted a long-term excavation of the NAN Ranch Ruin (LA2465), which provides a wealth of data about how Mimbres Classic sites were constructed and used. NAN Project archaeologists also conducted surveys and excavations in the surrounding area (Creel n.d.; Funk 1983; Shafer 1991).

The University of Texas at Austin and the Texas Archaeological Research Laboratory have sponsored a number of long-term projects in the study area. Neely and his students have worked at the WS Ranch site (LA3099) and in other parts of the middle San Francisco River valley (Accola 1981; Peterson 1988). Creel (1992, 1997) has obtained valuable data from the Old Town Ruin (LA1113), a site severely disturbed by looters.

Fitting directed a number of excavations in the Gila River valley around the towns of Cliff, Gila, and Riverside and in the Big Burro Mountains (Fitting 1971, 1972, 1973b, 1973c; Fitting et al. 1972; Baker 1971; Burns 1972; Lekson and Klinger 1973). Research projects continue to be

conducted in the study area (Duncan et al. 1991; Gilman et al. 1991; Linse 1997; Roth and Bettison 1992). However, since the 1970s the vast majority of archaeological research has been prompted by road construction and other kinds of development (cf. ARMS, Laboratory of Anthropology, Santa Fe).

THE MOGOLLON SEQUENCE REVIEWED AND ASSESSED

There is a general and understandable tendency for each investigator to interpret defined phases so as to fit his data. This suggests that phase assignment is an art, not a science. ...Such variation in interpretation is, in numerous ways, all to the good of archeology, but it is necessary to understand the nature of various assessments in order to describe the general evolution of the Mogollon culture pattern. (Wheat 1955: 12)

The purpose of the succeeding historical analysis is to determine the empirical basis for the primary settlement patterns identified in the Mogollon culture history sequence. This analysis is based on an extensive, but concise, inventory of culture history data from the study area for the phases of the Pithouse and Pueblo periods described in the first section of this chapter; the trait data are listed by phase in Appendix A. I do not provide a summary of the culture history in this chapter because narrative accounts tend to obscure the details of interest here and that are most visible in the form of trait lists (see Lekson [1992a] for a recent narrative synopsis of Mogollon culture history).

I begin this section with a description of the sources for the data in the Mogollon culture history inventory (Appendix A). I then describe the process by which a more concise inventory, Appendix B, was extracted from

Appendix A. Appendix B presents a more accurate view of how the sequence developed because it includes only original descriptions and eliminates repetitions derived from earlier publications.

The final section of this chapter uses a case study approach to exemplify the development of the Mogollon phase sequence. Although the details and timing differ across phases, each phase in the sequence develops in a similar manner. I chronicle the history of the San Francisco phase from its original definition by Haury (1936a) through the addition of traits and refinement of details by subsequent researchers.

Mogollon Culture History Inventories: Sources and Format

The data included in the culture history inventories (Appendices A and B) derive from a series of publications written by influential archaeologists that worked or continue to work in the study area. The publications from which I draw these data include: Haury (1936a), Martin and his colleagues (Martin 1940, 1943; Martin and Rinaldo 1947, 1950a, 1950b; Martin et al. 1949; Martin et al. 1957; Martin et al. 1957); Wheat (1954, 1955); Danson (1957); Bluhm (1957, 1960); Bullard (1962); Fitting and his students (Fitting 1972; Lekson and Klinger 1972); the Mimbres Foundation (Anyon 1980; Anyon et al. 1981; Anyon and LeBlanc 1984; Gilman 1980; LeBlanc 1975, 1976, 1977, 1980a, 1980b; Nelson and LeBlanc 1986); and Lekson (1992a).

These publications were chosen because they provide syntheses of data for particular phases, they are widely cited in the literature, or they have

shaped current conceptions of Mogollon prehistory. Some of the publications meet all of these criteria, while others are included because they represent a particular time period or subregion. For example, Fitting's (1972) interpretations are not widely accepted, but his work in the Gila River valley is critical because it is a large research project conducted in the southern part of the study area, but outside the Mimbres valley. Most of the authors describe only a few of the phases (e.g. Haury [1936a] and Wheat [1955] limit their descriptions to the Pithouse period), but together the publications represent the history of archaeology for the study area. Some of the publications include information about other parts of the Mogollon region (e.g. Wheat 1955; Bullard 1962), but in these inventories I include only data about the study area.

Twenty-seven excavated sites in the study area form the foundation for the original phase definitions in the Mogollon sequence (Table 2.2). These sites provided the initial data used by the researchers to define the traditional phases. Many of these sites also contain structures assigned to other phases, but in Table 2.2 the sites are listed only for those phases whose initial definitions were based on material from the sites. This is not an exhaustive list of excavated sites in the study area; see Appendix C for a more complete listing of excavated structures and associated references that contain descriptive data. More than 77% of the sites listed in Table 2.2 were excavated prior to 1955. This indicates that the phase sequence in use today was defined

Table 2.2 Excavated sites in the study area with data used in original phase definitions; some of these sites also contain structures assigned to other phases, but those structures were not used to define the phase (see Appendix C for publications with excavation data).

Phase	Site Names (LA numbers)	Year(s) Excavated
Salado/Cliff	Disert (LA15021)	1978
	Janss (LA12077)	1974-1975
	Stailey (LA18939)	1975-1976
Animas/ Black Mountain/El Paso	Galaz (LA634)	1975-1976
	Walsh (LA15044)	1976-1977
	Montoya (LA15075)	1976-1977
Tularosa	Higgins Flat (LA8682)	1953-1954
	Apache Creek (LA2949)	1954
	Valley View (LA3271)	1954
Reserve	Oak Springs (LA9725)	1947
	Wet Legget (no LA number)	1949
	Three Pines (LA43788)	1949
	South Leggett (LA9706)	1949
	Sawmill (LA9657)	1951-1952, 1954
	Starkweather (LA38624)	1935-1936
Mimbres Classic	Treasure Hill (LA16241)	1919-1923
	Cameron Creek (LA190)	1923
	Swarts (LA1691)	1924-1927
	Galaz (LA635)	1927, 1929-1931
	Mattocks (LA676)	1929-1930
Three Circle	Luna Village (LA45507)	1916
	Harris Village (LA1867)	1931
	Mogollon Village (LA11568)	1934
	Starkweather (LA38624)	1935-1936
	Wheatley Ridge (LA4424)	1939
	Twin Bridges (LA9726)	1947
	Turkey Foot Ridge (LA9709)	1947-1948
San Francisco	Harris Village (LA1867)	1931
	Mogollon Village (LA11568)	1934
	Starkweather (LA38624)	1935-1936
	Turkey Foot Ridge (LA9709)	1948
Georgetown	Harris Village (LA1867)	1931
	Starkweather (LA38624)	1935-1936
	Turkey Foot Ridge (LA9709)	1948
Pinelawn/ Cumbre	SU (LA56433)	1939, 1941, 1946
	Promontory (LA9713)	1947

more than 40 years ago and that data from relatively few sites have produced a substantial change in the sequence.

To trace development of the phase sequence more accurately, I derive a second inventory (Appendix B) from my original. Most of the cells in the phase tables of Appendix A are filled because later authors cite data from earlier publications. Of course, this is a perfectly acceptable strategy in a synoptic publication; however, it also gives the incidental impression that new data are regularly incorporated into the Mogollon database.

The first step in my historical analysis of the empirical basis for the culture history sequence is to determine when and what new data were incorporated into the sequence as it evolved. I accomplish this by eliminating all reiterations of a particular trait in later publications. Appendix B includes only the traits that are newly identified in each subsequent publication. Both inventories are included in this dissertation for a number of reasons. I include Appendix A so that the data presented by the authors is accurately represented. Second, readers may compare the inventories to see which data are repeated. Finally, Appendix B emphasizes that relatively little data is added to the sequence.

The data in both inventories (Appendices A and B) are arranged in tables by phase. The data are arranged chronologically in columns by author (or research group) to show the evolution of each phase. Within each phase table, the phase traits described by the authors are grouped into the following

row categories: phase name (which sometimes varies across authors), age range, settlement, architecture, entryways, postholes, other interior features, pottery, groundstone, other artifacts, and burials. Data listed in the artifact and burial categories include only material from the floor and subfloor assemblages. I exclude all descriptions of artifacts from structure fill and combined floor-and-fill contexts because this material cannot be definitively associated with the occupation of a structure.

The Pinelawn, Georgetown, San Francisco and Three Circle phase trait lists have not altered significantly since Wheat's synthesis was published in 1955 (see Appendix B). The Tularosa and Reserve phases in the northern part of the study area have remained virtually unaltered since Bluhm's additions (1957, 1960). In the Mimbres valley, the Pueblo period Classic Mimbres, Black Mountain/El Paso, and Cliff/Salado phases have changed little since their initial definition by the Mimbres Foundation during the late 1970s and early 1980s (Anyon and LeBlanc 1984; LeBlanc and Whalen 1980; Nelson and LeBlanc 1986).

Case Study: The San Francisco Phase

As noted above, the point of this chapter is not to synthesize Mogollon culture history, but instead to examine the data described by others and from which Mogollon settlement patterns are derived. To this end, I have selected the San Francisco phase as a representative example of how Mogollon phases evolved into their current conceptions.

The San Francisco phase was first delineated by Haury (1936a) and is based on the houses he excavated at Mogollon Village (LA11568) in the San Francisco River valley and Harris Village (LA1867) in the Mimbres River valley. Haury suggests that the San Francisco phase dates from A.D. 700–900 based on tree-ring samples from both sites. Although the tree-ring dates were later reevaluated (Bannister et al. 1970; Reid and Doyel 1986), the definition of the phase does not change.

The San Francisco phase is characterized by rectangular pithouses with rounded corners and plastered walls (Table 2.3, excerpted from Appendix B). San Francisco pithouses have step or inclined ramp entryways, a central posthole, and auxiliary postholes along the midline axis of the structure (Figure 2.1a). Haury describes the “ceremonial” structures of the San Francisco phase as kidney bean shaped with an inclined entry ramp (Figure 2.1b).

According to Haury (1936a), San Francisco phase ceramics include Mogollon Red-on-Brown, Three Circle Red-on-White, San Francisco Red, Alma Neck-Banded, Alma Scored, Alma Punched, Alma Plain, and a trace of Neck-Corrugated ware (see Haury [1936b] and Hawley [1936] for detailed descriptions of these pottery types). The groundstone assemblage includes closed-trough and basin metates, rounded (one-hand) manos, full- and 3/4-grooved mauls, and atlatl weights. Haury also describes bone awls, bone tubes, clay and stone pipes, and “cornucopias” (cone-shaped clay objects) as

Table 2.3 San Francisco phase traits, exclusive of redundant traits
(excerpted from Appendix B).

	Haury (1936)	Martin & Rinaldo (1950a, 1950b), Martin et al. (1949), Martin et al. (1957), Martin et al. (1952)	Wheat (1955)	Danson (1957) Northern Regions ¹
Phase	San Francisco	San Francisco	Mogollon III (San Francisco)	Pueblo I (~San Francisco & Three Circle)
Date	A.D. 700–900	A.D. 700–900	A.D. 600–900	A.D. 700–900
Settlement		"houses built in any choice spot, without an eye to defense" (1950a:566) dispersed, rather than clustered (1950a)		
Architecture	pithouses: rectangular, rounded corners, plastered ceremonial: pithouse, kidney-bean shaped (sides at entrance "drawn in")	pithouses: smaller than in Pine Lawn phase (1950a:566)	pithouses: large (Pine Lawn average 22.2 sq. m) or moderate (Mimbres average 15.0 sq. m); deep (Pine Lawn average 114 cm, Mimbres average 105 cm)	
Entryway	step &/or inclined ceremonial: inclined			
Postholes	center & midline auxiliary	or 4 corner or combination of midline & corner		
Features		floor pits: none or few wall niches extramural pits possibly ceremonial: firepit, deflector, ventilator, sipapu?	fire depressions stone-lined firepit (rare)	
Pottery	Mogollon R/b Three Circle R/w San Francisco Red Alma Neck-Banded Alma Scored Alma Punched Neck-Corrugated (trace) Alma Plain	Mimbres Boldface B/w (late; 1949) Reserve Smudged (1950b)		
Groundstone	Metates: closed trough, basin Manos: rounded, not shaped Axes: none Mauls: full & 3/4-grooved Other groundstone: all weights		Metates: slab Manos: uniface & biface Axes: flaked (present), full-grooved (rare) Other groundstone: mortars, pestles, bows, pitted pebbles, worked slabs, polishing stones, abrading stones, some grooved, hoes, balls, pendants	
Other Artifacts	Bone: awls (plain & notched), tubes Pipes: clay, long & short stone Cornucopia: cone-shaped clay Copper (worked) Shell (rare)		Chipped stone: points, knives, serrated knives, drills, graters, core choppers (abundant) Bone: needles, antler flakers, disc beads, dice Shell: olivella beads, vermetus tubes, disc beads, pendants, thin bracelets	
Burials	exterior, flexed cremations (rare)			

¹ This area includes Danson's Pinelawn, Upper San Francisco River, and Tularosa River-Apache Creek regions.

Table 2.3 San Francisco phase traits, cont.

	Bluhm (1960)	Bullard (1962)	Mimbres Foundation (Anyon 1980, Anyon et al. 1981)	Lekson (1992)
Phase	San Francisco/Three Circle	San Francisco (~Pueblo I)	Late Pit House: San Francisco	Late Pit House: San Francisco, Three Circle
Date	A.D. 700—1000	A.D. 700—900	A.D. 650—750	A.D. 700—900
Settlement	possibly clustering along drainages near water & arable land		close proximity to Early Pit House sites slow movement into side canyons & tributary valleys population increase	
Architecture				
Entryway	ceremonial: short or roof entry		communal: stylized lobes at interior end	
Postholes				
Features	ceremonial may have: floor grooves	flat hearthstone on entry side of firepit (Mimbres)	firepits: shallow (†20 cm), oval or round, unlined or adobe-lined	
Pottery			San Lorenzo R/b	
Groundstone				
Other Artifacts				
Burials			increased grave goods: none (majority), some with "killed" ceramics (smashed & scattered)	

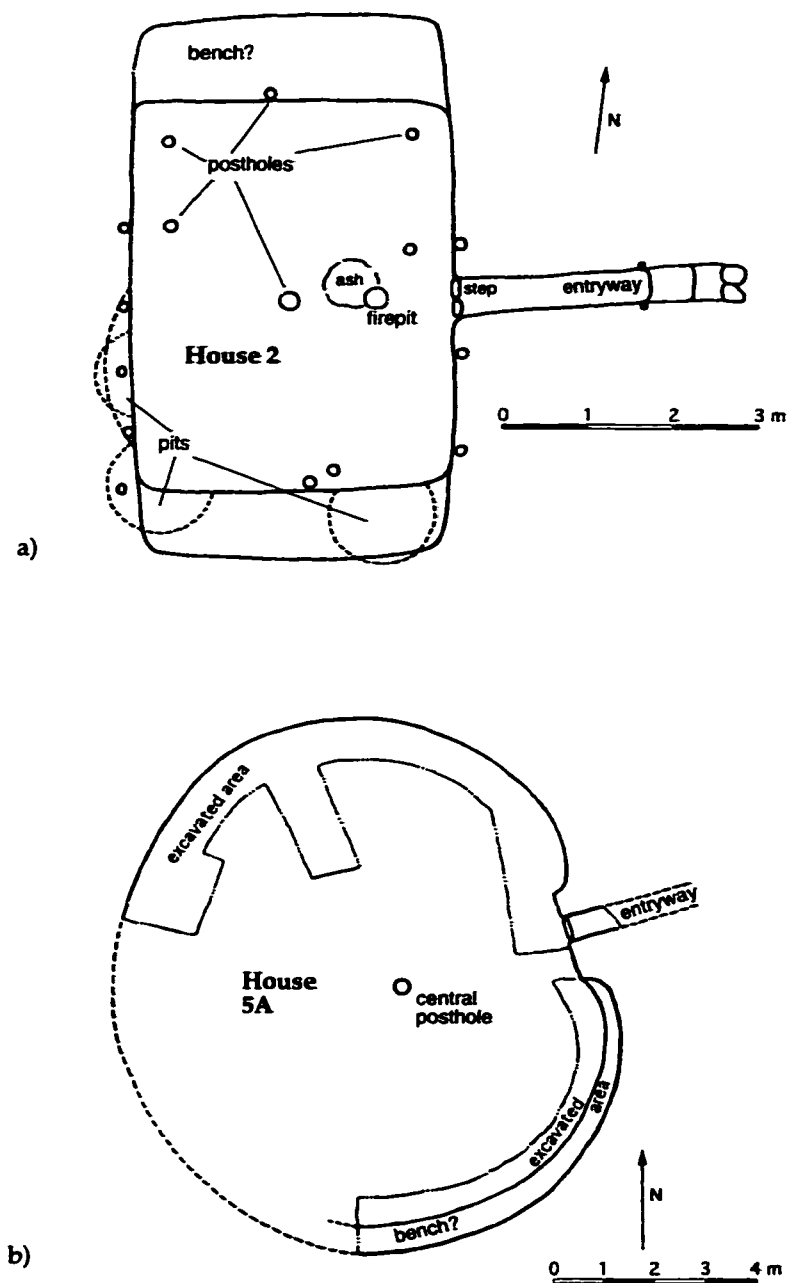


Figure 2.1 San Francisco phase pithouses from Mogollon Village (LA11568); a) House 2, a rectangular domestic pit structure (after Haury 1936a, Figure 6); b) House 5A, a rounded pit structure labeled "ceremonial(?)" (after Haury 1936a: 16 and Figure 5).

characteristic of the San Francisco phase and he notes the presence of worked copper and shell. San Francisco burials are flexed, located exterior to the structures, and cremations are rare.

Martin and Rinaldo (1950b) add a few interior feature traits (rare floor pits, wall niches) to the San Francisco phase description. They note that San Francisco structures are smaller than Pinelawn phase structures. Martin and Rinaldo also suggest that firepits, deflectors, ventilators, and sipapus might be characteristic features of San Francisco phase ceremonial structures. The only additions to the San Francisco artifact assemblage by Martin and Rinaldo are Mimbres Boldface Black-on-White (also known as Mimbres Style I B/w) and Reserve Smudged (Martin et al. 1949; Martin and Rinaldo 1950b).

Martin and Rinaldo (1950a) are the first to describe settlement characteristics for the phase, which they contrast to the settlement characteristics of the earlier Pinelawn phase. San Francisco sites are located on a variety of landforms and are dispersed, rather than clustered, across the landscape.

Wheat (1955) adds very specific details about the groundstone, chipped stone, bone, and shell assemblages associated with San Francisco structures. He also calculates average size measurements for the structures. After Wheat's contributions to the San Francisco phase description, subsequent reports add only a few or no new details.

Everything that Danson (1957) reports about the phase is contained within the earlier phase descriptions. This is not surprising given that Danson reports the results of his survey, while most of the earlier details were based on excavations.

In contrast to her colleagues' suggestions, Bluhm (1960) remarks that San Francisco structures might be clustered along drainages near water and arable land. She also suggests that floor grooves might be typical features of ceremonial structures. Bullard (1962) adds only that, in the Mimbres area, San Francisco phase firepits have a flat hearthstone on the entry side of the firepit.

Anyon (1980) notes that San Francisco sites are located near Early Pithouse sites, i.e. in the same area, but on other landforms. He also notes that San Francisco sites are found in areas not previously occupied, such as side drainages, which he suggests is evidence for population increase during this phase. Anyon also notes that firepits (a previously recognized trait) are typically shallow. He also states that grave goods are more common than in earlier phases, but affirms that most burials do not have grave goods. Lekson (1992a) adds that larger sites tend to have one or more very large pit structures (Great Kivas).

Despite that nine authors describe the San Francisco phase over a span of more than 50 years, the phase description changes very little after its initial definition by Haury (1936a) and expansion by Martin and

Rinaldo (1950b). Most of the new additions involve refinement of details and only once did a characteristic from a later publication contradict an earlier description. In contrast to Martin and Rinaldo's (1950a) suggestion that sites are dispersed, Bluhm (1960) suggests that San Francisco sites may be clustered along watercourses. Since Bluhm worked with Martin and Rinaldo and her report was part of the same publication series, we can only assume that they agreed with her suggestion.

Table 2.3 shows that the San Francisco phase, like the other phases inventoried in Appendices A and B, is based on data from just a few sites. In the study area, the San Francisco phase description is primarily based on only five sites. These include the Harris (LA1867) and Mogollon villages (LA11568) excavated by Haury (1936a), Turkey Foot Ridge (LA9709; Martin and Rinaldo 1950a, 1950b), Starkweather Ruin (LA38624; Nesbitt 1938), and Cameron Creek (Bradfield 1929).

SUMMARY

The culture history inventories (Appendices A and B) indicate that five settlement shifts apparently occurred between A.D. 300 and A.D. 1400. These five changes mark the boundaries between phases. Appendix B demonstrates that the sequence and current interpretations of Mogollon settlement have changed little over the past 40–60 years. Data accumulated during that time may not coincide with the original phase descriptions, which suggests that the five settlement patterns could be outdated, despite their widespread

acceptance in the archaeological literature. The lack of change might possibly reflect that the original descriptions are accurate and thorough. More likely, repeated citation of the traits provides a false sense of certainty about the phases.

For all phases defined in the study area, significant alteration is rare after the first formal definition of the phase. The most substantial changes include filling gaps in the sequence (e.g. Mimbres Pueblo period phases) and refinement of the chronology (usually due to increased numbers of chronometric dates).

This overview of the history of Mogollon research and review of the culture history inventories accentuates two difficulties in the study Mogollon settlement change. First, the settlement patterns were identified based on a small sample of sites, and second, the patterns may not still be accurate if we include modern archaeological data. Compilations of the data on which recognized settlement patterns are based (Appendices A and B) show that the sequence uses only a fraction of the available data. Since few recent data have been incorporated into the Mogollon sequence, I reassess the long-recognized settlement patterns using an enhanced database (Appendix C).

Chapter 3

MOGOLLON SETTLEMENT PATTERNS:

DESCRIPTIONS AND PROPOSED EXPLANATIONS

After the Cosgroves discovered the people behind Mimbres pottery and Emil Haury developed the Mogollon sequence, ...subsequent work has largely been refinement of details and expansion of coverage...The scale of data we control is large -- not huge, but far from insignificant. We have not yet made use of this sizable data base. This is a shame, for until we know what we have, we can't really tell what we need. (Lekson 1992a: 57)

INTRODUCTION

The purposes of this chapter are first, to highlight the importance of understanding settlement changes in the Mogollon territory, and second, to review the accepted settlement patterns identified in the study area.

Archaeologists have induced five settlement patterns from the culture history sequence, each of which is accompanied by a distinct ceramic assemblage. These settlement and ceramic differences are the primary distinguishing characteristics of each phase and they serve as the boundaries between phases.

Assessment of the culture history data (Chapter 2) indicates that the settlement patterns of the Mogollon sequence should be reevaluated because the patterns might not exist when all available data are examined. The

accuracy of the five settlement patterns is questionable because the phases were defined based on data from only a small sample of excavated sites. In addition, the phases change very little after their initial definition, despite decades of additional data collection.

Before the recognized settlement patterns can be reassessed, I need to explicitly describe each pattern and review the proposed explanations for each change. Each settlement pattern can then be treated as an untested hypothesis with empirical consequences for settlement in a particular locale and/or kind of structure. Identification of empirical consequences serves to direct future analyses using previously collected and newly generated data.

Five settlement shifts are widely accepted to have occurred in the prehistoric occupation of the study area. Each settlement change is associated with a boundary between two phases. The first three settlement changes occur during the Pithouse period, the later changes are associated with the Pueblo period.

The first significant recorded settlement pattern in the study area is the widespread use pit structures at the inception of the Early Pithouse period. The second change occurs when site location apparently shifts from isolated to accessible landforms at the boundary between the Early and Late Pithouse periods, beginning with the Georgetown phase. The first appearance of quadrangular pit structures at the beginning of the San Francisco phase is the third significant settlement change.

The fourth settlement change occurs at the boundary between the Three Circle phase and the Pueblo period, when surface structures made of cobble masonry and adobe replace the pit structure. Pueblo period settlements are eventually characterized by large numbers of contiguous structures clustered into roomblocks. In the northern part of the study area, this shift to aggregated structures marks the boundary between the Reserve and Tularosa phases at around A.D. 1150. In the southern part of the study area, aggregated surface structures of the late Classic Mimbres phase grew gradually by accretion throughout the phase, between A.D. 1000-1150 (LeBlanc 1986). The fifth settlement change occurs only in the southern part of the study area. Construction materials change from masonry to predominantly adobe wall construction at the beginning of the post-Classic era, also the beginning of the Black Mountain phase.

THE SIGNIFICANCE OF SETTLEMENT STUDIES

Although settlement studies typically fall in the domain of survey research (e.g. Accola 1981; Graybill 1973; Lekson 1978; Mimbres Foundation 1978; Peterson 1988), understanding prehistoric settlement is important for many aspects of archaeological research in the Mogollon territory. Interestingly, the most prominent Mogollon settlement patterns are difficult to address using survey data because the settlement patterns are based on data available only through excavation. Even the settlement patterns that do not seem to require excavation data (e.g. the shift from isolated-to-accessible

landforms) are still unresolved because it is difficult to identify sites of the appropriate ages using survey data.

The importance of the identified settlement patterns has increased as research questions have changed in recent decades. Anyon, Gilman, and LeBlanc (1981) note that each phase in the Mogollon sequence is differentiated based on a single settlement change and accompanied by a change in the ceramic assemblage. Although Anyon et al. (1981) refer specifically to the Mimbres Mogollon sequence, the same situation holds in the northern part of the study area although the details differ.

Understanding the nature of Mogollon settlement changes is crucial for answering many modern research questions. Settlement issues permeate research on subsistence (Diehl 1996; Hard 1990; Mauldin 1991, 1993), mobility (Diehl and Gilman 1996; Gilman 1997; Whalen and Gilman 1990), social interaction, and community organization (Hegmon et al. 1998). Questions about landuse are rarely, if ever, considered without reference to prehistoric settlement patterns. Regional surveys are concerned with the distribution of archaeological material across the landscape, and by default, in settlement patterns (cf. Stuart and Gauthier 1984, Lekson 1992b).

The elevated status of settlement traits as primary phase descriptors and the pervasiveness of settlement issues in Mogollon archaeology highlight the need for updated information about Mogollon settlement changes. Given that the descriptions and interpretations of Mogollon

settlement have changed little over the past 40 years, questions arise about the currency of the patterns. The five major settlement shifts identified by culture historians have not been systematically investigated on a region-wide scale. Consequently, most of the patterns are associated with untested explanations.

Are the settlement patterns, long embedded in the literature, sustained when recently accumulated data are examined? We have a century of Mogollon data collection on which to found a reevaluation as well as an array of sophisticated tools to aid in the analysis.

Review of the five recognized patterns shows that many of the changes are still unexplained. This may be a function of the traditional unit of measurement, the site, which is not necessarily the most valid measure of settlement. When sites are the unit of measurement and evidence exists for occupation during a particular time span, the entire site is assumed occupied even if only a single room or pithouse was inhabited.

MOGOLLON SETTLEMENT CHANGES REVIEWED

In the remainder of this chapter, I describe the five settlement pattern changes and discuss how archaeologists have interpreted them. This portion of the chapter is divided into five similarly organized subsections that correspond with the five settlement changes. Each subsection is organized in a similar manner. I first describe the settlement pattern change as currently conceived. I review the proposed explanations and current research on the

pattern. I then discuss the problems and challenges faced by researchers investigating the settlement change.

As defined in the introductory chapter, settlement occurs when people create an artificial environment in which to live. Thus, any change in the artificial environment constitutes a settlement change. In this study area, settlement change occurs along four primary dimensions: location, structure form, construction methods, and construction materials.

SETTLEMENT CHANGE ONE: EARLY PIT STRUCTURES

Architecture is one of the most common archaeological remains, yet archaeologists have probably done less to interpret and explain architectural variation than for any other data set.
(Gilman 1987: 538)

Pithouses Defined

One of the first measurable settlement changes in the study area is registered by evidence for constructed shelters, i.e. architecture. In the Mogollon area, the earliest formal architecture is the pit structure (Gilman 1987), or pithouse. Gilman (1987: 539) defines a pit structure as "any non-contiguous building whose floor is excavated below the ground surface." This includes a wide spectrum of shelters, from small huts built over a shallow basin, through houses whose floors are more than a meter below the surface, to non-contiguous masonry rooms whose floors are shallowly excavated into the substrate.

The term 'pithouse' means different things to different archaeologists. Definitional differences are probably the source of disagreement over the placement of the early boundary of the Pithouse period. Martin places the beginning of the Pinelawn phase much earlier than do all other archaeologists (cf. Appendix A).

In general, pit structures consist of a subsurface pit excavation capped by a superstructure. The sides of the pit form the lower walls of the structure; these walls are occasionally lined (or reinforced) with cobble and adobe masonry or wood. The upper walls and roof are composed of wood beams, other plant materials (e.g. reeds, bark, or twigs), and a covering of adobe (Figure 3.1). The subsurface pit is the primary archaeological evidence for a pit structure, although some structure pits also contain fragments of the superstructure in the sediment that fills the pit after abandonment.

The structure pits vary in shape, size, and depth. The earliest pit structures in the study area appear to be rounded (e.g. circular, oval, or a rounded D-shape). Later pit structures are quadrangular (e.g. square, rectangular, or trapezoidal). Excavated house pits vary in diameter (or length) from 1.1–12.0 m, and in depth from 0.2–2.6 m; this depth range may not be accurate, however, because the attribute is reported inconsistently and the surfaces from which pits were excavated are difficult to identify.

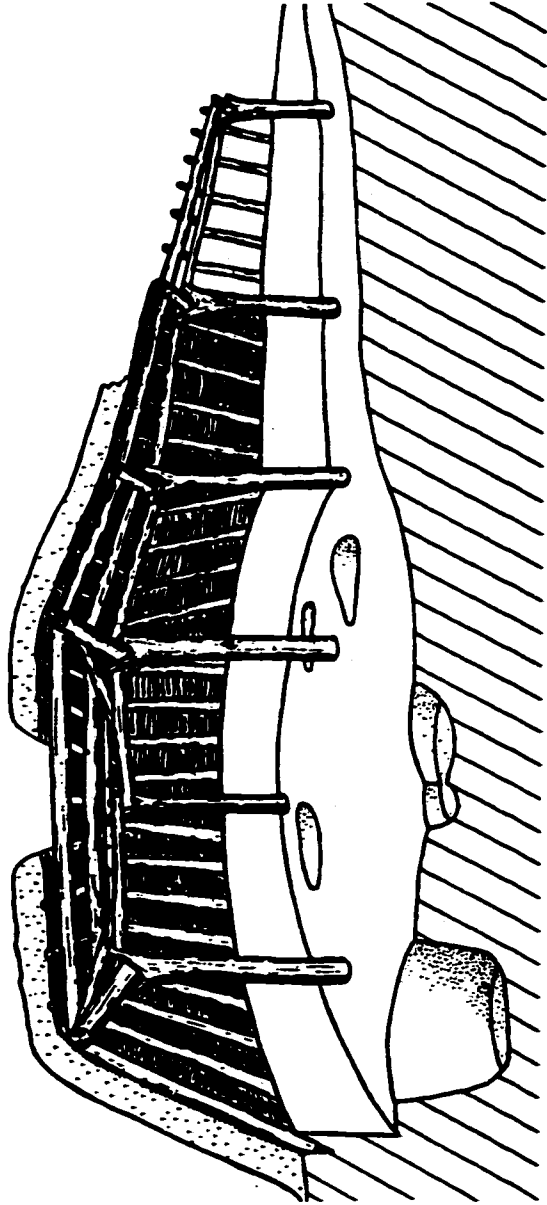


Figure 3.1 Reconstruction of a typical pit structure (after Martin 1940: 86, Figure 39).

Explanations and Current Research: Early Pit Structures

Archaeologists have interpreted the first pit structures as evidence for sedentary settlement and a subsistence system heavily dependent upon agriculture (Bluhm 1960; Cordell 1984; Haury 1962; LeBlanc 1983; Martin and Plog 1973; Woodbury and Zubrow 1979). In this view, agriculture provides a reliable food source, which allows for a reduction in mobility and creates a need for substantial architecture that can be occupied for lengthy periods. Rocek (1996:18) suggests that early archaeologists viewed the Pithouse period as a transitional stage between the nomadic lifestyle of the Archaic period and the fully sedentary lifestyle of the Pueblo period.

The concurrence of ceramics and agriculture are interpreted as evidence for dependence on agriculture that permitted year round occupation of an area (Wills 1988). Cordell (1984: 217) suggests that because ceramics are heavy and breakable they are not practical tools for mobile societies. She also argues that ceramics offer advantages to sedentary groups because they can be made quickly (thereby freeing time for other activities), they are more durable than baskets and hide containers, and they are pest- and fire-proof (Cordell 1984: 217).

LeBlanc (1982b) defines "true" pithouses as large and deep, with large support posts. He argues that these do not appear in the Mogollon area until around A.D. 200, along with a suite of other traits, including brownware ceramics, new varieties of maize, trough metates, and groundstone axes.

Gilman (1983, 1987) and Mauldin (1983) were the first to specifically challenge the assumptions inherent in traditional equation of pit structure use with sedentism in the American Southwest. Gilman's analysis of ethnographic data suggest that pithouses are used when mobility patterns are at least bi-seasonal, that pit structure occupation occurs during cool or non-growing seasons, and that pit structure residents depend on stored foods during the season of occupation.

Archaeologists have only just begun to explore the empirical implications of Gilman's model for the inception of pit structure architecture. Diehl (1996) investigates groundstone evidence for subsistence and settlement patterns in the Mogollon Highlands. Schmidt (1998) uses faunal remains to investigate Late Archaic subsistence and mobility in the San Simon area (west of my study area in southeastern Arizona). Mauldin (1999) investigates the conditions of pit structure use by examining variability in the size and depth of pit structures in the Jornada Mogollon (southeast of the study area).

Wills' (1988, 1989) research on early agriculture has also challenged various aspects of the correlations between agriculture, mobility, and architecture. He suggests that stored food might have permitted seasonally mobile hunter-gatherer groups to arrive in the uplands early and obtain information on the location and availability of autumn resources. That is, agriculture may increase the efficiency of hunter-gatherer resource procurement.

Although the appearance of ceramics continues to be an important change in the Mogollon archaeological record, the link between ceramic technology and sedentism is no longer presumed. Recent research (e.g. Arnold 1985; Barnett and Hoopes 1995) indicates that some groups classified as intermediate between the extremes of sedentism and nomadism produce ceramics in large quantities. This has led some researchers to reevaluate how they view the evolution of architecture and its relationship to mobility (e.g. Whalen 1994).

Challenges and Problems: Early Pit Structures

Scarcity of data is the primary obstacle to investigation of the earliest pit structures in the Mogollon area. Only a handful of structures have been assigned to the Late Archaic period in the study area. To determine why pit structures become the dominant form of constructed shelter requires sufficient data that spans the Late Archaic through the Early Pithouse period. So few early structures of any form have been excavated and dated that the available data are heavily biased toward pit structures occupied after A.D. 500.

Prior to A.D. 300, the primary archaeological evidence for structures consists of rockshelters and caves (e.g. Bat Cave, Tularosa Cave, and Cordova Cave mentioned in Chapter 2). Other kinds of structures may also have been constructed before pithouses, but the archaeological record of ephemeral structures is not easily recognized. Structures analogous to wickiups might have been made from wood, brush, and/or hides, but the probability that

such evidence would survive in the archaeological record is low. Such structures might not result in substantial alteration of the substrate and the building materials would be exposed to the elements, adding little or no evidence to the archaeological record. Unlike pit structures and pueblos, the process of wickiup disintegration does not contribute to preservation of the structure. When pit structures and pueblos decompose, sediments are deposited within and/or around the structures, which serves to protect floors and lower walls from further damage.

Chronological data are even scarcer than data about form and construction methods of early structures. Without chronometric data, early structures can be identified in only two ways, stratigraphically or using negative evidence, i.e. early structures should lack ceramics. The first pit structures predate the first phase of the Mogollon sequence, which begins around A.D. 200 with the concurrent use of pit structures and ceramics (see Appendix A).

A number of archaeologists have suggested the presence of preceramic pit structures in the study area. Wheat (1954:580) reports that these structures are "small, true pithouses with large interior storage or sleeping pits." Hammack, Bussey, and Ice (1966) identify a number of structures that may be pre-ceramic in age at Ormand Village (LA5793) and the Dinwiddie site (LA6783; not to be confused with the Mills' [1972] Dinwiddie site, LA106003). Without chronometric data, however, these structures cannot be assigned to

the preceramic era. Archaic pit structures probably exist in the study area because they have been reported in areas to the immediate north, east, and west (Huckell and Huckell 1988; Gilman 1991, 1995; LeBlanc 1982b; O'Laughlin 1980; O'Leary 1987; Sayles 1945).

In the study area, only five pit structures are associated with chronometric age ranges in the Late Archaic period (Table 3.1). Two pit structures at Mogollon Village (LA11568; Haury 1936a), House 12 and Feature 44, are associated with early dates. A portion of House 12 was excavated in 1991 (Duncan et al. 1991), but the area was not extensive enough to determine details of the form and construction materials. Interior floor pit features are associated with two possible settlement episodes, one in the Late Archaic period and the other during the San Francisco phase. Feature 44 is a small, shallow, circular pit structure, portions of which were excavated in 1991 (Duncan et al. 1991) and 1994 (Linse 1997).

One small pit structure at the Eaton site (LA34800; Fitting 1973a; Hemphill 1983) is confidently dated to the Late Archaic period. At Winn Canyon (LA34813; Fitting 1973b), an early date is associated with Feature 10, a large pit feature within a later structure, Pithouse/Room 2. At the HO Bar site (Brunnemann 1988), a small shallow pit structure (Pithouse 7) produced Late Archaic obsidian hydration and radiocarbon dates.

In the absence of chronometric dates, the only other way to identify early pit structures is by the absence of ceramics. Lack of a ceramic assemblage

Table 3.1 Excavated pit structures in the study area with chronometric ages in the Archaic period.

LA No.	Site Name	Structure	Obsidian Hydration Age	Radiocarbon Age ¹
11568	Mogollon Village	House 12	A.D. 294±107	A.D. 77-322 ²
11568	Mogollon Village	Feature 44	A.D. 56±96 A.D. 179±73 A.D. 288±91	A.D. 27-141 ² A.D. 145-338 ²
34800	Eaton Site	Pit Structure		401-208 B.C. (383 B.C.) ²
34813	Winn Canyon #1	Feature 10 in Room 2		757-170 B.C. (393 B.C.) ²
68160	HO Bar Site	Pithouse 7, Area C	626 B.C.±136, A.D. 303±82	512-257 B.C. (395 B.C.) ³ 361 B.C. - A.D 130 (45 B.C.) ³

¹ All radiocarbon age ranges are calibrated to 1σ, intercept values are in parentheses.

² Stuiver and Reimer (1986), Stuiver and Pearson (1986); Eaton and Winn Canyon dates are reported in Lekson (1992a), Table 4.2

³ Stuiver and Becker (1993), Stuiver and Pearson (1993)

is probably not a good criterion for identifying preceramic era pit structures.

Aceramic pit structures can post-date the appearance of ceramics as does a structure at LA29397, which is radiocarbon dated to A.D. 258-533 (Lekson 1992a, Table 4.2), well within the bounds of the Early Pithouse period.

Pithouse 3 at the HO Bar site (Brunnemann 1988), associated with a radiocarbon date of A.D. 146-390 and with no reported ceramics, has been assigned to the Pinelawn phase of the Early Pithouse period.

In fact, 447 (66%) of the 675 excavated pit structures for which data are available (Appendix C) can be considered aceramic because no ceramics are reported in their floor assemblages. Of these 447 aceramic pit structures, only 16% (73) have associated chronometric dates. Interestingly, none of the remaining 374 (84%) aceramic pit structures have been assigned to the Late Archaic period. This may indicate a bias in the classification criteria or it may reflect that that these structures were occupied during the Pithouse period, despite the lack of ceramics in their artifact assemblages.

Implications for Future Research: Early Pit Structures

To investigate adequately the adoption of pit structure architecture in the Mogollon territory, requires the ability to track the distribution of settlement variables from a time prior to the first appearance of pit structures into the Early Pithouse period. A reasonable place to begin is with the description of the settlement characteristics of the earliest available structures.

This would negate the problems inherent in attempting to define a "true" pit structure.

SETTLEMENT CHANGE TWO: MOVEMENT FROM "ISOLATED" TO "ACCESSIBLE" LANDFORMS

During the early part of this period there was a tendency for villages to be located in defensive positions, on the tops of high, almost inaccessible, mesas. Later communities were situated on low benches closely adjacent to arable fields. (Wendorf 1956:23)

The Landform Shift Defined

Archaeologists who work in the Mogollon area have long recognized a change in settlement location between the Early and Late Pithouse periods (Bluhm 1960; Bullard 1962; Danson 1957; Haury and Sayles 1947; Rice 1975, 1980; Wendorf 1956). Traditionally, this change is described as a move from high, isolated locations in the Early Pithouse period to low elevations during the late Pithouse and Pueblo periods (see Tables 9 and 10 in Appendix A; Wheat 1955). LeBlanc (1980a) suggests that the differences in landform elevation are relative, and do not refer to some absolute standard of isolation or arbitrary elevation.

The landforms associated with earlier structures are described as high knolls, mesas, bluffs, hilltops, and ridges. Typically they are steep-sided and situated at elevations 100 m or more above the surrounding landscape (LeBlanc 1980a). These settlement locales appear elevated, isolated, or inaccessible relative to later sites and to alternative locations in the same area

(LeBlanc 1980a). Later pithouses and surface structures are located on landforms described as terraces, benches, and low ridges and at lower elevations relative to earlier sites in the vicinity. Although there is no consensus on the timing of the change (Anyon et al. 1981), most researchers place it between A.D. 500 and A.D. 700, during the Georgetown phase.

Interpretations and Current Research: Inaccessible and Accessible Landforms

A number of explanations have been proposed for the early Pithouse locational trend. The most common explanation for the pattern is the need for a defensible site locale (Haury and Sayles 1947; LeBlanc 1980; Martin and Plog 1973; Wendorf 1956). Other proposed reasons to settle on inaccessible and/or elevated landforms include: the view (Bluhm 1960, Martin and Rinaldo 1947), resource accessibility (Rice 1975, 1980), drainage and favorable temperatures (Wheat 1955; Haury and Sayles 1947), ceremonial purposes (Hogg 1977), and to leave other land vacant (LeBlanc 1980a) for farming, hunting, or open intercommunity space. Wills' (1988) treatise on early agriculture might be considered an additional argument in support of the resource access explanation, although he does not present it as an explanation for this particular pattern.

The move to accessible landforms has been attributed to a decreased need for defense (Anyon 1980) and increased dependence on cultigens (Bluhm 1960), which created a need to be near arable land and permanent streams (Bullard 1962; Haury 1956). Occupation of the lowlands appears to

have remained relatively stable throughout the late Pithouse and Pueblo periods.

Challenges and Problems: Inaccessible and Accessible Landforms

None of the above proposed explanations for the settlement pattern have been systematically investigated. LeBlanc (1980a) reviews the defense proposition and notes the lack of evidence for warfare or violence. He also points out that evidence for conflict might not occur at the sites of successfully defended settlements (LeBlanc 1999).

Lekson (1992a) points out a more serious potential problem than untested hypotheses. He argues that the pattern of isolated landform use is a function of the criteria by which archaeologists identify Early Pithouse occupations—the absence of painted pottery. Locales with Early Pithouse occupations that are superimposed by later occupations (with painted pottery) are excluded from consideration because they are not recognizable (e.g. Herrington 1979).

The data indicating that relatively inaccessible landforms were occupied prior to A.D. 500 are compelling. What remains unclear is whether inaccessible landforms were the only landforms occupied before A.D. 500 and whether the landforms were completely abandoned after that time (LeBlanc 1983). Early culture historical data (see Appendix A) and regional survey data from the Mimbres valley (Blake et al. 1986), the Upper Gila valley (Lekson 1982), the Black Range (Laumbach and Kirkpatrick 1983), and more recently

from the Sapillo valley (Stokes 1994, 1995), appear to support the hypothesis that the shift occurs. However, in each case, pre-A.D. 500 structures situated on landforms also occupied later in the sequence would be archaeologically invisible because painted pottery would mask its absence in earlier artifact assemblages at the same locale.

Implications for Future Research: Inaccessible and Accessible Landforms

To determine whether and why this shift occurred requires information about the kinds of landforms occupied between A.D. 100 and A.D. 900. If the landform settlement patterns are discrete, other variables should confirm the pattern. For example, isolated early structures should be further from the nearest water source than accessible late structures. The landforms should also vary in terms of their geomorphic setting (stable, erosional, or depositional) and in the characteristics of subsurface deposits (alluvial, volcanic bedrock, etc.). If the landforms on which structures are situated vary, I would also expect measurable differences in the landform orientation. Given that many of the culture historians describe the early landforms as high, the structures might also vary in absolute and relative elevation.

If the data support the original pattern, then the empirical implications of previously proposed explanations may be tested. The defense hypothesis is the most widely cited explanation for the settlement change from isolated to accessible landforms. In order for the defense hypothesis to be tested,

however, it would first need to be rephrased so that it is no longer circular or dependent on negative evidence. Archaeologically visible consequences of defense, other than isolated landforms, need to be identified and data collected. Data indicating violence or conflict might be obtained from "unsuccessful" settlements in indefensible (accessible) locales. An unsuccessful settlement might be recognized by a short occupation span, while evidence for conflict might be inferred from data that suggests competition for resources or restricted access to resources. Unsuccessful settlements or conflict might also be recognized by evidence for violent death.

SETTLEMENT CHANGE THREE: ROUNDED PITHOUSES VERSUS QUADRANGULAR PITHOUSES

The noticeably rapid change, from basically circular to rectangular shapes, has never been explained by archaeologists. (Anyon 1980: 175)

Pithouse Shape Change Defined

One of the primary traits that culture historians use to differentiate the Georgetown and San Francisco phases is house form (see Appendix A). First described by Haury (1936a), Georgetown phase structures are rounded (circular, oval, D-shaped; Figure 3.2c), while San Francisco phase structures are quadrangular with rounded corners (Figure 3.2b). Initially, rounded structures were considered earlier based on the law of superposition (e.g. Figure 3.3). Later, the presence of the bichrome decorated ceramics became the primary method used to assign quadrangular structures to later pithouse

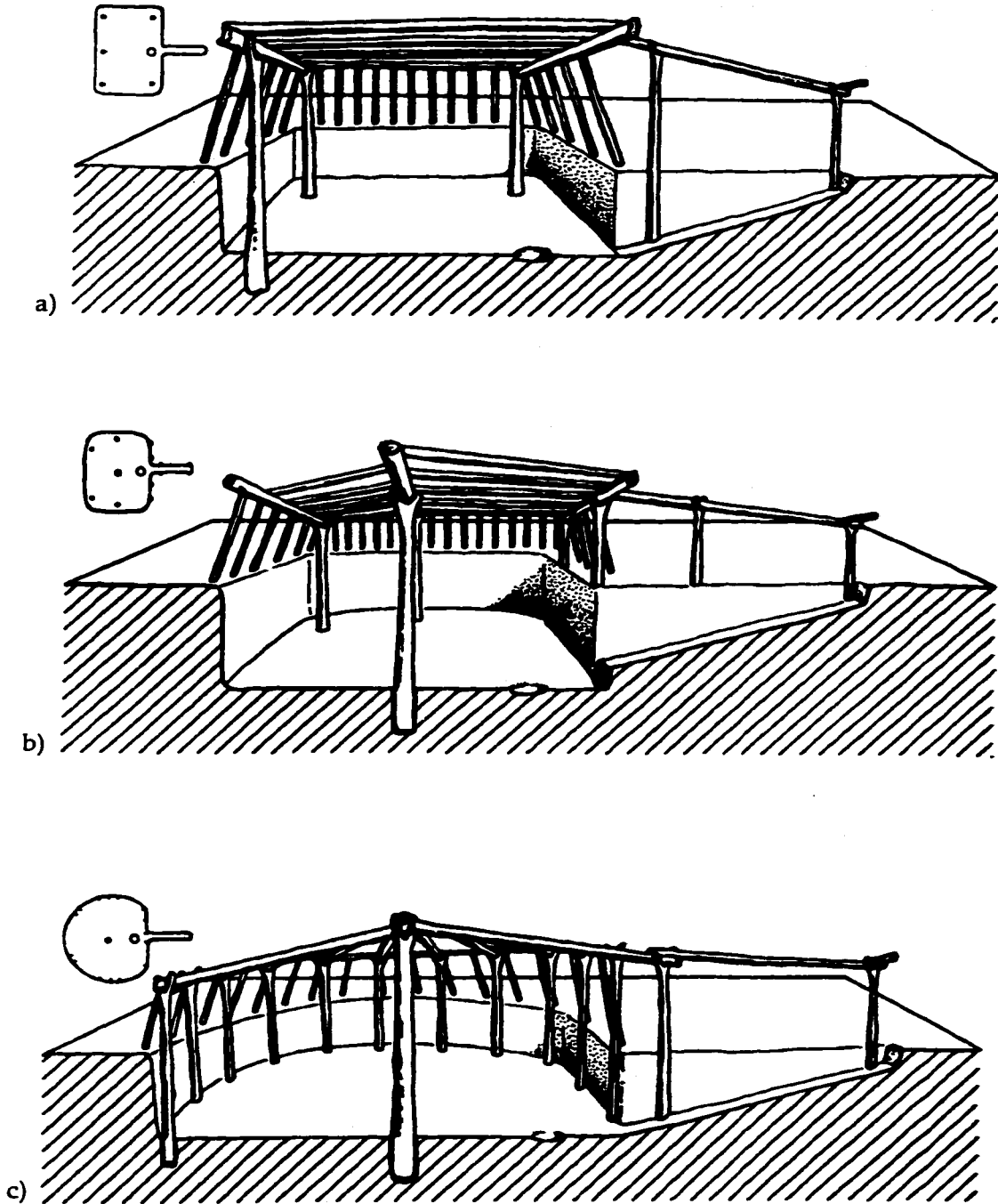


Figure 3.2 Mogollon pithouse reconstructions (after Haury 1936a, Figure 26). The change in pithouse shape from c to b marks the transition from the Georgetown to the San Francisco phase.

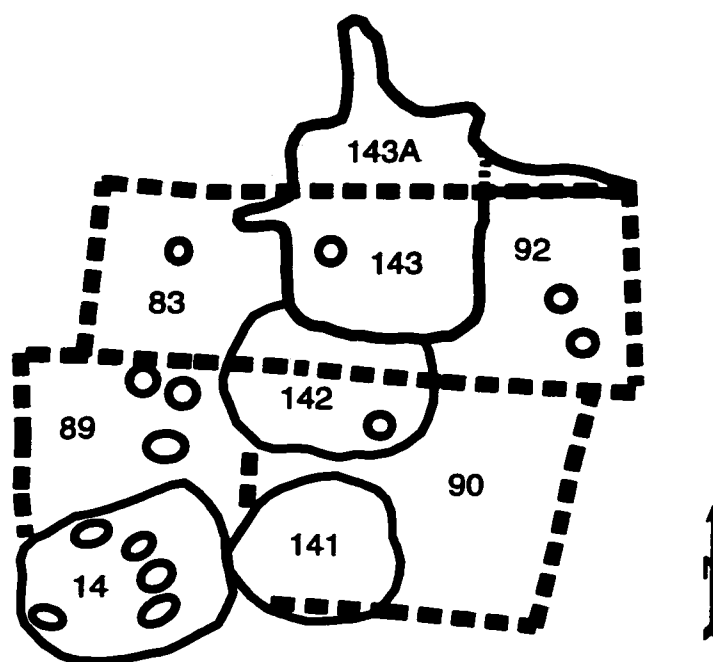


Figure 3.3. Superimposed pithouses 142, 143, and 143A and other structures at Cameron Creek Village (Bradfield 1929). Note that 143 and 143A are mislabeled as 18 and 81 on Bradfield's site map (numbers already assigned to other structures), but he refers to them as pit rooms 143 and 143A in the text (pp. 16).

phases. Plain brownware and San Francisco Red ceramics characterize the Georgetown phase, while Mogollon Red-on-Brown is the type ceramic for San Francisco phase pit structures.

Interpretations and Current Research: Pithouse Shape Change

In his summary of the Late Pithouse period, Anyon (1980) suggests a number of research perspectives that could provide insight about the change from rounded to quadrangular pit structures. He cites the ethnographic analyses of Robbins (1966) and Whiting and Ayres (1968) in which rounded and rectangular house forms are correlated to different community sizes, mobility patterns, and subsistence strategies. Anyon also discusses Hunter-Anderson's (1977) research that links house form to the number and kind of activities conducted, as well as the volume of materials stored inside the structure. Anyon's comment at the beginning of this section is still true today. Mogollon researchers have not pursued the question of whether the change from rounded to quadrangular structures occurred as outlined by the culture historians, nor have they asked how and why this change took place.

Challenges and Problems: Pithouse Shape Change

Despite that this change has never been systematically documented nor investigated, house form is still a primary method used to differentiate Georgetown from San Francisco phase structures. If rounded structures do not predate quadrangular structures, then these two Pithouse period phases

may be contemporaneous. This has serious classificatory implications because other methods for dating structures used between A.D. 550 and A.D. 750 are scarce. Chronometric dates in this age range are rare and chronological inferences based on ceramic assemblages may be unreliable.

The apparent change in pithouse shape from rounded to quadrangular may be a function of a biased classificatory scheme. That is, rounded pit structures may be classified as earlier because they are rounded. If rounded structures are in fact contemporaneous with round-cornered quadrangular structures, then a change is assumed when there is none. The Mogollon chronology may contain a logical error equivalent to Type II statistical error, that is, a significant difference is identified when no difference exists.

House G at the Ridout locus of the Wind Mountain site (LA127260; Woosley and McIntyre 1996) provides a good example of the problem of using shape as a temporal classification criterion. House G is a circular pit structure with plastered substrate walls, a floor that might be thinly plastered, and a central burned area instead of a formal firepit. These characteristics are consistent with Georgetown phase structure descriptions (Appendix A). Without chronometric data, House G would be assigned to the Georgetown phase, which has an age range of A.D. 550-650.

In fact, House G post-dates the Georgetown phase because it is the latest of three superimposed structures (Figure 3.4) and the earlier structures post-date the Georgetown phase. Since House G cuts into House I, which crosscuts

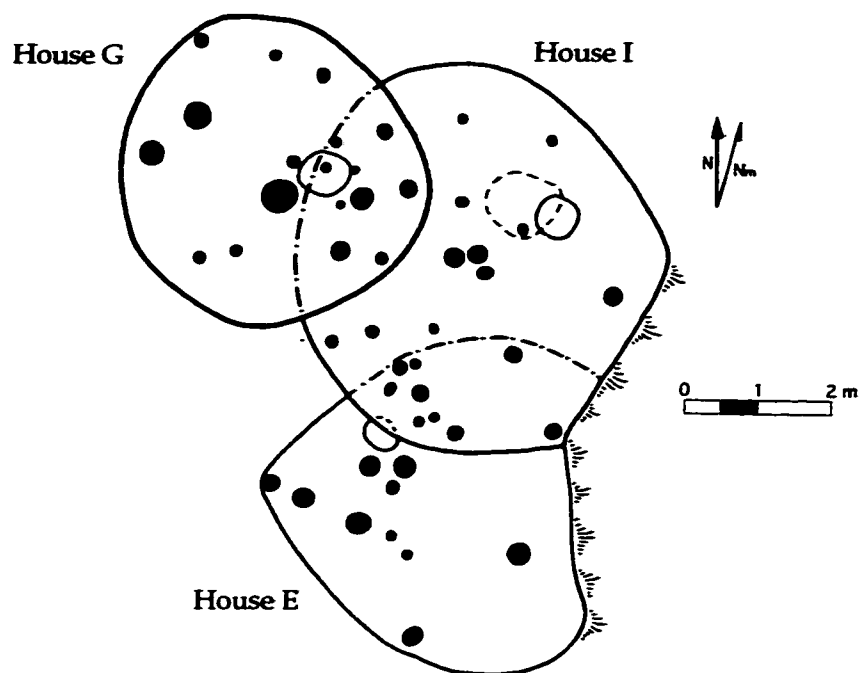


Figure 3.4 Superimposed pithouses at the Ridout Locus of the Wind Mountain site (LA127260; after Woosley and McIntyre 1996, Figure 4.122).

House E, then it must also post-date the Georgetown phase. House E, the earliest structure, is associated with an archaeomagnetic date from burned wall plaster of A.D. 710-940, in the Three Circle phase. House I, which is stratigraphically in the middle of this sequence, dates to either A.D. 640-730 or A.D. 820-1020¹. House I is also associated with a radiocarbon date of 390 B.C.-A.D. 4, but the authors interpret this as evidence for early occupation of the locale, not the occupation of House I (Woosley and McIntyre 1996: 287). The data from these structures provide an example of why shape is not a reliable criterion for assigning an age range to a structure.

Assigning a structure to the Georgetown and San Francisco phases based on its associated ceramic assemblage is also potentially problematic. Structures with only plain brownware and San Francisco red pottery are typically assigned to the Georgetown phase while structures associated with Mogollon-Red-on-Brown (R/b) are assigned to the San Francisco phase. This classification scheme is complicated, however, because the timing of Mogollon R/b pottery, the diagnostic ceramic for the San Francisco phase, has been questioned. Withers (1985a, 1985b) dismisses the view that Mogollon R/b, Three Circle Red-on-White (R/w), and Mimbres Boldface (Style I) B/w represent an evolutionary sequence. He suggests that Mogollon R/b and Three Circle R/w are roughly contemporaneous (Withers 1985b).

¹ Many archaeomagnetic samples produce two or more possible date ranges because the archaeomagnetic direction of a feature intersects the regional geomagnetic curve at more than one point (Eighmy and Sternberg 1990).

If Withers is correct, then the dates for the San Francisco phase and/or Three Circle phase are incorrect. If the dates for the latter part of the Pithouse period are incorrect, then the proposed settlement change from rounded to quadrangular pit structures is called into question, both in its occurrence and timing. If structure form does not change around A.D. 650, then perceptions of Pithouse period settlement would need to be revised.

Of the 675 pit structures excavated in the study area, 41% are associated with the Georgetown–San Francisco time span (Georgetown n=58; San Francisco n=121, and Georgetown or San Francisco n=101). Not only are chronometric data scarce and ceramic age ranges potentially ambiguous, less than half of all excavated pit structures in the study area (45%) are associated with a ceramic assemblage. Since structure form is not a reliable indicator of age, stratigraphy is the primary criteria from which to infer the relative age of the remaining 55% of the pit structures. Stratigraphic information is available for only a small portion of these structures and an even smaller number intersect chronometrically structures.

Implications for Future Research: Pithouse Shape Change

The first step in any investigation of this settlement change is to determine the temporal distribution of house shapes using chronometrically-dated structures. Data from excavated pit structures in the study area can provide information about the temporal distribution of structure forms. Of 133 pit structures with chronometric dates, about 75 of them have age-range

midpoint dates that fall between A.D. 500 and A.D. 800. If the pattern is supported by the chronometrically dated structures, then changes in the distributions of other related variables should provide insight on the nature, and perhaps the cause(s), of the change.

Additional variables that could be examined include those implicated in Hunter-Anderson's model (1977, 1986). She suggests that rectangular structures are easier to partition for varied activities and storage than are rounded structures. A detailed inventory of features that might document partitioned space would be useful for investigating Hunter-Anderson's (1977, 1986) model, despite that such data are limited for my study area. The handful of "wing" and partition walls reported for excavated structures occur in circular pit structures as well as rectangular surface structures. Interior features that might be interpreted as partitioned space (e.g. wall niches, recesses, shelves, and benches) are also reported for all structure forms.

Hunter-Anderson (1977, 1986) and Gilman (1987) both suggest that changes in subsistence and/or mobility strategies should result in increased numbers of interior activities or increased interior storage, which might have prompted the change to rectangular structures. Feature variability, total feature frequency, and frequencies of different feature types could be used to explore the implications of these models. Data from artifact assemblages or artifact patterning within structures might also be useful for addressing issues

of the models, but such evidence is rarely available from archival or published sources.

An alternative approach to the change from rounded quadrangular pit structures derives from disciplines concerned with building construction and engineering. I suggest that the shift to rectangular structures may be related to changes in construction costs associated with the two structure forms. More specifically, technological changes may have reduced the cost of acquiring roofing materials for rectangular structures.

Construction engineers know that rectangular structures are less durable and more difficult to maintain than rounded structures (Onouye and Kane 1999). Higher construction and maintenance costs result from weaknesses inherent in corners and along roof seams. Why, given these disadvantages and lesser effort required to excavate a circular pit, would builders construct quadrangular pit structures?

Rounded structures are generally associated with a center post, a peripheral or a lateral posthole pattern, and cribbed or radial roof beam pattern. In cribbed roofs, beams are laid in a circular pattern, and built up in layers of consecutively smaller diameter circles to form a conical shape (Figure 3.5b). The beams in cribbed roofs do not require uniformity in beam diameter, length, nor shape. In roofs constructed on a radial pattern (Figure 3.5a), the primary beams might be long, but the cross-beams may be of any size or shape.

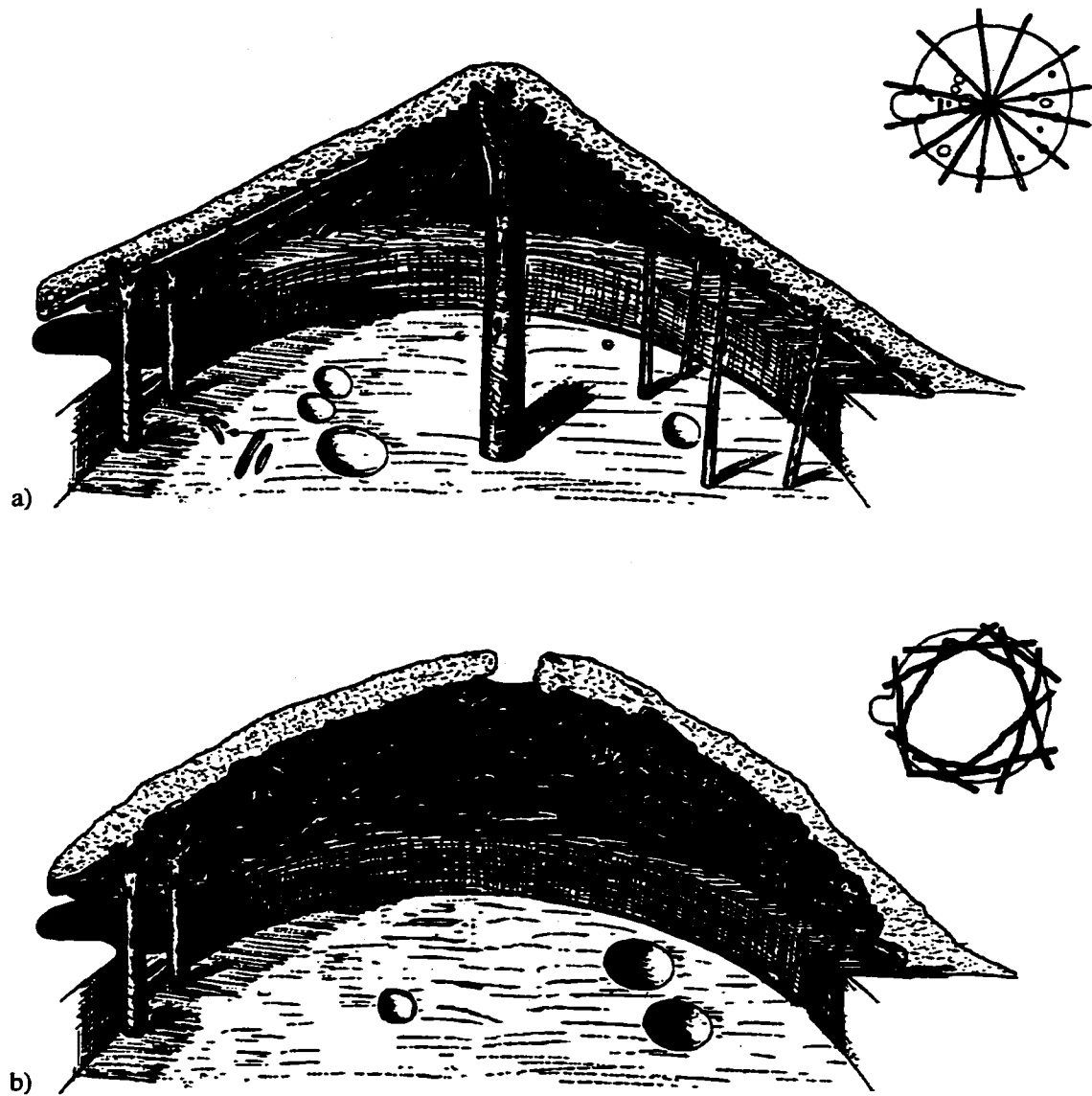


Figure 3.5 Pithouse reconstructions; a) pit structure with a radial roof construction pattern (after Martin 1943: 139, Figure 43), b) pit structure with a conical roof construction pattern (modified from Martin 1943: 139, Figure 43).

In contrast to rounded structures, quadrangular structures with 4-corner or mid-line posthole patterns (Figure 3.2b, c) require crossbeams that span larger distances. What little data survive about roof construction indicates that secondary crossbeams are aligned perpendicular to larger primary roof beams. The span and orientation of secondary beams in quadrangular houses puts constraints on beam size and shape and favors uniformity. Beams of uniform size and shape are associated with higher construction costs than beams of irregular shape and variable size.

New technology, such as the groundstone axe, might have made construction of quadrangular roofs less costly by making it easier to obtain homogeneous roofing materials. If so, then the advantages associated with rectangular structures identified by Hunter-Anderson (1977, 1986) could outweigh the time and energy costs of constructing and maintaining quadrangular structures.

Changes in house form and roof construction appear to coincide, but the timing and nature of the changes are still unknown. Future research into this settlement change should focus on the relationship between structure form and roof construction. Variables that could inform on the relationship include structure size, posthole patterns, posthole frequency, and evidence for repairs. Data on the kinds and forms of wood used in roof construction would also provide valuable details; however, these data are seldom preserved and rarely reported.

SETTLEMENT CHANGE FOUR: THE PITHOUSE-TO-PUEBLO TRANSITION

Whatever triggered the move into agglomerated surface pueblos is presently undetermined but the transition was rather fast, with no evidence for any transitional architectural forms in the Mimbres region. (Anyon 1980: 203)

The Pithouse-to-Pueblo Transition Defined

The pithouse-to-pueblo transition, although long-recognized, until recently has received little attention from archaeologists (Whalen and Gilman 1990). Surface structures eventually dominate the archaeological record in the study area. The change appears to take place during the time when Mimbres Transitional (Style II) B/w pottery was being manufactured (A.D. 880–1020).

Pueblo structures have floors at the ground surface and walls made of adobe or stone masonry. They are typically found in clusters of contiguous rooms called roomblocks. Gilman (1987) excludes single-room structures from her definition of pueblos. Contiguous structures are crucial to her argument for the transition to pueblos, and non-contiguous structures may lack the thermal efficiency of contiguous rooms.

Interpretations and Current Research: Pithouse-to-Pueblo

As late as 1980, Gilman states that the "causes behind the transition from pithouse to pueblo structures are unknown and rarely discussed" (p. 267). This lack of archaeological attention may be a function of seeing the

change as inevitable because modern puebloan people occupied large aggregated pueblo structures on a year-round basis (Rocek 1996). Early explanations of the architectural transition rely on diffusion of ideas or migration of people from the Anasazi territory (Haury 1936a; Martin 1954; Martin and Rinaldo 1950a; Wheat 1954).

Masonry architecture appears earlier in the Anasazi area, around A.D. 700/750 at the beginning of the Pueblo I period. This transition occurs later in the study area, between A.D. 900 and A.D. 1000, coincident with changes in the painted pottery. In the northern part of the study area, Reserve Black-on-White pottery appears at the same time as the first masonry architecture, at the beginning of the Pueblo period. This coincident appearance of ceramics and surface architecture may support the interpretation that the northern Mogollon archaeological record reflects Anasazi influence. Reserve B/w is sherd-tempered (while other Mogollon ceramics are not) and its "design style did not evolve out of the southern Mogollon styles" (i.e. Mogollon R/b, Three Circle B/w, and Boldface B/w; LeBlanc 1982a: 116).

Haury always maintained that the advent of surface architecture marked the "Anasazization" of the Mogollon area (personal communication 1991, see also Haury 1986), but by the early 1980s, a different perspective dominated in the literature about the Mimbres Mogollon area. In the latter view, ceramic and architectural data demonstrate cultural continuity from the Pithouse period through the Mimbres Classic phase (LeBlanc 1982a, 1989).

The shift appears to be a rapid one, in which “many Classic sites developed in situ from large Late Pithouse period sites” (Gilman 1980: 213; Anyon et al. 1981). Lekson (1992a: 86) questions why the ceramic changes are attributed to Anasazi influence in one case and not in the other when “both types employ very similar geometric designs, and both types are associated with the inception of pueblo-style building.”

Gilman (1983, 1987) presents an autochthonous model to account for the pithouse-to-pueblo transition. Based on an ethnographic analysis of pit structure and pueblo use, she identifies the conditions under which the two kinds of structures are used. Gilman then develops arguments that lead to the adoption of pueblo architecture in the American Southwest.

As the foundation of her model, Gilman (1987) assumes that a population increase results in a higher population density and subsequent subsistence intensification. She suggests that, in the Southwest, agricultural activities are intensified rather than other subsistence activities. In her model, agricultural intensification leads to the changes in storage, food preparation and cooking times, and in food information networks. An intensified subsistence system leads to increased storage time and an increase in the volume of stored foods, which in turn leads to more permanent storage, more secure storage, and larger storage facilities.

Gilman (1987) also suggests that agricultural intensification leads to increases in preparation and cooking times because agricultural products

make up a larger proportion of the diet. For example, if consumption of dried maize increases, greater amounts of time might be spent grinding the maize, and/or it might be cooked for longer periods to improve digestibility. If these activities typically took place outside, then the increased time spent on them increases the chances of encountering bad weather. This would result in food preparation activities being moved inside.

“Food information networks” (Gilman 1987: 556) are expected to contract as a function of subsistence intensification. That is, information about food resources is shared with fewer people, which results in interior facilities for storage, food preparation, and cooking, so that neighbors cannot see others’ resources. With movement of activities inside, interior space becomes partitioned and activities will take place in specific locations (e.g. grinding bins). Eventually, activities and space become so partitioned that each requires a separate specialized structure (e.g. storage rooms and granaries). Finally, Gilman (1987) argues that subsurface contiguous rooms cannot be constructed in the deposits into which most pit structures are excavated. Thus, contiguous surface structures became dominant.

Challenges and Problems: Pithouse-to-Pueblo

Two primary issues impede efforts to understand the change to surface architecture in the Mogollon area. The first issue is classificatory and related to how the change is defined and identified in the archaeological record. The second issue is chronological.

Just as archaeologists define pueblos differently, they also have different ideas about the characteristics of early surface architecture and the contexts in which it is found. The Gladwins (Gladwin and Gladwin 1934) define the first surface architecture phase as the Mangas phase, which includes small pueblos with Boldface B/w pottery. They consider that all Southwest architectural development passed through similar stages and equated the Mangas phase with the Pueblo II period of small pueblos in the northern (Anasazi) Southwest.

Subsequent use of the Mangas designation has varied in the Mogollon area (see Appendix A) and today it remains a matter for occasionally intense debate (Lekson 1999). The Mangas phase, as defined by the Gladwins, was largely ignored until it was revived by Danson (1957; Appendix A) who used it to classify small pueblos with Boldface B/w and Mimbres Classic B/w pottery. Later, Fitting (1972; Fitting et al. 1971) substantially modified the definition by using the presence of Boldface B/w pottery as the sole criterion for membership in the Mangas phase. This served to expand the temporal range of the phase to A.D. 700–1000 (Appendix A), well beyond the Gladwins' original conception of the phase. Interestingly, the controversy over the Mangas phase never extended into the northern part of the study area. There, the first surface structures are small pueblos with Reserve B/w pottery and the concept that small pueblos precede large pueblos has never been disputed.

Lekson (1988, 1990, 1992a, 1999) has rekindled the Mangas debate in response to the Mimbres Foundation contention that the Mangas phase should be dropped from Mogollon nomenclature (Anyon et al. 1981). The Mimbres Foundation holds that large Late Pithouse (Three Circle phase) villages developed into large Classic Mimbres pueblos in a relatively short amount of time (Anyon 1980; Anyon et al. 1981; Gilman 1980; LeBlanc 1983). They interpret the large number of small pueblo sites as special purpose or seasonally occupied sites (e.g. LA12109, Nelson et al. 1978; LeBlanc 1986; Minnis 1980). This original stance seems tempered by the identification of a small number of "core rooms" in the surface roomblocks at Galaz, a large Mimbres Classic site (LA 635; Anyon and LeBlanc 1984). The Mimbres Foundation stance is further altered by LeBlanc (1989) who suggests that small pueblos gradually developed into the large pueblos.

The Mangas debate seems to be founded on fundamental differences in the meaning attached to individual phases and the lines dividing them. For LeBlanc (1989), drawing a dividing line through the early part of the Mimbres Classic phase implies an abrupt change in settlement. On the other hand, Lekson (1999) suggests that we acknowledge that small pueblos precede large pueblos and that they are different enough from one another to warrant separate categories. Lekson (1992a) suggests that the debate cannot be resolved until we know more about the architectural changes that occurred during the Three Circle and Mimbres Classic phases between A.D. 750 and A.D. 1150.

Chronological data are crucial to the investigation of the pithouse-to-pueblo settlement change. However, only twenty excavated structures have associated chronometric age ranges that include the A.D. 900s. Although A.D. 1000 is the typical beginning date for the Pueblo period, this boundary probably reflects the scarcity of dates in the A.D. 900s rather than the timing of the change. Data from NAN Ranch (LA2965, Shafer 1986, 1987) and Saige-McFarland sites (LA5201, Lekson 1990) indicate that masonry architecture may predate the 9th century A.D.

Implications for Future Research: Pithouse-to-Pueblo

Ceramic dating offers archaeologists an alternative way to investigate the settlement change in absence of a large sample of chronometrically dated structures. Two ceramic types date to the period of interest, Mimbres Boldface (Style I) B/w, and Transitional (Style II) B/w. Shafer and Brewington (1995) assign Mimbres Boldface (Style I) B/w the age range of A.D. 750-900, and Transitional (Style II) B/w a date of A.D. 880-1020; they split the latter into early Style II (A.D. 880-1020) and late Style II (A.D. 970-1020).

Lekson (1992a) suggests that the characteristics of structures with Style II B/w pottery in floor and subfloor contexts will provide valuable information about the transition. The current database of excavated structures (Appendix C) contains 68 structures with Style II B/w ceramics in floor or subfloor contexts. When combined with the structures that have

chronometric dates, a relatively large dataset is available for characterization of the architecture and other structure attributes.

The subsample of ceramically or chronometrically dated structures should also permit examination of some aspects of Gilman's (1987) model. Although not specifically predicted by Gilman, the number of pueblo structures should exceed the number of pit structures. The number of surface rooms is commensurate with the model, which assumes a population increase and use of contiguous rooms with specialized functions. The model predicts changes in storage technology, food processing features, and cooking features. Based on her model and supporting data from Black Mesa, Arizona, Gilman (1987) predicts that the frequency of interior pits, interior bins, wall niches, and antechambers should increase initially and then decrease, as storage rooms become more common. Specialized food processing features such as grinding/mealing areas should be more common in pueblo structures than pit structures. Interior firepits should also increase in frequency during the settlement change. The number of different kinds of features (feature richness) should also increase as more and different kinds of activities occur inside structures and as interior space becomes increasingly partitioned (i.e. specialized).

If food information networks contract as Gilman (1987) suggests, then the frequency of antechambers and interior entryways (denoting contiguous rooms with interior access) should increase. However, a different kind of

social reorganization might also result from increased dependence on a few resources in an agriculturally risky environment. The potential for crop failure might make an interdependent social structure advantageous by distributing the risk across a larger group with access to varied resources. Construction of contiguous rooms might be correlated with community-based social organization and widespread sharing of food resources.

Technology may also become more efficient because of agricultural intensification. If more time is spent processing maize, then the grinding areas of manos and metates should increase in size and change in shape (Hard 1986, 1990; Lancaster 1983; Mauldin 1991, 1993). Mano form should change from circular "one-hand" forms to rectangular "two-hand" forms. The grinding area of metates should increase and change from a basin to a slab or trough form. Mauldin (1991, 1993) suggests that in the northern Mogollon area, agricultural dependence fluctuates before increasing significantly during the Tularosa phase. Hard et al. (1996) find support for this model in various parts of the Southwest. Diehl (1996) disagrees, and instead suggests that agricultural intensification occurs during the San Francisco phase. However, his statistical comparisons of mano grinding areas show no significant difference between adjacent phases (Georgetown : San Francisco and San Francisco : Three Circle), only between the Georgetown and Three Circle phases (Diehl 1996: 111).

SETTLEMENT CHANGE FIVE: THE SHIFT TO ADOBE WALL CONSTRUCTION

Houses are built of adobe, and well made. (Mills and Mills 1972: 1)

The later pueblo was constructed of adobe walling with flat slabs laid against the base of the walls. Such architecture represents a radical departure from the cobble-walled masonry of the Classic Mimbres period. (Anyon and LeBlanc 1984: 144)

The architectural change from cobble and adobe wall construction to adobe wall construction occurs only in the southern portion of the study area; the data about this change derive primarily from the Mimbres River valley and Cliff valley on the Gila River. This architectural change marks the end of the Mimbres Classic phase and the beginning of the post-Classic era. As noted in Chapter 2, both the Black Mountain (El Paso) phase and Cliff (Salado) phase post-date the Mimbres Classic phase and ceramic changes accompany the architectural change. El Paso Polychrome, Chupadero B/w, and Playas Red characterize Black Mountain ceramic assemblages, which date to between A.D. 1200 and A.D. 1300 or 1400.

Black Mountain phase structures have puddled adobe walls occasionally set in foundation trenches (Anyon and LeBlanc 1984; LeBlanc 1980). The rooms are large and clustered in roomblocks arranged around a plaza. The Cliff phase is also characterized by adobe architecture, but the walls are more massive (LeBlanc 1989), the rooms are larger, and foundation trenches with upright footing stones are more common. There is little variability among Cliff phase rooms, which seem to serve as both storage and

habitation rooms (Nelson 1980). The Cliff phase ceramic series includes relatively high frequencies of the Salado polychromes (Pinto, Gila, Tonto), which appear to post-date A.D. 1300 (Lekson 1992a). See Appendix A for additional details of Black Mountain and Cliff phase rooms.

Interpretations and Current Research: Adobe Wall Construction

Rather than explaining the advent of adobe pueblos, most archaeologists focus on explaining the "Mimbres Collapse" after which Mimbres Classic (Style III) B/W pottery was no longer manufactured. The end of the Mimbres Classic phase has been attributed to a catastrophic population decline due to disease (Bandelier 1892) and warfare (Gladwin and Gladwin 1934). More recently, LeBlanc (1980, 1983, 1989) argues that the architectural and ceramic changes marking the end of the Mimbres Classic reflect the influence of Casas Grandes society, centered in what is now northern Chihuahua, Mexico.

The expansion of the Casas Grandes interaction sphere into the Mimbres valley may have been aided by population decline due to resource stress (LeBlanc 1983, 1989 citing Minnis 1985). LeBlanc (1989) further suggests that the boundary between the Black Mountain and Cliff phases registers the breakdown of the Casas Grandes interaction sphere. Nelson and LeBlanc (1986:246-7) deemphasize the architectural and artifactual differences between Black Mountain and Cliff and instead emphasize continuity. Nelson (1999) suggests that the post-Mimbres settlement changes reflect a process of social

reorganization at a regional scale associated with the abandonment of large villages.

Challenges and Problems: Adobe Wall Construction

Lekson (1992a) argues that the Black Mountain phase sites of the Mimbres valley contain little evidence for Chihuahuan influence. Less than one percent of the decorated sherds recovered by the Mimbres Foundation at Black Mountain phase sites are Chihuahuan polychromes (Lekson 1992a). Furthermore, the dating of Casas Grandes has been revised based on reanalysis of tree-ring specimens (Dean and Ravesloot 1988; Ravesloot et al. 1986), which now range from A.D. 1300 possibly up to A.D. 1500 (Lekson 1992a). This shift to a later date for Casas Grandes reduces the chances that a Casas Grandes interaction sphere caused the changes evident in the Mimbres valley at A.D. 1150.

Implications for Future Research: Adobe Walls

The multiple phases defined for the post-Classic era indicate serious classificatory problems, and until the chronological issues are resolved, questions about architectural change will remain unanswered. The settlement change from cobble to adobe-wall construction occurs whether the structure is assigned to the Black Mountain/Animas/El Paso or Cliff/Salado phase. Nonetheless, the classificatory issues influence archaeological

interpretations for the change and affect the choice of variables that could be used to disprove proposed explanations.

SUMMARY

In this chapter, I describe five major settlement changes discussed in the Mogollon literature and discuss previously proposed explanations for each change. The first significant settlement change in the Mogollon region occurs when we see the first appearance of formally constructed pit structures at around A.D. 200–300. The next change occurs at about A.D. 500–550, when structures are, apparently, first constructed on accessible landforms such as benches and terraces. At about A.D. 650, quadrangular structures with rounded corners appear to replace rounded structures. Between A.D. 900 and A.D. 1050, surface architecture replaces the pit structure as the predominant architectural form. And finally, in the southern part of the study area, construction materials change from masonry to predominantly adobe wall construction around A.D. 1200–1300.

Nearly all of the explanations proposed by culture historians have been challenged either because theoretical perspectives have changed or because the data do not seem to support earlier interpretations. In a number of cases, proposed hypotheses have yet to be tested. For each settlement pattern, avenues for further research have been identified based on the descriptions of the accepted patterns and the accompanying explanations.

Our ability to answer modern archaeological questions has been limited, to some extent, because most of the data were collected under a different research design, one whose goal was to document normative characteristics and differences. I have tried to reframe the data requirements to address specific questions of settlement change and variability, so that previously collected data can be combined with newly collected data and utilized to answer settlement questions. The next step in the process involves identification of variables that are explicitly linked to the settlement change, i.e. variables that have implications for settlement of a particular locale and documentation of settlement variability.

Chapter 4

SETTLEMENT CHANGE:

DATA COLLECTION AND IDENTIFICATION

Obviously, what is needed is the formulation of problems and the invention of procedures for gathering and studying comparable data. (Haury 1956:3)

INTRODUCTION

As noted in previous chapters, I am interested in understanding how and why people built the buildings that they did and moved to the places that they lived. Most earlier explanations of settlement patterns imply that different settlement strategies offer selective advantages at different times and places. Given previous explanations of settlement change, one of the primary goals of this research is to document settlement variability through time and across space.

Documentation of variability is important to the explanation of settlement change because settlement variability is the ultimate source of successful settlement strategies as cultural and/or environmental conditions change. Successfully settled locales are those that are occupied for lengthy time spans or that continue to be occupied after conditions change. If settlements in an area vary from each other, then when

conditions change, some settlements are potentially successful while others will be abandoned. If all settlements were identical, then when conditions change, all settlements would be either successful or unsuccessful. If the latter, then the population becomes extinct and the archaeological record will reflect that all settlements in the area were abandoned when conditions changed.

In the traditional phase system, settlements of a similar age are assumed identical and settlement changes are inferred to represent widespread abandonment of a particular settlement type, or even extinction of the inhabitants. The phase system depends on the simultaneous appearance and disappearance of a suite of identifiable traits. While some attributes are common over large areas or over long time periods, the settlements in the study area are not homogeneous. Appendices A and B show that, individual traits are differentially distributed across time and space.

This alternative framework does not assume that all structures are identical, or that multiple traits change at the same rate. Documenting variability in the physical characteristics of settlements in the study area will help me to identify the conditions under which certain structure attributes are advantageous. When particular attributes are advantageous, they will increase in frequency, and then stabilize, in a population.

Three primary factors, validity, reliability, and data availability affect archaeological documentation of settlement variability. First, the typical

unit of analysis, the site, is not the most valid measure of settlement for my purposes because it obscures settlement variability at other scales. Second, the sample of sites originally used to define the settlement changes is small and thus probably not representative of the entire range of settlement variability in the study area. The sample is so small that the reliability of any identified patterns will be questionable. Finally, relevant settlement data are dispersed across such a wide array of source materials (e.g. site files at the Laboratory of Anthropology, publications, unpublished research reports, theses and dissertations) that evaluation of the settlement patterns across the Mogollon territory is difficult.

In this chapter, I propose a framework for investigating Mogollon settlement change that differs from traditional approaches and addresses the problems of validity, accuracy, and data availability. The chapter is divided into three parts. In the first section, I discuss the problems of settlement validity in terms of the unit of analyses (sites and structures) and chronology (periods, phases, and chronometric dates). I then discuss the reasoning behind the size and shape of the study area and the influence these have on sample size and data comparability.

In the second section of this chapter, I provide details about how I document settlement variability. The variables I select for measurement bear on the distribution and frequency of structures through time and across the study area. The chosen variables are divided into three primary categories: identification variables, location variables, and structure

variables. For each category, I define the pertinent variables and describe how they are measured and reported in Appendix C. In the final section, I describe the physiographic characteristics of the study area. Some of the location variables in the database have been excluded from Appendix C as a precaution against vandalism. All location information is available to archaeologists from the Laboratory of Anthropology, Museum of New Mexico, Santa Fe, using the identification variables provided in Appendix C.

A suite of settlement variables that reflect the consequences of living in a particular place is measured for every structure in the database. Some of the variables record the environmental context of the structure (e.g. elevation, vegetation). However, since structures are the primary mediating factor between people and their environment, I also consider as settlement variables, those that relate physical details of the structure and its construction. The variables are commensurate with the four dimensions of settlement variability identified in Chapter 3 (location, structure form, construction materials, and construction methods). The data are culled from the extant literature and material on file at the Laboratory of Anthropology. Some of the data are listed as described by the excavators and analysts, while other data are newly recorded observations.

SETTLEMENT SCALE

In the following sections, I discuss the methodological changes that help to resolve the validity and reliability problems of Mogollon settlement

data. First, I change the unit of analysis from the site to the smallest archaeologically recognizable unit of settlement, the structure. This unit is a valid reflection of the scale at which settlement occurs because it is the smallest unit of occupancy in a constructed shelter. The shift in the unit of observation increases the sample size from 124 sites to more than 2000 structures. This unit shift also has temporal implications because an age range is assigned to each individual structure rather than to the site, which improves the temporal resolution of the analyses. The resolution is further improved by including chronometric dates for twelve percent of the structures in the sample. Structures without chronometric dates are assigned to a temporal phase based on the determination of the archaeologists that excavated the sites, the physical characteristics of the structure, and/or the artifact assemblage in contact with the floor.

Second, the study area from which the data are drawn is large, and includes more than 24,000 square kilometers. This stands in contrast to the typically smaller geomorphic provinces of earlier research and serves to increase the sample size. The study region is defined using geodetic coordinates and includes the area from 32°22'30" to 34° N longitude and from 107°30' to 109° W latitude (Figure 4.1). Delineating the region in this manner reduces substantially the possibility that the study area boundaries determine the identified spatial patterns.

I address the final issue of dispersed and non-comparable data by compiling into a single database information from all structures excavated

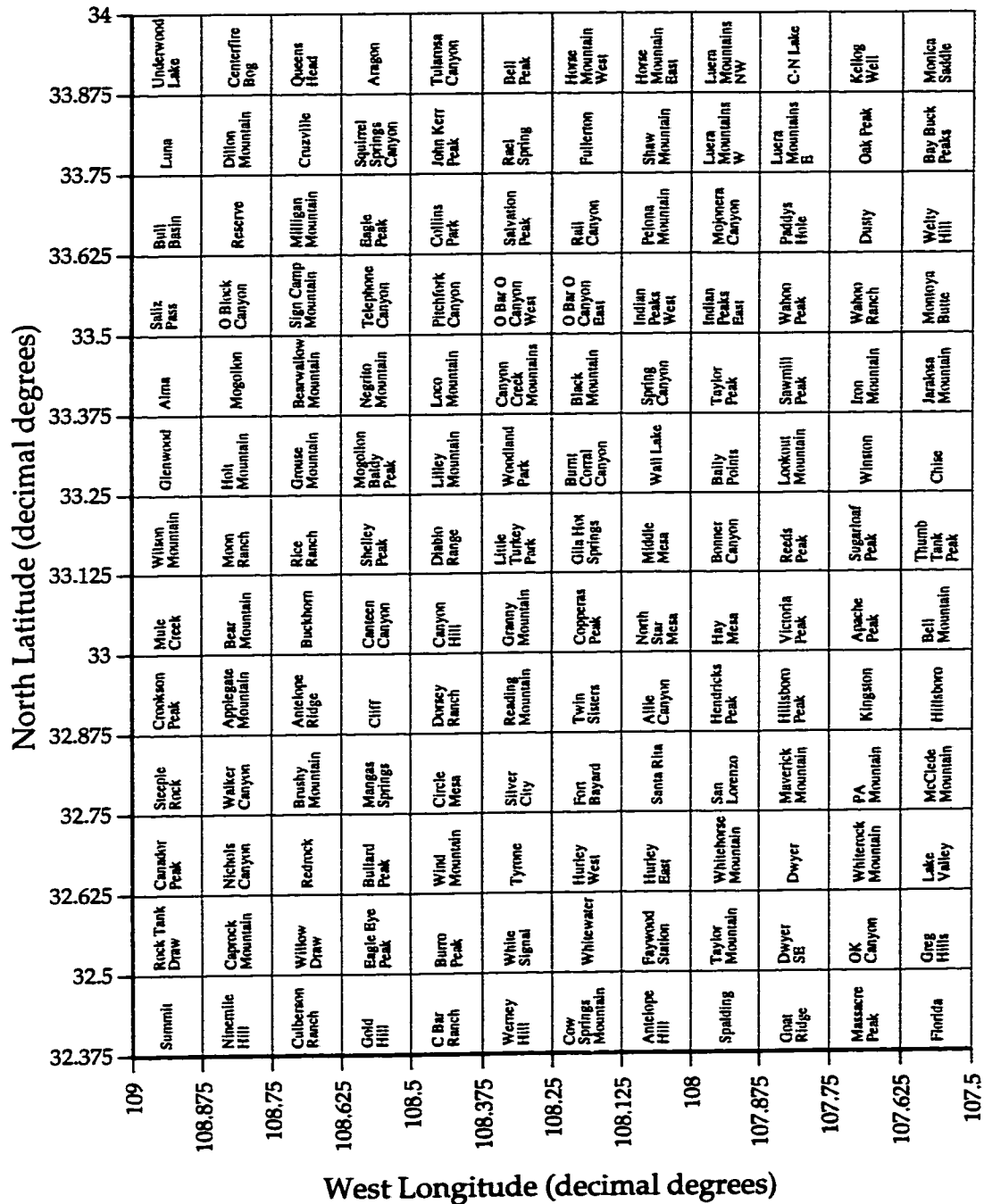


Figure 4.1 Study area defined by geodetic coordinates with USGS 7.5 minute topographic quadrangle names.

prior to 1995 for which data are available. The decision to restrict the analyses to excavated structures is appropriate for analytical as well as historical reasons. Since the unit of observation is the structure, the attributes of structures are the focus of the analyses, and structure-level details are generally not available from survey data. In addition, the culture history trait sequence that defines settlement patterns is based primarily on excavated sites (see Table 2.2 and Appendix A). My assessments of Mogollon settlement patterns are strengthened because they are based on data comparable to that used by the culture historians who first constructed the settlement patterns for the region.

SETTLEMENT VALIDITY

To address previous explanations for change, I need information about the scale and timing of Mogollon settlement changes. How I choose to document settlement change influences the kinds of change I can detect. The spatial and temporal scales at which data are recorded affect the validity of the settlement record. I discuss these issues in two subsections. First, I describe the reasoning behind my choice of the individual structure, rather than the more traditional site, as the unit of analysis. In the second section, I discuss the affect this shift has on how chronological data are recorded.

Sites and Structures

Many of the houses at long-occupied villages were not contemporary. (Bullard 1962: 109)

As the quote above indicates, Mogollon archaeologists have long recognized the possibility that every structure on a site was not occupied at the same time (cf. Haury 1936a; Bullard 1962). However, inferences about Mogollon settlement are typically drawn for the site, usually a village or pueblo. When sites are the unit of analysis and the subject of interpretation, all structures on a site are, by default, assumed occupied and abandoned simultaneously. When settlement is recorded at a site scale, it is difficult to detect changes or consider explanations that operate at scales affecting areas smaller than a site.

The unit of observation for recording settlement characteristics in this study is the individual structure. I use this as a proxy for measuring the settlement success of the inhabitants. People, not artifacts, are successful in the settlement of any locale, but accurate measurement of the settlement success of individual people is not possible archaeologically. Therefore, a proxy measure is needed that registers the relationship between individuals and the environments in which they live.

In architectural settings, the smallest empirical unit required for successful settlement is an individual structure. The term structure refers only to a single self-contained unit of occupancy, such as an individual pithouse or one room in a pueblo roomblock.

Changing the unit of analysis to the structure avoids the assumption of simultaneous occupation and accommodates different episodes of occupation within a single structure. When a structure is reoccupied after a period of disuse, individual occupation surfaces are sometimes differentiable. Each surface is potentially associated with distinct features and artifact assemblages, and in some cases, with remodeling or additional episodes of wall-construction. If the excavators recognize more than one distinct episode of use for a structure, I record separately each individual occupation of the structure.

In structures with multiple settlement episodes, excavators typically designate each episode by consecutive letters or numbers, but use only a single structure label (e.g. Room 1A, 1B, and 1C; Pithouse D-1 and D-2). A good example of this labeling convention, is a set of chronologically sequent rooms at the Apache Creek Pueblo site (LA2949; Figure 4.2). The descriptions and data (Martin et al. 1957) indicate that three distinct settlement episodes are associated with the room labeled Room 3. I record structure data separately for the three individual settlement episodes as Room 3, Room 3A, and Room 3B. The earliest Room 3B is large (7 x 4.4 m) with a firepit and an entryway in the center of one wall. Later, the entryway was sealed with rocks and adobe and a partition wall was constructed to form two smaller rooms, Room 3 and 3A. Room 3 (4.5 x 4.7 m) contains a rectangular slab-lined firepit, a ventilator, and a three-bin mealing feature. The adjacent Room 3A is smaller (2.0 x 4.4 m) and contains only two postholes.

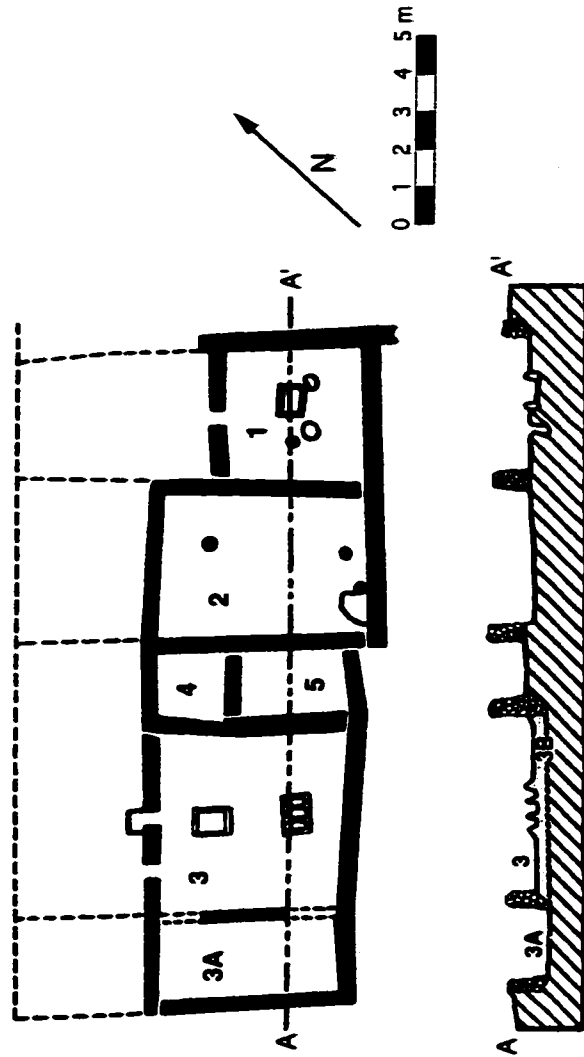


Figure 4.2 Apache Creek Pueblo, Rooms 1-5. The numbering sequence of Rooms 3, 3A, and 3B exemplifies the way structures with multiple settlements are labeled by archaeologists working in the study area (after Martin et al. 1957: 28, Figure 14).

which data are recorded helps address the sample size problem because it increases the sample size of structures from which data are available by more than 16 times. If each episode of settlement (i.e. each occupation of a structure) is analyzed separately, the database is considerably larger than if each site were treated as a single analytic unit. Figures 4.3 and 4.4 demonstrate this increase by showing the occupational frequencies for each phase categorized in two different ways. In Figure 4.3, the data are presented by site, while in Figure 4.4 the data are presented by episodes of structure use.

All analyses in this dissertation are conducted using the structure scale data contained in Appendix C. When appropriate, the structure scale data may be grouped at other scales (e.g. site scale, landform scale). All analyses that address change through time are conducted at the structure scale because age varies from structure to structure. The traditional culture history sequence serves as the site scale contrast to the structure scale analyses of this research.

Comparable site scale analyses would be difficult to conduct because the occupation of most sites in the study area spans multiple phases. At least 55% of the excavated sites are occupied during more than one phase (Table 4.1). These sites may have been occupied continuously for hundreds of years or they may have been reoccupied after a hiatus. How should multiphase sites be counted for the purposes of settlement analysis?

Multiphase sites may be counted in a number of ways. They may be counted once for the entire span of occupation. This approach is statistically

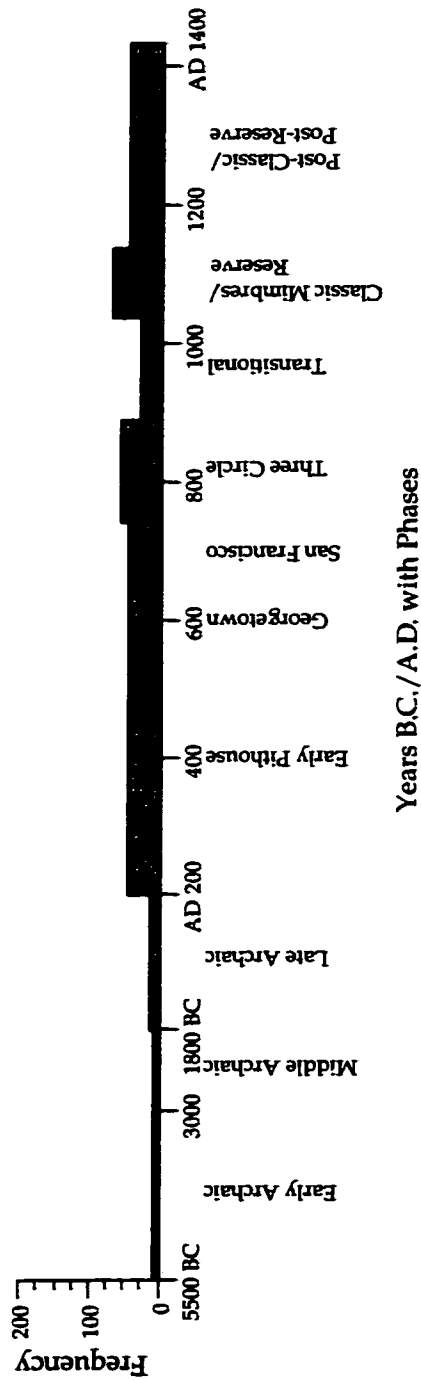


Figure 4.3 Site occupancy by phase. Each bar represents one phase or period. Bar height indicates the frequency of occupied sites and bar width represents the duration of the phase. Multicomponent sites are counted once for each phase of the occupation range. The scale of the x-axis varies so that the entire sequence may be included in the graphic. For the portion of the axis prior to A.D. 200, the scale is 0.35" per 1000 years. After A.D. 200, the scale is 0.35" per 100 years.

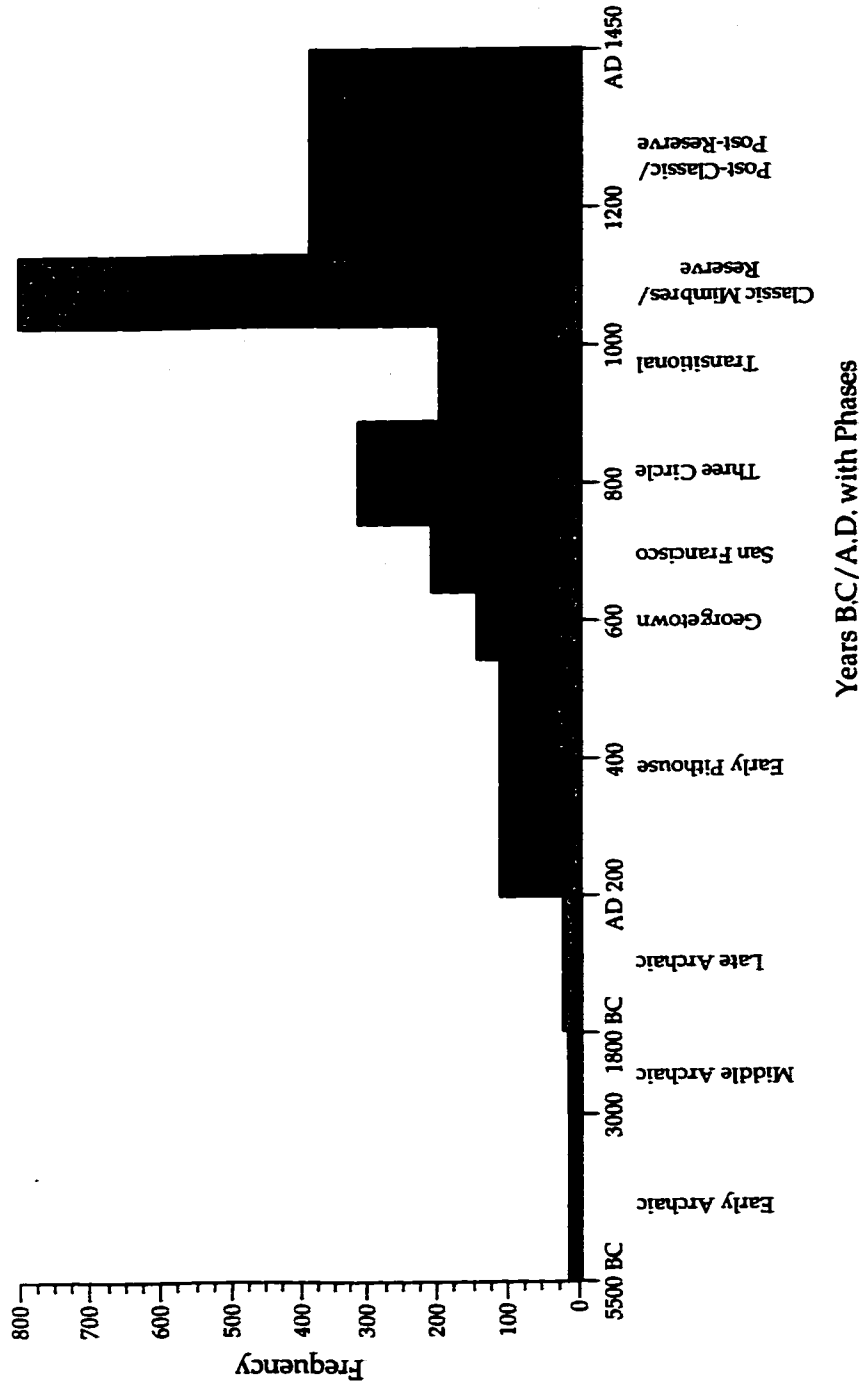


Figure 4.4 Structure occupancy by phase. Each bar represents a period or phase of occupation. Bar height represents the number of occupied structures and bar width represents the duration of the time period. Structures that cannot be assigned to a single phase are indicated by a bar that spans multiple phases. The scale of the x-axis varies so that the entire sequence may be included. For the portion of the axis prior to A.D. 200, the scale is 0.35" per 1000 years. After A.D. 200, the scale is 0.35" per 100 years.

Table 4.1 Excavated sites in the study area, cont.

LA (site) Number	Archaic			Late Pitthouse					Pueblo				Historic	
	Early	Middle	Late	Early Pitthouse	Georgetown	San Francisco	Three Circle	Early Mimbres/ Mangas	Mimbres Classic	Reserve	Tularosa	Black Mountain/ El Paso		Salado/Cliff
6783				x	x	x	x	x x x						
6882								x x x						
8675				x	x	x	x	x x x	x					
8682										x				
8886								x	x x x					
8887									x x x					
8888									x x x					
8889									x x x	x				
8890							x		x x x	x				
8891									x x x	x				
9657									x x x					
9676									x x x					
9706				x	x		x		x x x					
9709				x	x	x	x		x x x					
9713				x					x					
9725									x					
9726						x	x							
10645										x				
11568				x	x	x	x							
11609						x	x							
12076						x	x		x					
12077									x				x	
12109									x					
12110				x	x									
12992												x		
13658										x				
13921								x		x				
14976					x									
14998					x	x	x		x					
15016									x					
15021									x				x	
15044									x			x		
15050									x					
15075												x		
16241							x		x					
18888							x		x					
18890						x	x		x					
18903						x	x		x					
18939													x	
19001									x					
19074					x									
19075				x										
19167									x					

Table 4.1 Excavated sites in the study area, cont.

LA (site) Number	Archaic			Early Pitthouse	Late Pitthouse				Mimbres Classic	Pueblo			Historic
	Early	Middle	Late		Georgetown	San Francisco	Three Circle	Early Mimbres/ Mangas		Reserve	Tularosa	Black Mountain/ El Paso	
19178							x	x					
29376													
29397				x					x				
32532								x					
34787								x					
34788								x					
34789				x	x	x		x			x		
34794								x			x		
34800			x										
34813			x	x									
38624				x	x				x				
43788				x					x				
44182			x	x									
45507								x					
50644				x									
50652									x				
61756									x				
64931				x				x					
66314											x		
66315										x			
68160				x	x								
68924									x				
71877				x	x			x					
71914								x					
73822								x					
73823								x					
78337								x					
78633									x				
85069												x	
88762								x					
88763	x	x	x										
88764				x	x	x		x					
88765								x					
106003											x		
127260				x	x	x		x		x			
75956								x					
Burro Springs1								x					
Cordova Cave	x	x	x	x	x	x	x	x					
Delk-1								x					
Wet Leggett				x	x	x	x		x				

valid because it avoids counting a single unit multiple times. However, lengthy occupation spans are essentially useless for describing and explaining settlement changes.

Multiphase site might also be counted only once for a single phase, such as the phase associated with the most abundant archaeological evidence. For example, many of the pueblo sites in the Mimbres valley are generally referred to as Classic Mimbres sites because the material of that phase dominates the archaeological record at those sites (e.g. Cameron Creek, LA190; Galaz, 635; Mattocks, LA676; Old Town, LA1113; Swarts, LA1691; NAN Ranch, LA2465). While assigning a site to a single phase is also a statistically valid recording procedure, it is unsatisfactory archaeologically because it requires that other data be ignored.

Finally, the temporal span of a site may be divided and individual occupations counted. In one approach, the site is counted multiple times, once for every phase of occupation. When sites are recorded as occupied or unoccupied (i.e. as a presence/absence variable) it implies that every structure was used during every phase the site was occupied, which obscures differences or changes in the degree of occupation. When such a strategy is used, changes from occupation of only a few structures to hundreds of rooms on a single site are not observable. Data about the character or intensity of occupation might be obtained from artifact distributions on a site. While these data exist for many sites in the study area, early occupations are

generally not detectable because the ceramics that characterize them also occur in later assemblages (Lekson 1992a).

Two sites, Old Town (LA1113) and Mogollon Village (LA13568), demonstrate the difficulties of conducting site scale analyses using multiphase sites. Old Town contains structures that are unquestionably Mimbres Classic phase in age (Figure 4.5, based on data from Appendix C). Other structures at the site have been assigned to the Early and Late Pithouse periods, the Early Mimbres phase, and to the post-Classic phases. I could assign an age of A.D. 200-1450 to the site, consider it a Mimbres Classic site, or divide the site by phase and treat each as an equal unit of occupation. The first option would not be helpful for documenting settlement changes in the Pithouse and Pueblo periods. The latter options would misrepresent the history of Old Town settlement. The structure scale excavation data and descriptive data from unexcavated parts of the site indicate that the Mimbres Classic and Black Mountain dominate the record of settlement at Old Town, but the earlier occupations are largely invisible at the surface of the site. Additional chronometric dates could help narrow the age range, but this would not resolve the problem of how to measure settlement at Old Town.

Data from Mogollon Village, one of the best-dated sites in the study area, shows that chronometric data may make subdivision of a site scale occupation sequence even more difficult. Mogollon Village is associated with 15 chronometric dates, from tree ring, radiocarbon, archaeomagnetic, and obsidian hydration specimens. At the site scale, Mogollon Village appears to

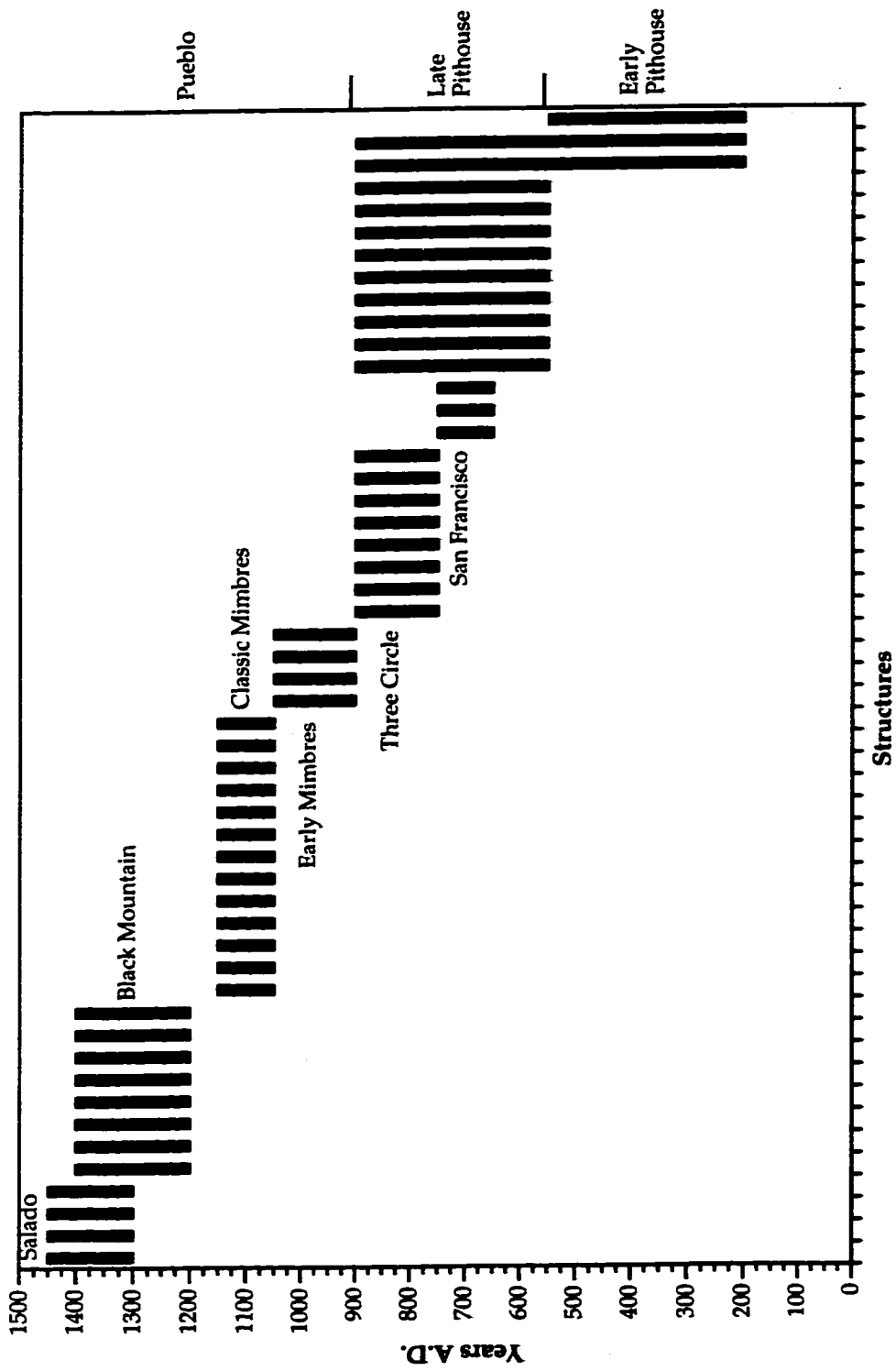


Figure 4.5 Phase or period age-ranges for excavated structures at the Old Town site (LA1113).

have been occupied for at least 700 years. When the data are examined at the structure scale, the dates clearly indicate that the structures were probably not occupied simultaneously (Figure 4.6). Structure scale analyses is the most elegant solution for measuring settlement, particularly at locales occupied during more than one phase. Structure-scale observations can easily be grouped into site-scale units if evidence exists for contemporaneous occupation. This strategy preserves information about the degree of occupation at a particular locale, but avoids counting a single site multiple times.

Some of the sites in the area (45%) have produced evidence for a single phase. However, 75% of these sites have 5 or fewer excavated structures (compared to 31% for multicomponent sites). With additional excavations, single component sites might produce material of another phase. Mogollon Village also serves as an example of a site whose earliest phases of occupation are unidentifiable without additional excavations and structure scale chronometric data. Haury (1936a) documented that the site was occupied during the San Francisco and Three Circle phases. The site was considered a Late Pithouse village until Gilman and Mauldin excavated structures that date to earlier phases (Mauldin et al. 1996). The earliest structures at Mogollon Village are completely invisible at the modern surface (Duncan et al. 1991; Gilman et al. 1991; Linse 1997) and cannot be confidently dated based on their ceramic assemblages. Other single-phase sites in the study area may also contain unperceived evidence for earlier or later occupations.

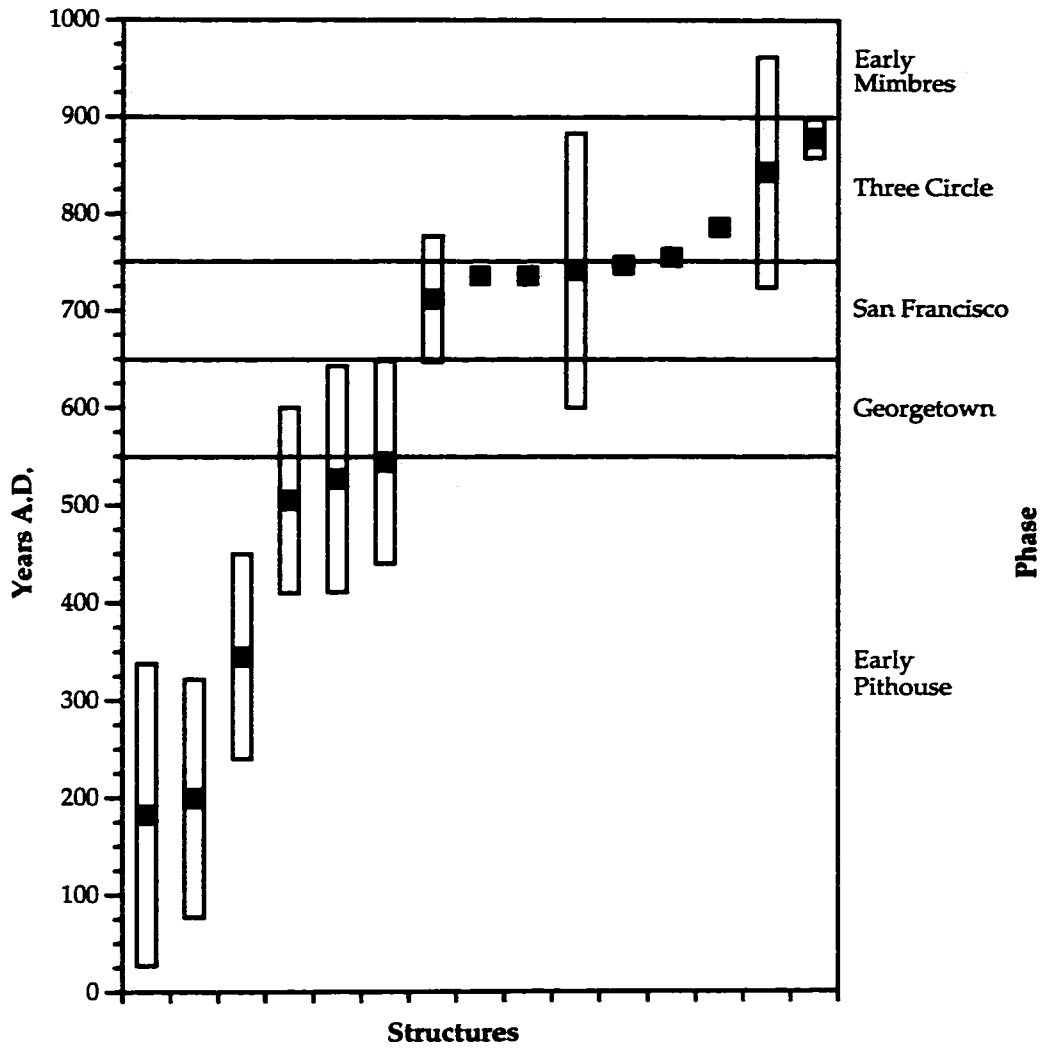


Figure 4.6 Chronometric age-ranges for excavated structures at the Mogollon Village site (LA11568). Bars represent statistical error terms around the chronometric date; tree-ring samples have no error terms.

Periods, Phases, and Chronometric Dates

Dating each pithouse or at least being able to assign it to a phase by its floor ceramics is a basic step in being able to see temporal changes and to detect spatial variability with temporal control.
(Anyon 1980: 166)

The shift to a structural unit of analysis is accompanied by a change in the way that chronological data are recorded. Rather than assign an age range to a site, I assign an age range to each individual structure, and to each settlement episode in a structure.

When variability in structure form, construction materials, and environmental settings can be traced across smaller increments of time, changes are not as abrupt, nor as prominent. In the traditional phase-based chronological system, the process of change is constrained to the boundary between periods or phases. Thus, by definition, all changes are rapid and conspicuous because they occur directly at the boundary between two time periods. For example, when using the phase chronology, changes that occur across the time span between A.D. 750 and A.D. 1150 are grouped into two phases. The physical differences between Three Circle pithouse villages and Classic Mimbres pueblos are unmistakable. However, when the data are viewed across smaller temporal increments, differences become less distinct and gradual changes become visible across the A.D. 850–1050 time span.

When the occupation of each structure is analyzed separately, we have more information about the distribution of variability through time than if each site is treated as a single datum. Twelve percent of the structures in my

database are associated with chronometric dates. Because the database includes both phase-based and chronometric age ranges, the characteristics of the smaller chronometrically-dated sample can be compared to those structures assigned only a phase date.

SETTLEMENT RELIABILITY

Details that have been interpreted as chronological in the Mimbres Valley may instead be geographic facies of broader horizons. (Lekson 1992a: 59)

Differences in site selection between Mogollon [southern Mogollon] and Anasazi-like [northern Mogollon] groups are probably related to the nature of the topographic and vegetative zones inhabited by each group and not an expression of distinctive "cultural" preferences. (Berman 1979:31)

The quotes above, as well as the culture history synopsis compiled in Appendix A, indicate that Mogollon settlement varies spatially as well as chronologically. Problems of scale, sample size, data comparability, and the potential for boundary effects hinder investigation of Mogollon settlement across space. The large size of the study area and the manner in which it is defined eliminate or reduce these problems.

Spatial Scale

When considering areas larger than a single site, the "region" (cf. Binford 1964) is the spatial scale preferred by many archaeologists. Study areas may have been restricted in size, at least initially, because the primary way to learn about an area was to walk across it. Unfortunately, the practice of working at a restricted spatial scale, whether on a single site or in a single

valley, prevents recognition of processes that operate at broader spatial scales.

In the study area, river valleys and valley segments are the most common determinants of an archaeological region (Lekson 1992a). For example, Hough (1907) and Danson (1957) divide their study areas into subregions based on river valleys. Fitting (1972) and LeBlanc (1983) focus their energies on a portion of a single drainage system (river and tributary streams).

Each river valley or valley segment, is a small, and probably not representative, subset of the much larger area labeled Mogollon. Surveys conducted in the 1970s and 1980s in southern New Mexico range in area from 0.1–140 sq km (Lekson 1992a, Table 3.2; Mimbres Foundation 1978). These “regional” surveys cover less than 1% of the larger Mogollon territory, which includes over 100,000 sq km in New Mexico, Arizona, Texas, and at least half as much in northern Mexico.

The advances in computer software and technology in the past decade allow data compilation from a large number of previous research projects (e.g. Chicago Field Museum of Natural History, Mimbres Foundation, and New Mexico Highway Salvage Program) into a single database. The study area includes more than 50% of the Mogollon territory in New Mexico (Figure 4.7). Such a large area has a greater probability of including the full range of environments and landforms utilized by the prehistoric inhabitants of the territory. The sample of structures encompassed by this area is more likely representative of the range of variability in the archaeological materials assigned the Mogollon label.

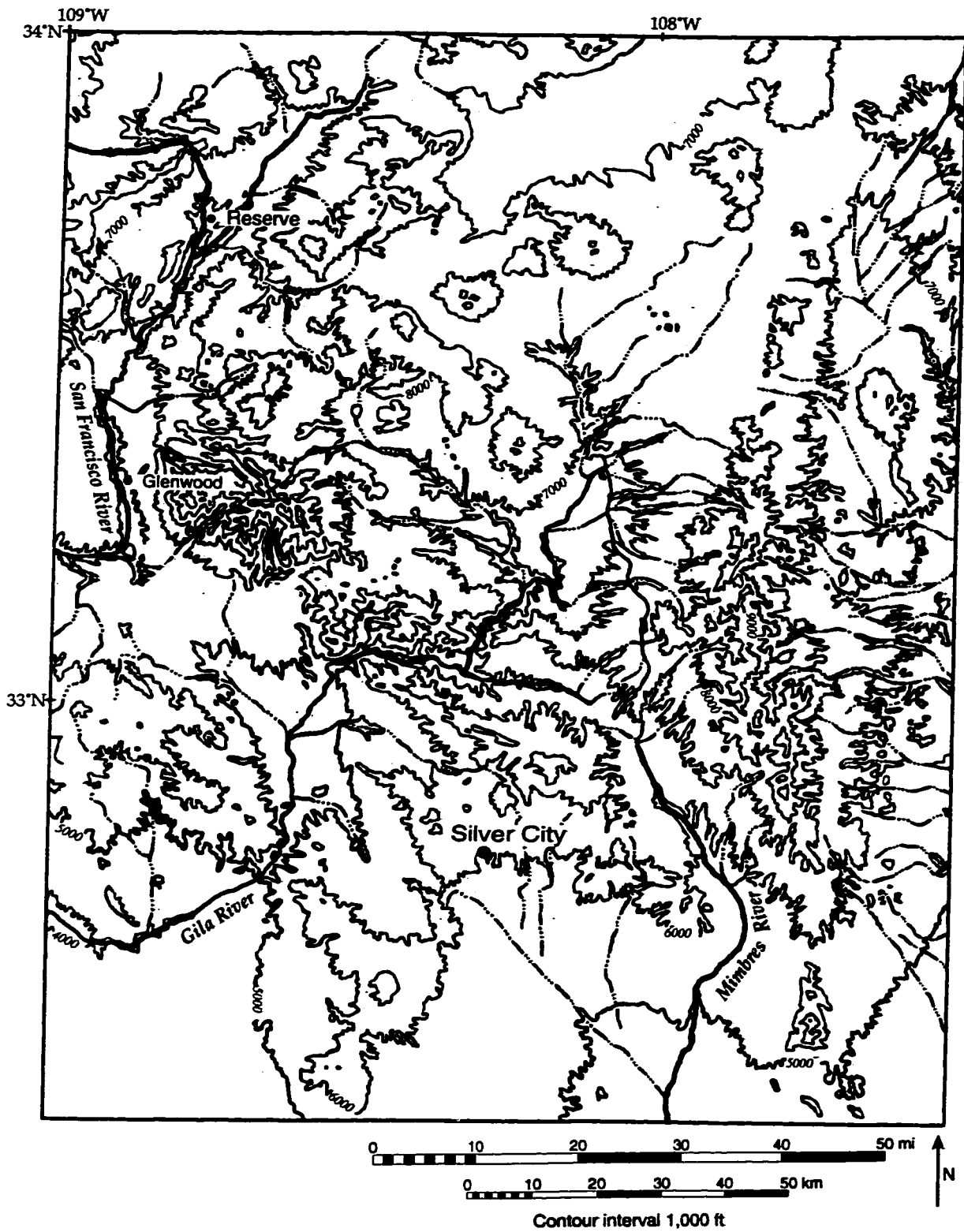


Figure 4.7 Study area with topography and major drainage systems.

Sample Size

River valleys and other geomorphically defined study areas are at a convenient scale for archaeological analyses. Small regions generally produce small sample sizes and serve to restrict the sample to a size that is manageable with limited technology and funds. Although the total number of sites recorded by surveyors sometimes number into the 100s, the number of excavated sites for any one sampled region is less than 1 excavated site per 100 sq km (cf. Lekson 1992a, Table 3.2).

The large size of the current study area results in an increased sample size. As I noted above, the five settlement patterns were identified based on data from the few excavated "type sites" for each phase in the sequence (see Table 2.2). The data that I examine include information gathered over more than a century and includes data from all excavated structures in the study area for which information are available.

Comparability

Many archaeologists, particularly those interested in survey data, have noted the difficulties of drawing regional conclusions about the Mogollon area because of incompatible research designs and recording strategies (Blake et al. 1986; Graybill 1973; Mimbres Foundation 1978; Lekson 1992a, 1992b). Application of systematic data recording techniques for the entire area increases the probability that processes affecting large areas can be detected. In

addition, data from the primary subregions (e.g. Mimbres, Gila/Cliff, and Pinelawn valleys) may be more easily compared.

Boundary Effects

Using geomorphology (or physiography) to define a study area can potentially influence research results and interpretations. Differences between study areas may reflect boundary effects rather than archaeological or cultural variability. When the boundary of a study area matches the distribution of archaeological phenomena, the accuracy of the pattern is equivocal in absence of data from the larger surrounding region. For example, do sites assigned to the Tularosa phase really represent a riverine adaptation (cf. Bluhm 1960) or do they reflect that areas studied were limited to the Tularosa and San Francisco River valleys?

In my study area, the likelihood that data patterns are a function of the size or shape of the region is extremely low because the area is defined using impartial geodetic coordinates measured in degrees of latitude and longitude (Figure 4.1). Although the study area is large, it is restricted, primarily for logistical and data collection reasons. As with any spatially delimited study area, the choice of coordinates may affect my interpretations because surrounding areas are excluded. However, in this case, the effect is explicit and potentially measurable.

The Mangas debate, described in Chapter 3, is a good example of an issue that cannot be resolved without examining comparable data from a

large area. The debate is, in part, founded on differences in the archaeological record of early surface structures in the Gila and the Mimbres River valleys. The current study area includes both the river valleys, as well as all of the area in between, and data are recorded in the same manner for the entire study area. Although I make no claim that my data will resolve the Mangas debate, I can provide valuable information about the distribution of attributes across the disputed area and temporal boundary.

VARIABLES

It would be most helpful in correlating trends in pottery, architecture, and tools to have the data listed in the most explicit manner. If this is done, a student may take any archaeological report and rework the data by techniques that may develop in the future. (Martin, et al. 1949: 221)

The probability of answering specific questions about Mogollon settlement increases if recorded data are linked to the material consequences of settlement. In other words, the data should reflect aspects of settlement that are recognizable and interpretable using the archaeological record. As noted in Chapter 2, most of the data available from earlier research were recorded to validate the Mogollon concept, not to document and explain settlement change. Much of the data is not useful in its current format, but some of the data from previous research could be useful for examining settlement change. Once gathered into a consistent format and a single database, these data may be used to test hypotheses about previously proposed settlement patterns.

Many early reports provide summary data about the material from a site. Bradfield (1929) describes typical features of the structures he assigns to ordered time periods. The Cosgroves (Cosgrove and Cosgrove 1932) provide a little more detail by describing some of the variability in hearths, doorways, and other kinds of features. Eventually, the convention of describing the materials, features, and characteristics of each individual structure separately became the dominant format in the literature.

Other data is left out of published reports, but is available from unpublished field excavation forms, maps, and photographs. Much of the unpublished paperwork is available from the Laboratory of Anthropology. Copies of other materials were made available by museums and colleagues. For example, Carlson's (1965) write-up of Earl Morris' excavations in the Mimbres valley is widely cited in the literature, but is unavailable for loan and few archaeologists have copies of the report. The University of Colorado Museum, Boulder, graciously allowed me to copy the manuscript. Other material is available only in Master's theses, and only some of these could be borrowed from university libraries.

Variables that measure settlement change reflect the relationship between individual structures and the environment. This view is consistent with the concept that abandonment attributes link systemic and archaeological contexts (Cameron 1991; Schiffer 1972). That is, attributes of abandoned structures (in the archaeological context) can inform us about the causes for abandonment (in the systemic context). The variables in this

database were chosen because they reflect the physical consequences of occupying a particular locale, and hence the transition from systemic to archaeological contexts.

Select settlement variables are grouped into three categories: identification, location, and structure variables. With additional subdivision, the variables conform to the four dimensions of settlement identified from previous research: location, structure form, construction methods, and construction materials (Table 4.1). As noted above, the structure (room or pithouse) is my primary unit of analysis, thus, all data are recorded by structure, and when possible, by distinct occupations of a single structure.

IDENTIFICATION VARIABLES

This category includes variables used to identify and differentiate individual structures. Each structure is associated with a suite of identification variables beginning with the LA number. LA Numbers are site numbers assigned consecutively within the state of New Mexico by the Laboratory of Anthropology. Four sites in my database were not reported to ARMS by the excavators and thus have no LA number; I refer to them by site name. Other identifying variables include other number (usually a project or field site number), federal number (typically US Forest Service or Bureau of Land Management site numbers), site name, and structure number (or name).

Table 4.2 Settlement variables measured in this study.

IDENTIFICATION VARIABLES

LA Number
 Other Number
 Federal Number
 Site Name
 Structure Number or Name

LOCATION VARIABLES**Geographic**

Universal Transverse Mercator System (UTM)
 Zone
 Easting
 Northing
 Geodetic Coordinates
 Latitude
 Latitude (decimal degrees)
 Degrees Latitude
 Minutes Latitude
 Seconds Latitude
 Longitude
 Longitude (decimal degrees)
 Degrees Longitude
 Minutes Longitude
 Seconds Longitude
 Public Lands Survey System (PLSS)
 Township
 Range
 Section
 USGS 7.5' Topographic Quadrangle Name
 County

Environmental

Elevation (feet above mean sea level)
 Landform (e.g. terrace, floodplain, mesa, hilltop, ridge, alluvial fan)
 Vegetation Community (e.g. grassland, woodland, forest)
 Substrate (e.g. alluvium, colluvium, volcanic)
 Landform Aspect (e.g. N, SE, WSW)
 Geomorphic Setting (stable, depositional, erosional)
 Water (e.g. drainage, river, stream, spring)
 Nearest Water Source
 Distance (m)
 Other Water Sources
 Distance (m)

Chronological (exclusive of samples from fill contexts)

Phase/Period
 Chronometric Dates
 Archaeomagnetic
 Obsidian Hydration
 Radiocarbon Age (calibrated 1 sigma range [intercepts])
 Tree-Ring
 Chronometric Age Range Midpoint
 Earliest Possible Chronometric Age
 Latest Possible Chronometric Age

Table 4.2 Settlement variables, cont.

STRUCTURE VARIABLES**Structure Form**

Size (dimensions)

Length/Diameter (m)

Width (m)

Depth (m)

Shape (e.g. circle, square, rectangle, quadrangle)

Structure Type

Structure Kind (pit structure, pueblo room, cave, rockshelter, cliff dwelling)

Contiguous? (yes/no)

Descriptive Depth/Height (subterranean, semi-subterranean, surface)

Reuse/Remodeling

Structure Materials

Materials

Walls

Floor

Roof

Features (frequency, kind, dimensions [cm])

Floor Artifacts

Comments

REFERENCE

Author

Year Publication

Title & Publisher

Each episode of use identified by the excavators within an individual structure is associated with a separate structure name or number. As noted earlier, structures described as having more than one episode of use are typically assigned a single structure number, but combined with a letter to designate each distinct occupation. Occupation labels do not conform to any consistent format, but most archaeologists in the study area assign a single number to the first structure encountered during excavation; this structure is typically the youngest structure in the series. Subordinate letters or numbers are added as each floor or episode of reuse or remodeling is encountered; I include data on superposition in the reuse/remodeling variable or the comments variable (Table 4.2 and described below).

LOCATION VARIABLES

Locational variables measure the unmodified environment surrounding the structure and reflect the external physical consequences of occupation in a particular locale. Much of the locational information was obtained from the New Mexico Cultural Resources Information System (NMCRIS¹). The NMCRIS database is housed at the Laboratory of Anthropology in Santa Fe and maintained by the Archaeological Records Management Section (ARMS) of the New Mexico State Historic Preservation Division (HPD). Some of the values I record differ from those in the state

¹ New Mexico Cultural Resource Inventory System, Archaeological Records Management Section, New Mexico State Historic Preservation Division, Santa Fe.

database. In some cases, incomplete information is reported to ARMS and I was able to establish the site location more accurately based on additional data.

Geographic Variables

Location variables are divided into three categories: geographic, environmental, and chronological. The geographic location of the structure is recorded at a variety of spatial scales. Geographic variables include two systems of point location data, Universal Transverse Mercator (UTM) and geodetic coordinates (latitude/longitude). The geodetic coordinates are recorded in decimal degrees as well as in degrees, minutes, and seconds of north latitude and west longitude. The Public Lands Survey System (PLSS) is used to report the location to a 1 square mile section of land within a particular township south and range west relative to the New Mexico Principal Meridian. Also reported are the names of the U.S. Geological Survey 7.5' topographic quadrangle (1:24,000 scale) and the county in which the structure is located. All of these data were originally obtained from the NMCRIS database, but the location of each site was checked by comparison of the site description with the topographic maps and many of the attributes were updated based on new or corrected information.

I have removed the locational variables from the data included in Appendix C because site locations are confidential by New Mexico state law (18-6-11.1 New Mexico Statutes Annotated, 1978 Compilation [NMSA 1978]).

Locational information may be obtained from NMCRIS after authorization by ARMS.

Environmental Variables

Environmental variables record details of the environment surrounding and underlying the structures. The variables elevation (feet above mean sea level), landform, and vegetation community were obtained primarily from the NMCRIS database. Elevation and vegetation attributes were rarely determined to be different from those in the NMCRIS database. Since many of the sites were reported decades ago, all landforms were map-checked and the designations were frequently changed to match the more detailed and current landform definitions (ARMS 1993). Vegetation zone boundaries in the study area have been stable for at least the past 2000 years (Betancourt et al. 1990; Wills 1988). Although vegetation in the study area has been impacted by ranching activities, vegetation zones are defined broadly enough (e.g. grassland, woodland, and forest) that they are generally not altered with small scale changes in landuse.

The variables substrate, slope aspect, geomorphic setting, and water sources are all newly recorded in this database. Substrate designations were made based on the excavator's descriptions of the rock or sediment that underlie a structure. The three categories are very broad due to the limited descriptions of non-cultural sediment in most archaeological reports. The structures in the study area fall in to only three of the substrate categories:

alluvium, colluvium and volcanic. The brevity of most sedimentological descriptions did not permit differentiation of the alluvium into subclasses (e.g. fluvium, Quaternary valley fill, etc.).

The aspect of a slope is defined as the direction toward which it faces (Bates and Jackson 1987). Archaeologists might also refer to this variable as slope or landform orientation. Slope aspect is reported as one of 16 subdivisions of the compass (e.g. S, NW, and SSE). The geomorphic setting is divided into three broad categories (stable, depositional, erosional). Attributes of the geomorphic setting were assigned based on excavator descriptions and topographic position.

Variables associated with water resources are subdivided into nearest water source and other water source, each with associated metric distances. Water sources are listed either as named or by a general description of the type of water source (e.g. stream, spring). Distance is measured using site maps provided by the excavators or, if site maps are not available, the appropriate 7.5' topographic quadrangle map. All distances are slope distance (not horizontal distance).

Chronological Variables

Data about the occupation age of the structure are included in the locational dimension because they locate the structure in time. That is, chronological variables give the structure its temporal position. These variables include the phase assignment and, when available, chronometric

data. The chronometric data divided into four analytic methods (archaeomagnetic, obsidian hydration, radiocarbon, and tree-ring), each of which might include more than one dated specimen. The dates included in the database are exclusive of specimens from the fill because fill dates cannot be confidently associated with the occupation of the structure. Three additional variables were derived from the suite of chronometric dates including, earliest possible age, latest possible age, and age-range midpoint. The age-range is determined from the two former variables and is used to calculate the midpoint, which serves as the chronometric date used in all subsequent analyses.

STRUCTURE VARIABLES

The three dimensions of structure form, construction methods, and construction materials reflect resource costs by recording the kinds and quantities of resources utilized. Construction costs are significantly reduced if new structures take advantage of earlier construction episodes (e.g. shared walls, recycled building material, or reuse of previously abandoned structures; Cameron 1990). Evidence for modification or maintenance reflects the use-life (durability) of structures, as well as changes in their use (Ahlstrom 1985; Cameron 1990, 1991; McGuire and Schiffer 1983; Schiffer 1987; Schlanger 1985, 1986).

Structure Form

Structure form variables include attributes of size and shape. Variation in structure size or shape may reflect differences in use or maintenance costs (Adams 1983; Bullard 1962; Ciolek-Torrello 1985; Gilman 1983; Gross 1987; Hill 1970; Jorgenson 1975).

Structure size is recorded in terms of length (or in the case of rounded structures, diameter), width, and depth. Attributes of size were collected in two ways. If the dimensions were reported in publications or field notes, those measurements were recorded in the database; measurements in inches and feet were transformed into metric units. The majority of the structure dimensions were measured using field maps (at ARMS) or published maps of the site or structures. Structure depth is inconsistently reported and is of relatively limited utility because the significance of the depths is unknown. Depths measured from a structure floor to the modern surface may have little relation to the depths of the structure due to post-occupational deposition or erosion. Some structure depths appear to be measured from the point where pit structure edges are identified, such as the upper boundary of unmodified substrate (i.e., parent material of a soil profile [C horizon]). The latter could be useful for documenting variability in structure depth within a limited area subject to homogeneous soil formation processes. Unfortunately, this kind of information is rarely specified in field notes or profile drawings and can only be inferred.

All measurements are reported to two significant figures (to the nearest decimeter). However, the scale of some site and structure maps is relatively small, so I do not consider the measurements accurate beyond one half meter. I would not consider size classes that differ by less than 0.5 meters in any statistical analyses.

The attributes of structure shape are reported as circle, square, rectangle, oval/ellipse, quadrangle, trapezoid, and rhomboid. To ensure consistency in shape observations, I do not use excavator descriptions. Instead, new determinations were made for each structure using available site and structure maps. Only rarely do my observations differ from those of the excavator, and generally because I use a larger number of shape attributes.

Structure Type

The variables grouped under this category reflect the overall design and construction of a structure. Type of structure, whether it is contiguous with adjacent structures, floor depth, and a variable that records the relationship between floor depth and wall height, reflect different aspects of construction. The category labeled reuse/remodeling records physical alterations to the structure.

Using multiple variables to describe the structure type accommodates differing definitions of structures among archaeologists. A masonry-walled structure with a floor 15 cm below the surface provides a good example of the need for more than a single variable to describe structure type. This structure

could be labeled a pueblo room because its walls are freestanding masonry, or because it has contiguous walls. It could also be justifiably labeled as a pithouse because it has a sunken floor. Classifying structures using the three variables permits me to select a sample of structures using different structure definitions. The definitions of structure classes could impact the results of some analyses and using these three variables allows comparison across the different kinds of structure definitions.

The 'structure kind' variable records the descriptive label assigned by the excavators or authors (e.g. pit structure, pueblo room, cave, rockshelter, cliff dwelling). A second nominal variable distinguishes between contiguous and non-contiguous structures; data are recorded as yes (contiguous) or no. Contiguous structures are those with at least one wall shared with another structure.

I also include an ordinal variable that reflects the relationship between floor depth and wall height. The attributes of this variable are subterranean, semi-subterranean, surface, and chamber-base; the latter is for structures built in rockshelters or caves. Surface structures are those with floors at the surface and the entire wall was constructed above the surface. Subterranean structures are those with floors and a majority of the wall below the surface. Semi-subterranean structures with floors below the surface, but with a majority of their wall height above ground. My determinations for this variable are based not on absolute wall heights, but on excavator/author

descriptions and estimates of wall height. Analyses based on this variable should be interpreted with caution.

Evidence for remodeling or reuse is also included in this section. This is a general descriptive variable providing information from the report or field forms describing possible evidence for reuse or reconstruction. The most common kinds of evidence include multiple floor surfaces, multiple versions of a particular feature (e.g. firepits, central postholes), multiple posthole patterns (e.g. center and 4-corner), plastered-over/sealed features (e.g. entryways, firepits, postholes), and room subdivision. I also include stratigraphic information for superimposed structures in this category because it indicates reuse of a particular locale. For example, some pit structures are excavated within a previously occupied and infilled pit structure, which may significantly reduce construction costs of the later structure.

Structure Materials

This dimension includes the materials used in construction and use of the structure. It includes construction materials, features, and artifacts. I divide the construction materials into three descriptive categories: walls, floor, and roof. The descriptions have been standardized as much as possible to facilitate comparability. For example, I standardize the term "substrate" in reference to all non-cultural deposits underlying the structures.

The most common wall construction materials are substrate, cultural deposits, and masonry (cobbles or slabs with adobe mortar). Walls are

sometimes coated with adobe plaster. Floors are typically covered with a layer of adobe plaster or are unfinished substrate or cultural deposits. Data about structure roofs are rare, but I have included details when reported by the excavators/authors.

Features include non-portable artifacts or clusters of artifacts whose form would be destroyed upon excavation. The most common features reported by archaeologists working in the study area are entryways (doorways, entry ramps), firepits (hearths), pits excavated below the floor surface, postholes, and subfloor burials. Less common are mealing areas and artifact caches; the former typically consist of a metate and a floor basin sometimes associated with manos, upright slabs at the sides of the metate, and a ceramic bowl lining the floor basin. The dimensions of individual features, in centimeters, are included when provided by authors or when measurable from site or structure maps. Wall features (e.g. entryways, niches, shelves, or roof beam sockets) are, by convention, included with other features rather than listed as part of the wall construction materials.

Artifact assemblage information and additional comments are also included under the structure materials dimension. Only information about artifacts from what is typically referred to as the "floor assemblage" and artifacts in association with sub-floor burials are recorded in this category.

By convention, archaeologists working in the study area include in the floor assemblage artifacts in direct contact with a floor surface, but also artifacts from the "floor deposit." This practice has a long tradition in the

Southwest and artifact data from a single structure are typically reported by "floor" and "fill" categories. "Floor deposits" sometimes include all of the material from the sedimentary layer immediately above a floor, but more commonly, it refers to the lower portion of that deposit. Floor deposits are typically situated beneath the "roofall deposit" (material deposited when a roof collapses or is dismantled). Fill deposits overlay either the floor deposit or the roofall deposit.

All artifacts in the floor deposit are potentially part of the floor assemblage, but generally, only artifacts within 10 cm, or less, of the floor are included in the floor assemblage. I exclude artifact data from "fill" because these artifacts cannot be unequivocally associated with the occupation of the structure.

REFERENCE

Publication data are included in the final category. This information is reported when at least some of the data were gathered from published sources. The category is blank when data were obtained directly from the site files at the Laboratory of Anthropology. Author and publication year are listed separately, so that references may be sorted chronologically or alphabetically. When data were collected from more than one publication, that information is listed under additional references.

STUDY AREA

The study area includes most of Catron and Grant counties and smaller portions of Socorro, Sierra, Hidalgo, and Luna counties. It extends from the arid lowlands just north of the town of Deming, New Mexico, through semiarid uplands, and into the higher and cooler elevations of several mountain ranges (Figure 4.5).

Three-quarters of the northern and central portions of the study area are dominated by uplands. The principal mountain ranges include, from north to south and with the highest elevation in parentheses, the San Francisco Mountains (8,500'), Tularosa Mountains (10,000'), Mogollon Mountains (10,892'), Black Range (10,011'), Mimbres Mountains (10,000'), Piños Altos Range (8,000'), and the Big and Little Burro Mountains (7,500').

Three major river systems drain the region west of the continental divide, which crosscuts the southwestern corner of the study area. The northwest is dominated by the San Francisco River (5,000-7,000') and its primary tributary the Tularosa River. The Upper Gila (4,000-6,500') and its tributaries (North Fork, West Fork, Middle Fork, Sapillo Creek, Duck Creek, and Mangas Creek) extend throughout the central and southwestern uplands. The Mimbres River (4,500-8,000') and streams in Gallinas Canyon, the Rio Arenas valley, and San Vicente Arroyo flow south and southeast. These drainages eventually evaporate in the internal basins of the Chihuahuan Desert at the southern edge of the study area.

Portions of two basins with internal drainage are also included in the region. The open plains of the Animas valley (4,500') dominate the landscape of the southwest corner. The Plains of San Augustin (7,000'), a former Pleistocene lake, is situated in the north. Streams in the northeast, including the headwaters of Alamosa, Cuchillo, Palomas, and Percha creeks, drain into the Rio Grande.

Archaeologists have assigned sites to four broadly defined vegetation zones: forest, woodland, scrubland, and grassland. These correspond to the nine biotic communities identified in the area by Brown and Lowe (1983) and listed in Table 4.3. Of those nine, four dominate the area: Great Basin Conifer Woodland, Rocky Mountain and Madrean Montane Conifer Forests, Semidesert Grasslands, and Plains and Great Basin Grasslands (Plains Grasslands are dominant in the southern Southwest). The conifer woodland community occurs in the uplands surrounding the three major river valleys and in the foothills of the Mogollon, Black, Mimbres, and Piños Altos mountain ranges at elevations between 6000' and 7000'. The community is characterized by an open piñon and juniper woodland interspersed with oak and small areas of grassland (Brown 1994). Over 70 percent of the structures in the database are associated with this environmental zone. Archaeologists identify the vegetation community as either "woodland" or "grassland," the latter presumably associated with the open patches of grassland within the woodland community.

Table 4.3

Biotic communities in the study area (Brown 1994; Brown and Lowe 1983) arranged in approximate order from largest area to smallest area.

Biotic Communities	Dominant Plant Species
Great Basin Conifer Woodland	Piñon (<i>Pinus edulis</i>), Juniper (<i>J. monosperma</i> , <i>J. scopulorum</i>), Gambel Oak (<i>Quercus gambelii</i>)
Rocky Mountain (Petran) and Madrean Montane Conifer Forests	Ponderosa Pine (<i>Pinus ponderosa</i>), Gambel Oak (<i>Quercus gambelii</i>), Juniper (<i>Juniperus deppeana</i>)
Semidesert Grasslands	Grama grass (<i>Bouteloua</i> spp.), Yucca (<i>Yucca</i> spp.), Mesquite (<i>Prosopis juliflora</i> , <i>P. glandulosa</i>), Sotol (<i>Dasylirion wheeleri</i> , <i>D. leiophyllum</i>), Snakeweed (<i>Gutierrezia sarothrae</i>)
Plains and Great Basin Grasslands	Grama grass (<i>Bouteloua</i> spp.), Snakeweed (<i>G. sarothrae</i>), Buffalo grass (<i>Buchloe dactyloides</i>), Yucca (<i>Y. glauca</i>), Cholla (<i>Opuntia</i> spp.) and prickly pear (<i>O. macrohiza</i>)
Madrean Evergreen Woodland	Oak (<i>Quercus</i> spp.), Juniper (<i>J. deppeana</i> , <i>J. monosperma</i>)
Rocky Mountain (Petran) Subalpine Conifer	Engelmann Spruce (<i>Picea engelmannii</i>)
Chihuahuan Desertscrub	Creosote (<i>Larrea divaricata</i>), Mesquite (<i>P. juliflora</i> , <i>P. glandulosa</i>),
Rocky Mountain Alpine and Subalpine Grasslands	Fescue/Bunchgrass (<i>Festuca thurberi</i> , <i>F. arizonica</i>), Sedge (<i>Carex</i> spp.)
Interior Chaparral	Scrub Oak (<i>Q. turbinella</i> , <i>Q. intricata</i>), Mountain Mahogany (<i>Cercocarpus betuloides</i> , <i>C. breviflorus</i>)

The conifer forests are defined by the presence of Ponderosa pine, typically in association with oak and juniper (Brown 1994). This biotic community dominates in the San Francisco and Tularosa Mountains of the northwest quadrant and in the Mogollon Mountains and the Black Range above about 7000'. Approximately 11% of the structures in the database are located in this biotic zone.

Semidesert grasslands cover most of the area south of latitude 32°45' N, where the topography begins to level out away from the foothills of the Mimbres and Burro Mountains. Various Grama grasses, yucca, and mesquite characterize the area (Brown 1994). Although this vegetation community covers a relatively large part of the study area, only a small percentage (0.1%) of the excavated sites are located in this community.

The Plains Grassland community predominates in the San Augustin Plains in the northeastern corner, as well as the far eastern edge of the study area. This zone is characterized Grama grass, buffalo grass, snakeweed, yucca, and various cacti (Brown 1994). Less than 10% of the structures are located in this zone.

SUMMARY

In this chapter, I present an alternative framework for data collection and study of settlement changes. I describe the basis for my decision to alter the unit of analysis and observation to the structure. I also discuss why this helps to resolve the problem of settlement validity.

The remainder of the chapter focuses on the four dimensions of settlement change identified in the study area and variables that I use to document settlement. I describe each variable, its attributes, and how the information was obtained from publications, field notes and maps, and unpublished reports, theses, and dissertations. In the final section, I report on the geomorphic and biotic communities of study area.

Previous interpretations of settlement may be modified when the perspective outlined here is applied using an inclusive Mogollon database. I expect that settlement patterns will not be as well defined, nor the changes as definitive, as they currently appear. Neither do I expect settlement changes to correspond as closely to the physical and temporal boundaries of traditional phases.

Chapter 5

MOGOLLON SETTLEMENT CHANGE:

PITHOUSE PERIOD MOVEMENT

FROM ISOLATED TO ACCESSIBLE LANDFORMS

Almost all known Mogollon sites from the early pottery-producing period in this large region are on high ground. This use of hilltops is probably one of the most clear-cut and prevalent settlement patterns found for the entire history of the Southwest. (LeBlanc 1999: 130)

INTRODUCTION

The purpose of this chapter is to demonstrate the advantages of the framework presented in Chapter 4 by using it to investigate a specific settlement pattern. The settlement pattern I choose to examine is one of the most widely accepted changes in Mogollon settlement, the shift from "isolated" to "accessible" landforms during the Pithouse period. Although there is no consensus on the timing of the change, Anyon et al. (1981) place it at about A.D. 550, at the boundary between the Early and Late Pithouse periods (Table 1.1, Appendix A).

Previous research shows that isolated landforms were occupied prior to A.D. 500, however, the corollary assumption that *all* early sites are situated on these landforms (cf. LeBlanc 1983) has not been demonstrated. Similarly, that

accessible landforms are occupied after about A.D. 700 is well-documented.

However, the assumption that *all* isolated locations are abandoned after A.D. 700 (cf. LeBlanc 1980a: 124) has not been corroborated.

Understanding the nature of this proposed settlement change is important for two reasons. This locational change is assumed to mark a major adaptive change in prehistoric lifeways (Anyon et al. 1981; LeBlanc 1999). If the settlement pattern is inaccurate, the accuracy of any inferences drawn from the pattern is also suspect. The shift has chronological significance because it is one of two primary characteristics used to distinguish sites dating to the Early Pithouse period from those occupied during the Georgetown phase.

If structure locations do not vary temporally, one of the two primary criteria for differentiating between Early Pithouse and Georgetown phase occupations is no longer valid. This leaves the presence of only plainware ceramics as the sole criteria for identification of Early Pithouse structures. As I noted in Chapter 3, dating a structure based solely on ceramics is not a particularly reliable method. Portions of the ceramic chronology have been questioned and many structures have no ceramics in the associated floor assemblages. Later structures may lack slipped and painted wares for other reasons (e.g. specialized use or curation of painted wares). If the same landform is occupied before and after the appearance of slipped and painted ceramics, early structures at that locale are identifiable only if excavations

provide chronometric data or a floor assemblage that lacks slipped and painted ceramics. Ultimately, chronometric dates are the most reliable way to identify early structures if landforms do not vary through time.

The analyses in this chapter address two primary issues. First, I determine whether the settlement change occurs at the specified time. I divide the structures into "accessible" and "inaccessible" landform classes and examine changes in their distribution through time. The shift to a structure scale improves the chronological resolution of the analysis and shows that the nature of Pithouse period settlement change is more complex than previously considered. The initial results indicate that the predicted change does not occur as proposed. Rather than showing abrupt changes in landform use, the data indicate that both kinds of landforms are occupied throughout the Pithouse period in varying frequencies.

The second issue I address in this chapter concerns the empirical basis for the interpretation of a landform as "accessible" and "isolated." I accomplish this by examining changes in a series of variables whose attributes are implicit in the archaeological descriptions of settlement locales (elevation, distance to water, substrate, and landform orientation). Results of these analyses show that accessibility is not a simple dichotomous variable. Changes in Pithouse period landform use may be understandable only after the composite accessibility variable is separated into discrete components.

I begin the chapter with a brief review of specific settlement locale details described by culture historians and currently used by archaeologists. The vocabulary that culture historians use to classify settlement landforms implicates the variables I use for the analyses in this chapter. From the traditional settlement descriptions, I extract a definition of "inaccessible" landforms that can be consistently applied and that permits me to define mutually exclusive landform classes. I use "inaccessible" rather than "isolated" because the former is the complement to "accessible," however, I consider the terms synonymous.

In the first set of analyses, I test whether the expectations of the traditional settlement pattern are supported using two samples from a database compiled from field records, publications, and unpublished reports for excavated structures (Appendix C). The first sample includes those constructed structures (i.e. exclusive of caves and rockshelters) with a chronometric age-range midpoint between A.D. 150 and A.D. 900 (n=112); hereafter referred to as the chronometric sample. The chronometric sample constitutes 18% of the structures assigned to the Pithouse period. The second sample includes constructed structures that are assigned to only a single phase of the Pithouse period (n=484); hereafter referred to as the phase-dated sample. Not included in the phase-dated sample are 135 structures that are not assigned to an individual phase of the Pithouse period. Some of these structures cannot be differentiated to a specific phase (e.g. those assigned to

'Early Pithouse or Georgetown'), while others are assigned a multiphase range (e.g. Late Pithouse).

My analyses of the two samples indicate that settlement change does occur, but that the change in landform is neither as drastic as proposed nor at the specified time. Both kinds of landforms are occupied throughout the Pithouse period, although the frequency of settlement on accessible landforms does increase after A.D. 800; the increase occurs during the Three Circle phase rather than at the beginning of the Georgetown phase.

The occurrence of structures on inaccessible landforms appears to increase during the San Francisco phase at around A.D. 700, rather than at A.D. 550. Despite my conclusions that the nature and timing of the change are different than predicted by the traditional sequence, the data also illuminate the empirical basis for the pattern as originally identified by culture historians.

The second set of analyses show that the Early Pithouse period and Georgetown phase are not only indistinguishable with respect to landform type, but also in distance to water, substrate, and landform orientation. In this set of analyses, I use data grouped at both structure and landform scales. The choice of scale depends on whether an attribute varies from structure to structure within a site. All analyses that examine temporal change are conducted at the structure scale because age varies by structure. Analyses that do not involve temporal change, such as the elevation analyses, are

conducted appropriately at the landform scale with no loss of information because the attribute is the same for all structures on the same landform.

PITHOUSE PERIOD SETTLEMENT

Generally, the early villages are more often located on high, isolated hills. Later villages, as judged by the presence of painted ceramics..., more often are located on prominences of less elevation and thus nearer the drainage channel. (Herrington 1979: 62)

Early Pithouse period sites are traditionally characterized by rounded pit structures with only plain brownware pottery, and they are located on isolated landforms distant from water resources (Appendix A). Haury and Sayles (1947:12) describe the landforms on which the early sites are situated as "high eminences" (Haury and Sayles 1947: 12). Martin concurs for the Pinelawn valley, describing the landforms as "high, steep-sided, flat-topped mesas" (Martin et al. 1949: 23) and "high and easily defended ridges" (Martin and Rinaldo 1950a: 566). Wendorf and Danson coin the descriptions that are used by most archaeologists today. Wendorf (1956: 23) describes the early settlement locations as "the tops of high, almost inaccessible mesas," while Danson (1957: 97) notes that they are located "on the tops of high mesas and isolated ridges."

Although the culture historians emphasize height, LeBlanc (1980a: 122) argues that that these archaeologists "are concerned with relative height and isolation," rather than absolute elevation, when they contrast earlier sites with later site locations or alternative landform choices. LeBlanc further

specifies that early sites are "in relatively high places in low lying areas" (LeBlanc 1980a: 122) and "required considerable work just to get up and down each day" (LeBlanc 1983: 45). He also provides a specific height reference when he notes that the early locales are "often several hundred feet above water supplies or field areas" (LeBlanc 1980a: 122).

Georgetown phase sites are characterized by rounded pit structures and the addition of "true" San Francisco Red (Anyon et al. 1981; LeBlanc 1982) pottery to the ceramic assemblage. These and later sites are located in the same general area as earlier sites, but they are situated "along the margin of the valley floor" (Hauray and Sayles 1947: 12) closer to water and arable land (Wendorf 1956; Wheat 1955). The landforms of Georgetown sites are commonly described as low ridges, terraces, or benches. In contrast to the earlier sites, Martin notes that later sites are located "in any choice spot, without concern for defense" (Martin and Rinaldo 1950a: 566).

LANDFORM CLASSIFICATION CRITERIA

I assign sites to "inaccessible" or "accessible" categories based on the topographic descriptions listed for each site in the NMCRIS database (see footnote in Chapter 4 for definition). Sites situated on a bench, terrace, in the floodplain or valley are "accessible." A site on a mesa, butte, hilltop, or cliff(top) is assigned to the "inaccessible" category. Unfortunately, these landforms make up less than 50% of the landform descriptions used for excavated Mogollon sites (Table 5.1). The remainder of landforms cannot be

Table 5.1 Terms used to describe landforms with excavated Mogollon structures.

Inaccessible	Accessible	Unknown
Bluff	Bench	Alluvial Fan
Butte	Floodplain	Arroyo/Wash
Canyon Rim	Plain/Flat	Cave
Cliff	Terrace	Hill Slope
Hilltop	Valley	Hillock
Mesa		Knoll
Scarp		Low Hill
Steep Scarp		Low Ridge
		Ridge
		Ridgetop
		Rockshelter
		Small Mesa
		Talus Slope

confidently assigned to one of the two categories. Thus, I further refine the definition of "inaccessible" to include all locations on top of steep-sided landforms (cf. Danson 1957) that are at least 100 feet above the surrounding terrain (cf. Rice 1975); steep-sided landforms in the study area are those with at least a 40 percent slope ($>20^\circ$).

The need for a more explicit definition of accessibility is exemplified by landforms labeled as ridges. The term 'ridge' is assigned to a variety of landforms, all of which are elevated, but to varying degrees. The landform on which Treasure Hill (LA16241; Cosgrove 1923) is situated is described in the ARMS database as a ridge. The topographic map shows that the site is situated on an elevated, but gently sloping landform with a slope of less than 5% ($<3^\circ$). The Wind Mountain site (LA 127260; Woosley and McIntyre 1996) is also on a ridge, yet this site was situated on a steep-sided landform with a 53% (28°) slope.

Some topographic descriptions are inconclusive or result in spurious categorization of landforms as accessible or inaccessible. Therefore, all accessible/inaccessible classifications were checked against a 1:24,000 scale topographic map for accuracy. In a few cases, the topographic designation in the NMCRIS database was contradictory to the topographic map. For example, the Saige-McFarland (LA5421) and Winn Canyon (LA34813) sites are both listed as terrace sites. However, both sites are on steep-sided landforms that are relatively high above the Gila River and both landforms were created

as a result of post-Pleistocene lowering of the river base-level. Although similar in form to terraces, these landforms are actually benches because they have been formed by erosional rather than depositional processes (Bates and Jackson 1987). These benches have been further modified by erosion to form the mesa and hilltop on which the sites are situated.

SETTLEMENT PATTERN ANALYSIS

Isolated, "defensive" Early Pit House period sites are real, but they may simply represent the most easily recognized sites from this period and not the only (or even most important) Early Pit House site locations. (Lekson 1992: 74, emphasis in original)

The following analysis of the "isolated-to-accessible" settlement shift is divided into two primary components. The first series of analyses address questions about change through time. This involves assessing expectations derived from the culture historical settlement pattern, specifically the landforms occupied during the two earliest phases of the Pithouse period (Early Pithouse and Georgetown). Based on the results of that analysis, I then expand my investigation to include all four phases of the Pithouse period (Early Pithouse, Georgetown, San Francisco, and Three Circle).

The purpose of the final series of analyses is to investigate the proposition that examination of individual variables provides a more efficient way to document settlement variability than using a multivariate such as landform class. I investigate changes in elevation, distance to water,

substrate, and slope aspect, all of which are expected to vary with landform differences.

EARLY PITHOUSE-TO-GEORGETOWN SETTLEMENT CHANGE?

In this section, I assess whether the specified landform change occurs at the transition from the Early Pithouse period to the Georgetown phase around A.D. 550. The data included in my samples indicate that the change does not occur at the specified time, but instead much later in the Pithouse period during the Three Circle phase. Neither does the increased occupation of accessible structures appear to be as extreme as proposed because both landforms are occupied throughout the Pithouse period.

Using the chronometric and phased-dated samples of excavated structures, I conduct three chi-square (χ^2) tests of independence ($\alpha=0.01$). The null hypothesis, for all three tests, states that the probability of a structure being on an inaccessible or accessible landform is independent of its age. The culture history settlement pattern serves as the alternate hypothesis, which states that the landform differs between the phases in a specific way before and after A.D. 550, at the boundary between the Early Pithouse period and Georgetown phase. Before A.D. 550, inaccessible landforms are occupied, but after that time, accessible landforms are occupied.

The χ^2 test is appropriate in this context, even with small cell frequencies (Zar 1996: 501-502, citing Cochran 1952, 1954). In the past, chi-square analyses were considered appropriate only if every cell in the table had

a value of 5.0. More recent statistical research provides updated guidelines that suggest the test is appropriate when the average expected frequency is at least 10.0 for testing at $\alpha=0.01$, or 6.0 for $\alpha=0.05$ (Zar 1996: 502 citing Roscoe and Byars 1971).

I first divide the chronometrically-dated structures into time ranges equivalent to the Early Pithouse period (A.D. 150-550) and the Georgetown phase (A.D. 550-650). The null hypothesis of independence is not rejected ($p=0.37$; Table 5.2a). Based on this sample of dated structures, the type of landform on which a structure is situated is independent of its age. Archaeologically, the culture history settlement pattern is not supported. The distribution of structures on the two landforms is similar for both time periods.

Although the χ^2 test is robust to sample size differences, the results may have been influenced by the fact that the early time period spans 400 years while the later period spans only 100 years and includes fewer structures. This does not appear to be the case, however, because even when the sample is divided into 100-year increments the null hypothesis is not rejected ($p=0.92$; Table 5.2b). The result of this second χ^2 test of the chronometric sample confirms that age and landform are independent. That is, occupation of the two landforms does not vary through time between A.D. 150 and A.D. 550.

Table 5.2 Chi-square tests of independence between age and landform class using structures dated to the Early Pithouse period or Georgetown phase; a) chronometrically dated structures divided into phase-equivalent temporal groups, b) chronometrically dated structures divided into 100-year intervals, c) phase-dated structures.

a)

observed (expected)	Accessible	Inaccessible	Total
Early, AD 150-550	12 (13.03)	11 (9.97)	23
Late, AD 550-650	5 (3.97)	2 (3.03)	7
Total	17	13	30

$\chi^2=0.81$, p-value=0.368

b)

observed (expected)	Accessible	Inaccessible	Total
A.D. 150-249	0 (1.70)	3 (1.3)	3
A.D. 250-349	0 (1.13)	2 (0.87)	2
A.D. 350-449	5 (4.53)	3 (3.47)	8
A.D. 450-549	7 (5.67)	3 (4.33)	10
A.D. 550-649	5 (3.97)	2 (3.03)	7
Total	17	13	30

$\chi^2=7.99$, p-value=0.091

c)

observed (expected)	Accessible	Inaccessible	Total
Early Pithouse	41 (39.12)	28 (29.88)	23
Georgetown	31 (32.88)	27 (25.12)	7
Total	17	13	30

$\chi^2=0.46$, p-value=0.499

Further support for the suggestion that landforms do not differ between the two phases is provided by analysis of the larger sample of phase-dated structures. The results of this χ^2 test indicate that structures situated on inaccessible landforms are no more likely to be dated to the Early Pithouse period than to Georgetown phase. The observed and expected counts are so similar that there is a 50% probability that we would see these observed frequencies by chance processes alone (Table 5.2c).

Unassigned Structures

The phase-dated sample of structures, as noted previously, includes only those structures that can be assigned to a single phase of the Pithouse period. The results might have been different if the unassigned structures could have been confidently affiliated with a particular phase. That is, exclusion of the unassigned structures might have biased the results for the phase-dated sample.

Fifty-five of the 135 unassigned structures are relevant for the current analyses. They are assigned the label "Early Pithouse or Georgetown" because they cannot be differentiated into one or the other time period. Although they cannot be confidently assigned to a single phase, they can be classified according to landform; 34 are situated on accessible landforms and 21 on inaccessible landforms (Table 5.3).

To determine whether the exclusion of the unassigned structures biased the earlier χ^2 test, I need to know how many of those structures would

Table 5.3 Frequencies of Early Pithouse, Georgetown, and unassigned structures.

Phase	Inaccessible	Accessible
Early Pithouse	28	41
Georgetown	27	31
Early Pithouse or Georgetown	21	34

have to conform to the culture history pattern to produce a statistically significant result. In other words, how many *inaccessible* structures need be added to the Early Pithouse group, and how many *accessible* structures to the Georgetown phase?

I approach this analysis in two ways. I first distribute the unassigned structures evenly into the landform classes. The 34 accessible structures are divided equally with 17 added to each time period. The 21 inaccessible structures are distributed similarly. The sample size is increased for each time period and the overall proportions remain roughly the same, although not identical to the original proportions. Therefore, the results of the χ^2 test ($p=0.53$; Table 5.4a) agrees with the earlier test result. Using the accessible structures as an example, 56.9% of the accessible structures are Early Pithouse and 43.1% are Georgetown, but with the unassigned structures evenly distributed between those two phases, 54.7% are Early Pithouse and 45.5% are Georgetown.

At the other extreme from equal distribution of the unassigned structures is the ideal of the culture history settlement pattern. In the ideal case, all of the unassigned inaccessible structures would belong to the Early Pithouse period and all of the unassigned accessible structures would be assigned to the Georgetown phase. Not surprisingly, that distribution results in a sound rejection of the null hypothesis (Table 5.4d, $p<0.001$).

Table 5.4

Chi-square tests of independence between age and landform class using Early Pithouse period, Georgetown phase, and unassigned structures. Tables a-d vary in their percentage of unassigned structures added to the different cells of the table. Each cell lists the percentage of unassigned structures added, the resultant observed value, and the expected value (in parentheses). Values marked with a * are significant.

a)

% unassigned added observed (expected)	Accessible	Inaccessible	Total
Early Pithouse	50% 58 (55.91)	50% 38 (40.09)	96
Georgetown	50% 48 (50.09)	50% 38 (36.91)	86
Total	106	76	182

$\chi^2=0.40$, p-value=0.530

b)

% unassigned added observed (expected)	Accessible	Inaccessible	Total
Early Pithouse	15% 46 (53.85)	85% 46 (38.42)	92
Georgetown	85% 60 (52.42)	15% 30 (37.58)	90
Total	106	76	182

$\chi^2=5.20$, p-value=0.023

c)

% unassigned added observed (expected)	Accessible	Inaccessible	Total
Early Pithouse	10% 44 (53)	90% 47 (38)	91
Georgetown	90% 62 (53)	10% 29 (38)	91
Total	106	76	182

$\chi^2=7.32$, p-value=0.007*

d)

% unassigned added observed (expected)	Accessible	Inaccessible	Total
Early Pithouse	0% 41 (52.42)	100% 49 (37.58)	90
Georgetown	100% 65 (53.58)	0% 27 (38.42)	92
Total	106	76	182

$\chi^2=11.78$, p-value=0.001*

When the sample is biased toward the ideal culture history pattern, the data reflect a significant change from inaccessible to accessible structures. The question remains, however, where between these two extremes (ideal vs. equal) lies the true distribution of the unassigned structures? The true age distribution of the unassigned structures is unknown at this time, but it is unlikely to be the extreme ideal predicted by culture history pattern (i.e. inaccessible/early and accessible/late). Instead, it probably lies somewhere between the two.

If the results are altered by the addition of just a few structures to the ideal age/landform classes, then doubt is cast on the conclusions drawn from the three earlier χ^2 tests. If, however, the pattern remains non-significant even when many of the unassigned structures are added to the ideal culture history categories, then the above conclusions of independence are probably correct and the culture history pattern is probably inaccurate.

To determine at which point sufficient unassigned structures have been added to reject the null hypothesis of no difference, the number of structures added to the ideal categories are systematically increased. I increase the percent of unassigned structures added to the ideal landform classes, incrementally from 50% through 100%. Between 85% and 90% of the unassigned structures would have to conform to the pattern in order to reject the hypothesis of independence (Table 5.4b-c).

Although the true allocation of the unassigned structures will remain unknown without additional chronometric data, that 85% of the unassigned structures would conform to the predicted culture historical pattern is unlikely. I would not expect the unassigned structures to have distributions that conform to the pattern because the chronometric sample does not conform to it. The chronometric sample is a subset of the larger Pithouse period sample and these dated structures can be considered formerly unassigned structures.

In the previous set of χ^2 tests, the same percent of unassigned structures were added to the ideal culture historical categories; i.e. 50% of the unassigned inaccessible structures were added to the Early Pithouse period and 50% of the unassigned accessible structures were added to the Georgetown phase (70%, 80%, etc.). However, I also want to know whether the culture history pattern would be supported if the percentage of unassigned structures allocated to the categories differed between the landform classes. For example, would the pattern be supported if 100% of the inaccessible structures were assigned to the Early Pithouse period, but only 20% of the accessible were added to the Georgetown phase?

I performed the tests again, but this time holding the percentage constant for one landform class while varying the percentage added to the other class. I added 100% of the unassigned inaccessible structures (n=34) to the Early Pithouse period, but varied the percent of the unassigned accessible

Table 5.5 Chi-square tests of independence between age and landform class using Early Pithouse period, Georgetown phase, and unassigned structures. The χ^2 data shown (a-b) are those distributions that result in significant χ^2 values.

a)

% unassigned added observed (expected)	Accessible	Inaccessible	Total
Early Pithouse	15% 46 (55.33)	100% 49 (39.67)	95
Georgetown	85% 60 (50.67)	0% 27 (36.32)	87
Total	106	76	182

$\chi^2=7.88$, p-value=0.005

b)

% unassigned added observed (expected)	Accessible	Inaccessible	Total
Early Pithouse	20% 48 (56.49)	100% 49 (40.51)	97
Georgetown	80% 58 (49.50)	0% 27 (35.49)	85
Total	106	76	182

$\chi^2=6.55$, p-value=0.010

structures added to the Georgetown phase. To produce a significant χ^2 value, the percent of accessible structures added to the Georgetown phase had to be high, from 80-85% (Table 5.5), even with all of the unassigned inaccessible structures added to the Early Pithouse period.

Summary: Early Pithouse-to-Georgetown Settlement Change

Neither the chronometric sample nor the phase-dated sample supports the culture history pattern that settlement shifted from inaccessible to accessible landforms between the Early Pithouse period and Georgetown phase. Even when the phase-dated sample is biased in favor of the pattern by adding unassigned structures to the ideal landform classes, the data do not conform to the pattern except in extreme cases.

The analyses above show that the change did not occur at the proposed time, at around A.D. 550, and that both landforms are occupied during both time periods. However, this does not lead to outright rejection of the settlement pattern. The shift toward accessible locales does occur at some point because by the Pueblo period, structures on inaccessible landforms are relatively rare. Thus, the culture historians were correct that a change occurred, but incorrect about the timing and the nature of the change.

PITHOUSE PERIOD LANDFORM VARIABILITY

I suggest that the shift to accessible landforms occurs later in the Pithouse period and that the increase is not as significant as proposed in the

culture history sequence. To investigate these possibilities, I expand the temporal range of the analysis to include the entire Pithouse period (A.D. 150-900). As in the previous section, I examine the chronometric sample in two ways, divided into 100-year increments and grouped into phase-equivalent categories. These data are then compared to the distribution for the phase-dated sample.

Since the timing of the traditional settlement pattern is inaccurate, but accessible settlement locations do eventually predominate, the analyses need to be expanded to include the entire Pithouse period. Expanding the temporal range alters the settlement expectations to a more general statement that older structures should be located on inaccessible landforms and younger structures on accessible landforms. The frequency of the inaccessible structures should decrease through time (a positively skewed distribution), while the frequency of the accessible structures should increase through time (a negatively skewed distribution).

The chronometric distributions for the two landform classes are remarkably similar rather than complementary. Box-and-whisker plots (Figure 5.1) show that both landform classes have medians in the late A.D. 700s. The mean ages are also nearly identical, but because the distributions are skewed, the mean is not the best descriptive statistic to characterize the data. The boxplots also show that, although both distributions are negatively skewed, the inaccessible distribution is more strongly skewed because its older

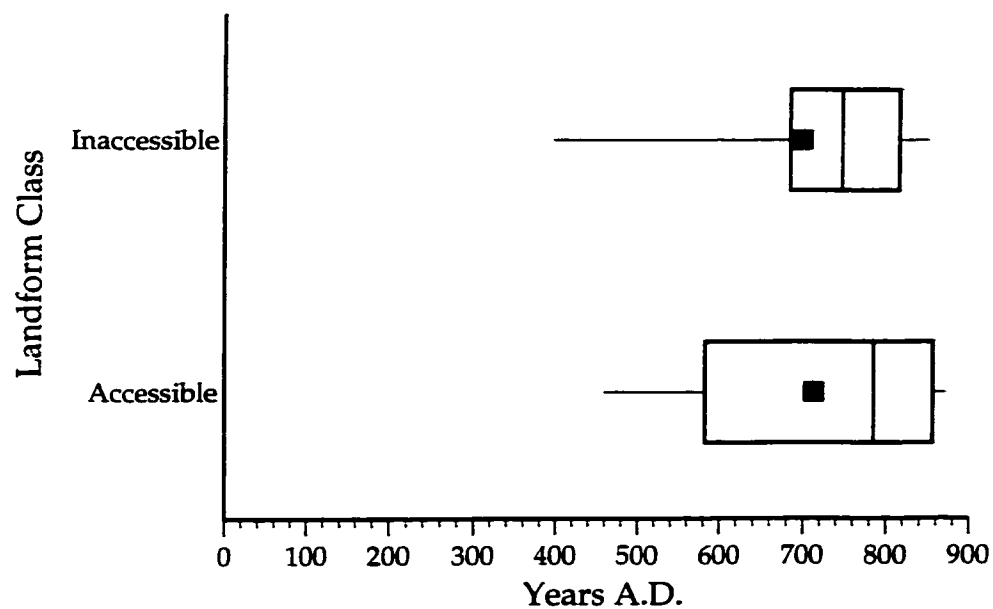


Figure 5.1 The age distributions of inaccessible and accessible structures chronometrically dated to the Early Pithouse period. The small solid square marks the mean age and the vertical line the median age. The box delimits the middle 50 percent of the data (the interquartile range, between the 25th and 75th percentiles). The horizontal lines extend to the most extreme value.

dates are more dispersed through time. The frequency distributions of the two landforms through time provide similar information, that both are negatively skewed (Figure 5.2).

Analysis of the data using the Mann-Whitney U test demonstrates that the distributions are not significantly different ($0.25 > p > 0.1$). The Mann-Whitney U test is the nonparametric analog of the t-test and is appropriate because the distributions are skewed.

Interestingly, before A.D. 400, more structures are located on inaccessible than accessible landforms (Figure 5.2). Although the pre-A.D. 400 sample is small, 98% of these chronometrically dated structures are located on inaccessible landforms. This scarcity of early structures on accessible landforms probably provided the empirical foundation for the culture historians' inference that *all* Early Pithouse period settlements were situated on inaccessible landforms. As Lekson (1992) points out, however, the frequency of early structures on accessible landforms is probably a function of the criteria used to identify early sites for excavation. He suggests that early sites on accessible landforms are not identifiable because they were also occupied in later times. If early sites contain slipped and painted ceramics from later occupations, then the other primary criteria for identification of early sites, presence of only plainware pottery, is essentially eliminated. This makes early sites on accessible landforms virtually invisible archaeologically, if chronometric data are unavailable.

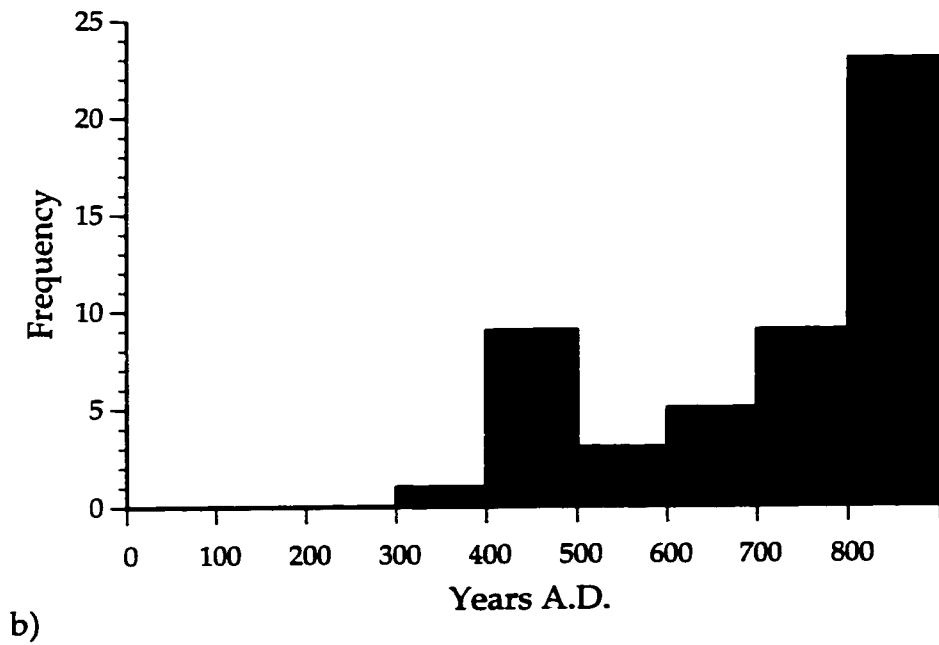
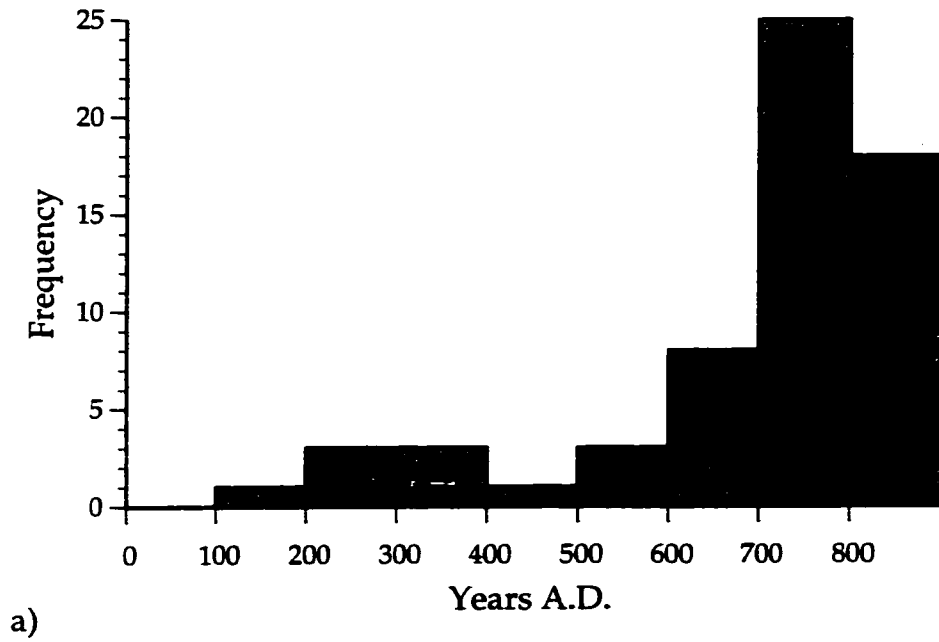


Figure 5.2 Structure frequency by age-range midpoint; located on a) inaccessible landforms, and b) accessible landforms.

The frequency distributions of the chronometric sample (Figure 5.2) appear to both contradict and support the generalized culture history settlement pattern. In contradiction to the pattern, the frequency of inaccessible structures appears to *increase* rather than decrease through time, with a significant increase between A.D. 700 and A.D. 800 (Figure 5.2a). In support of the settlement pattern, the use of accessible landforms does appear to increase through time with a significant increase between A.D. 800 and A.D. 900 (Figure 5.2b). A similar pattern exists for the phase-dated sample (Figure 5.3). Again, both distributions are negatively skewed with an increase in inaccessible landforms during the San Francisco phase (A.D. 650-750) and an increase in accessible landforms during the Three Circle phase (A.D. 750-900).

To assess whether the distributions are significantly different requires analysis using a statistical test that is not sensitive to departures from normality and robust to unequal sample sizes. I conduct a series of χ^2 tests of independence to evaluate the distributions of inaccessible and accessible structures through time. As above, the null hypothesis states that the probability of a structure being on an inaccessible or accessible landform is independent of its age.

I first divide the chronometric data into 100-year increments (Table 5.6a). This results in some cells with small expected values. Statistical research has shown that use of the χ^2 test is appropriate when the average

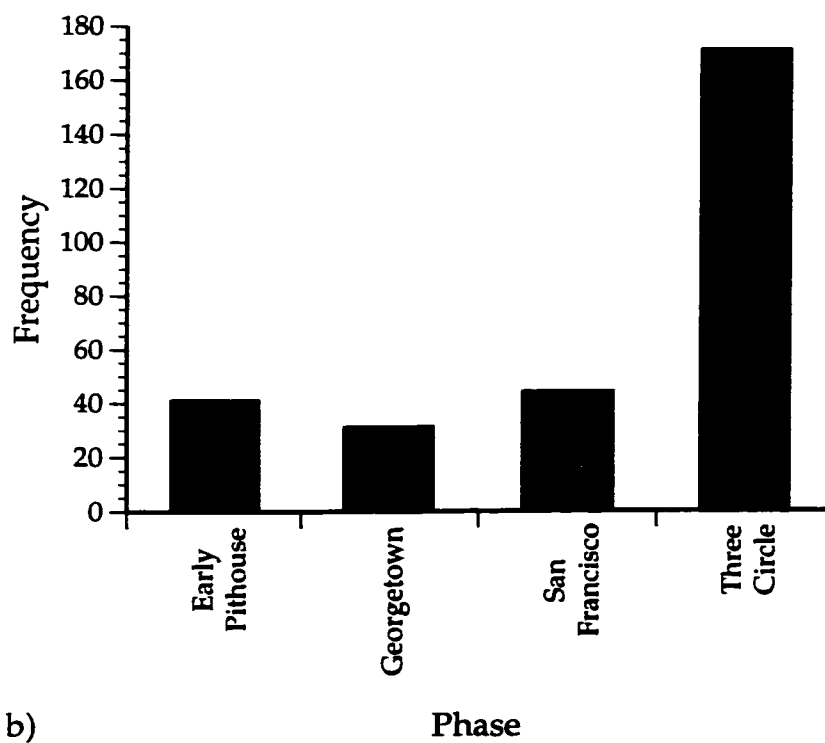
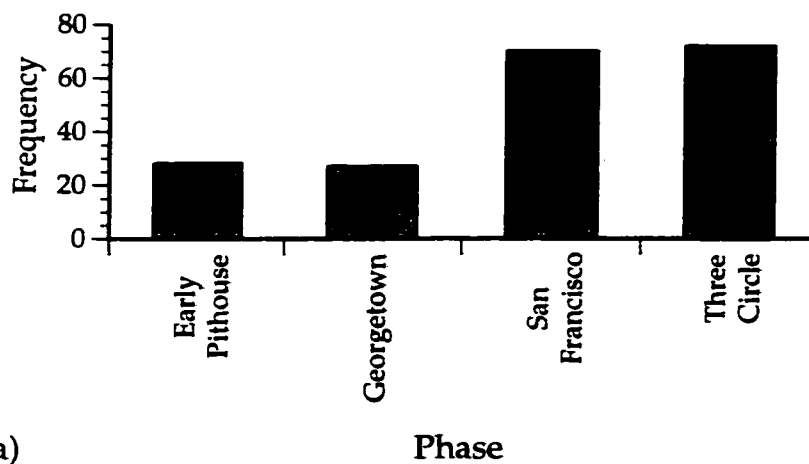


Figure 5.3 Structure frequency by phase; located on a) inaccessible landforms, and b) accessible landforms.

expected frequency is at least 6.0 for testing at $\alpha=0.05$ (Zar 1996: 502, citing Roscoe and Byars 1971). The average expected frequency for Table 5.6a is 7.0. The problem of low expected frequencies is resolved when the chronometric sample is grouped into temporal periods that are equivalent to the duration of the four phases (Table 5.6b) and also makes comparison of the chronometric and phased-dated samples easier.

The null hypothesis is rejected for the first test of the chronometric sample (Table 5.6a; $p=0.008$). The probability of a chronometrically dated structure being located on an inaccessible or accessible landform is not independent of its age. That is, the proportion of accessible and inaccessible structures differs across the different time intervals. To reiterate, the traditional settlement pattern predicts that there will be significantly more structures located on inaccessible landforms for time increments prior to A.D. 500 and significantly more structures situated on accessible landforms after A.D. 600.

The adjusted residuals show that two of the 100-year increments are driving the high χ^2 value (Table 5.6a) and they both contradict the traditional settlement pattern. These two increments have significant adjusted residuals because their absolute value is greater than the 5% standard normal deviate of 1.96. The A.D. 400-499 increment has significantly *fewer* structures than expected on inaccessible landforms; the traditional settlement pattern predicts that this increment would have significantly greater numbers of structures on

Table 5.6 Chi-square test of independence between landform class and age using the chronometric sample divided into a) 100-year increments, and b) phase-equivalent temporal categories.

a)

observed (expected) <i>adjusted residuals</i>	Accessible	Inaccessible	Total
AD 100-199	0 (0.45) -0.90	1 (0.55) 0.90	1
AD 200-299	0 (1.34) -1.58	3 (1.66) 1.58	3
AD 300-399	1 (1.79) -0.80	3 (2.21) 0.80	4
AD 400-499	9 (4.46) 3.02	1 (5.54) -3.02	10
AD 500-599	3 (2.68) 0.27	3 (3.32) -0.27	6
A.D. 600-699	5 (5.80) -0.48	8 (7.20) 0.48	13
A.D. 700-799	9 (15.18) -2.55	25 (18.82) 2.55	34
A.D. 800-899	23 (18.30) 1.85	18 (22.70) -1.85	41
Total	50	62	112

$\chi^2=19.17$, p-value=0.008

b)

observed (expected) <i>adjusted residuals</i>	Accessible	Inaccessible	Total
A.D. 150-550 (Early Pithouse)	12 (10.27) 0.82	11 (12.73) -0.82	23
A.D. 550-650 (Georgetown)	5 (3.13) 1.47	2 (3.88) -1.47	7
A.D. 650-750 (San Francisco)	5 (11.61) -2.97	21 (14.39) 2.97	26
A.D. 750-900 (Three Circle)	28 (25) 1.14	28 (31) -1.14	56
Total	50	62	112

$\chi^2=10.00$, p-value=0.019

inaccessible landforms because it pre-dates A.D. 550. Similarly, the A.D. 700-799 increment (which overlaps with the San Francisco phase) shows significantly more structures on inaccessible landforms, when the traditional settlement pattern would predict greater numbers on accessible landforms.

The difference between the expected and observed values is also conspicuous when presented graphically for inaccessible structures (Figure 5.4). Note that the χ^2 test uses raw frequencies, not the percents used in Figure 5.4; percents are used in this figure because they provide a useful visual display of the statistically significant trend. This figure provides insight into the reason why culture historians suggested that all early structures were located in inaccessible locales. Although there are more early sites than expected on inaccessible landforms, the χ^2 test shows that the pattern is not significant given the small sample size of early structures.

In order to compare the distributions of the chronometric and phase-dated samples, I group the chronometric sample into time increments equivalent to the phases. The adjusted residuals in Table 5.6b demonstrate that the San Francisco values are significant. Although the number of structures on accessible landforms during the Three Circle phase is, as predicted, higher than expected, the adjusted residuals are not significant. Figure 5.5a shows the unexpectedly high values for inaccessible structures in the San Francisco phase and the predicted lower, but insignificant ($\alpha=0.05$), values in the Three Circle phase.

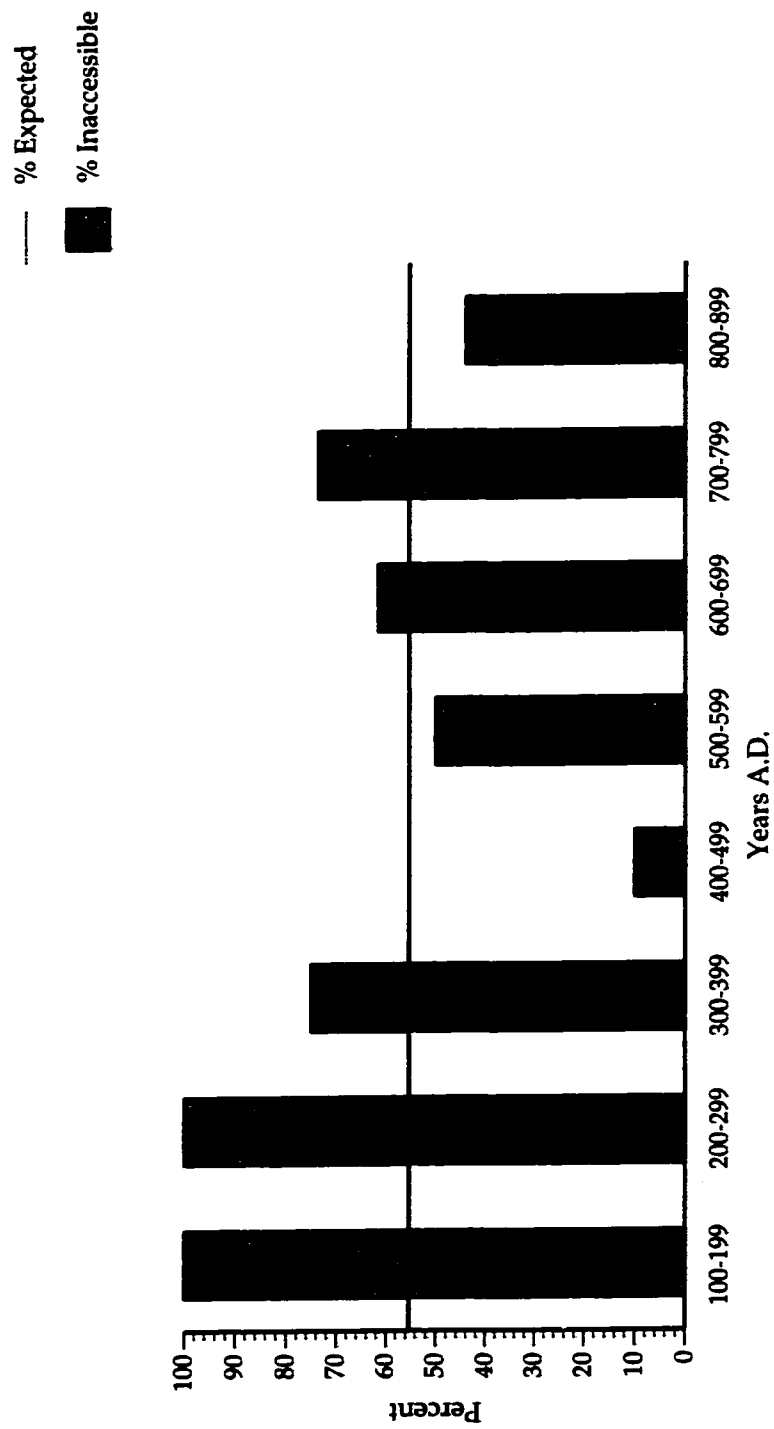


Figure 5.4 Percentage of chronometrically dated structures located on inaccessible landforms, grouped by age range midpoint.



Figure 5.5 Percentage of structures located on inaccessible landforms; a) chronometrically dated structures grouped, by age range midpoint, into phase-equivalent time periods, and b) structures grouped by phase.

The χ^2 test of the phase-dated sample produces similar results (Table 5.7). The null hypothesis that landform is independent of age is again rejected ($p < 0.001$). The adjusted residuals in Table 5.7 show that the values for the San Francisco and Three Circle phase observations are driving the high χ^2 value. The pattern predicted by the culture historians does not hold for the Early Pithouse period nor for the Georgetown phase. The San Francisco phase does exhibit a high value for inaccessible structures and the Three Circle phase a low value (Figure 5.5b). Contrary to the settlement pattern, the San Francisco phase has significantly more structures on inaccessible landforms than expected. As predicted, the Three Circle phase has significantly more structures in accessible locales than expected.

Comparability of Chronometric and Phase-Dated Samples

Grouping the chronometric sample into phase-equivalent categories might be problematic if it was not a representative sample of the Pithouse period structures. The chronometric sample is reasonably representative of the Pithouse period structures. If the chronometric and phase-dated structures come from the same Pithouse period population, the proportion of observations falling into each age class will be the same for chronometrically and phase-dated structures.

Using chi-square, I test whether the chronometric sample is representative of the larger sample of excavated Pithouse period structures. In the null hypothesis, the probability that a structure will be in the

Table 5.7 Chi-square test of independence between landform class and age using the phase-dated sample.

observed (expected) <i>adjusted residuals</i>	Accessible	Inaccessible	Total
Early Pithouse	41 (40.92) 0.002	28 (28.08) -0.002	69
Georgetown	31 (34.39) -0.97	27 (23.61) 0.97	58
San Francisco	44 (67.60) -5.15	70 (46.40) 5.15	144
Three Circle	171 (144.09) 4.98	72 (98.91) -4.98	243
Total	287	197	484

$\chi^2=33.41$, p-value<0.001

chronometric sample or the phase-dated sample (i.e. associated with a chronometric date or not) is the same across all age classes. The null hypothesis is not rejected, thus the chronometric and phase-dated distributions are not significantly different (Table 5.8; $p=0.32$ for accessible structures, $p=0.11$ for inaccessible structures).

That the chronometric sample appears to be representative of the larger group of excavated Pithouse period structures, does not imply that the sample of excavated structures are representative of the population of Pithouse period structures in the archaeological record. At this point, however, the representativeness of a database that includes only excavated structures cannot be assessed. Nonetheless, the sample on which these analyses are based is large relative to the 27 sites excavated by 1955, when the settlement pattern was well established in the literature (see Table 2.2).

Summary: Pithouse Period Landform Variability

In sum, the frequency of structures on inaccessible landforms in the Early Pithouse period and Georgetown phases are not at the levels predicted by the traditional culture historical settlement pattern. The frequency of structures on accessible landforms does increase during the Pithouse period, however, the shift occurs much later in the sequence than proposed. All temporal groupings of the data show that the peak in frequency of inaccessible locations occurs later, at around A.D. 700, during the San Francisco phase. The data show that the expected increase in the frequency of accessible

Table 5.8 Chi-square test to determine whether the proportion of observations that fall into each age class are the same for the chronometric and phase-dates samples; a) accessible structures and b) inaccessible structures.

a)

observed (expected)	Phase-Dated	Chronometric	Total
Early Pithouse	41 (45.14)	12 (7.86)	53
Georgetown	31 (30.66)	5 (5.34)	36
San Francisco	44 (41.73)	5 (7.27)	49
Three Circle	171 (169.47)	28 (29.53)	199
Total	287	50	337

$\chi^2=3.51$, p-value=0.320

b)

observed (expected)	Phase-Dated	Chronometric	Total
Early Pithouse	28 (29.66)	11 (9.34)	39
Georgetown	27 (22.06)	2 (6.94)	29
San Francisco	70 (69.22)	21 (21.78)	91
Three Circle	72 (76.06)	28 (29.93)	100
Total	197	62	259

$\chi^2=5.96$, p-value=0.114

locations also occurs much later, during the Three Circle phase (A.D. 750-950), rather than during the Georgetown phase (A.D. 550-650).

DEFINING ACCESSIBLE AND INACCESSIBLE LANDFORMS

The data and analyses above indicate that although settlement appears to change during the Pithouse period, the nature of the change is perhaps too complex to be captured by a single dichotomous nominal variable. LeBlanc (1980a) began the process of delineating other variables implicit in the culture history designations of "isolated" and "accessible." He identifies relative elevation as the potentially definitive variable. I continue in that approach by suggesting that the two landform classes are multidimensional or multivariate. I begin the process of disassembling the multivariate landform classes by investigating changes in other variables that may be constituents of the accessible/inaccessible distinction. The variables examined here, by no means an exhaustive list, include elevation, distance to water, substrate, and slope aspect.

ELEVATION

As noted above, culture historians typically describe Early Pithouse period site locales as "high" (Danson 1957; Haury and Sayles 1947; Haury 1956; Herrington 1979; Wendorf 1956), which suggests that elevation was a component of the original settlement pattern definition. Alternatively, use of the term high may denote relative rather than absolute elevation (LeBlanc

1980a). In this section, I investigate whether elevation is one component of the landform accessibility classification. I ask whether elevation is a critical factor in the identification of a landform as inaccessible.

LeBlanc (1980a) suggests that isolated structures are located on landforms considered inaccessible only in relation to alternative settlement locations in the same area. That is, a particular landform may not be high in absolute elevation, but it is relatively higher than other landforms in the surrounding area. If occupied inaccessible landforms are near occupied accessible landforms, then the distribution of structures by absolute elevation should be similar for the two landform classes and elevation differences would be apparent only for structures on landforms in a restricted local area. There should be little difference in the distributions for the two landform classes by absolute elevation. Both landform classes should be found at a variety of elevations within the range of elevations that characterize the study area.

Descriptive statistics provide an initial view of the landform elevation distributions and show that they are quite similar for both samples (Table 5.9). The average elevations of the accessible and inaccessible groups overlap at one standard deviation and measures of central tendency (mean, median, and mode) for the distributions in the larger phase-dated sample are similar.

The frequency distributions are also quite similar (Figures 5.6 and 5.7), but this graphic format shows the differences between the two landform

Table 5.9 Elevation statistics for chronometric and phase-dated samples.

	Chronometric		Phase-Dated	
	Accessible	Inaccessible	Accessible	Inaccessible
Mean	5769.80	5574.65	5589.71	5768.08
Median	5970	5680	5710	5696
Mode	5970	5680	5710	5680
Standard Deviation	581.16	448.55	708.33	454.25
Standard Error	82.19	56.97	36.82	28.79
Kurtosis	-0.09	0.09	-0.70	0.32
Skewness	-0.68	-0.10	-0.17	-0.46
Range	2690	2220	3190	2220
Smallest Value	4120	4450	4020	4450
Largest Value	6810	6670	7210	6670
Count	50	62	370	249

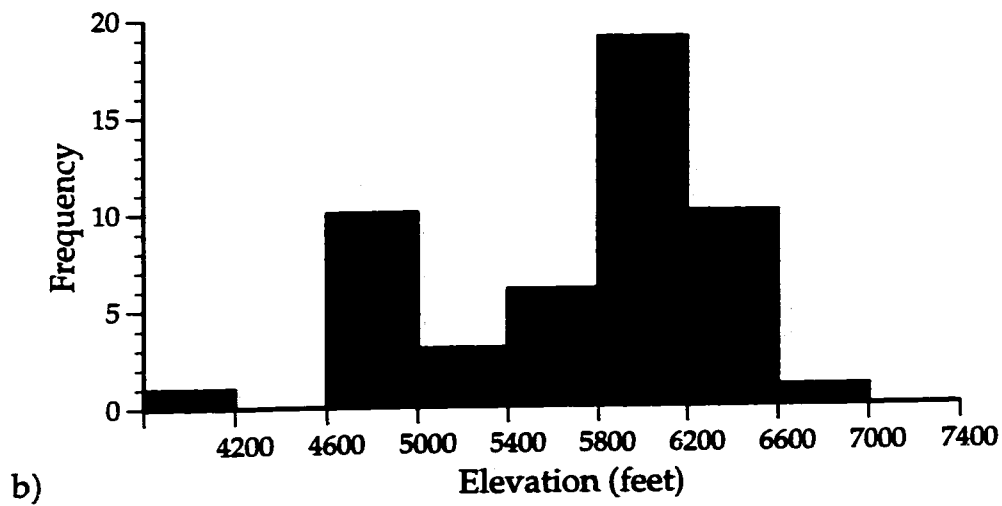
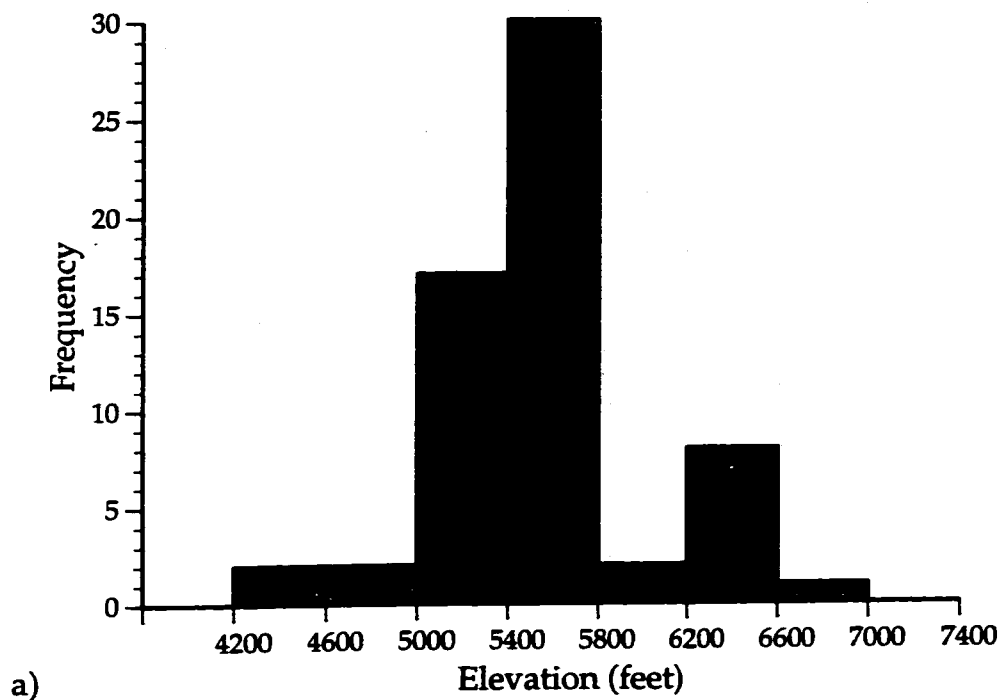


Figure 5.6 Elevation frequency for structures with chronometric dates; a) inaccessible landforms, b) accessible landforms.

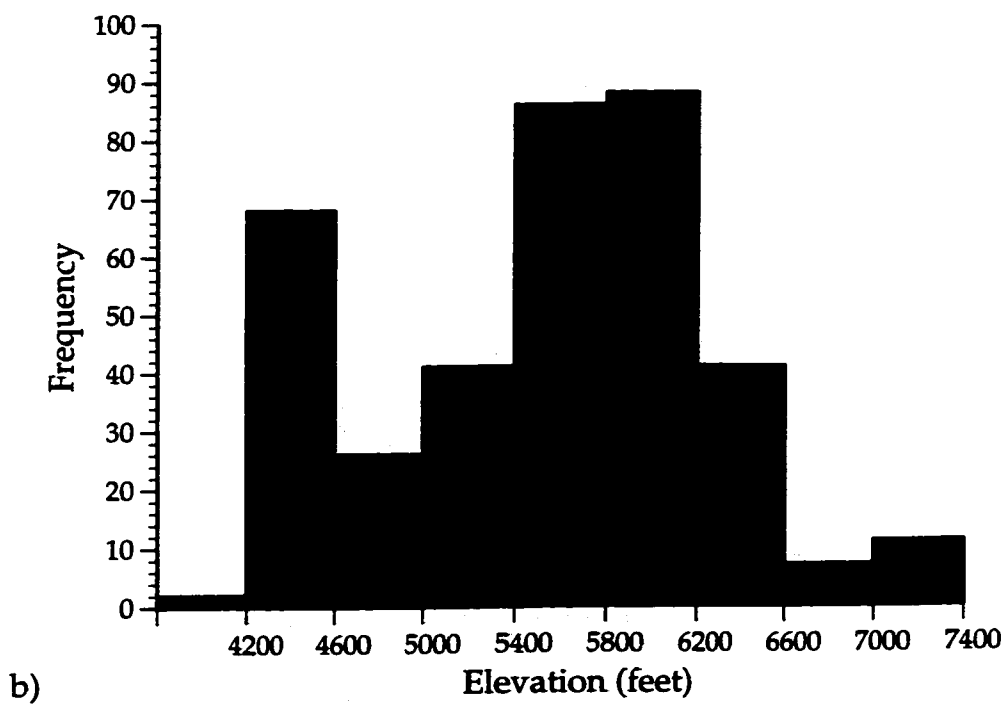
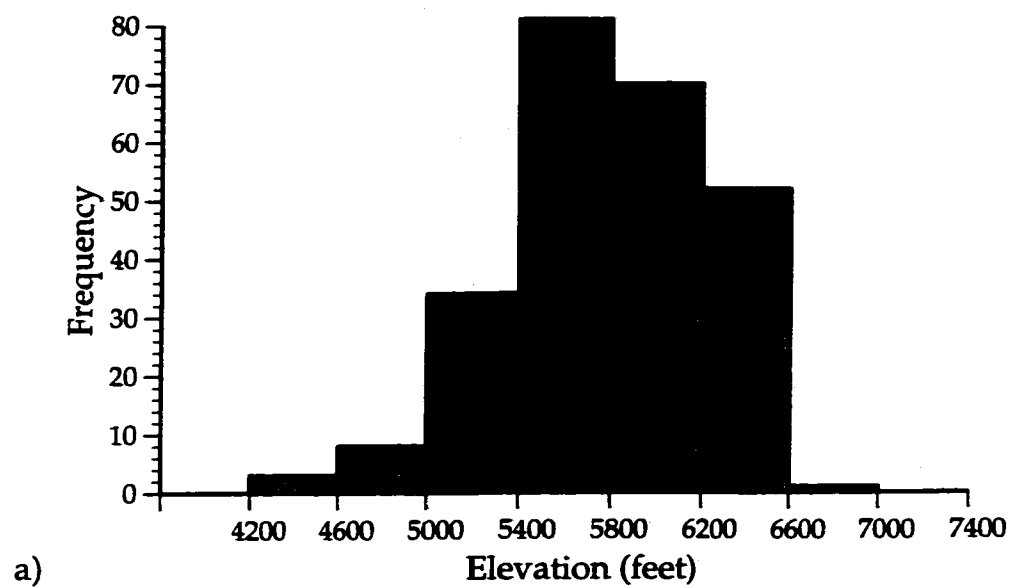


Figure 5.7 Elevation frequency for phase-dated structures;
a) inaccessible landforms and b) accessible landforms.

classes more clearly than the descriptive statistics. Accessible structures appear to be situated on landforms at a greater variety of elevations than inaccessible structures. This most likely reflects the exclusive nature of the definition for inaccessible landforms (i.e. relatively few landforms meet the criteria for inaccessibility), rather than that only a narrow elevation range qualifies a landform as inaccessible. The chronometric sample shows a bimodal distribution for both inaccessible and accessible landforms (Figure 5.6). However, the bimodality of the inaccessible landforms disappears in the larger sample of phase-dated structures (Figure 5.7).

The results of χ^2 tests for both samples show that the elevation distributions between the two landform classes are significantly different. For the chronometric sample (Table 5.10), the adjusted residuals show that the landform distributions differ most between 5800' and 6200'. Fewer structures than expected are located on inaccessible landforms in this elevation range. The phase-dated sample also has significant adjusted residuals for high elevations, 6200'–6600' (Table 5.11). These results may suggest that at higher elevations in the study area, most landforms are relatively accessible.

In sum, comparisons between the two landform classes indicate that both are situated at a variety of absolute elevations within the study area. Differences between the classes are more likely due to sample size effects and geomorphology, rather than a prehistoric preference for landforms situated within a particular range of absolute elevation.

Table 5.10 Chi-square test of independence between landform class and elevation using the chronometric sample.

observed (expected) <i>adjusted residuals</i>	Accessible	Inaccessible	Total
≤4200 feet	1 (0.45) 1.11	0 (0.55) -1.11	1
≤4600 feet	0 (0.89) -1.28	2 (1.11) 1.28	2
≤5000 feet	10 (5.36) 2.85	2 (6.64) -2.85	12
≤5400 feet	3 (8.93) -2.94	17 (11.07) 2.94	20
≤5800 feet	6 (16.07) -4.10	30 (19.93) 4.10	36
≤6200 feet	19 (9.38) 4.69	2 (11.63) -4.69	21
≤6600 feet	10 (8.04) 1.02	8 (9.94) -1.02	18
≤7000 feet	1 (0.89) 0.15	1 (1.11) -0.15	2
Total	50	62	112

$\chi^2=47.375$, p-value<0.001

Table 5.11 Chi-square test of independence between landform class and elevation using the phase-dated sample.

observed (expected) <i>adjusted residuals</i>	Accessible	Inaccessible	Total
≤4200 feet	2 (1.20) 4.16	0 (0.80) -4.16	2
≤4600 feet	68 (42.44) 6.57	3 (28.56) -6.57	71
≤5000 feet	26 (20.32) 2.02	8 (13.68) -2.02	34
≤5400 feet	41 (44.83) -.096	34 (30.17) 0.96	75
≤5800 feet	86 (99.80) -2.55	81 (67.18) 2.55	167
≤6200 feet	88 (94.44) -1.21	70 (63.56) 1.21	158
≤6600 feet	41 (55.59) -3.35	52 (37.41) 3.35	9
≤7000 feet	7 (4.78) 1.61	1 (3.22) -1.61	8
≤7400 feet	11 (6.58) 2.75	0 (4.42) -2.75	11
Total	370	249	619

$\chi^2=69.702$, p-value<0.001

Relative Elevation

In this section, I investigate whether relative elevation is a component of the culture history definition of accessible and inaccessible landforms. This requires information about elevation differences between the landforms in proximity of one another. This ostensibly simple calculation is confounded by the fact that elevation is positively correlated with latitude throughout most of the Southwest. Relative elevation differences between landform classes may be obscured or exaggerated even if landforms are only a few kilometers distant from each other. If latitudinal variation in elevation is controlled, then relative differences in the elevation of accessible and inaccessible landforms can be assessed.

The relationship between latitude and elevation is not uniform across the study area because of geologic and topographic variations. The hypothesis that inaccessible and accessible landforms vary in relative elevation can, however, be tested using a smaller area with relatively homogeneous physiography. The best area for testing the hypothesis is one in which the landforms are distributed along an axis oriented the same as the dip of the landscape, such as a river valley. In the study area, the land dips roughly south/southwest, as do the major river valleys. Many of the excavated structures are located in the major river valleys and their associated tributaries.

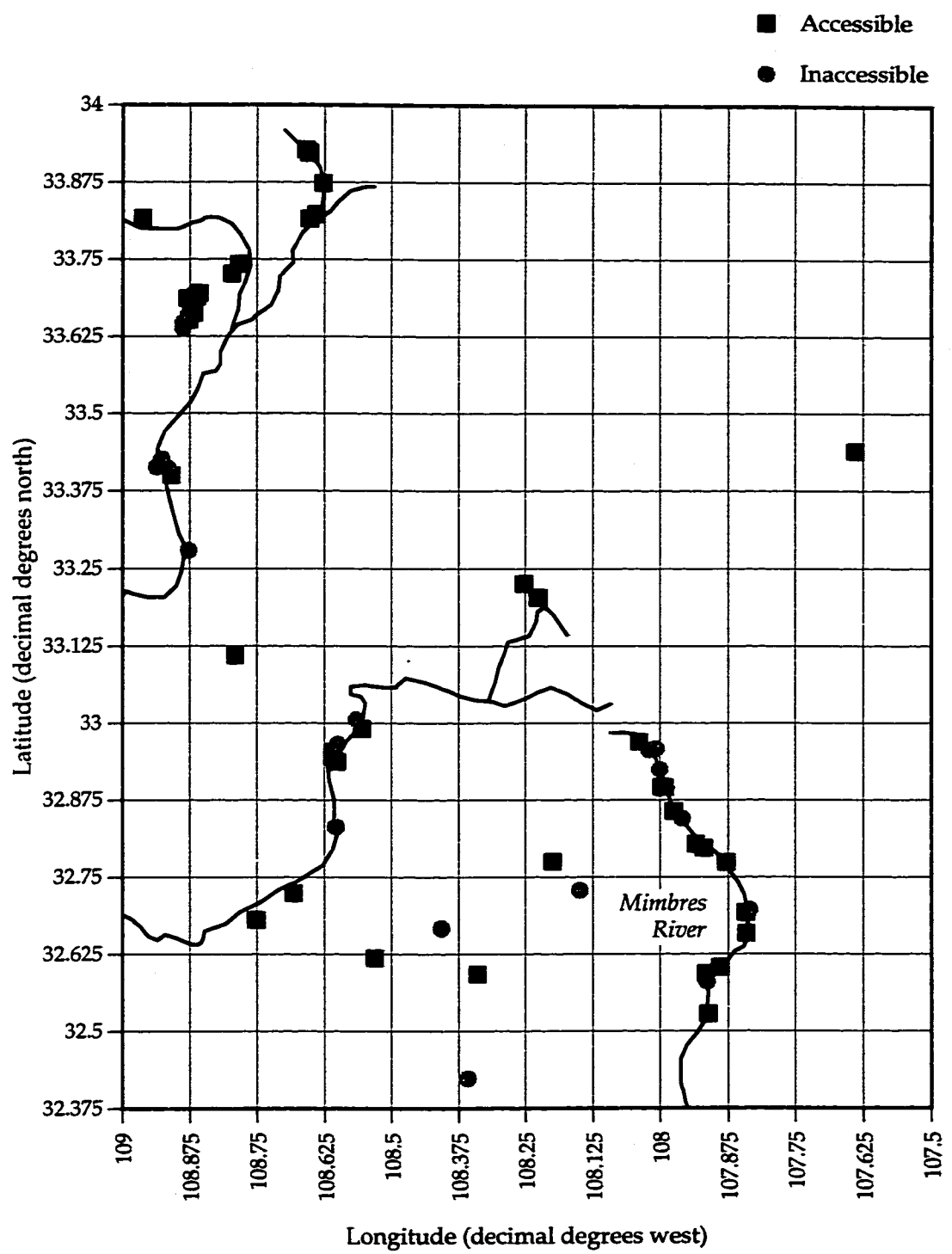


Figure 5.8 Landforms occupied during the Pithouse period with excavated structures.

The Mimbres valley is the ideal setting for testing the hypothesis (Figure 5.8). First, the land dips to the south and the valley is oriented roughly north-to-south; the Gila and San Francisco rivers follow more sinuous courses. Second, structures situated on both inaccessible and accessible landforms have been excavated in Mimbres valley. Finally, the sample of occupied accessible and inaccessible landforms in the Mimbres valley is large and evenly distributed along the drainage. If elevation is positively correlated with latitude, then the elevation occupied accessible and inaccessible landforms situated in the Mimbres drainage should vary consistently with latitude.

The first step in this analysis is to verify that elevation is positively correlated with latitude in the Mimbres valley. I document this relationship in the valley using only one kind of landform, which falls unambiguously into the accessible landform class, terrace/bench (Figure 5.9). Restricting the initial analysis to a single kind of landform, limits the probability that deviations from the regression line are due to some factor other than latitude. Linear regression of the occupied terraces/benches in the Mimbres valley demonstrates a strong relationship between elevation, the dependent variable, and latitude, the independent variable ($R^2=0.98$, $p<2.3^{-8}$). That is, 98% of the variation in elevation for this sample is explained by changes in latitude (Figure 5.10).

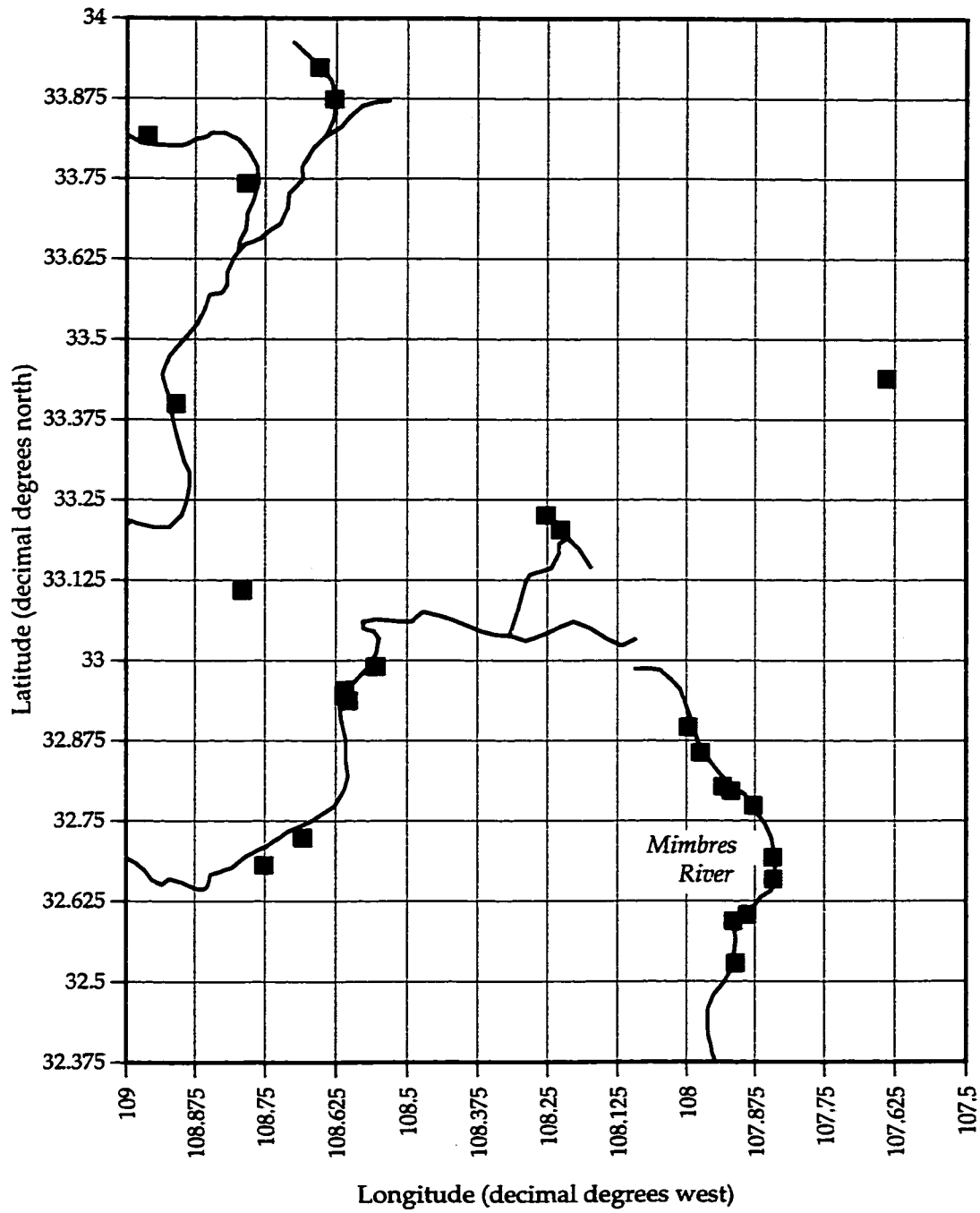


Figure 5.9 Landforms occupied during the Pithouse period with excavated structures situated on terraces or benches.

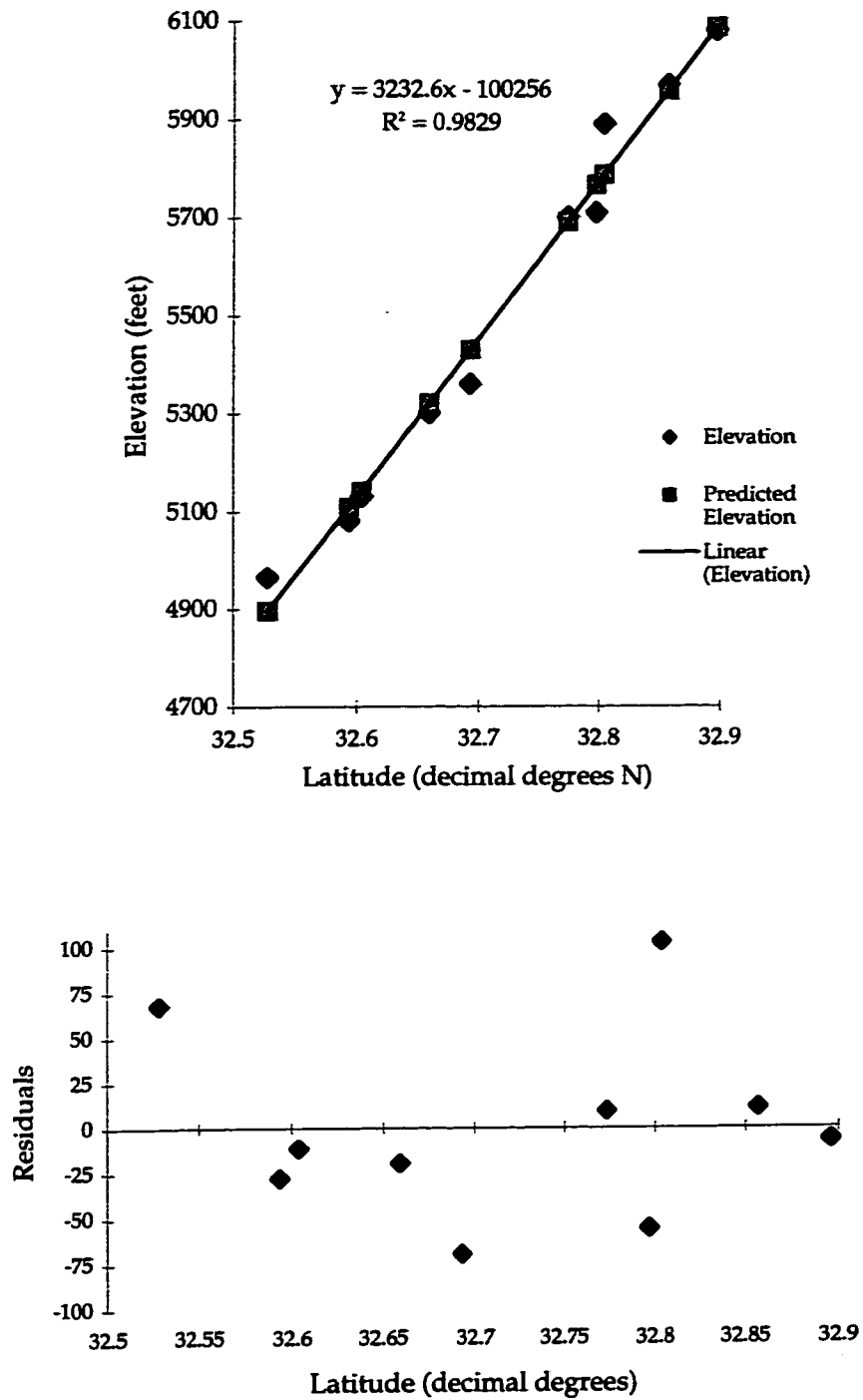


Figure 5.10 Elevation as a function of latitude for terraces and benches in the Mimbres valley with excavated structures dating to the Pithouse period.

Note that in this and subsequent analyses of elevation data, occupied landforms are the unit of analysis because all structures on a single landform have the same latitude and elevation. Analyses at the landform scale are appropriate in this case because changing the unit of observation has little impact on the results and adds no new information. The empirical definition of accessible and inaccessible landforms does not change with the shift from structures to landforms. The same cannot be said for analyses concerned with temporal change because the age of a settlement unit varies with the scale. If a structure is situated on an accessible landform, then all structures on that landform are classified as accessible. If an individual structure on a landform dates to A.D. 550, all structures on that same landform cannot be assumed to also date to A.D. 550. For this particular question, computations based on individual structures add no new information. Even if elevation data were available at a finer resolution for each structure (e.g. in centimeters), the interpretation would be similar.

Given the linear relationship between latitude and elevation within the Mimbres valley, the regression equation can be used to control for the trend that elevation increases with increasing distance upstream. The regression essentially levels the valley by removing the influence of distance upstream. If occupied landforms have distinct elevational ranges, then the best fit regression line should bisect the distributions of the two landform classes. Inaccessible landforms should be situated at higher elevations than

predicted by the fitted regression and accessible landforms at lower elevations than predicted. If this is the case, then inaccessible landforms should fall above the regression line and have positive residuals, while accessible landforms should fall below the line and have negative residuals.

Table 5.12 presents the results of regressing elevation on latitude for occupied landforms in the Mimbres drainage with excavated Pithouse period structures. The relationship is strongly linear ($R^2=0.95$) and significant ($p<0.001$) and the residuals are normally distributed. As in the earlier terrace/bench regression, a large percentage of the variation in elevation for this sample (95%) can be explained by changes in latitude. The residuals are distributed normally, as expected, with a majority of small residuals centered on 0 and a few larger residuals in the tails of the distribution (i.e. with standard residuals >1). They are not significantly different from normal given the relatively small sample size ($n=19$; symmetry/skewness=1.24, $p>0.01$; kurtosis=2.09, $p>0.01$), although the distribution of residuals appear slightly skewed and slightly leptokurtic (Figure 5.11).

The regression of elevation on latitude meets all expectations, yet occupied inaccessible landforms do not always have positive residuals and the occupied accessible landforms do not always have negative residuals. This results from overlap in the distributions of relative elevation for the two landform types. While the tails of the two distributions overlap, the residuals

Table 5.12 Mimbres valley regression of elevation on latitude. Analysis of variance (ANOVA) testing the significance of the regression.

<i>Regression Statistics</i>	
Multiple R	0.974
R ²	0.948
Adjusted R ²	0.945
Standard Error	125.814
Observations	19

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	4888669.02	4888669.020	308.838	2.449 ⁻¹²
Residual	17	269096.772	15829.222		
Total	18	5157765.790			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Statistic</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	-113706.475	6801.630	-16.718	5.4787 ⁻¹²	-128056.680	-99356.270
Slope	3645.778	207.455	17.574	2.4492 ⁻¹²	3208.085	4083.471

<i>LA#</i>	<i>Latitude* (decimal °N)</i>	<i>Landform Class</i>	<i>Elevation (feet)</i>	<i>Predicted Elevation</i>	<i>Residuals</i>	<i>Standard Residuals</i>
75956	32.969518	Accessible	6540	6493.06	46.94	0.38
19074	32.958479	Inaccessible	6440	6452.82	-12.82	-0.10
53	32.956003	Inaccessible	6520	6443.79	76.21	0.62
19075	32.924424	Inaccessible	6670	6328.66	341.30	2.79
12076	32.896509	Accessible	6080	6226.89	-146.89	-1.20
18890	32.895299	Accessible	6160	6222.48	-62.48	-0.51
18888	32.894719	Inaccessible	6220	6220.36	-0.36	-0.002
1867	32.856920	Accessible	5970	6082.56	-112.56	-0.92
12110	32.845119	Inaccessible	6020	6039.53	-19.53	-0.16
676	32.803789	Accessible	5890	5888.85	1.15	0.01
635	32.797204	Accessible	5710	5864.84	-154.84	-1.27
18903	32.773989	Accessible	5700	5780.21	-80.21	-0.66
14998	32.697200	Inaccessible	5640	5500.25	139.75	1.14
1691	32.693202	Accessible	5360	5485.68	-125.68	-1.03
2465	32.659143	Accessible	5300	5361.51	-61.51	-0.50
4051	32.603996	Accessible	5130	5160.45	-30.45	-0.25
1118	32.593708	Accessible	5080	5122.94	-42.94	-0.35
14976	32.580585	Inaccessible	5240	5075.10	164.90	1.35
1113	32.528446	Accessible	4965	4885.01	79.99	0.65

* arranged from north to south

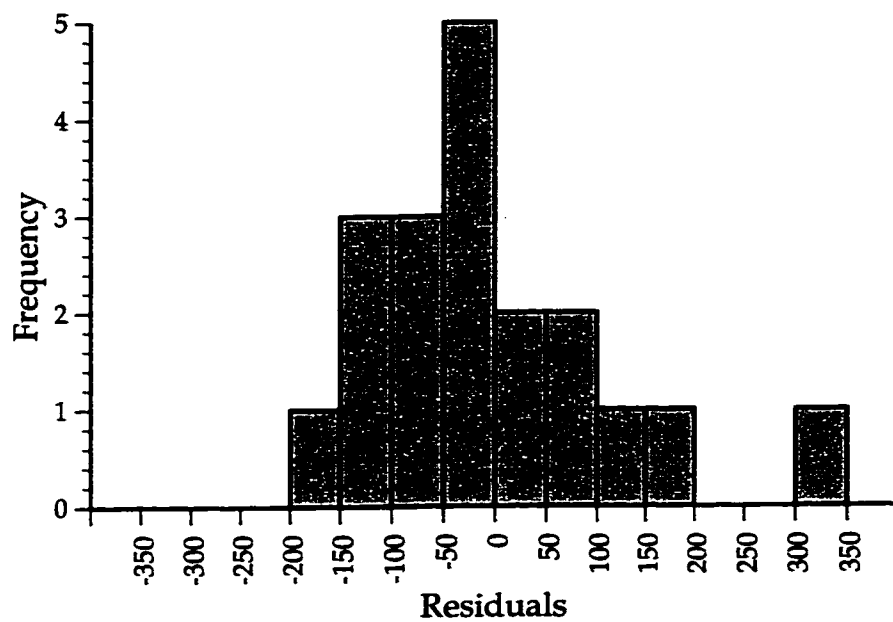


Figure 5.11 Histogram of residuals from regressing elevation on latitude for landforms occupied during the Pithouse period in the Mimbres River drainage.

also show that the elevation difference between the two landform groups is less than 200 feet (Figure 5.12).

Despite the overlap, the proposal that the distributions of accessible and inaccessible landforms should be bifurcated by the regression line remains plausible. All six landforms whose residuals have signs opposite than expected are small and within one standard deviation of the regression line (i.e. their standard residuals are less than 1.0; see Table 5.12). Thus, the incorrect predictions are not significant because there is a high probability that the sign is incorrect due to chance. Four of these landforms (occupied by LA 676, LA12110, LA18888, and LA19074) are plotted close to the regression line and associated with high probabilities ($p=0.44-0.50$). Although the other two landforms with incorrect signs (occupied by LA1113 and LA75956) also have standard residuals less than 1.0, their residuals are relatively large. Valley geomorphology is the most likely factor affecting the classification of these two landforms.

Old Town (LA1113) is situated on the landform with the largest deviation with an incorrectly predicted residual sign (Figure 5.13). The landform is an accessible bench of the Mimbres River surrounded by relatively flat terrain, but it is in an atypical geomorphic setting. Of the landforms occupied during the Pithouse period in the Mimbres valley, this is located the furthest south (see Figure 5.9). The residual is positive probably

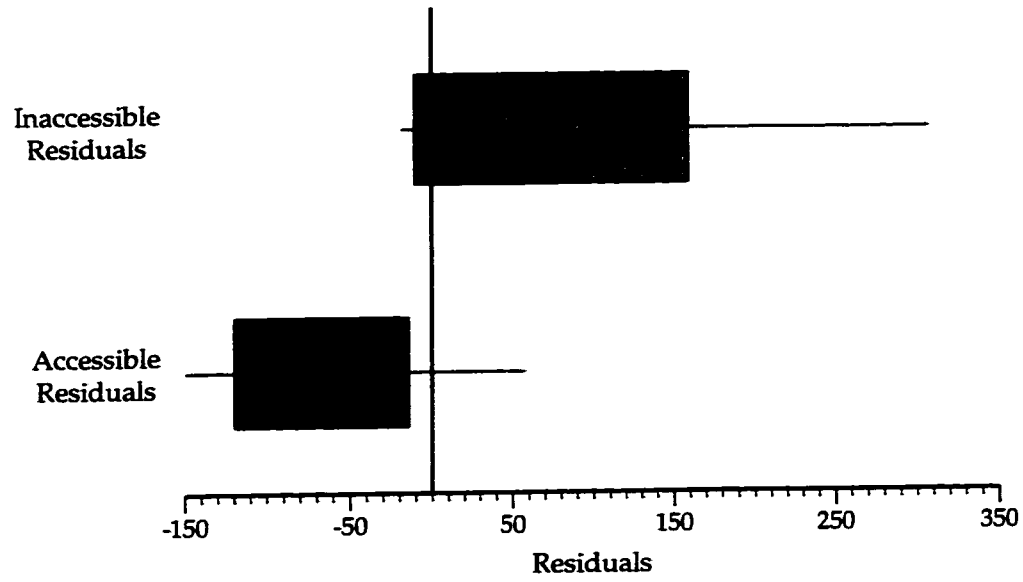


Figure 5.12 Boxplots of residuals from regressing elevation on latitude for occupied landforms in the Mimbres River valley. [See Figure 5.1 for an explanation of boxplots.]

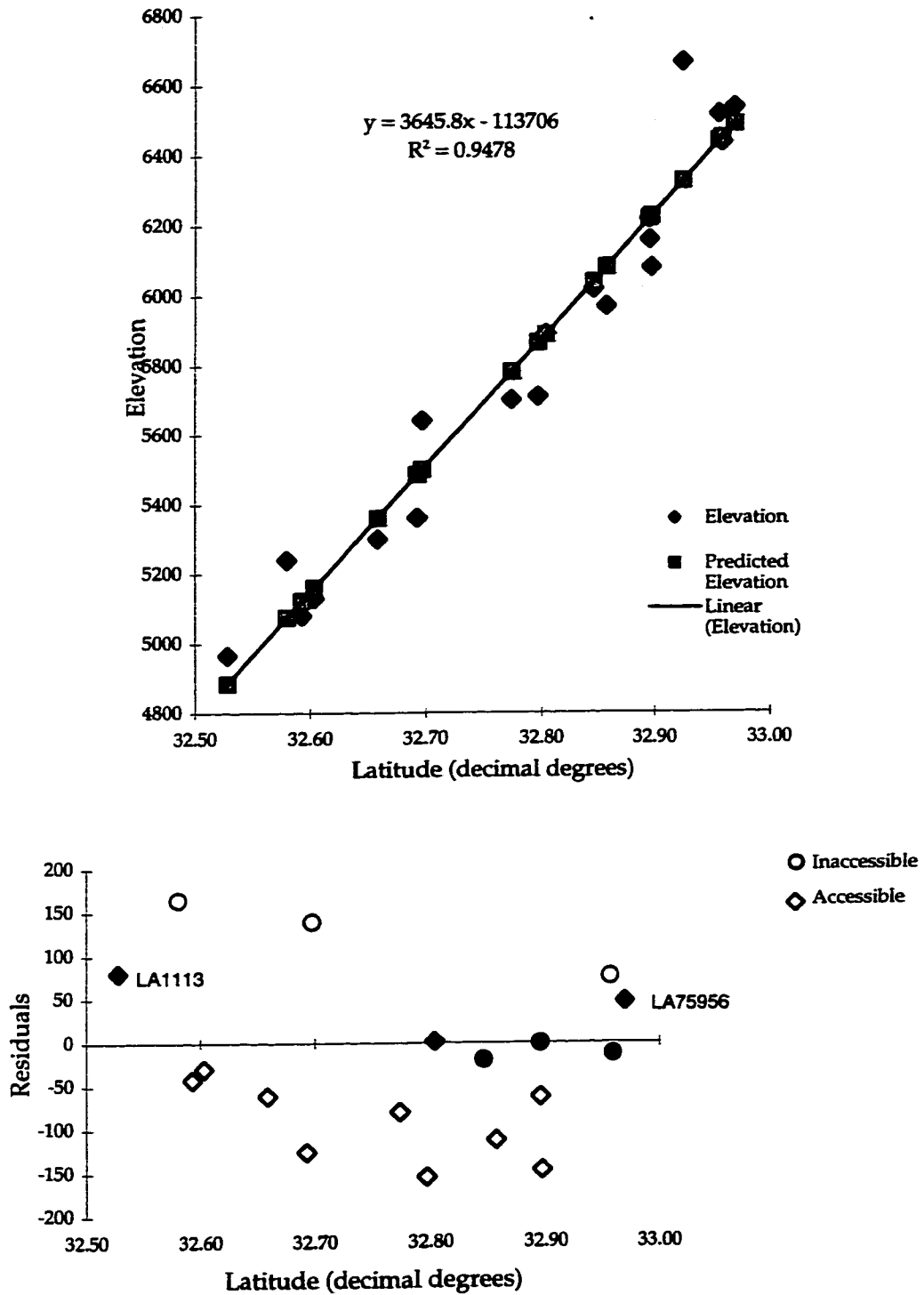


Figure 5.13 Latitude by elevation for all occupied lanforms in the Mimbres valley with excavated structures dating to the Pithouse period. In the residual plot (lower), the filled symbols indicate landforms with signs opposite that predicted.

because the landform is high relative to the riverbed, about 80 feet above it, but it is not high relative to the surrounding terrain.

LA75956 (ASM Y:4:7) is also situated on a landform with an unexpected positive residual. Although the landform is well above the Mimbres riverbed, it is topographically accessible because it has a gradual slope ($<7^\circ$) and the site is less than 10 meters from a side drainage of the West Fork of the Mimbres River. The excavator describes the landform as a "semi-isolated hillock" (Hogg 1977: 54).

In general, the residuals follow the predicted pattern (inaccessible/positive residuals; accessible/negative residuals). Most of the exceptions have extremely small residuals and the two exceptions with larger residuals can be explained by specific riverine geomorphology. This pattern indicates that, in the Mimbres valley, most of the landforms classified as inaccessible are relatively higher than most of the accessible landforms. This supports LeBlanc's (1980a) suggestion that inaccessible sites are high relative to alternative site locales on accessible landforms in the Mimbres valley.

To further explore differences in relative elevation, I run separate regressions for the occupied accessible and inaccessible landforms in the Mimbres valley. The regression lines appear to be parallel and about 170 feet apart (Figure 5.14). Nonetheless, a Student's t (Zar 1996: 353-354) test for the equality of the two regression coefficients documents that the slopes of the regression lines are statistically different ($|t| = 31.10$, $p < 0.001$). In fact, the

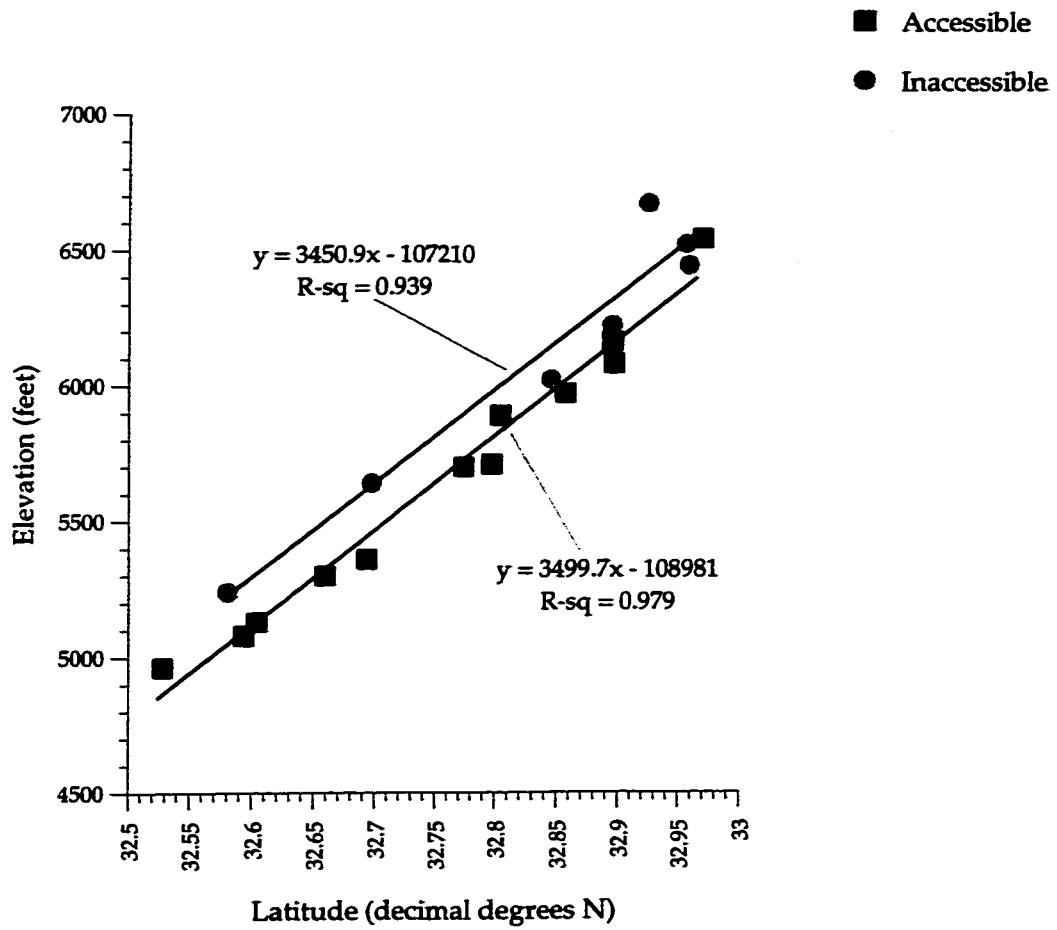


Figure 5.14 Regressions of elevation on latitude for inaccessible and accessible landforms in the Mimbres valley.

difference in elevation of the two regression lines ranges from 160 feet in the northern Mimbres drainage and about 180 feet in the southern part of the drainage.

While the two regression lines are not parallel, the statistical difference in slope may have little practical significance. The regression plots in Figure 5.14 indicate that the two landforms differ in relative elevation by at least 160 feet. This relatively consistent difference suggests that within the Mimbres valley, the two landform groups can be differentiated based on differences in relative elevation, which supports the previous analysis of residuals. The relatively small difference in relative elevation between the two landform types, and the overlapping distributions probably account for some of the difficulty that archaeologists have had assigning meaning to the terms "isolated" and "accessible" as well as classifying structures in these categories.

Summary: Elevation

The above regression analyses investigate the role of elevation in defining accessible and inaccessible landform classes. Landforms with excavated Pithouse period structures are used to test whether elevation is a crucial element in the identification of accessible and inaccessible landforms. The first regression shows that there is a functional relationship between latitude and elevation in the Mimbres valley, i.e. as latitude increases, elevation increases.

The second and third regressions show that landform class is not determined solely by relative elevation. Although the relationship between latitude and elevation is strong and linear, and thus the effects of latitude can be controlled, other factors affect whether archaeologists consider a site to be on an inaccessible or accessible landform. Other than elevation, the factor that has the greatest affect on landform classification is river system geomorphology.

DISTANCE TO WATER

Haury (1956: 5) notes that Late Pithouse sites are "strategically located with respect to water and arable land." Bluhm (1960: 541) states that "later sites occurred at lower elevations along canyons and on mesas close to water and arable land." These comments suggest that the variable "distance to water" might also have played a role in the development of the culture historical isolated-to-accessible settlement pattern. Furthermore, if the shift to accessible landforms does occur during the Late Pithouse period, as the analyses above indicate, then distance to water should also decrease through time. Accessible landforms should be closer to water because they are formed by stream flow and are thus near stream channels (e.g. bench, terrace, floodplain, and valley).

In order to determine whether proximity to water changes through time, I examine this variable for the chronometric and phase-dated samples of Pithouse period structures; as noted above, because temporal change is of

interest here, the unit of observation is the structure. Figure 5.15 shows the distributions of distance to nearest water source for the chronometric and phase-dated samples. Both distributions are positively skewed and thus the data are not appropriate for parametric statistical analysis such as traditional analysis of variance (ANOVA). Instead, I use the Kruskal-Wallis (K-W) test to assess whether distance to water varies across temporal classes. The K-W test is a non-parametric analysis of variance that is about 95% as powerful as ANOVA (Conover 1980). This test is robust in cases where the data violate the assumption of normality because it uses data ranks rather than raw data values. The data are ordered from shortest to longest distance to water and then assigned ranks, with 1 the shortest distance.

The null hypothesis for the Kruskal-Wallis test (Conover 1980: 229-232) is that the distance to water is equal across the categories, i.e. that the distance to water does not vary through time. I apply the K-W test to three separate groupings of the distance to water data. I test the chronometric sample divided first into 100-year increments and then grouped into phase-equivalent categories. I also test the distribution across the phases using the larger sample of structures assigned to the four phases of the Pithouse period. The results of the three tests are listed in Table 5.13.

In each case, the null hypothesis of no significant difference is rejected. However, rejection of the null hypothesis indicates only that at least two groups differ significantly from one another. As in an analysis of variance, a

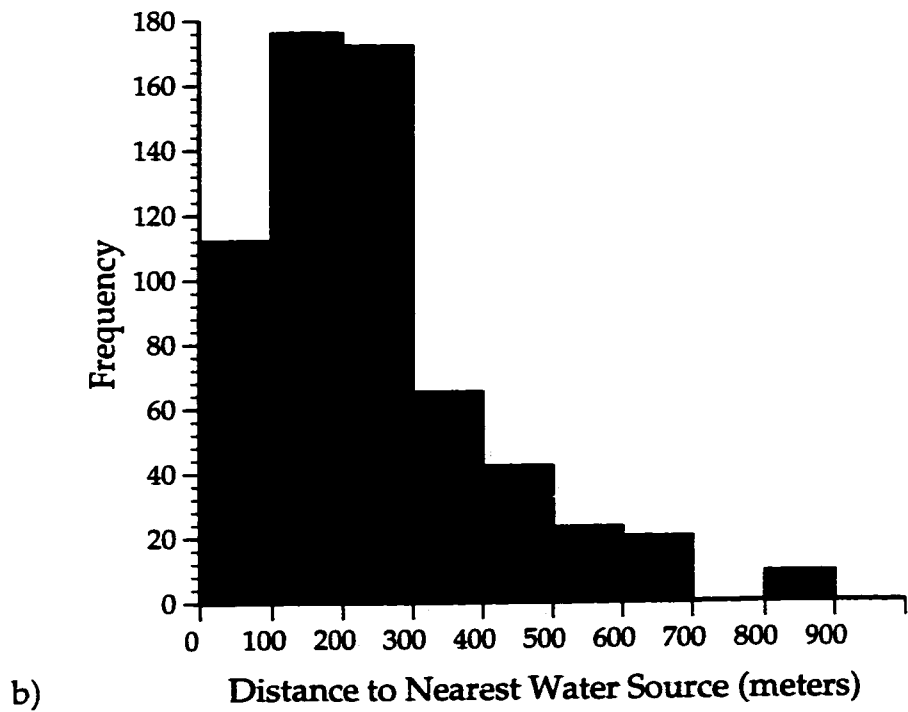
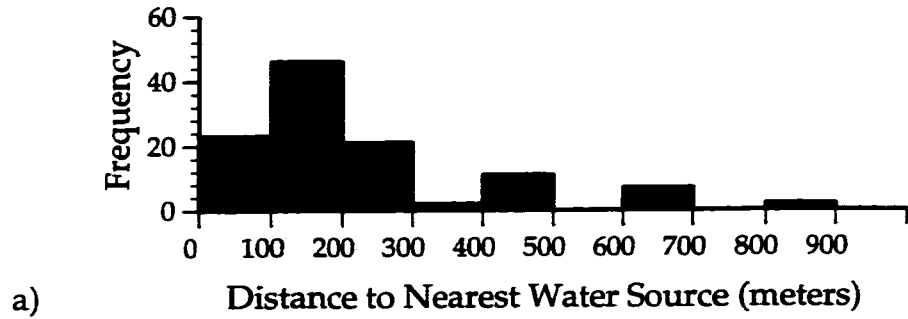


Figure 5.14 Distance to water for a) chronometric sample, and b) phase-dated sample.

Table 5.13 Results of Kruskal-Wallis tests for temporal changes in the distance to water.

Sample (increments)	df	Critical $H_{.010}$	H_c	Probability (H_c)
Chronometric (100 year)	7	24.322	29.38	<.001
Chronometric (phases)	3	16.266	54.34	<.001
Phase-dated (phases)	3	16.266	37.24	<.001

*A correction factor was applied to each test statistic (H) because all samples contained tied ranks that crossed groups.

multiple comparison test needs to be conducted to determine which groups are significantly different. I use the Dunn nonparametric multiple comparison test to contrast pairs of temporal classes within a sample (Zar 1996: 227; Dunn 1964). This test is appropriate because sample size varies across the temporal classes. The Dunn multiple comparison test is the nonparametric equivalent of the Bonferroni test, which is also known as Dunn's test because it was first formalized by Dunn (1961; Howell 1992). The nonparametric Dunn test is analogous to the more familiar Tukey and Student-Newman-Keuls multiple comparison tests that are typically conducted after an ANOVA.

Table 5.14 presents the results of the Dunn pairwise comparisons. The results for the chronometric sample divided into 100-year increments indicate that only one comparison is significant (Table 5.14a). The group of structures that date to the A.D. 400s differs in their distance to water from the group dated to the A.D. 800s. All other groups are not significantly different. The early sites are further from water than later sites, but the mean ranks of the temporal classes show that there are no significant decreases between consecutive time intervals. This suggests that the use of accessible landforms, as recorded by distance from water, increased gradually over time.

When the chronometric sample is grouped into the four pithouse phases, the A.D. 550-650 group (Georgetown) is significantly different from all other phases (Table 5.14b). Sample size may be the reason for the significance

Table 5.14 Dunn multiple comparison test of distance to water for paired temporal classes; a) chronometric sample divided into 100-year increments, b) chronometric sample divided into phase-equivalent classes, and c) phase-dated sample. Values with ** are significant.

a)

Years A.D.	n	Mean Rank	400	300	200	100	500	700	600
800	41	40.54	4.16**	2.29	1.93	1.12	2.07	3.36	0.06
600	13	41.15	3.44	2.07	1.77	1.08	1.80	2.33	
700	34	65.49	1.92	0.80	0.62	0.35	0.29		
500	6	69.58	1.09	0.46	0.35	0.21			
100	1	77.00	0.32	0.06	0.01				
200	3	77.50	0.48	0.06					
300	4	79.00	0.45						
400	10	87.60							

Significant at $\alpha = 0.01$ if >3.57 .

b)

Years A.D. (phase)	n	Mean Rank	A.D. 150-550 (Early Pithouse)	A.D. 750-900 (Three Circle)	A.D. 650-750 (San Francisco)
A.D. 550-650 (Georgetown)	7	12.22	5.07**	3.59**	3.14**
A.D. 650-750 (San Francisco)	26	55.70	2.97	0.42	
A.D. 750-900 (Three Circle)	56	58.95	3.03		
A.D. 150-550 (Early Pithouse)	23	83.31			

Significant at $\alpha = 0.01$ if >3.144 .

c)

Phase	n	Mean Rank	Early Pithouse	Georgetown	Three Circle
San Francisco	114	211.04	5.19**	3.29**	0.87
Three Circle	243	224.73	5.08**	5.06	
Georgetown	58	285.03	1.46		
Early Pithouse	69	321.30			

Significant at $\alpha = 0.01$ if >3.144 .

of all pairings with this temporal group. The other temporal groups have samples at least three times larger than that of the A.D. 550-650 group ($n=7$).

The final test uses the entire sample of Pithouse period structures grouped into phases. If the traditional settlement pattern is interpreted loosely to apply to Pithouse period changes, it predicts an increasing preference through time for locations closer to water. The mean ranks provide minor support for the traditional pattern. The mean ranks show an overall decrease in the distance to water through time (Table 5.14c).

The results of the Dunn test using the phase-dated sample do not support the culture history pattern, which states that the Early Pithouse period is different from *all* later phases. Structures assigned to Early Pithouse period are not significantly different in their distance to water from structures of the Georgetown phase. Early Pithouse period structures are significantly further from water than are structures assigned to the San Francisco and Three Circle phases. This and the results of the previous test (Table 5.14b) corroborate analyses in previous sections that suggest settlement changes occurred during the San Francisco phase, rather than at the beginning of the Georgetown phase.

Summary: Distance to Water

The K-W and Dunn tests indicate that the nature and timing of Pithouse period settlement is different from that outlined by the traditional culture history pattern. The predicted significant difference between the Early

Pithouse period and Georgetown phase is not evident in structures' distance to water. If any significant decrease occurs, it appears to happen at the end, rather than the beginning of the Georgetown phase. In all tests using phases or temporally equivalent categories, structures assigned to the Georgetown and San Francisco phases differ in their distance to water.

Not only does the change occur later in the Pithouse period than predicted, the chronometric data show that the change is not as drastic as culture historians describe. The chronometric data display no differences between consecutive 100-year intervals. These data indicate that distance to water decreased gradually, though inconsistently, through time. Future research on this variable might focus on differentiating classes of water resources, such as different stream orders or kinds of water sources, to gain information about resource reliability.

As with analyses of other variables, although the specific expectations of the traditional settlement pattern are not upheld, the culture historians were partially correct. The data show that Early Pithouse period structures are more distant from water than are structures that date to the latter part of the Late Pithouse period.

SUBSTRATE

If structures are preferentially located on inaccessible and accessible landforms, the substrate of the landforms might also be expected to vary across the two categories. That is, the surface geology of the locations should

differ with the landform. For example, volcanic rock or other bedrock might be expected to underlie a larger proportion of the inaccessible locales, or alluvium might be disproportionately high among the accessible landforms.

Only three substrate classes are reported for the entire sample of Pithouse period structures: alluvium, colluvium, and volcanic bedrock. The structures are overwhelmingly constructed on landforms composed of alluvium (Table 5.15) and the proportions vary little across the temporal classes. Chi-square tests of the distributions across the three substrate classes (Table 5.16) show that none of the distributions are significant. The chi-square test can be considered reliable if the average expected frequency is at least 10 for $\alpha=0.01$, or 6 for $\alpha=0.5$ (Zar 1996: 502, citing Roscoe and Byars 1971). The chronometric sample divided into 100-year increments is problematic because its average expected frequency is less than 6. However, when the colluvium and volcanic categories are collapsed into a single category, the expected values are sufficiently large and all results are non-significant. The proportions of structures in the two substrate categories do not vary significantly through time.

Summary: Substrate

I suspect that the proportion of structures situated on recent valley alluvium, compared to older alluvium, increases through time. Further investigation of substrate variability will require differentiation of Quaternary and Tertiary alluvium (e.g. Gila Conglomerate) from Quaternary valley

Table 5.15 Substrate frequencies for Pithouse period structures.

Sample	Alluvium	Colluvium	Volcanic	Total
Phase-dated Sample				
Early Pithouse	62	1	6	69
Georgetown	55	0	3	58
San Francisco	111	0	3	114
Three Circle	231	3	9	243
Total	459	4	21	484
Chronometric Sample				
A.D. 100-199	1	0	0	1
A.D. 200-299	3	0	0	3
A.D. 300-399	3	0	1	4
A.D. 400-499	9	1	0	10
A.D. 500-599	6	0	0	6
A.D. 600-699	13	0	0	13
A.D. 700-799	33	0	1	34
A.D. 800-899	37	0	4	41
Total	105	1	6	112
A.D. 150-549 (EP)	21	1	1	23
A.D. 550-659 (G)	7	0	0	7
A.D. 650-749 (SF)	26	0	0	26
A.D. 750-900 (TC)	51	0	5	57
Total	105	1	6	112

Table 5.16 Chi-square results for the tests of independence between substrate and age; a) three substrate categories (alluvium, colluvium, and volcanic), b) two substrate categories (alluvium and other).

a)	Sample (increments)	df	$P(\chi^2)$	Mean Expected Frequency
	Chronometric (100 year)	14	.253	4.7
	Chronometric (phases)	6	.301	9.3
	Phase-dated (phases)	6	.360	40.3

b)	Sample (increments)	df	$P(\chi^2)$	Mean Expected Frequency
	Chronometric (100 year)	7	.579	7
	Chronometric (phases)	3	.373	14
	Phase-dated (phases)	3	.171	60.5

alluvium. Unfortunately, this will probably require field-checking the sites because the surface geology maps available for the study area are generally not at a scale that permits identification of different classes of alluvium.

LANDFORM ASPECT

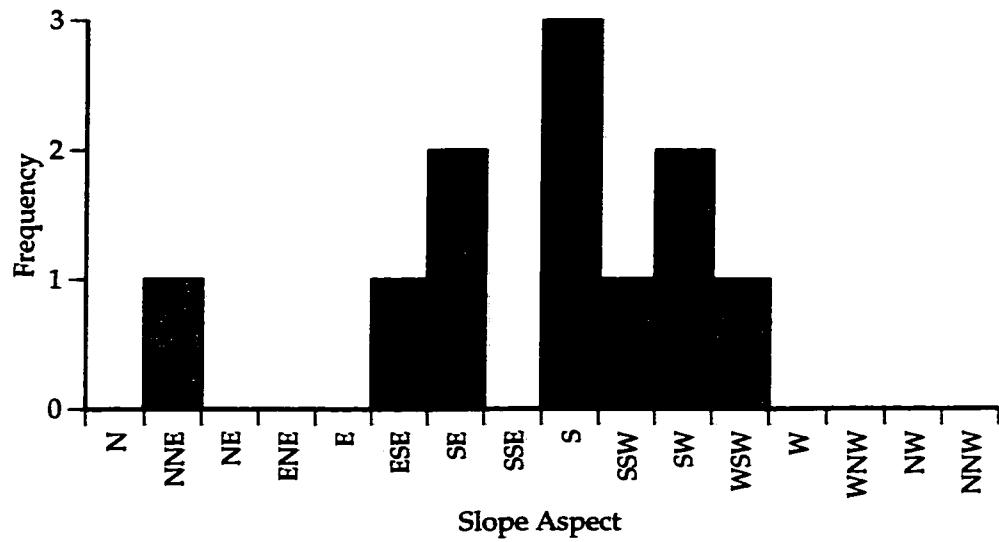
Landform aspect, the direction that a slope faces (Bates and Jackson 1987), may also differ between inaccessible to accessible landforms. The distributions should differ because accessible landforms (e.g. benches, terraces, floodplains, and valleys) are influenced by the orientation of adjacent rivers and tributary streams. Watercourses in the study area flow predominantly south and southwest, which should limit the possible orientations of accessible landforms to those with orientations orthogonal to primary and secondary watercourses. Based on broad geomorphic trends, I predict aspect orientations from northwest, southward to southeast. In contrast to accessible landforms, the orientations of inaccessible landforms are not necessarily determined by stream flow orientation. This, combined with the corresponding greater exposure at the summit of inaccessible landforms, is expected to be manifest in occupation of landforms with a greater variety of slope aspects. As noted in previous sections, the landform scale is appropriate for this comparison because the orientation of the landform does not vary from structure to structure.

The chronometric sample appears to support the prediction (Figure 5.16). Sites on inaccessible landforms appear to be oriented at a greater

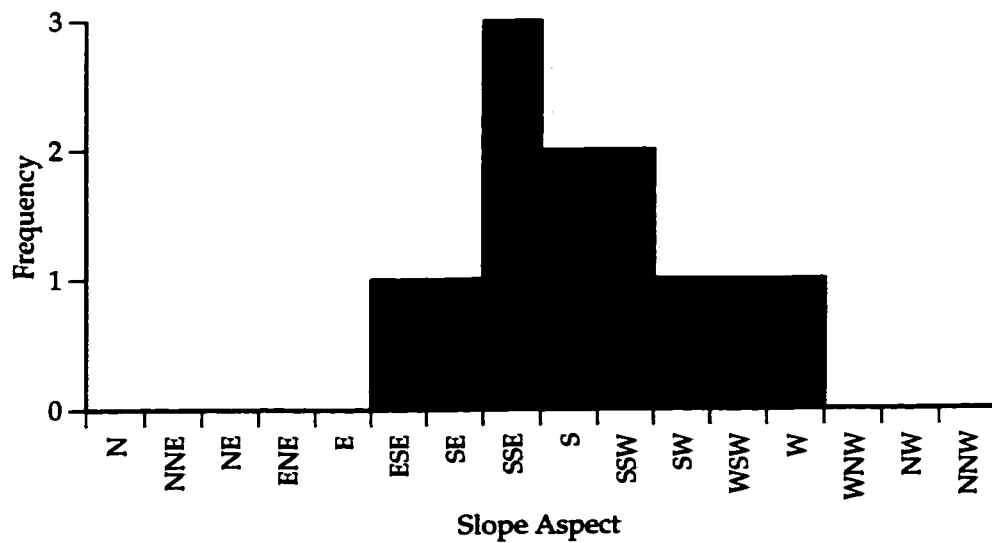
diversity of slope aspects than sites on accessible landforms, although the modes are similar. In fact, the distributions are not significantly different ($\chi^2=6.3$, $p=0.61$); chi-square analysis is appropriate in this case because slope aspect was recorded as a nominal variable, not as a continuous variable such as degrees from north.

Examination of the distributions for the phase-dates sample (Figure 5.17) shows that the deceptively different chronometric distributions are most likely a function of sample size. The number of sites on inaccessible locales remains relatively small, even in the phase-dated sample. However, with a larger sample, the spread of the accessible landforms more closely resembles the spread of the inaccessible landforms. The accessible and inaccessible distributions are not significantly different for the phase-dated sample ($\chi^2=11.0$, $p=0.52$). The modes for the inaccessible landforms are the same for both samples (SSE). In general, all of the distributions are consistent with the orientation of watercourses in the study area.

Sample size, rather than a distinct settlement change, appears to have the greatest influence on the shape of the distributions. The statistical differences between the landform classes probably reflects the overall increase in the frequency of occupied landforms rather than a distinct change in the aspect of occupied locales. When the frequency distributions of slope aspect are viewed chronologically, the effects of increasing sample size on the



a)



b)

Figure 5.16 Orientation of chronometrically dated occupied landforms; a) inaccessible, b) accessible.

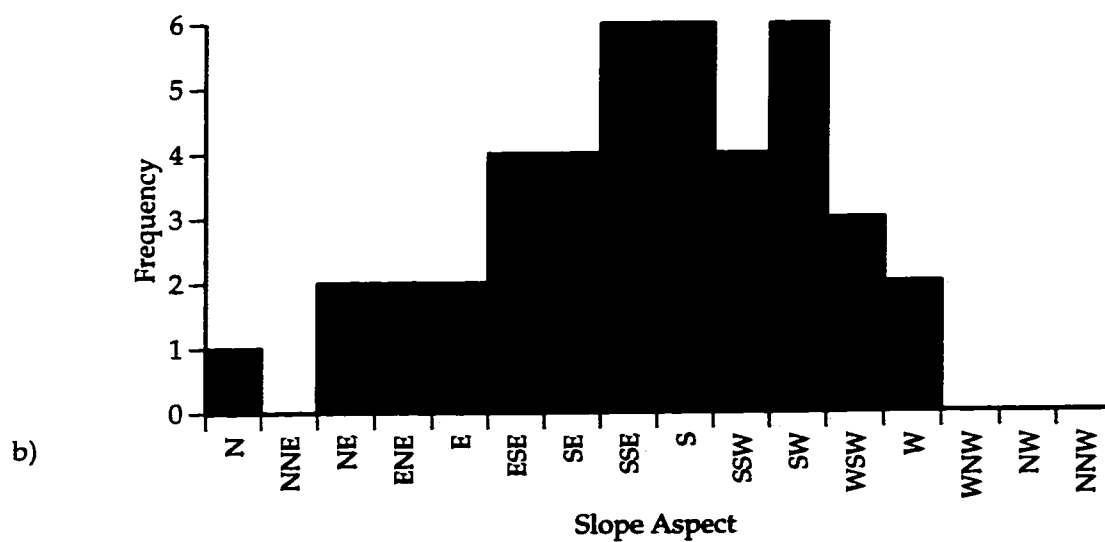
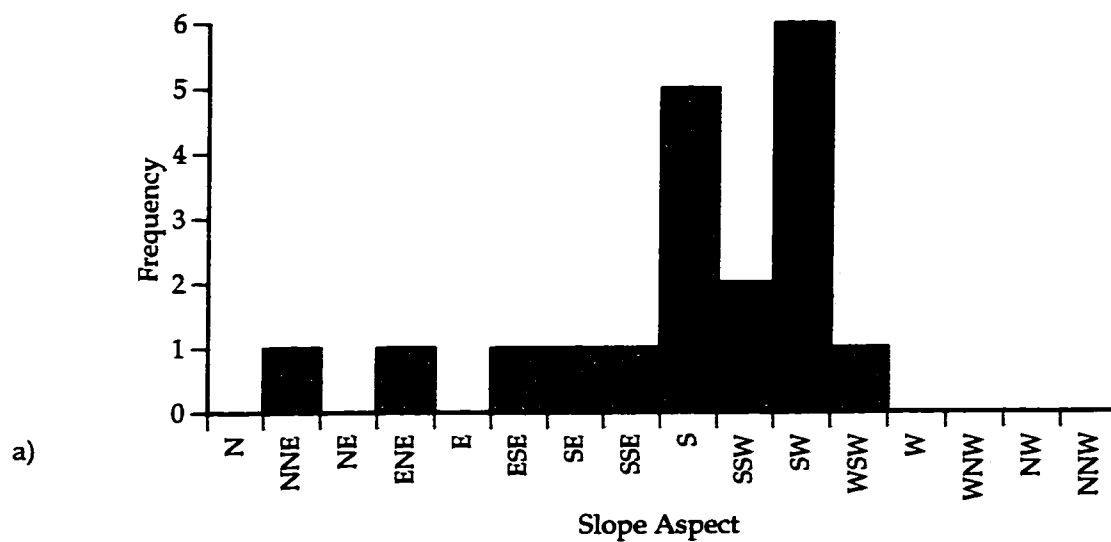


Figure 5.17 Orientation of phase-dated occupied landforms; a) inaccessible, b) accessible.

diversity of slope aspects are apparent. In order to examine chronological trends, the unit of settlement is shifted to the structure.

The chronometric sample, divided into 100-year increments (Figure 5.18), clearly shows that aspect diversity increases with sample size. The A.D. 700s and A.D. 800s have the greatest diversity of structures as well as the largest sample sizes. The relationship between aspect diversity and sample size is also evident when the chronometric sample is grouped by phase (Figure 5.19).

Comparison of the two chronometric distributions (Figures 5.18 and 5.19), which differ in how time is partitioned, also suggests that sample size affects slope aspect distributions. The manner in which the time sequence is divided alters the sample sizes of the temporal groups and the consequent interpretations. When time is divided equally (Figure 5.18), the sequence shows a gradual increase in the diversity of landform orientations through time and with increasing sample sizes. This stands in contrast to the phase groupings (Figure 5.19), which exaggerate the differences between phases.

When time is collapsed into the phase categories, the sample size of the Early Pithouse period is increased, which serves to exaggerate the difference between it and subsequent phases. The Georgetown, San Francisco, and Three Circle appear more similar to each other than to the Early Pithouse period. This trend is also evident in the phase-dated sample (Figure 5.20), where the distribution is unimodal only during the Early Pithouse period.

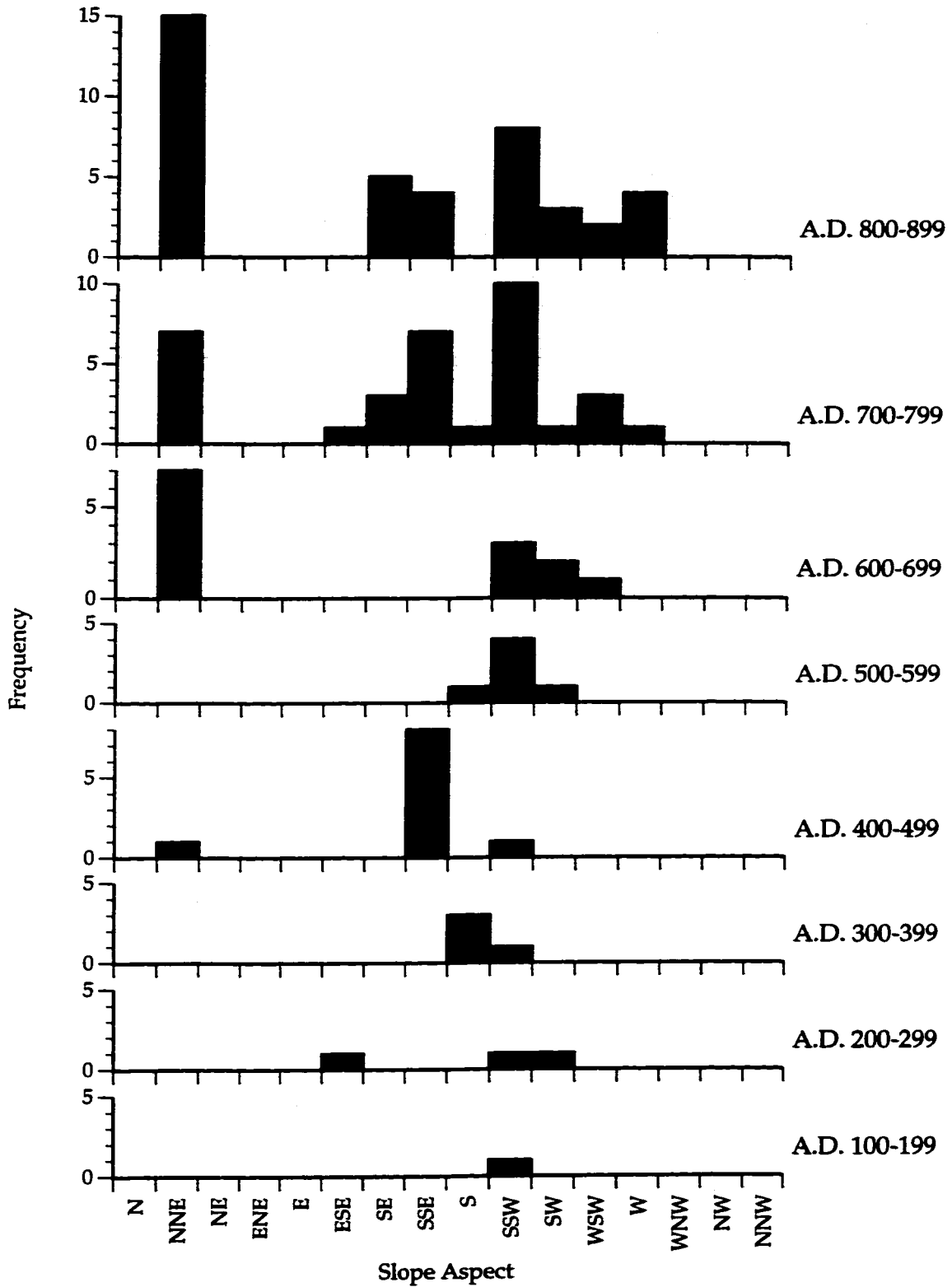


Figure 5.18 Distribution of landform orientation for the chronometric sample by 100-year increments.

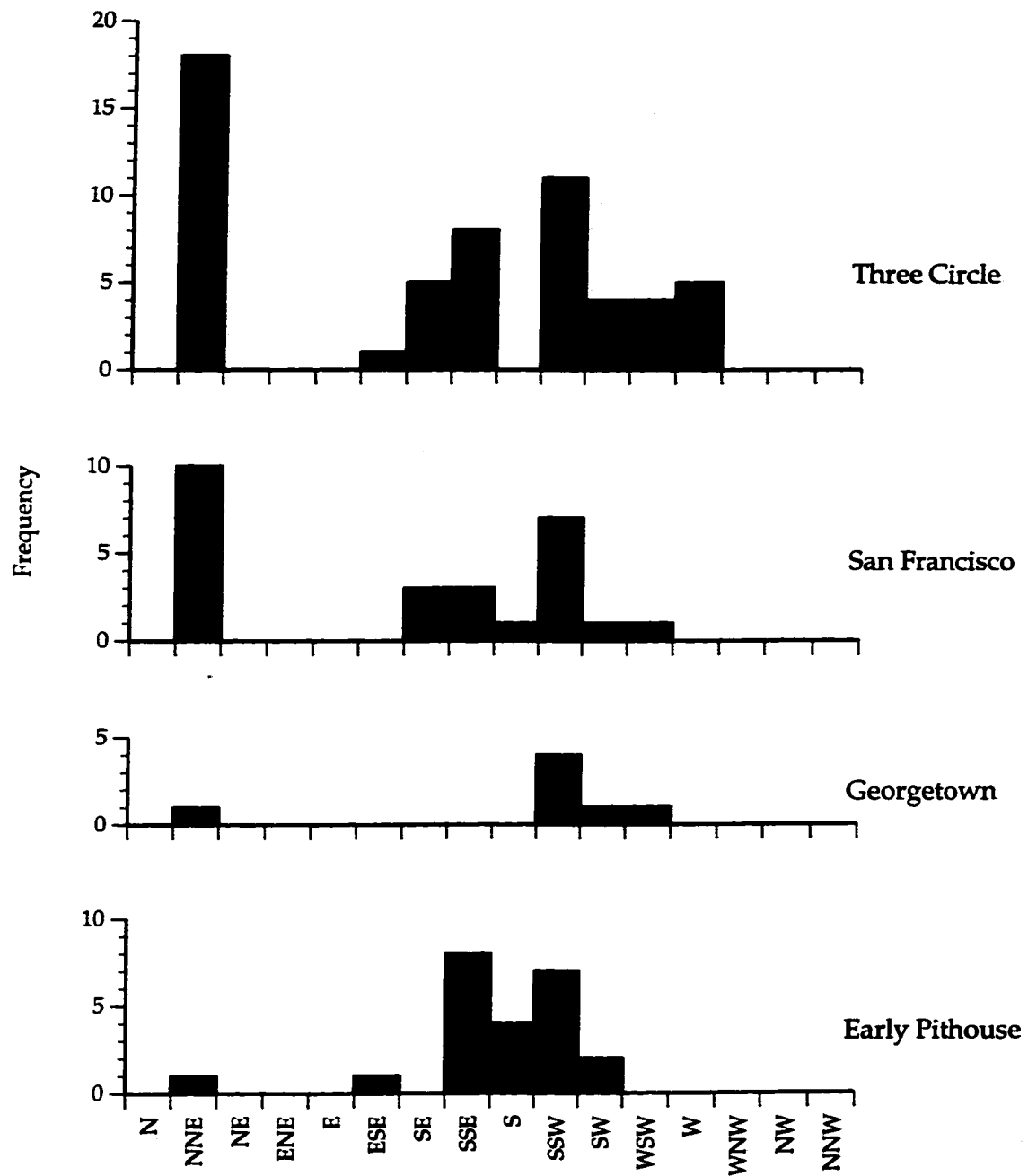


Figure 5.19 Distribution of landform orientation for the chronometric sample by phase-equivalent increments.

Interestingly, when time is divided equally (Figure 5.18), the distribution is unimodal until around A.D. 600 and the changes appear gradual. If we discount the affect of the large numbers of structures excavated at the Wind Mountain site (LA127260), the greatest change appears during the A.D. 700s. At this time, the distribution becomes strongly bimodal.

Although the smaller chronometric sample is distributed over a narrower range of aspects within each phase than the larger phase-dated sample, the primary difference between the two sequences appears to be sample size. For each phase, the two samples show the same modes, which indicates that despite its smaller size, the chronometric sample is representative of the phase-dated sample. The distributions are essentially the same, but the gaps in the chronometric distribution are filled in the phase-dated sample.

Summary: Aspect

In general, landforms at a variety of aspects were occupied throughout the sequence with a constant southerly mode, which may reflect the thermal properties of south-facing slopes. Aspect diversity increases late in the Pithouse period, but the chronometric distributions by 100-year intervals (Figure 5.18) show that the increase was gradual, not rapid. The increased diversity appears to be a function of an increased number of structures, rather than a settlement change, or a change in preference for a particular locale.

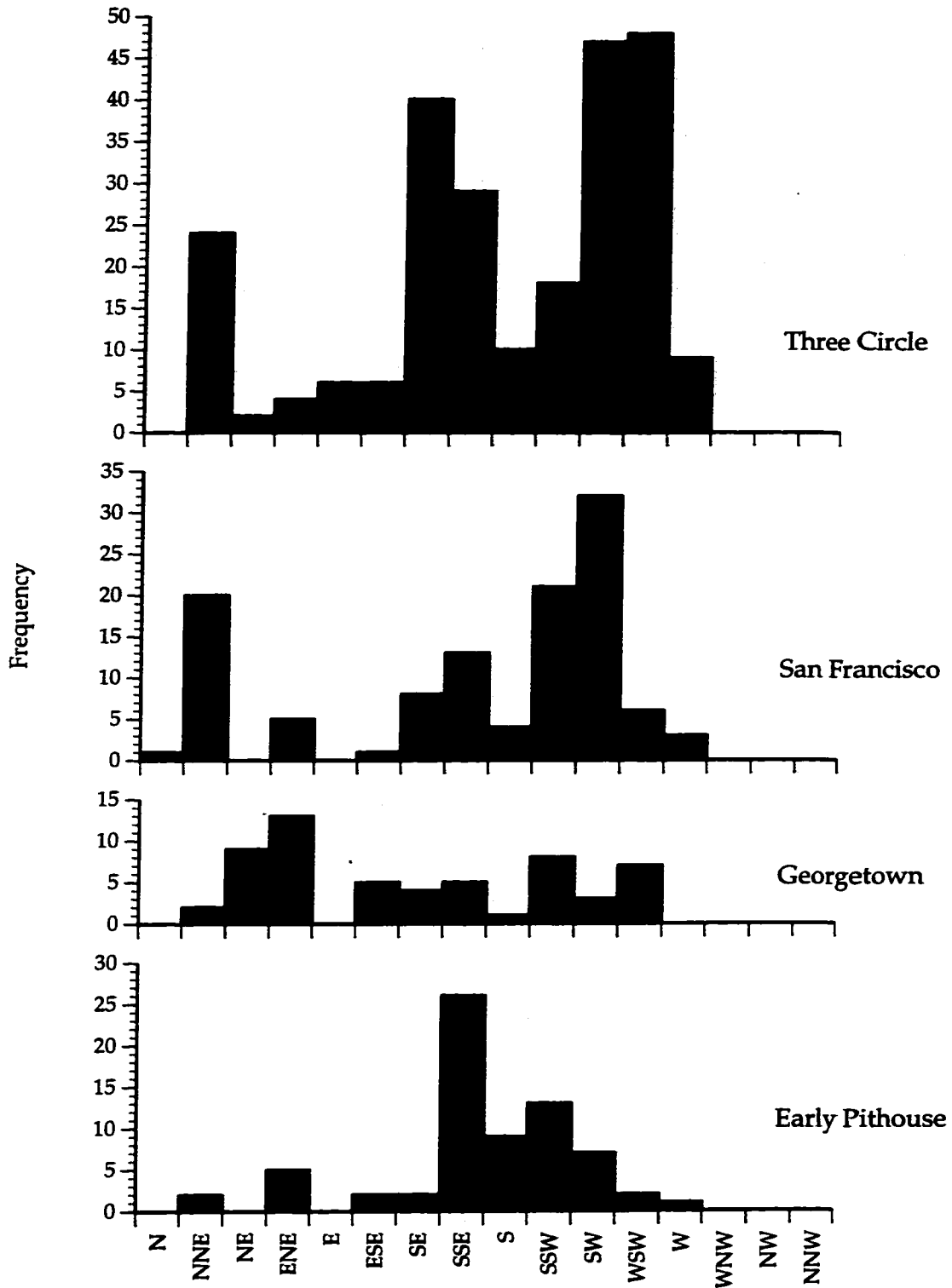


Figure 5.20 Distribution of landform orientation for the phase-dated sample.

Comparisons of the different distributions indicate that the process of unit formation serves to exaggerate the effects of sample size on the shape of slope aspect distributions. The settlement pattern identified by culture historians is reflected in the phase-based temporal groupings (Figures 5.18-5.19), in which the Early Pithouse period and Georgetown phase appear to have distinct distributions. Those distributions are, however, most likely a function of the way that time is divided. The phase-dated sample shows a marked decrease in the frequency of structures on landforms oriented from SSE through SSW between the Early Pithouse and Georgetown phases. In contrast, the chronometric sample (Figure 5.18) indicates stability in the orientation of occupied landforms until the A.D. 700s, perhaps slightly earlier, when the diversity of landforms increases.

SUMMARY AND FUTURE RESEARCH

I am completely unconvinced that Early Pit House settlement is limited to defensive locales at some distance from major streams. (Lekson 1992: 73)

SUMMARY

As I noted in the introduction, the focus of the above analyses is twofold. First, I examine whether the Pithouse period archaeological record reflects the proposed settlement pattern. I then investigate changes in a number of other variables. Two of these, elevation and distance to water, are implicit variables in what appear to be multivariate landform categories.

Substrate and slope aspect are also variables that represent related characteristics of the two landform classes. These variables should also vary with significant changes in the use of different landforms.

The analyses in this chapter show that the pattern of settlement does change during the Pithouse period, but not at the time proposed by culture historians. The expected pattern is that only inaccessible landforms are occupied before the Georgetown phase and only accessible landforms are occupied after that time. Statistical tests document that the proposed change does not occur at the boundary between the Early Pithouse period and Georgetown phase. The frequency of accessible and inaccessible landforms does not differ between two time periods and both landform types are occupied throughout that time.

Two settlement changes are apparent when the analyses are expanded to include structures from all phases of the Pithouse period. The first change is an increase in the occupation frequency for inaccessible landforms at around A.D. 700 coincident with the San Francisco phase. Another settlement change occurs in the A.D. 800s, when occupation of accessible locales increases in frequency.

Not only are the timing of these changes different than proposed by the culture historians, the nature of the changes are also different. The traditional perspective is that occupation of the two types of landforms is mutually exclusive. That is, all early settlement was on high isolated

landforms and when these locales were abandoned, all subsequent settlement was on low accessible landforms.

Data from Pithouse period structures show that instead of an abrupt and comprehensive change, settlement change is both subtle and gradual. A variety of landforms are occupied throughout the Pithouse period, so that although the use of a particular landform does increase, the increase is not accompanied by complete abandonment of alternative locales.

Corollary variables, when evaluated independently, can provide additional information on the nature and timing of settlement changes. In this case, analyses of additional variables (elevation, distance to water, aspect, and substrate) also indicate that settlement changes occur late in the Pithouse period. They also support the conclusions of preceding analyses, that the changes were neither rapid nor extreme.

The elevation data show that "height" is a critical element of culture historical landform classification. Using a subset of the larger Pithouse period elevation data from the Mimbres valley, regression analyses support the hypothesis that inaccessible landforms are relatively higher than accessible landforms. The analyses also show that, although the two landforms regularly differ in relative elevation, the distributions overlap to some extent. Landscape geomorphology, specifically river valley geomorphology, explains most of the overlap in the distributions.

Distance to water appears to be another variable used implicitly by culture historians when they classified landforms as accessible or isolated. The average distance to water does not differ from the Early Pithouse period to the Georgetown phase. However, both the chronometric and phase-dated samples show that Early Pithouse period structures are, on average, more distant from water sources than structures occupied during the San Francisco and Three Circle phases. Chronometric data show that the increase is gradual because consecutive time periods are similar to each other and only intervals distant from each other in time (e.g. A.D. 400s and A.D. 800s) differ significantly in their average distance to water. Like previous analyses, the distance to water data indicate that settlement changes occur late in the Pithouse period after A.D. 700.

The substrate into which Pithouse period structures were excavated does not vary significantly through time when using three broad categories (alluvium, colluvium, and volcanic). I suggest that the results of this analysis are inconclusive because the categories are too broad. Nearly all Pithouse period structures are excavated in alluvial deposits and available data rarely permit differentiation of this category into distinct classes of alluvium. If distinct kinds of alluvium could be differentiated (e.g. Tertiary and Quaternary alluvium) through field-checks of occupied landforms, I predict that substrate distributions will vary through time. I predict that the peak in location of accessible landforms at around A.D. 800 will be disproportionately

associated with Quaternary alluvium and valley fill. I hypothesize that the inaccessible landforms occupied throughout the sequence are associated with ancient alluvium as well as Quaternary alluvium.

My hypothesis that accessible landforms are associated with a narrower range of landform aspects than inaccessible landforms was not supported. Instead of a difference between landform types, the diversity of landform orientations increases throughout the Pithouse period as a function of sample size. The same modes are represented in both the chronometric and phase-dated samples, which indicates that the modal aspects are representative and not solely a function of sample size. Incremental changes in the chronometric sample suggest that landform aspect diversity increased regularly through time until A.D. 700, after which variability increased at a greater rate. These results support preceding conclusions that settlement change was gradual and occurred late in the Pithouse period sequence.

FUTURE RESEARCH

This settlement pattern can be investigated in greater detail by examining other variables and by further differentiating the attributes of variables examined in this chapter. The data used in these analyses is structured to be eventually used in conjunction with Geographic Information Systems (GIS). I am particularly interested in using digital environmental and geographic data to investigate spatial variability in settlement within the study area.

For example, the analysis exploring the role of elevation in landform classification would be greatly enhanced by use of Digital Elevation Matrices (DEM), which provide information similar to that on topographic maps, but in a form that is more amenable to quantitative and spatial analyses using GIS. The relative elevation of each structure, at a variety of distances from the landform, could be determined from the DEMs and would permit a more thorough analysis of changes or variability in elevation for the structures in the database. DEM data at a resolution that would permit recognition of differences less than the approximately 200 feet noted for the Mimbres valley is available for only two of the 7.5 minute quads in the study area, neither of which include excavated structures. DEM data at this resolution (10-meter) are currently being prepared by the U.S.G.S. for only 38% (59/156 quads) of the study area. While data are available for purchase at a 30-meter resolution, this is probably not sufficient to permit classification into the inaccessible and accessible landform categories as they are currently defined.

Future research on the quality and reliability of water, a crucial resource in arid environments, is also important. I would first want to focus on refining water resource attributes, in particular, on differentiating stream orders and the variety of water resources in a local area. Digital hydrological data is available for purchase from the U.S.G.S. for a single 7.5 minute quadrangle of the study area. The Little Turkey Park Quad contains 94 excavated structures on two sites, West Fork Ruin (LA8675) and Gila Cliff

Dwellings (LA13658); only seven of the structures are associated with chronometric dates.

As noted earlier, the substrate variable would clearly benefit from increased data about the surface geology in the vicinity of the structures that have already been excavated. Minimally, additional data is required for differentiation of Quaternary and Tertiary alluvium (e.g. Gila Conglomerate) from Quaternary valley alluvium. Such data will help to inform about the time and energy costs of construction in different geological settings. This kind of data collection does not necessarily involve additional excavation, but could be collected during a relatively small-scale, non-destructive field project. Digital soil data is available from the U.S.D.A. State Soil Geographic (STATSGO) database, however, the map scale is small (1:25,000) and of limited utility for the analyses suggested above.

Finally, increasing the sample size of dated structures remains an important goal. Materials from sites excavated in the early part of the century might be submitted for chronometric dating. Biological remains previously unconsidered for radiocarbon dating might be dated using the AMS technique (e.g. samples considered too small or too precious for traditional radiocarbon methods). Many collections include material suitable for obsidian hydration dating. Another, though more costly, avenue to pursue might include using thermoluminescence to date ceramics from floor assemblages. Additional chronometric dates might also help to refine the early ceramic chronology.

Chapter 6

SUMMARY AND IMPLICATIONS

While it is now recognized that trait lists do not provide the requisite precision for addressing most questions of interest today, the early work of Emil Haury, the Gladwins, H. P. Mera, and Paul Martin provided the foundation for all later substantive archaeological efforts in Mogollon archaeology. (Benson and Upham 1986: v)

The definitions of settlement and settlement change in Chapter 1 of this dissertation provide a foundation for my research in a portion of the Mogollon territory in New Mexico. I begin, in Chapter 2, with an analysis of the Mogollon culture history sequence. I review the history of research in the study area and conduct a developmental analysis of the Mogollon phase chronology. Two aspects of Mogollon culture history hinder documentation and explanation of settlement changes. First, the cultural chronology was developed using a small sample of sites excavated in the early part of this century, which indicates that identified settlement patterns may not be accurate today. Second, the culture history changes little after the initial description of each phase. New data are fit into the extant framework and described using the traits from the original phase definitions. Although these traits are used to identify settlement patterns, they are not necessarily relevant for answering questions about settlement change. Pertinent settlement data

exist, but are not readily available.

In Chapter 3, I describe five principal settlement changes for the study area, review applicable research, and discuss proposed explanations for each change. Little doubt exists in the archaeological community that the changes occur, but specific information about the nature and timing of the changes is scarce. Despite the lack of details, multiple explanations have been proposed for the changes. Many of these have explicit empirical implications, but few have been tested using data from the study area.

From the developmental analysis (Chapter 2) and review of the settlement changes (Chapter 3), I identify a series of problems that impede investigation of settlement change in the study area. Problems with the available data, including the small sample size, poor chronological resolution, and dispersed and non-comparable data, make it difficult to test proposed hypotheses about settlement change. The scale at which data are typically recorded and analyzed further restricts explanations. Site scale data are difficult to use in testing explanations with empirical implications at other spatial and temporal scales.

The framework for settlement analysis presented in Chapter 4 resolves these problems. Four aspects of this framework differ from previous approaches to the study of settlement change. I change the unit of analysis from sites to structures (e.g. room or pithouse), the smallest archaeologically observable unit of settlement. Structure scale data can be grouped to consider

explanations at different scales, including the traditional site scale. Grouped structure scale data provide a more accurate view of site scale processes because details about the degree of occupancy of a site are observable. The shift to structure scale and inclusion of data from a large study area serves to increase the sample size. Data from excavated structures are compiled in a single database and reported in a consistent format, which addresses the problems of accessibility and comparability. And finally, the attributes of variables reported in the database reflect the consequences of settlement change in a particular time and place.

In Chapter 5, I demonstrate the applicability of this new approach by investigating the empirical evidence for one of the five Mogollon settlement changes. I demonstrate that the proposed abandonment of isolated landforms in favor of accessible locales does not occur between the Early Pithouse period and the Georgetown phase at about A.D. 550. Instead, the data indicate that both landforms are occupied throughout the Pithouse period. The improved resolution of the structure scale data shows that occupation of inaccessible landforms increases at around A.D. 700 and that use of accessible landforms increases during the A.D. 800s. In addition, the changes are neither extreme nor complete as previously supposed. Landform changes appear to be gradual when distributed across equivalent temporal increments rather than phases.

SETTLEMENT CHANGE IMPLICATIONS

While study of the social organization of this time level would be useful, until a firmer grip is available on the details of the settlement patterns and time of the events..., such studies would seem premature. (LeBlanc 1980a: 140)

One of the most important implications of the research in this dissertation is that the scale of analysis determines what settlement changes are recognizable and which explanations can be considered. Accordingly, I consider the implications of this research at three different scales. I first discuss the how this research affects explanation of changes in the settlement of accessible and inaccessible landforms in the study area. Next, I explore the implications for other aspects of Mogollon settlement research. And finally, I consider the methodological and theoretical ramifications of this approach for the study of prehistoric settlement change in general.

IMPLICATIONS: INACCESSIBLE AND ACCESSIBLE STRUCTURES

The research presented here challenges a widely accepted view that Mogollon settlement shifted from inaccessible to accessible landforms in the early part of the Pithouse period. Application of a new analytic framework to this particular settlement change helps to demonstrate that the phase-based approach to settlement pattern identification can distort settlement data. In this case, the magnitude and timing of changes in the settlement of accessible and inaccessible landforms are exaggerated by the phase-based approach. Consequently, substantial research effort has been expended attempting to

explain a settlement pattern that does not appear to exist.

Most of the previous explanations for the accessible-to-inaccessible shift attempt to account for an abrupt shift from one landform type to another. Since this abrupt shift does not happen, new explanations will need to be developed, or old explanations reformulated, to account for occupation on a diversity of landforms throughout the Pithouse period and for a gradual increase in the frequency of accessible structure locations.

The shift to accessible locales has been ascribed to a decreased need for defense (Anyon 1980; Bluhm 1960) and/or an increased dependence on cultigens (Bluhm 1960) that, in turn, created a need to be near arable land and permanent streams (Bullard 1962; Haury 1956; Wendorf 1956). Since the timing of the settlement change is not a determinative factor in either explanation, the defense and subsistence hypotheses are still plausible. Each could be applied to settlement change at any point in the Pithouse period. Neither explanation fundamentally requires an abrupt settlement shift and could be altered to accommodate a more gradual alteration in the patterns of settlement.

The Defense Hypothesis

Defense explanations attribute the change to an alteration in the frequency or degree of conflict between groups, and the actual or perceived threat of violence and warfare. The defense hypothesis remains viable if it can be rephrased so that it is no longer circular, and if independent data

support the suggestion that inaccessible landforms were occupied for defensive purposes.

Use of both inaccessible and accessible landform types throughout the sequence is more difficult to incorporate into the defense hypothesis than the change in timing and extremity of the change. As currently formulated, the hypothesis can account for an increase or decrease in the occupation of "defensible" locales, but not for their occupation throughout the Pithouse period.

LeBlanc (1999) cites Mogollon settlement on inaccessible locales, along with defensible sites in other areas (e.g. stockaded sites, cliff overhangs, and caves), as evidence for warfare and violence in the American Southwest. Thus, the same data serve to document a need for defense and explain occupation of inaccessible landforms. In the study area, no other compelling evidence for violent conflict has been identified.

Independent criteria for identification of conflict, warfare, or violence remain to be developed for the study area. Recent work by Turner and Turner (1999) provide provocative suggestions for evidence of violence and warfare that might support the defense hypothesis. Although faunal analyses are scarce in the study area, such analysis might be used to bolster the defense hypothesis by providing independent evidence for resource competition.

If conflict is responsible for the settlement pattern documented in this dissertation, then the scale of the violence is different than previously

proposed because inaccessible and accessible landforms appear to be used simultaneously. Clarification of whether the landforms are occupied simultaneously or exclusively would require a finer temporal resolution and a larger sample of chronometrically dated structures. A temporal resolution at intervals less than 100 years would increase the accuracy of the settlement pattern and ensure that the temporal interval is not determinative of the pattern as the phase-based system was for the original pattern. A larger sample of structures with chronometric dates is needed to fill gaps in the chronological sequence of occupied structures.

The defense hypothesis can be altered to include local fluctuations in the use of both landform types due to intermittent conflicts or episodes of violence. Alternatively, the landforms could have been occupied simultaneously by warring groups, but this is problematic in areas where the accessible and inaccessible sites are in close proximity. If structures on inaccessible landforms are occupied for brief spans during periods of greater conflict, then the landforms should show evidence for episodic use. A number of sites in the study area contain evidence for this kind of settlement. Mogollon Village (LA11568; Linse 1997; Mauldin et al. 1996), Wind Mountain (LA 127260; Woosley and McIntyre 1996), and Turkey Foot Ridge (LA9709; Martin et al. 1949) all have chronometrically dated structures occupied at different times throughout the Pithouse period. Phase-dated sites like Three-Circle Ranch (LA 53; Everett 1992) and Cameron Creek (LA190; Bradfield 1929)

may provide similar evidence.

The Subsistence Hypothesis

Subsistence explanations typically associate the abandonment of inaccessible locales and an increased preference for accessible locations to an increased dependence on cultigens. Accessible locations are presumed to be located near arable land. A number of arguments have been developed that support use of a variety of habitats and landforms by early agriculturalists in order to spread risk. I briefly summarize the arguments below and discuss whether the data in Chapter 5 conform to expectations derived from the arguments.

Two groundstone studies indicate changes in the role of cultigens during the Late Pithouse period. Diehl (1996) suggests that Mogollon settlement and subsistence strategies shifted from one based on foraging and horticulture to a sedentary agricultural system at A.D. 650/700. The increased use of inaccessible landforms at around A.D. 700 documented in Chapter 5 is difficult to reconcile with Diehl's scenario, as is the use of both landforms throughout the Pithouse period. However, data in Chapter 5 that indicate gradual change in settlement are commensurate with Diehl's (1996) groundstone data, which show no significant differences between consecutive phases.

An earlier groundstone study (Mauldin 1991, 1993) indicates that the importance of agricultural products varies across Late Pithouse period sites.

Mauldin argues that intersite differences may reflect a variety of concurrent subsistence strategies. Data in Chapter 5 that show use of a variety of landforms throughout the Pithouse period are consistent with a subsistence system based on a variety of food acquisition strategies. Whether the groundstone variability corresponds to the increase in inaccessible structures after A.D. 700 and the increase in accessible structures after A.D. 800 cannot be determined because Mauldin includes sites of this age into a single group.

Lekson (1992a, citing Shaw n.d.) suggests that between A.D. 600 and A.D. 1000 episodes of drought were less severe in the Mimbres area than in the Upper San Francisco/Reserve area. Thus, in the study area, environmental changes could have resulted in periods of resource scarcity (food in the north and land in the south). If, however, a more productive form of maize is also introduced at the beginning of this period of environmental flux as Diehl (1996) hypothesizes, then resource scarcity may not have had a significant impact on settlement.

A change in Mogollon subsistence toward a greater reliance on food production after A.D. 650 might actually strengthen the case for the defense hypothesis. If reliance on cultigens and/or population increases late in the Pithouse period (Anyon 1980), then scarce resources and competition for arable land may have resulted in violent conflict. The case for defense is weaker if the population is relatively small and not heavily dependent upon cultivated resources because mobility offers a plausible alternative to direct

competition and violent conflicts.

Rice (1975, 1980) suggests that use of accessible and inaccessible landforms during the Early Pithouse period is commensurate with a seasonally mobile settlement-subsistence system, and that decreased use of inaccessible landforms is associated with a shift to a dispersed sedentary settlement system. Although Rice (1975) uses the landform as one of the primary identifying criteria, neither settlement system is necessarily tied to use of a particular type of landform. A mobile settlement system could be marked simply by repeated occupation of a particular locale. A sedentary dispersed settlement system might be manifest by large numbers of simultaneously occupied structures clustered together in relatively few locales. Both patterns are more easily discernable using a structure-scale rather than a site-scale dataset.

Both hypotheses, the defensive occupation of inaccessible landforms and the shift to accessible locales because of changing resource requirements, have yet to be thoroughly tested using settlement data from the study area. That these explanations, proposed four decades ago, can accommodate a change in timing from A.D. 550 to A.D. 800, as well as a change in the nature of the shift, indicates that links between the explanations and empirical consequences are not well developed. If measurable consequences had been specified for each hypothesis, significant modification of the settlement change documented here might not have been accommodated.

More important than the lack of well formulated hypotheses, is the potential provided by the data in Appendix C to explore other aspects of the changes documented in Chapter 5. The chronological data in Appendix C could help improve the resolution of the site- and phase-based groundstone analyses of Mauldin (1993) and Diehl (1996) by allowing division into smaller temporal units. While additional chronometric data are desirable, the compilation of data at the structure scale removes the need to assume that all structures on a site represent the same subsistence strategy. If the groundstone data are associated with specific structures, then the data in Appendix C could be used to document spatial and temporal variability in groundstone use without having to assume that all occupations of a site represent the same level of agricultural dependence.

Information on the spatial distribution of structures occupied after A.D. 600, contained in Appendix C, can be used to evaluate the implications of other arguments. Lekson's (1992) suggestion of spatial variability in settlement due to differences in the drought severity can be investigated using locational and chronological data from Appendix C. The same data can be used to determine whether structure-level data displays characteristics of seasonally mobile and/or dispersed sedentary settlement (Rice 1975, 1980), and whether either settlement pattern is correlated with occupation of a particular kind of landform.

The analyses above would be further strengthened if spatial

environmental data were available for comparison with data in Appendix C using a Geographic Information System (GIS). For example, environmental data could be used to identify arable land in the study area and GIS used to compare the distribution of arable land and settlement locations. Although independent criteria for violence and conflict have yet to be identified, GIS can be used to analyze the proximity of contemporaneous accessible and inaccessible settlements. If these settlements are consistently located in close proximity, as suggested by the Mimbres Foundation research (Anyon 1980), then it might provide support for the suggestion that inaccessible landforms were only periodically occupied during episodes of conflict.

IMPLICATIONS: MOGOLLON SETTLEMENT

The research approach presented in this dissertation has the potential to affect other aspects of the Mogollon sequence through analysis of the remaining four settlement changes discussed in Chapter 3. As with the inaccessible-to-accessible shift, the characteristics of the changes are widely accepted and only rarely disputed. Settlement changes certainly occur throughout the sequence, however, as with the example discussed in Chapter 5, the timing, rate, and details of the change may be different than presumed. Given that one settlement change differs so markedly from expected, can we continue to accept the other settlement patterns without question? The accuracy and timing of the four remaining settlement pattern shifts could benefit from an investigation using the same approach. The same questions

asked about the inaccessible-to-accessible shift can be asked about the remaining four settlement changes.

- Does the change occur?
- Does the change occur at the proposed time?
- What are the characteristics of the change?

For example, the change from rounded to quadrangular structures has never been thoroughly documented or explained. This may be due to a scarcity of chronometric data and the questionable reliability of ceramic data for identifying structures of relevant age. However, until the accuracy and timing of this proposed settlement change has been assessed, the empirical expectations for changes in the use and organization of interior space (Hunter-Anderson 1986) cannot be investigated.

Similarly, questions endure about the pithouse-to-pueblo transition. Although there is ample evidence for the change, we know relatively little about physical attributes of the earliest surface structures. The second and third questions above are at the heart of the "Mangas Debate" (Lekson 1999; described in Chapter 3). As with the inaccessible-to-accessible transition, the arguments about the pithouse-to-pueblo transition may change once the timing and characteristics of the change are known. With these issues resolved, efforts can then be focused on testing the empirical expectations derived from Gilman's (1987) explanation for the transition.

Questions about the timing and rate of change are also critical for

understanding the change to settlement of adobe-walled pueblos in the Late Pueblo period. At this point, we cannot resolve between alternative interpretations for the end of the Mimbres Classic phase. LeBlanc (1989) suggests that Mimbres populations abandoned the area and were later replaced by people who built adobe-walled pueblos. Creel (1997) argues that the transition from the Mimbres Classic to the Black Mountain phase reflects cultural continuity. Information on the distribution of settlement attributes between A.D. 1100 and A.D. 1300 would either help resolve between these competing interpretations or change the questions so that new explanations may be formulated.

If the other settlement changes in the study area are altered because of the analytical approach presented here, research in other parts of the Mogollon territory could be impacted as well. Information about spatial variability in settlement attributes within the study area will be crucial for comparing this region with surrounding areas. Similar settlement data would need to be amassed to facilitate comparison between the study area and the Mogollon Rim in eastern Arizona, the San Simon in southeastern Arizona, and the Jornada Mogollon in southwestern New Mexico and west Texas.

IMPLICATIONS: SETTLEMENT CHANGE RESEARCH

The approach to settlement change analysis presented in this dissertation is also relevant for settlement research in other areas. Different

aspects of the approach have implications for areas that are characterized by site scale units of observation and phase-based (or analogous) settlement patterns.

Areas with Site Scale Units of Observation

My approach has implications for settlement studies anywhere the archaeological site is the standard unit of observation. As I have shown for a portion of the Mogollon territory, site scale units of observation routinely determine the patterns that can be recognized. In other areas where site scale research dominates, different patterns may also be observable if the scale of observation is altered. When the patterns are recorded only for sites, then potential explanations are also limited to processes that affect sites. Consciously altering the scale of data collection will alter interpretations of settlement change in any area.

The claim that the scale at which we collect data determines what we see is not new for archaeologists. Despite this, few consider changing the unit of observation to something other than the site (for exceptions, see Camilli et al. 1988; Ebert 1992; Mauldin 1995; Thomas 1975, 1983; Wandsnider 1989). Determinations about the division of spatial and temporal continua no longer seem to be explicit decisions, but instead are part of standardized field methods. Site scale observations have become so thoroughly embedded in disciplinary methodology, and codified into preservation laws, that the effects of site scale data collection on pattern recognition and interpretation are

seldom considered.

If data continue to be collected and managed at the site scale, explanations will also be limited to that scale and scales that encompass larger areas. Empirical expectations associated with explanations that operate at a structure scale cannot be considered because data are not available, which renders the explanations untestable. Even processes that cover large areas can only be considered if they affect whole sites. For example, a climate change that affects a large area could result in only partial abandonment of sites, dispersal of a portion the population, and construction of new sites. That kind of pattern would not be recognizable, nor could it be tested, using site-scale data. In general, data should be collected at the smallest scale possible, allowing questions to be asked not only at that scale, but also at scales that encompass larger areas and larger units of settlement (e.g. sites).

Areas with Phase-Based Settlement Patterns

My results are important for areas that use a phase or analogous system because they show that phase-based systems can distort the magnitude and rate of settlement changes. The research might encourage scrutiny of the empirical foundations of extant frameworks in other areas. Without periodic reexamination, the framework and its associated variables may be unrelated to the questions that justify and guide the research.

In the study area, settlement changes were distorted because temporal units were of unequal duration and age ranges for sites were lengthy, both of

which suppressed recognition of temporal change. In any area where the materials are organized into internally homogeneous temporal units, differences between periods are emphasized. Variability in the distributions of individual attributes through time is obscured because it is condensed into the boundaries between time periods. When emphasis is placed on difference rather than variability, change is, by default, swift and radical. Other kinds of change (e.g. gradual, incremental, or random) must be observable before explanations other than the traditional diffusion, migration, and independent invention can be considered.

A culture history framework can easily become self-perpetuating, even when based on a small (and possibly not representative) original sample. In regions with an established culture history framework, the temporal and spatial continua have already been divided into relatively homogeneous segments using variables of significance at the time the framework was constructed.

In this kind of culture historical classification, each temporal-spatial segment is associated with a particular suite of attributes. Those attributes are then used to assign sites to a particular segment. The sites are then interpreted, based on their membership in a particular segment, to be a particular age or cultural affiliation. As sites are fit into the classification, the classification is validated. When a site does not have all of the appropriate attributes, it is either assigned to the closest category or classed as

“unidentifiable.” Rarely is the framework questioned or remodeled to accommodate new or contradictory data. Thus, as typically structured and applied, this process is circular because in order to be interpreted, the data must first fit the framework.

The patterns observed in the archaeological record are, in part, determined by decisions, often implicit, about how to record data. When we use established phased-based culture historical frameworks and record data only at the site scale, we relinquish the opportunity to observe patterns and test explanations that exist at other spatial and temporal scales. The choices have already been made and it becomes almost inevitable that previously identified patterns and differences will be confirmed. Only through questioning the bases for our interpretations and reexamining the way that data are collected can the relevance of our conclusions be assessed. This dissertation is an example of the power of such an approach.

References Cited

Accola, Richard, M.

- 1981 Mogollon Settlement Patterns in the Middle San Francisco River Drainage, West-Central New Mexico. *Kiva* 46: 155-168.

Adams, E. Charles

- 1983 The Architectural Analogue to Hopi Social Organization and Room Use, and Implications for Prehistoric Northern Southwestern Culture. *American Antiquity* 48: 44-61.

Ahlstrom, R. V. N.

- 1985 The Interpretation of Archaeological Tree-Ring Dates. Unpublished Ph.D. dissertation, Department of Anthropology, University of Arizona, Tucson.

Anonymous

- 1916 Explorations and Field-Work of the Smithsonian institution in 1915. *Smithsonian Miscellaneous Collections* 66(3): 84-89.

Anyon, Roger

- 1980 The Late Pithouse Period. In, *An Archaeological Synthesis of South-Central and Southwestern New Mexico*, by S. A. LeBlanc and M. E. Whalen, pp. 143-204. Office of Contract Archaeology, University of New Mexico. Albuquerque, New Mexico.

Anyon, Roger, Patricia A. Gilman, and Steven A. LeBlanc

- 1981 A Reevaluation of the Mogollon-Mimbres Archaeological Sequence. *Kiva*, 46(4): 209-225.

Anyon, Roger, and Steven A. LeBlanc

- 1984 *The Galaz Ruin: A Prehistoric Village in Southwestern New Mexico*. Maxwell Museum of Anthropology, University of New Mexico, Albuquerque.

ARMS

- 1993 *User's Guide: New Mexico Cultural Resource Information System, Guidelines for Submitting Archeological Records*. Archeological Records Management Section, Historic Preservation Division, Office of Cultural Affairs, State of New Mexico. Santa Fe, New Mexico. Document Control No.: OCA/HPD/ARMS 93-101 REV. 1.00.

Arnold, Brigham A.

- 1943 An Archaeological Survey in the Vicinity of the SU Site. In, *The SU Site: Excavations at a Mogollon Village, Western New Mexico, 1941*, by P.S. Martin, pp. 252-265. *Field Museum of Natural History, Anthropological Series 32(2)*. Chicago, Illinois.

Arnold, Dean E.

- 1985 *Ceramic Theory and Cultural Process*. Cambridge University, New York.

Baker, Gayla S.

- 1971 The Riverside Site, Grant County, New Mexico. *Southwestern Research Reports*, No. 5. Department of Anthropology, Case Western Reserve University, Cleveland, Ohio.

Bandelier, Adolf F.

- 1892 *Final Report of Investigations Among the Indians of the Southwestern United State, Carried on Mainly in the Years from 1880 to 1885, Part II*. Papers of the Archaeological Institute of America, American Series IV. Archaeological Institute of America, Cambridge, Massachusetts.

Bannister, Bryant, John W. Hannah, and William J. Robinson

- 1970 *Tree-Ring Dates from New Mexico M-N, S, Z: Southwestern New Mexico Area*. Laboratory of Tree-Ring Research, University of Arizona, Tucson.

Barnett, William K., and John W. Hoopes, editors

- 1995 *The Emergence of Pottery: Technological Innovation in Ancient Societies*. Smithsonian Series in Archaeological Inquiry. Smithsonian Institution, Washington D.C.

Bates, Robert L., and Julia A. Jackson

- 1987 *Glossary of Geology*. American Geological Institute, Alexandria, Virginia.

Benson, Charlotte and Steadman Upham

- 1986 *Mogollon Variability*. The University Museum Occasional Papers, No. 15. New Mexico State University, Las Cruces.

Berman, Mary Jane

- 1979 *Cultural Resources Overview: Socorro Area, New Mexico*. Cibola National Forest and Gila National Forest, USDA Forest Service, Southwestern Region, Albuquerque, New Mexico. Bureau of Land Management, New Mexico State Office, Santa Fe, New Mexico.

- Betancourt, Julio L., Thomas R. Van Devender, and Paul Schultz Martin
1990 *Packrat Middens: the Last 40,000 Years of Biotic Change*. University of Arizona, Tucson.
- Binford, Lewis R.
1964 A Consideration of Archaeological Research Design. *American Antiquity* 29(4): 425-441.
- Blake, Michael, Steven A. LeBlanc, and Paul E. Minnis
1986 Changing Settlement and Population in the Mimbres Valley, Southwest New Mexico. *Journal of Field Archaeology* 13:439-464.
- Bluhm, Elaine
1957 The Sawmill Site: A Reserve Phase Village, Pine Lawn Valley Western New Mexico. *Fieldiana: Anthropology* 47(1). Chicago, Illinois.
1960 Mogollon Settlement Patterns in Pine Lawn Valley, New Mexico. *American Antiquity* 25(4): 538-546.
- Bradfield, Wesley
1929 *Cameron Creek Village: A Site in the Mimbres Area in Grant County, New Mexico*. Monographs of the School of American Research, No. 1. Santa Fe, New Mexico.
- Brown, David E., editor
1994 *Biotic Communities: Southwestern United States and Northwestern Mexico*. University of Utah, Salt Lake City.
- Brown, David E., and Charles H. Lowe
1983 *Biotic Communities of the Southwest* [thematic map]. Rocky Mountain Forest and Range Experiment Station, USDA Forest Service, 1980 [revised 1983], Tempe, Arizona.
- Brunnemann, Eric J.
1988 Field Report of the 1986 Season: HO-Bar Site Project. University of Texas at Austin. Ms. on file at the Laboratory of Anthropology, Museum of New Mexico, Santa Fe.
- Bryan, Bruce
1927a The Galaz Ruin in the Mimbres Valley. *El Palacio* 23: 323-337.
1927b The Mimbres Expedition. *The Masterkey* 1(4): 19-30.

- 1931a Excavation of the Galaz Ruin. *The Masterkey* 4(6): 179-189.
- 1931b Excavation of the Galaz Ruin. *The Masterkey* 4(7): 221-226.
- 1931c Excavation of the Galaz Ruin, Mimbres Valley, New Mexico. *Art and Archaeology* 32(1-2): 35-42.

Bullard, William R. Jr.

- 1962 The Cerro Colorado Site and Pithouse Architecture in the Southwestern United States Prior to A.D. 900. *Papers of the Peabody Museum of Archaeology and Ethnology* 44(2), Harvard University, Cambridge, Massachusetts.

Burns, Peter E.

- 1972 The Heron Ruin, Grant County, New Mexico. *Southwestern Research Reports*, No. 7. Department of Anthropology, Case Western Reserve University, Cleveland, Ohio.

Bussey, Stanley D.

- 1972 Late Mogollon Manifestation in the Mimbres Branch, Southwestern New Mexico. Unpublished Ph.D. dissertation, Department of Anthropology, University of Oregon, Eugene.
- 1975 *The Archaeology of Lee Village: A Preliminary Report*. Center of Anthropological Study, Monograph No. 2. COAS, Las Cruces, New Mexico.

Cameron, Catherine M.

- 1990a The Effect of Varying Estimates of Pit Structure Use-Life on Prehistoric Population Estimates in the American Southwest. *Kiva* 55(2):155-166.
- 1991 Structure Abandonment in Villages. *Archaeological Method and Theory*, 3: 155-194.

Camilli, Eileen L., LuAnn Wandsnider, and James I. Ebert

- 1988 *Distributional Survey and Excavation of Archaeological Landscapes in the Vicinity of El Paso, Texas*. Report prepared for the Las Cruces District Office, Bureau of Land Management, Las Cruces, New Mexico.

Carlson, Roy L.

- 1965 *Four Mimbres Sites: the Earl Morris Excavations of 1926*. Manuscript on file at the University of Colorado Museum, Boulder.

Ciolek-Torrello, Richard S.

1985 A Typology of Room Function at Grasshopper Pueblo, Arizona. *Journal of Field Archaeology* 12:40-63.

Cochran, W. G.

1952 The χ^2 Test for Goodness of Fit. *Annals of Mathematical Statistics* 23:315-345.

1954 Some Methods for Strengthening the Common χ^2 Tests. *Biometrics* 37:256-266.

Conover, W. J.

1980 *Practical Nonparametric Statistics*. John Wiley, New York.

Cordell, Linda S.

1984 *Prehistory of the Southwest*. Academic Press, Orlando.

1997 *Archaeology of the Southwest*, 2nd edition. Academic Press, San Diego.

Cosgrove, Cornelius Burton

1923 Two Kivas at Treasure Hill. *El Palacio* 15: 19-21.

Cosgrove, C. B., Jr., and W. E. Felts

1927 At Work on the Mimbres. *The Masterkey* 1(3):21-24.

Cosgrove, Harriet S., and Cornelius Burton Cosgrove

1932 The Swarts Ruin: A Typical Mimbres Site in Southwestern New Mexico. *Papers of the Peabody Museum of American Archaeology and Ethnology* 15(1). Harvard University, Cambridge, Massachusetts.

Creel, Darrell G.

1997 Interpreting the End of the Mimbres Classic. In, *Prehistory of the Borderlands: Recent Research in the Archaeology of Northern Mexico and the Southern Southwest*, edited by J. Carpenter and G. Sanchez, pp. 25-31. Arizona State Museum Archaeological Series 186. Arizona State Museum, University of Arizona, Tucson.

1992 Research at Old Town Ruin, a Mimbres Site in Luna County, New Mexico. In, *Interpreting the Past: Research with Public Participation*, edited by L. Jacobson and J. Piper, pp. 21-29. Cultural Resources Series No. 10, 1992. New Mexico Bureau of Land Management, Albuquerque.

n.d. Survey notes and forms on file at the Laboratory of Anthropology, Museum of New Mexico, Santa Fe.

Danson, Edward B.

- 1957 An Archaeological Survey of West Central New Mexico and East Central Arizona. *Papers of the Peabody Museum of Archaeology and Ethnology*, 44(1). Harvard University, Cambridge, Massachusetts.

Dean, Jeffrey S., and John C. Ravesloot

- 1988 The Chronology of Cultural Interaction in the Gran Chichimeca. Paper presented at Culture and Contact: Charles C. DiPeso's Gran Chichimeca conference. Amerind Foundation, Dragoon, Arizona.

DeAtley, Suzanne P.

- 1980 Regional Interaction of the Animas Phase Settlements on the Northern Casas Grandes Frontier. Unpublished Ph.D. dissertation, Department of Anthropology, University of California, Los Angeles.

DeAtley, Suzanne P., and Frank J. Findlow

- 1982 Regional Integration of the Northern Casas Grandes Frontier. In, *Mogollon Archaeology*, edited by P. H. Beckett, pp. 263-277. Acoma Books, Ramona.

Dick, Herbert W.

- 1965 Bat Cave. *Monographs of the School of American Research*, No. 27. School of American Research, Santa Fe, New Mexico.

Diafuku, Hiroshi

- 1952 A New Conceptual Scheme for Prehistoric Cultures in the Southwestern United States. *American Anthropologist* 54: 191-200.

Diehl, Michael

- 1996 The Intensity of Maize processing and Production in Upland Mogollon Pithouse Villages, A.D. 200-1000. *American Antiquity* 61(1): 102-115.

Diehl, Michael, and Patricia A. Gilman

- 1996 Implications From the Designs of Different Southwestern Architectural Forms. In, *Interpreting Southwestern diversity: Underlying Principles and Overarching Patterns*, edited by P. R. Fish and J. J. Reid, pp. 189-193. Anthropological Research Papers, No. 48. Arizona State University, Tempe.

Duncan, Marjorie, Patricia A. Gilman, Raymond P. Mauldin

- 1991 *The Mogollon Village Archaeological Project, 1991: Preliminary Report*. Submitted to Gila National Forest, USDA Forest Service, Silver City, New Mexico.

Dunn, Olive Jean

1961 Multiple Comparisons Among means. *Journal of the American Statistical Association* 56: 52-64.

1964 Multiple Comparisons Using Rank Sums. *Technometrics* 6(3): 241-252.

Ebert, James I.

1992 *Distributional Archaeology*. University of New Mexico, Albuquerque.

Eighmy, Jeffrey L., and Robert S. Sternberg, editors

1990 *Archaeomagnetic Dating*. University of Arizona, Tucson.

Everett, Robert F.

1992 The Three Circle Site: A Late Pithouse Period Settlement in the Upper Mimbres Valley of Southwestern New Mexico. Unpublished Master's thesis, Department of Anthropology, University of Texas at Austin.

Fitting, James E.

1971 Excavations at MC110, Grant County, New Mexico. *Southwestern Research Reports*, No. 2. Department of Anthropology, Case Western Reserve University, Cleveland, Ohio.

1972 Preliminary Notes on Cliff Valley Settlement Patterns. *The Artifact*, 10(4):15-30.

1973a The Preceramic Eaton Site. *The American Philosophical Society Year Book 1973*, pp. 578-579. The American Philosophical Society, Philadelphia.

1973b An Early Mogollon Community: a Preliminary Report on the Winn Canyon Site. *The Artifact*, 11 (1 & 2): 1-94.

1973c *Four Archaeological Sites in the Big Burro Mountains of New Mexico*. Center of Anthropological Study, Monograph No. 1. COAS, Las Cruces, New Mexico.

1974 The Preceramic Eaton Site. *The American Philosophical Society Year Book 1973*. The American Philosophical Society, Philadelphia.

Fitting, James E., David G. Anderson, and Timothy C. Klinger

1972 Archaeological Survey and Excavation in Dark Thunder Canyon. *Southwestern Research Reports*, No. 9. Department of Anthropology, Case Western Reserve University, Cleveland, Ohio.

Fitting, James E., James L. Ross, and B. Thomas Gray

- 1971 Preliminary Report on the 1971 Intersession Excavations at the Saige-McFarland Site (MC146). *Southwestern Research Reports*, No. 4. Department of Anthropology, Case Western Reserve University, Cleveland, Ohio.

Funk, Dory Boyd

- 1983 Investigations at Three Small Classic Mimbres Sites, Grant County, New Mexico. Unpublished Master's thesis, Department of Anthropology, Texas A & M University, College Station.

Gilman, Patricia A.

- 1980 The Early Pueblo Period: Classic Mimbres. In, *An Archaeological Synthesis of South-Central and Southwestern New Mexico*, by S. A. LeBlanc and M. E. Whalen, pp. 205-270. Office of Contract Archaeology, University of New Mexico. Albuquerque, New Mexico.
- 1983 Changing Architectural forms in the Prehistoric Southwest. Unpublished Ph.D. dissertation, Department of Anthropology, University of New Mexico, Albuquerque.
- 1987 Architecture as Artifact: Pit Structures and Pueblos in the American Southwest. *American Antiquity* 52:538-564.
- 1990 Social Organization and Classic Mimbres Period Burials in the SW United States. *Journal of Field Archaeology* 17(4):457-469.
- 1991 Changing Land Use and Pit Structure Seasonality Along the San Simon Drainage in Southeastern Arizona. In, *Mogollon V*, edited by P. H. Beckett, pp. 11-27. COAS Publishing and Research, Las Cruces, New Mexico.
- 1995 Multiple Dimensions of the Archaic-to-Pit Structure Period Transition in Southeastern Arizona. *Kiva* 60(4): 619-632.
- 1997 *Wandering Villagers: Pit Structures, Mobility and Agriculture in Southeastern Arizona*. Anthropological Research Paper, No. 49. Arizona State University, Department of Anthropology, Tempe, Arizona.

Gilman, Patricia A., Raymond P. Mauldin, and Valli S. Powell

1991 *The Mogollon Village Archaeological Project, 1989*. Report submitted to U.S.D.A. Forest Service, Gila National Forest, Silver City, New Mexico.

Gladwin, Winifred, and Harold S. Gladwin

1933 *Some Southwestern Pottery Types: Series III*. Medallion Papers No. 16. Gila Pueblo, Globe, Arizona.

1934 *A Method for Designation of Cultures and their Variations*. Medallion Papers No. 15. Gila Pueblo, Globe, Arizona.

Graybill, Donald A.

1973 *Prehistoric Settlement Pattern Analysis in the Mimbres Region, New Mexico*. Unpublished Ph.D. dissertation, Department of Anthropology, University of Arizona, Tucson.

Gross, G. T.

1987 *Anasazi Storage Facilities in the Dolores Region, Colorado: AD. 600-920*. Unpublished Ph.D. dissertation, Department of Anthropology, Washington State University, Pullman.

Hammack, Laurens C.

1966 *Diablo Highway Salvage Project for the New Mexico State Highway Department*. *Laboratory of Anthropology Notes*, No. 41. Laboratory of Anthropology, Museum of New Mexico, Santa Fe.

Hammack, Laurens C., Stanley D. Bussey, and Ronald Ice

1966 *The Cliff Highway Salvage Project*. *Laboratory of Anthropology Notes*, No. 40. Laboratory of Anthropology, Museum of New Mexico, Santa Fe.

Hard, Robert J.

1986 *Ecological Relationships Affecting the Rise of Farming Economies: A test from the American Southwest*. Unpublished Ph.D. dissertation, Department of Anthropology, University of New Mexico, Albuquerque.

1990 *Agriculture Dependence in the Mountain Mogollon*. In, *Perspectives on Southwestern Prehistory*, edited by P. E. Minnis and C. L. Redman, pp. 135-149. Westview, Boulder.

- Hard, Robert J., Raymond P. Mauldin, and Gerry R. Raymond
 1996 Mano Size, Stable Carbon Isotope Ratios, and Macrobotanical Remains as Multiple Lines of Evidence of Maize Dependence in the American Southwest. *Journal of Archaeological Method and Theory* 3(4):253-318.
- Haury, Emil W.
 1936a *The Mogollon Culture of Southwestern New Mexico*. Medallion Papers, No. 20. Gila Pueblo, Globe, Arizona.
 1936b *Some Southwestern Pottery Types, Series IV*. Medallion Papers, No 19. Gila Pueblo, Globe, Arizona.
- 1956 Speculations on prehistoric settlement Patterns in the Southwest. In, *Prehistoric Settlement Patterns in the New World*, edited by G. Willey, pp. 3-10. Viking Fund Publications in Anthropology, 23. Wenner-Gren Foundation for Anthropological Research, New York.
- 1962 The Greater American Southwest. In, *Courses Toward Urban Life*, edited by R. J. Braidwood and G. R. Willey, pp. 106-131. Viking Fund Publications in Anthropology, No. 32.
- 1986 Thoughts After Sixty Years as a Southwestern Archaeologist. In, *Emil W. Haury's Prehistory of the American Southwest*, edited by J. J. Reid and D. E. Doyel, pp. 435-464. University of Arizona, Tucson.
- Haury, Emil W., and E. B. Sayles
 1947 An Early Pithouse Village of the Mogollon Culture, Forestdale Valley, Arizona. *University of Arizona Bulletin* 18(4), *Social Science Bulletin* No. 16, Tucson.
- Hawley, Florence
 1936 Field manual of prehistoric southwestern pottery types. *University of New Mexico Bulletin*, No. 261, *Anthropological Series* 4(1). University of New Mexico, Albuquerque.
- Hegmon, Michelle, Margaret C. Nelson, and Susan Ruth
 1998 Abandonment, Reorganization, and Social Change: Analysis of Pottery and Architecture from the Mimbres Region of the American Southwest. *American Anthropologist* 100:148-162.
- Hemphill, Claudia B.
 1983 The Eaton Site: Late Archaic in the Upper Gila. Unpublished Master's thesis, Department of Anthropology, University of Oregon, Eugene.

Herrington, Selma LaVerne C.

- 1979 Settlement Patterns and Water Control Systems of the Mimbres Classic Phase, Grant County, New Mexico. Unpublished Ph.D. dissertation, Department of Anthropology, University of Texas, Austin.

Hill, James N.

- 1970 *Broken K Pueblo: Prehistoric Social Organization in the American Southwest*. University of Arizona Press, Tucson.

Hogg, Don Jack

- 1977 Report on the Excavation of Three Mogollon Pit Houses on the Upper Mimbres River, New Mexico. Unpublished Master's thesis, Department of Anthropology, Eastern New Mexico University, Portales.

Hough, Walter

- 1907 Antiquities of the Upper Gila and Salt River Valleys in Arizona and New Mexico. *Bureau of American Ethnology Bulletin*, No. 35. Smithsonian Institution, Washington D. C.

- 1914 Culture of the Ancient Pueblos of the Upper Gila River Region, New Mexico and Arizona. *U.S. National Museum Bulletin* No. 87. Washington D. C.

- 1919 Exploration of a Pit House Village at Luna, New Mexico. *Proceedings of the U.S. National Museum*, 55(2280): 409-431 with Plates 28-38. Washington, D.C.

Howell, David C.

- 1992 *Statistical Methods for Psychology*, 4th ed. Duxbury, Boston, Massachusetts.

Huckell, Bruce B., and Lisa W. Huckell

- 1988 Crops Come to the Desert: Late Preceramic Agriculture in Southeastern Arizona. Paper presented at the 53rd Annual Meeting of the Society for American Archaeology, Phoenix.

Hunter-Anderson, Rosalind L.

- 1977 A Theoretical Approach to the Study of House Form. In, *For Theory Building in Archaeology: Essays on Faunal Remains, Aquatic Resources, Spatial Analysis, and Systemic Modeling*, edited by L. R. Binford, pp. 287-315.

- 1986 *Prehistoric adaptation in the American Southwest*. Cambridge University Press, New York.
- Ice, Ronald
1968 West Fork Ruin. *Laboratory of Anthropology Notes*, No. 48. Laboratory of Anthropology, Museum of New Mexico, Santa Fe.
- Jenks, Albert E.
1928 The Mimbres Valley Expedition. *Minneapolis Institute of Arts Bulletin* 17:154-159.
- Jorgenson, J.
1975 A Room Use Analysis of Table Rock Pueblo, Arizona. *Journal of Archaeological Research* 31:149-161.
- Judd, Neil M.
1940 Progress in the Southwest. In, *Essays in Historical Anthropology of North America*, Smithsonian Miscellaneous Collections, Volume 100. Smithsonian Institution, Washington D. C.
- Kidder, Alfred V.
1927 Southwestern Archaeological Conference. *Science* 66(1716): 489-491.

1936 Discussion. In, *The Pottery of Pecos, Volume 2*, by A. V. Kidder and Anna O. Sheppard, pp. 589-628. Yale University, New Haven, Connecticut.
- Lancaster, James
1983 An Analysis of Manos and Metates from the Mimbres Valley, New Mexico. Unpublished Master's thesis, Department of Anthropology, University of New Mexico, Albuquerque.
- Laumbach, Karl W., and David T. Kirkpatrick
1983 *The Black Range Survey*. Cultural Resources Management Division, New Mexico State University, Report No. 566. New Mexico State University, Las Cruces.
- LeBlanc, Steven A.
1975 *Mimbres Archeological Center: Preliminary Report of the First Season of Excavation, 1974*. Institute of Archaeology, University of California Los Angeles.

- 1976 Mimbres Archeological Center: Preliminary Report of the Second Season of Excavation 1975. *Journal of New World Archaeology* 1(6): 1-23. Institute of Archaeology, University of California Los Angeles.
- 1977 The 1976 Field Season of the Mimbres Foundation in Southwestern New Mexico. *Journal of New World Archaeology* 2(2): 1-24. Institute of Archaeology, University of California Los Angeles.
- 1980a The Early Pithouse Period. In, *An Archaeological Synthesis of South-Central and Southwestern New Mexico*, by S. A. LeBlanc and M. E. Whalen, pp. 119-141. Office of Contract Archaeology, University of New Mexico, Albuquerque.
- 1980b The Post Mogollon Periods in Southwestern New Mexico: the Animas/Black Mountain Phase and the Salado Period. In, *An Archaeological Synthesis of South-Central and Southwestern New Mexico*, by S. A. LeBlanc and M. E. Whalen, pp. 271-316. Albuquerque, New Mexico.
- 1982a Temporal Change in Mogollon Ceramics. In, *Southwestern Ceramics I Comparative Review*, edited by A. H. Schroeder, pp. 107-127. The Arizona Archaeologist, No. 15. Arizona Archaeological Society, Phoenix.
- 1982b The Advent of Pottery in the Southwest. In, *Southwestern Ceramics I Comparative Review*, edited by A. H. Schroeder, pp. 27-51. The Arizona Archaeologist, No. 15. Arizona Archaeological Society, Phoenix.
- 1983 *The Mimbres People : Ancient Pueblo Painters of the American Southwest*. Thames and Hudson, New York.
- 1986 Development of Archaeological Thought on the Mimbres Mogollon. In, *Emil W. Haury's Prehistory of the American Southwest*, edited by J. Reid and D. E. Doyel, pp. 297-304. University of Arizona, Tucson.
- 1989 Cultural Dynamics in the southern Mogollon Area. In, *Dynamics of Southwest Prehistory*, edited by L. S. Cordell and G. J. Gummerman, pp. 179-207. Smithsonian Institution, Washington D. C.
- 1999 *Prehistoric Warfare in the American Southwest*. University of Utah, Salt Lake City, Utah.

LeBlanc, Steven A., and Michael E. Whalen

- 1980 *An Archaeological Synthesis of South-Central and Southwestern New Mexico*. Office of Contract Archaeology, University of New Mexico. Albuquerque, New Mexico.

Lehmer, Donald J.

- 1948 *The Jornada Branch of the Mogollon*. *Social Science Bulletin* 17. *University of Arizona Bulletin* 19(2). University of Arizona, Tucson.

Lekson, Stephen H.

- 1978 *Settlement Patterns in the Redrock Valley, Southwestern New Mexico*. Unpublished Master's thesis, Department of Anthropology, Eastern New Mexico University, Portales.

- 1982 *Architecture and Settlement Plan in the Redrock Valley of the Gila River, Southwestern New Mexico*. In, *Mogollon Archaeology: Proceedings of the 1980 Mogollon Conference*, edited by P. H. Beckett, pp. 61-74. Acoma Books, Ramona, California.

- 1988 *The Mangas Phase in Mimbres Archaeology*. *Kiva* 53:129-145.

- 1990 *Mimbres Archaeology of the Upper Gila, New Mexico*. University of Arizona Anthropological Paper No. 52. University of Arizona, Tucson.

- 1992a *Archaeological Overview of Southwestern New Mexico*. Prepared for New Mexico State Historic Preservation Division, Santa Fe, New Mexico. Submitted by Human Systems Research, Las Cruces, New Mexico.

- 1992b *The Surface Archaeology of Southwestern New Mexico*. *The Artifact* 30(3): 1-36.

- 1999 *Unit Pueblos and the Mimbres Problem*. In, *La Frontera: Papers in Honor of Patrick Beckett*, edited by Meliha Duran and David Kirkpatrick, pp. 43-54. Papers of the Archaeological Society of New Mexico 25, Albuquerque.

Lekson, Stephen H., and Timothy Klinger

- 1973 *Villareal II: Preliminary Notes on an Animas Phase Site in Southwestern New Mexico*. *Awanyu* 1(2):33-38.

Linse, Angela R.

- 1997 *Excavations at Mogollon Village and Survey of Surrounding Areas: University of Washington 1993 Archaeological Field School.* Submitted to U.S.D.A. Forest Service, Gila National Forest, Silver City, New Mexico.

Martin, Paul Sidney

- 1940 The SU Site Excavations at a Mogollon Village Western New Mexico, 1939. *Anthropological Series, Field Museum of Natural History*, 32(1): 1-97. Chicago, Illinois.
- 1943 The SU Site Excavations at a Mogollon Village Western New Mexico: Second Season, 1941. *Anthropological Series, Field Museum of Natural History*, 32(2): 101-267. Chicago, Illinois.
- 1954 The Mogollon Culture in Western New Mexico. *Southwestern Lore* 20(1): 1-4.

Martin, Paul S. and Fred Plog

- 1973 *The Archaeology of Arizona: A Study of the Southwest Region.* American Museum of Natural History, Natural History Press, Garden City, New Jersey.

Martin, Paul S., and John B. Rinaldo

- 1947 The SU Site: Excavations at a Mogollon Village, Western New Mexico, 1946. *Anthropological Series, Field Museum of Natural History*, 32(3): 275-382. Chicago, Illinois.
- 1950a Sites of the Reserve Phase, Pine Lawn Valley, Western New Mexico. *Fieldiana: Anthropology* 38(3). Chicago Natural History Museum, Chicago, Illinois.
- 1950b Turkey Foot Ridge Site: A Mogollon Village, Pine Lawn Valley, Western New Mexico. *Fieldiana: Anthropology* 38(2). Chicago Natural History Museum, Chicago, Illinois.
- 1954 The Southwestern Co-Tradition. *Southwestern Journal of Anthropology* 7:215-229.

Martin, Paul S., John B. Rinaldo, and Ernst Antevs

- 1949 Cochise and Mogollon Sites, Pine Lawn Valley, Western New Mexico. *Fieldiana: Anthropology* 38(1). Chicago Natural History Museum, Chicago, Illinois.

- Martin, Paul S., John B. Rinaldo and Eloise R. Barter
 1957 Late Mogollon Communities: Four Sites of the Tularosa Phase, Western New Mexico. *Fieldiana: Anthropology* 49(1). Chicago Natural History Museum, Chicago, Illinois.
- Martin, Paul S., John B. Rinaldo, Elaine A. Bluhm, and Hugh C. Cutler
 1956 Higgins Flat Pueblo, Western New Mexico. *Fieldiana: Anthropology* 45. Chicago Natural History Museum, Chicago, Illinois.
- Martin, Paul S., John B. Rinaldo, Elaine A. Bluhm, Hugh C. Cutler, and R. Grange, Jr.
 1952 Mogollon Cultural Continuity and Change: The Stratigraphic Analysis of Tularosa and Cordova Caves. *Fieldiana: Anthropology* 40. Chicago Natural History Museum, Chicago, Illinois.
- Mauldin, Raymond P.
 1983 An Inquiry into the Past: Basketmaker II Settlement on Northeastern Black Mesa, Arizona. Unpublished Master's thesis, Department of Anthropology, University of Texas at Austin, Austin.
- 1991 Agricultural Intensification in the Mogollon Highlands. In *Mogollon V*, edited by P. H. Beckett, pp. 62-74. COAS, Las Cruces, New Mexico.
- 1993 The Relationship Between Ground Stone and Agricultural Intensification in Western New Mexico. *Kiva* 58: 317-330.
- 1995 Groping for the Past: Investigating Archaeological Patterns Across Space and Time in the Southern Southwestern United States. Unpublished Ph.D. dissertation, Department of Anthropology, University of New Mexico, Albuquerque.
- 1999 Pit Structure Variability in the Southern Jornada Mogollon Region. Paper in possession of the author, Center for Archaeological Research, University of Texas at San Antonio, San Antonio.
- Mauldin, Raymond P., Patricia A. Gilman, and Christopher A. Stevenson
 1996 Mogollon Village Revisited: Recent Chronometric Results and Interpretations. *Kiva* 61: 385-400.
- McGuire, Randall H., and Michael B. Schiffer
 1983 A Theory of Architectural Design. *Journal of Anthropological Archaeology* 2:277-303.

Mills, Jack P., and Vera M. Mills

1972 The Dinwiddie Site: A Prehistoric Salado Ruin on Duck Creek, Western New Mexico. *The Artifact* 10(2): 1-50.

Mimbres Foundation

1978 *A Brief Summary of Prehistoric Settlement Patterns in Southwestern New Mexico*. Prepared for the New Mexico State Historic Preservation Officer. Santa Fe, New Mexico.

Minnis, Paul

1980 Prehistoric Population and Settlement Configuration in Southwestern New Mexico: An Analysis of Systematic Archaeological Surveys. In, *An Archaeological Synthesis of South-Central and Southwestern New Mexico*, edited by S. A. LeBlanc and M. E. Whalen, Appendix A, pp. 460-505. Office of Contract Archaeology, University of New Mexico. Albuquerque, New Mexico.

1985 *Social Adaptation to Food Stress: A Prehistoric Southwestern Example*. University of Chicago, Chicago.

Nelson, Ben A.

1980 Cultural Responses to Population Change: A Comparison of Two Prehistoric Occupations of the Mimbres Valley, New Mexico. Unpublished Ph.D. dissertation, Department of Anthropology, Southern Illinois University, Carbondale.

Nelson, Ben A., and Steven A. LeBlanc

1986 *Short Term Sedentism in the American Southwest: the Mimbres Valley Salado*. The Maxwell Museum, University of New Mexico. Albuquerque, New Mexico.

Nelson, Ben A., Margaret C. Ruge, Steven A. LeBlanc

1978 LA 12109: A Small Classic Mimbres Ruin in the Mimbres Valley. In, *Limited Activity and Occupational Sties: A Collection of Conference Papers*, edited by A. E. Ward, pp. 191-206. University of New Mexico, Albuquerque.

Nelson, Margaret C.

1999 *Mimbres During the Twelfth Century: Abandonment, Continuity, and Reorganization*. University of Arizona, Tucson.

Nesbitt, Paul H.

1931 *The Ancient Mimbrenos, Based on Investigations at the Mattocks Ruin, Mimbres Valley, New Mexico.* Logan Museum Bulletin No. 4. Beloit, Wisconsin.

1938 *Starkweather Ruin: A Mogollon-Pueblo Site in the Upper Gila Area of New Mexico, and Affiliative Aspects of the Mogollon Culture.* Logan Museum Publications in Anthropology, Beloit College Bulletin #6, Beloit, Wisconsin.

O'Laughlin, Thomas C.

1980 *The Keystone Dam Site and other Archaic and Formative Sites in Northwest El Paso, Texas.* Publications in Anthropology No. 8. El Paso Centennial Museum, University of Texas at El Paso, El Paso.

O'Leary, Beth L.

1987 *Prehistoric Land Use in the Southern Mesilla Bolson: Excavations on the Navajo-Hopi Exchange near Santa Teresa, New Mexico.* Office of Contract Archaeology, University of New Mexico, Albuquerque.

Onouye, Barry, and Kevin Kane

1999 *Statics and Strength of Materials for Architecture and Building Construction.* Prentice Hall, Upper Saddle River, New Jersey.

Peckham, Stewart

1957 *The Switchback Site: A Stratified Ruin Near Reserve, New Mexico.* *Highway Salvage Archaeology*, 3: 10-38. New Mexico State Highway Department and Museum of New Mexico, Santa Fe.

1958 *Hillside Pueblo: Early Masonry Architecture in the Reserve Area, New Mexico.* *El Palacio* 65(3): 81-94.

1963 *The Luna Junction Site, An Early Pit House in the Pine Lawn valley, New Mexico.* *Highway Salvage Archaeology*, 4: 41-55. New Mexico State Highway Department and Museum of New Mexico, Santa Fe.

Peckham, Stewart, Fred Wendorf, and Edwin N. Ferndon, Jr.

1956 *Excavations near Apache Creek, New Mexico.* *Highway Salvage Archaeology*, 2: 17-86. New Mexico State Highway Department and Museum of New Mexico, Santa Fe.

Peterson, John A.

- 1988 Settlement and Subsistence Patterns in the Reserve Phase and Mountain Mogollon: A Test Case in Devil's Park, New Mexico. *Kiva* 53: 113-127.

Ravesloot, John C.

- 1979 The Animas Phase: The Post Classic Mimbres Occupation of the Mimbres Valley, New Mexico. Unpublished Master's thesis. Department of Anthropology, Southern Illinois University, Carbondale.

Ravesloot, John C., Jeffrey S. Dean, and Michael S. Foster

- 1986 A New Perspective on Casas Grandes Tree-Ring Dates. Paper presented at the 4th Mogollon Conference, Tucson.

Reed, Erik K.

- 1950 Eastern-Central Arizona Archaeology in Relation to the Western Pueblos. *Southwestern Journal of Anthropology*, 6: 120-138.

Reid, J. Jefferson

- 1986 Historical Perspectives on the Concept of Mogollon. In, *Mogollon Variability*, edited by C. Benson and S. Upham, pp. 1-8. The University Museum Occasional Papers, No. 15. New Mexico State University, Las Cruces.

- 1990 History of Southwestern Archaeology. In, *Perspectives on Southwestern Prehistory*, edited by P. E. Minnis and C. L. Redman, pp. 317-318. Westview, Boulder.

Reid, J. Jefferson, and David E. Doyel, editors

- 1986 *Emil W. Haury's Prehistory of the American Southwest*. University of Arizona, Tucson.

Rice, Glen E.

- 1975 A Systemic Explanation of Change in Mogollon Settlement Patterns. Unpublished Ph.D. dissertation, Department of Anthropology, University of Washington, Seattle.

- 1980 An Analytical Overview of the Mogollon Tradition. In, *Studies in the Prehistory of the Forestdale Region, Arizona*, edited by C. R. Stafford and G. E. Rice, pp. 9-40. Anthropological Field Studies, No. 1. Office of Cultural Resource Management, Department of Anthropology, Arizona State University.

Rinaldo, John B.

- 1941 Conjectures on the Independent Development of the Mogollon Culture. *American Antiquity* 7: 5-19.

Rocek, Thomas R.

- 1996 Sedentism and mobility in the Southwest. In, *Interpreting Southwestern diversity: Underlying Principles and Overarching Patterns*, edited by P. R. Fish and J. J. Reid, pp. 17-22. Anthropological Research Papers, No. 48. Arizona State University, Tempe.

Robbins, Michael C.

- 1966 House Types and Settlement Patterns: An Application of Ethnology to Archaeological Interpretation. *Minnesota Archaeologist* 28(1): 3-26.

Roscoe, J. T., and J. A. Byars

- 1971 Sample Size Restraints Commonly Imposed on the Use of the Chi-Square Statistic. *Journal of the American Statistical Association* 66: 755-759.

Roth, Barbara J., and Cynthia Ann Bettison

- 1992 *A Preliminary Report of the Excavations at the Lake Roberts Vista Site*. Submitted to U.S.D.A. Forest Service, Gila National Forest, Silver City, New Mexico.

Rowe, Chandler W.

- 1947 The Wheatley Ridge Site, its Relation to the Mogollon Culture of Southwestern New Mexico. Unpublished Master's thesis, University of Chicago, Chicago, Illinois.

Sayles, E. B.

- 1945 *The San Simon Branch, Excavations at Cave Creek and in the San Simon Valley 1: Material Culture*. Medallion Papers 29, Gila Pueblo, Globe Arizona.

Schiffer, Michael B.

- 1972 Archaeological Context and Systemic Context. *American Antiquity* 37:156-165.
- 1987 *Formation Processes of the Archaeological Record*. Academic Press, New York.

Schlanger, Sarah

1985 Prehistoric Population Dynamics in the Dolores Area, Southwestern Colorado. Unpublished Ph.D. dissertation, Washington State University, Pullman.

1986 Population Studies. In, *Dolores Archaeological Program: Final Synthetic Report*, edited by D. A. Breternitz, C. K. Robinson, and G. T. Gross, pp. 492-524. Bureau of Reclamation, U.S. Department of the Interior, Denver.

Schmidt, Kari M.

1998 Logistical Mobility and Faunal Remains: A Diachronic Study from the San Simon Valley of Southeastern Arizona. Unpublished Master's thesis, Department of Anthropology, University of Oklahoma, Norman.

Shafer, Harry J.

1986 *The NAN Ranch Archaeological Project: 1985 Interim Report*. Special Report No. 7. Anthropology Laboratory, Texas A & M University, College Station.

1987 *The NAN Ranch Archaeological Project: 1986 Interim Report*. Special Report No. 8. Anthropology Laboratory, Texas A & M University, College Station.

1991 Archaeology at the NAN Ruin. *The Artifact* 29(1-4).

Shafer, Harry, and Robbie Brewington

1995 Microstylistic Changes in Mimbres Black-on-White Pottery: Examples from the NAN Ruin, Grant County, New Mexico. *Kiva* 6(1): 5-29.

Shaw, C. W., Jr.

n.d. July Drought Estimates for the Cibola and Mimbres Regions of West-Central and Southwest New Mexico. Ms. in possession of the author.

Stokes, Robert

1994 A Critical Look at Mimbres-Mogollon Settlement Patterning: The Sapillo Valley Survey Project, 1993. Poster presented at the 59th Annual Meeting of the Society for American Archaeology, Anaheim, California.

1995 The Prehistory of the Sapillo Valley. Paper presented at the 68th Pecos Conference, Silver City, New Mexico.

- Stuart, David E., and Rory P. Gauthier
1984 *Prehistoric New Mexico: Background for Survey*. University of New Mexico, Albuquerque.
- Stuiver, M. and B. Becker
1993 High-Precision Calibration of the Radiocarbon Time Scale A.D. 1950-6000 BC. *Radiocarbon* 35: 35-65
- Stuiver, M. and G. W. Pearson
1986 High-Precision Calibration of the Radiocarbon Time Scale, A.D. 1950-500 B.C. *Radiocarbon* 28:805-838
- 1993 High-Precision Bidecadal Calibration of the Radiocarbon Time Scale, A.D. 1950-500 B.C. and 2500-6000 B.C. *Radiocarbon*, 35: 1-23.
- Stuiver, M. and P. J. Reimer
1986 A Computer Program for Radiocarbon Age Calibration. *Radiocarbon* 28: 1022-1030.
- Thomas, David H.
1975 Non Site Sampling in Archaeology: Up the Creek without a Site? In, *Sampling in Archaeology*, edited by J. W. Mueller, pp. 61-81. University of Arizona, Tucson.
- 1983 *The Archaeology of Monitor Valley: 1. Epistemology*. Anthropological Papers of the American Museum of Natural History, 59(1): 1-194. American Museum of Natural History, New York.
- Trigger, Bruce G.
1989 *A History of Archaeological Thought*. Cambridge University, Cambridge.
- Turner, Christy G., and Jacqueline A. Turner
1999 *Man Corn: Cannibalism and Violence in the Prehistoric American Southwest*. University of Utah, Salt Lake City.
- Wandsnider, LuAnn
1989 Long-term Land use, Formation Processes, and the Structure of the Archaeological Landscape: A Case Study from Southwestern Wyoming. Unpublished Ph.D. dissertation, Department of Anthropology, University of New Mexico, Albuquerque.

Wandsnider, LuAnn, and Eileen L. Camilli

- 1992 The Character of Surface Archaeological Deposits and its Influence on Survey Accuracy. *Journal of Field Archaeology* 19(2): 169-188.

Wendorf, Fred

- 1954 *Highway Salvage Archaeology*, 1. New Mexico State Highway Department and Museum of New Mexico, Santa Fe.

- 1956 Some Distributions of Settlement Patterns in the Pueblo Southwest. In, *Prehistoric Settlement Patterns in the New World*, edited by G. Willey, pp. 18-25. Viking Fund Publications in Anthropology, 23. Wenner-Gren Foundation for Anthropological Research, New York.

- 1957 A Mimbres Pueblo near Glenwood, New Mexico. *Highway Salvage Archaeology*, 3: 71-84. New Mexico State Highway Department and Museum of New Mexico, Santa Fe.

- 1963 *Highway Salvage Archaeology*, 4. New Mexico State Highway Department and Museum of New Mexico, Santa Fe.

Whalen, Michael E.

- 1994 *Turquoise Ridge and Late Prehistoric Residential Mobility in the Desert Mogollon Region*. University of Utah Anthropological Papers, No 118. University of Utah, Salt Lake City.

Whalen, Michael E., and Patricia A. Gilman

- 1990 Introduction: Transitions to Sedentism. In, *Perspectives on Southwestern Prehistory*, edited by P. E. Minnis and C. L. Redman, pp. 71-75. Westview, Boulder.

Wheat, Joe Ben

- 1954 Southwestern Cultural Interrelationships and the Question of Area Co-tradition. *American Anthropologist* 56: 576-591.

- 1955 *Mogollon Culture Prior to A.D. 1000*. Memoirs of the Society for American Archaeology 10. Memoirs of the American Anthropological Association 82.

Whiting, John W. M., and Barbara Ayres

- 1968 Inferences from the Shape of Dwellings. In, *Settlement Archaeology*, edited by K. C. Chang, pp. 117-133. National, Palo Alto, California.

- Willey, Gordon R., and Philip Phillips
1958 *Method and Theory in American Archaeology*. University of Chicago, Chicago.
- Willey, Gordon R., and Jeremy A. Sabloff
1980 *A History of American Archaeology*, 2nd edition. W. H. Freeman, San Francisco.
- Wills, Wirt H.
1988 *Early Prehistoric Agriculture in the American Southwest*. School of American Research, Santa Fe.
- 1989 Patterns of Prehistoric Food Production in West-Central New Mexico. *Journal of Anthropological Research* 45: 139-157.
- Withers, Arnold
1985a The Short, Happy Life of Mogollon Red-on-Brown. In, *Prehistory and History in the Southwest*, edited by N. Fox, pp. 15-18. Papers of the Archaeological Society of New Mexico, Albuquerque, New Mexico.
- 1985b Three Circle Red-on-White: An Alternative to Oblivion. In, *Southwestern Culture History*, edited by C. H. Lange, pp. 15-26.
- Woodbury, Richard B.
1993 *Sixty Years of Southwestern Archaeology*. University of New Mexico, Albuquerque.
- Woodbury, Richard B., and Ezra B. W. Zubrow
1979 Agricultural Beginnings, 2000 B. C. – A. D. 500. In, *Handbook of North American Indians: Southwest, Volume 9*, edited by A. Ortiz, pp. 43-60. Smithsonian Institution, Washington D. C.
- Woosley, Anne E., and Allan J. McIntyre
1996 *Mimbres Mogollon Archaeology: Charles C. DiPeso's Excavations at Wind Mountain*. University of New Mexico, Albuquerque.
- Wormington, H. Marie
1947 *Prehistoric Indians of the Southwest*. Popular Series No. 7, Denver Museum of Natural History, Denver.
- Zar, Jerrold H.
1996 *Biostatistical Analysis*, 3rd edition. Prentice Hall, Upper Saddle River, New Jersey.

APPENDIX A

MOGOLLON CULTURE HISTORY INVENTORY: ALL REPORTED TRAITS

The following appendix is divided into ten tables. Each table includes the traits reported by authors of a series of publications. Each table is arranged with trait categories in rows (Date, Settlement, Architecture, Entryway, Postholes, Features, Pottery, Ground Stone, Other Artifacts, Burials). Each column represents a an author or group of authors and the publications from which trait data were collected. The number of columns in each table varies because some authors discuss only a few of the phases. The columns are arranged chronologically by date of publication(s). The references cited are listed at the end of Appendix B.

Pinelawn/Cumbre Phase

	Martin (1943), Martin & Rinaldo (1947, 1950a) Martin et al. (1952)	Wheat (1955)	Danson (1957) Pinelawn, Upper San Francisco River, & Tularosa River-Apache Creek Regions	Bluhm (1960)	Bullard
Phase	Pinelawn	Mogollon I (~Pinelawn)	pre-Pueblo I (~Pinelawn)	Pine Lawn	Pine L (~Mimbri Basket
Date	150 BC-A.D. 500	300/250 BC-A.D. 100	pre-A.D. 700	200 BC-A.D. 500	pre A.D. 475-70
Settlement	many sites located on high & easily defended ridges (1950a)		high steep sided mesas, benches, bluffs, or ridges well-back from edge, not overlooking valley	high defensible mesas or ridges with a view small sites close together or near a large site sedentary agricultural & hunting all houses may not have been occupied at the same time	
Architecture	pithouses: rounded (1947) or irregular (1943) possibly ceremonial (1947): large, deep, kidney-shaped	pithouses: roundish (majority) or irregular; large (average 27.1 sq. m)	pithouses	pithouses: oval or round, average 30.7 sq. m random arrangement of houses small & large sites (1-26 houses/site, 6 sites with >10 pithouses,) ceremonial: larger, kidney-shaped	pithouses houses front; large range from large); s all sites ceremonial domestic shaped
Entryway	long (common), short (less common) ceremonial: short, steeply sloped	none (majority) short inclined or short & broad inclined long inclined(rare)		short lateral or roof	short
Postholes	varying number & pattern (1943) 1-2 primary, varying number of secondary, unpatterned (1947)	center, center & marginal, marginal, quadrilateral, none roof possibly gabled			>4 peripheral none
Features	floor pits: deep, various sizes stone walls across most accessible approach	fire depressions: rare floor pits: large &/or small, rarely none, moderate depth (46 cm)		ceremonial: floor grooves	subfloor p large

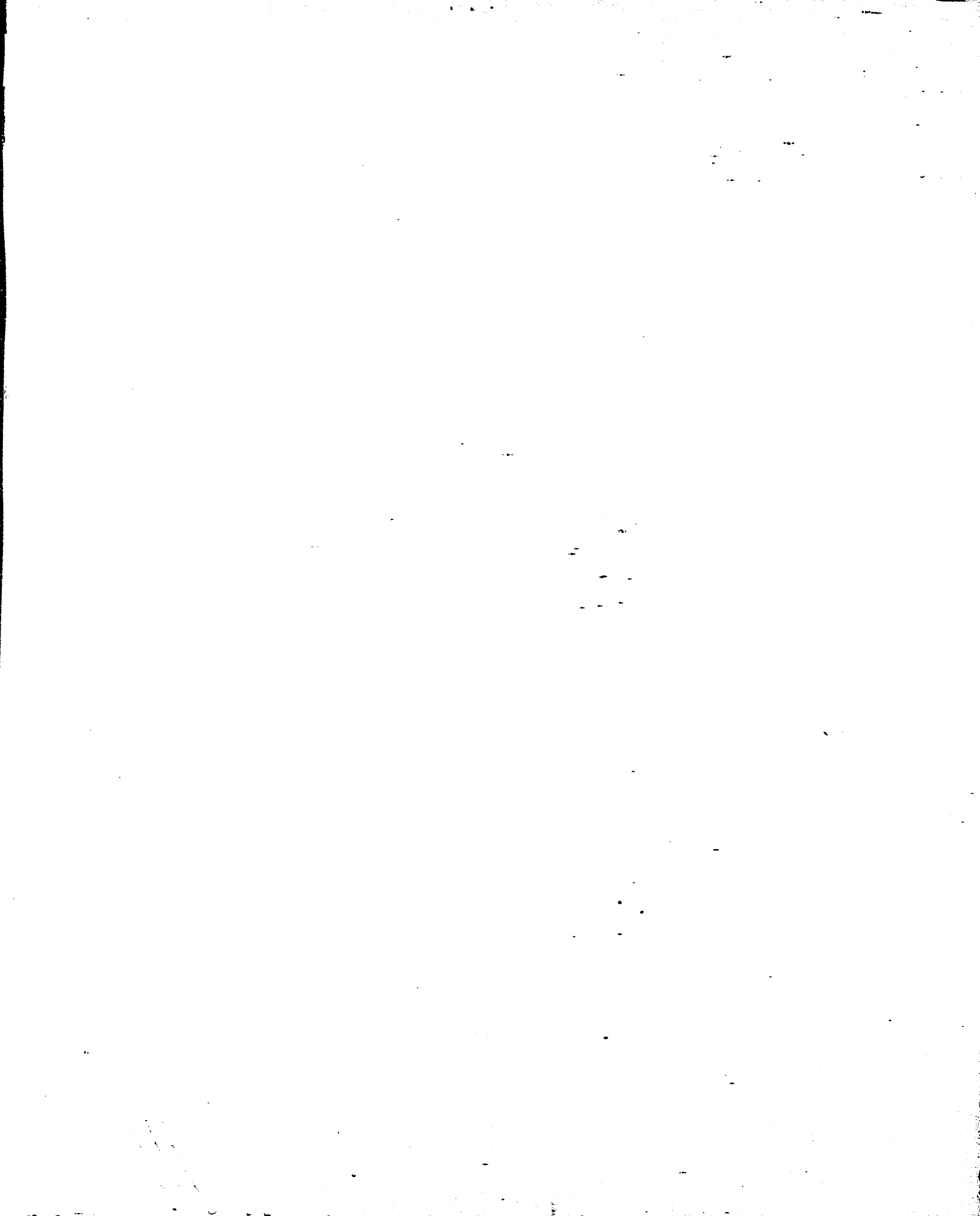


	Bullard (1962)	Fitting (1972)	Mimbres Foundation (LeBlanc 1980, Anyon et al. 1981)	Lekson (1992)
	Pine Lawn (-Mimbres Georgetown & Basketmaker III)	Brownware Phase	Early Pithouse (Cumbre)	Early Pit House (Cumbre/Pine Lawn & Georgetown)
500	pre A.D. 700 (BM III A.D. 475-700)	200 BC-A.D. 400	A.D. 200-550	A.D. 300-
ole mesas or a view close together rge site gricultural & ay not have ied at the			large villages, occupied year-round, fully sedentary; small proportion of structures occupied contemporaneously high knolls, mesas, ridges, or other isolated locations, near major valley areas some sites in accessible locations (occupied into Late Pithouse) pinyon/juniper zone along well-watered streams; lower settings (rare) along water courses major dependence on agriculture, wild game, & possibly wild plants	pithouses: average 7; a few larger sites (>60 pithouses) larger sites have a few large pithouses (possibly communal or kivas)
or round, .7 sq. m ngement of sites (1-26 6 sites with es.) arger, kidney-	pithouses: circular, a few houses with flattened front; large (majority, but range from medium-very large); shallow, but not at all sites ceremonial: larger than domestic, D- or bean-shaped	pithouses: circular	pithouses: circular, oval communal: extra large with earthen lobes	pithouses: simple, shallow, round or oval
or	short		ramp	
	>4 peripheral, center, or none	center		
oor grooves	subfloor pits: numerous, large		firepits: ephemeral or none storage pits, large, bell-shaped, sometimes interior rock walls across most accessible route to village	

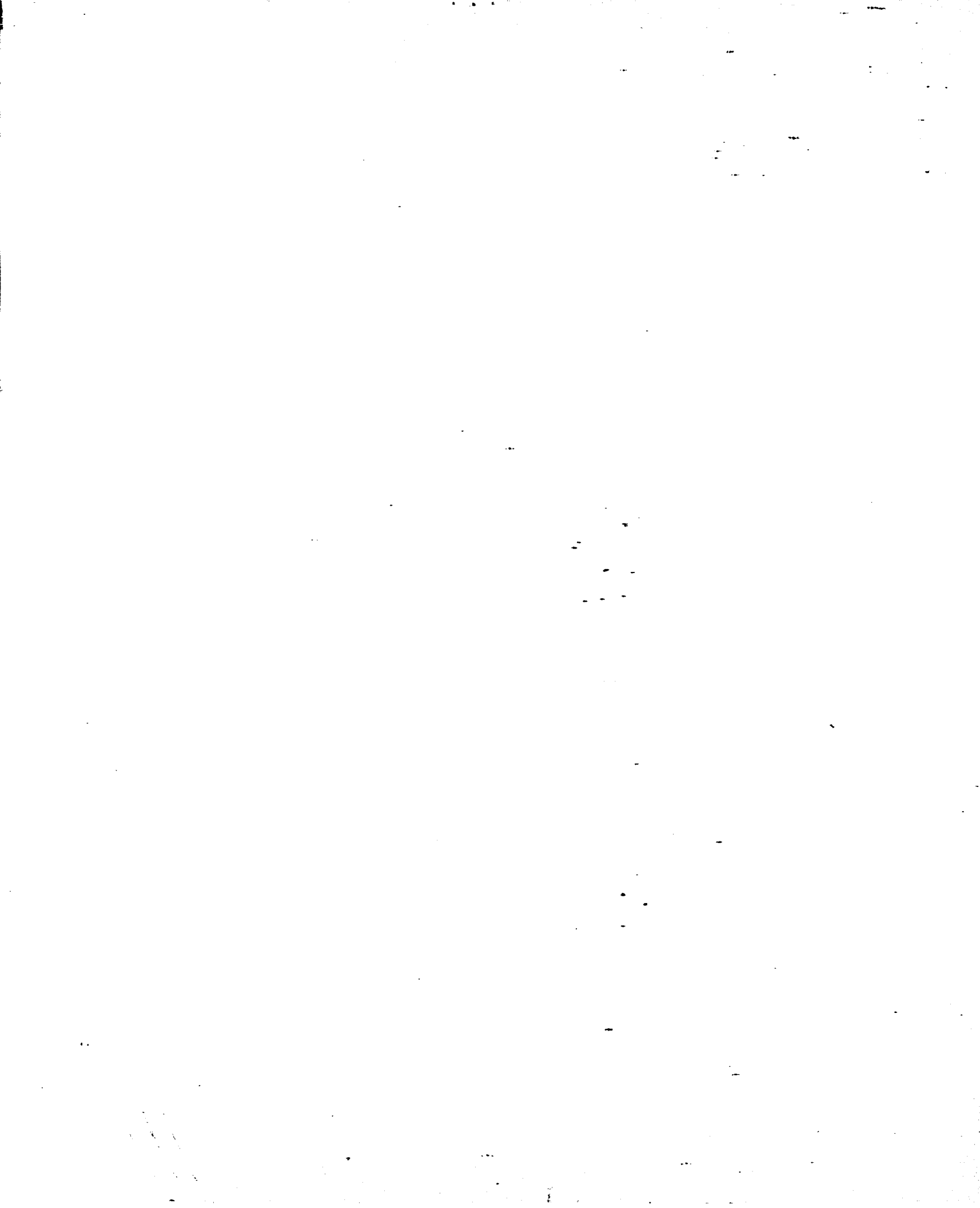


Pinelawn/Cumbre Phase, cont.

	Martin (1943), Martin & Rinaldo (1947, 1950a) Martin et al. (1952)	Wheat (1955)	Danson (1957) Pinelawn, Upper San Francisco River, & Tularosa River-Apache Creek Regions	Bluhm (1960)	Bullard
Phase	Pinelawn	Mogollon I (~Pinelawn)	pre-Pueblo I (~Pinelawn)	Pine Lawn	Pine I (~Mimb Basket
Pottery	Alma Plain Alma Rough San Francisco Red, Saliz var.	Alma Plain Alma Rough Redware	Alma Plain Alma Rough Alma Scored Alma Punctate Alma Smudged/smudged brown Neck-Banded (may be later) possible Intrusives: Lino Gray La Plata B/g		
Ground Stone	Metates: basin, trough (with basin grinding area); trough metates & rectangular manos less numerous than milling stones (1947) Manos: disc, oval	Metates: basin, slab, closed-trough Manos: round, oval, uniface Mauls: grooved (common) Other ground stone: palettes (rare), mortars, bowls, pestles (abundant), pitted pebbles (common), worked slabs, polishing stones (abundant), abrading stones (abundant, some grooved), hoes, atl atl stones, balls, disc beads, pendants	Metates: basin		
Other Artifacts	Chipped stone: flake knives (utilized flakes) Bone: awls (notched), pins Pipes: shouldered, tubular Beads Pendants Shell bracelets	Chipped stone: points, drills, scrapers, gravers, hand axes, core choppers Bone: awls (deer ulna, rabbit, notched podial), needles, pins, small short tubes, antler flakers, disc beads, dice, incised discs Pipes: stone, long & short cylindrical, long conical Shell: olivella beads, vermetus tubes, disc beads, pendants, bracelets			
Burials	occasionally sub-floor				



	Bullard (1962)	Fitting (1972)	Mimbres Foundation (LeBlanc 1980, Anyon et al. 1981)	Lekson (1992)
	Pine Lawn (~Mimbres Georgetown & Basketmaker III)	Brownware Phase	Early Pithouse (Cumbre)	Early Pit House (Cumbre/Pine Lawn & Georgetown)
		plain brownwares (90%) slipped & polished redwares (10%)	Alma Plain red slip (not highly polished)/fugitive red wash	Plain brownware Saliz Red (thinly slipped or self-slipped redware; very minor amounts) absence of later decorated or textured wares
			Metates: full trough Manos: two-hand	
		Chipped stone: points Bone: deer		



Georgetown Phase

	Haury (1936)	Martin & Rinaldo (1950a, 1950b), Martin et al. (1949, 1952)	Wheat (1955)	Danson (1957) Mimbres & Middle and Upper Gila Regions	Bluhm (1957)
Phase	Georgetown	Georgetown	Mogollon I (Georgetown)	pre-Pueblo I (-Georgetown)	Georgetown
Date	pre-A.D. 700	A.D. 500-700	A.D. 100-400	pre-A.D. 700	A.D. 500-700
Settlement		"houses built in any choice spot, without an eye to defense" (1950a:566) dispersed, rather than clustered (1950a)		bluff	villages scattered on bluffs, some still on ridges or ridges; sites are scattered rather than clustered; sites still on ridges
Architecture	pithouses: rounded with flat side ceremonial pithouses: same as domestic, but larger	smaller (1950a:566)	pithouses: roundish, medium (average 14.9 sq. m), deep (88 cm)	pithouses	pithouses: average 1-2 m diameter, random arrangement; 1-14 houses; ceremonial: ceremonial
Entryway	inclined entrance (on flat side)		long, narrow, inclined (majority)- step-inclined (minority)		ceremonial: ceremonial
Postholes	primary center post, secondary peripheral posts		quadrilateral, center & marginal, none; center (rare)		
Features		floor pits (1950b): fewer or none	fire depressions (rare) floor pits: none (majority), small or large & small (few)		ceremonial: ceremonial
Pottery	Alma Plain San Francisco Red Alma Punched (traces) Alma Scored (traces) Alma Neck-Banded (traces) Alma Neck-Corrugated (traces)	(1950b) Alma rough (scarce or none) textured (scarce or none)	Alma Plain Alma rough San Francisco Red	Alma Plain Alma Rough San Francisco Red possibly, corrugated no painted wares	
Ground Stone	Metates: basin		not reported separately - from Mogollon I Pinelawn		
Other Artifacts	Pipes: clay		not reported separately from Mogollon I Pinelawn		
Burials			not reported separately from Mogollon I Pinelawn		



	Bluhm (1960)	Bullard (1962)	Fitting (1972)	Mimbres Foundation (Anyon 1980, Anyon et al. 1981)	Lekson (1992)
	Georgetown	Georgetown (-Basketmaker III)	Georgetown	Late Pithouse (Georgetown)	Early Pit house (Cumbre/Pine Lawn & Georgetown)
	A.D. 500-700	pre-A.D. 700 (BM III A.D. 475-700)		A.D. 550-650	A.D. 300-
	villages scattered w/o concern for defense, but some still on high mesas or ridges sites are scattered, rather than clustered some sites still on high mesas or ridges			first bench or terrace above the rivers, or non-isolated mesa/bluff (where no 1st terrace) (Anyon); low lying areas (LeBlanc 1980) close proximity to Early Pithouse sites population increase	pithouses: average 7 per site; a few larger sites (>60 pithouses) larger sites have a few large pithouses (possibly communal or kivas)
	pithouses: oval or round, average 14.5 sq. m; random arrangement of 1-14 houses (average 6) ceremonial: larger, round	pithouses: circular or D-shaped; medium-sized, a few small	pithouses: circular	pithouses: round or D-shaped communal: very large with earthen lobes	
	ceremonial: ramp			inclined/ramp communal: earthen lobes at interior end	
		centerpost		central w/ peripheral auxiliaries	
	ceremonial: floor grooves	subfloor pits: numerous, large (Pinelawn area)		firepits: shallow ephemeral or none Communal: floor grooves rare	
		Alma Plain San Francisco Red textured (e.g. Alma Scored)	a few crude R/gray	San Francisco Red Alma Plain Alma Neck-banded (late, 1st appearance) Alma Scored	Saliz Red (thinly slipped or self-slipped redware) absence of later decorated or textured wares
				Metates: full trough	
				exterior or-in abandoned pithouse fill flexed to some degree increased grave goods	



San Francisco Phase

	Haury (1936)	Martin & Rinaldo (1949, 1950a, 1950b), Martin et al. (1952, 1957)	Wheat (1955)	Danson (1957) Pinelawn, Upper San Francisco River, & Tularosa River-Apache Creek Regions	Bluhm
Phase	San Francisco	San Francisco	Mogollon III (San Francisco)	Pueblo I (~San Francisco & Three Circle)	San Francisco Three
Date	A.D. 700-900	A.D. 700-900	A.D. 600-900	A.D. 700-900	A.D. 700-900
Settlement		"houses built in any choice spot, without an eye to defense" (1950a:566) dispersed, rather than clustered (1950a)		ridges & bluffs that overlook valleys	scattered clusters high & low water &
Architecture	pithouses: rectangular, rounded corners, plastered ceremonial: pithouse, kidney-bean shaped (sides at entrance "drawn in")	pithouses: rectangular & rounded (rare); smaller than in Pine Lawn phase (1950a:566)	pithouses: quadrangular, roundish (rare); large (Pine Lawn average 22.2 sq. m) or moderate (Mimbres average 15.0 sq. m); deep (Pine Lawn average 114 cm, Mimbres average 105 cm)	pithouses: many with later, small surface pueblo occupations	pithouse random 26 houses average ceremonial smaller
Entryway	step &/or inclined ceremonial: inclined		long, inclined (majority) long, step/inclined none (its possible that entries missed at Cameron Creek)		ceremonial entry
Postholes	center & midline auxiliary	center & two lateral/peripheral or 4 corner, or combination of midline & corner			
Features		floor pits: none or few wall niches extramural pits possibly ceremonial: firepit, deflector, ventilator, sipapu?	fire depressions stone-lined firepit (rare) floor pits: rare		ceremonial grooves
Pottery	Mogollon R/b Three Circle R/w San Francisco Red Alma Neck-Banded Alma Scored Alma Punched Neck-Corrugated (trace) Alma Plain	Alma Plain Mogollon R/b Three-Circle R/w (late) Mimbres Boldface B/w (late) Reserve Smudged (1950b)	Alma Plain - Textured Neck-banded Redware Mogollon R/b Three-Circle R/w (late) Smudged (late)	Mimbres Boldface B/w Three Circle R/w Mogollon R/b San Francisco Red Alma Plain Alma Neckbanded Three Circle Neck Corrugated corrugated brown smudged brown	



Pinelawn, Rio River, Apache	Bluhm (1960)	Bullard (1962)	Mimbres Foundation (Anyon 1980, Anyon et al. 1981)	Lekson (1992)
Three	San Francisco/ Three Circle	San Francisco (~Pueblo I)	Late Pithouse (San Francisco)	Late Pit House (San Francisco, Three Circle)
	A.D. 700-1000	A.D. 700-900	A.D. 650-750	A.D. 700-900
	scattered, but possibly clustering along drainages high & low elevations near water & arable land		first bench or terrace above the rivers, or non- isolated mesa/bluff close proximity to Early Pithouse sites slow movement into side canyons & tributary valleys population increase	terraces above major drainages larger villages more villages, population increased throughout built in same areas as Mimbres pueblos; some have Mimbres pueblos built over them
with later, to	pithouses: rectangular; random arrangement, 1- 26 houses (average 9); average 18.4 sq. m ceremonial: larger or smaller	pithouses: rectangular (later in Pinelawn area), or rectangular with rounded corners (some with slightly curved walls), some circular; small- medium size ceremonial: round, D-, or bean-shaped	pithouses: rectangular, often with slightly rounded sides communal: very large, round or oval	pithouses: deeper, more formalized communal structure/Great Kiva: on larger sites, ≥1 large pit structure
	ceremonial: short or roof entry		communal: ramp lobes at interior end	
		center & midline; four- post (Pinelawn area)	central w/ long axis auxiliaries	
	ceremonial may have: floor grooves, ventilator	subfloor pits: scarce firepits: circular; flat hearthstone on entry side of firepit (Mimbres)	firepits: shallow (≤20 cm), oval or round, unlined or adobe-lined	
w		Alma Plain San Francisco Red textured wares, Alma Neck Banded early: Mogollon R/b (scarce in Pinelawn area) late: Three Circle R/w & Mimbres Bold Face B/w	Mogollon R/b San Lorenzo R/b San Francisco Red Alma Plain Alma Neck-Banded (diagnostic) Alma Scored	Three Circle R/w Mimbres Boldface B/w (Style 1) Mogollon R/b Plain brownware San Francisco Red (slipped & polished)



San Francisco Phase, cont.

	Haury (1936)	Martin & Rinaldo (1949, 1950a, 1950b), Martin et al. (1952, 1957)	Wheat (1955)	Danson (1957) Pinelawn, Upper San Francisco River, & Tularosa River-Apache Creek Regions	Bluhm (1957) Three Circle
Phase	San Francisco	San Francisco	Mogollon III (San Francisco)	Pueblo I (-San Francisco & Three Circle)	San Francisco Three Circle
Ground Stone	Metates: closed trough, basin Manos: rounded, not shaped Axes: none Mauls: full- & 3/4-grooved Other ground stone: atlatl weights		Metates: closed trough, basin, slab Manos: round & ovoid, uniface & biface Axes: flaked (present), full-grooved (rare) Mauls: grooved Other ground stone: mortars, pestles, bowls, pitted pebbles, worked slabs, polishing stones, abrading stones (some grooved), hoes, balls, pendants		
Other Artifacts	Bone: awls (plain & notched), tubes Pipes: clay, long & short stone Comucopia: cone-shaped clay Copper (worked) Shell (rare)		Chipped stone: points, knives, serrated knives, drills, graters, core choppers (abundant) Bone: awls (deer ulna, rabbit, notched podial), needles, antler flakers, disc beads, dice Pipes: stone, long & short cylindrical or long conical Shell: olivella beads, vermetus tubes, disc beads, pendants, thin bracelets		
Burials	exterior, flexed cremations (rare)				



Bluhm (1960)	Bullard (1962)	Mimbres Foundation (Anyon 1980, Anyon et al. 1981)	Lekson (1992)
San Francisco/ Three Circle	San Francisco (-Pueblo I)	Late Pithouse (San Francisco)	Late Pit House (San Francisco, Three Circle)
		exterior or in abandoned pithouse fill flexed to some degree increased grave goods: none (majority), some with "killed" ceramics (smashed & scattered)	



Three Circle Phase

	Haury (1936)	Martin & Rinaldo (1947, 1950a, 1950b), Martin et al. (1952, 1957)	Wheat (1955)	Danson (1957) Pinelawn, Upper San Francisco River, & Tularosa River-Apache Creek Regions	Bluhm
Phase	Three Circle	Three Circle	Mogollon IV (Three Circle)	Pueblo I (~San Francisco & Three Circle)	Pueblo I (~San Francisco & Three Circle)
Date	A.D. 900-1000	A.D. 900-1000	A.D. 900-1000	A.D. 700-900	A.D. 700-900
Settlement		*houses built in any choice spot, without an eye to defense* (1950a:566) dispersed, rather than clustered (1950a) more villages, increased population density (1950a)		ridges & bluffs that overlook valleys	possibly drainage near water
Architecture	pithouses: rectangular, sharp corners, stone-lined, plastered walls ceremonial: pithouse, rectangular, sharp corners, plastered walls, semisubterranean	pithouses: rectangular or round; smaller than in Pine Lawn phase (1950a) kivas: square (1947) Great Kiva	pithouses: quadrangular (majority), rounded (small %); medium (~19 sq. m)	pithouses: many with later, small surface pueblo occupations	
Entryway	step/inclined ceremonial: inclined entry		long, inclined step/inclined (15%)		ceremonial entry
Postholes	corner posts		quadrilateral (33%) midline (10%) unknown (50-60%)		
Features		firepits (common, 1949) floor pits: few or none (1950b)	fire depression stone-lined firepits (rare) floor pits: rare		ceremonial grooves
Pottery	Mimbres Boldface B/w Textured (primarily Alma Neck-Corrugated, Alma Punched, Alma Scored, Alma Neck-Banded) San Francisco Red Three Circle R/w Alma Plain	Mogollon R/b Three-Circle R/w Alma Plain Alma Rough Alma Scored Alma Neck-Banded San Francisco Red Three Circle Neck Corrugated, Reserve Smudged Reserve Fillet Rim (1950b)	Three-Circle R/w Mimbres Boldface B/w Textured neck-corrugated Plain Redware	Mimbres Boldface B/w Three Circle R/w Mogollon R/b San Francisco Red Alma Plain Alma Neckbanded Three Circle Neck Corrugated corrugated brown smudged brown	

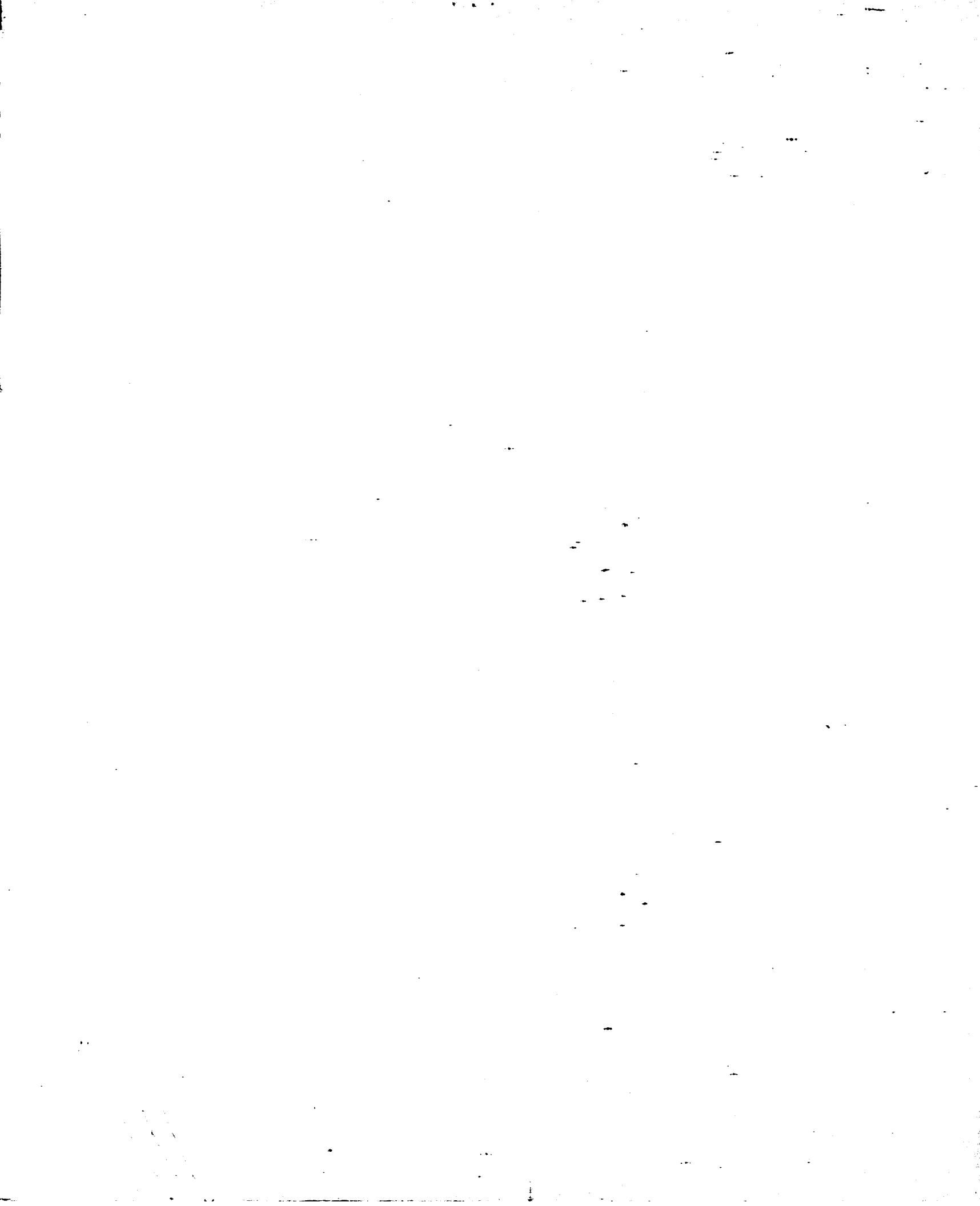


1957) Pinelawn, San Francisco River, a River-Apache regions	Bluhm (1960)	Bullard (1962)	Mimbres Foundation (Anyon 1980, Anyon et al. 1981)	Lekson (1992)
San Francisco & Three Circle	Pueblo I (-San Francisco & Three Circle)	Three Circle (-early Pueblo II)	Late Pithouse (Three Circle)	Late Pit House (San Francisco, Three Circle)
1000	A.D. 700-1000	A.D. 900-1100	A.D. 750-1000	A.D. 700-900
bluffs that valleys	possibly clustering along drainages near water & arable land		first bench or terrace above the rivers, or non-isolated mesa/bluff (where no 1st terrace); also marginally agricultural areas close to Early Pithouse sites accelerated movement into side canyons & tributary valleys accelerated population increase	terraces above major drainages larger villages more villages, population increased throughout built in same areas as Mimbres pueblos; some have Mimbres pueblos built over them
many with later, ce pueblo s		pithouses: rectangular with straight walls, some masonry-lined; some circular; size: small - large, slightly more in small ceremonial: rectangular	pithouses: rectangular & square communal: rectangular, often masonry-lined, very large on large sites	pithouses: deeper, more formalized communal structure/Great Kiva: on larger sites, ≥1 large pit structure
	ceremonial: short or roof entry		ramp	
		midline, but rarely center	four corner, four-corner with center, center with two midline, center (some center postholes have rock base)	
	ceremonial may have: floor grooves, ventilator	firepits (Mimbres): rectangular, some slab-lined ventilators (usually in pithouses with masonry-lined walls)	firepits: shallow, oval or round unlined or adobe-lined; deep, rectangular, slab-lined large jars embedded in floor (rare)	
face B/w R/w Red Banded Neck brown wn		Three Circle R/w Mimbres Bold Face B/w Three Circle Neck Corrugated (Mimbres) Three Circle Neck Banded (Pinelawn)	Three Circle R/w (early) Transitional B/w (late) Boldface B/w San Francisco Red Alma Plain Alma Neck-banded Alma Scored Three Circle Neck Corrugated	Three Circle R/w Mimbres Boldface B/w (Style- I) Mogollon R/b Plain brownware San Francisco Red (slipped & polished)



Three Circle Phase, cont.

	Haury (1936)	Martin & Rinaldo (1947, 1950a, 1950b), Martin et al. (1952, 1957)	Wheat (1955)	Danson (1957) Pinelawn, Upper San Francisco River, & Tularosa River-Apache Creek Regions
Phase	Three Circle	Three Circle	Mogollon IV (Three Circle)	Pueblo I (-San Francisco & Three Circle)
Ground Stone	Metates: trough, closed-trough (unshaped) Manos: 4-sided Axes: "crude" notched Mauls: full- & 3/4-grooved Other ground stone: slate palettes	Axes: grooved (1950b)	Metates: full trough, closed-end trough, basin, slab Manos: round uniface/biface, ovoid/rectangular uniface/biface Axes (rare): 3/4- & full-grooved Mauls: less common than Mill) Other ground stone: mortars, pestles, bowls, pitted pebbles, worked slabs, polishing stones, abrading stones, hoes (present), disc beads, pendants	
Other Artifacts	Bone: awls (plain, notched), dice Basketry: 2-rod & bundle Pipes: 2-piece, short clay; long & short stone		Chipped stone: points, knives, serrated knives, drills, choppers Bone: awls (deer ulna, bird, rabbit, notched podial), needles, tubes (large), antler flakers, disc beads, incised discs Pipes: stone, long & short cylindrical or long conical Shell: olivella beads, disc beads, pendants, bracelets	
Burials	exterior, flexed interior, flexed (1st appearance, especially infants)			

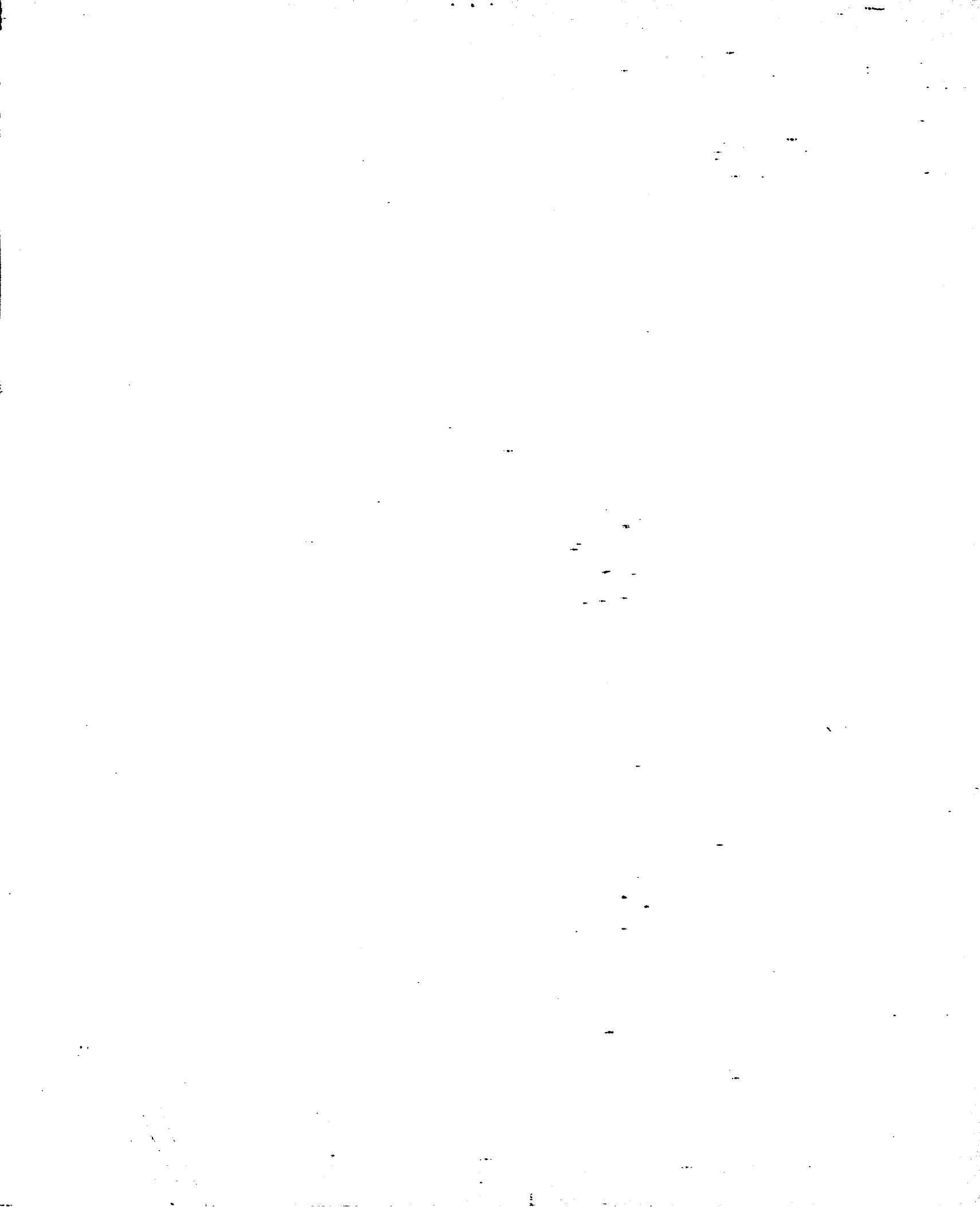


<p>957) Pinelawn, San Francisco River, River-Apache sites</p>	<p>Bluhm (1960)</p>	<p>Bullard (1962)</p>	<p>Mimbres Foundation (Anyon 1980, Anyon et al. 1981)</p>	<p>Lekson (1992)</p>
<p>San Francisco & Three Circle</p>	<p>Pueblo I (~San Francisco & Three Circle)</p>	<p>Three Circle (~early Pueblo II)</p>	<p>Late Pithouse (Three Circle)</p>	<p>Late Pit House (San Francisco, Three Circle)</p>
			<p>Axes: 3/4-grooved & full- grooved, polished</p>	
			<p>interior subfloor & exterior flexed to some extent possibly rare cremation increased grave goods: ceramics (some "punch killed" bowls & handled pitchers), shell bracelets & beads, crystals, stone beads, palettes, points, turquoise beads/pendants, manos, metates</p>	



Pithouse-to-Pueblo Transition

	Haury (1936)	Martin (1943:120)	Wheat (1954, 1955)	Danson (1957) Mimbres & Middle and Upper Gila Regions
Phase	Pithouse-to-Pueblo Transition	Pithouse-to-Pueblo Transition	early Mogollon V (Mangas)	Pueblo II (-Mangas)
Date	A.D. 900-1000		A.D. 1000-1100	A.D. 900-1100
Settlement				high ridge/bluff overlooking valley, or bench immediately above valley bottom, or ridge overlooking creek
Architecture	<p>peublos: semi-subterranean (e.g. Mattocks)</p> <p>pithouses: contiguous, masonry-lined (e.g. Galaz)</p>	<p>peublos: small, masonry</p> <p>rapid shift from pithouses to peublos</p>	<p>peublos: semi-subterranean, contiguous, masonry</p> <p>possibly jacal in Pinelawn area</p>	<p>peublos: river cobbles & boulders; medium sized (5-8 rooms), large room</p>
Entryway				
Postholes				
Features				
Pottery		B/w textured		<p>Mimbres Boldface B/w</p> <p>Three Circle R/w</p> <p>San Francisco Red</p> <p>Three circle Corrugated</p> <p>Alma Plain</p> <p>Reserve B/w</p>
Ground Stone				
Other Artifacts				
Burials				



Mimbres Upper Gila	Fitting (1972)	Lekson (1992)
	Mangus/ post-Brownware	Mangas
	A.D. 700-1000	A.D. 900 -1050
alley, or entirely above or along creek		
cobble & medium sized large rooms	small & large pueblos	masonry & jacal surface architecture (cf. Chapman, et al. 1985) postholes at surface, rooms of fist-sized cobble set in compact adobe mortar (Shafer and Taylor 1986; Shafer 1986)
		surface postholes (cf. Shafer and Taylor 1986)
Black B/w Red Rugated	Mimbres Boldface B/w (predominant)	Mimbres Boldface (Style I) Mimbres Transitional B/w (Style II) Mimbres Classic B/w (Style III; some/sometimes)



Mimbres Classic Phase

	Haury (1936)	Danson (1957) Mimbres & Middle and Upper Gila Regions	Fitting (1972)
Phase	Mimbres	Pueblo III (~Mimbres)	Mimbres Classic
Date	A.D. 1000-	A.D. 900-1100	A.D. 1000-1200
Settlement		low bench above stream; flat bluff overlooking valley bottom	
Architecture	pueblos: single story, masonry ceremonial: rectangular pithouse	pueblos: cobble & abundant adobe mortar; medium (14 rooms); large (≥100 rooms) with multiple roomblocks kivas Great Kiva	
Entryway	ceremonial: inclined entry		
Postholes			
Features	ceremonial: vent shaft	firepits: slab-lined	
Pottery	Mimbres B/w San Francisco Red Alma Plain Mimbres Corrugated	Mimbres Classic B/w (dominant) Mimbres Boldface B/w (less common) brown corrugated plain brown ware (less common) associated with early occupations: Mogollon R/b Three Circle R/w	Mimbres Classic B/w Mimbres Boldface B/w Intrusive: El Paso Polychrome Chupadero B/w Three Rivers R/t St. Johns Polychrome
Ground Stone	Metates: full-trough (often shaped) Manos: 4-sided Axes: 3/4-grooved, fewer full-grooved Mauls: 3/4-grooved & fewer full-grooved Other ground stone: slate palettes, notched stones	Metates: trough	
Other Artifacts	Bone: awls (plain, notched, some with rounded heads), dice Pipes: 1-piece shaped clay; long stone Copper bells Shell: more common, more varied, more species		
Burials	interior, flexed exterior (occasional) cremations (rare)		50% cremations in Classic Mimbres vessels



	Mimbres Foundation (Anyon 1980, Gilman 1980, LeBlanc 1980, Anyon et al. 1981)	Lekson (1992)
	Mimbres Classic A.D. 1000-1150	Mimbres Classic A.D. 1050-1130/50
	first bench or terrace above the rivers (LeBlanc 1980), along major drainage flood plains (Gilman 1980) accelerated population increase (Anyon 1980) movement into areas less desirable for agriculture large sites (≥ 100 rooms; grew in situ from large Late Pithouse sites) medium-sized sites (~20, or 10-40, or 20-75 rooms; distributed between large sites or along secondary drainages) small sites (<10-15 rooms; seasonal farming stations near arable land)	more sites, larger sites, larger population most built over late Pithouse period occupations population aggregated along Mimbres river late: movement into secondary drainages & upland parkland settings Outside Mimbres Valley: away from major creeks clusters of sites over several sq. miles with central Great Kiva population concentrated in the Transitional zone between uplands & basin-and-range desert; these zones were also occupied, but more sparsely
	pueblos: masonry & adobe, contiguous rooms; multiple roomblocks, unless only a single room site larger rooms along Mimbres River & major tributaries communal/ceremonial: semisubterranean with masonry, or large surface masonry rooms; both near roomblock or contiguous & with one exterior wall	single story, river cobble & adobe small roomblocks (4-5 rooms) grew by accretion into pueblos of up to 200 rooms Outside Mimbres Valley: small roomblock & pit structure
	roof entry	
	communal: partially or wholly recessed roof support posts	
	communal: ventilator	diversion irrigation features: irrigation canals, check dams, terraces
w	Mimbres Classic B/w Transitional B/w Obliterated Clapboard Corrugated Incised, Scored, Punched (uncommon) San Francisco Red (rare)	Mimbres Classic B/w (Style III)
ae		
	possibly more "exotic" lithic raw materials (chert, jasper, quartzite, obsidian) possibly more shell	
Classic Mimbres	flexed or semiflexed on back or side oval pits increased grave goods: punch-killed vessel (abundant), ground stone, shell, & turquoise	some subfloor pit cremations in jars with upside down "killed" bowl covers

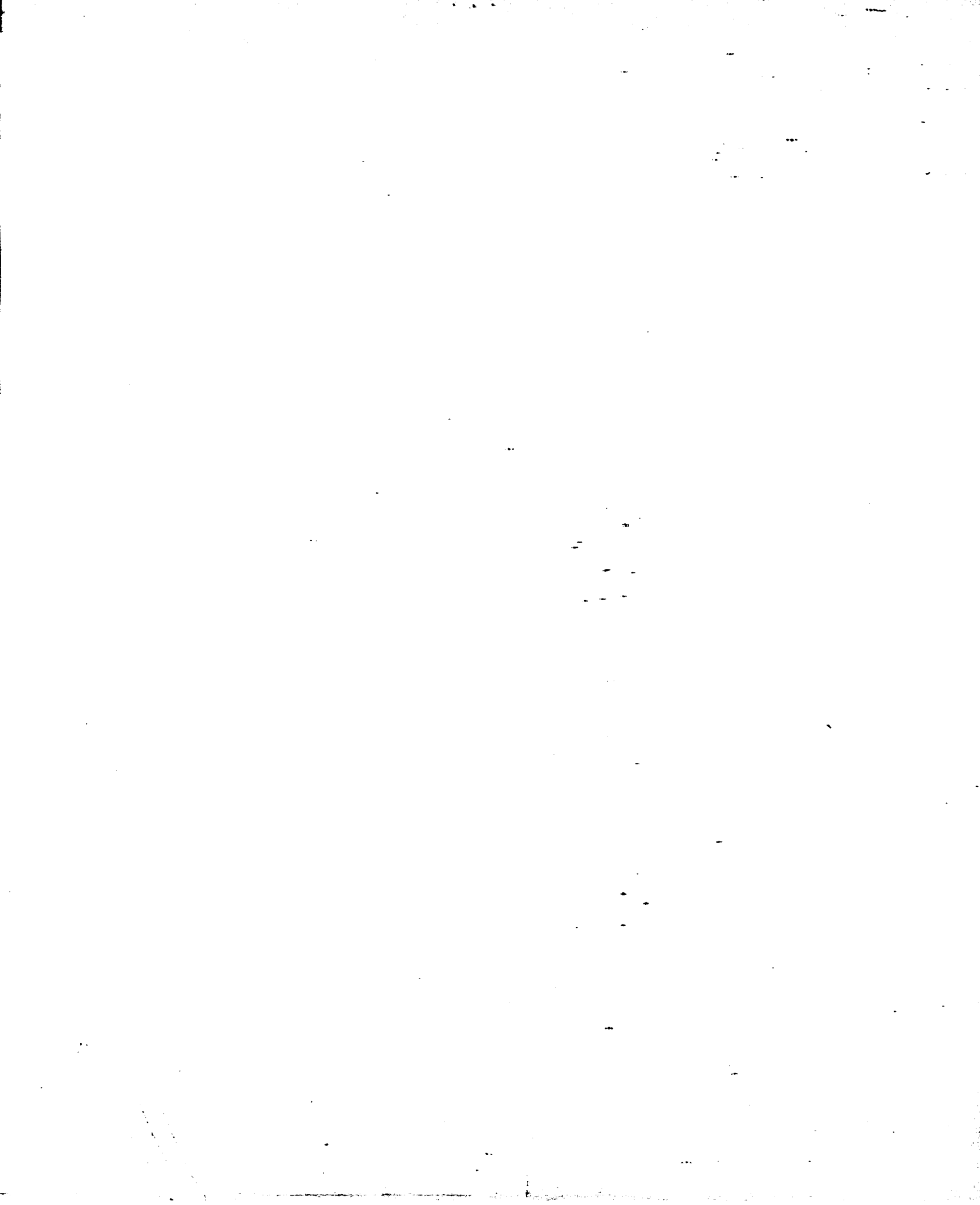


Reserve Phase

	Martin (1943), Martin & Rinaldo (1950a, 1950b), Martin et al. (1949, 1952, 1957); Bluhm (1957)	Danson (1957) Pinelawn, Upper San Francisco River, & Tularosa River-Apache Creek Regions	Bluhm (1960)
Phase	Reserve	Pueblo II (-Reserve)	Reserve
Date	A.D. 1000- ?	A.D. 900-1100	A.D. 1000-1100
Settlement	one extended family per hamlet (1950a) increased number of roomblocks & greater population density (1950a) N Pine LawnValley: flat areas next to watercourses (1943) S Pine LawnValley: low ridges/mesas along arroyos (1943)	ridges & benches immediately above the valleys, close to & overlooking valley increased number of house structures	clustered in open areas scattered storerooms single ceremonial room on edges of mesas bordering some farther up valley site area smaller than p
Architecture	pueblos: contiguous rooms; floors slightly semi-subterranean (1949) S Pine LawnValley: most small (4-6 rooms), some 8-12 rooms; N Pine LawnValley: 1-2 rooms (Bluhm 1957) pueblos (1950a): "crude" dry-laid, unshaped boulders with some flat-faced or tabular stone, rare coursing, copious mud mortar, some rubble & adobe core with boulder exterior; floors all semi-subterranean; 3-7 contiguous rooms, rectangular or L-shaped roomblock jacal construction (one site) some sites have associated pithouses Great Kivas (e.g. Higgins Flat & Sawmill; 1957)	Pueblos: boulder & adobe masonry, sometimes ashlar masonry (square/rectangular blocks); rooms average 3x4 m; 4-20 rooms per unit; plazas/courts (framed by rooms or single walls); possibly some jacal rooms, large 5x6 m Kivas (on some sites near roomblocks) Great Kiva, large, rectangular(1 poss in mid-upper Gila) many continued to be occupied or were reoccupied in later times	pueblos: smaller rooms, (average 12.4 sq. m); some roomblocks; 1-12 rooms masonry sites than pit ceremonial: very large (rectangular, jacal or ma
Entryway			ceremonial: long, wide, in
Postholes	none, beams laid on walls		
Features	firepits: none (1949); some rectangular, some slab-lined (1950a)		ceremonial: firepit, floor
Pottery	(1949) Reserve B/w Mimbres Boldface B/w (disappeared during Reserve) San Francisco Red Smudged Decorated Alma Rough Reserve Smudged Mimbres Neck-Corrugated Incised Corrugated (1950a) Indented Neck-Corrugated Plain Corrugated Reserve Indented-Corrugated Plain Corrugated Smudged	Reserve B/w Reserve Smudged brown ware corrugated brown wares incised corrugated brown wares Intrusive: Mimbres Boldface B/w Socorro B/w Puerco B/w Puerco B/r	very few sherds
Ground Stone	Metates: through trough Manos: beveled, rocker-bottomed Axes: 3/4-grooved, full-grooved Other ground stone: worked slabs, hoe fragments; rubbing stones, bowls, mortars		
Other Artifacts	Chipped stone: saws, points; knives, scrapers, choppers, drills Bone: awls, flakers Shell: bracelets		
Burials	interior, on or under floors in trash		



960)	Lekson (1992)
	Reserve
-1100	late A.D. 900s – late A.D. 1100s
<p>in open areas along watercourses</p> <p>storerooms</p> <p>monial room for multiple sites</p> <p>of mesas bordering the canyons</p> <p>er up valley slopes</p> <p>smaller than pithouse sites</p>	<p>clustered in a community pattern around central Great Kiva</p> <p>widely dispersed over landscape in river & creek valleys & in upland settings</p>
<p>smaller rooms, but variable</p> <p>12.4 sq. m); small, compact</p> <p>s; 1–12 rooms, average 5; more</p> <p>sites than pithouse sites</p> <p>: very large (when present),</p> <p>ar, jacal or masonry</p>	<p>pueblo-like structures: small, 4-8 room masonry</p>
: long, wide, inclined	
: firepit, floor grooves	
herds	Reserve B/w



Tularosa Phase

	Martin et al. (1957)	Danson (1957) Pinelawn, Upper San Francisco River, & Tularosa River-Apache Creek Regions	Bluhm (1960)
Phase	Tularosa	Pueblo III (-Tularosa)	Tularosa
Date	A.D. 1100-1250 (or A.D. 1220-1350†)	A.D. 1100-1300	A.D. 1100-1250/1300
Settlement	possibly on high ground or a defensible mesa near a spring or other good water supply	low benches overlooking valley farmland, or ridges & bluffs overlooking valley farmland, usually near edge decreased number of sites, but increased number of rooms per site	river valleys with dependable water ceremonial: scattered several mounds associated with large pueblo centers pueblos
Architecture	pueblos: "masonry of fairly high order" (p. 133); large conglomeration of rooms (50-100); 2-3 stories in height, roomblocks around plaza (U-shaped with wall at open end or roomblocks on 4 sides & central plaza) Great Kivas (e.g Higgins Flat) Kiva-pithouses within plaza, & possibly exterior to roomblocks	Pueblos: shaped & coursed sandstone & basalt masonry; large (10-75, or 20-100), multiple roomblocks; medium (6-10 rooms per unit); small 1-2 rooms per unit plazas/courts (framed by roomblocks or walls) Kivas (on large sites), multiple depressions Great Kivas: large, rectangular (less common)	pueblos: rooms average 14.8 sq ft
Entryway			
Postholes			
Features			
Pottery	Tularosa B/w Tularosa W/r Springerville Polychrome Tularosa Fillet Rim Tularosa Patterned Corrugated Reserve Indented Corrugated (Tularosa variety) Reserve B/w (decreased) St. Johns Polychrome* (occasional) Pinedale Polychrome Plain Corrugated* (decreased) present, but not diagnostic: Mimbres Boldface B/w* Mimbres Classic B/w* Red Neck-Corrugated	Tularosa B/w Tularosa W/r corrugated smudged corrugated Tularosa Fillet Rim Alma Plain/brown ware (less common) polished red ware (less common) Reserve B/w (probably from earlier occupation) Intrusive: Mimbres Classic B/w Chaco B/w Puerco B/w Puerco B/r Wingate B/r St. Johns Polychrome	
Ground Stone	Metates: through trough (often concave; increased); closed-end trough (decreased) Manos: rectangular; tabular beveled (increased); round manos (decreased) Axes: full-grooved, 3/4-grooved Mauls: full-grooved, 3/4-grooved Other ground stone: rectangular &/or painted stone bowls, stone hoes, painted slabs decreased # mortars & pestles, fewer polishing stones (decreased polished pottery)		
Other Artifacts	Chippedstone: points (replacement of all atlatl by bow & arrow), scrapers, choppers (fewer, replaced by grooved axes), flake knives Shell: abundant (some carved) Pipes: large		
Burials			

†Martin felt that the A.D. 1100-1250 range was too early, but admitted that the later age range was "based on a hunch" and that his colleagues did not agree (1957: 133).



	Lekson (1992)
	Tularosa
50/1300	late A.D. 1100s – early A.D. 1300s
with dependable water supply scattered several miles apart with large pueblo or group of	lower elevations in Mimbres Valley fewer pueblos, smaller population than Mimbres Classic many large Mimbres Classic sites occupied into post-Mimbres period (ceramic &/or architectural evidence)
s average 14.8 sq. m	adobe pueblos Apache Creek (early Tularosa): medium- sized pueblos, square kiva-like pit structures
	Chupadero B/w Playas Red El Paso Polychrome



	†Fitting (1972), ‡Lekson & Klinger (1972)	Mimbres Foundation (LeBlanc 1980, Anyon and LeBlanc 1984)	Lekson (1992)
Phase	Animas	Black Mountain	El Paso (Black Mountain)
Date	A.D. 1200–1300	A.D. 1175–1300	A.D. 1200–1300/1400
Settlement		concentrated along Mimbres River or near mouths of water courses aggregation located at elevations below pinyon/juniper belt precipitous population decline (Nelson & LeBlanc 1986)	lower elevations in Mimbres Valley fewer pueblos, smaller population than Mimbres Classic many large sites reoccupied or continuously occupied from the Mimbres Classic
Architecture		pueblos: puddled adobe walls with occasional small cobbles; footing trenches, plastered walls & floors; large rooms roomblock(s) & plaza; typically U-shaped around central plaza	
Entryway			
Postholes		1–2 (for primary beams) or none	
Features		firepits: small, shallow, circular, adobe-lined, or; raised rectangular platform (rare)	
Pottery	Playas Red Incised† St. Johns Polychrome† Chupadero B/w†‡ Three Rivers R/t†‡ El Paso Polychrome†‡ Jornada Brown† El Paso Brown† Gila Polychrome‡ Tonto Polychrome‡ Tucson Polychrome‡ Mimbres B/w‡ Mimbres Bold Face B/w‡ Tularosa B/w‡ Wingate B/r‡ Indented Corrugated‡ Tularosa Fillet Rim‡	plain brownwares corrugated textured wares Playas Red (polished; punched, tooled, cord marked) Ramos Black (polished) Ramos Polychrome Babicora Polychrome Tradewares: El Paso Polychrome Chupadero B/w Three Rivers R/t Tucson Polychrome (late) Gila Polychrome (late) Tonto Polychrome (late) Huerigos Polychrome (very rare) Villa Ahmada Polychrome (very rare) Corralitos Polychrome (very rare) Carretas Polychrome (very rare)	Chupadero B/w Playas Red El Paso Polychrome
Ground Stone			
Other Artifacts			
Burials		subfloor cremations interior subfloor, semiflexed decapitated skeltons (common?)	subfloor pit inhumations with "killed" bowl subfloor pit cremations in jars with upside down "killed" bowl covers

	Fitting (1972)	Mimbres Foundation (LeBlanc 1980; Nelson & LeBlanc 1986)	Lekson (1992)
Phase	Salado	Cliff	Salado
Date	A.D. 1300-1500	A.D. 1300-1450	A.D. 1300/late 1300s-
Settlement		higher elevation than Animas 12-250 rooms per site gradual population decline (Nelson & LeBlanc 1986)	fewer sites, thus smaller population than earlier phases population concentrated in Cliff Valley, Duck, & Mule Creeks; secondary movement to Mimbres Valley
Architecture	pueblos: adobe walls with vertical slab foundation; often multistoried	pueblos: adobe, cobbles set in adobe, with footing trenches & footing stones; walls better preserved than Animas (up to 2 m); very large rooms large sites freestanding walls enclosing compound/plaza	adobe pueblos
Entryway		roof entry internal wall (rare) external wall (very rare)	
Postholes			
Features		firepits: slab-lined, slab- and adobe-lined, adobe-lined (Nelson & LeBlanc 1986); slab, adobe-ringed, or unlined, large, some with firedogs (LeBlanc 1980) grinding complex: 2-3 metates on adobe stands with associated bowls embedded in floor (LeBlanc 1980)	
Pottery	Tonto Polychrome Gila Polychrome slipped redware	(Nelson & LeBlanc 1986) Playas Red (present in some sites, absent in others) Gila Polychrome Tonto Polychrome Ramos Polychrome (very rare) El Paso Polychrome (rare, but ubiquitous) Chupadero B/w Obliterated Corrugated interior smudging (black burnished) Zuni Glazed (rare)	Gila Polychrome Tonto Polychrome Pinto Polychrome smattering of Chihuahuan
Ground Stone			
Other Artifacts		in situ assemblages less turquoise & shell	
Burials		cremations (Nelson & LeBlanc 1986)	subfloor pit cremations in jars with upside down "killed" bowl covers

APPENDIX B

MOGOLLON CULTURE HISTORY INVENTORY: ONLY NEWLY REPORTED TRAITS

The following appendix is divided into ten tables. Each table includes only the traits newly reported by authors of a series of publications. Traits that were previously identified by another researcher have been eliminated from the tables.

Each table is arranged with trait categories in rows (Date, Settlement, Architecture, Entryway, Postholes, Features, Pottery, Ground Stone, Other Artifacts, Burials). Each column represents an author or group of authors and the publications from which trait data were collected. The number of columns in each table varies because some authors discuss only a few of the phases. The columns are arranged chronologically by date of publication(s). The references cited are listed at the end of this Appendix.

Pinelawn/Cumbre Phase

	Martin (1943), Martin & Rinaldo (1947, 1950a), Martin et al. (1952)	Wheat (1955)	Danson (1957) Pinelawn, Upper San Francisco River, & Tularosa River-Apache Creek Regions	Bluhm (1960)
Phase	Pinelawn	Mogollon I (-Pinelawn)	pre-Pueblo I (-Pinelawn)	Pine Lawn
Date	150 BC-A.D. 500	300/250 BC-A.D. 100	pre-A.D. 700	200 BC-A.D. 500
Settlement	many sites located on high and easily defended ridges (1950a)		well-back from edge, not overlooking valley	small sites close together or near a large site sedentary agricultural & hunting
Architecture	pithouses: rounded (1947) or irregular (1943) possibly ceremonial (1947): large, deep, kidney-shaped	pithouses: large (average 27.1 sq. m)		random arrangement of houses small & large sites (1-26 houses/site, 6 sites with >10 pithouses.) all houses may not have been occupied at the same time
Entryway	long (common), short (less common) ceremonial: short, steeply sloped	none (majority) long inclined (rare)		
Postholes	varying number & pattern (1943) 1-2 primary, varying number of secondary, unpatterned (1947)	center, center & marginal, marginal, quadrilateral, none roof possibly gabled		
Features	floor pits: deep, various sizes stone walls across most accessible approach			ceremonial: floor grooves
Pottery	Alma Plain Alma Rough San Francisco Red, Saliz var.		Alma Scored Alma Punctate Alma Smudged/ smudged brown Neck-Banded (may belong to later occupation) possible Intrusives: Lino. Gray La Plata B/g	
Ground Stone	Metates: basin, trough (with basin grinding area); trough metates & rectangular manos less numerous than milling stones (1947) Manos: disc, oval	Metates: slab Manos: uniface Mauls: grooved (common) Other groundstone: palettes (rare), mortars, pestles (abundant), bowls, pitted pebbles (common), worked slabs, polishing stones (abundant), abrading stones (abundant, some grooved), hoes, atl atl stones, balls, disc beads, pendants		



	Bullard (1962)	Fitting (1972)	Mimbres Foundation (LeBlanc 1980, Anyon et al. 1981)	Lekson (1992)
	Pine Lawn (-Mimbres Georgetown & Basketmaker III)	Brownware Phase	Early Pithouse (Cumbre)	Early Pit House (Cumbre/Pine Lawn & Georgetown)
	pre A.D. 700 (BM III A.D. 475-700)	200 BC-A.D. 400	A.D. 200-550	A.D. 300-
together or			large villages pinyon/juniper zone along well-watered streams; lower settings (rare) along water courses (1980: 128) some sites in accessible locations (those occupied into "Late Pithouse period)	pithouses: average 7; a few larger sites (>60 pithouses) larger sites have a few large pithouses (possibly communal or kivas)
of				
-26 with				
have the same				
oves			bell-shaped storage pits	
			red slip (not highly polished)/fugitive red wash (Anyon et al. 1981)	Saliz Red (thinly slipped or self-slipped redware) absence of later decorated or textured wares
			Metates: full trough Manos: two-hand	



Pinelawn/Cumbre Phase, cont.

	Martin (1943), Martin & Rinaldo (1947, 1950a), Martin et al. (1952)	Wheat (1955)	Danson (1957) Pinelawn, Upper San Francisco River, & Tularosa River-Apache Creek Regions	Bluhm (1960)
Phase	Pinelawn	Mogollon I (-Pinelawn)	pre-Pueblo I (-Pinelawn)	Pine Lawn
Other Artifacts	Chipped stone: flake knives (utilized flakes) Bone: awls (notched), pins Pipes: shouldered, tubular Beads Pendants Shell bracelets	Chipped stone: points, drills, scrapers, gravers, hand axes, core choppers Bone: needles, small short tubes, antler flakers, disc beads, dice, incised discs Pipes: stone, long & short cylindrical, long conical Shell: olivella beads, vermetus tubes, disc beads, pendants		
Burials	occasionally, sub-floor			



n (1960)	Bullard (1962)	Fitting (1972)	Mimbres Foundation (LeBlanc 1980, Anyon et al. 1981)	Lekson (1992)
Lawn	Pine Lawn (-Mimbres Georgetown & Basketmaker III)	Brownware Phase	Early Pithouse (Cumbre)	Early Pit House (Cumbre/Pine Lawn & Georgetown)



Georgetown Phase

	Haury (1936)	Martin & Rinaldo (1949, 1950a, 1950b), Martin et al. (1952)	Wheat (1955)	Danson (1957) Mimbres & Middle and Upper Gila Regions
Phase	Georgetown	Georgetown	Mogollon I (Georgetown)	pre-Pueblo I (-Georgetown)
Date	pre-A.D. 700	A.D. 500-700	A.D. 100-400	pre-A.D. 700
Settlement		"houses built in any choice spot, without an eye to defense" (1950a:566) dispersed, -rather than clustered (1950a)		
Architecture	pithouses: rounded with flat side ceremonial pithouses: same as domestic, but larger	smaller (1950a:566)	pithouses: medium (average 14.9 sq. m); deep (88 cm)	
Entryway	inclined entrance (on flat side)		long, narrow step-inclined (minority)	
Postholes	primary center post, secondary peripheral posts			
Features		floor pits (1950b): fewer or none	fire depressions (rare)	
Pottery	Alma Plain San Francisco Red Alma Punched (traces) Alma Scored (traces) Alma Neck-Banded (traces) Alma Neck-Corrugated (traces)	(1950b) Alma rough (scarce or none) textured (scarce or none)		
Ground Stone	Metates: basin		not reported separately from Mogollon I Pinelawn	
Other Artifacts	Pipes: clay		not reported separately from Mogollon I Pinelawn	
Burials			not reported separately from Mogollon I Pinelawn	



Mimbres Upper Gila	Bluhm (1960)	Bullard (1962)	Fitting (1972)	Mimbres Foundation (Anyon 1980, Anyon et al. 1981)	Lekson (1992)
	Georgetown	Georgetown (-Basketmaker III)	Georgetown	Late Pithouse (Georgetown)	Early Pit House (Cumbre/Pine Lawn & Georgetown)
	A.D. 500-700	pre-A.D. 700 (BM III A.D. 475-700)		A.D. 550-650	A.D. 300-
	some sites still on high mesas or ridges			close proximity to Early Pithouse sites population increase	pithouses: average 7 per site; a few larger sites (>60 pithouses) larger sites have a few large pithouses (possibly communal or kivas)
	random arrangement of 1-14 houses (average 6)				
				communal: earthen lobes near entry	
	ceremonial: floor grooves	subfloor pits: numerous, large (Pinelawn area)			
			a few crude R/gray		Saliz Red (thinly slipped or self-slipped redware) absence of later decorated or textured wares
				Metates: full trough	
				increased grave goods	



San Francisco Phase

	Haury (1936)	Martin & Rinaldo (1950a, 1950b), Martin et al. (1949, 1952, 1957)	Wheat (1955)	Danson (1957) Pinelawn, Upper San Francisco River, & Tularosa River-Apache Creek Regions
Phase	San Francisco	San Francisco	Mogollon III (San Francisco)	Pueblo I (-San Francisco & Three Circle)
Date	A.D. 700-900	A.D. 700-900	A.D. 600-900	A.D. 700-900
Settlement		"houses built in any choice spot, without an eye to defense" (1950a:566) dispersed, rather than clustered (1950a)		
Architecture	pithouses: rectangular, rounded corners, plastered ceremonial: pithouse, kidney-bean shaped (sides at entrance "drawn in")	pithouses: smaller than in Pine Lawn phase (1950a:566)	pithouses: large (Pine Lawn average 22.2 sq. m) or moderate (Mimbres average 15.0 sq. m); deep (Pine Lawn average 114 cm, Mimbres average 105 cm)	
Entryway	step &/or inclined ceremonial: inclined			
Postholes	center & midline auxiliary	or 4 corner or combination of midline & corner		
Features		floor pits: none or few wall niches extramural pits possibly ceremonial: firepit, deflector, ventilator, sipapu?	fire depressions stone-lined firepit (rare)	
Pottery	Mogollon R/b Three Circle R/w San Francisco Red Alma Neck-Banded Alma Scored Alma Punched Neck-Corrugated (trace) Alma Plain	Mimbres Boldface B/w (late: 1949) Reserve Smudged (1950b)		
Ground Stone	Metates: closed trough, basin Manos: rounded, not shaped Axes: none Mauls: full & 3/4-grooved Other groundstone: all weights		Metates: slab Manos: uniface & biface Axes: flaked (present), full-grooved (rare) Other groundstone: mortars, pestles, bowls, pitted pebbles, worked slabs, polishing stones, abrading stones, some grooved, hoes, balls, pendants	
Other Artifacts	Bone: awls (plain & notched), tubes Pipes: clay, long & short stone Cornucopia: cone-shaped clay Copper (worked) Shell (rare)		Chipped stone: points, knives, serrated knives, drills, gravers, core choppers (abundant) Bone: needles, antler flakers, disc beads, dice Shell: olivella beads, vermetus tubes, disc beads, pendants, thin bracelets	
Burials	exterior, flexed cremations (rare)			

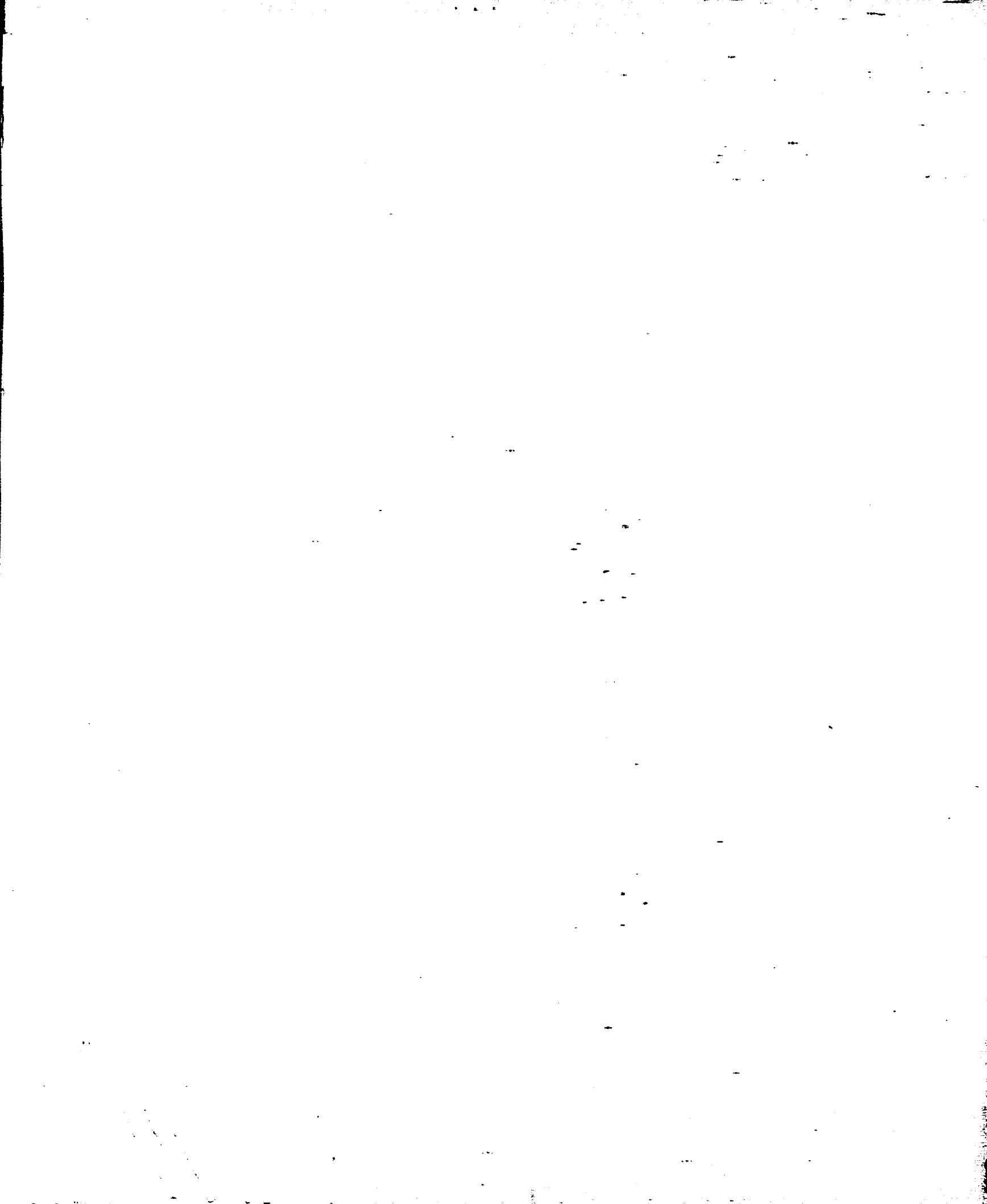


(1957) Pinelawn, San Francisco River, & River-Apache Creek	Bluhm (1960)	Bullard (1962)	Mimbres Foundation (Anyon 1980, Anyon et al. 1981)	Lekson (1992)
San Francisco & Three Circle	San Francisco/ Three Circle	San Francisco (-Pueblo I)	Late Pithouse (San Francisco)	Late Pit House (San Francisco, Three Circle)
900	A.D. 700-1000	A.D. 700-900	A.D. 650-750	A.D. 700-900
	possibly clustering along drainages near water & arable land		close proximity to Early Pithouse sites slow movement into side canyons & tributary valleys population increase	
	ceremonial: short or roof entry		communal: stylized lobes at interior end	
	ceremonial may have: floor grooves	flat hearthstone on entry side of firepit (Mimbres)	firepits: shallow (≤ 20 cm), oval or round, unlined or adobe-lined	
			San Lorenzo R/b	
			increased grave goods: none (majority), some with "killed" ceramics (smashed & scattered)	

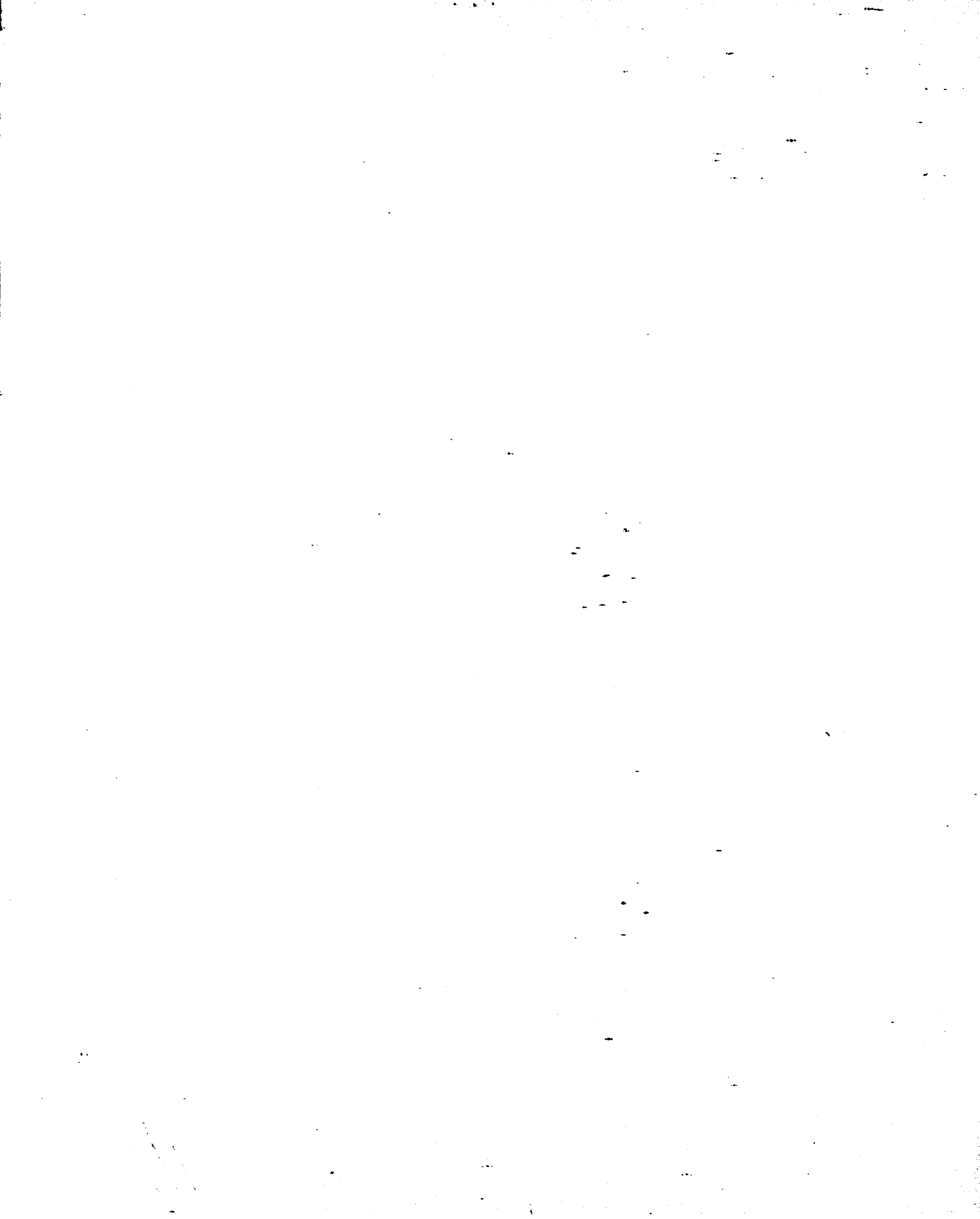


Three Circle Phase

	Haury (1936)	Martin & Rinaldo (1947, 1950a, 1950b), Martin et al. (1952, 1957)	Wheat (1955)	Danson (1957) Mimbres & Middle and Upper Gila Regions	Danson (1957) Upper & Tulare Creek
Phase	Three Circle	Three Circle	Mogollon IV (Three Circle)	Pueblo I (-San Francisco & Three Circle)	San Francisco & Three Circle
Date	A.D. 900-1000	A.D. 900-1000	A.D. 900-1000	A.D. 700-900	A.D. 700-900
Settlement		"houses built in any choice spot, without an eye to defense" (1950a:566) dispersed, rather than clustered (1950a) more villages and increased population density (1950a)			
Architecture	pithouses: rectangular, sharp corners, stone-lined, plastered walls ceremonial: pithouse, rectangular, sharp corners, plastered walls, semisubterranean	pithouses: or round; smaller than in Pine Lawn phase (1950a) kivas: square (1947) Great Kiva	pithouses: medium (~19 sq. m)		
Entryway	step/inclined ceremonial: inclined entry		long, inclined		
Postholes	corner posts		quadrilateral (33%) midline (10%) unknown (50-60%)		
Features		firepits (common, 1949) floor pits: few or none (1950b)	stone-lined firepits (rare)		
Pottery	Mimbres Boldface B/w Textured (primarily Alma Neck-Corrugated, Alma Punched, Alma Scored, Alma Neck-Banded) San Francisco Red Three Circle R/w Alma Plain	Mogollon R/b Alma rough Three Circle Neck-Corrugated, Reserve Smudged Reserve Fillet Rim (1950b)			
Ground Stone	Metates: trough, closed-trough (unshaped) Manos: 4-sided Axes: "crude" notched Mauls: full- & 3/4-grooved Other groundstone: slate palettes	Axes: grooved (1950b)	Metates: basin, slab - Manos: round uniface & biface, ovoid/rectangular uniface & biface Axes: 3/4-grooved (rare), full-grooved (rare) Mauls: less common than Mill Other groundstone: mortars, pestles, bowls, pitted pebbles, worked slabs, polishing stones, abrading stones, hoes (present), disc beads, pendants		

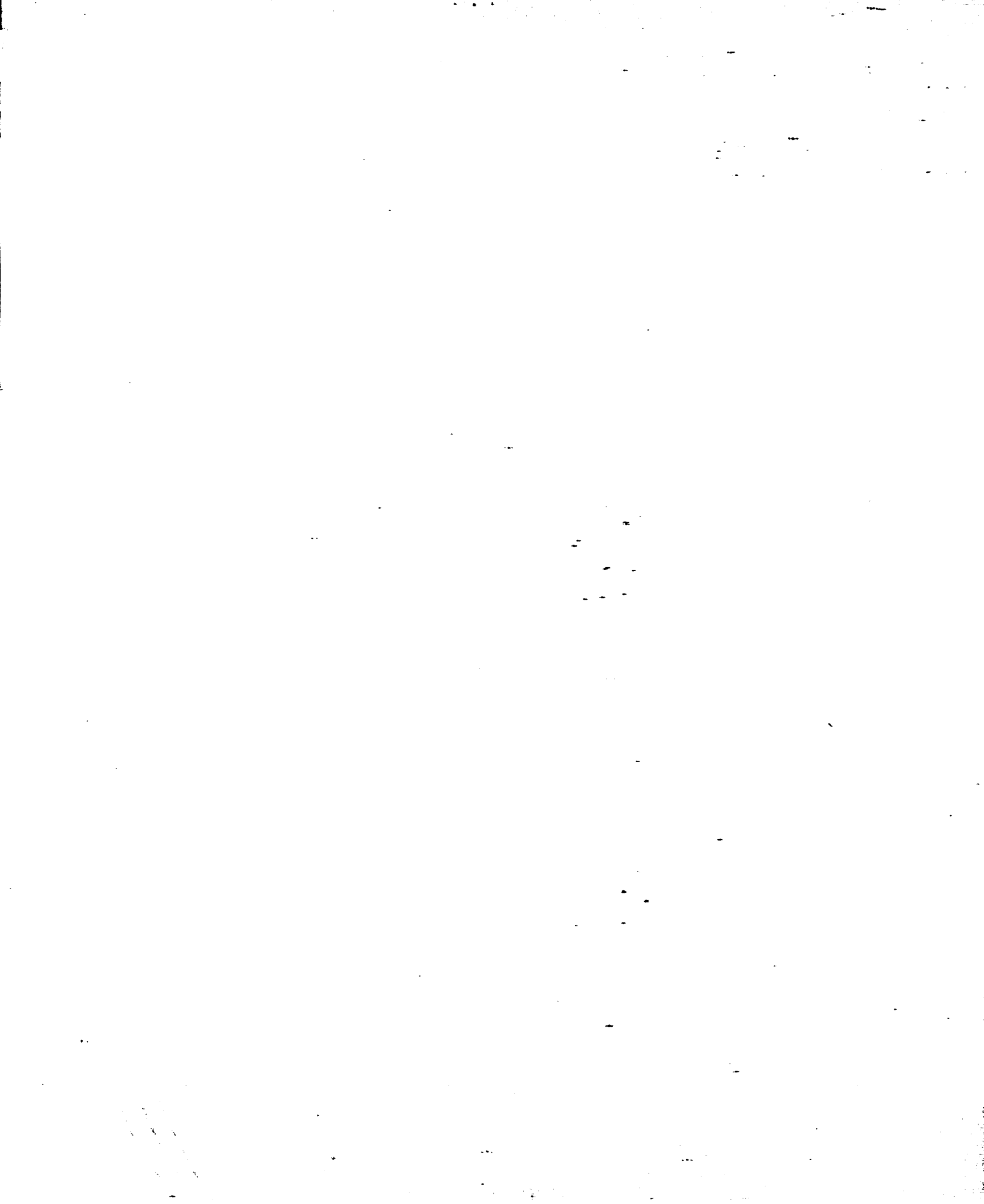


es a	Danson (1957) Pinelawn, Upper San Francisco River, & Tularosa River-Apache Creek Regions	Bluhm (1960)	Bullard (1962)	Mimbres Foundation (Anyon 1980, Anyon et al. 1981)	Lekson (1992)
	San Francisco/ Three Circle	San Francisco/ Three Circle	Three Circle (~early Pueblo II)	Late Pithouse (Three Circle)	Late Pit House (San Francisco, Three Circle)
	A.D. 700-900	A.D. 700-1000	A.D. 900-1100	A.D. 750-1000	A.D. 700-900
		possibly clustering along drainages near water & arable land		close proximity to Early Pithouse sites accelerated movement into side canyons & tributary valleys	
				pithouses: &square communal: very large on large sites	pithouses: deeper Great Kiva: on larger sites, ≥1 large pit structure
		ceremonial: short or roof entry			
			center (rare)	some center postholes have rock base	
		ceremonial may have: floor grooves, ventilator		firepits: oval or round unlined or adobe-lined; deep, rectangular, slab- lined large jars embedded in floor (occasional)	
			firepits (Mimbres): rectangular, some slab- lined ventilators (usually in pithouses with masonry- lined walls)	Transitional B/w (late)	
				Axes: 3/4- & full-grooved, polished.	



Three Circle Phase, cont.

	Haury (1936)	Martin & Rinaldo (1947, 1950a, 1950b), Martin et al. (1952, 1957)	Wheat (1955)	Danson (1957) Mimbres & Middle and Upper Gila Regions	Danson Upper San Francisco & Tularosa Creek Regions
Phase	Three Circle	Three Circle	Mogollon IV (Three Circle)	Pueblo I (-San Francisco & Three Circle)	San Francisco Three Circle
Other Artifacts	Bone: awls (plain, notched), dice Basketry: 2-rod & bundle Pipes: 2-piece, short clay; long & short stone		Chipped stone: points, knives, serrated knives, drills, core choppers Bone: needles, tubes (large), antler flakers, disc beads, incised discs Shell: olivella beads, disc beads, pendants, broad bracelets, thin bracelets		
Burials	exterior, flexed interior, flexed (first appearance, especially infants)				

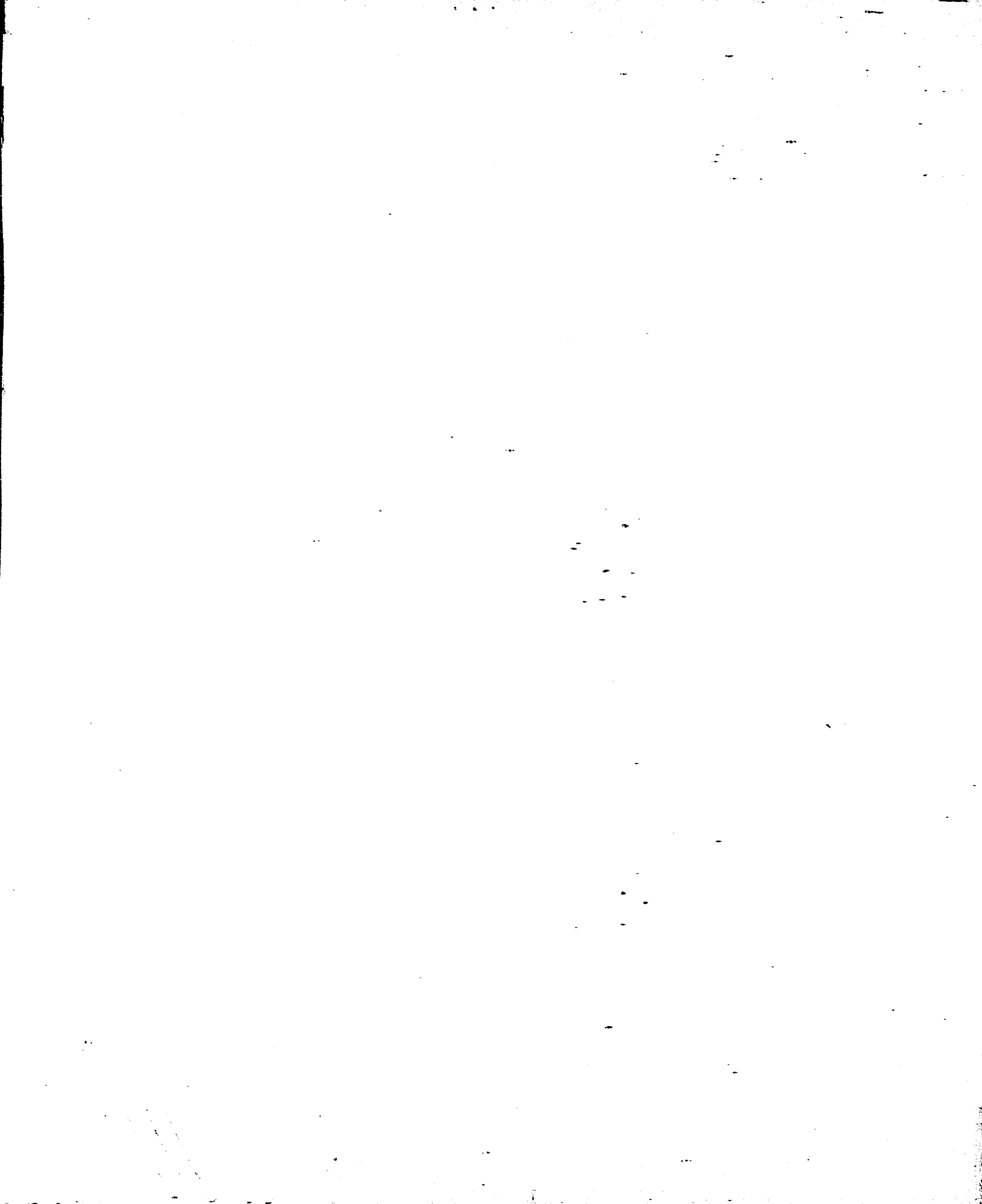


Mimbres Pit House	Danson (1957) Pinelawn, Upper San Francisco River, & Tularosa River-Apache Creek Regions	Bluhm (1960)	Bullard (1962)	Mimbres Foundation (Anyon 1980, Anyon et al. 1981)	Lekson (1992)
	San Francisco/ Three Circle	San Francisco/ Three Circle	Three Circle (~early Pueblo II)	Late Pithouse (Three Circle)	Late Pit House (San Francisco, Three Circle)
				possibly, rare cremation increased grave goods: ceramics (some "punch killed" bowls & handled pitchers); shell bracelets & beads, crystals, turquoise beads/pendants, palettes, manos, metates, points, stone beads	



Pithouse-to-Pueblo Transition

	Haury (1936)	Martin (1943:120)	Wheat (1954, 1955)	Danson (1957) Mimbres Region and Middle and U Gila Region
Phase	Pithouse-to-Pueblo Transition	Pithouse-to-Pueblo Transition	early Mogollon V (Mangas)	Pueblo II (~Mangas)
Date	A.D. 900-1000		A.D. 1000-1100	A.D. 900-1100
Settlement				high ridge/bluff overlooking valley, or bench immediately above valley bottom, or ridge overlooking creek
Architecture	pueblos: semi-subterranean (e.g. Mattocks) pithouses: contiguous, masonry-lined (e.g. Galaz)	pueblos: small, masonry rapid shift from pithouses to pueblos	pueblos: contiguous possibly jacal in Pinelawn	pueblos: river cobbles & boulders; medium sized (rooms), large rooms
Entryway				
Postholes				
Features				
Pottery		B/w textured		Mimbres Boldface B/w Three Circle R/w San Francisco Red Three circle Corrugated Alma Plain Reserve B/w
Ground Stone				
Other Artifacts				
Burials				



son (1957) Mimbres ion and Middle and Upper Region	Fitting (1972)	Lekson (1992)
to II (-Mangas)	Mangus/ post-Brownware	Mangas
900-1100	A.D. 700-1000	A.D. 900 -1050
ridge/bluff overlooking y, or a immediately above y bottom, or overlooking creek		
os: river cobbles & ers; medium sized (5-8 s), large rooms	&large pueblos	jacal surface architecture (cf. Chapman, Gossett, & Gossett 1985)
		surface postholes (cf. Shafer & Taylor 1986)
es Boldface B/w Circle R/w rancisco Red circle Corrugated Plain ve B/w		Mimbres Transitional B/w (Style II)



Mimbres Classic Phase

	Haury (1936)	Danson (1957) Mimbres & Middle - and Upper Gila Regions	Fitting (1972)
Phase	Mimbres	Pueblo III (-Mimbres)	Mimbres Classic
Date	A.D. 1000-	A.D. 900-1100	A.D. 1000-1200
Settlement		low bench above stream; flat bluff overlooking valley bottom	
Architecture	pueblos: single story, masonry ceremonial: rectangular pithouse	pueblos: cobble & abundant adobe mortar; medium (14 rooms); large (≥100 rooms) with multiple roomblocks Great Kiva	
Entryway	ceremonial: inclined entry		
Postholes			
Features	ceremonial: vent shaft		
Pottery	Mimbres B/w San Francisco Red Alma Plain Mimbres Corrugated	Mimbres Classic B/w (dominant) Mimbres Boldface B/w (less common) assoc. with earlier occupations: Mogollon R/b Three Circle R/w	Intrusive: El Paso Polychrome Chupadero B/w Three Rivers R/t St. Johns Polychrome
Ground Stone	Metates: full-trough (often shaped) Manos: 4-sided Axes: 3/4-grooved, fewer full-grooved Mauls: 3/4-grooved & fewer full-grooved Other groundstone: slate palettes, notched stones		
Other Artifacts	Bone: awls (plain, notched, some with rounded heads), dice Pipes: 1-piece shaped clay; long stone Copper bells Shell: more common, more varied, more species		
Burials	interior, flexed exterior (occasional) cremations (rare)		50% cremations in Classic Mimbres vessels



	Mimbres Foundation (Anyon 1980, Gilman 1980, LeBlanc 1980, Anyon et al. 1981)	Lekson (1992)
	Mimbres Classic	Mimbres Classic
	A.D. 1000–1150	A.D. 1050–1130/50
	accelerated population increase (Anyon 1980) movement into areas less desirable for agriculture large sites (≥ 100 rooms; grew in situ from large Late Pithouse sites) medium-sized sites (~20, or 10–40, or 20–75 rooms; distributed between large sites or along secondary drainages) small sites (<10–15 rooms; seasonal farming stations near arable land)	more sites Outside Mimbres Valley: away from major creeks clusters of sites over several sq. miles with central Great Kiva population concentrated in the Transitional zone between uplands & basin-and-range desert; these zones were also occupied, but more sparsely
	pueblos: some one-room sites larger rooms along Mimbres River & major tributaries communal/ceremonial: semisubterranean with masonry, or large surface masonry rooms; both near roomblock or contiguous and with one exterior wall	small roomblocks (4–5 rooms) grew by accretion into pueblos of up to 20Q rooms Outside Mimbres Valley: small roomblock & pit structure
	roof entry	
	communal: partially or wholly recessed roof support posts	
		diversion irrigation features: irrigation canals, check dams, terraces
	Transitional B/w Obliterated Clapboard Corrugated Incised, Scored, Punched (uncommon)	
	possibly more "exotic" lithic raw materials (chert, jasper, quartzite, obsidian) possibly more shell	
Classic Mimbres	flexed or semiflexed on back or side oval pits increased grave goods: punch-killed vessel (abundant), groundstone, shell, & turquoise	some subfloor pit cremations in jars with upside down "killed" bowl covers

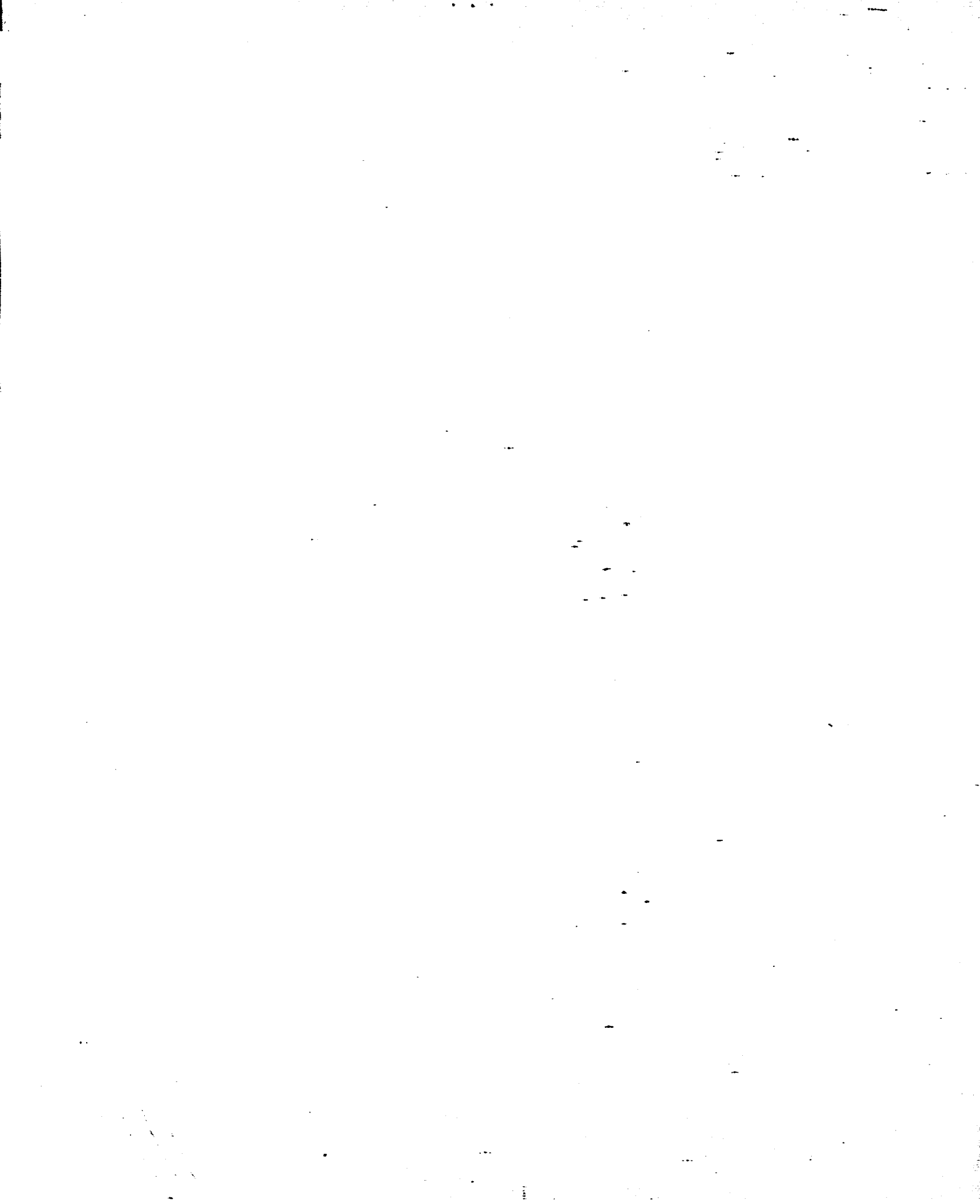


Reserve Phase

	Martin (1943), Martin & Rinaldo (1950a, 1950b), Martin et al. (1949, 1952, 1957); Bluhm (1957)	Danson (1957) Pinelawn, Upper San Francisco River, & Tularosa River-Apache Creek Regions	Bluhm (1960)
Phase	Reserve	Pueblo II (~Reserve)	Reserve
Date	A.D. 1000- ?	A.D. 900-1100	A.D. 1000-1100
Settlement	one extended family per hamlet (1950a) increased number of roomblocks and greater population density (1950a) N Pine Lawn Valley: flat areas next to watercourses (1943) S Pine Lawn Valley: low ridges/mesas along arroyos (1943)		on edges of mesas bordering some farther up valley slopes site area smaller than pithouses
Architecture	pueblos: contiguous rooms; floors slightly semi-subterranean (1949) S Pine Lawn Valley: most small (4-6 rooms), some 8-12 rooms; N Pine Lawn Valley: 1-2 rooms (Bluhm 1957) pueblos (1950a): "crude" dry-laid, unshaped boulders with some flat-faced or tabular stone, rare coursing, copious mud mortar; some rubble & adobe core with boulder exterior; floors, all semi-subterranean; 3-7 contiguous rooms, rectangular or L-shaped roomblock jacal construction (one site) some sites have associated pithouses Great Kivas (e.g. Higgins Flat & Sawmill; 1957)		pueblos: smaller rooms, but (average 12.4 sq. m) ceremonial: very large, rectangular masonry
Entryway			ceremonial: long, wide, inclined
Postholes	none, beams laid on walls		
Features	firepits: none (1949); some rectangular, some slab-lined (1950a)		ceremonial: firepit, floor grooves
Pottery	(1949) Reserve B/w Mimbres Boldface B/w (disappeared during Reserve) San Francisco Red Smudged Decorated Alma Rough Reserve Smudged Mimbres Neck-Corrugated Incised Corrugated (1950a) Indented Neck-Corrugated Plain Corrugated Reserve Indented-Corrugated Plain Corrugated Smudged	Intrusive: Socorro B/w Puerco B/w Puerco B/r	very few sherds
Ground Stone	Metates: through trough Manos: beveled, rocker-bottomed Axes: 3/4-grooved, full-grooved Other groundstone: worked slabs, hoe fragments; rubbing stones, bowls, mortars		
Other Artifacts	Chipped stone: saws, points; knives, scrapers, choppers, drills Bone: awls, flakers Shell: bracelets		
Burials	interior, on or under floors in trash		



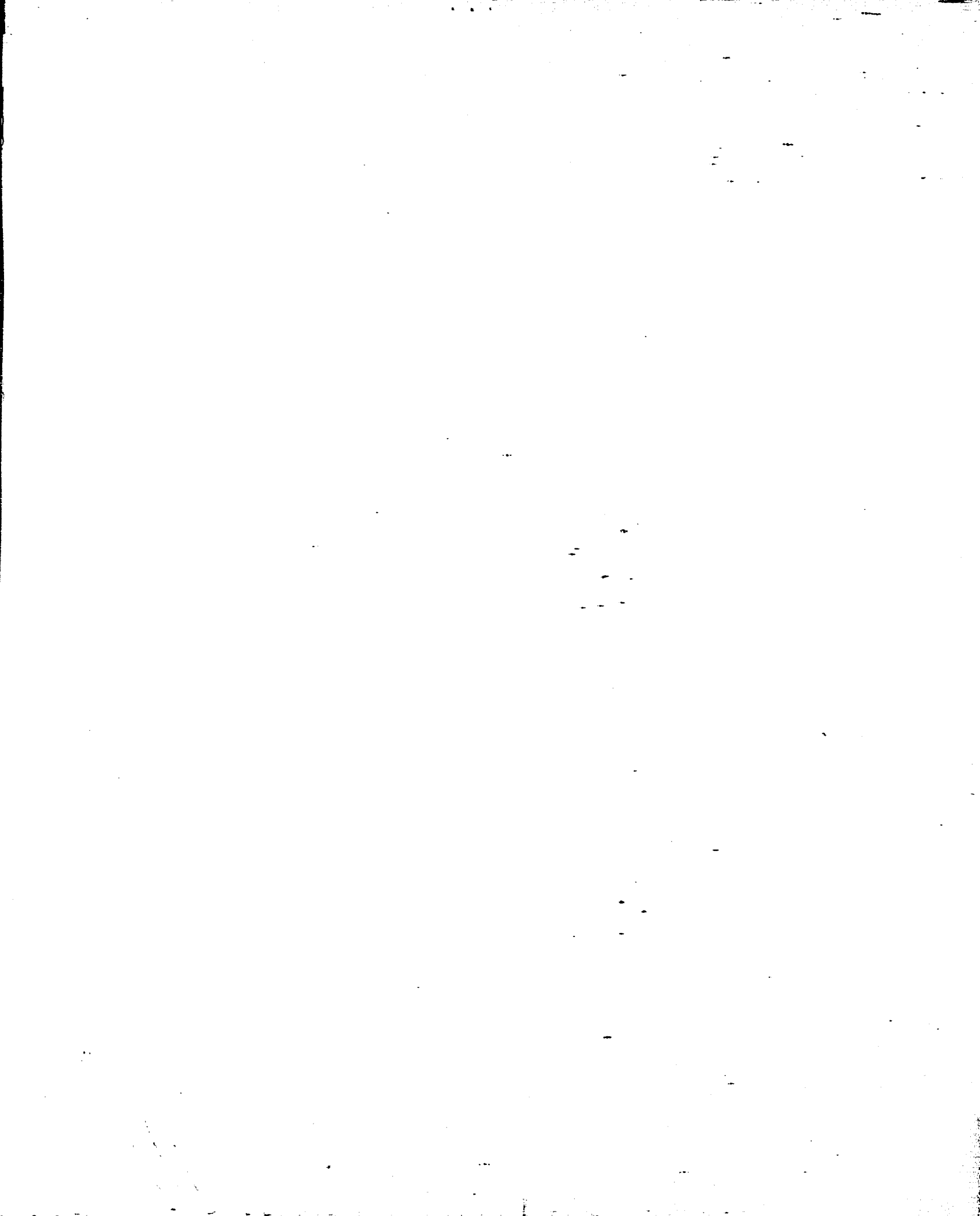
60)	Lekson (1992)
	Reserve
1100	late A.D. 900s – late A.D. 1100s
f mesas bordering the canyons er up valley slopes smaller than pithouse sites	
smaller rooms, but variable (2.4 sq. m) very large, rectangular, jacal or	
long, wide, inclined	
firepit, floor grooves	
erds	



Tularosa Phase

	Martin et al. (1957)	Danson (1957) Pinelawn, Upper San Francisco River, & Tularosa River-Apache Creek Regions	Bluhm (1960)
Phase	Tularosa	Pueblo III (~Tularosa)	Tularosa
Date	A.D. 1100-1250 (or A.D. 1220-1350 [†])	A.D. 1100-1300	A.D. 1100-1250/1300
Settlement	possibly on high ground or a defensible mesa near a spring or other good water supply	low benches overlooking valley farmland, or; ridges & bluffs overlooking valley farmland, usually near edge decreased number of sites, but increased number of rooms per site	river valleys with dependable water supply ceremonial: scattered several miles apart assoc. with large pueblo or group of pueblos
Architecture	pueblos: "masonry of fairly high order" (p. 133); large conglomeration of roomblocks around plaza (U-shaped with wall at open end or roomblocks on 4 sides & central plaza) Great Kivas (e.g. Higgins Flat) Kiva-pithouses within plaza, and possibly exterior to roomblocks		pueblos: rooms average 14.8 sq. m
Entryway			
Postholes			
Features			
Pottery	Tularosa B/w Tularosa W/r Springerville Polychrome Tularosa Fillet Rim Tularosa Patterned Corrugated Reserve Indented Corrugated (Tularosa variety) Reserve B/w (decreased) St. Johns Polychrome (occasional) Pinedale Polychrome Plain Corrugated (decreased) present, but not diagnostic: Mimbres Boldface B/w Mimbres Classic B/w Red Neck-Corrugated	Reserve B/w (probably from earlier occupation) Intrusive: Chaco B/w Puerco B/w Puerco B/r Wingate B/r St. Johns Polychrome	
Ground Stone	Metates: through trough (often concave; increased); closed-end trough (decreased) Manos: rectangular; tabular beveled (increased); round manos (decreased) Axes: full-grooved, 3/4-grooved Mauls: full-grooved, 3/4-grooved Other groundstone: rectangular &/or painted bowls, hoes, painted slabs, decreased mortars & pestles, fewer polishing stones (decreased polished pottery)		
Other Artifacts	Chipped stone: points (replacement of atlatl by bow & arrow), scrapers, choppers (fewer, replaced by grooved axes), flake knives Shell: abundant (some carved) Pipes: large		
Burials			

[†] Martin felt that the A.D. 1100-1250 range was too early, but admitted that the later age range was "based on a hunch" and that his colleagues did not agree.



	Lekson (1992)
	Tularosa
00	late A.D. 1100s – early A.D. 1300s
pendable water	
d several miles apart ueblo or group of	
age 14.8 sq. m	Apache Creek (early Tularosa): medium-sized pueblos, square kiva-like pit structures

his colleagues did not agree (1957: 133).



	†Fitting (1972), ‡Lekson & Klinger (1972)	Mimbres Foundation (LeBlanc 1980, Anyon and LeBlanc 1984)	Lekson (1992)
Phase	Animas	Black Mountain	El Paso (Black Mountain)
Date	A.D. 1200–1300	A.D. 1175–1300	A.D. 1200–1300/1400
Settlement		concentrated along Mimbres River or near mouths of water courses aggregation located at elevations below pinyon/juniper belt precipitous population decline (Nelson & LeBlanc 1986)	fewer pueblos many large sites reoccupied or continuously occupied from the Mimbres Classic
Architecture		pueblos: puddled adobe walls with occasional small cobbles; footing trenches, plastered walls & floors; large rooms roomblock(s) & plaza; typically U-shaped around central plaza	
Entryway			
Postholes		1–2 (for primary beams) or none	
Features		firepits: small, shallow, circular, adobe-lined, or; raised rectangular platform (rare)	
Pottery	Playas Red Incised† St. Johns Polychrome† Chupadero B/w†‡ Three Rivers R/t†‡ El Paso Polychrome†‡ Jornada Brown† El Paso Brown† Gila Polychrome‡ Tonto Polychrome‡ Tucson Polychrome‡ Mimbres B/w‡ Mimbres Bold Face B/w‡ Tularosa B/w‡ Wingate B/r‡ Indented Corrugated‡ Tularosa Fillet Rim‡	plain brownwares corrugated textured wares Playas Red (polished; punched, tooled, cord marked) Ramos Black (polished) Ramos Polychrome Babicora Polychrome Huerigos Polychrome (very rare) Villa Ahumada Polychrome (very rare) Corralitos Polychrome (very rare) Carretas Polychrome (very rare)	
Ground Stone			
Other Artifacts			
Burials		subfloor cremations interior subfloor, semiflexed decapitated skeletons (common?)	subfloor pit inhumations with "killed" bowl subfloor pit cremations in jars with upside down "killed" bowl covers

	Fitting (1972)	Mimbres Foundation (LeBlanc 1980; Nelson & LeBlanc 1986)	Lekson (1992)
Phase	Salado	Cliff	Salado
Date	A.D. 1300-1500	A.D. 1300-1450	A.D. 1300/late 1300s-
Settlement		higher elevation than Animas 12-250 rooms per site gradual population decline (Nelson & LeBlanc 1986)	fewer sites population concentrated in Cliff Valley, Duck, & Mule Creeks; secondary movement to Mimbres Valley
Architecture	pueblos: adobe walls with vertical slab foundation; often multistoried	pueblos: adobe, cobbles set in adobe; footing trenches; walls better preserved than Animas; very large rooms large sites freestanding walls enclosing compound/plaza	
Entryway		roof entry internal wall (rare) external wall (very rare)	
Postholes			
Features		firepits: slab-lined, slab- & adobe-lined, adobe-lined (Nelson & LeBlanc 1986); slab, adobe-ringed, or unlined, large, some with firedogs (LeBlanc 1980) grinding complex: 2-3 metates on adobe stands with associated bowls embedded in floor (LeBlanc 1980)	
Pottery	Tonto Polychrome Gila Polychrome slipped redware	(Nelson & LeBlanc 1986) Playas Red (present in some sites, absent in others) Ramos Polychrome (very rare) El Paso Polychrome (rare, but ubiquitous) Chupadero B/w Obliterated Corrugated interior smudging (black burnished) Zuni Glazed (rare)	Pinto Polychrome smattering of Chihuahuan
Ground Stone			
Other Artifacts		in situ assemblages less turquoise & shell	
Burials		cremations (Nelson & LeBlanc 1986)	subfloor pit cremations in jars with upside down "killed" bowl covers

References Cited in Appendices A and B

Anyon, Roger

- 1980 The Late Pithouse Period. In, *An Archaeological Synthesis of South-Central and Southwestern New Mexico*, by S. A. LeBlanc and M. E. Whalen, pp. 143-204. Office of Contract Archaeology, University of New Mexico. Albuquerque, New Mexico.

Anyon, Roger, Patricia A. Gilman, and Steven A. LeBlanc

- 1981 A Reevaluation of the Mogollon-Mimbres Archaeological Sequence. *Kiva*, 46(4): 209-225.

Anyon, Roger, and Steven A. LeBlanc

- 1984 *The Galaz Ruin: A Prehistoric Village in Southwestern New Mexico*. Maxwell Museum of Anthropology, University of New Mexico, Albuquerque.

Bluhm, Elaine

- 1957 The Sawmill Site: A Reserve Phase Village, Pine Lawn Valley Western New Mexico. *Fieldiana: Anthropology* 47(1). Chicago, Illinois.

- 1960 Mogollon Settlement Patterns in Pine Lawn Valley, New Mexico. *American Antiquity* 25(4): 538-546.

Bullard, William R. Jr.

- 1962 The Cerro Colorado Site and Pithouse Architecture in the Southwestern United States Prior to A.D. 900. *Papers of the Peabody Museum of Archaeology and Ethnology* 44(2), Harvard University, Cambridge, Massachusetts.

Danson, Edward B.

- 1957 An Archaeological Survey of West Central New Mexico and East Central Arizona. *Papers of the Peabody Museum of Archaeology and Ethnology*, 44(1). Harvard University, Cambridge, Massachusetts.

Fitting, James E.

- 1972 Preliminary Notes on Cliff Valley Settlement Patterns. *The Artifact*, 10(4):15-30.

Gilman, Patricia A.

- 1980 The Early Pueblo Period: Classic Mimbres. In, *An Archaeological Synthesis of South-Central and Southwestern New Mexico*, by S. A. LeBlanc and M. E. Whalen, pp. 205-270. Office of Contract Archaeology, University of New Mexico. Albuquerque, New Mexico.

Haury, Emil W.

- 1936 *The Mogollon Culture of Southwestern New Mexico*. Medallion Papers, No. 20. Gila Pueblo, Globe, Arizona.

LeBlanc, Steven A.

- 1980a The Early Pithouse Period. In, *An Archaeological Synthesis of South-Central and Southwestern New Mexico*, by S. A. LeBlanc and M. E. Whalen, pp. 119-141. Office of Contract Archaeology, University of New Mexico, Albuquerque.

- 1980b The Post Mogollon Periods in Southwestern New Mexico: the Animas/Black Mountain Phase and the Salado Period. In, *An Archaeological Synthesis of South-Central and Southwestern New Mexico*, by S. A. LeBlanc and M. E. Whalen, pp. 271-316. Albuquerque, New Mexico.

Lekson, Stephen H.

- 1992 *Archaeological Overview of Southwestern New Mexico*. Prepared for New Mexico State Historic Preservation Division, Santa Fe, New Mexico. Submitted by Human Systems Research, Las Cruces, New Mexico.

Lekson, Stephen H., and Timothy Klinger

- 1973 Villareal II: Preliminary Notes on an Animas Phase Site in Southwestern New Mexico. *Awanyu* 1(2):33-38.

Martin, Paul S.

- 1943 The SU Site Excavations at a Mogollon Village Western New Mexico: Second Season, 1941. *Anthropological Series, Field Museum of Natural History*, 32(2): 101-267.

Martin, Paul S., and John B. Rinaldo

- 1947 The SU Site: Excavations at a Mogollon Village, Western New Mexico, 1946. *Anthropological Series, Field Museum of Natural History*, 32(3): 275-382. Chicago, Illinois.

- 1950a Sites of the Reserve Phase, Pine Lawn Valley, Western New Mexico. *Fieldiana: Anthropology* 38(3). Chicago, Illinois.

1950b Turkey Foot Ridge Site: A Mogollon Village, Pine Lawn Valley, Western New Mexico. *Fieldiana: Anthropology* 38(2). Chicago, Illinois.

Martin, Paul S., John B. Rinaldo, and Ernst Antevs

1949 Cochise and Mogollon Sites, Pine Lawn Valley, Western New Mexico. *Fieldiana: Anthropology* 38(1). Chicago, Illinois.

Martin, Paul S., John B. Rinaldo and Eloise R. Barter

1957 Late Mogollon Communities: Four Sites of the Tularosa Phase, Western New Mexico. *Fieldiana: Anthropology* 49(1). Chicago, Illinois.

Martin, Paul S., John B. Rinaldo, Elaine A. Bluhm, Hugh C. Cutler, and R. Grange, Jr.

1952 Mogollon Cultural Continuity and Change: The Stratigraphic Analysis of Tularosa and Cordova Caves. *Fieldiana: Anthropology* 40.

Nelson, Ben A., and Steven A. LeBlanc

1986 *Short Term Sedentism in the American Southwest: the Mimbres Valley Salado*. The Maxwell Museum, University of New Mexico. Albuquerque, New Mexico.

Wheat, Joe Ben

1954 Southwestern Cultural Interrelationships and the Question of Area Co-tradition. *American Anthropologist* 56: 576-591.

1955 *Mogollon Culture Prior to A.D. 1000*. Memoirs of the Society for American Archaeology 10. Memoirs of the American Anthropological Association 82.

CURRICULUM VITAE

Angela R. Linse

Address Center for Instructional Development and Research
University of Washington
Box 351725
Seattle, WA 98195-1725

P.O. Box 45673
Seattle, WA 98145-0673

Telephone Office: (206) 543-6588
Home: (425) 603-0175
E-Mail: linse@u.washington.edu

EDUCATION

- 1999 Ph.D. Department of Anthropology, University of Washington, Seattle
"Settlement Change Documentation and Analysis: A Case Study from the Mogollon Region of the American Southwest"
- 1995 Visiting Scholar, Museum of New Mexico, Laboratory of Anthropology, Archaeological Archives, Santa Fe
- 1991 Ph.D. Candidate, Department of Anthropology, University of Washington
- 1989 M.A., Department of Anthropology, University of Washington
"Bone Preservation and Diagenesis in Alkaline Archaeological Deposits"
- 1989 Visiting Graduate Student, University of Wisconsin, Departments of Anthropology and Geography, Madison
- 1986 B.A., Anthropology with Distinction, Cum Laude, University of Washington, Seattle. Senior Honors Thesis: "A Study of Abrasion Orientation and its Relation to Bone Tool Manufacture and Usewear"

GRANTS / HONORS / AWARDS

- 1999 Fellow, Preparing Future Faculty Program, Summer Working Conference
- 1997 Crook Fellowship, Graduate School, University of Washington

GRANTS / HONORS / AWARDS, cont.

- 1996 Huckabay Teaching Fellowship, Graduate School, University of Washington
- 1996 Nominee, Dissertation Fellowship, University of Washington
- 1994 Niles Fellowship, Department of Anthropology, University of Washington
- 1993 "Anthropology Curriculum for Human Prehistory" National Science Foundation, Undergraduate Curriculum and Course Development. Awarded \$73,730 February 1993. (with J. Stein and J. Green)
- 1987-1990 Graduate Fellowship Recipient, National Science Foundation Fellowship Competition
- 1990 Student Paper Award, Archaeological Geology Division, Geological Society of America
- 1988 Education Grant, Explorer's Club Youth Activity Fund
- 1986 Phi Beta Kappa
- 1985 Certificate of High Scholarship, University of Washington

INSTRUCTIONAL DEVELOPMENT

- August 1999 - June 1999 Post-Doctoral Fellow and Instructional Consultant
Preparing Future Faculty Project
The Graduate School
University of Washington
- June 1997 - June 1999 Instructional Consultant
Center for Instructional Development and Research
University of Washington

TEACHING EXPERIENCE

All teaching appointments are with the Department of Anthropology, University of Washington, unless otherwise stated.

- June 1999 - August 1999 Instructor
World Prehistory
- September 1996 - March 1997 Teaching Assistant
Statistical Inference in Applied Research
Center for Quantitative Science, University of Washington
- January - March 1996 Teaching Assistant
Analysis of Ceramic Artifacts

TEACHING EXPERIENCE, cont.

- September 1995 - June 1996 Instructor
Undergraduate Independent Study
(working with former field school students on
research projects)
- September - December 1995 Teaching Assistant
Analysis of Archaeological Data (introductory
laboratory)
- June - August 1995 Instructor
World Prehistory
- March - June 1995 Instructor
World Prehistory
- June - August 1994 Instructor
Mogollon Highlands Archaeological Field
School
Gila National Forest, Glenwood, NM
- March - June 1994 Instructor
Principles of Archaeology
(introduction to archaeology)
- January - March 1994 Instructor
Principles of Archaeology
- September 1993 - June 1994 Instructor
Undergraduate Independent Study
- September - December 1993 Teaching Assistant
Geoarchaeology
- June - August 1993 Instructor
Mogollon Village Archaeological Field School
Gila National Forest, Glenwood, NM
- September 1992 - June 1993 Instructor
Introduction to Anthropology
- September 1991 - June 1992 Lead Teaching Assistant, Anthropology
TA training, co-instructor for "Effective
Teaching of Anthropology," TA supervision,
curriculum development, lectures, NSF
curriculum development grant

TEACHING EXPERIENCE, cont.

March - May 1991	Research Assistant Entry Level Initiative Curriculum Development Program Curriculum development for introductory anthropology courses
January - March 1991	Teaching Assistant Introduction to World Prehistory
September - December 1990	Teaching Assistant Analysis of Biological Remains
June - August 1990	Teaching Assistant Washington State University Field School Burnt Mesa Pueblo, Bandelier National Monument, NM
June - August 1989	Teaching Assistant Washington State University Field School Burnt Mesa Pueblo, Bandelier National Monument, NM
June - August 1988	Teaching Assistant University of New Mexico Field School SU Site, Reserve, NM

FIELD and LAB EXPERIENCE

June 1996	Project Archaeologist Vashon-Maury Island Archaeological Project Burke Museum, University of Washington
June-August 1994	Instructor/Director Mogollon Highlands Field School Gila National Forest, Glenwood NM Department of Anthropology, University of Washington
June-August 1993	Instructor/Director Mogollon Village Field School Gila National Forest, Glenwood NM Department of Anthropology, University of Washington

FIELD and LAB EXPERIENCE, cont.

June - September 1992 Field Director
Southwest Archaeological Consultants
Santa Fe, NM

June - September 1991 Crew Chief
Southwest Archaeological Consultants
Santa Fe, NM

May - June 1991 Field Director
Bandelier Archaeological Excavation Project
Shokkaha Pueblo,
Bandelier National Monument, NM
Department of Anthropology,
Washington State University

June - August 1990 Field Supervisor
Bandelier Archaeological Excavation Project
Washington State University Field School
Burnt Mesa Pueblo, Bandelier National
Monument, NM.

August 1990 Assistant
Chaco Canyon Wood Project
Chaco Canyon National Historic Park, NM

June - August 1989 Crew Chief and Teaching Assistant
Bandelier Archaeological Excavation Project,
WSU Field School
Burnt Mesa Pueblo,
Bandelier National Monument, NM
Department of Anthropology,
Washington State University

July 1989 Assistant
Chaco Canyon Wood Project
Chaco Canyon National Historic Park, NM

July 1989 Geoarchaeological Consultant
Mogollon Village Archaeological Project
Gila National Forest, Glenwood, NM

August 1989 Archaeomagnetic Field Assistant
Rio Rancho Site, Albuquerque, NM

May - July 1988 Teaching Assistant
University of New Mexico Field School
SU Site, Reserve, NM

FIELD and LAB EXPERIENCE, cont.

- October 1987- May 1988 Research Assistant
University of Washington, Seattle, WA
San Juan Island Archaeological Project (SJIAP)
- June - July 1987 Crew Chief
The Museum, Texas Tech University, Lubbock, TX
Lubbock Lake Project, Lubbock Lake Landmark, TX
- January 1986 - May 1987 Director, SJIAP Archaeology Laboratory
University of Washington, Seattle, WA
Garrison Bay Site, WA
- September - October 1986 Field Technician
Infotec Research Inc., Eugene, OR
Elk Creek Site, OR
- June - August 1986 Lab Supervisor
University of Washington, SJIAP Field School
Garrison Bay Shell Midden, San Juan County, WA
- October 1985- March 1986 Lab Technician
University of Washington, Seattle, WA
Robards and McHaney Projects, MO
- June - September 1985 Field Technician
Center for American Archaeology,
Kampsville Archaeological Center, Kampsville, IL
Bushmeyer and Pierre Marquette Sites, IL
- September 1984 - June 1985 Lab/Field Assistant
University of Washington, Seattle, SJIAP
Garrison Bay Shell Midden, San Juan Island, WA
- June - August 1984 Field School Student
San Juan Island Archaeological Project, University
of Washington
Garrison Bay Shell Midden, San Juan Island, WA

PUBLICATIONS

- in prep. *Excavations at Six Sites and Survey Near Alma, New Mexico:*
University of Washington 1994 Archaeological Field School. To be
submitted to U.S.D.A. Forest Service, Gila National Forest, Silver
City, New Mexico.
- in press *Recent Investigations at Mogollon Village, New Mexico.* In,
Exploring Variability in Mogollon Pithouses, edited by B. Roth.
Arizona State University Research Papers. Tempe, Arizona.

PUBLICATIONS, cont.

- 1998 Teaching Portfolios for Archaeologists. *Society for American Archaeology Bulletin*, 16(2): 6, 8.
- 1997 *Excavations at Mogollon Village and Survey of Surrounding Areas: University of Washington 1993 Archaeological Field School*. Submitted to U.S.D.A. Forest Service, Gila National Forest, Silver City, New Mexico.
- 1993 Geoarchaeological Scale and Archaeological Interpretation: Examples from the Jornada Region. In, *The Effects of Scale on Archaeological and Geological Perspectives*. Geological Society of America, Special Papers Series.
- 1993 Excavations at Shohakka Pueblo (LA 3840). In, *The Shohakka Pueblo (LA3840) and the Early Classic Period in the Northern Rio Grande* edited by T.A. Kohler and A.R. Linse. Washington State University, Department of Anthropology Reports of Investigations 66. Pullman. (with T.A. Kohler)
- 1993 *The Shohakka Pueblo (LA3840) and the Early Classic Period in the Northern Rio Grande*. Washington State University, Department of Anthropology Reports of Investigations 66. Pullman. (editor with T.A. Kohler)
- 1992 Excavations in Area 1 of Burnt Mesa Pueblo. In, *Bandelier Archaeological Excavation Project: Summer 1990 Excavations at Burnt Mesa Pueblo*, edited by T.A. Kohler and M. Root. Washington State University, Department of Anthropology Reports of Investigations 64, Pullman. (with M. Reilly and T.A. Kohler)
- 1992 Is Bone Safe in a Shell Midden? In, *Deciphering a Northwest Coast Shell Midden: Preliminary Report of the San Juan Island Archaeological Project (1983-1988)*, edited by J.K. Stein, pp. 327-345. Academic Press, New York.
- 1992 Requiring a Pro-Seminar. *Teaching* 2(3):1-3. Entry Level Initiative, University of Washington, Seattle.
- 1990 Excavations in Area 1. In, *Bandelier Archaeological Excavation Project: Summer 1989 Excavations at Burnt Mesa Pueblo*, edited by T.A. Kohler, pp. 27-48. Washington State University, Department of Anthropology Reports of Investigations 62, Pullman.
- 1990 Excavations in Area 2. In, *Bandelier Archaeological Excavation Project: Summer 1989 Excavations at Burnt Mesa Pueblo*, edited by T.A. Kohler, pp. 49-74. Washington State University, Department of Anthropology Reports of Investigations 62, Pullman. (with I. Carlson and T. Kohler)

PRESENTATIONS at PROFESSIONAL MEETINGS

- in prep. "Mogollon Settlement Change: Pithouse Period Movement From Isolated To Accessible Landforms?" Abstract submitted for the 65th Annual Meeting of the Society for American Archaeology, Philadelphia.
- 2000 "Preparing Future Archaeology Faculty: the TA-to-Instructor Transition." Workshop accepted for the 65th Annual Meeting of the Society for American Archaeology, Philadelphia.
- 1994 "Mogollon Village and Beyond: Recent Investigations in the Highlands of Western New Mexico." Paper presented at the 8th Mogollon Archaeology Conference, University of Texas at El Paso.
- 1993 "Room Use and Disuse: Deciphering the Depositional Record at Pueblo Sites, Bandelier National Monument, New Mexico." Paper presented at the 58th Annual Meeting of the Society for American Archaeology, St. Louis.
- 1991 "The Big, the Little, and the Left Behind: Macro- and Microartifacts from Burnt Mesa Pueblo, NM." Poster presented at the 56th Annual Meeting of the Society for American Archaeology, New Orleans.
- 1990 "Bone Solubility and Preservation in Alkaline Depositional Conditions." Paper presented at the 55th Annual Meeting of the Society for American Archaeology, Las Vegas. (with J.H. Burton)
- 1990 "Regional Geological analysis and Archaeology: Are They Compatible?" Paper presented at the Annual Meeting of the Geological Society of America, Dallas.
- 1988 "Is Bone Safe in Shell Middens?" Paper presented at the 53rd Annual Meeting of the Society for American Archaeology, Phoenix.

BOOK and MEETING REVIEWS

- 1995 Book review of "Abandonment of Settlements and Regions" by C. Cameron and S. Tomka. *Geoarchaeology* 10(1):85-92.
- 1992 Book review of "Principles of Archaeological Stratigraphy" 2nd ed., by E. Harris. *Geoarchaeology* 7(5):490-494. (with J. K. Stein)
- 1990 Review of 55th Annual Meeting of the Society for American Archaeology. *Geoarchaeology* 5(4):382-383.
- 1990 Book review of "Stratigraphica Archaeologica," Volumes 1 & 2, edited by L. De Meyer. *Geoarchaeology* 5(3):292-295. (with J. K. Stein)

INVITED LECTURES and PRESENTATIONS

- 1998 "Columbian Consequences: European Contact in the Americas," for Introduction to Anthropology courses, University of Washington, Seattle.
- 1995 "Mimbres Settlement and Landuse," discussion co-leader with Darrell Creel, Mimbres Workshop, Conference on Southwest Archaeology, Durango Colorado.
- 1995 "Mogollon Prehistory," for Western Archaeology course, University of Washington, Seattle.
- 1993 "Introduction to the Southwest," "The Southwest Archaic," "Early Agriculture," "Mogollon Prehistory," for Western Archaeology course, University of Washington, Seattle.
- 1992 "The Prehistoric Art of Çatal Hüyük," for Introduction to Archaeology course
- 1991 "Effective Teaching of Anthropology: Evolution and Adaptation." Entry Level Initiative Quarterly Meeting, University of Washington, Seattle.
- 1991 "Mogollon Archaeology," for Western Archaeology course, University of Washington, Seattle.

PUBLIC OUTREACH

- 1998 Vashon Archaeology, McMurray Middle School, 8th grade science classes, Vashon Island, Washington.
"Archaeology, not Paleontology!" for Pacific Middle School, 8th grade science classes, Des Moines, Washington.
Expanding Your Horizons, conference for introducing high school girls to careers in science, Shoreline Community College, Seattle, Washington.
- 1997 "Who Are Archaeologists and What Do They Do?" Ancient Secrets Session, Summer Day School, University of Washington Extension. (children, ages 9-11)
- 1996 - 1997 Mentor Scientist, Rural Girls in Science, Northwest Center for Research on Women, University of Washington, Seattle.
- 1995 - 1996 Mentor Scientist, Rural Girls in Science, Northwest Center for Research on Women, University of Washington, Seattle.
Mentor for Neah Bay High School, Neah Bay, Washington.
- 1996 "Columbian Consequences: European Contact in the Americas," for Franklin High School (12th graders), Seattle, Washington.
- 1996 "Real Archaeology Fieldwork versus the Myth of Indiana Jones" for Frank Wagner Middle School (6th graders) at the Burke Memorial Museum, University of Washington, Seattle.

PUBLIC OUTREACH, cont.

- 1994 "Mogollon Village Project," Glenwood Women's Club Spring
Lecture, Glenwood, New Mexico.
- 1990 "Anasazi Prehistory in the American Southwest." Recreational
Equipment Incorporated (REI), President's Forum, Seattle,
Washington.

DEPARTMENTAL COMMITTEES

Teaching Effectiveness Committee (since September 1991)

PROFESSIONAL SOCIETY MEMBERSHIPS

Society for American Archaeology
New Mexico Archaeological Council
Arizona Archaeological and Historical Society
Geological Society of America
New Mexico Geographic Information Council